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KAROS

2026

2026 International Symposium of
The Korean Association
of Robotic Surgeons

| *K.A.R.O.S – The Kairos of Robotic Surgery*

May 14^(Thu)–16^(Sat), 2026
Hyatt Regency Incheon Paradise City,
Incheon, Korea



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LIVSMED is a medical device company specializing in laparoscopic devices, established in June 2011. Our goal and vision is to lead the global medical device industry with our unique products beginning with ArtiSential™.



Bringing articulation into the hands of surgeons,
one patient at a time.

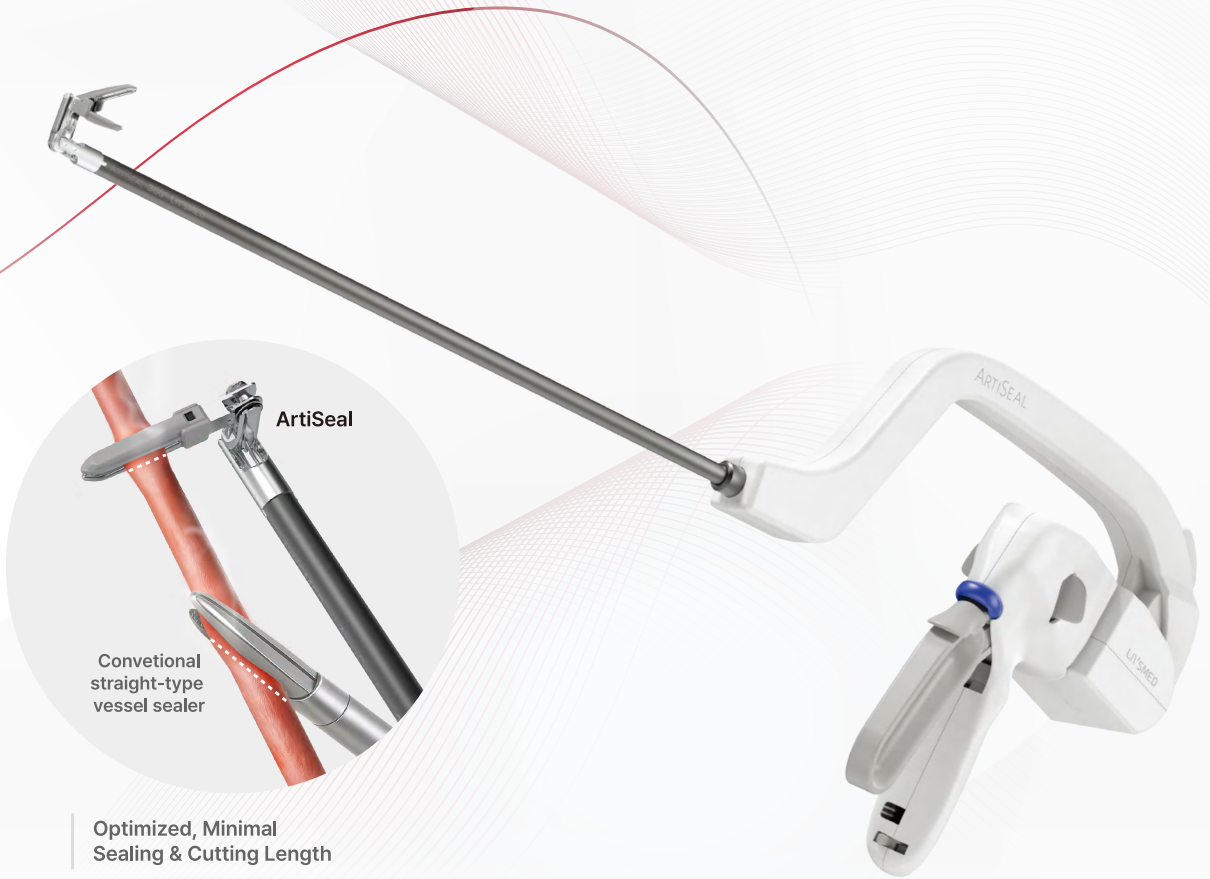
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MEMO CUE[®]

의료기기

의료전문가용

"이 제품은 '의료기기'이며 '사용상의 주의사항'과 '사용방법'을 잘 읽고 사용하십시오"



KR-MMP-2600001

Smart AI Telemetry



- EX871 수가 적용
- 별도 통신망 공사 불필요
- 8일 지속 배터리
- 제세동 보호 기능
- 부정맥 AI 부문 PhysioNet 2021 우승



1

MEMO Patch M

심전도, 호흡 측정 장치

- 최대 배터리 지속 기간: 8일 / 무게: 배터리 포함 12g
- 안정적인 데이터 전송 (연결 해제 시 알림)
- 제세동으로부터의 보호
- 사용자 친화적 디자인 적용 (디자인 어워드 수상)

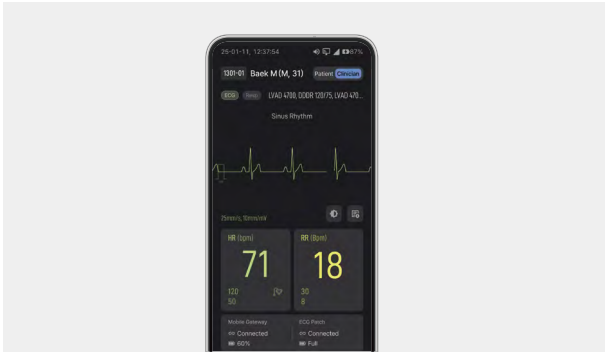


2

MEMO Cue

중앙 모니터링 소프트웨어

- 웹 기반 소프트웨어로 병원 내 어디서나 모니터링
- 다중 환자 실시간 모니터링 및 이상 신호 알림
- Cloud 또는 On-Premise 옵션 제공



3

MEMO Cue Mobile

휴대형 데이터 전송 장치 (게이트웨이)

- 실시간 생체 신호 및 알람 표시
- Samsung Galaxy 디바이스
- LTE / WiFi (별도 통신망 공사 필요)



4

Wearable Pulse Oximeter

휴대형 데이터 전송 장치 (게이트웨이)

- 말초 산소포화도 측정
- Nonin 웨어러블 산소포화도 기기와 연동하여 지속적인 SpO₂ 모니터링
 - * 다양한 형태의 웨어러블 산소포화도 기기와 연동 가능 (Option: Nonin / 참케어 / 올케어러블)



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Reference: Fish oil in critical illness: mechanisms and clinical applications. Crit Care Clin 2010 Jul;26(3):501-14.





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※ Revo-i™: 자동화시스템로봇수술기 / 전립선절제술, 담낭절제술을 포함하는 일반적 내시경(복강경) 수술에서 수술 시 의사의 통제하에 수술 부위의 위치, 파악, 절개, 절단, 결찰, 전기 소작, 봉합, 삼입물의 삽입 및 고정 등에 사용되는 로봇 자동화시스템

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광고심의필 : 심의번호 2020-GJ-12-40023

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- ☑ 지혈 성공시간 : 헤모펜스 114.0초 vs 젤라틴 매트릭스 122.3초⁷⁾

Ref. 1) MFDS 허가 신청 자료, 2) 대한민국 공개특허 10-2018-0027126, 3) 미국/일본/러시아 특허 등록 정보, 4) In-house test, 5) 헤모펜스 헤모스타틱, 플로스 매트릭스 매트릭스 MFDS 허가, 6) 헤모펜스 허가용 임상 시험자 평가 지혈성공률, 7) 헤모펜스 허가용 임상 단회투여 첫번째 출혈부위 지혈시간



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* Based on time-adjusted SPD₁₀s, calculated from VAS pain intensity scores recorded up until the time of consumption of the first dose of rescue.¹ ** Based on the total oral Morphine Milligram Equivalent (MME) dose of all rescue medication over the full 48 hour study period.¹ *** According to VAS pain intensity, Pain Intensity Differences and Pain Relief scores. Dosed as one vial every 6 hours over 48 hour period.¹

References : 1. Daniels, S.E, Playne, R., Stanescu, I., Zhang, J., Gottlieb, J.J, Atkinson, H.C. (2019). Efficacy and safety of an intravenous acetaminophen/ibuprofen fixed-dose combination after bunionectomy: A randomized, double-blind, factorial, placebo-controlled trial. Clinical Therapeutics <https://doi.org/10.1016/j.clinthera.2019.07.008>. Research sponsored by AFT Pharmaceuticals.

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| 세포독성효과 (Cytotoxicity)

압노바비스쿰® 을 투여하게 되면 미슬토렉틴에 의한 암세포 사멸 (apoptosis)과 비스코톡신에 의한 암세포의 괴사(necrosis)가 일어나서, 암세포의 성장을 억제하고 암세포를 파괴시켜 줍니다.

| 면역조절작용 (Immunomodulatory Effects)

미슬토렉틴 등의 성분이 인터루킨 (IL-1,IL-2,IL-6), 인터페론(IFN-γ), 종양괴사인자(TNF-α)등의 사이토카인 (cytokine) 분비를 촉진시키며, 올리고당 및 다당류 성분이 NK 세포(natural killer cell) 활성을 향상시키고, 소포체(vesicle)는 T-helper cell 의 증식을 유도하여 면역조절효과 (Immunomodulatory effects)를 나타냅니다.

| 베타 엔도르핀의 분비 (β-endorphin release)

베타 엔도르핀의 분비증가로 암 환자의 통증을 감소시키고 삶의 질을 향상시켜줍니다.

효능·효과

종양의 치료(조혈기관의 장애를 동반한 악성종양질환 포함), 종양수술후 재발의 예방, 전암성 병변, 악성 흉막삼출(압노바비스쿰 F20mg의 경우)



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Integrated Therapy for Anti-Cancer treatment

항악성종양제 미슬토 항암면역요법

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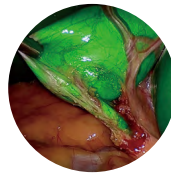
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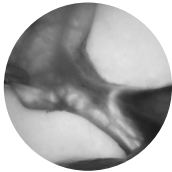
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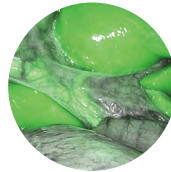
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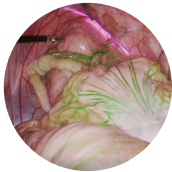
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High-contrast fluorescence visualization in grayscale.



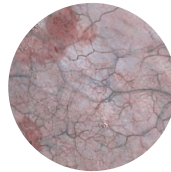
SPY ENV mode

4K fluorescence displayed in grayscale.



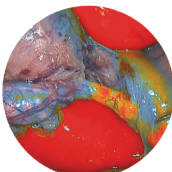
IRIS

Improved usability by enabling simultaneous visualization of fluorescence imaging and IRIS ureteral stents.



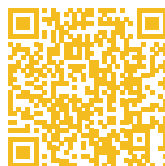
SPY Cyan Spectral Imaging (CSI)

SPY Cyan Spectral Imaging (CSI) is an enhanced cystoscopic technique designed to enhance the visualization of vasculature.¹



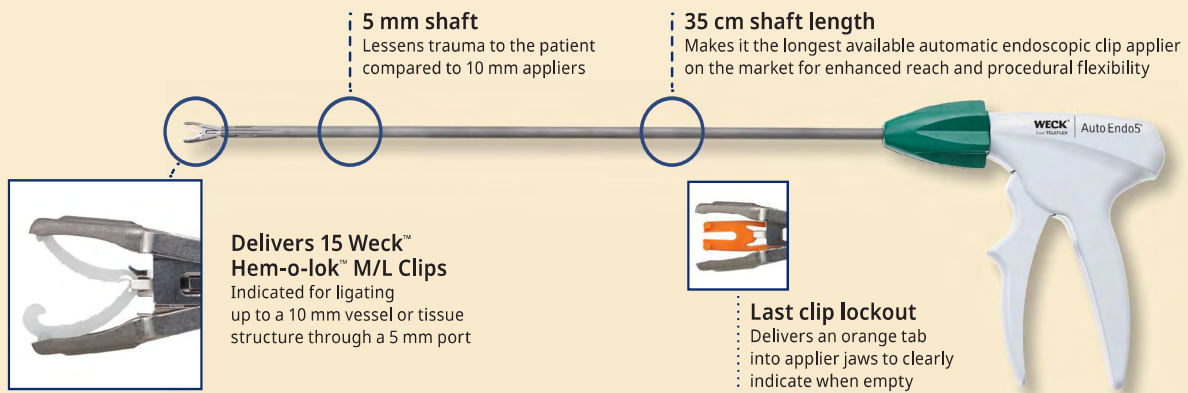
SPY Color Segmented Fluorescence (CSF)

With SPY CSF, users can now see fluorescence intensity levels with a white light overlay.



Contact us for
more information

Weck™ Auto Endo5™ Hem-o-lok™ Clip Applier Features



Weck™ Hem-o-lok™ Clip Features

Integrated ridges

designed to prevent slippage with a reliable 360° grip¹

Locking mechanism

provides secure closure with tactile and auditory feedback

Three points of contact

in the applier jaws for enhanced stability

Flexible hinge

enables 10 mm structure ligation through a 5 mm port

Bow shape

designed for easy removal with appropriate instrument

Weck™ Auto Endo5™ Automatic Hem-o-lok™ Clip Applier Ordering Information

PRODUCT CODE	PRODUCT DESCRIPTION	QUANTITY / SALES UNIT
AE05ML	Weck™ Auto Endo5™ 5 mm Automatic Endoscopic 35 cm Clip Applier	3 / Box
544121	Weck™ Hem-o-lok™ Reusable Endoscopic Clip Remover	1 Each



With the Hem-o-lok™ Clip's large distal opening and polymer flexibility, the Weck™ Auto Endo5™ Hem-o-lok™ Clip Applier is indicated for ligating larger structures than comparable 5 mm metal clip appliers.¹

Weck™ Ligation Systems – Tried and Trusted

Weck™ offers innovative products and services that empower surgeons to operate with maximum effectiveness and performance.

For further information, contact your Teleflex surgical sales professional.

To place an order, contact customer service at 1.866.246.6990.

References:

1. Data on file (2013 internal study), Teleflex Incorporated, Report #D001591. Based on ex-vivo testing of three common clip failure modes conducted on porcine carotids, sample size = 33, p<0.05. Clinical performance cannot be extrapolated from the data. Testing pressures range beyond physiological pressures. The Weck™ Hem-o-lok™ medium/large clip was compared to Ethicon® LIGAMAX™ 5, Ethicon® 10 mm LIGACLIP®, and Covidien® Endo Clip™ III. The Weck™ Hem-o-lok™ large clip was compared to Ethicon® 12 mm LIGACLIP® and Covidien® Endo Clip™.
2. Hem-o-Lok™ clip is safe in minimally invasive surgery: a single center experience and review of data from Food and Drug Administration.

Rx only.
Hem-o-lok Ligating Clips are contraindicated for use as a fallopian contraceptive tubal occlusion device and contraindicated for use in ligating the renal artery during laparoscopic donor nephrectomies.

Ethicon, LIGACLIP, and LIGAMAX 5 are trademarks or registered trademarks of Johnson & Johnson. Covidien and Endo Clip are registered trademarks of Covidien.

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Information in this material is not a substitute for the product Instructions for Use. Not all products may be available in all countries. Please contact your local representative.

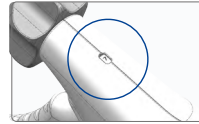
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T. CLIP

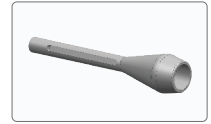
Polymer Auto Clip



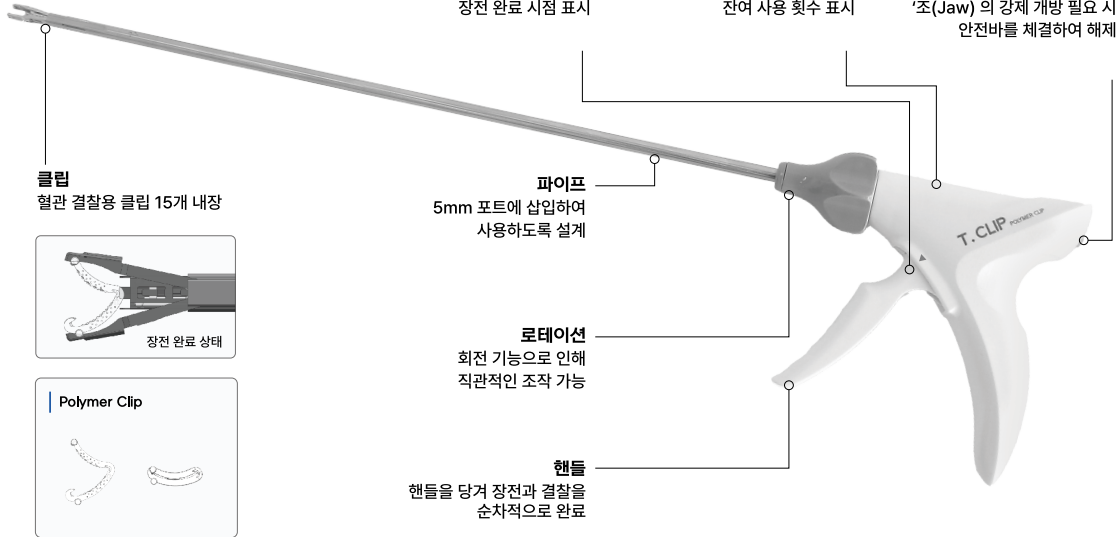
장전 확인 표시
장전 완료 시점 표시



카운터바
잔여 사용 횟수 표시



안전바
'조(Jaw)'의 강제 개방 필요 시
안전바를 체결하여 해제



T. POUCH

Specimen Retrieval Pouch



Tip Type



Spring



Non Spring



Drop

Synergy^{ID}

Near-Infrared Fluorescence 4K Imaging

See more than ever before with new image modes for customizable white light color augmentation, 4 times the number of pixels as HD, a multi-sensory camera design, 10-bit precision color reproduction, and direct LED integration. Using endoscopic imaging, the Synergy^{ID} UHD 4K system offers dynamic range and depth of light for unrivaled contrast and depth of field for optimal sharpness.

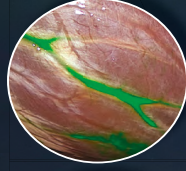
At the touch of a button, new visualization options include standard visible light imaging with near-infrared (NIR) overlay, grayscale visible light imaging with NIR overlay, or NIR imaging-only modes. This valuable modularity provides immediate access to critical features with flexibility to scale investment in the system to meet future needs.

Reveal the Power of Fluorescence

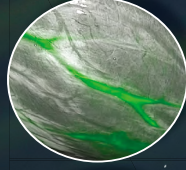
Experience the Synergy^{ID} all-in-one console's* outstanding 4K video with advanced visualization, fluorescence imaging, LED lighting, image management, OR integration, and an easy-to-use tablet interface that allows staff to focus on patients instead of equipment. Multiple modes and color options put premier customized visualization at your fingertips.



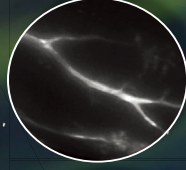
Standard visible light



Standard visible light
+ NIR overlay



Grayscale visible light
+ NIR overlay



NIR only



4K
Synergy^{ID}

Arthrex[®]
Synergy.Arthrex.com

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■ **Reusable
Reusable System**

Reusable applier and
single use clip cartridge

AESCULAP® Challenger® Ti-P

PNEUMATIC REUSABLE MULTI-FIRE CLIP APPLIER



Sterile package of clip cartridge
(clip cartridge + CO₂ cylinder),
last clip color-coded

B. Braun Korea Co., Ltd.

The New Innovative Therapy For Shocks

ULISTINTM Inj.

(URINASTATIN)

What Is New

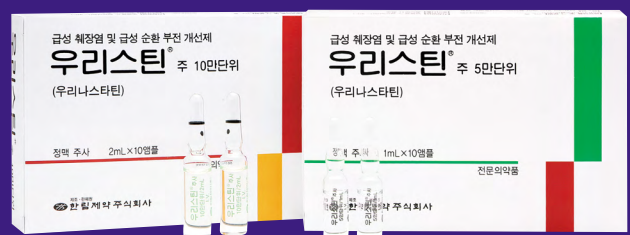
- Expanded Spectrum of Pancreatic Enzymes' Inhibition
- Inhibition of Releasing and Activating of Lysosomal Enzymes
- Lower the Production of MDF

How To Be Improved From Shocks

- Protection Of Cells From Damage
- Alleviation of Local and Systemic Circulatory Disorder
- Enhancement of Anti-Shock Mechanisms

For Various Shocks

- Septic Shock
- Traumatic Shock
- Haemorrhagic Shock
- Other Shocks



【표준코드】

5만단위: 645301310

10만단위: 645301320

Prevention of PONV is as Important as Treatment¹

PONV



PONV, Post, Operative Nausea & Vomiting

[Reference] 1. Gan, Tong J., et al. "Fourth consensus guidelines for the management of postoperative nausea and vomiting." *Anesthesia & Analgesia* 131.2 (2020): 411-448.



DAIICHI SANKYO KOREA

Prescribing Information



Nasea Injection 0.3mg

P25-164-2027.05-V1

출혈 효과적으로 잡습니다

국내 혈장 유래 수술용 지혈제 시장점유율 1위¹⁾



신속한 응고작용 | 조직접착 및 지혈작용 | 내시경적 시술에 사용 가능

그린플라스트 큐는 체내 혈액 응고시스템과 동일한 방식으로 지혈작용을 하는 생리적 조직접착제입니다²⁾

Greenplast Q pre-filled syringe kit

그린플라스트 큐

프리필드시린지 키트

대한민국 37호 신약!
P-CAB의 새로운 돌풍!

**동아ST와 제일약품이
함께 나아갑니다.**



[Abbreviation] P-CAB : Potassium-Competitive Act1 Blocker.

[Reference]

1. 국내 개발신약 허가현황, 한국신약개발연구조합 Available at <https://www.kdra.or.kr/website/03web02.php> accessed Sep-11-2024.

[제조의뢰자] 은코닉테라퓨틱스(주) 서울특별시 강남구 테헤란로 26길 12 11층 **[제조 및 판매원]** 제일약품(주) 공장: 경기도 용인시 처인구 백암면 청강가창로 7 (9동 외) 본사 : 서울특별시 서초구 사평대로 343 Tel. 080-555-7171

[공동판매원] 동아ST 서울특별시 동대문구 천호대로 64 Tel. 02-920-8111 ※ 제품에 대한 자세한 정보는 제품에 동봉된 제품설명서 및 식품의약품안전처 의약품안전나라 (<https://nedrug.mfds.go.kr/index>)를 참고하시기 바랍니다.

[제조의뢰자]



[제조판매원]



[공동판매원]



미란성위식도역류질환 · 위염치료제

From **Gastritis** To **GERD**

FEXUOLUE® **Tab.**

펙수클루® 정 Fexuprazan hydrochloride
10mg, 40mg



【제품명】 펙수클루®정 10mg, 40mg **【원료약품 및 구분량】** 펙수프라잔염산염 10mg, 40mg **【성상】** 10mg: 주황색 장방형의 필름코팅정제, 40mg: 연녹색 장방형의 필름코팅정제 **【효능 효과】** 1. 미란성 위식도역류질환의 치료, 2. 급성위염 및 만성위염의 위장파 방변 개선 <10mg에 한함> **【작용·용량】** 이 약은 성인에게 다음과같이 투여한다. 1. 미란성 위식도역류질환의 치료: 1일 1회, 40mg을 4주간 경구투여한다. 식도염이 치료되지 않거나 증상이 계속되는 환자의 경우 4주 더 투여한다. 2. 급성위염 및 만성위염의 위장파 방변 개선: <10mg에 한함> 1일 2회, 1회 10mg을 2주간 경구투여한다. 이 약은 식사와 관계없이 투여할 수 있다. **【저장방법】** 기밀용기, 실온(1~30°C) 보관 **【사용기간】** 제조일로부터 36개월 **【포장 단위】** 28정/병, 100정/병, 300정/병 **【제조사(판매사)]** (제조사(판매사)) (제대용제약/송정북도 청주시 흥덕구 오송읍 오송생명2로 1 (공동판매사) (주)종근당 (서울시 서대문구 홍천로88) * 본 의약품은 일정한 품질관리를 필한 제품입니다. 만약 구입시 사용기한 또는 유효기한이 지났거나, 변질·변패·오염되었거나 손상된 의약품은 공정거래위원회의 고시(소비자 분쟁해결기준)에 의거, 구입한 약국 및 의약품판매업자를 통해 교환 또는 환불받을 수 있습니다. * 부작용보고 및 피해구제신청: 한국의약품안전관리원(1644-6223), 대용제약 소비자센터(수신자 부담전화): 090-550-8308-9 (www.daewoong.co.kr) * 자세한 최신의 허가사항은 식약처 의약품 통합정보시스템(<http://nedrug.mfds.go.kr>) (QR코드) 또는 제품설명서를 참조하시기 바랍니다.



TachoSil

SEALANT MATRIX

- Quick onset of hemostasis
- Safe tissue sealing
- Easy handling
- Shorter operation time
- Minimize risk of re-bleeding
- Reduce the likelihood of blood transfusion



[원료약품 및 분량]

Tachosil contains per (1 cm²)

· Collagen (sponge)	2.1 mg
· Human Fibrinogen	5.5 mg
· Human Thrombin	2.0 IU
· Riboflavin	18.2 μm

[성상]

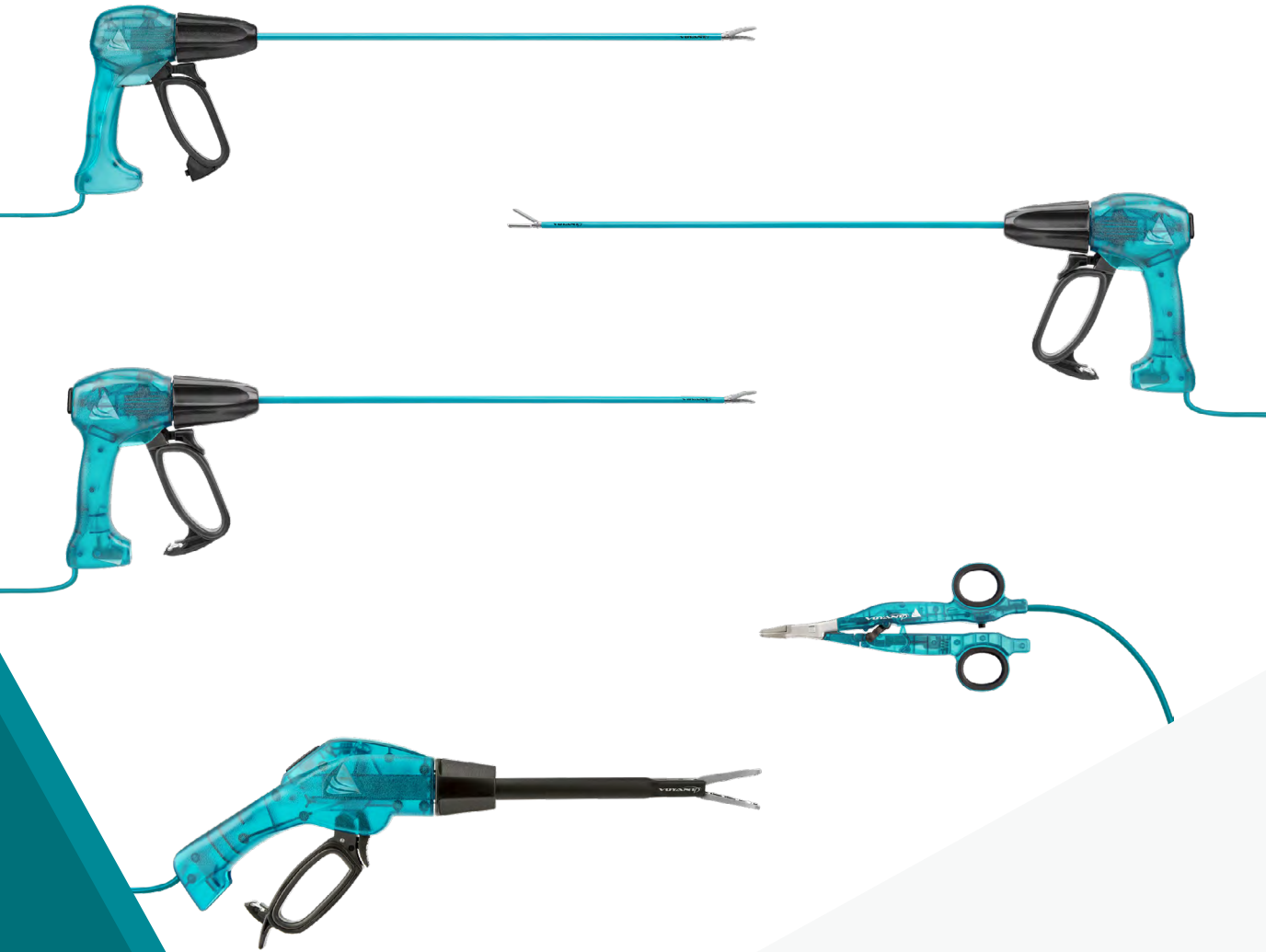
한면에 황색 약물이 도포된 백색 스폰지

[표능 및 효과]

1. 기존 치료법으로 조절할 수 없는 경우 또는 기존 치료법으로 불충분하다고 예상되는 경우의 출혈 또는 담즙, 림프, 액, 공기 누출
2. 간, 비장, 췌장, 신장, 폐, 부신, 갑상선, 림프절과 같은 실질적 기관 수술시의 지혈 및 조직접착, 또한 이비인후과, 부인과, 비뇨기과, 혈관계, 뼈(예를 들면 해면골)수술, 외상관련 수술시의 지혈
3. 림프, 담즙, 액의 누공의 예방적 처치
4. 폐수술시 일어나는 공기누출의 봉합

[포장단위]

- (9.5X4.8X0.5)cm² X 1매
- (4.8X4.8X0.5)cm² X 2매
- Pre-rolled (4.8X4.8X0.5)cm² X 1매
- (2.5X3.0X0.5)cm² X 1매



Voyant[®]

Intelligent Energy System

THE NEXT STEP FORWARD IN VESSEL SEALING

To learn more, visit
appliedmedical.com/Voyant.

The advertised product is a medical device and the use instructions and warnings must be read carefully prior to use.

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351370-EN-D 07/2023

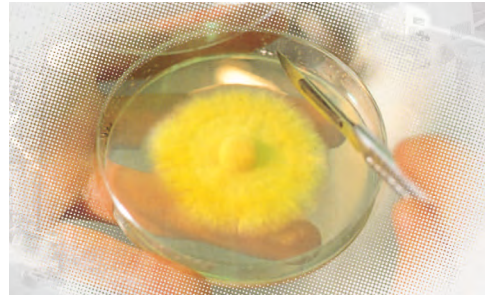
항암 면역 증강제

메시마[®] Cap.산

메시마[®](Mesima[®])는 첨단대량배양 기술을 이용하여 펠리누스 린테우스(Phellinus linteus yoo)를 배양하고 정제하여 생산되는 단백다당체를 주성분으로 한 항암면역증강제입니다.

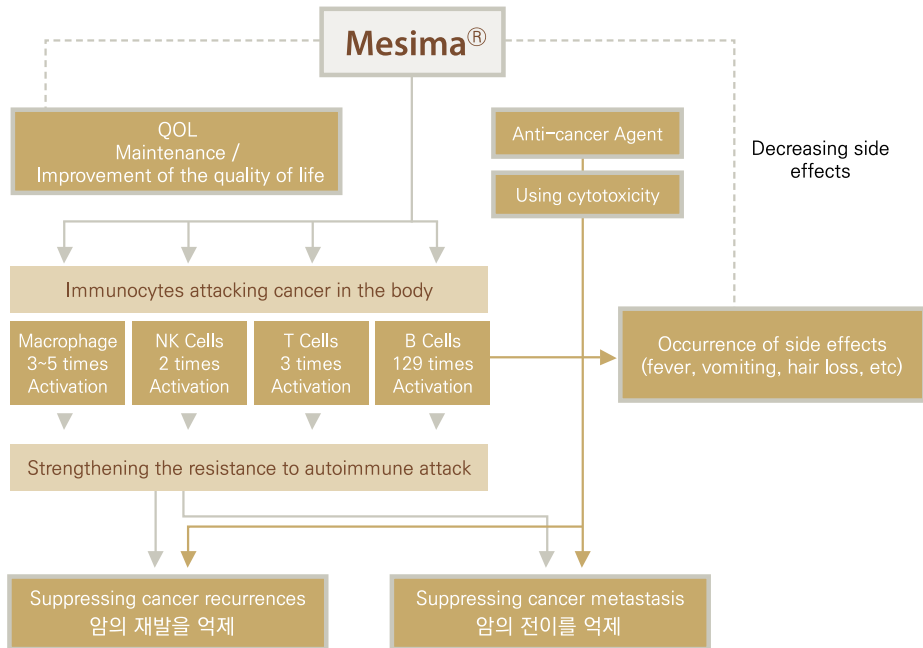
sarcoma180 고형암 억제활성 스크리닝을 통해 펠리누스 린테우스의 놀랄 만한 종양억제 효과가 확인되었습니다.

Mesima[®]s a special treatment for anticancer immune function which has obtained many successful domestic and international patents with success in clinical research and research on anticancer, immune function, extraction of active substance and purification technology in cooperation with major university hospitals and Korea Institute of Bioscience and Biotechnology.



Action mechanism of Mesima[®] in the body

메시마[®]의 항암면역작용



- Mesima[®] inhibits cancer cells from growing or spreading through activation of immune cells to attack cancer, and has no side effect.
- Most chemotherapeutic anti-cancer drugs attack cancer cells through cell toxicity, and have side effects.
- Joint treatment of a third of an ordinary dose of Adriamycin, an anti-cancer drug, and Mesima[®] showed a great anti-tumor effect, and also reduced side effects.

SINCE 1961

HS 한국신약

Ⓜ33023 충청남도 논산시 양촌면 중산길 39-83
Tel : 041-740-8900 <http://www.hsp.co.kr>

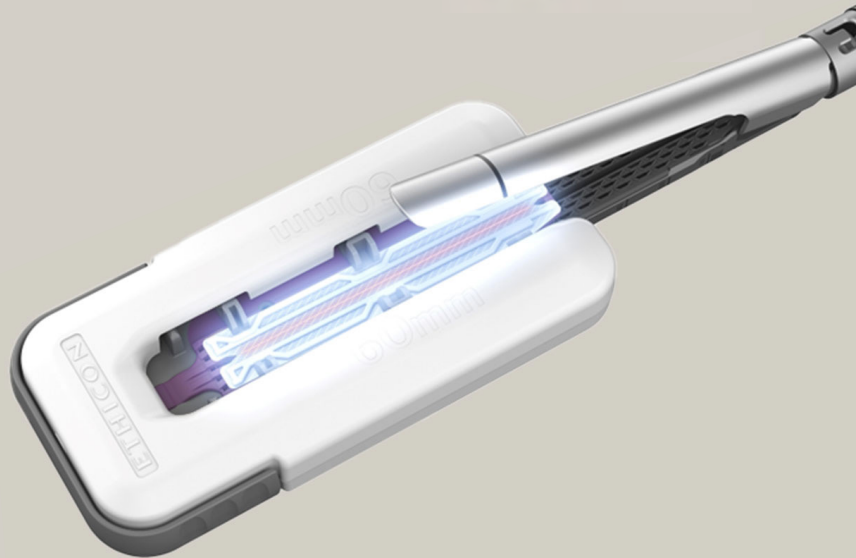
[본 제품에 대한 문의사항(당사 소비자 상담실)]
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with **GST Cartridge**

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ENDOPATH
Staple Line
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Baxter

Tisseel
FIBRIN SEALANT

Floseal
HEMOSTATIC MATRIX

Hemopatch
HEMOSTAT

Ostene
BONE HEMOSTASIS
MATERIAL



고함량 판크레아틴의 새로운 대안

크레아정 (Crea Tab. 40000)

크레아 베이직정 (Crea Basic Tab. 25000)

크레아 포르테정 (Crea Forte Tab. 60000)

Pancreatin + UDCA의 시너지 Effect

DRUG INFORMATION

[제품명 · 비급여코드] 크레아정 649808300, 크레아베이직정 649808330, 크레아포르테정 649808340 [성분 · 함량 · 성상] 크레아정 Pancreatin 400mg / UDCA 20mg, 노란색의 타원형 장용코팅정, 크레아베이직정 Pancreatin 270mg / UDCA 20mg, 연한 주황색의 타원형 장용코팅정, 크레아포르테정 Pancreatin 540mg / UDCA 20mg, 갈색의 타원형 장용코팅 [효능 · 효과] 소화불량, 식욕감퇴(식욕부진), 과식, 체함, 소화촉진, 소화불량으로 인한 위부팽만감 [용법 · 용량] 만 15세 이상의 성인 : 1회 1정, 1일 3회 식후에 복용한다.

DIC환자의 Antithrombin III 결핍증 치료제¹

에스케이항트롬빈 III^주 500단위

Solvent/Detergent treatment와 Nanofiltration을 이용하여
혈액 매개 바이러스를 효과적으로 불활화 및 제거하였습니다.^{2,3}

S/D Treatment

바이러스 지질막을 파괴하여 lipid enveloped virus(HIV, HCV, HBV) 를 효과적으로 불활화⁴

Nanofiltration

Pore size가 20nm이하인 filter를 사용하여 HAV, Parvovirus B19와 같이 제거하기 힘든 small non-enveloped virus까지 제거⁵



* DIC: Disseminated Intravascular Coagulation, ATIII: Anti-Thrombin III

* HIV: Human Immunodeficiency Virus, HCV: Hepatitis C Virus, HBV: Hepatitis B Virus, HAV: Hepatitis A virus



제품요약정보

【제품명】 에스케이항트롬빈III주(건조농축사람항트롬빈III) **【원료약품 및 그 분량】** 이 약 1 바이알 중 유효성분: 농축사람항트롬빈III(별규) 500 IU. **【효능·효과】** 1. 선천성 항트롬빈III 결핍에 기인하는 혈전색전합병증의 예방 및 치료 2. 후천성 항트롬빈III 결핍의 예방 및 치료 - 중독, 간염, 대상부전 간경변증 등에 의한 급성 간부전증 - 패혈증, 다발성인상, 양수색전증 등에 있어서의 소모성 응혈이상증 **【용법·용량】** 1. 용량: 용량은 항트롬빈III 결핍 정도 또는 항트롬빈III의 소모 정도에 따라 결정한다. 체중 1 kg 당 항트롬빈III 1 단위를 투여할 경우, 항트롬빈III 활성이 통상 정상치의 1% 이상 증가한다. 항트롬빈III의 소모 정도가 심한 경우에는 이 상승치가 더 적을 수 있다. 일반적으로 항트롬빈III의 생물학적 반감기는 약 2.5 일이다. 그러나 항트롬빈III의 소모가 많을 경우에는 몇 시간으로 감소될 수도 있다. 이런 환자의 경우 1 일 여러 번 항트롬빈III 활성을 측정할 필요가 있다. (1) 예방: 항트롬빈III 소모 정도에 따라 1 일 1,000~1,500 단위 투여 (2) 치료: 초기용량은 1 일 1,000~2,000 단위, 유지용량으로는 1 일 2,000~3,000 단위를 항트롬빈III의 소모 정도에 따라 4~6 시간 간격으로 1 회 500 단위씩 분할 투여하거나 계속 정적 정맥주사한다. (3) 치료기간: 항트롬빈III 혈장 수준이 정상화되고 재발증상이 없어질 때까지 투여한다. 2. 용법: 10 mL의 주사용 증류수로 건조농축물을 용해시킨 후 정맥 내로 천천히 주사하거나 정적 정맥주사한다. 정적 정맥주사 시에는 5%의 사람알부민용액이 희석액으로 가장 적당하며 110까지의 비율로 희석하는 데는 링거유사염용액, 생리식염수 및 5% 포도당용액 등을 사용할 수 있다. **【사용상의 주의사항】** 1. 경고 ① 이 약은 사람 혈장으로부터 제조되어 현재의 과학기술 수준에서 혈액매개바이러스 또는 다른 종류의 감염원(이른말로로는 CJD)의 감염 위험을 완전히 배제할 수 없다. (중략) 2. 다음 환자에는 투여하지 말 것. 이 약 및 이 약의 성분에 대하여 속 등 과민반응의 병력이 있는 환자 (후략) **【제조자】** 에스케이플라즈마(주) 경상북도 안동시 풍천읍 산입단지길 157 (편매지) 에스케이플라즈마(주) 경기도 성남시 분당구 판교로 310
* 처방하기 전 제품설명서 전문을 참고하십시오. 최신 허가사항에 대한 정보는 '식품의약품안전처 의약품안전나라(<https://nedrug.mfds.go.kr/index>)'에서 확인할 수 있습니다.

【전문의약품】 분류번호 634

경기도 성남시 분당구 판교로 310(삼평동)
Tel. 080-969-9967
www.skplasma.com
ATH-HA05-202508-01

References 1. 에스케이항트롬빈III주 허가정보, 식품의약품안전처 의약품통합정보시스템 [Cited 2025.08.29] Available from: <https://nedrug.mfds.go.kr> 2. 에스케이항트롬빈III주 허가증, Data on file, SK플라즈마 3. Guidelines on viral inactivation and removal procedures intended to assure the viral safety of human blood plasma products, WHO Technical Report, Series No. 924, 2004, Annex 4, Available from: https://www.who.int/bloodproducts/publications/WHO_TRS_924_A4.pdf 4. Dichtelmueller HO et al., Robustness of solvent/detergent treatment of plasma derivatives: a data collection from Plasma Protein Therapeutics Association member companies, Transfusion, 2009 Sep;49(9):1931-43 5. Caballero S et al., Robustness of nanofiltration for increasing the viral safety margin of biological products, Biologicals, 2014 Mar;42(2):79-85

고농도 면역글로불린
LIV-GAMMA SN
 Inj. 10%



함량 & 편의성 **UP!**

투여시간 & 볼륨 **DOWN!**

10% 1g, 3g, 10g, 15g **출시!**

IVIG: Intravenous Immunoglobulin G



제품요약정보

【제품명】 리브감마에스엔주10%(글리세린)인자사람면역글로불린(아사이) **【의료약품 및 그 분량】** 이 약 1mL 중 유효성분: 사람면역글로불린-지(별규) 100mg **【효능·효과】** 1. 저 및 무감마글로불린혈증 2. 중증간염증에 항생물질 병용 3. 특발성소관강소자색반병(타게기 무효로서 현저한 호발 경향이 있고, 일과적 처치 또는 출산 등 일시적 지혈 관리를 필요로 하는 경우) 4. 길림바레중후군(급성특발성발진경형) 5. 기와사키병(관상동맥질환병증 예방 목적) **【용법·용량】** 1. 저 및 무감마글로불린혈증 1회 사람면역글로불린-지로서 체중 kg 당 200~600mg을 3~4주 간격으로 점적 정맥주사 또는 직접 정맥주사한다. 2. 중증간염증에 항생물질 병용 시 1회 성인 2,500~5,000mg, 소아 체중 kg 당 50~150mg을 점적 정맥주사 또는 직접 정맥주사한다. 3. 특발성소관강소자색반병 이 약으로서 1일 1,000mg/kg, 2일간 사용하더라도 증상의 개선이 보이지 않으면 중지한다. 4. 길림바레중후군: 체중 kg 당 400mg을 1일 1회 5일간 투여한다. 5. 기와사키병 1일 체중 kg 당 400mg을 5일간(중간) 혹은 체중 kg 당 2,000mg을 1회 점적 정맥주사한다(적의간격). 기와사키병에 사용하는 경우에는 발병 후 7 일 이내에 투여를 개시하는 것이 바람직하다. 체중 kg 당 2,000mg을 1 회 투여할 경우 기본적으로 아래 투여속도를 준수하는 것으로 하지만 기준으로서는 2시간 이상에 걸쳐 점적 정맥주사한다. 투여속도: 초기 30분 동안은 0.01~0.02mL/kg/min으로 투여하고 (중략) 환자의 상태에 이상이 없으면 0.06mL/kg/min까지 점차적으로 투여속도를 증가할 수 있다. 투여 후 환자의 상태를 충분히 관찰하고, 만약 투여속도 증가로 인해 환자의 상태에 이상이 발생할 경우 즉시 투여속도를 줄이거나 증상이 호전될 때까지 투여를 중단한다. **【사용상의 주의사항】** 1. 경고 1) 이 약은 사람 혈장으로부터 제조되어 현재의 과학기술 수준에서 혈액매개바이러스 또는 다른 종류의 감염원(이론적으로는 CJD)의 감염 위험을 완전히 배제할 수 없다. (중략) 2. 다음 환자에는 투여하지 말 것 1) 이 약의 성분에 대하여 과민반응의 병력이 있는 환자 2) 이 약의 성분에 대하여 축의 병력이 있는 환자 (후략) **【제조자】** 에스케이플라즈마(주) 경상북도 안동시 풍천읍 신암단지길 157 **【판매자】** 에스케이플라즈마(주) 경기도 성남시 분당구 판교로 310 2023.06.13 개정

전문의료약품 분류번호 634

* 처방하시기 전 제품설명서 전문을 참고하십시오. 최신 허가사항에 대한 정보는 '식품의약품안전처 의료품통합정보시스템'(https://nedrug.mfds.go.kr/)에서 확인하실 수 있습니다.

Reference 1. 리브감마에스엔주10% 허가정보. 약물안전나라 [Cited 2024.04.17]. Available from: https://nedrug.mfds.go.kr/

에스케이 알부민^주 5%/20%

Human serum albumin

- » 40년 이상 오랫동안 사용되어 왔습니다.¹
- » 60℃에서 10시간 동안 열처리[†]하여
혈액유래 바이러스를 효과적으로
불활화 하였습니다.²

[†]Heated as a liquid at 60±0.5℃ for 10-11 hours²

제품요약정보¹

【제품명】 에스케이알부민5%/20%주(사람혈청알부민) **【원료약품 및 그 분량】** 100mL 중 • 알부민5% 주 유효성분: 사람혈청알부민(별규) 5g • 알부민20% 주 유효성분: 사람혈청알부민(별규) 20g **【효능·효과】** 알부민의 상실(화상, 신중추근 등) 및 알부민 함성저하(간경변증 등)에 의한 저알부민혈증, 출혈성 속 **【용법·용량】** 1. 5% 주 : 1일 사람혈청알부민으로서 25g(5%로서 500ml)을 분당 2~4ml의 속도로 천천히 정맥 또는 정적 정맥주사합니다. 체중, 연령, 증상에 따라 적절히 증감합니다. 2. 20% 주 : 1일 사람혈청알부민으로서 25~75g에 해당하는 양(20%로서 125~375ml)을 분당 2~4ml의 속도로 천천히 정맥 또는 정적 정맥주사합니다. 필요에 따라 5% 포도당 주사액에 희석 사용이 가능합니다. 체중, 연령, 증상에 따라 적절히 증감합니다. **【사용상의 주의사항】** 1. 경고 1) 이 약은 사람혈청으로부터 제조되어 현재의 과학기술 수준에서 혈액 매개 바이러스 또는 다른 종류의 감염원(이론적으로는 CJD)의 감염위험을 완전히 배제할 수 없습니다.

※ 처방하기 전 제품설명서 전문을 참고하십시오. 최신 허가사항에 대한 정보는 '의약품통합정보시스템(nedrug.mfds.go.kr)'에서 확인할 수 있습니다.

References 1. 에스케이알부민주5%(사람혈청알부민) 허가정보. 의약품통합정보시스템, [Cited 2019 Mar 22]. Available from: <https://nedrug.mfds.go.kr> 2. Guidelines on viral inactivation and removal procedures intended to assure the viral safety of human blood plasma products [Internet]. WHO; 2004 [cited 2015 Apr 6]. Available from: http://www.who.int/foodproducts/publications/WHO_TRS_924_A4.pdf

전문약품 분류번호 : 634

SK 플라즈마

경기도 성남시 분당구 판교로 310(삼평동)
Tel 080-969-9967 www.skplasma.com

정주용 헤파불린^{에스앤} 주

정맥주사용 B형 간염 사람면역글로불린

INDICATIONS
Prevention of Hepatitis B
recurrence following liver
transplantation¹



제품요약정보¹

【전문약품】 634

【제품명】 정주용 헤파불린에스앤주(정맥주사용 B형 간염 사람면역글로불린) **【원료약품 및 그 분량】** 이 약 10 mL 중 유효성분: B형간염사람면역글로불린(별규) 2,000 IU. **【효능·효과】** 간이식환자에서 B형 간염의 재발 방지 **【용법·용량】** 다음의 투여 용량대로 10,000 IU.를 5 % 포도당 주사액 150 mL에 희석하여 정적 정맥주사한다. · HBV-DNA(-), HBeAg(-): 수술 중 10,000 IU. 1회 투여, 수술 후 1주일까지 10,000 IU./day, 수술 후 1개월까지 10,000 IU./week, 수술 후 1개월 이후 10,000 IU./4 weeks · HBV-DNA(+) 또는 HBeAg(+): 수술 중 20,000 IU. 1회 투여, 수술 후 1주일까지 10,000 IU./day, 수술 후 1개월까지 10,000 IU./week, 수술 후 1개월 이후 10,000 IU./4 weeks. 다만, 1년 이상 장기간 이 약을 투여하는 경우에는 이 약의 사용 경험이 있는 의사의 감독 하에 anti-HBs의 농도를 유지하며 투여한다. **【사용상의 주의사항】** 1. 경고 1) 이 약은 사람혈장으로부터 제조되어 현재의 과학기술 수준에서 혈액 매개 바이러스 또는 다른 종류의 감염원(이론적으로는 CJD)의 감염 위험을 완전히 배제할 수 없다. (중략) 2. 다음 환자에는 투여하지 말 것. 이 약(면역글로불린)의 성분에 대한 과민반응의 병력이 있는 환자 (후략) **【제조자】** 에스케이플라즈마(주) 경상북도 안동시 풍산읍 산업단지길 157 **【판매자】** 에스케이플라즈마(주) 경기도 성남시 분당구 판교로 310 2020.07.03 개정
※ 처방하시기 전 제품설명서 전문을 참고하십시오. 최신 허가사항에 대한 정보는 '식품의약품안전처 의약품안전나라(<https://nedrug.mfds.go.kr/index>)'에서 확인할 수 있습니다.

Reference. 1. 정주용 헤파불린에스앤주 허가정보, 의약품안전나라 [Cited 2023.07.14] Available from: <https://nedrug.mfds.go.kr/>

HFS-HA03-202308-03

저온 플라즈마 멸균 멸균 분야의 든든한 파트너

FDA승인 의료용 저온 플라즈마 멸균기 STERRAD™ 멸균기

STERRAD™ 멸균기를 이용해 의료 기구를
멸균하고 기구로 인한 교차감염을 예방하고자 노력합니다.

“환자의 안전을 위해
끊임없이 노력합니다.”



이 제품은 의료기기이며, 사용상의 주의사항과 사용방법을 잘 읽고 사용하십시오.
(의료용 저온 플라즈마 멸균기, 의료용 제품을 저온 플라즈마를 이용하여 멸균하는 기구이다.)
STERRAD™ 100NX Sterilizer with ALLClear™ Technology (수인18-4562호)

신뢰로 함께 걸어온 길, 변함없이, TacroBell®

● 장기간 입증된 유효성과 안전성

TacroBell® 은 수년간 축적된 임상연구를 통해 유효성과 안전성이 입증된 면역억제제입니다.^{1, 2}

● 국내 유일 0.25mg 함량 보유

TacroBell® 은 국내 유일하게 0.25mg 제형을 보유한 제품으로, 목표 혈중 농도를 정밀하게 조절할 수 있습니다.^{3, 4}

Study design

1. 후향적, 관찰 연구로 2000년 1월부터 2013년 6월까지 신이식을 받고 타크로벨®(n=444) 또는 대조약(Prograf®, n=245)을 1차 면역억제제로 투여 받은 성인 수혜자의 유효성과 안전성 데이터 분석
2. 후향적, 관찰 연구로 2009년 1월부터 2016년 3월까지 간이식을 받고 타크로벨®(n=86) 또는 대조약(Prograf®, n=81)을 1년 이상 투여 받은 성인 수혜자의 유효성과 안전성 데이터 분석
3. 후향적, 단일기관 횡단분석 연구로 2000년부터 2016년까지 1차 간이식을 받은 성인 수혜자 3,620명의 면역억제제 데이터 분석

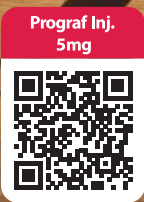
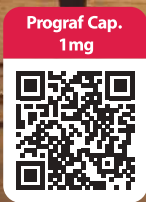
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1. Son SY, et al. Drug Des Devel Ther. 2017 Jan
2. Choi HJ, et al. Drug Des Devel Ther. 2018 Feb
3. Hwang S, et al. Ann Hepatobiliary Pancreat Surg. 2018 Feb
4. 식품의약품안전처, 의약품통합정보시스템 (열람기준일: 2025.09)

※ 본 자료에 인용된 문헌은 타크로벨 정궐술과 동일한 유효성분을 함유한 제제를 사용한 자료입니다.
※ 자세한 제품정보는 최신의 제품설명서 또는 의약품통합정보시스템(nedrug.mfds.go.kr)을 참고하시기 바랍니다.

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References
1. Kim SH, et al. *Hepatobiliary Pancreat Dis Int* 2015;14:374-9. 2. Guirado L, et al. *Transplantation Direct* 2015;1:224 [epub]

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(타크로리무스수화물)

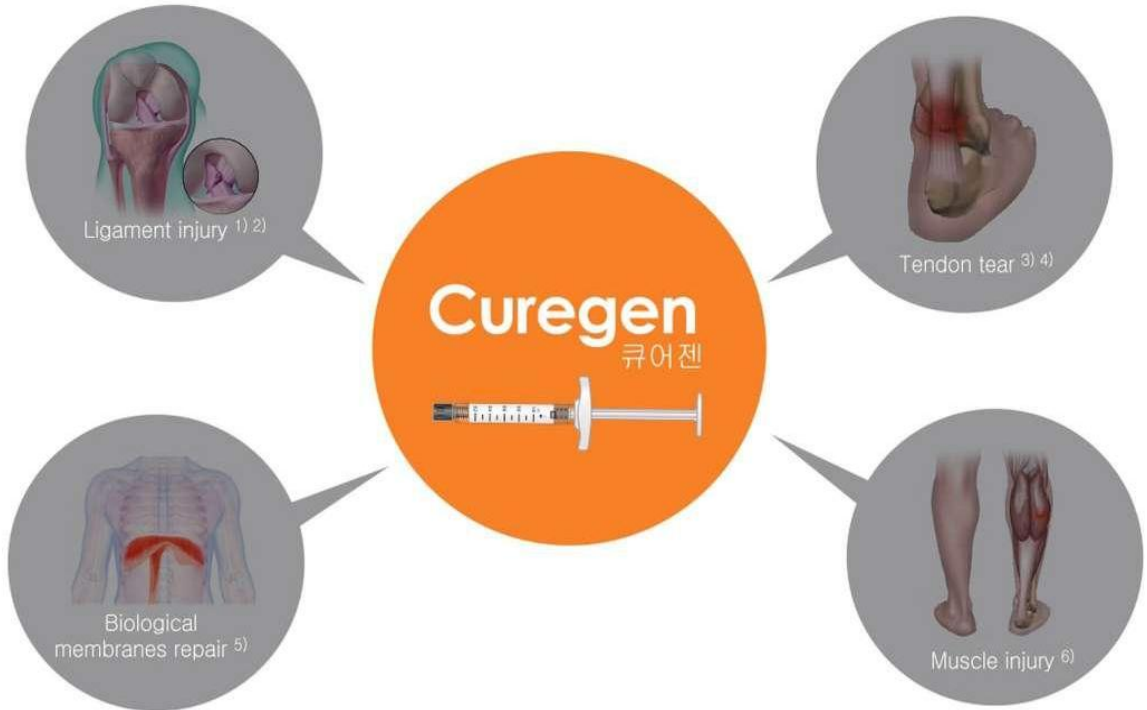


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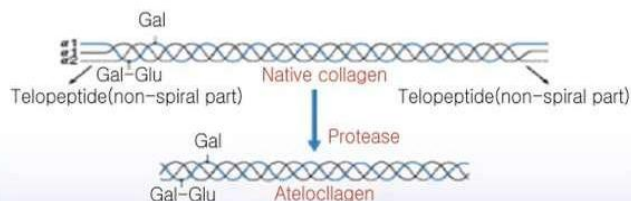


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Ref. 1) Maurits F.J et al., 2005, Age and Ageing, 34:120-124 3) Makoio N et al., 2002, Nutrition, 18:35-39 4) 효.외., 1991, 기초와 임상 25(6), 193 5) 효.외., 1990, JJPEN, 12(9):1160



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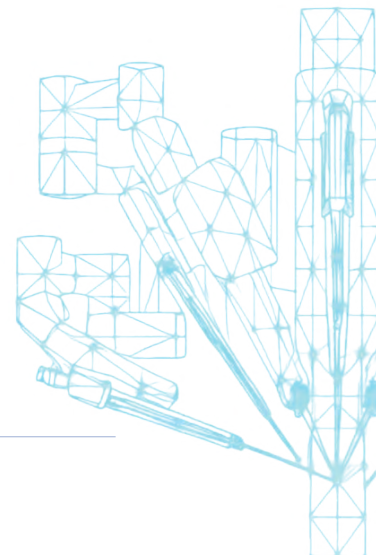


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Reference 1. Mizushima Y et al. Lipo-Prostaglandin E1-Development and Targeted Delivery of PGE1. In: *Progress In The Therapy Of Peripheral Vascular Diseases By Drug Delivery System*. Kawasaki: St. Marianna University; 1994:403-407.

	Day1_ May 14 (Thu)		Day2_ May 15 (Fri)		Day3_ May 16 (Sat)	
	Room 1	Room 2	Room 1	Room 2	Room 1	Room 2
09:00	Opening Ceremony					
09:30	Live Demonstration I Robotic Thyroidectomy	Video presentation I	Live Demonstration II Robotic Colectomy	Oral Presentation I	Unedited Surgical Video Demonstration I Hernia Repair KOR	Unedited Surgical Video Demonstration II Cholecystectomy KOR
10:00						
10:30	Break					
11:00	Plenary Session					
11:30	Special Lecture I		Special Lecture III		General Assembly of KAROS	
	Break					
12:00	Special Lecture II		Special Lecture IV		Award & Closing Ceremony	
12:30	Luncheon Symposium I HUINNO <small>Powering Healthcare</small>	Luncheon Symposium II meere company	Luncheon Symposium III LIV'SMED	Luncheon Symposium IV INTUITIVE		
13:00	Joint Symposium 01 KAROS - TRSA Joint Symposium	Symposium 01 BREAST Robotic Breast Surgery: Techniques and Outcomes	Joint Symposium 02 KAROS - ARIS Joint Symposium	Symposium 06 HBP Robotic HBP Surgery: Standardization and Innovative Techniques		
13:30						
14:00	Poster Presentation & Sponsored Spotlight Session					
14:30	Symposium 02 ENDO Robotic Endocrine Surgery: Techniques, Indications, and Outcomes	Symposium 03 New Technology KOR	Symposium 07 CR Advances in Robotic Colorectal Surgery: Techniques, Technologies, and Outcomes	Symposium 08 Basic Academy for Robotic Surgery Education Session KOR		
15:00						
15:30	Break					
16:00	Symposium 04 UGI Robotic Upper Gastrointestinal Surgery: Standardization, Techniques, and Outcomes	Symposium 05 Bridging Young Surgeons: Sharing the Path to Robotic Excellence	Oral Presentation II	Symposium 09 Robotic Surgery: Insights and Experiences from the Nursing Perspective KOR		
16:30						
17:00	Faculty Dinner		Gala Dinner			
17:30						
18:00						



Live Demonstration I

ENG

Chairs Sang-Wook Kang (Yonsei Univ.), Su-jin Kim (Seoul National Univ.)

09:00–11:00	Endocrine: Robotic Thyroidectomy	June Young Choi (Seoul National Univ.)	64
	Discussion	In Eui Bae (Konyang Univ.) Joon Hyop Lee (Sungkyunkwan Univ.)	

11:00–11:10 Break

Special Lecture I

ENG

Chair Hoon Yub Kim (Korea Univ.)

11:10–11:30	Robotic Thyroid Surgery	Woong Youn Chung (Yonsei Univ.)	67
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11:30–11:40 Break

Special Lecture II

ENG

Chair Hyung Jun Kwon (Kyungpook National Univ.)

11:40–12:00	Current Situation of Robotic Surgery in Taiwan	Yao-Ming Wu (National Taiwan Univ., Taiwan)	71
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Luncheon Symposium I

HUIINNO

ENG

Chair Boram Lee (Seoul National Univ.)

12:00–13:00	The Necessity of Perioperative ECG Monitoring in Patients Undergoing Non-Cardiac Surgery	Jae-Seung Jung (Korea Univ.)	75
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Joint Symposium 01 KAROS - TRSA Joint Symposium

ENG

Chairs Chang Moo Kang (Yonsei Univ.), Yao-Ming Wu (National Taiwan Univ., Taiwan)

13:00–13:20	The Hidden Key to Robotic Pancreaticoduodenectomy: Optimizing Bedside Assistant Performance	Po-Da Chen (National Taiwan Univ., Taiwan)	83
13:20–13:40	Experience in Liver Resection and Differences Between Da Vinci and Hugo	YoungRok Choi (Seoul National Univ.)	85
13:40–14:00	Single-stapled Anastomosis in Robotic Surgery	Chucheng Chang (China Medical Univ., Taiwan)	88
14:00–14:20	Integration of Single-Port and Multiport Approaches in Colorectal Cancer Surgery	Hye-Jin Kim (Kyungpook National Univ.)	90
14:20–14:30	MOU Ceremony	Moderator Hye-Jin Kim (Kyungpook National Univ.)	
14:30–14:50	Poster Presentation & Sponsored Spotlight Session		

Symposium 02 ENDO

ENG

Robotic Endocrine Surgery: Techniques, Indications, and Outcomes

Chairs Sang-Wook Kang (Yonsei Univ.), Hyunsuk Suh (American Endocrine., USA)

14:50–15:10	Robotic Thyroid and Adrenal Surgery: Indications, Technique, and Outcomes	Kwangsoon Kim (The Catholic Univ. of Korea)	93
15:10–15:30	Implementing Robotic Thyroidectomy in the U.S.: Bilateral Approach, Adoption, and Outcomes	Hyunsuk Suh (American Endocrine, USA)	96
15:30–15:50	Robotic Transaxillary Thyroidectomy and Lateral Neck Dissection (RTLND): Large-Scale Experience and Oncologic Outcomes	Jin Kyong Kim (Yonsei Univ.)	98
15:50–16:10	Robotic and Minimally Invasive Thyroidectomy: Patient Selection, Technique, and Outcomes	Pawan Prakash Rane (Healthway Hosp., India)	101
16:10–16:20	Discussion	Jin Wook Yi (Ain Hosp.) Ja Kyung Lee (Seoul National Univ.)	
16:20–16:30	Break		

Symposium 04 UGI

ENG

Robotic Upper Gastrointestinal Surgery: Standardization, Techniques, and Outcomes

Chairs Woo Jin Hyung (Yonsei Univ.), Aung Myint Oo (Tan Tock Seng Hosp.,Singapore)

16:30–16:50	Robotic Sleeve Gastrectomy: Early Experience and Safety from a Single Center	Young Suk Park (Seoul National Univ.)	105
16:50–17:10	Advances in Minimally Invasive Upper GI Surgery: The Singapore Experience	Aung Myint Oo (Tan Tock Seng Hosp.,Singapore)	107
17:10–17:30	Advanced Minimally Invasive Gastric Cancer Surgery: Robotic Techniques and Oncologic Safety	Masanori Tokunaga (National Cancer Center, Japan)	109
17:30–17:50	Robotic D2 Lymph Node Dissection During Distal Subtotal Gastrectomy for Gastric Cancer: Toward Procedural Standardization	Yoo Min Kim (Yonsei Univ.)	111
17:50–18:00	Discussion	Ji-Hyeon Park (The Catholic Univ. of Korea) Dongjae Jeon (Seoul National Univ.)	

Video Presentation I ENG

Chairs Sanghee Kang (Korea Univ.), Daegwang Yoo (Soonchunhyang Univ.)

09:00–09:10	Robot-Assisted Central Pancreatectomy: Laparoscopic Resection with Robotic Pancreaticojejunostomy Using a Modified Dunking Method	Hiang Jin Tan (Changi General Hosp., Singapore)	114
09:10–09:20	Robotic Gastric Wedge Resection: Why Orientation and Coordination Between Surgeon and Endoscopist Matter	Sathish Kumar Anandan (Surgical Oncology, India)	115
09:20–09:30	Single-Port Robotic Extended Totally Extraperitoneal Approach (ETEP) With Modified Madrid Transverse Abdominis Release (TAR) For Ventral Hernia With Wide Diastasis Recti	Seung-Rim Han (AIN Hosp.)	116
09:30–09:40	Robotic Duodenal Resection for GIST: Technical Tips and Operative Strategies	Junghoon Lee (Univ. of Ulsan)	117
09:40–09:50	Standardized Technique for Robotic Intracorporeal Overlap Anastomosis in Colon Cancer: Reliable Common Enterotomy Closure Using Bidirectional Barbed Sutures in 39 Consecutive Cases	Masatsune Shibutani (Osaka Metropolitan Univ., Japan)	118
09:50–10:00	SP Robot-Assisted Abdomino-Perineal Resection (Miles' Operation)	Woosung Son (Yonsei Univ.)	119
10:00–10:10	Robotic Transduodenal Tumor Excision For Periampullary Neuroendocrine Tumor In An Obese Patient	Dakyum Shin (Chosun Univ.)	120
10:10–10:20	Hybrid Choledochal Cyst Resection: A Video Demonstration of Laparoscopic Resection and Robotic Reconstruction	Abdullah Alqarni (King Abdullah Medical City, Saudi Arabia)	121
10:20–10:30	Feasibility of SP Robotic Appendectomy via the vNOTES Approach: Initial Experience During Concurrent Gynecologic Surgery	Sung Pil Choo (Inha Univ.)	122
10:30–10:40	Robotic Distal Pancreatectomy Using the Warshaw Technique With Unified Pancreas–Splenic Vein Transection	Quang Hung Vu (Univ. Medical Center of Ho Chi Minh City, Vietnam)	123
10:40–11:10	Break		

Special Lecture I Live Streaming from Room 1 | ENG

Chair Hoon Yub Kim (Korea Univ.)

11:10–11:30	Robotic Thyroid Surgery	Woong Youn Chung (Yonsei Univ.)	67
11:30–11:40	Break		

Special Lecture II Live Streaming from Room 1 | ENG

Chair Hyung Jun Kwon (Kyungpook National Univ.)

11:40–12:00	Current Situation of Robotic Surgery in Taiwan	Yao-Ming Wu (National Taiwan Univ., Taiwan)	71
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Luncheon Symposium II ENG

meerecompany

Chair Hyoung-II Kim (Yonsei Univ.)

12:00–13:00	Experience with the Revo-i Korean Robotic System for Gastrectomy in Gastric Cancer	Sung Hyun Park (Yonsei Univ.)	125
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Symposium 01 BREAST

ENG

Robotic Breast Surgery: Techniques and Outcomes

Chairs Ku Sang Kim (Kosin Univ.), Hyung Seok Park (Yonsei Univ.)

13:00–13:20	The First Multicenter Study of Robot-Assisted Breast-Conserving Surgery: Insights from the KoREa-BSG Group	Hee Jun Choi (Sungkyunkwan Univ.)	128
13:20–13:40	From Frontier to Follower Maturation of Robot-Assisted Breast Surgery	Young-Joon Kang (The Catholic Univ. of Korea)	130
13:40–14:00	Minimally Invasive Breast Surgery – Is the Future of Breast Surgery Robotic, Endoscopic, or Both?	Wen-Ling Kuo (Chang Gung Memorial Hosp., Taiwan)	134
14:00–14:20	Use of the da Vinci SP Surgical System in Robot-Assisted Nipple-Sparing Mastectomy	Sae Byul Lee (Univ. of Ulsan)	137
14:20–14:30	Discussion	Jee Ye Kim (Yonsei Univ.) Chihwan Cha (Hanyang Univ.)	
14:30–14:50	Poster Presentation & Sponsored Spotlight Session		

Symposium 03 New Technology

KOR

Chairs Chang Min Lee (Korea Univ.), Sangrok Jin (Pusan National Univ.)

14:50–15:10	Minimally Invasive Surgery Using Continuum Robot	Jongwoo Kim (Kyung Hee Univ.)	141
15:10–15:30	Update of Fluorescence Image-Guided Robotic Surgery	Gyung Mo Son (Pusan National Univ.)	143
15:30–15:50	Distributed Robot Intelligence	Seoungkyou Lee (Korea Univ.)	146
15:50–16:10	Physical AI Makes Surgery Reproducible and Scalable	Namkee Oh (Sungkyunkwan Univ.)	149
16:10–16:20	Discussion	Sahong Min (Univ. of Ulsan) Dakyum Shin (Chosun Univ.)	
16:20–16:30	Break		

Symposium 05 Bridging Young Surgeons: Sharing the Path to Robotic Excellence

ENG

Chairs Jae Do Yang (Jeonbuk National Univ.), Jae Hun Chung (Pusan National Univ.)

16:30–16:45	Learning Curve and Technical Insights in Robotic Colorectal Surgery	Hong-Min Ahn (Seoul National Univ.)	152
16:45–17:00	Expanding Indications of Robotic Gastrectomy: Challenges and Lessons from Early Experience	Chang Seok Ko (Univ. of Ulsan)	155
17:00–17:15	Overcoming the Learning Curve in Robotic Thyroidectomy: A Junior Surgeon’s Perspective	Jin Seok Lee (Ajou Univ.)	168
17:15–17:30	First Steps in Robotic HBP Surgery: Challenges and Opportunities in a Developing Center	Dakyum Shin (Chosun Univ.)	171
17:30–17:45	Integrating Robotics Into Bariatric Surgery: Early Outcomes and Technical Pearls	Bomina Paik (H+ Yangji Hosp.)	173
17:45–18:00	Discussion	Dong Gyu Kim (CHA Univ.) Sung Hyun Park (Yonsei Univ.)	

Live Demonstration II		ENG
		Chair Jin Kim (Korea Univ.)
09:00–11:00	CR: Robotic Colectomy	Gyoung Tae Noh (Ewha Womans Univ.) 177
	Discussion	Min Hyun Kim (Univ. of Ulsan) Jung Wook Suh (Dankook Univ.)
11:00–11:10	Break	
Special Lecture III		ENG
		Chair Kil Yeon Lee (Kyung Hee Univ.)
11:10–11:30	Recent Trends in Robotic Colorectal Surgery	Gyu-Seog Choi (Kyungpook National Univ.) 180
11:30–11:40	Break	
Special Lecture IV		ENG
		Chair Jung Wook Huh (Sungkyunkwan Univ.)
11:40–12:00	Building Robotic Surgery in Emerging Regions: The ARIS Initiative	Subhash Khanna (Swagat Hosp., India) 183
Luncheon Symposium III LIV SMED		ENG
		Chair Gyu-Seog Choi (Kyungpook National Univ.)
12:00–13:00	Feasibility and Safety of the New K-Surgical Robot (STARK) in a Porcine Model: Lessons Learned and Future Directions	Yoon Suk Lee (The Catholic Univ. of Korea) 188
Joint Symposium 02 KAROS – ARIS Joint Symposium		ENG
		Chairs Chang Moo Kang (Yonsei Univ.), Subhash Khanna (Swagat Hosp., India)
13:00–13:20	Robotic Abdominal Wall Reconstruction: State of the Art	Vivek Bindal (Max Healthcare, India) 191
13:20–13:40	Robotic Surgery for Advanced Gastric Cancer	Hyoung-Il Kim (Yonsei Univ.) 193
13:40–14:00	SSI Mantra Indian Robot: Recent Advances and Telesurgery	Somashekhar S.P (Aster DM Healthcare, India) 195
14:00–14:20	Robotic Abdominal Surgeries in Pediatric Age Group	Manjiri Somashekhar (Aster Hosp., India) 198
14:20–14:30	MOU Ceremony	Moderator Hye-Jin Kim (Kyungpook National Univ.)
14:30–14:50	Poster Presentation & Coffee Break	

Symposium 07 CR **ENG**
Advances in Robotic Colorectal Surgery: Techniques, Technologies, and Outcomes

Chairs Jun Seok Park (Kyungpook National Univ.), Jong Lyul Lee (Univ. of Ulsan)

14:50–15:10	Robotic Right Colectomy for Obese Patients	Mina Ming-yin Shen (China Medical Univ., Taiwan)	202
15:10–15:30	AI-Assisted Robotic Total Mesorectal Excision and Autonomic Nerve Preservation for Rectal Cancer	Sung Uk Bae (Keimyung Univ.)	204
15:30–15:50	Comparison between Robotic and Laparoscopic Staplers	Nan Zun Teo (Changi General Hosp., Singapore)	206
15:50–16:10	Robotic Surgery and Laparoscopic Surgery for Rectal Cancer	Songsoo Yang (Univ. of Ulsan)	208
16:10–16:20	Discussion	In Jun Yang (Chungnam National Univ.) Jeehye Lee (Yonsei Univ.)	
16:20–16:30	Break		

Oral Presentation II **ENG**

Chairs June Young Choi (Seoul National Univ.), Hye-Jin Kim (Kyungpook National Univ.)

16:30–16:40	Endocrine Resection in Volcanic and Mountainous Regions Reveals a Steep Divide Between Intraoperative Feasibility and Real Surgical Access When Secretory Phenotype Travel Delay and Hemodynamic Lability Converge	Muhammad Ibrahim Uwaisu (Annahda International Univ., Nigeria)	212
16:40–16:50	Conservative Deep Reinforcement Learning for Safety-Bounded Bimanual Micro-Assist in Robotic Suturing Using ROSMA and da Vinci Research Kit Evaluation	Sahnaz Vivinda Putri (Indonesia Open Univ., Indonesia)	214
16:50–17:00	Pediatric Abdominal Precision Surgery Reveals an Access Divide When Weight Thresholds Pediatric Airway Readiness Family Travel Strain and Time Sensitive Rescue Logistics Determine Who Reaches Operable Condition	Aminatus Saadah (Telkom Univ., Indonesia)	216
17:00–17:10	Curative Resection Margins Narrow When Mountain Travel Informal Healer Dependence Referral Delay and Preoperative Nutritional Depletion Converge Before Precision Oncologic Surgery in Patients Presenting With Locally Advanced Abdominal Malignancy	Ayuni Kemala Safira (Bandung Institute of Technology, Indonesia)	218
17:10–17:20	Single-Port versus Multiport Robotic Distal Pancreatectomy: Operative Outcomes and the Journey of the Learning Curve	Young-dong Yu (Korea Univ.)	220
17:20–17:30	Learning Curve of Single-port Axillary to Midline (SAM) Approach Robotic Thyroidectomy: A CUSUM Analysis	JungHak Kwak (Gibbeum Hosp.)	222

Oral Presentation I

ENG

Chairs **Min-Su Park** (Kyung Hee Univ.), **Young Suk Park** (Seoul National Univ.)

09:00–09:10	Textbook Outcomes of Totally Robotic Versus Totally Laparoscopic Pancreaticoduodenectomy for Periampullary Neoplasm: A Propensity Score-Matched Cohort Study	Pia Angelyn Sandoval (St Luke’s Medical Center - Quezon City, Philippines)	225
09:10–09:20	Not All Adrenal Masses Are Adrenal: A Robotic Revelation	Sathish Kumar Anandan (Surgical Oncology, India)	227
09:20–09:30	Long-Term Oncologic Outcomes of Robotic Versus Laparoscopic Total Mesorectal Excision for Rectal Cancer: A Propensity Score – Matched Study	Sung Uk Bae (Keimyung Univ.)	229
09:30–09:40	Novel Reconstruction Method After Minimally Invasive Segmental Gastrectomy For Early Gastric Cancer	Gennaro Melone (Univ. Campus Bio-medico, Italy)	231
09:40–09:50	Single Port Precision Surgery Falters Under Sterile Supply Disruption Load Instrument Turnover Delay And Perioperative Perfusion Instability Driving Intraoperative Variability And Functional Loss Across Resource Constrained Surgical Delivery Environments	Falakh Abdillah (Bhinneka Growth Generation Consultant, Indonesia)	233
09:50–10:00	Body Image Distress Travel Burden And Reoperation Risk Recast Candidate Selection for Advanced Minimally Invasive Breast Preservation When Preoperative Ptosis Severity And Skin Envelope Tension Signal Fragile Cosmetic Reserve	Farah Miftakul Ilfa (Pratama Clinic & Education Health Center, Indonesia)	235
10:00–10:10	Machine Learning Radiogenomic Model for Preoperative Case Selection in Robotic D2 Gastrectomy Stratifies Technical Complexity and Oncologic Suitability Using Integrated Imaging and Genomic Features	Prihantini Prihantini (IMCDS-BioMed Research Foundation, Indonesia)	237
10:10–10:20	Learning Curve of Advanced Platform Surgery Emerges When Team Attrition Instrument Readiness Volatility and Referral Leakage Amplify Console Idle Gap Procedural Drift and Late Stage Failure in Complex Robotic Practice	Nadeem Alam (Doha Institute for Graduate Studies, Qatar)	239
10:20–10:30	Image Guided Surgery for Complex Abdominal Disease Requires Readiness Metrics Linking Sterile Field Resilience Referral Queue Compression Instrument Reprocessing Delay and Intraoperative Navigation Drift in Resource Pressured Hospitals	Irish Merlyn Alvarez (National Univ. of Dasmariñas, Philippines)	241
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Special Lecture III

Live Streaming from Room 1 | ENG

Chair **Kil Yeon Lee** (Kyung Hee Univ.)

11:10–11:30	Recent Trends in Robotic Colorectal Surgery	Gyu-Seog Choi (Kyungpook National Univ.)	180
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Live Streaming from Room 1 | ENG

Chair **Jung Wook Huh** (Sungkyunkwan Univ.)

11:40–12:00	Building Robotic Surgery in Emerging Regions: The ARIS Initiative	Subhash Khanna (Swagat Hosp., India)	183
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Luncheon Symposium IV INTUITIVE

ENG

Chair **Jin Kim** (Korea Univ.)

12:00–13:00 My Experience with Advanced Energy (VSE & VSC) in CR Surgeries **In Ja Park** (Univ. of Ulsan) 244

Symposium 06 HBP

ENG

Robotic HBP Surgery: Standardization and Innovative Techniques

Chairs **Gi Hong Choi** (Yonsei Univ.), **Jae Hoon Lee** (Univ. of Ulsan)

13:00–13:20 Robotic Living Donor Liver Transplantation **Suk Kyun Hong** (Seoul National Univ.) 247

13:20–13:40 Robot-Assisted Pancreatectomy: SMA Approach **Kosuke Kobayashi** (Cancer Institute Hosp., Japan) 249

13:40–14:00 Applying the da Vinci SP Platform in Hepatobiliary Surgery: Practical Pearls and Pitfalls **Kwan Woo Kim** (Dong-A Univ.) 252

14:00–14:20 Minimally Invasive/Robotic Liver Resection **Taiga Wakabayashi** (Ageo Central General Hosp., Japan) 255

14:20–14:30 Discussion **Na Reum Kim** (Yonsei Univ.)
Soo Yeun Lim (Korea Univ.)

14:30–14:50 Poster Presentation & Sponsored Spotlight Session

Symposium 08 Basic Academy for Robotic Surgery Education

KOR

Chairs **Ki Byung Song** (Univ. of Ulsan), **Munseok Choi** (Yonsei Univ.)

14:50–15:10 Robotic Systems in Korea: What Every Surgical Trainee Should Know **Jin Kyong Kim** (Yonsei Univ.) 259

15:10–15:30 Learning Curve Evaluation of Surgical Trainees: Robotic vs. Laparoscopic Training Systems **Jimin Son** (National Cancer Center) 262

15:30–15:50 Becoming a Robotic Surgeon: From Simulation Lab to Operating Room **Hyokyung Kim** (Univ. of Ulsan) 264

15:50–16:10 Journey of a Surgical Trainee in Robotic Surgery: From Simulation to Clinical Practice **Hyunsik Jeong** (Univ. of Ulsan) 267

16:10–16:20 Discussion **Donghoon Kim** (Seoul National Univ.) **Ha Eun Kim** (Seoul National Univ.)
Heaeyeong Jeong (Seoul National Univ.) **Seok Jun Noh** (Univ. of Ulsan)
Da-hae Seo (Univ. of Ulsan) **Bora Hwang** (Yonsei Univ.)
Gayun Kim (Yonsei Univ.) **Jiwon Yang** (Soonchunhyang Univ.)
Jisoo Seo (Soonchunhyang Univ.) **Eunjee Kim** (Kyung Hee Univ.)
Seong Hee Lee (Chosun Univ.) **Kyungha Kim** (Chosun Univ.)
Kwonil Kim (Sungkyunkwan Univ.) **Mi Jin Kim** (Korea Univ.)

16:20–16:30 Break

Symposium 09 Robotic Surgery: Insights and Experiences from the Nursing Perspective **KOR**

Chairs **Hyun Jo Youn** (Jeonbuk National Univ.), **Jeonghee Lee** (Seoul National Univ. Bundang Hosp.)

16:30 – 16:45	Beyond the Console: The Power of Nursing in Robotic Surgery	Hyun-jung Song (Severance Hosp.)	274
16:45 – 17:00	All-Round Robotic SA: Role and Necessity	Juyeong Cheon (Seoul National Univ. Bundang Hosp.)	282
17:00 – 17:15	Efficient Management of Robot Instruments	Hyewon Kim (Kyung Hee Univ. Hosp.)	286
17:15 – 17:30	Methods for Increasing Robot Motion	Hyung Min Kim (Asan Medical Center)	294
17:30 – 17:40	Discussion	Jieun Moon (Asan Medical Center) Seonju Hwang (Yongin Severance Hosp.) Seok Ha Noh (Seoul National Univ. Bundang Hosp.) Hae Seok Oh (Severance Hosp.) Jieun Lee (Kyung Hee Univ. Hosp.)	

Unedited Surgical Video Demonstration I Hernia Repair **KOR**

Chairs **Kyung Won Seo** (Kosin Univ.), **Seung Kyu Jeong** (Yang Hosp.)

09:00–09:20	Robotic Inguinal Hernia Repair	Manwoo Park (Koo Hosp.)	298
09:20–09:40	SP Robotic eTEP with Unilateral TAR for Incisional Hernia	Seung-Rim Han (Ain Hosp.)	301
09:40–10:00	TAPP Repair for Inguinal Hernia	Sung Ryul Lee (Damsoyu Hosp.)	304
10:00–10:20	Discussion	Chul Seung Lee (Hansol Hosp.) Eunju Lee (Chung-Ang Univ.)	
10:20–10:30	Break		

Plenary Session **ENG**

Chairs **Jung Wook Huh** (Sungkyunkwan Univ.), **Hyung Jun Kwon** (Kyungpook National Univ.)

10:30–10:42	Proposal for Grading Intraoperative Bleeding and Hemostasis Strategies During Robot-Assisted Pancreatoduodenectomy	Yui Sawa (Japanese Foundation for Cancer Research, Japan)	308
10:42–10:54	Simultaneous Robotic Bilateral Nephrectomy and Kidney Transplantation in Autosomal Dominant Polycystic Kidney Disease: First Reported Case in Asia	Sung Shin (Univ. of Ulsan)	310
10:54–11:06	Robot Single-Site Plus One Spleen-Preserving Distal Pancreatectomy: Initial Experience	Jaewoo Kwon (Sungkyunkwan Univ.)	314
11:06–11:18	Comparison of Open, Laparoscopic, and Robotic Liver Resection for Intrahepatic Cholangiocarcinoma: Focus on Lymphadenectomy Adequacy	Na Reum Kim (Yonsei Univ.)	316
11:20–11:40	General Assembly of KAROS		
11:40–12:00	Award & Closing Ceremony		

Unedited Surgical Video Demonstration II Cholecystectomy KOR

Chairs Wan Wook Kim (Samil Hosp.), Kee Hwan Kim (The Catholic Univ. of Korea)

09:00–09:20	Single-Port Robotic Cholecystectomy with the Da Vinci SP Platform	Jin Woo Lee (Gibbeum General Hosp.)	319
09:20–09:40	Three-Port Versus Single-Port Laparoscopic Cholecystectomy: Balancing Surgeon Ergonomics, Safety, And Cosmetic Outcomes	Jinju Kim (Seongnam Citizens Medical Center)	322
09:40–10:00	Single-Port Robotic Cholecystectomy Using the da Vinci Xi System: Feasibility, Technical Modifications, and Limitations	Hwakyung Jung (Samil Hosp.)	325
10:00–10:20	Discussion	Junyub Kim (Chamjoeun Hosp.) Hyelim Joo (Kyung Hee Univ.)	
10:20–10:30	Break		

Plenary Session Live Streaming from Room 1 | ENG

Chairs Jung Wook Huh (Sungkyunkwan Univ.), Hyung Jun Kwon (Kyungpook National Univ.)

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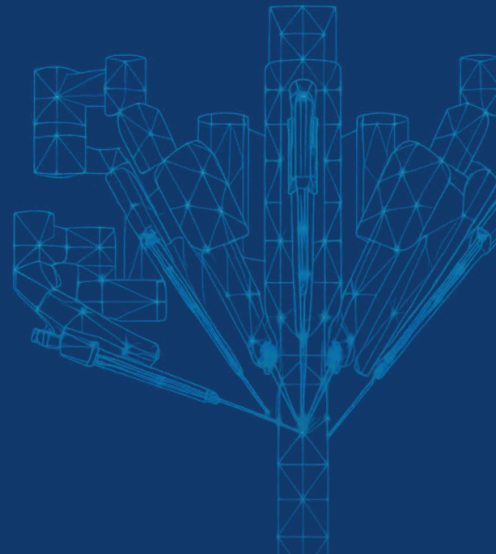


KAROS 2026

ENG

Live Demonstration I

Chairs Sang-Wook Kang (Yonsei Univ.), Su-jin Kim (Seoul National Univ.)



Day 1

| **Room 1** |



June Young Choi

Seoul National Univ.

EDUCATION

- 1996–2002 Bachelor's degree, Seoul National University College of Medicine, Seoul, Korea
- 2010–2012 Master's degree, Seoul National University College of Medicine, Seoul, Korea
- 2012–2018 Doctor of Philosophy, Seoul National University College of Medicine, Seoul, Korea

CAREER

- 2002–2007 Internship & Resident Course, Department of Surgery, Seoul National University Hospital, Seoul, Korea
- 2010–2011 Fellowship, Division of Endocrine Surgery, Department of Surgery, Seoul National University Hospital, Seoul, Korea
- 2012–2013 Clinical Assistant Professor, Department of Surgery, Seoul National University Hospital, Seoul, Korea
- 2013–2016 Clinical Assistant Professor, Department of Surgery, Seoul National University Bundang Hospital, Seongnam-si, Gyeonggi-do, Korea
- 2016–2022 Clinical Associate Professor, Department of Surgery, Seoul National University Bundang Hospital, Seongnam-si, Gyeonggi-do, Korea
- 2022– Clinical Professor, Department of Surgery, Seoul National University Bundang Hospital, Seongnam-si, Gyeonggi-do, Korea



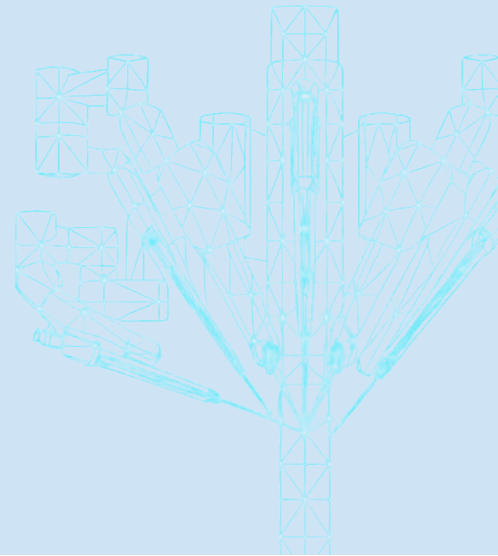


KAROS 2026

ENG

Special Lecture I

Chair Hoon Yub Kim (Korea Univ.)



Day 1

| **Room 1** |



Woong Youn Chung

Yonsei Univ.

EDUCATION

- 1985–1991 Medical Degree, Yonsei University College of Medicine, Korea
- 2001– Master Degree, Graduate School of Yonsei University, Korea
- 2011– Degree of Ph. D. Graduate School of Korea University, Korea

CAREER

- 2009–2013 Executive director, the Korean Society of Head and Neck Oncology
- 2009–2011 Founding Member of Clinical Robotic Surgery Association (CRSA)
- 2010–2011 Chair of Endocrine organizing committee of Clinical Robotic Surgery Association (CRSA)
- 2011–2012 The president, the Society of Robotic Surgery (SRS)
- 2013–2015 The vice president, the Korean Association of Robotic Surgery
- 2014–2019 The vice president, the Korean Intraoperative Neural Monitoring Society
- 2014–2016 Editor in chief, the Korean Association of Endocrine Surgeons
- 2015–2017 The president, the Korean Association of Robotic Surgery
- 2017–2019 The founding president, the Asia–pacific association of Robotic Surgeons
- 2018– The vice president, the Korean Association of Endocrine Surgeons
- 2019–2021 The chairman of the board of directors, the Korean Intraoperative Neural Monitoring Society
- 2021–2022 The president, the Korean Thyroid Association
- 2024–2026 The chairman of the board of directors, the Korean Association of Endocrine Surgeons



Robotic Thyroid Surgery

Woong Youn Chung Yonsei Univ.

The da Vinci robot is currently the most widespread robotic surgical system. By using this surgical system, four different types of robotic surgical approach (trans-axillary, BABA, retro-auricular and trans-oral) have been developed with the advantage of a superior field vision and technical advancements of robotic technology. Many authors reported various advantages in terms of post-operative outcomes. The safety and efficacy of these approaches make many surgeons possible to remove the thyroid gland with highly improved cosmetic outcomes.

I developed and started the procedure of gasless trans-axillary robotic thyroidectomy (RT) from 2007. I found that the robotic technique is safe and feasible in thyroid cancer patients, yielding excellent cosmetic results, reduced pain, improved sensory changes and decreased postoperative voice changes and swallowing discomfort. For surgeons, the use of a robot offers a shorter operation time and the need for a shorter learning curve than endoscopic thyroidectomy. RT also causes less musculoskeletal discomfort to surgeons than open or endoscopic thyroidectomy. These advantages of robotic surgery over open or endoscopic surgery suggest that RT may become the preferred surgical option for thyroid cancer patients with or without lateral LN metastasis.



Recently, AI has been integrated into various fields, particularly in medicine, where it has been enthusiastically embraced and can even rival the expertise of experienced medical professionals in the fields of disease diagnosis and even surgery. With the continuous advancement of technology and the refinement of regulations, we can anticipate that the combination of AI and robotic surgery will bring about further innovation and breakthroughs in the medical field.

Robotic thyroid surgery has seen significant advancements in recent years, offering patients more diverse treatment options. As technology continues to advance, the application of robotic thyroid surgery is expected to expand further, bringing benefits to a greater number of patients.



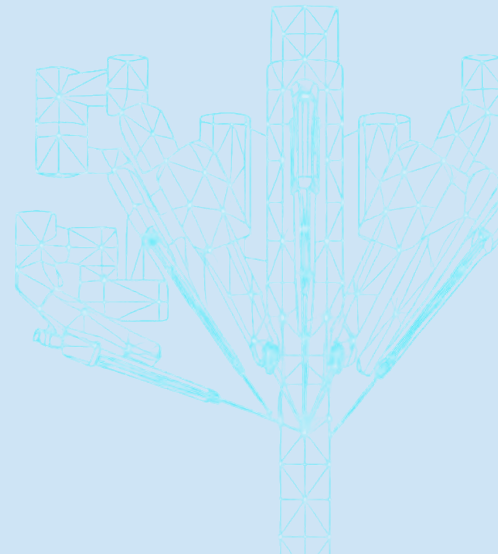


KAROS 2026

ENG

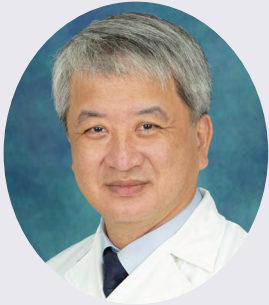
Special Lecture II

Chair Hyung Jun Kwon (Kyungpook National Univ.)



Day 1

| **Room 1** |



Yao-Ming Wu

National Taiwan Univ.,
Taiwan

EDUCATION

1987–1994 Medical college of National Taiwan University (NTUH)

CAREER

1994–2000 Resident and fellowship training in NTUH

2000– Housing staff in the Surgical Department of NTUH

2003–2005 Postdoctor research in Liver Research Center, Albert Einstein Medical College, New York City, USA

2005– Visiting liver transplant surgeon in UPMC (University Pittsburgh Medical Center)

2008–2014 Assistant Professor, Medical College, National Taiwan University

2014–2019 Associate Professor, Medical College, National Taiwan University

2019– Professor, Medical College, National Taiwan University

2021– Vice Superintendent of National Taiwan University Cancer Center (NTUCC)

2021– Director, Department of Surgery, NTUCC

2022– President of Taiwan Robotic Surgery Association (TRSA)



Current Situation of Robotic Surgery in Taiwan

Yao-Ming Wu National Taiwan Univ., Taiwan

Robotic-assisted surgery has become an integral component of modern surgical practice worldwide. From the perspective of the national robotic surgery community, Taiwan represents a notable example of sustained robotic surgical development characterized by gradual growth, expanding procedural diversity, and broad multi-specialty application.

Robotic surgery was first introduced in Taiwan in the mid-2000s. Over the past two decades, robotic platforms have been progressively incorporated into routine clinical practice nationwide. At present, nearly 100 robotic surgical systems are in clinical use, with over 100,000 patients having undergone robotic-assisted procedures and more than 1,000 surgeons receiving formal robotic training. These figures reflect widespread institutional adoption rather than experience limited to a small number of pioneer centers.

Robotic surgery in Taiwan has evolved from early adoption in a limited number of index specialties to a broadly applied, multi-specialty platform. While urology and gynecology remain foundational disciplines, recent years have witnessed rapid expansion into colorectal, general, hepatopancreatobiliary, and thoracic surgery. Currently, robotic surgery in Taiwan encompasses 40 or more distinct procedures across multiple organ systems, reflecting increasing procedural diversity, growing surgeon experience, and the maturation of robotic techniques in routine clinical practice.



In summary, robotic surgery in Taiwan has progressed from early adoption to a mature, widely utilized, multi-specialty surgical modality. The Taiwanese experience illustrates how robotic surgery can achieve broad clinical application at a national level and may provide useful insights for regions seeking to expand the scope and integration of robotic surgery.





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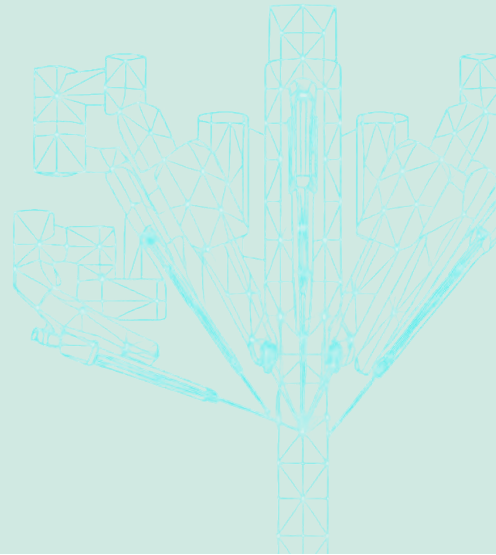
ENG

Luncheon Symposium I

HUINNO

Innovating Healthcare

Chair Boram Lee (Seoul National Univ.)



Day 1

| **Room 1** |



Jae-Seung Jung

Korea Univ.

EDUCATION

- 1993–1999 M.D. & Bachelor in Medical Science, Medical School of Korea University, Seoul, Republic of Korea
- 2000–2002 Master in Medical Science, Graduate School of Korea University, Seoul, Republic of Korea
- 2000–2002 Master Thesis, Effectiveness of Esophageal Ultrasonography in Surgical Therapy of Esophageal Cancer (Director: Prof. Kwang Taik Kim)
- 2002–2007 Ph.D. in Medical Science, Graduate School of Korea University, Seoul, Republic of Korea
- 2002-2007 Ph.D. Thesis, The Flow of Non-Pulsatile Pump to Maintain an Equal Coronary Flow on Fibrillating Heart by Pulsatile Pump. (Director: Prof. Kyung Sun)

CAREER

- 2007–2009 Clinical Fellow, Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, Seoul, Republic of Korea
- 2009–2014 Clinical Assistant Professor, Department of Thoracic and Cardiovascular Surgery, Advisor, Organ Transplantation Center, Korea University Medical Center, Seoul, Republic of Korea
- 2014–2015 Assistant Professor, Department of Thoracic and Cardiovascular Surgery, Korea University Medical Center, Seoul, Republic of Korea
- 2015–2020 Associate Professor, Department of Thoracic and Cardiovascular Surgery, Korea University Medical Center, Seoul, Republic of Korea
- 2019–2020 Visiting Academic Researcher, Critical Care Research Group, The Prince Charles Hospital / The University of Queensland, Brisbane, Australia
- 2018– Chief, Bloodless Medicine and Surgery Center, Korea University Medical Center
- 2020– Professor, Department of Thoracic and Cardiovascular Surgery, Korea University Medical Center, Seoul, Republic of Korea
- 2022– Chief, Intensive Care Unit, Korea University Medical Center



The Necessity of Perioperative ECG Monitoring in Patients Undergoing Non-Cardiac Surgery

Jae-Seung Jung Korea Univ.

Documents

CLINICAL PRACTICE GUIDELINE

2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines
Developed in Collaboration With and Endorsed by the American College of Surgeons, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and the Society for Vascular Medicine



Circulation Journal of Cardiology 20 2023 57-82

Society Guidelines

Canadian Cardiovascular Society Guidelines on Perioperative Cardiac Risk Assessment and Management for Patients Who Undergo Noncardiac Surgery
Emmanuelle Dorey, MD,^{1,2,3,4} Joel Fawcett, MD, MSc,^{5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}



European Heart Journal 2023 44, 3026-3104
https://doi.org/10.1093/eurheartj/ehad275



ESC GUIDELINES

2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery

Developed by the task force for cardiovascular assessment and management of patients undergoing non-cardiac surgery of the European Society of Cardiology (ESC)
Endorsed by the European Society of Anaesthesiology and Intensive Care (ESAIC)

AHA SCIENTIFIC STATEMENT

Diagnosis and Management of Patients With Myocardial Injury After Noncardiac Surgery A Scientific Statement From the American Heart Association

Kurt Ruetzler, MD, PhD, FAHA, Chair¹; Nathaniel R. Smolowitz, MD, MS, Vice Chair²; Jeffrey S. Berger, MD, MS³; P.J. Devereaux, MD, PhD, Bradley A. Maron, MD; L. Kristin Newby, MD, MHS; Vinicio de Jesus Perez, MD⁴; Daniel J. Soslow, MD, Danisa N. Vijayarathna, MD, PhD, FAHA on behalf of the American Heart Association Council on Cardiovascular, Critical Care, Perioperative and Resuscitation; Council on Clinical Cardiology; and Council on Cardiovascular Surgery and Anesthesia

2

왜 이 주제가 중요한가?

Perioperative cardiac complication 은 흔하고, 예후에 직접 연결됩니다.

- major noncardiac surgery 후 사망 수 환자에서 심혈관 합병증이 발생함이다.
 - Worldwide 1 in every 30-40 adults has major noncardiac surgery annually, and >10 million ... will suffer a major cardiac complication ... in the first 30 days after surgery.¹
 - CCS Guideline, 2017, Introduction, p.18.
- MINS는 약 20% 수준으로 보고되며, 대부분 무증상입니다.
 - Myocardial injury after noncardiac surgery occurs in ≈20% of patients who have major inpatient surgery, and most are asymptomatic.²
 - AHA Scientific Statement on MINS, abstract, 2021. p.e287.
- MINS와 관련된 30일 mortality는 높습니다.
 - Overall, 30-day mortality associated with MINS is high (approximately 10%).³
 - AHA/ACC Guideline, 2024, Perioperative Surveillance and Management of Myocardial Injury and Infarction section, p.1933.

Predictor	Preoperative/Intraoperative		Perioperative		Major Vascular		Major Mortality		Population
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
Preoperative risk factors									
Age									
65-74 yr	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
≥75 yr	1.58	1.45-1.72	1.58	1.45-1.72	1.58	1.45-1.72	1.58	1.45-1.72	1.58
Female	0.87	0.78-0.97	0.87	0.78-0.97	0.87	0.78-0.97	0.87	0.78-0.97	0.87
Major surgery	1.85	1.72-1.99	1.85	1.72-1.99	1.85	1.72-1.99	1.85	1.72-1.99	1.85
Major vascular surgery	2.05	1.91-2.20	2.05	1.91-2.20	2.05	1.91-2.20	2.05	1.91-2.20	2.05
Major mortality	2.18	2.04-2.33	2.18	2.04-2.33	2.18	2.04-2.33	2.18	2.04-2.33	2.18
History of MI	1.85	1.72-1.99	1.85	1.72-1.99	1.85	1.72-1.99	1.85	1.72-1.99	1.85
History of stroke	1.58	1.45-1.72	1.58	1.45-1.72	1.58	1.45-1.72	1.58	1.45-1.72	1.58
History of COPD	1.25	1.13-1.38	1.25	1.13-1.38	1.25	1.13-1.38	1.25	1.13-1.38	1.25
History of HF	1.42	1.30-1.55	1.42	1.30-1.55	1.42	1.30-1.55	1.42	1.30-1.55	1.42
History of PAD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of AKI	1.42	1.30-1.55	1.42	1.30-1.55	1.42	1.30-1.55	1.42	1.30-1.55	1.42
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of HTN	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of DM	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32	1.21-1.44	1.32
History of obesity	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18	1.08-1.29	1.18
History of CKD	1.								

왜 놓치는가?

Peri-OP myocardial injury/MI 는 대부분 증상으로 드러나지 않습니다.



- 수술 직후에는 진정, 진통, 수술부 통증 때문에 허혈 증상이 가려집니다.
 - "Most myocardial infarctions occur within 48 hours of noncardiac surgery when patients are receiving analgesic medications that can mask ischemic symptoms."
 - CCS Guideline, 2017, troponin monitoring section, p.27.
- 실제로 perioperative MI의 65%는 ischemic symptom 없이 발생합니다.
 - "65% of patients who suffer a perioperative myocardial infarction do not experience ischemic symptoms..."
 - CCS Guideline, 2017, troponin monitoring section, p.27-28.
- ESC도 PMI의 대부분이 무증상이라 surveillance 없이는 routine practice에서 놓친다고 설명합니다.
 - "PMI ... is largely asymptomatic in >90% of patients and is therefore missed in routine clinical practice in the absence of surveillance for PMI."
 - ESC Guideline, 2022, section 8, p.3893-3894.

4

증상이 없다고 안전한 것이 아닙니다.

Silent event 라도 예후는 결코 가볍지 않습니다.



- 무증상 perioperative MI도 30일 mortality 증가와 연관됩니다.
 - "Asymptomatic myocardial infarctions are associated with an increased risk of 30-day mortality..."
 - CCS Guideline, 2017, troponin monitoring section, p.27-28.
- MI criteria를 충족하지 않는 허혈성 troponin elevation도 30일 mortality 증가와 연관됩니다.
 - "Moreover, asymptomatic perioperative troponin elevation ... are also associated with an increased risk of 30-day mortality..."
 - CCS Guideline, 2017, troponin monitoring section, p.27-28.
- postoperative hsTnT 상승은 허혈성 feature가 없어도 30일 mortality와 연관됩니다.
 - "Elevated postoperative hsTnT without an ischemic feature was also associated with 30-day mortality."
 - Devereaux et al., JAMA 2017, abstract, p.1642.

SUPPLEMENTAL MATERIAL

Supplemental digital content 2, Table 1. Cox model exploring independent association between potential MINS diagnostic criteria of a peak Troponin T ≥ 0.04 ng/mL with and without an ischemic feature and 30-day mortality

Potential diagnostic criteria	Adjusted HR (95% CI)	p-value
Peak TnT ≥ 0.04 ng/mL with ≥ 1 ischemic feature	5.06 (3.55-7.21)	<0.001
Peak TnT ≥ 0.04 ng/mL without an ischemic feature	3.33 (2.28-4.87)	<0.001
TnT < 0.01 ng/mL	1.00	-

CI = confidence intervals; HR = hazard ratio; MINS = myocardial injury after noncardiac surgery; % = percentage; TnT = 4th generation Troponin T

Botto F, Alonso-Cuello P, Chan MT, et al. Myocardial injury after noncardiac surgery: a large, international, prospective cohort study establishing diagnostic criteria, characteristics, predictors, and clinical outcomes. *Anesthesiology* 2014;120:564-76.

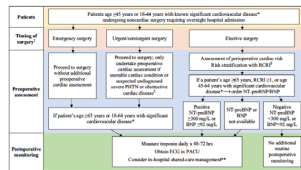
5

그래서 structured surveillance가 필요합니다.

가이드라인은 고위험군 surveillance를 일관되게 지지합니다.



- CCS는 고위험군에서 48-72시간 daily troponin과 PACU ECG를 포함한 monitoring flow를 제시합니다.
 - "measuring daily troponin for 48 to 72 hours after surgery ..."
 - CCS Guideline, 2017, abstract, p.17-18.
 - "Measure troponin daily x 48-72 hrs / Obtain ECG in PACU"
 - CCS Guideline, 2017, Figure 1, p.19.
- AHA 2021 statement는 고위험군에서 MINS surveillance가 warranted하다고 명시합니다.
 - "surveillance of myocardial injury after noncardiac surgery is warranted in patients at high risk ..."
 - AHA Scientific Statement on MINS, abstract, 2021, p.e287.
 - "troponin screening is indicated for high-risk patients."
 - AHA Scientific Statement on MINS, POSTOPERATIVE SURVEILLANCE section, 2021, p.e295.
- AHA/ACC 2024와 ESC 2022도 postoperative surveillance와 PMI work-up의 중요성을 강조합니다.
 - "Troponin surveillance may be reasonable ... to identify patients at elevated risk of postoperative events."
 - AHA/ACC Guideline, 2024, Perioperative Surveillance and Management of Myocardial Injury and Infarction section, p.1933.
 - "It is recommended to have high awareness ... combined with surveillance for PMI ..."
 - ESC Guideline, 2022, Recommendation Table 34 p.3899.
 - "Systematic PMI work-up is recommended ..."
 - ESC Guideline, 2022, Recommendation Table 34, p.3899.



Recommendation Table 34 — Recommendations for peri-operative cardiovascular complications

Recommendations	Class ^a	Level ^b
It is recommended to have high awareness of peri-operative CV complications, combined with surveillance for PMI in patients undergoing intermediate- or high-risk NCS. ^{1,11,12,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}	I	B
Systematic PMI work-up is recommended to identify the underlying pathophysiology and define therapy. ^{1,11,12,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}	I	B

6



왜 ECG 인가? (1/2)

1 ESC 2022: "ECG를 PMI work-up의 Step 1으로 명시"



"Detection of PMI should trigger ECG recording and detailed clinical evaluation for PMI work-up and therapy."
— ESC Guideline, 2022, Figure 4 caption, p.3850.

"To identify the underlying pathophysiology and define causal therapy, systematic work-up and early differentiation of primarily non-cardiac causes (e.g. severe sepsis, PE) vs. the different cardiac causes—including type-1 MI, type-2 MI, tachyarrhythmia, and acute HF—is of major importance (Figures 18 and 19)."
— ESC Guideline, 2022, section 8, p.3895.

Figure 19 (Systematic work-up of PMI) — Step 1: "12-lead ECG, symptoms, and haemoglobin"
— ESC Guideline, 2022, Figure 19, p.3896.

7

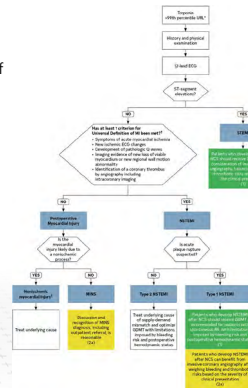
왜 ECG 인가? (2/2)

2 AHA/ACC 2024: Troponin 이상 시 "ECG"가 알고리즘의 첫 분기점



"overt postoperative MI, defined by ischemic symptoms or electrocardiographic changes..."
— AHA/ACC Guideline, 2024, Perioperative Surveillance and Management of Myocardial Injury and Infarction section, p.1933.

Figure 6 (Evaluation of an Abnormal Troponin)
— AHA/ACC Guideline, 2024, Figure 6, p.1934.



"Patients with perioperative STEMI due to acute plaque rupture ... is associated with in-hospital mortality of 30% to 35%. GDMT for patients with perioperative STEMI should be promptly initiated ... Emergent ICA should be strongly considered."
— AHA/ACC Guideline, 2024, section 9.2, p.1935.

8

그럼 단발성 ECG로 충분한가?

CCS 2017: ECG ischemic finding; 조기에 시작되며, 놓칠 수 있다.



"Another small study in vascular patients noted that 88% of patients who had ischemic findings on any postoperative ECG had changes detected on the immediate postoperative ECG (15 minutes after surgery); the concordance between ischemia on an ECG and elevation of troponin T level was 85%."
— CCS Guideline, 2017, Postoperative ECG section, p.28.

"The frequent onset of myocardial ischemia during the early postoperative period (< 60 minutes) was also seen in a study using continuous 12-lead ECG recordings after surgery."
— CCS Guideline, 2017, Postoperative ECG section, p.28.

"electrocardiographic abnormalities are usually transient..." — AHA Scientific Statement on MINS, POSTOPERATIVE SURVEILLANCE section, 2021, p.e295.

9



Telemetry ; Continuous ECG Monitoring



CCS 2017은 postoperative telemetry에 대해 "추가 이익이 확립되지 않았다"고 서술합니다.

"Because we recommend monitoring troponin in at-risk patients after surgery, the additional **benefits of postoperative telemetry monitoring have not been established**, and postoperative telemetry is associated with substantial **resources and costs**, panel members believed that the evidence was too weak to support a recommendation regarding postoperative telemetry monitoring."

— CCS Guideline, 2017, Postoperative telemetry section, p.28.

AF/POAF 관점 — ECG만이 잡을 수 있는 별도의 임상적 entity

"Patients with newly diagnosed atrial fibrillation ... have an increased risk of stroke ... These patients should be followed closely after surgery to treat reversible causes of arrhythmia and to assess the need for rhythm control and long-term anticoagulation."

— AHA/ACC Guideline, 2024, Top Take-Home Messages, p.1872.

"POAF is associated with increased risk of short- and long-term stroke and mortality."

— AHA/ACC Guideline, 2024, section 6.5, p.1908–1909.

10

Smart AI Telemetry (1/5)



유환양행-휴이노, AI 텔레메트리 솔루션 '메모큐' 공급...상용화 본격화

작성일 : 2026. 4. 21. 16:48



11

Smart AI Telemetry (2/5)



MEMO Patch M (ECG,HR,RR)
3rd Party Wearable Devices (SpO₂, etc.)



12



Smart AI Telemetry (3/5)



구분	HUINNO 휴이노	글로벌 A사
기기형태	패치형(초소형 초경량)	본체형(파우치, 벨트 착용)
무게(배터리 제외)	9g	240g
구성품	심전계(호흡포함), 산소포화도	심전계, 산소포화도, 호흡
Holter 수가 연동	✓	X
게이트웨이	무선 통신기기	-
통신환경	LTE, WIFI	무선(WLAN, ITS 전용망)
모니터링기간	8일	약 18 ~ 24시간
EX871 수가 적용	✓	○
제세동기보호(ICD) 및 페이스메이커(PPM) 호환	✓	○
인공지능 적용	AI (21년 글로벌대회 1등)	자체 SW
무상보증기간	3년	1년(표준)



13

Smart AI Telemetry (4/5)



14

Smart AI Telemetry (5/5)



기존 텔레메트리의 한계를 넘어 진단의 정밀함과 간편함을 동시에, 웨어러블 멀티리드 MEMO Patch T

임상 가치

기존 우선 텔레메트리와 동일한 수준의 멀티리드 심전도 감시를 유지하면서도, 환자에게는 선 없는 자유로움을 제공

* 3채널 측정 신호를 기반으로 한 알고리즘을 통해 최대 7개 유도 신호 (Lead I, II, III, aVR, aVL, aVF, V)를 생성

독보적 안전성

제세동 보호회로 적용으로 응급 상황 및 특수 환자군에서도 검증된 신뢰성으로 중단 없는 모니터링을 제공

15



| Summary



"가이드라인은 post-NCS continuous ECG monitoring을 아직 routine으로 권고하지 않지만, 유보의 근거였던 resource-cost 제약이 해소되고 있는 현 시점에서, 고위험군에 대한 임상적 활용은 적극 재고될 가치가 있습니다."

16



Q&A

17



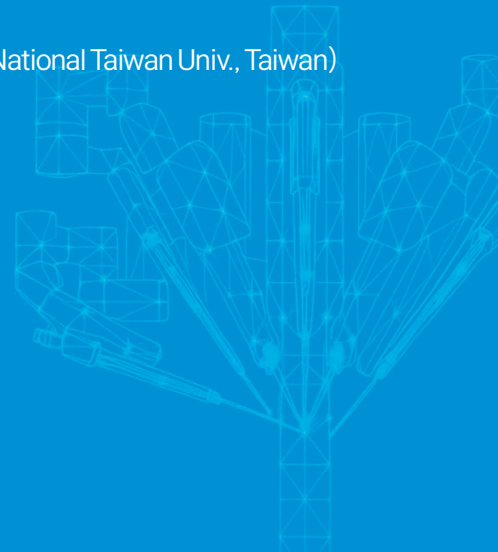


KAROS 2026

ENG

Joint Symposium 01
**KAROS - TRSA Joint
Symposium**

Chairs Chang Moo Kang (Yonsei Univ.), Yao-Ming Wu (National Taiwan Univ., Taiwan)



Day 1

| **Room 1** |



Po-Da Chen

National Taiwan Univ.,
Taiwan

EDUCATION

Doctor of Philosophy, Graduate Institute of Anatomy and Cell Biology,
National Taiwan University, Taipei, Taiwan

Doctor of Medicine, Taipei Medical University, Taipei, Taiwan

CAREER

Attending staff, Department of integrated diagnostics and therapeutics,
NTUH

Attending staff, Department of surgery, NTUH, Yun-Lin branch

- Present Attending staff, Department of surgery, National Taiwan University Hospital
- Present Attending staff, Department of surgical oncology, National Taiwan University Cancer Center
- Present Associate Professor, College of Medicine, National Taiwan University



The Hidden Key to Robotic Pancreaticoduodenectomy: Optimizing Bedside Assistant Performance

Po-Da Chen National Taiwan Univ., Taiwan

Robotic pancreaticoduodenectomy is often perceived as a console-driven procedure; however, its success depends equally on the performance of the bedside assistant. Far from a passive role, the assistant provides critical functions—including retraction, suction, vascular control, and stapling—particularly during key phases such as uncinete dissection and reconstruction. These contributions directly shape operative flow, safety, and efficiency.

With increasing experience, it becomes evident that the learning curve extends beyond the console surgeon to the entire operative team. An effective assistant must anticipate procedural steps, respond dynamically to intraoperative challenges, and maintain seamless coordination with the surgeon. This active engagement is essential for achieving a stable and controlled operative environment.

Robotic pancreaticoduodenectomy should therefore be regarded as a truly teambased endeavor. Recognizing, refining, and standardizing the role of the bedside assistant is crucial not only for improving perioperative outcomes but also for facilitating the broader adoption of robotic techniques in hepatopancreatobiliary surgery.





YoungRok Choi

Seoul National Univ.

EDUCATION

- 1999–2003 Busan National University College of Medicine
- 2007–2012 M.S., College of Medicine, Seoul National University

CAREER

- 2013–2014 Clinical instructor in Organ Transplantation Center
Seoul National University Hospital, Seoul, Korea
- 2014–2019 Clinical assistant Professor, Division of HBP, Department of Surgery
Seoul National University Bundang Hospital, Seoul, Korea
- 2019–2020 Clinical Associate Professor, Division of HBP, Department of Surgery
Seoul National University Bundang Hospital, Seoul, Korea
- 2018–2019 Visiting scholar at the University of Minnesota
- 2020– Associate Professor, Division of HBP, Department of Surgery
Seoul National University College of Medicine Seoul National University Hospital



Experience in Liver Resection and Differences Between Da Vinci and Hugo

YoungRok Choi Seoul National Univ.

Robotic liver surgery is entering a new phase as the field moves from a single-platform environment to a multi-platform era. The Da Vinci system remains the current benchmark, supported by mature technology, a broad instrument portfolio, stable docking, integrated fluorescence imaging, and extensive clinical experience. These strengths are particularly relevant in liver surgery, where precise dissection, reliable bleeding control, suturing capability, and safe workflow are essential.

At the same time, emerging platforms such as the Hugo RAS system are introducing new concepts in robotic surgery. Hugo offers an open console, modular arm carts, flexible operating room positioning, digital connectivity, and potential economic advantages. These features may provide benefits in team communication, teaching, and workflow flexibility, especially in complex upper abdominal procedures. However, compared with Da Vinci, Hugo is still a younger platform with a more limited instrument portfolio and less accumulated evidence in hepatobiliary surgery.



This presentation reviews the evolution of robotic liver surgery, compares the practical differences between Da Vinci and Hugo from the viewpoint of liver surgeons, and shares the early experience of Hugo robotic liver resection at Seoul National University Hospital. Our initial experience suggests that Hugo robotic liver surgery is feasible when cases are carefully selected and the surgical team is well prepared. Nevertheless, safe adoption requires structured training, thoughtful port placement and docking, technical adaptation for liver transection, and strong assistant support.

The key message is that robotic liver surgery should not be understood simply as a competition between platforms. Rather, surgeons must understand the strengths and limitations of each system and apply them safely, logically, and reproducibly to improve patient outcomes.





Chucheng Chang

China Medical Univ.,
Taiwan

EDUCATION

2002–2009 M.D., School of Medicine, Taipei Medical University, Taipei, Taiwan

CAREER

2010–2012 Taoyuan Veterans Hospital

2012–2016 Taipei Veterans General Hospital

2017–2018 Taipei Veterans General Hospital

2018–2020 En Chu Kong Hospital 2021- China Medical University
HsinChu Hospital





Hye-Jin Kim

Kyungpook National Univ.

EDUCATION

- 2001–2005 Bachelor of Science, Kyungpook National University, School of Medicine, Daegu, Korea
- 2006–2008 Master of Science, Kyungpook National University, School of Medicine, Daegu, Korea

CAREER

- 2010–2014 Clinical fellowship, Department of Colorectal Surgery, Kyungpook National University Hospital, Daegu, Korea
- 2014–2019 Assistant professor, Department of Colorectal Surgery, Kyungpook National University Hospital, Daegu, Korea
- 2019–2026 Associate professor, Department of Colorectal Surgery, Kyungpook National University Hospital, Daegu, Korea
- 2022–2023 Visiting scholar, University of California, San Diego, CA, USA
- 2026– Professor, Department of Colorectal Surgery, Kyungpook National University Hospital, Daegu, Korea





KAROS 2026

ENG

Symposium 02 ENDO

Robotic Endocrine Surgery: Techniques, Indications, and Outcomes

Chairs Sang-Wook Kang (Yonsei Univ.), Hyunsuk Suh (American Endocrine., USA)



Day 1

| **Room 1** |



Kwangsoon Kim

The Catholic Univ. of Korea

EDUCATION

- 1999–2005 Chemical and Biomolecular Engineering, KAIST, Republic of Korea
- 2005–2009 Eulji University, Republic of Korea Medicine
- 2011–2022 Ph.D., Eulji University, Republic of Korea

CAREER

- 2010–2014 Resident in Eulji Hospital
- 2017–2019 Fellowship in Severance Hospital
- 2019–2020 Fellowship in Seoul St. Mary Hospital
- 2020–2022 Clinical assistant professor in Seoul St. Mary Hospital
- 2022–2023 Assistant professor in Seoul St. Mary Hospital
- 2024– Associate professor in Seoul St. Mary Hospital



Robotic Thyroid and Adrenal Surgery: Indications, Technique, and Outcomes

Kwangsoon Kim The Catholic Univ. of Korea

Robotic surgery has emerged as a transformative approach in endocrine surgery, particularly for the management of thyroid and adrenal diseases. With advancements in surgical technology, including the development of single-port systems, robotic platforms now enable surgeons to perform complex procedures with enhanced precision, improved visualization, and greater dexterity in confined anatomical spaces. This presentation aims to provide a comprehensive overview of the current indications, operative techniques, and clinical outcomes of robotic thyroidectomy and adrenalectomy.

In thyroid surgery, robotic approaches such as transaxillary and transoral techniques have been widely adopted to improve cosmetic outcomes while maintaining oncologic safety. Indications have expanded from benign nodules to selected cases of differentiated thyroid cancer, including those requiring central or lateral neck dissection. Technical considerations, including flap creation, nerve identification, and preservation of critical structures such as the recurrent laryngeal nerve and parathyroid glands, will be discussed in detail.

In adrenal surgery, robotic adrenalectomy—particularly via the posterior retroperitoneoscopic approach—offers significant advantages in terms of direct access to the adrenal gland, reduced postoperative pain, and faster recovery. The role of robotic systems in complex cases, including pheochromocytoma and bilateral adrenal disease requiring cortical-sparing techniques, will also be highlighted.



Clinical outcomes from recent literature and institutional experience demonstrate that robotic endocrine surgery is safe and feasible, with favorable perioperative outcomes and high patient satisfaction. However, limitations such as cost, learning curve, and equipment availability remain important considerations.

In conclusion, robotic thyroid and adrenal surgery continues to evolve, expanding its indications and refining surgical techniques. With ongoing technological advancements and accumulation of clinical evidence, robotic approaches are expected to play an increasingly important role in the future of endocrine surgery.





Hyunsuk Suh

American Endocrine, USA

EDUCATION

- 1991–2001 B.S. in Biology, Emory University
 2001–2006 M.D., Johns Hopkins University School of Medicine

CAREER

- 2008–2010 Division of Surgical Oncology Research Lab. Principal Investigator: Jennifer E. Rosen, M.D. F.A.C.S.
 2006–2013 General Surgery Residency at Boston University Medical Center–Department of Surgery, Boston, MA 02118.
 2014 Endocrine Surgery Fellowship at Brigham and Women’s Hospital Department of Surgery, Boston, MA 02114.
 2013–2014 Endocrine Surgery Fellowship at Massachusetts General Hospital Department of Surgery, Boston, MA 02114.
 2014–2015 Robotic Endocrine Surgery Fellowship at Seoul National University Hospital Department of Surgery, Seoul, Korea
 2015–2020 Attending, General Surgery The Mount Sinai Hospital, Assistant Professor of Surgery Icahn School of Medicine at Mount Sinai
 2018–2020 Program Director of Mount Sinai Endocrine Surgery Fellowship
 2019–2020 Director of Surgery at Downtown Union Square Mount Sinai
 2023 Robotic Endocrine Surgery Fellowship at Yonsei University Severance Hospital Department of Surgery, Seoul, Korea
 2020–2024 Founder and Chief Surgeon at Suh Scarless Thyroid Center Hospital for Endocrine Surgery, Tampa FL
 2024– Founder & Chief Surgeon American Endocrine Atlanta





Jin Kyong Kim

Yonsei Univ.

EDUCATION

- 2013 M.D. Degree, Yonsei University College of Medicine, Seoul, Korea
- 2013–2014 Internship (Rotating), Yonsei University Medical Center, Seoul, Korea
- 2014–2018 Residency (Department of Surgery), Yonsei University Medical Center, Seoul, Korea
- 2018–2020 Fellowship (Division of Thyroid and Endocrine Surgery, Department of Surgery), Yonsei University Medical Center, Seoul, Korea

CAREER

- 2020– Clinical Assistant Professor (Department of Surgery), Yonsei University College of Medicine, Seoul, Korea



Robotic Transaxillary Thyroidectomy and Lateral Neck Dissection (RTLND): Large-Scale Experience and Oncologic Outcomes

Jin Kyong Kim Yonsei Univ.

Since our institution performed the world's first transaxillary robotic thyroidectomy in 2007, robotic thyroid surgery has undergone remarkable technical evolution. Beginning in 2008, we expanded this approach beyond thyroidectomy to include robotic modified radical neck dissection for selected patients with thyroid cancer and lateral neck lymph node metastasis. Over the last 18 years, our institution has accumulated extensive experience in robotic transaxillary thyroidectomy and robotic lateral neck dissection, establishing one of the largest single-institution experiences worldwide.

The purpose of robotic transaxillary thyroid surgery is not limited to avoidance of a visible cervical scar. Rather, its ultimate goal is to achieve oncologically radical surgery through a remote-access approach while minimizing procedure-related invasiveness. Throughout the past two decades, improvements in robotic platforms, endoscopic visualization, surgical instruments, and energy devices, together with accumulated surgical expertise, have enabled progressive refinement of operative techniques. These include optimized flap design, working space creation, docking strategy, dissection sequence, and compartment-oriented lymph node dissection.



Robotic transaxillary lateral neck dissection requires precise anatomic understanding from a lateral remote-access perspective. Safe and effective dissection demands meticulous identification and preservation of critical structures, including the internal jugular vein, carotid artery, vagus nerve, spinal accessory nerve, phrenic nerve, brachial plexus, thoracic duct, and cervical lymphatic structures. With increasing experience, our technique has evolved toward maintaining oncologic radicality while reducing flap extent, tissue trauma, and procedure-related morbidity.

In this presentation, we will share our 18-year journey and large-scale experience with robotic transaxillary thyroidectomy and lateral neck dissection. We will discuss the technical evolution of the procedure, perioperative outcomes, oncologic safety, and long-term institutional efforts to reduce surgical invasiveness without compromising oncologic completeness. Our experience may provide insight into the current role and future direction of robotic transaxillary surgery in the treatment of thyroid cancer requiring lateral neck dissection.





Pawan Prakash Rane

Healthway Hosp., India

EDUCATION

- 2001–2006 Bachelor of Medicine, Bachelor of Surgery (MBBS), Goa Medical College, Bambolim, Goa University, India
- 2007–2010 Master of Surgery (MS) in Otorhinolaryngology (ENT), Goa Medical College, Bambolim, Goa University, India

CAREER

- 2010–2012 Senior Research Fellow, Department of Head and Neck Surgical Oncology, Tata Memorial Hospital, Mumbai, India
- 2015–2019 Consultant Head and Neck Surgical Oncologist, Kolhapur Cancer Centre, Kolhapur, India
- 2019– Co-Founder and Consultant, Reverse Infinity Clinic & Lab, Goa, India
- 2019– Visiting Consultant Head and Neck Surgical Oncologist, Kolhapur Cancer Centre, Kolhapur, India



Robotic and Minimally Invasive Thyroidectomy: Patient Selection, Technique, and Outcomes

Pawan Prakash Rane Healthway Hospital, India

Minimally invasive thyroid surgery has changed significantly in just twenty years. People want better cosmetic results and more precise surgery, so it's no surprise that robotic systems have become mainstream. Surgeons now have tools that offer sharper visuals, easier handling, and better ergonomics. The da Vinci system paved the way, but new options like the CMR Versius Surgical System, SSI Mantra, and Medtronic's Hugo are showing up more and more. These systems bring flexibility, and the cost benefits are fairly balanced.

This review dives into how surgeons choose the right patients, the procedures themselves, and what's happening with outcomes for robotic and minimally invasive thyroidectomy. It especially looks at how different robotic platforms fit into the picture, drawing on practical experience with the Versius system.

We cover the main remote-access techniques—transaxillary, BABA (bilateral axillo-breast), TOETVA (transoral vestibular), and retroauricular approaches. Picking the right patient depends on their local factors, anatomy, and making sure treatment stays safe. We look at the details that make robotic thyroidectomy unique, talking through methods with both the da Vinci and Versius systems. The focus is on staying ergonomic throughout the operation.



Robotic thyroidectomy matches the results of open surgery for the right patients. It keeps rates of complications like nerve injury and hypoparathyroidism low. In daily practice, the Versius platform stands out for its modular arms, flexible port placements, and how it adapts to different operating rooms. These strengths really help when surgeons need flexibility—especially if resources are limited. Comparing systems shows the basics don't really change, but little differences in handling and workflow can affect speed and how quickly surgeons master the technique.





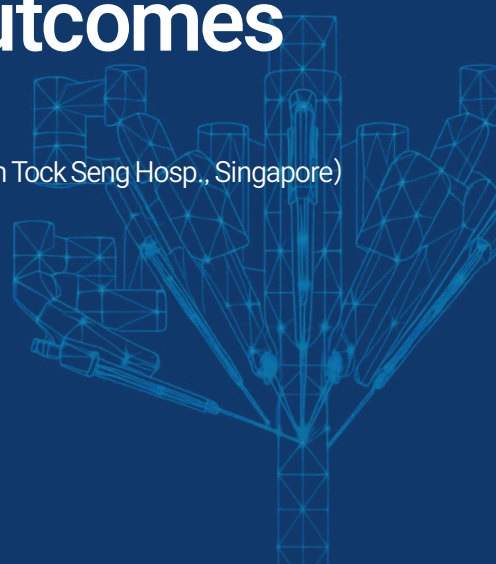
KAROS 2026

ENG

Symposium 04 UGI

Robotic Upper Gastrointestinal Surgery: Standardization, Techniques, and Outcomes

Chairs Woo Jin Hyung (Yonsei Univ.), Aung Myint Oo (Tan Tock Seng Hosp., Singapore)



Day 1

| **Room 1** |



Young Suk Park

Seoul National Univ.

EDUCATION

- 2001–2007 MD, Seoul National University School of Medicine, Seoul, Korea
- 2014–2016 MS(Clinical Medical Sciences), Seoul National University School of Medicine, Seoul, Korea
- 2016–2024 PhD(GI Surgery), Seoul National University School of Medicine, Seoul, Korea

CAREER

- 2007–2008 Internship, Medicine, Seoul National University Hospital
- 2010–2014 Residency, Surgery, Seoul National University Hospital
- 2014–2016 Fellowship, GI Surgery, Seoul National University Bundang Hospital
- 2016–2017 Clinical Instructor, GI Surgery, Seoul National University Bundang Hospital
- 2017–2020 Clinical Assistant Professor, GI Surgery, Seoul National University Bundang Hospital
- 2020–2024 Assistant Professor, GI Surgery, Seoul National University Bundang Hospital
- 2024– Associate Professor, GI Surgery, Seoul National University Bundang Hospital
- 2024–2025 Research Scholarship, Laboratory for Surgical and Metabolic Research, Brigham and Women's Hospital, Boston, MA, USA





Aung Myint Oo

Tan Tock Seng Hosp.,
Singapore

EDUCATION

2013–2016 Master of Clinical Investigation (MCI), Ministry of Health
Healthcare Research Scholarship, National University of
Singapore

CAREER

Fellowship training, Health Manpower Development Plan (HMDP)
scholarship, Seoul National University Bundang Hospital, Korea

Present Senior Consultant Surgeon, Department of General Surgery
and Assistant Chief Clinical Informatics Officer, Tan Tock
Seng Hospital, Singapore

Present Clinical Lead in the Digital Innovation Office, Centre for
Healthcare Innovation (CHI), National Healthcare Group
Health

Present Assistant Professor and an assistant clinical module
lead (gastrointestinal system), Lee Kong Chian School of
Medicine, Nanyang Technological University of Singapore

Present Clinical senior lecturer, Yong Loo Lin School of Medicine,
National University of Singapore



Advances in Minimally Invasive Upper GI Surgery: The Singapore Experience

Aung Myint Oo Tan Tock Seng Hosp., Singapore

Minimally invasive surgery (MIS) has markedly transformed upper gastrointestinal (GI) surgery by reducing surgical trauma, accelerating recovery, and improving perioperative outcomes without compromising surgical or oncological principles. Singapore has been at the forefront of this transformation through early adoption of advanced laparoscopy, robotic-assisted surgery, and innovative endoscopic techniques within a highly integrated healthcare and academic ecosystem.

This presentation will highlight the evolution and current role of MIS in upper GI surgery in Singapore, with particular emphasis on the expanding application of robot-assisted upper GI surgery, driven by its technical advantages in precision, dexterity, and complex dissection. The integration of advanced endoscopic and hybrid approaches, together with other minimally invasive adjuncts, will be discussed as part of a patient-centred, multimodal treatment strategy.

Institutional outcomes from Singapore demonstrate reduced postoperative morbidity, shorter hospital stays, and oncologic outcomes comparable to conventional open surgery. Finally, future directions—including image-guided surgery, artificial intelligence, and next-generation robotic platforms—will be explored. Singapore’s continued emphasis on innovation, subspecialisation, and surgical education remains central to advancing minimally invasive upper GI surgery.





Masanori Tokunaga

National Cancer Center,
Japan

EDUCATION

1994–2000 M.D. College of Medicine, Kyushu University, Fukuoka, Japan

CAREER

2000–2006 Department of Surgery, Aso-lizuka Hospital, Fukuoka, Japan

2006–2009 Department of Gastroenterological surgery, Cancer Institute Hospital, Tokyo, Japan

2009–2017 Division of Gastric Surgery, Shizuoka Cancer Center, Shizuoka, Japan

2017–2019 Gastric Surgery Division, National Cancer Center Hospital East, Kashiwa, Japan

2019– Department of Gastrointestinal Surgery, Institute of Science Tokyo (Tokyo Medical and Dental University), Tokyo, Japan



Advanced Minimally Invasive Gastric Cancer Surgery: Robotic Techniques and Oncologic Safety

Masanori Tokunaga National Cancer Center, Japan

The number of robotic gastrectomies is increasing in Japan, with robotic surgery accounting for around a quarter of all gastrectomy cases in 2023. Robotic surgery has attracted many surgeons due to its numerous advantages, including articulated instruments, a tremor-cancelling function, better ergonomics and a high-quality 3D view. These features are believed to contribute to improved surgical outcomes for patients. However, the lack of tactile feedback in conventional robots was considered one of their drawbacks. This issue has been partially resolved by newly developed surgical robots, such as the da Vinci 5, which has force feedback, and the Suro, which has installed grasping force feedback.

In our institution, the robotic approach has become the preferred option for all types of gastrectomy, including conversion cases and gastric stump carcinoma. Our procedure is straightforward: a dry surgical field is crucial for robotic surgery to be performed safely and effectively. We prefer to use the so-called double bipolar method with soft coagulation mode to achieve this. This presentation will showcase a typical robotic gastrectomy case from our institution and clarify the short- and long-term outcomes to evaluate the oncological safety of the robotic procedure.





Yoo Min Kim

Yonsei Univ.

EDUCATION

- 2004 M.D., Yonsei University College of Medicine
- 2011 M.S., Graduate School of Medicine, Yonsei University
- 2017 Ph.D., Graduate School of Medicine, Yonsei University

CAREER

- 2006–2010 Internship and Residency, Department of Surgery, Severance Hospital, Yonsei University College of Medicine
- 2011–2012 Clinical Fellow, Division of Gastrointestinal Surgery, Department of Surgery, Severance Hospital, Yonsei University College of Medicine
- 2013 Clinical Professor, Division of Gastrointestinal Surgery, Dong-A University Medical Center
- 2014–2019 Assistant Professor, Department of Surgery, CHA Bundang Medical Center, CHA University



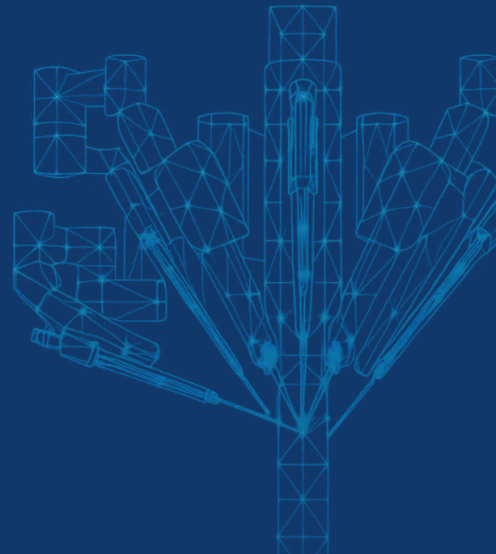


KAROS 2026

ENG

Video Presentation I

Chairs Sanghee Kang (Korea Univ.), Daegwang Yoo (Soonchunhyang Univ.)



Day 1

| **Room 2** |

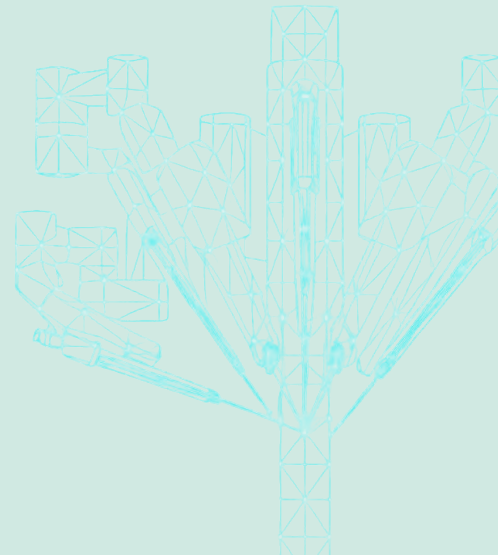


KAROS 2026

ENG

Luncheon Symposium II
meerecompany

Chair Hyoung-II Kim (Yonsei Univ.)



Day 1

| **Room 2** |



Sung Hyun Park

Yonsei Univ.

EDUCATION

- 2011 Yonsei University, Pre-medicine Program
- 2015 Yonsei University, College of Medicine, Seoul, Korea: MD
- 2022 Yonsei University, College of Medicine, Seoul, Korea: BS
- 2022 Yonsei University, College of Medicine, Seoul, Korea

CAREER

- 2015–2016 Internship, Severance Hospital, Yonsei University, Seoul, Korea
- 2016–2020 Resident, Department of Surgery, Severance Hospital, Yonsei University, Seoul, Korea
- 2021–2023 Fellow, Department of Surgery, Severance Hospital, Yonsei University, Seoul, Korea
- 2023–2026 Clinical Assistant Professor, Department of Surgery, Severance Hospital, Yonsei University, Seoul, Korea
- 2026– Assistant Professor, Department of Surgery, Severance Hospital, Yonsei University, Seoul, Korea





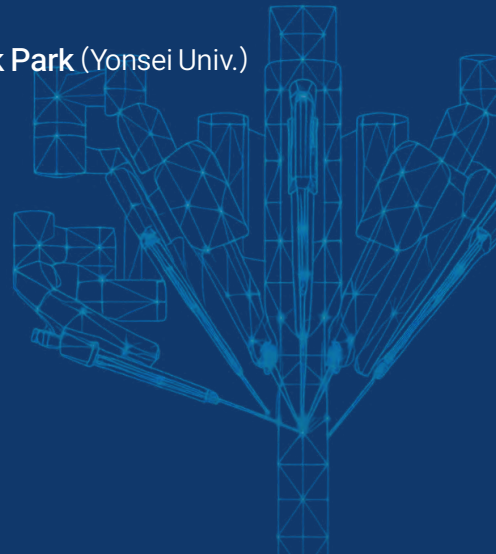
KAROS 2026

ENG

Symposium 01 BREAST

Robotic Breast Surgery: Techniques and Outcomes

Chairs Ku Sang Kim (Kosin Univ.), Hyung Seok Park (Yonsei Univ.)



Day 1

| **Room 2** |



Hee Jun Choi

Sungkyunkwan Univ.

EDUCATION

B.S., Gachon University College of Medicine

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Ph.D., Pusan National University

CAREER

Resident in Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine

Clinical Fellow in Breast Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine

Assistant Professor, Department of Surgery, Samsung Changwon Hospital, Sungkyunkwan University School of Medicine

Present Associate Professor, Department of Surgery, Director of the Breast & Thyroid Cancer Center, Samsung Changwon Hospital, Sungkyunkwan University School of Medicine



The First Multicenter Study of Robot-Assisted Breast-Conserving Surgery: Insights from the KoREa-BSG Group

Hee Jun Choi Sungkyunkwan Univ.

Robot-assisted breast conserving surgery (RABCS) improves the cosmetic outcomes without any scar on the breast over conventional breast conserving surgery (CBCS). However, data on the feasibility and safety of the RABCS are limited.

A retrospective review was conducted to identify women who underwent RABCS as part of the Korea Robot-Endoscopy & Minimal Access Breast Surgery Study Group (KoREa-BSG) multicenter trial between 2019 and 2023.

This was the first multicenter report of RABCS. RABCS could be a technically feasible and acceptable. Further subsequent comparative study with CBCS and prospective research are needed to evaluate the surgical and oncologic outcomes.





Young-Joon Kang

The Catholic Univ. of Korea

EDUCATION

Medical Doctor, Dongguk University College of Medicine

Master's degree in medicine, Surgery, Dongguk University College of Medicine

Doctoral degree in Medicine, Surgery, Dongguk University College of Medicine

CAREER

Assistant Professor, Department of Breast and Thyroid Surgery, Incheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea

Chief, Department of Surgery, Incheon Medical Center

Clinical Professor, Department of Breast Surgery, Seoul National University Hospital

Consultant Department of Surgical Oncology, Sheikh Khalifa Specialty Hospital

Clinical Fellow, Breast and Endocrine Surgery, Seoul National University Hospital

Intern, Resident, Department of Surgery, Dongguk University Ilsan Hospital



From Frontier to Follower Maturation of Robot-Assisted Breast Surgery

Young-Joon Kang The Catholic Univ. of Korea

Robotic breast cancer surgery has progressed through the contributions of pioneer groups in Korea and internationally. This lecture reviews that development from an academic perspective, presents a Korean multicenter learning-curve study on robot-assisted nipple-sparing mastectomy (RANSM), and outlines the direction of AI applications in robotic surgery, with particular relevance to surgical training.

The base of robotic mastectomy evidence in Korea has been produced by the Korea Robot-endoscopy Minimal Access Breast Surgery Study Group (KoREa-BSG), which established feasibility and initial oncologic safety of RANSM in a multicenter setting (Ryu JM et al., *Annals of Surgery*, 2022). Subsequent work extended the evidence base to a comparison of 1,583 patients undergoing minimal-access versus conventional nipple-sparing mastectomy across 21 Korean hospitals, with oncologic and complication outcomes supporting the safety of the minimal-access approach (Kim JH et al., *JAMA Surgery*, 2024). The multicenter experience of robot-assisted breast-conserving surgery in 150 patients across 7 institutions was reported in 2025 (*Surgical Endoscopy*, 2025). An international consensus statement on RANSM incorporating experts input was published in 2025 (*J Breast Cancer*, 2025).



Among the KoREa-BSG outputs, a multicenter retrospective study was designed to compare RANSM learning curves between surgeons who adopted the technique in different periods. The study analyzed 306 patients treated by 17 surgeons at 16 Korean academic hospitals between November 2016 and October 2022. Surgeons were categorized by the calendar date of their first RANSM into frontier ($n = 8$; first RANSM November 2016–January 2020) and follower ($n = 9$; first RANSM February 2020–July 2022) groups. Mastectomy operation time was modeled against sequential case number by linear regression in each group; the follower group showed a slope of -3.18 minutes per case versus -0.86 for the frontier group ($p < 0.0001$), with a plateau approached at approximately 10 to 15 cases. This corresponds to a 3.7-fold faster reduction in operation time in follower surgeons, with the operative-time plateau reached earlier in their adoption sequence (Kim JH et al., manuscript under review).

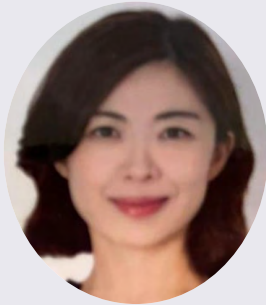
Extending the preceding Korean studies, the ROM prospective multicenter randomized controlled trial is currently in progress, while AI-based approaches are developing as a future research direction, including training and educational applications that extend the learning-curve findings. The ROM trial (Robot-assisted versus Open nipple-sparing Mastectomy with Immediate Breast Reconstruction) compares RANSM with conventional open NSM, both with immediate breast reconstruction, across 14 Korean centers ($n = 790$). The primary endpoint is 5-year disease-free survival with a pre-specified non-inferiority margin of 7.2 percentage points.

Work on AI-based assistance specific to robotic breast surgery is currently limited. A deep learning-based model for guiding the dissection plane during RANSM was trained on 8,834 annotated frames from 10 RANSM videos performed between 2016 and 2020, with Dice similarity coefficients of 0.83 and 0.82 against two expert annotators (Lee J, Ham S, Kim N, Park HS. Breast Cancer Research, 2025). Broader computer vision applications in robotic surgery education — automated skill assessment, surgical phase recognition, anatomical landmark identification, and intraoperative performance feedback — have been studied primarily outside breast surgery. Translation of these methods to robotic breast surgery has not been established.



The evidence reviewed above addresses RANSM at three connected levels. First, oncologic safety, feasibility, and comparative outcomes have been shown across Korean multicenter cohorts, with international consensus recommendations available and prospective validation through the ROM trial in progress. Second, the learning-curve study identified participation in structured training components as the factor associated with a steeper learning curve, shifting the adoption question from case volume to training quality. Third, AI-based assistance — including training and educational applications — is a developing research direction at a preliminary stage of breast-specific evidence, with methodological templates available from broader robotic surgery computer vision research.





Wen-Ling Kuo

Chang Gung Memorial
Hosp., Taiwan

EDUCATION

- 1994–2001 M.D., Department of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan
- 2007–2018 Ph.D., Graduate Institute of Clinical Medicine, College of Medicine, Chang Gung University, Taoyuan, Taiwan
- 2013–2016 Visiting Scientist, Department of Molecular and Cellular Oncology, UT MD Anderson Cancer Center, Texas, US

CAREER

- 2012– Instructor & Attending Surgeon, Division of General Surgery and Breast Surgery, Department of Surgery, Chang Gung Medical Foundation, Linko and Taipei, Taiwan
- 2018– Assistant Professor & Attending Surgeon, Division of General Surgery and Breast Surgery, Department of Surgery, Chang Gung Medical Foundation, Linko and Taipei, Taiwan
- 2021– Surgical Training Workshop, Intuitive Surgical Deutschland GmbH, Medizin im Gruenen, Wendisch-Rietz, Germany
- 2022– Jointly Appointed Assistant Professor, School of Medicine, National Tsing Hua University / Chang Gung University
- 2022– Director, Comprehensive Breast Cancer Center, Chang Gung Memorial Hospital Northern Medical Complex
- 2024– Associate Professor, Division of General Surgery and Breast Surgery, Department of Surgery, Chang Gung Medical Foundation, Linko and Taipei, Taiwan



Minimally Invasive Breast Surgery – Is the Future of Breast Surgery Robotic, Endoscopic, or Both?

Wen-Ling Kuo Chang Gung Memorial Hosp., Taiwan

Minimally invasive surgery (MIS) has significantly transformed the field of breast surgery by reducing surgical trauma, preserving esthetic results, and improving overall surgical results and patient's quality of life. Endoscopic techniques have been foundational in this transition, offering enhanced visualization and superior cosmetic outcomes compared with conventional open surgery.

Robotic-assisted surgery represents the next step in breast surgery technological continuum. Building upon endoscopic principles, robotic systems provide three-dimensional high-definition visualization, tremor filtration, motion scaling, and wristed instruments with seven degrees of freedom. These features enable greater precision, improved tissue discrimination, and enhanced access to anatomically challenging regions, while maintaining the systemic benefits of MIS. This is helpful in preserving the precise surgical plane in small surgical cavities in breast pocket during nipple-sparing mastectomy.

Comparative analyses demonstrate that both robotic and endoscopic mastectomy are oncologically safe, with outcomes comparable to open surgery. Robotic approaches, however, offer distinct advantages in operative precision, reduced rates of nipple-areola complex necrosis, and improved surgeon ergonomics. Patient-reported outcomes also tend to favor robotic surgery due to better perceived quality of care and cosmetic satisfaction.



Despite these advancements, challenges remain. Robotic systems are associated with higher costs, longer operative times, and a substantial learning curve requiring structured training and multidisciplinary team adaptation.

Future innovations—including artificial intelligence, real-time tissue characterization technologies such as the i-Knife, and multimodal imaging integration—are expected to further enhance intraoperative decision-making and precision.

In conclusion, robotic-assisted surgery should not be viewed as a replacement for endoscopic techniques, but rather as their natural evolution. The future of breast surgery will likely follow a divergent trajectory, where robotic platforms enable precision-driven care, while endoscopic approaches remain essential for scalable and cost-effective surgical practice.





Sae Byul Lee

Univ. of Ulsan

EDUCATION

- 2001–2007 Medical Science, College of Medicine, Konyang University
- 2013– Acquisition of Master of Medicine (College of Medicine, Ulsan University)
- 2015– Acquisition of Ph.D of Medicine (College of Medicine, Ulsan University)
- 2008 Graduate College of Nursing
Yonsei University, Seoul, Korea

CAREER

- 2008–2009 Internship Completion (Seoul Asan Medical Center)
- 2009–2013 Resident Completion (Surgery, Seoul Asan Medical Center)
- 2013–2016 Fellow (Breast Surgery, Seoul Asan Medical Center)
- 2016–2019 Clinical Full-time Instructor (Breast Surgery, Seoul Asan Medical Center)
- 2019–2024 Assistant Professor (College of Medicine, Ulsan University)
- 2024– Associate Professor (College of Medicine, Ulsan University)



Use of the da Vinci SP Surgical System in Robot-Assisted Nipple-Sparing Mastectomy

Sae Byul Lee Univ. of Ulsan

Robot-assisted nipple-sparing mastectomy (R-NSM) has recently emerged as an important minimally invasive surgical option aimed at improving cosmetic outcomes while maintaining oncologic principles in selected patients with breast cancer. Among the available robotic platforms, the da Vinci SP (Single Port) surgical system introduces a novel approach through a single-incision technique combined with flexible, multi-jointed instruments and a fully wristed camera, potentially allowing enhanced visualization and maneuverability in the limited working space of subcutaneous breast surgery. In this presentation, we provide a comprehensive overview of the surgical application of the SP system in R-NSM, with a focus on practical and technical considerations. Key topics include patient selection criteria, preoperative planning, and optimal incision design—particularly the use of the inframammary fold approach to maximize cosmetic outcomes while maintaining adequate surgical access. We will also describe the docking process and port placement strategy unique to the SP system, followed by a step-by-step discussion of the surgical technique, including flap elevation, dissection of the glandular tissue, and preservation of the nipple–areolar complex. Particular attention is given to intraoperative challenges such as maintaining consistent flap thickness, avoiding thermal injury, and ensuring adequate exposure within a confined operative field. In addition, we address the integration of immediate breast reconstruction, highlighting coordination with reconstructive procedures and considerations for implant placement through a minimally invasive access point. Finally, the presentation discusses the potential advantages and limitations of the SP platform



compared to conventional multiport robotic systems, as well as current evidence and evolving indications for its use in breast surgery. Through this overview, we aim to provide practical insights and share surgical strategies that may facilitate the safe and effective adoption of single-port robotic techniques in nipple-sparing mastectomy.



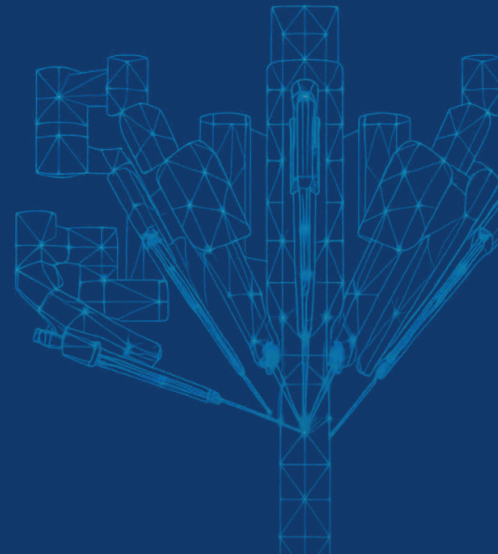


KAROS 2026

KOR

Symposium 03
New Technology

Chairs Chang Min Lee (Korea Univ.), Sangrok Jin (Pusan National Univ.)



Day 1

| **Room 2** |



Jongwoo Kim

Kyung Hee Univ.

EDUCATION

Doctor of Philosophy (Integrated Master/Ph.D.) in Mechanical & Aerospace Engineering

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Dissertation: “Variable Stiffness Mechanism using Anisotropic Patterning for Needle Steering”

Advisor: Prof. Kyu-Jin Cho

Bachelor of Science in Mechanical & Aerospace Engineering

Department of Mechanical & Aerospace Engineering, Seoul National University, Seoul, Korea

High School Diploma in Science and Technology

Korea Science Academy of KAIST, Busan, Korea

CAREER

2021 – Assistant Professor Department of Mechanical Engineering, Kyung Hee University, Republic of Korea

2021 – Director, Biomedical and Intelligent Robotics Laboratory, Kyung Hee University, Republic of Korea

2022 – Adjunct Professor, Graduate School of Artificial Intelligence, Kyung Hee University, Republic of Korea





Gyung Mo Son

Pusan National Univ.

EDUCATION

Bachelor, Pusan National Univ., School of Medicine

Master of Medicine, Pusan National Univ., Postgraduate School (medicine)

Ph.D., Pusan National Univ., Postgraduate School (medical science)

CAREER

1999 – 2000 Internship, Pusan National Univ. Hospital

2000 – 2004 Residency, Dep. Of Surgery, Pusan National Univ. Hospital

2007 – 2008 Clinical Fellow, Catholic Univ. of Korea, St. Vincent Hospital

2008 – 2014 Clinical Professor, Pusan National Univ. Yangsan Hospital

2015 – 2019 Assistant Professor, Pusan National Univ. School of Medicine

2020 – 2024 Associate Professor, Pusan National Univ. School of Medicine

2022 – Chair of Institutional Review Board (IRB), Institute of Biomedical Convergence, Pusan National Univ. Yangsan Hospital

2023 – Head of Research Support Division, Institute of Biomedical Convergence, Pusan National Univ. Yangsan Hospital

2025 – Pusan National Univ. School of Medicine



Update of Fluorescence Image-Guided Robotic Surgery

Gyung Mo Son Pusan National Univ.

Background: Fluorescence-guided surgery (FGS) has increasingly been integrated into colorectal cancer surgery to enhance intraoperative visualization and decision-making. Among available fluorophores, indocyanine green (ICG) has been most widely adopted due to its safety profile and real-time imaging capability. This study aims to review the current clinical applications of ICG-based fluorescence imaging and to introduce emerging optical imaging modalities that may overcome its limitations.

Current Applications of ICG Fluorescence: ICG fluorescence imaging has been utilized in three principal domains of colorectal surgery. First, fluorescent lymph node mapping enables identification of lymphatic drainage pathways and potentially improves nodal harvest and staging accuracy. Second, ICG-based tumor localization is particularly useful in minimally invasive surgery, facilitating precise identification of lesions that are not externally visible. Third, real-time perfusion assessment using ICG angiography has been widely adopted to reduce anastomotic complications, especially anastomotic leakage. Quantitative approaches, including time–intensity curve analysis and perfusion metrics, have further refined its clinical utility.



Limitations: Despite these advantages, ICG fluorescence imaging has inherent limitations. These include limited tissue penetration depth, variability in fluorescence intensity depending on imaging systems and acquisition conditions, and lack of standardized quantitative thresholds. Additionally, ICG provides indirect perfusion assessment and lacks detailed information on microvascular and tissue oxygenation status.

Emerging Optical Imaging Technologies: To address these limitations, novel imaging modalities are being explored. Laser speckle contrast imaging (LSCI) enables real-time, dye-free assessment of microvascular blood flow with high temporal resolution. Hyperspectral imaging (HSI) provides quantitative information on tissue oxygenation, hemoglobin concentration, and metabolic status without the need for exogenous contrast agents. These technologies offer complementary information to ICG fluorescence and have the potential to enhance intraoperative decision-making.

Future Perspectives: The integration of ICG fluorescence with advanced optical imaging modalities may represent the next paradigm in colorectal cancer surgery. Multimodal imaging approaches, combined with quantitative analysis and artificial intelligence, could enable more precise assessment of tissue perfusion, tumor margins, and lymphatic mapping. Further clinical validation and standardization are required before widespread adoption.

Conclusion: Fluorescence-guided surgery using ICG has become an essential tool in colorectal surgery. Emerging imaging technologies such as LSCI and HSI are expected to overcome current limitations and further advance the field toward precision surgery.





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Korea Univ.

EDUCATION

- 2000–2007 Bachelor of Engineering
School of Electrical Engineering, Korea University, Seoul, South Korea
- 2007–2009 Master of Science
Department of Electrical Engineering, Korea University, Seoul, South Korea
- 2010–2015 Doctor of Philosophy
Department of Computer Science, Rice University, Houston, TX, U.S.A.

CAREER

- 2006–2008 Research Assistant at Robotics Laboratory Robotics Laboratory, Korea University, Seoul, South Korea.
- 2009–2010 Research Assistant at Center for Cognitive Robotics Korea Institute of Science and Technology, Seoul, South Korea
- 2010–2015 Research Assistant at Multi-Robot System Laboratory Rice University, Houston, TX, U.S.A.
- 2015–2016 Senior Research Associate at Microsurgical Robotics Laboratory University of Texas Health Science Center at Houston, Houston, TX, U.S.A.
- 2016–2020 Instructor at Department of Neurosurgery University of Texas Health Science Center at Houston, Houston, TX, U.S.A.
- 2020–2025 Senior Software Engineer
EndoQuest Robotics (former ColubrisMX Inc.), Houston, TX, U.S.A.
- 2025– Associate Professor
Korea University, Seoul, S. Korea



Distributed Robot Intelligence

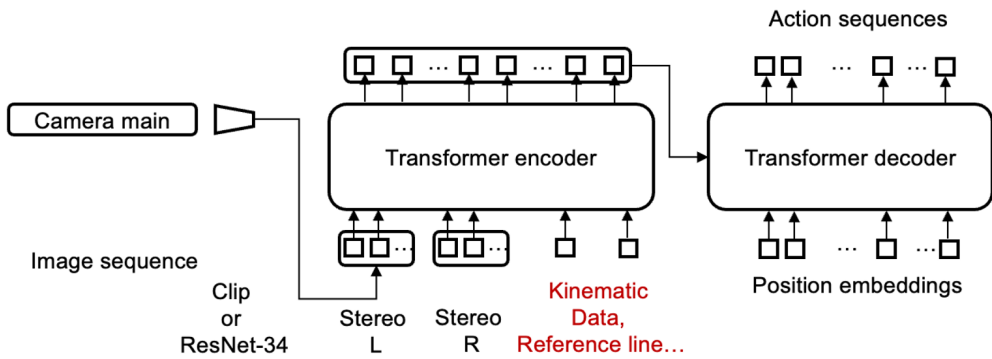
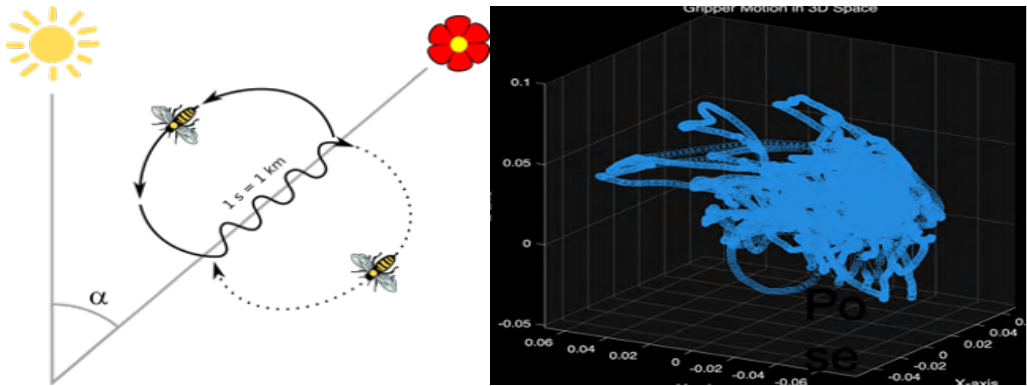
Seoungkyou Lee Korea Univ.

이 강의는 2017년부터 2025년까지 다년간 최소침습 및 무침습 수술로봇을 개발하며 반영한 최신 연구 내용과, 이를 바탕으로 한 미래 의료로봇 개발의 방향과 목표를 제시하려 합니다. 크게 두 가지 다른 구성으로 되어 있습니다.

- 1) 먼저 2017년 부터 2025년까지 개발한 무침습 수술로봇 Endo-Luminal Surgical Robot 시스템을 소개합니다. 무침습 수술로봇은, 기존 복강에 4개의 침습적 상처를 환자에게 가했던 수술법을 진보시켜, 로봇을 이용하여 상처없이 환자의 대장과 위장 등에 인입되어 집도위가 자유롭게 암 조직을 제거할 수 있도록 설계 되었습니다. 특히, 로봇이 집도위의 상태 (제스처, 등)을 분석하고, 주변에 깔린 의도를 함께 학습하여 이용하는 Context-awareness를 융합하여, 로봇이 집도위가 미처 판단하지 못하는 다양한 위험으로 부터 환자를 보호하도록 설계 되었습니다.



2) 두번째는 미래의 수술로봇 개발 방향입니다. 현재 자율 수술로봇 개발의 트렌드와 관련 연구를 분석하고, 수술로봇 자율화의 6단계를 이용하여 가장 현실적인 미래 자율 수술로봇 개발의 방향성에 관해 논의하고자 합니다. 특히, 현실의 로봇수술 집도위의 고충을 고려하여, 로봇과 의사가 상생하여 발전할 수 있는 Surgeon-robot interaction에 대해 논의하고자 합니다.





Namkee Oh

Sungkyunkwan Univ.

EDUCATION

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- 2016 M.D., Korea University School of Medicine
- Ph.D. Sungkyunkwan University School of Medicine

CAREER

- 2017–2018 Intern, Samsung Medical Center
- 2018–2022 Resident, Samsung Medical Center
- 2022–2024 Clinical Fellow, Samsung Medical Center
- 2024– Clinical Assistant Professor, Samsung Medical Center





KAROS 2026

ENG

Symposium 05

Bridging Young Surgeons: Sharing the Path to Robotic Excellence

Chairs Jae Do Yang (Jeonbuk National Univ.), Jae Hun Chung (Pusan National Univ.)



Day 1

| **Room 2** |



Hong-Min Ahn

Seoul National Univ.

EDUCATION

- 2005–2009 Pusan National University Molecular Biology & Biomedical Study, Bachelor
- 2009–2013 Pusan National University, School of Medicine, Master & Medical Doctor
- 2024– Seoul National University, School of Medicine, Doctorate (ABD)

CAREER

- 2013–2016 Public Health Physician for National Service
- 2016–2017 Internship, Pusan National University Yangsan Hospital
- 2017–2021 Residency in General Surgery, Pusan National University Yangsan Hospital
- 2021–2022 Clinical Fellowship in Colorectal Surgery, Seoul National University Bundang Hospital
- 2023–2024 Clinical Professor in Colorectal Surgery, Seoul National University Bundang Hospital
- 2024– Assistant Professor in Colorectal Surgery, Seoul National University Bundang Hospital



Learning Curve and Technical Insights in Robotic Colorectal Surgery

Hong-Min Ahn Seoul National Univ.

The robotic colorectal surgery became a new wave of minimally invasive surgery (MIS). Robotic systems let surgeons see a confined anatomical dissection plane with a steady camera. In addition, by the delicate movements, such as if robot arms were surgeon's hands, there may be a great benefit from dissecting the narrow pelvis. Despite these theoretical advantages, comparative clinical studies have yet to demonstrate consistent superiority over conventional laparoscopic approaches; however, robotic surgeons, somehow, believe there must be a benefit to the patients with the robotic surgery.

For me, robotic surgery was always a question and I was not sure of robotic surgeries other than it is brand new and fancy surgery. Early in my career as a junior faculty member in a high-volume teaching hospital, limited opportunities for elective surgeries and the burden of emergency cases posed significant challenges to adopting robotic surgery into the routine practice. Furthermore, more recently, changes in the healthcare environment in Korea have led to a shortage of surgical assistants, complicating the execution of conventional laparoscopic procedures. To do the laparoscopic surgery, only one help was allowed with the scope, and the 3rd and 4th ports were vacated with every major surgery.



In this context, robotic systems—particularly single-port platforms—offered practical advantages, including enhanced ergonomics with extra help of an additional robotic arm and the potential for reduced abdominal wall trauma. However, the transition to single-port robotic surgery was accompanied by a steep and challenging learning curve. My initial experiences with robotic single-port colorectal surgery were technically demanding and, at times, suboptimal.

This presentation aims to revisit these early experiences and critically examine the learning curve associated with robotic colorectal surgery. By demonstrating the technical challenges encountered during the initial phase, evolving strategies for dissection and exposure, and the gradual optimization of surgical performance would be highlighted. These insights may provide a more understanding of how single-port robotic systems can be effectively integrated into colorectal surgeries.





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EDUCATION

- 2005–2011 M.D. Chung-Ang University College of Medicine, Seoul, Korea
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CAREER

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- 2015–2019 Residency, Department of Surgery, Asan Medical Center, Seoul, Korea
- 2016 Exchange program, Memorial Sloan Kettering Cancer Center, NY, USA
- 2019--2021 Clinical fellowship, Division of Gastrointestinal Surgery, Department of Surgery, Asan Medical Center, Seoul, Korea
- 2021–2026 Clinical Assistant Professor, Division of Gastrointestinal Surgery, Department of Surgery, Asan Medical Center, Seoul, Korea
- 2026– Associate Professor, Division of Gastrointestinal Surgery, Department of Surgery, Asan Medical Center, Seoul, Korea



Expanding Indications of Robotic Gastrectomy: Challenges and Lessons from Early Experience

Chang Seok Ko Univ. of Ulsan

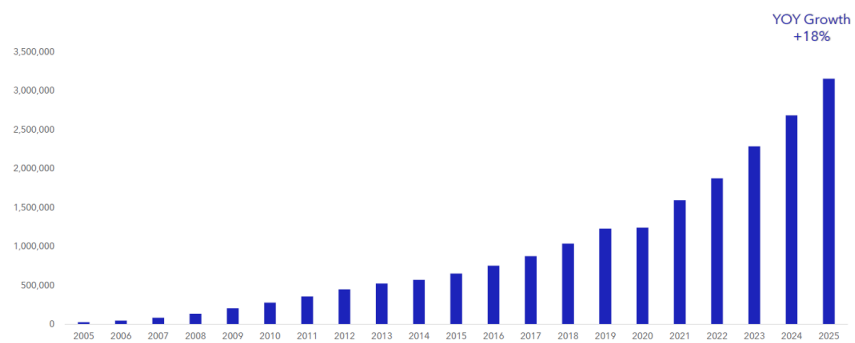
Contents

- Background and Institutional Experience
- Before Starting Robotic Gastrectomy
- Expanding Indications, Lessons Learned & Future Directions



Robotic surgery with da Vinci in Worldwide

Total Procedure Trend



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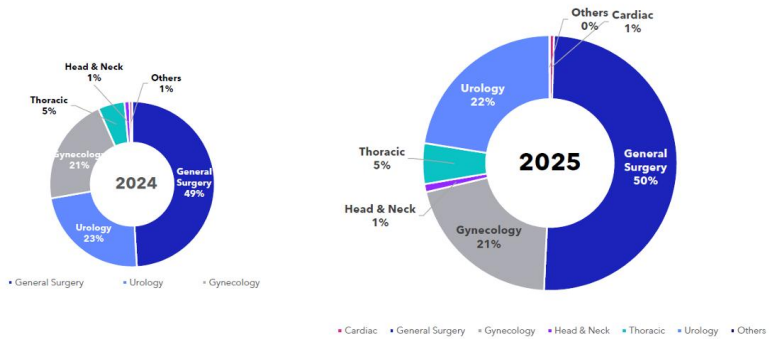


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Robotic Surgery Composition with dV in Worldwide

Ratio of specialty in 2025



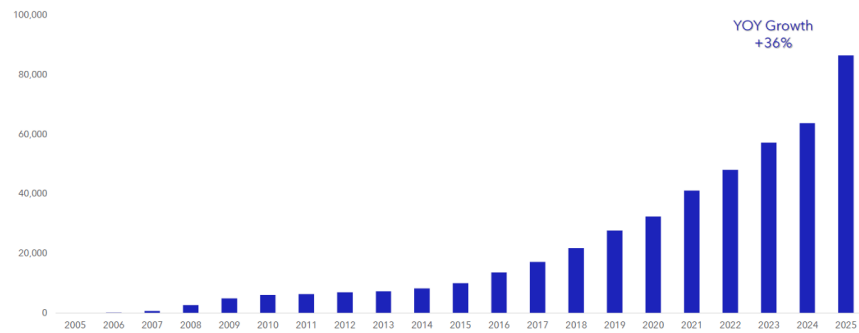
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INTUITIVE

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Robotic surgery with da Vinci in Korea

Total Procedure Trend



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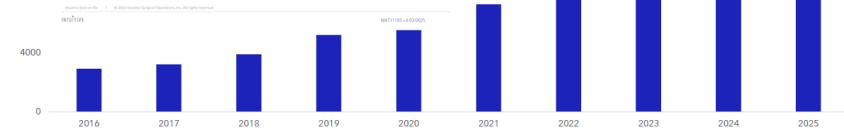
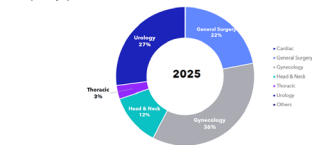
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Korea Procedure Trend

General Surgery

Korea Robotic Surgery Composition

Each specialty's portion



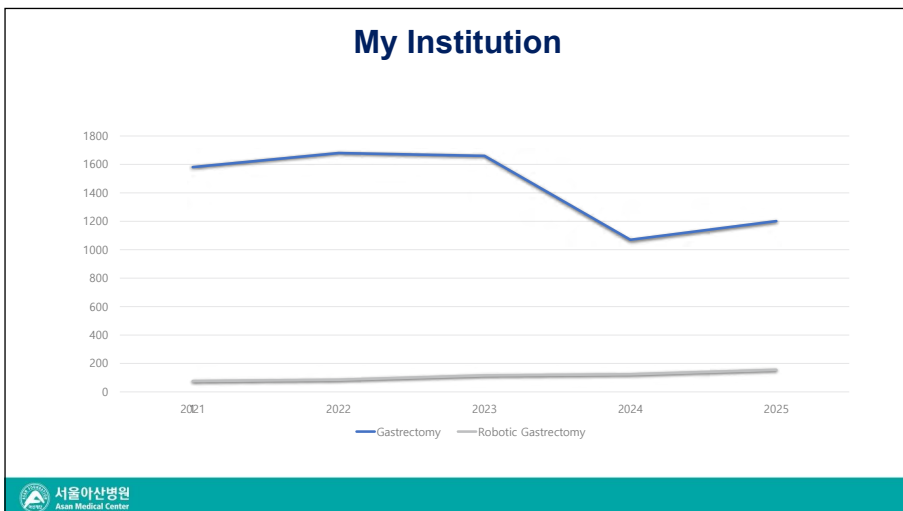
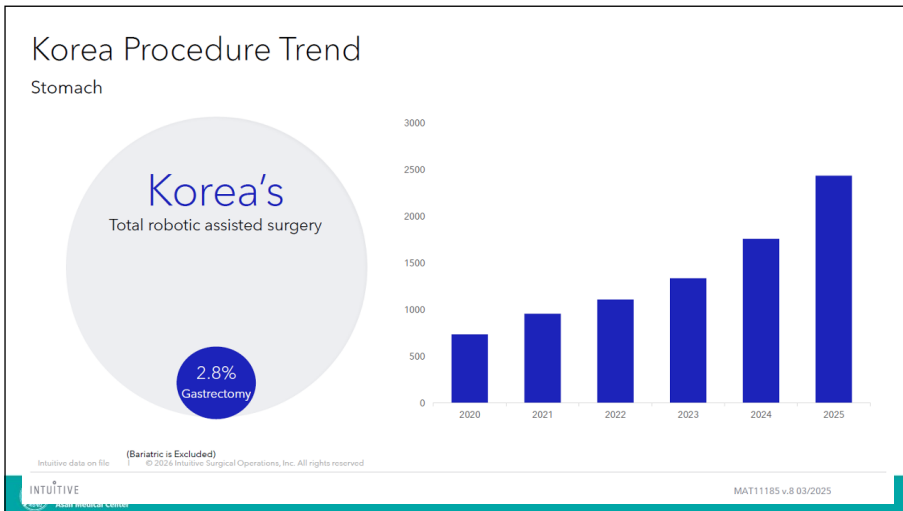
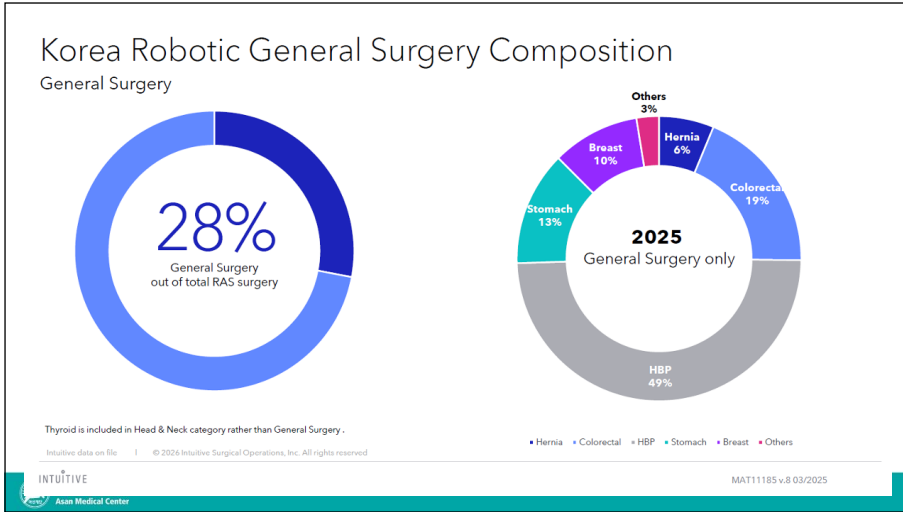
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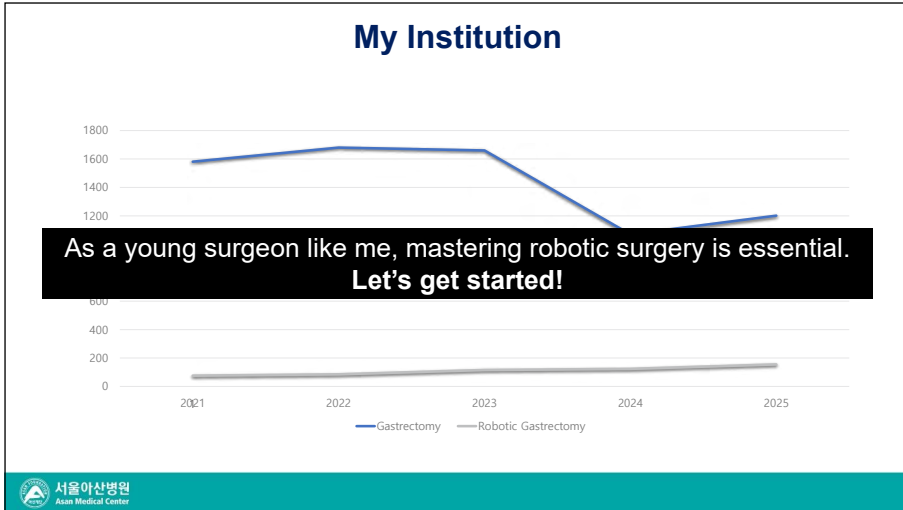
INTUITIVE

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Thyroid is included in Head & Neck category rather than General Surgery







- ### Before Starting Robotic Gastronomy
- **Review** of Current Evidence on MIS and Robotic Gastronomy
 - Apply workflow similar to **laparoscopic surgery**
 - Apply the advantages of the robotic platform during **lymph node dissection**
 - **Gradual expansion** of robotic application from LN dissection to anastomosis
- 서울아산병원
Asan Medical Center

Expanding Indications for MIS Gastronomy

EGC LADG

1992 Seigo Kitano

Summary: Laparoscopic distal partial gastrectomy is still technically difficult under conditions of a pneumoperitoneum because of the lack of appropriate techniques and laparoscopic instruments. We describe here a technique of laparoscopy-assisted Billroth I gastrectomy under an abdominal wall-elevating method. **Key Words:** Laparoscopy-assisted gastrectomy—U-shaped retractor—Abdominal wall-elevating method

서울아산병원
Asan Medical Center

Surgical Laparoscopy & Endoscopy Vol. 4, No.2, pp. 146-148



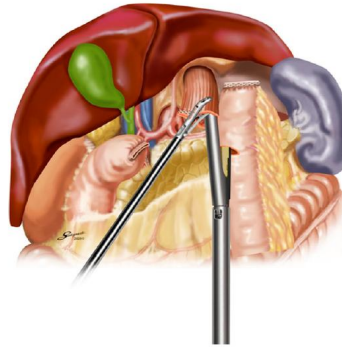
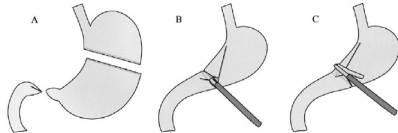
Expanding Indications for MIS Gastrectomy

EGC LADG

1992 Seigo Kitano

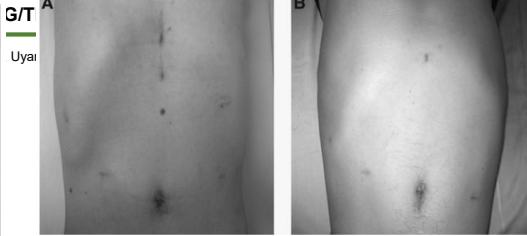
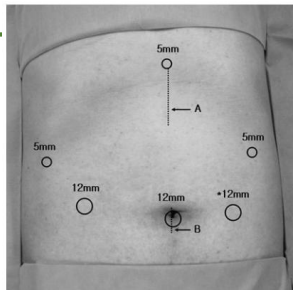
EGC TLDG/TLTG AGC TLDG/TLTG

2000s Kanaya, Uyama



Expanding Indications for MIS Gastrectomy

EGC TLDG/TLTG AGC TLDG/TLTG



Evidences for MIS Gastrectomy

EGC DG

2016 Ann Surg (M)
2019 JAMA Oncol (5y)
KLASS-01

2017 Gastric Cancer (M)
2020 Lancet Gastroenterol
Hepatol. (5y)
JCOG-0912

AGC DG

2019 Ann Surg (M)
2020 J Clin Oncol (3y)
2022 JAMA Surg (5y)
KLASS-02

2016 J Clin Oncol (M)
2019 JAMA (3y)
2022 JAMA Surg (5y)
CLASS-01

2015 World J Surg (II)
2023 JAMA Surg (5y)
JLSSG0901

EGC TG EGC PG/PPG

2019 Gastric Cancer (II)
KLASS-03

2016 J Clin Oncol (M)
2019 JAMA (3y)
2022 JAMA Surg (5y)
CLASS-01

2015 World J Surg (M)
2023 JAMA Surg (5y)
JLSSG0901

AGC Neoadjuvant AGC TG Reduced Port Surgery

KLASS-06
KLASS-08

2025 JGC
KLASS-12

CLASS-03b

Evidences for MIS Gastrectomy

EGC DG	AGC DG	EGC TG EGC PG/PPG	AGC Neoadjuvant AGC TG Reduced Port Surgery
2016 Ann Surg (M) 2019 JAMA Oncol (5y) KLASS-01	2019 Ann Surg (M) 2020 J Clin Oncol (3y) 2022 JAMA Surg (5y) KLASS-02	2019 Gastric Cancer (II) KLASS-03	KLASS-06 KLASS-08
2017 Gastric Cancer (M) 2020 Lancet Gastroenterol Hepatol. (5y) JCOG-0912	2016 J Clin Oncol (M) 2019 JAMA (3y) 2022 JAMA Surg (5y) CLASS-01	2016 J Clin Oncol (M) 2019 JAMA (3y) 2022 JAMA Surg (5y) CLASS-01	2025 JGC KLASS-12 CLASS-03b

**More Advanced Cancer
More Complex Surgery
Less Invasive Approach**



Evidences for Robotic Gastrectomy

Outcome	The FUGES-011 trial			The Japanese trial		
	RDG (n=141)	LDG (n=142)	P-value	RG (n=113)	LG (n=117)	P-value
Operation time (min)	201.2 (± 32.0)	181.6 (± 44.4)	< 0.001	297 (179-654)	245 (131-534)	0.001
Lymphadenectomy						
Total LN	40.9 (± 11.2)	39.9 (± 12.2)	0.452	30 (10-103)	35 (5-92)	0.09
Extra-gastric LN	17.6 (± 5.8)	15.8 (± 6.6)	0.018			
Postop. recovery						
1 st flatus (day)	3.2 (± 0.6)	3.5 (± 0.9)	< 0.001	2 (1-4)	2 (1-6)	0.01
Hospital stay	7.9 (± 3.4)	8.2 (± 2.5)	0.062	12 (7-43)	13 (6-45)	0.93
Analgesic drug				1 (0-12)	2 (0-21)	0.001
Postop. complication						
Overall	13 (9.2)	25 (17.6)	0.039	10 (8.8)	23 (19.7)	0.02
≥ CDC 3				6 (5.3)	19 (16.2)	0.01
intra-abdominal abscess ≥ CDC 2	3 (2.1)	2 (1.4)	0.684	7 (6.2)	10 (8.5)	0.50
Mortality	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	



From Prof. Lee IS

Ongoing Trials for Robotic Gastrectomy

Mackay School of BMC Cancer | 0022-27387
https://doi.org/10.1186/s12859-023-14481-2

STUDY PROTOCOL Open Access

Randomized controlled phase III trial to investigate superiority of robot-assisted gastrectomy over laparoscopic gastrectomy for clinical stage T1-4aN0-3 gastric cancer patients (JCOG1907, MONA LISA study): a study protocol

Rie Makuuchi¹, Masanori Terashima², Mitsumi Terada³, Junki Mizusawa⁴, Ryoike Kita⁵, Masanori Tokunaga⁶, Takeshi Omori⁷, Toshiyasu Ojima⁸, Kazuhisa Ehara⁹, Masaya Watanabe¹⁰, Yoshitomo Yanagimoto¹¹, Soya Nambu¹², Takahiro Kinoshita¹³, Seiji Ito¹⁴, Yasunori Noheda¹⁵, Jun Hihara¹⁶, Naikazu Boku¹⁷, Yukunori Kurokawa¹⁸, Takaki Yoshikawa¹⁹ The Stomach Cancer Study Group of Japan Clinical Oncology Group

Search Details: Viewing 1-10 out of 59 studies for: gastric cancer | Robotic Gastrectomy

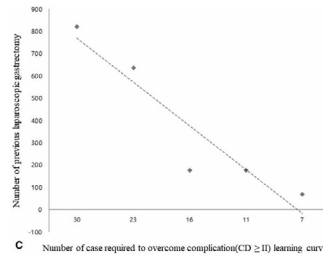
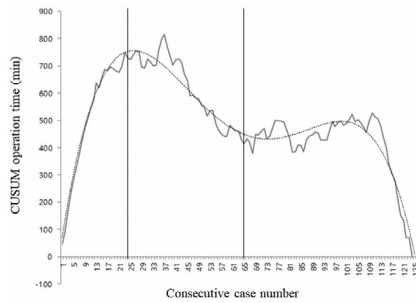
Clear (0) | Download | Save | RSS | Display

NCT03313760 **Completed**
Clinical Outcomes of Robotic Versus Laparoscopic Distal Gastrectomy for Gastric Cancer
Conditions: Stomach Neoplasms | Robotic Surgery
Locations: Fuzhou, Fujian, China

NCT02331454 **Not yet recruiting** **New**
Robotic vs Laparoscopic Gastrectomy for cT4a Gastric Cancer
Conditions: Gastric Cancer (EG)
Locations: Hangzhou, Zhejiang, China



Before Starting Robotic Gastrectomy

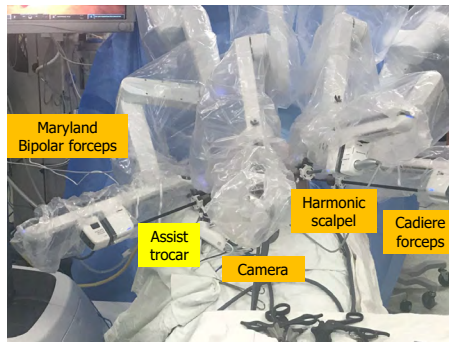


Advantages of Robotic Gastrectomy

- Enhanced 3D high-definition visualization
- Articulated instruments with wristed motion
- Facilitates meticulous lymph node dissection



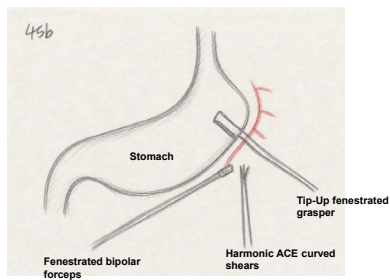
Similarities Between Lap and Robotic Gastrectomy



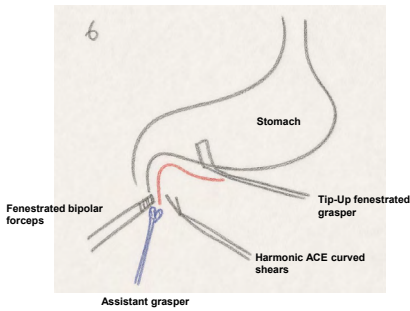
Similarities Between Lap and Robotic Gastrectomy

- Omentectomy
- Dissection of LN 4sb and Ligation of Left Gastroepiploic Vessel
- Dissection of LN 6 and Ligation of Right Gastroepiploic Vessel
- Dissection of LN 5 and Ligation of Right Gastric Vessel
- Resection of Duodenum
- Dissection of LN 7,8,9 and Ligation of Left Gastric Vessel
- Dissection of LN 1,3
- Resection of Stomach
- Reconstruction

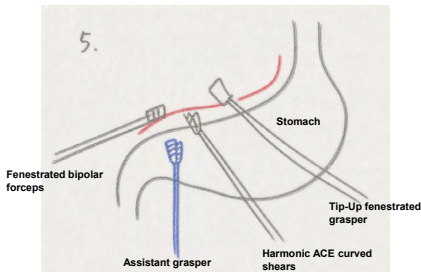
Case



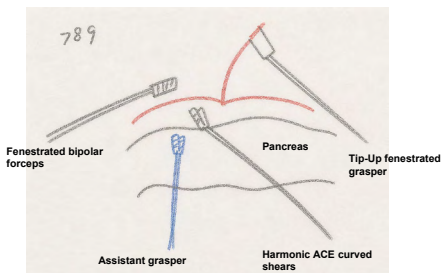
Case



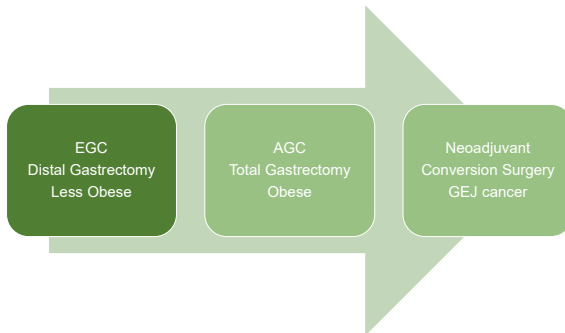
Case



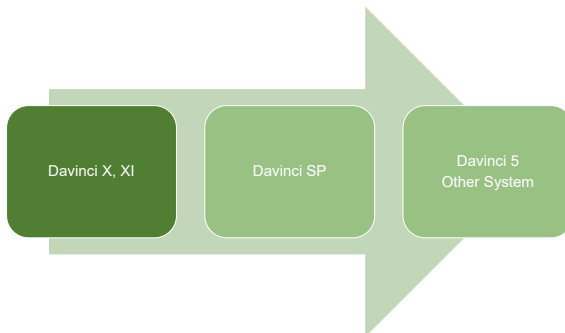
Case



Expanding Indications for Robotic Gastrectomy



Expansion of Robotic Systems



Technical Challenges and Limitations

- Traction: 4 arm
- Non-Articulating Energy Device
- Unexpected Event: Bleeding



Technical Challenges and Limitations

- Traction: 4 arm
- Non-Articulating Energy Device
- Unexpected Event: Bleeding

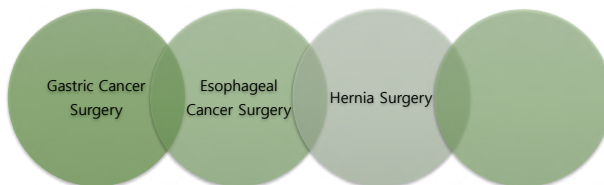


Barriers to Expansion of Robotic Systems

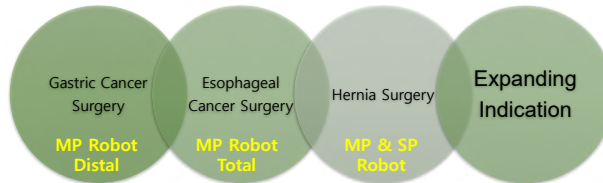
- Limited use of robotic systems
Only one SP system available in our institution
- High-Cost Burden
- Fast update speed
- Wide variety of robot systems



Junior Staff In My Institution



Junior Staff In My Institution



Lessons Learned and Future Directions

- Apply **laparoscopic experience** to adapt to robotic surgery, particularly in terms of visual perception and the absence of tactile feedback.
- Adopt a **stepwise approach** rather than a fully robotic approach from the beginning.
- Gain experience across multiple evolving robotic platforms.





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EDUCATION

- 2012 Bachelor of Korea University Division of Biotechnology, Seoul, Korea
- 2017 Master of Kyungpook national University school of Medicine, Daegu, Korea
- 2017 M.D. Degree, Kyungpook national University school of Medicine, Daegu, Korea

CAREER

- 2018–2022 Residency, Dept. of Surgery, Yonsei University College of Medicine, Seoul, Korea
- 2022–2024 Fellow, Dept. of Surgery, Division of Endocrine surgery, Gangnam Severance Hospital, Yonsei University College of Medicine, Seoul, Korea
- 2024–2026 Clinical assistant professor, Dept. of Surgery, Division of Endocrine surgery, Ajou University College of Medicine, Suwon, Korea
- 2026– Current Assistant professor, Dept. of Surgery, Division of Endocrine surgery, Ajou University College of Medicine, Suwon, Korea



Overcoming the Learning Curve in Robotic Thyroidectomy: A Junior Surgeon's Perspective

Jin Seok Lee Ajou Univ.

Background: The adoption of robotic systems in thyroid surgery has provided significant advantages, including enhanced three-dimensional visualization and increased instrument maneuverability. However, the complexity of robotic docking and the transition from conventional open or endoscopic techniques necessitate a structured learning curve. For junior surgeons, navigating this period is critical to ensuring patient safety and oncological completeness.

Methods: This presentation reviews the established benchmarks for the robotic thyroidectomy learning curve, which previous literature typically identifies as ranging from 40 to 60 cases to achieve stabilization in operative time and complication rates. Drawing from a junior surgeon's experience within the first five years of practice, we analyze the technical challenges encountered during the initial phase, including flap dissection, identification of the recurrent laryngeal nerve, and parathyroid preservation.

Results: A review of recent studies suggests that while the "plateau" in operative time is a common metric, true proficiency involves a multifaceted reduction in postoperative morbidity. For the junior surgeon, the learning curve is not a linear progression but a series of qualitative shifts. Key strategies for overcoming this curve include standardized surgical steps, the use of intraoperative neuromonitoring, and transitioning from supervised to independent practice.



Furthermore, the integration of diverse robotic approaches (e.g., Bilateral Axillo-Breast Approach or Transoral Robotic Thyroidectomy) requires specific adaptations that can prolong the technical adjustment period.

Conclusion: The learning curve in robotic thyroidectomy exhibits significant individual variability based on prior surgical volume and institutional support. However, from a junior surgeon's perspective, clinical mastery should not be sought through speed alone. Success depends on a steadfast commitment to surgical principles and a relentless effort to refine techniques through various methodologies. Junior surgeons must remain dedicated to continuous practice and proactive learning to bridge the gap between initial competency and expert-level proficiency.





Dakyum Shin

Chosun Univ.

EDUCATION

- 2014 M.D., College of Medicine, Chung-Ang University, Seoul, Korea
- 2019 M.S. in Medicine, College of Medicine, University of Ulsan, Seoul, Korea

CAREER

- 2014–2015 Intern, Asan Medical Center, Seoul, Korea
- 2015–2019 Resident, Department of Surgery, Asan Medical Center, Seoul, Korea
- 2019–2022 Clinical Fellow, Division of Hepatobiliary and Pancreatic Surgery, Department of Surgery, Asan Medical Center, Seoul, Korea
- 2022–2023 Research Fellow, Division of Hepatobiliary and Pancreatic Surgery, Department of Surgery, Asan Medical Center, Seoul, Korea
- 2023–2024 Research Associate, OMICS Lab, Department of Bio and Brain Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea
- 2024–2025 Clinical Assistant Professor, Division of Hepato-Biliary-Pancreatic Surgery and Transplantation, Department of Surgery, Chosun University Hospital, Gwangju, Korea
- 2025– Assistant Professor, Department of Surgery, College of Medicine, Chosun University, Gwangju, Korea





Bomina Paik

H+ Yangji Hosp.

EDUCATION

- 2011 – Graduated from Kyung Hee University, College of Medicine
- 2020 – Doctoral & master's degree from Catholic University of Korea, College of Medicine

CAREER

- 2011 – 2012 Intern, Kyung Hee University Hospital
- 2012 – 2013 General Physician, Kangbuk Samsung Hospital
- 2013 – 2014 General Physician, Changdong Jeil Hospital
- 2014 – 2018 Resident, General Surgery, Kyung Hee University Hospital at Gang Dong
- 2019 – 2020 General Surgeon, Gangseo Yonsei Hospital
- 2020 – 2022 General Surgeon, Gangdong Seoul Colorectal Clinic
- 2022 – 2023 Hospitalist, Kyunghee University Hospital at Gangdong
- 2023 – Surgical fellow, Metabolic and Bariatric Surgery Center, H+ Yangji Hospital



Integrating Robotics Into Bariatric Surgery: Early Outcomes and Technical Pearls

Bomina Paik H+ Yangji Hosp.

Background: While laparoscopic surgery is the standard for bariatric procedures, it faces significant limitations in “hostile” surgical environments, such as super-super obese patients (BMI ≥ 60) or revisional cases. These challenges include restricted working space, heavy abdominal walls, and complex adhesions. Robotic platforms are increasingly utilized to mitigate these issues through 3D vision, tremor filtration, and wristed instrumentation. Although large-scale data from the MBSAQIP database currently shows comparable short-term clinical outcomes between robotic and laparoscopic approaches, the ergonomic precision and ability to bypass abdominal wall resistance drive the ongoing transition to robotics.

Objective: To report the initial institutional experience and technical refinements for robotic-assisted sleeve gastrectomy (RSG) using the Da Vinci X system, focusing on the tactical transition from advanced laparoscopy to robotics.

Methods: Beginning in July 2024, 28 patients (mean BMI 39.0 kg/m²) with at least two obesity-related comorbidities underwent RSG. The “In-Situ” technique was applied in 26 cases, characterized by creating the gastric tube before mobilizing the greater curvature. Specialized technical pearls, including standardized port placement and internal liver retraction, were implemented to optimize workflow.



Technical Pearls:

- **Liver Retraction:** To prevent robotic arm collisions common with external retractors, a “DIMA stitch” was utilized. This internal hammock, created with a 3-0 barbed suture anchored to the 10th costochondral junction and the right crura, eliminates extra incisions and provides a stable field.
- **Strategic Port Placement:** Ports were placed 15–18 cm below the xiphoid with 8–10 cm intervals. Crucially, Arm 2 was positioned approximately 2 cm below the camera port to ensure the robotic stapler could reach the antral window at the correct angle without collision.
- **The In-Situ Technique:** Gastric transection was performed while the stomach remained attached to the omentum, providing superior exposure of the short gastric vessels and the left crus. Key steps included Angle of His dissection, antral window creation, and using the “dimple” landmark between the left gastric pedicle and posterior gastric vessel to safely reach the left crus.

Results: All 28 operations were completed successfully without conversion to laparoscopic or open surgery. No major perioperative complications, leaks, or 30-day mortalities were observed. The learning curve was pronounced; console time dramatically improved from 196 minutes in the first case to a stable plateau of 66 minutes by the 15th case.

Conclusion: The integration of specific technical pearls—such as the In-Situ technique and the liver hammocking stitch—facilitates a safe and efficient transition to the robotic platform. While clinical parameters may be similar to laparoscopy, the superior ergonomic precision justifies the use of robotics in complex bariatric cases. Success relies on mastering the robotic architecture and maintaining seamless teamwork between the console and assistant surgeons.



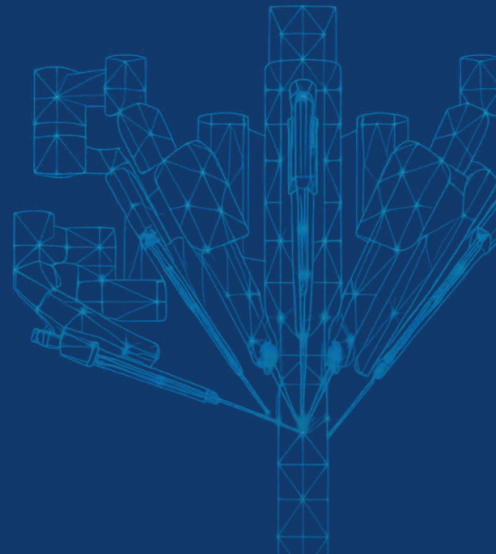


KAROS 2026

ENG

Live Demonstration II

Chair Jin Kim (Korea Univ.)



Day 2

| **Room 1** |



Gyoung Tae Noh

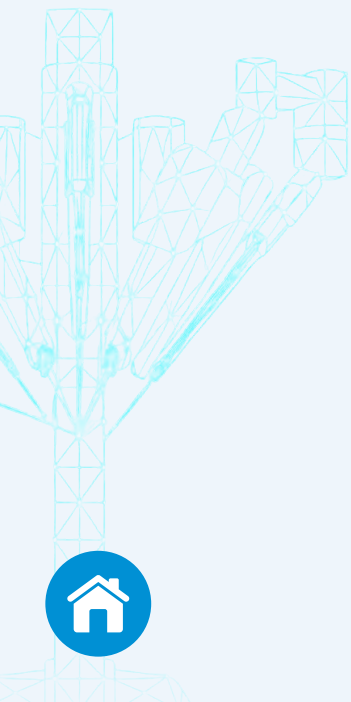
Ewha Womans Univ.

EDUCATION

- 2000–2006 M.D., Chosun University College of Medicine, Gwang-ju, Korea
- 2011–2015 M.S., Korea University Postgraduate School, Seoul, Korea
- 2016–2021 Ph.D., Yonsei University Postgraduate School, Seoul, Korea

CAREER

- 2006–2012 Internship, Residency, Fellow, Department of Surgery, Mokdong Hospital, Ewha Womans University, College of Medicine
- 2015–2017 Fellow, Division of Colorectal Surgery, Department of Surgery, Severance Hospital, Yonsei University
- 2017–2021 Clinical assistant professor, Division of Colorectal Surgery, Department of Surgery, Ewha Womans University, College of Medicine
- 2021 – Assistant professor, Division of Colorectal Surgery, Department of Surgery, Ewha Womans University, College of Medicine



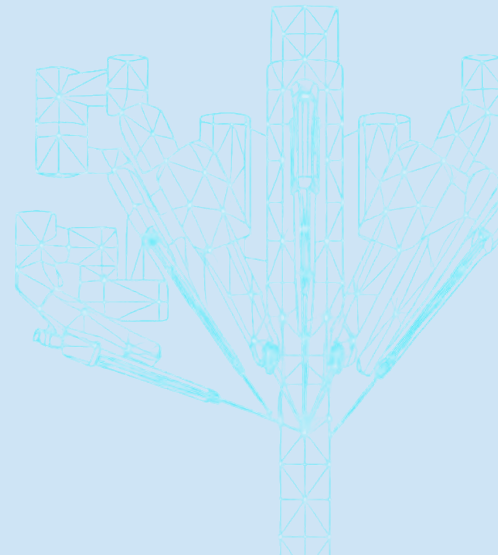


KAROS 2026

ENG

Special Lecture III

Chair Kil Yeon Lee (Kyung Hee Univ.)



Day 2

| **Room 1** |



Gyu-Seog Choi

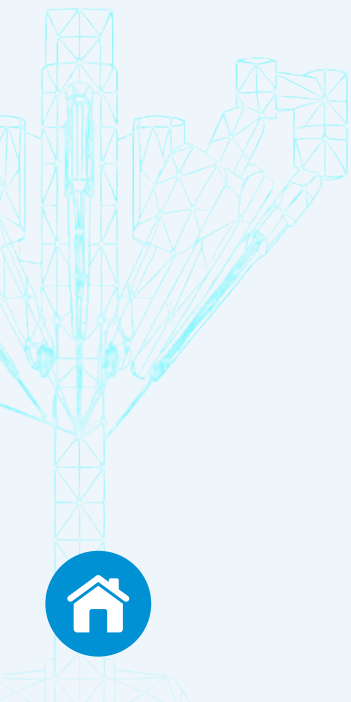
Kyungpook National Univ.

EDUCATION

- 1987 Graduated Kyungpook National University, School of Medicine
- 1999 Graduated Kyungpook National University, Postgraduate School

CAREER

- 1992 – 1996 Faculty, Department of Surgery, Sangju Red Cross Hospital, Sangju, Korea
- 1996 – 1998 Full-time Lecturer, Department of Surgery, Kyungpook National University Hospital, Daegu, Korea
- 1998 – 2007 Assistant Professor, Kyungpook National University Hospital, Daegu, Korea
- 2000 – 2002 Post-doctoral research course in Cancer & Immunogenetics Laboratory, Cancer research UK, Institute of Molecular Medicine, John Radcliffe Hospital, Oxford
- 2007 – Professor, Kyungpook National University Hospital, Daegu, Korea
- 2010 – Head of Department of Surgery, Kyungpook National University Hospital, Daegu, Korea
- 2011 – Head of Colorectal cancer center, Kyungpook National University Chilgok Hospital, Korea
- 2023 – Adjunct Professor, China Central South Univ. Xiangya Hosp., China



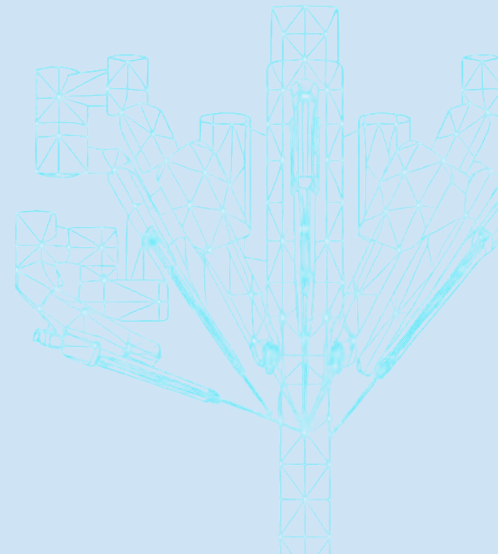


KAROS 2026

ENG

Special Lecture IV

Chair Jung Wook Huh (Sungkyunkwan Univ.)



Day 2

| **Room 1** |



Subhash Khanna

Swagat Hosp., India

EDUCATION

- 1979– M.B.B.S., Gauhati Medical College, Gauhati University
- 1983– M.S., Gauhati Medical College, General Surgery, Gauhati University
- 2020– FRCS, Edinbergh

CAREER

- 1998–2000 Professor of Surgery, Gauhati Medical College, India
- 2000–2006 Chief Medical Director & Chief Consultant, Swagat Endolaparoscopic Surgical Research Institute, India
- 2006–2012 Professor of Surgery, Agartala Govt. Medical College, India
- 2012– Dean, Swagat Academy of Medical Sciences, India
- 2015– Head, Dept. of Minimal Access, Bariatric, GI & Robotic Surgery, Swagat Super Speciality Surgical Institute, India
- 2015– Managing Director & Chairman, Swagat Hospitals Pvt. Ltd., India
- Present Honorary Visiting Professor, Dept. of Surgical Gastroenterology, GSL Medical College, India



Building Robotic Surgery in Emerging Regions: The ARIS Initiative

Subhash Khanna Swagat Hosp., India

Robotic surgery represents a paradigm shift in modern surgical practice, offering enhanced precision, improved ergonomics, and the potential for superior clinical outcomes. It has transformed multiple surgical specialties by enabling minimally invasive approaches with improved dexterity, visualization, and control. Despite its rapid adoption, a major global limitation remains the absence of standardized, competency-based training and credentialing frameworks. Existing training pathways are often heterogeneous, predominantly industry-driven, and lack uniform assessment metrics and structured progression, thereby limiting widespread and safe adoption.

The Association of Robotic and Innovative Surgeons (ARIS) has developed a comprehensive and structured training program—the Fellowship in Advanced Robotic and Innovative Surgery (FARIS)—to address these challenges. FARIS is a one-year hybrid fellowship designed to integrate theoretical knowledge, simulation-based skill acquisition, hands-on cadaveric training, and supervised clinical exposure through a network of Centres of Excellence. This structured approach ensures a stepwise progression from basic understanding to advanced surgical competence.



The program is delivered in academic collaboration with the Royal College of Surgeons of Edinburgh and Sri Ramachandra Medical University, and is further endorsed by the Sri Aurobindo Institute of Medical Sciences (SAIMS), Indore, and IRCAD India, ensuring strong academic alignment and global credibility. These collaborations strengthen the academic rigor of the program and facilitate global benchmarking of training standards.

The curriculum is modular and competency-driven, encompassing structured didactic sessions, virtual learning platforms, contact courses, cadaveric workshops, and longitudinal clinical observerships. Emphasis is placed on progressive skill acquisition, development of non-technical skills such as decision-making and team communication, and adherence to patient safety principles. Assessment is comprehensive and multi-dimensional, incorporating logbook evaluation, objective structured clinical examinations (OSCE), written assessments, viva voce, and dissertation-based academic work.

Outcome analysis from program participants demonstrates a significant positive impact on robotic surgical adoption. A majority of trainees reported enhanced confidence and active involvement in robotic surgical programs, with a substantial proportion initiating independent robotic procedures following completion of the fellowship. High satisfaction rates further validate the effectiveness of this structured training pathway, indicating its potential as a scalable model.

Collaborative Perspective:

The ARIS initiative envisions global collaboration as a key driver for advancing robotic surgery education, particularly in emerging regions. Partnerships with leading international societies such as the Korean Association of Robotic Surgeons (KAROS), the Society of Robotic Surgery (SRS), and the Society of Endo Laparoscopic Surgeons of Malaysia (SELSMAR) provide opportunities to exchange expertise, harmonise training standards, and foster joint academic initiatives. Such collaborations are essential for creating a globally unified approach to robotic surgery training.



Conclusion:

The ARIS–FARIS model provides a standardized, scalable, and competency-based framework for robotic surgery training and credentialing. It offers a globally adaptable solution to bridge existing gaps in surgical education. Nearly 50% of surgeons trained under ARIS have started performing independent robotic procedures within one year of completing the FARIS certification and diploma. This model has the potential to significantly influence the future of robotic surgery training, particularly in resource-constrained and emerging healthcare settings.





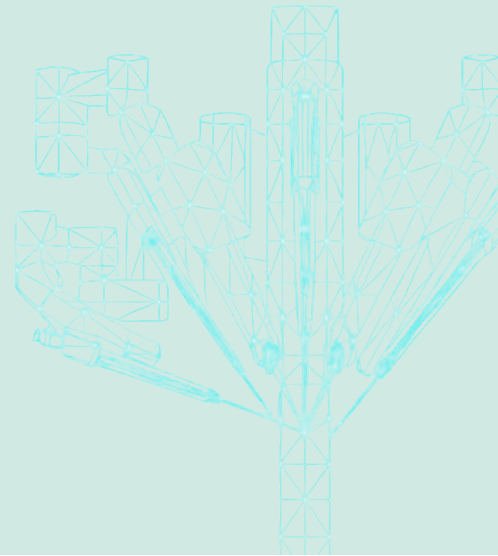
KAROS 2026

ENG

Luncheon Symposium III

LIV'SMED

Chair Gyu-Seog Choi (Kyungpook National Univ.)



Day 2

| **Room 1** |



Yoon Suk Lee

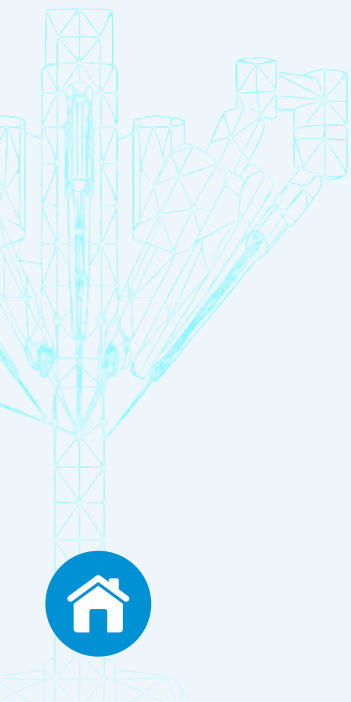
The Catholic Univ. of Korea

EDUCATION

- 1996 M.D., College of Medicine, The Catholic University of Korea
- 2001 M.S., College of Medicine, The Catholic University of Korea
- 2008 Ph.D., College of Medicine, The Catholic University of Korea

CAREER

- 2019–2020 Global Colorectal Advisory Consultant, Verb Surgical
- 2004– Professor, Division of Colorectal Surgery, The Catholic University of Korea
- 2016– Faculty Member, School of Minimally Invasive Surgery (SoTM), Asia-Pacific Region
- 2021– Executive Director, Korean Society of Coloproctology
- 2023– Editorial Director, Korean Society of Endoscopic & Laparoscopic Surgeons





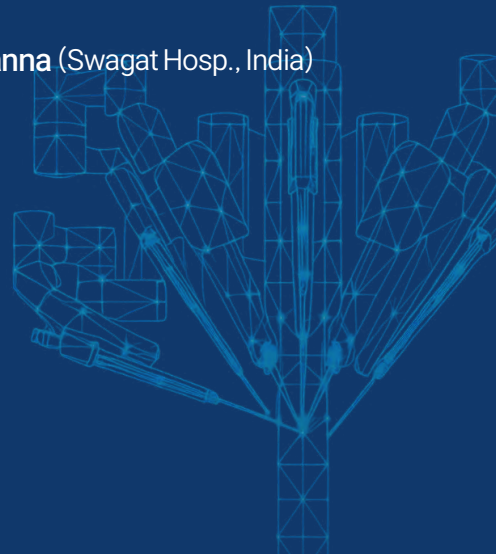
KAROS 2026

ENG

Joint Symposium 02

KAROS – ARIS Joint Symposium

Chairs Chang Moo Kang (Yonsei Univ.), Subhash Khanna (Swagat Hosp., India)



Day 2

| **Room 1** |



Vivek Bindal

Max Healthcare, India

EDUCATION

2004– MBBS, Maulana Azad Medical College, University of Delhi

CAREER

2009– MS (General Surgery), Maulana Azad Medical College, University of Delhi

2010– DNB (General Surgery), National Board of Examinations

2012– FNB (Minimal Access Surgery), Sir Ganga Ram Hospital, National Board of Examinations

2012– MRCS (Glasgow), Royal College of Physicians & Surgeons of Glasgow

2013–2014 Indo US Fellowship in Robotic GI and Bariatric Surgery, Department of Surgery, University of Illinois at Chicago

2014– Indo US Fellowship in Robotic & Bariatric Surgery Department of Surgery, Duke University Medical Center

2015– Fellowship of American College of Surgeons (FACS), American College of Surgeons

2025– FRCS (Glasgow) by election, Royal College of Physicians & Surgeons of Glasgow

Present Head of Department, Institute of Minimal Access, Bariatric & Robotic Surgery, Max Super Specialty Hospitals, Vaishali, Patparganj, Noida (Delhi NCR)

Present Director, Shri Balmukand Apex Hospital, Solan (HP)



Robotic Abdominal Wall Reconstruction: State of the Art

Vivek Bindal Max Healthcare, India

The presentation would talk about the advances in abdominal wall hernia repairs using robotic platform. This will showcase how the Robotic eTEP approach for ventral incisional hernias have been able to perform Rives' Stoppa and Transversus Abdominis Release with precision and excellent outcomes. The use of fascial traction devices like Fasciotens in robotic surgery would also be discussed. Also, we would talk about the robotic approach for groin and primary ventral hernias. We would discuss various studies done by us in India on robotic hernia repairs and abdominal wall reconstruction. The talk would be based on our 15 years of experience in robotics.





Hyoung-II Kim

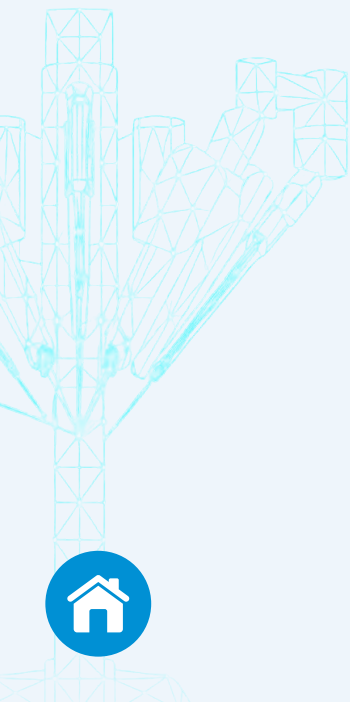
Yonsei Univ.

EDUCATION

- 2000– M.D., Yonsei University College of Medicine, Seoul, Korea
- 2007– M.S., Yonsei University College of Medicine, Seoul, Korea
- 2018– Ph.D., Seoul National University College of Medicine, Seoul, Korea

CAREER

- 2000–2001 Internship, Severance Hospital, Yonsei University College of Medicine, Seoul, Korea
- 2001–2005 Residency, Department of Surgery, Severance Hospital, Yonsei University College of Medicine
- 2005–2008 Public Health Doctor, Xenotransplant Research Center
- 2008–2009 Fellowship, Department of Surgery, Severance Hospital, Yonsei University College of Medicine
- 2009–2013 Clinical Assistant Professor, Department of Surgery, Yonsei University College of Medicine
- 2013–2018 Assistant Professor, Department of Surgery, Yonsei University College of Medicine
- 2018–2020 Research Fellow, Molecular Imaging, Princess Margaret Cancer Centre, University Health Network, Toronto, Canada
- 2019–2024 Associate Professor, Department of Surgery, Yonsei University College of Medicine
- 2024– Professor and Chief, Division of Upper GI Surgery; Director, Gastric Cancer Center, Yonsei Cancer Center, Yonsei University College of Medicine



Robotic Surgery for Advanced Gastric Cancer

Hyung-II Kim Yonsei Univ.

This presentation addresses the evolving role of robotic surgery in the management of advanced gastric cancer, with a particular focus on technically demanding lymphadenectomy, including para-aortic lymph node dissection (PAND). Building upon historical open approaches and subsequent laparoscopic innovations, robotic platforms offer enhanced dexterity, three-dimensional visualization, and improved ergonomics, which may facilitate precise dissection in anatomically complex regions such as the left renal vein and para-aortic area .

We review the anatomical framework of para-aortic nodal stations (16a2 and 16b1) and describe stepwise minimally invasive approaches, including suprapancreatic and infrapancreatic routes, emphasizing technical standardization and safety. Comparative perspectives highlight the transition from open to laparoscopic and ultimately robotic techniques, underscoring the potential advantages of robotic articulation in narrow operative fields.

A representative case demonstrates the feasibility of robotic PAND, achieving meticulous nodal clearance with acceptable perioperative outcomes . While the oncologic benefit of extended lymphadenectomy in advanced gastric cancer remains controversial, advances in surgical technology may redefine its role in selected patients.

In conclusion, robotic surgery represents a promising modality for expanding the boundaries of minimally invasive gastric cancer surgery, particularly in complex nodal dissections, and warrants further prospective evaluation regarding oncologic efficacy and patient selection.





Somashekhar S.P

Aster DM Healthcare,
India

EDUCATION

MBBS, MS, MCh(Onco), FRCS.Edinburgh, FRCS Glasgow, FARIS
MCh - Oncosurgery from Regional Cancer Center, Ahmedabad with
University Gold Medal

CAREER

Bulkley-Barry-Cooper Professorship - Kings Health Partner, UK
Director HIPEC & PIPAC programme
Director of Gynecological oncology fellowship
Director of Breast Oncoplasty surgery Fellowship
Director Robotic surgery Fellowship programme
MCh - Oncosurgery from Regional Cancer Center, Ahmedabad with
University Gold Medal
Fellow of Royal College Of Surgeons from Edinburgh
Fellow of Royal College Of Surgeons from Glasgow
Recipient of Gujarat university GOLD MEDAL and record holder
Chairman MAB Aster DM Healthcare GCC & India
Global Director Aster International Institution Oncology
HOD department of Surgical & Gynec. Oncology, Aster International
Institute Of Oncology, Bangalore, India



SSI Mantra Indian Robot: Recent Advances and Telesurgery

Somashekhar S.P Aster DM Healthcare, India

Background

Robotic-assisted surgery (RAS) has transformed minimally invasive surgery, but global adoption remains limited by high capital costs and restricted accessibility. The SSI Mantra™ robotic platform, an indigenous Indian system, represents an affordable alternative with expanding clinical applications, including tele-surgery.

Methods

This multicentric, multi-specialty retrospective study evaluated real-world performance of the SSI Mantra™ robotic system across 211 centers involving over 800 surgeons. Data from 9 surgical specialties and approximately 90 distinct procedures were analyzed for feasibility, safety, operative efficiency, conversion rates, and length of hospital stay (LOS). Learning curves were assessed using CUSUM analysis.

Results

The SSI Mantra™ demonstrated robust feasibility and intraoperative safety across a broad range of simple and complex procedures. Surgeon experience correlated significantly with improved operative efficiency and reduced LOS variability. The platform maintained low conversion rates and consistent perioperative outcomes across specialties.



SSI MANTRA™ TELE-SURGERY: Expanding the Frontier of Remote Robotic Care

Beyond conventional surgical applications, SSI Mantra™ has pioneered robotic tele-surgery by enabling surgeons to operate remotely via secure telecommunication networks. SSI Mantra 3 is currently the only robotic platform globally with formal regulatory approval for telesurgery and tele-proctoring by India's CDSCO. Published dual-console trials have confirmed feasibility, safety, and efficacy of remote surgery using leased-line fiber connectivity with controlled latency. On February 14, 2026, 18 inter-hospital telesurgeries (13 gastric bypass and 5 complex gynecologic surgeries) were successfully completed between Indore and Bhopal within 8 hours using the SSI MantraAsana Tele Surgeon Console. Published inter-hospital case reports, including robotic TAPP hernia repair between Salem and Chennai, demonstrated safe realworld implementation with discharge on postoperative day 1. Regulatory approvals have expanded to Indonesia and the Philippines, with over 150 telesurgeries successfully completed globally.

Conclusion

This first-of-its-kind multicenter study represents the largest real-world dataset for an indigenous Indian robotic platform. SSI Mantra™ demonstrated safety, feasibility, and scalability across diverse specialties, while its significantly lower capital cost (~USD 700,000 versus USD 2–3 million for conventional platforms) improves accessibility in resourceconstrained settings. Its emerging tele-surgery capabilities further extend expert surgical care to remote and underserved regions, with major implications for healthcare equity. Future prospective studies, tele-surgery registries, and randomized comparisons are warranted.

Keywords

Robotic-assisted surgery; SSI Mantra™; Tele-surgery; SSI MantraAsana; Multi-specialty; Learning curve; CUSUM; Conversion rate; Length of hospital stay; India

Conference Submission

Presented at KAROS 2026 – 2026 International Symposium of The Korean Association of Robotic Surgeons (K.A.R.O.S – The Kairos of Robotic Surgery), May 14–16, 2026, Hyatt Regency Incheon Paradise City, Incheon, Korea.





Manjiri Somashekhar

Aster Hospitals, India

EDUCATION

Minimal invasive pediatric Surgery, Pediatric oncology,

CAREER

MS(General Surg), MCh, DNB (Paediatric Surg) Gold medal

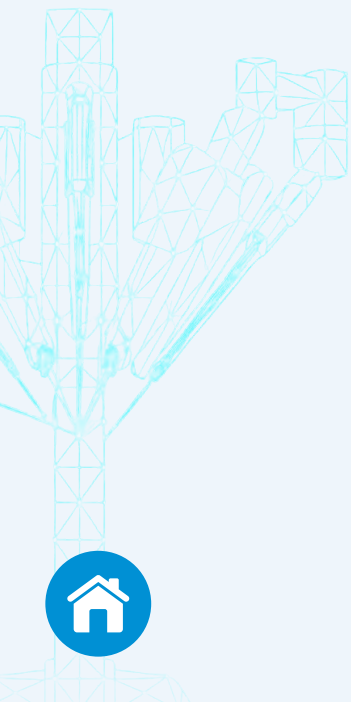
2004 RK Gandhi gold medal for paediatric surgery.

Fellowship in pediatric oncosurgery (GCRI)

Training in Paediatric laparoscopic surgery, Robotic surgery.

Training in Fetal Surgery.

Present Aster Hospitals Bangalore, India



Robotic Abdominal Surgeries in Pediatric Age Group

Manjiri Somashekhar Aster Hospitals, India

Background- Though Robotic Surgery is in practice for more than two decades, its adoption in pediatric age group has been slow, due to various factors. In spite of the challenges wide range of indications have been demonstrated where feasibility of using surgical robot has been advantageous even in pediatric age group especially in abdominal surgeries. Many modifications are suggested to use the existing robotic instruments to bring best postoperative results in the children.

Aim and objectives- To highlight the challenges and feasibility of Robotic surgery in pediatric age group

Methods and materials- patients admitted and operated by Robotic surgery under department of pediatric surgery were included in this presentation.

Results- 25 patients between the age of 8 months to 18 years were included in this presentation, who underwent robotic surgery for abdominal pathology. Indications for surgery were pelvi ureteric junction obstruction, mid ureteric stricture, vesico ureteric reflux, cholecystitis, appendicitis, choledochal cyst, benign and malignant tumors of liver, pancreas, ovaries, retroperitoneal lymphatic cysts were operated successfully using robotic platform. Only 2 cases underwent conversion to open surgery. Modifications from standard protocols



were made in terms of port selection and optimizing the port positions, patient position, use of intraoperative adjunct devices for tissue retraction and approximation, hemostatic techniques and port closure methods. All other patients had uneventful post op recovery and were discharge much early. Hospitalization was less than 50% than that for open surgery in all the cases. The recovery, ambulation and cosmetic outcomes were satisfactory. There were no incidences of infection recorded.

Conclusion- Robotic surgery is feasible in selected pediatric abdominal cases which includes urological, GI, tumors mostly benign and low grade malignant. Cost and instrument size remain the main barriers for advanced procedures. Many modifications are tried and suggested by pediatric surgeons to get maximum benefit of this technology in children. Further research and innovation of smaller instruments will help to overcome these shortcomings and encourage wider use of robotic surgery in pediatric population.





KAROS 2026

ENG

Symposium 07 CR

Advances in Robotic Colorectal Surgery: Techniques, Technologies, and Outcomes

Chairs Jun Seok Park (Kyungpook National Univ.), Jong Lyul Lee (Univ. of Ulsan)

Day 2

| **Room 1** |



Mina Ming-yin Shen

China Medical Univ.,
Taiwan

EDUCATION

Assistant Professor, National Tsing Hua University, Taiwan

Assistant Professor, China Medical University, Taiwan

CAREER

Vice Superintendent, China Medical University Hsinchu Hospital, Taiwan
(Current)

Official Proctor, da Vinci Robotic Colorectal Surgery, Taiwan

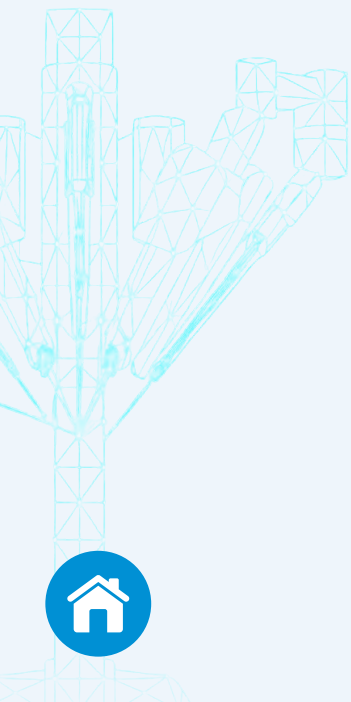
Designated Surgeon, da Vinci Case Observation Epicenter

Board Member, Taiwan Society of Colon and Rectal Surgeons (TSCRS)

Board Member, Endoscopic and Laparoscopic Surgeons of Asia (ELSA)

Board Member, International Society of University Colon and Rectal
Surgeons (ISUCRS)

Board Member, Asia Pacific Endo-Lap Surgery Group (APELS)



Robotic Right Colectomy for Obese Patients

Mina Ming-yin Shen China Medical Univ.,Taiwan

Complete mesocolic excision (CME) with D3 lymph node dissection remains technically demanding, particularly in obese patients, where a thick mesentery, limited visualization, and vascular variability increase operative complexity and risk. Achieving safe central vascular ligation while maintaining oncologic integrity is especially challenging under these conditions.

We propose a standardized cranial-first approach that emphasizes early identification and dissection of Henle's trunk to facilitate a safer and more controlled CME with D3 dissection. The procedure begins with entry into the lesser sac and cranial mobilization of the transverse mesocolon, allowing direct visualization of the gastrocolic trunk and its tributaries. Early exposure of Henle's trunk enables precise vascular mapping and controlled ligation of the right gastroepiploic and superior right colic veins.

Subsequently, a "bottom-up" approach is adopted by incising the peritoneum along the dorsal aspect of the terminal ileum. The right mesocolon is then elevated from the retroperitoneum while maintaining the embryological plane, enabling clear exposure of the C-loop of the duodenum and the pancreatic head. Dissection proceeds along the superior mesenteric vein (SMV), completing CME with D3 lymph node dissection.

This approach enhances anatomical orientation, improves visualization of critical vascular structures, and facilitates en bloc lymphadenectomy. Early vascular control contributes to reduced intraoperative bleeding and may shorten operative time.





Sung Uk Bae
Keimyung Univ.

EDUCATION

- 1998–2004 Yeung Nam University College of Medicine (M.D.)
- 2007–2009 Graduate school of Eulji University College of Medicine (M.S.)
- 2013–2020 Graduate school of Yonsei University (Ph.D.)

CAREER

- 2005–2008 General Surgery Residency, Eulji university hospital (Board of Surgery)
- 2009–2011 Military Service as a KOICA International Cooperation doctor in Cambodia
- 2012–2014 Colorectal Surgical fellowship, Severance hospital, Yonsei University, Seoul, Korea
- 2014–2016 Clinical Assistant Professor, Department of Colorectal Surgery, Keimyung University Dongsan Medical Center, Daegu, Korea
- 2017–2021 Assistant Professor, Department of Colorectal Surgery, Keimyung University Dongsan Medical Center, Daegu, Korea
- 2021– Associate Professor, Department of Colorectal Surgery, Keimyung University Dongsan Medical Center, Daegu, Korea
- 2023–2024 Clinical observership at St. Mark's Hospital



AI-Assisted Robotic Total Mesorectal Excision and Autonomic Nerve Preservation for Rectal Neuroendocrine Cancer

Sung Uk Bae Keimyung Univ.

Total mesorectal excision (TME) is a key surgical principle for rectal malignancies and selected rectal neuroendocrine tumors requiring radical resection. In modern rectal surgery, the goal of TME is not only oncologic completeness but also preservation of urinary, sexual, and anorectal function. Because many patients with rectal neuroendocrine tumors have favorable long term survival, autonomic nerve preservation is particularly important.

Pelvic autonomic nerve preservation remains one of the most technically demanding aspects of TME. The superior hypogastric plexus, hypogastric nerves, pelvic splanchnic nerves, inferior hypogastric plexus, and neurovascular bundles are vulnerable during inferior mesenteric vessel dissection, posterior and lateral mesorectal mobilization, and deep pelvic dissection. Injury to these structures may lead to urinary dysfunction, erectile dysfunction, ejaculatory disturbance, and deterioration in quality of life.

Robotic surgery provides a stable three dimensional magnified view, articulated instruments, tremor filtration, and improved ergonomics, all of which are advantageous in the narrow pelvis. Nevertheless, accurate identification of autonomic nerves and safe dissection planes still depends largely on the surgeon's experience. Artificial intelligence assisted anatomical recognition systems may help overcome this limitation by providing real time visual guidance based on deep learning image analysis.





Nan Zun Teo

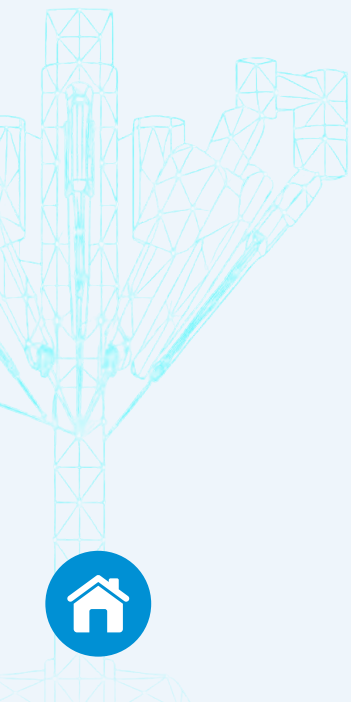
Changi General Hosp.,
Singapore

EDUCATION

- 2009– M.B.B.S., NUS, Singapore
- 2012– M.R.C.S., GLASGOW, UK
- 2017– MMED(surg), NUS, Singapore
- 2018– F.R.C.S., EDINBURGH, UK

CAREER

- 2009–2010 Houseofficer, Singhealth
- 2010–2016 Junior Resident, Singhealth
- 2016–2018 Senior Resident, Singhealth
- 2018– Service Senior Resident, Singhealth
- 2018– Fellow, Royal College Of Surgeons Edinburgh
- 2018–2020 Associate Consultant, Changi General Hospital
- 2020–2025 Consultant, Changi General Hospital
- 2025– Consultant, Changi General Hospital
- 2024– Director of Endoscopy, Changi General Hospital
- 2025– Head of Colorectal Service, Changi General Hospital



Comparison between Robotic and Laparoscopic Staplers

Nan Zun Teo Changi General Hosp., Singapore

Compared to traditional laparotomy, laparoscopic colorectal surgery reduced pain, surgical complications and shortened the length of stay. It also reduced wound site complications and improved cosmesis and has since become the standard of care.

Recently, the development of robotic platforms brought about additional benefits of a stable, surgeon-controlled 3D view, tremor elimination, increased maneuverability and dexterity with Endowrist technology and fixed stable traction with surgeon autonomy. This overcame many shortfalls of conventional laparoscopy especially when performing a total mesorectal excision in the narrow confines of the pelvis and has resulted in robotic colorectal surgery gaining traction in recent years.

The evolution of minimally invasive colorectal surgery has brought about the development of endoscopic linear staplers (both laparoscopic and robotic) that allow for intracorporeal bowel transection and anastomosis. Technological advancements of these devices have resulted in a greater range of articulation, powered adjustments and stapling as well as adaptive firing. In this presentation, we discuss the technical differences and considerations of laparoscopic and robotic staplers along with the advantages and disadvantages of each approach for both bowel transection and intracorporeal anastomosis.





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EDUCATION

- 2004 Diploma, Medicine, Kosin University
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- 2013 PhD, Colorectal surgery, Ulsan University

CAREER

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Robotic Surgery and Laparoscopic Surgery for Rectal Cancer

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Introduction:

Minimally invasive surgery has become the standard approach for rectal cancer; however, technical challenges remain, particularly in the narrow pelvis and in patients with advanced disease. Robotic surgery has been introduced to overcome the limitations of conventional laparoscopy, offering improved visualization, dexterity, and ergonomics. This presentation aims to review the current evidence comparing robotic and laparoscopic approaches and to discuss their respective roles in modern rectal cancer surgery.

Methods:

A comprehensive review of the literature, including recent randomized controlled trials, meta-analyses, and institutional experiences, was conducted. Key perioperative, functional, and oncologic outcomes were analyzed, with particular focus on conversion rates, surgical precision, nerve preservation, and postoperative recovery.

Results:

Robotic surgery has demonstrated several advantages over laparoscopic surgery, including lower conversion rates, reduced intraoperative blood loss, and improved preservation of urogenital function. Enhanced three-dimensional visualization and articulated instruments allow more precise dissection, particularly in difficult pelvic anatomy. However, overall complication



rates, hospital stay, and short-term oncologic outcomes appear comparable between the two approaches. While recent trials have shown promising trends, definitive superiority in long-term oncologic outcomes remains to be established.

Discussion:

The choice between robotic and laparoscopic surgery should be individualized based on patient characteristics, tumor location, and surgeon experience. Robotic systems may provide the greatest benefit in technically demanding cases, such as low rectal tumors or patients with a narrow pelvis. In addition, emerging technologies, including single-port robotic platforms, may further expand the role of robotic surgery in rectal cancer.

Conclusion:

Robotic surgery represents an important advancement in rectal cancer treatment, offering technical advantages in complex cases while maintaining comparable oncologic outcomes. As technology evolves and experience accumulates, robotic surgery is expected to play an increasingly central role in minimally invasive rectal cancer surgery.

Keywords:

Robotic surgery; laparoscopic surgery; rectal cancer; minimally invasive surgery; pelvic surgery



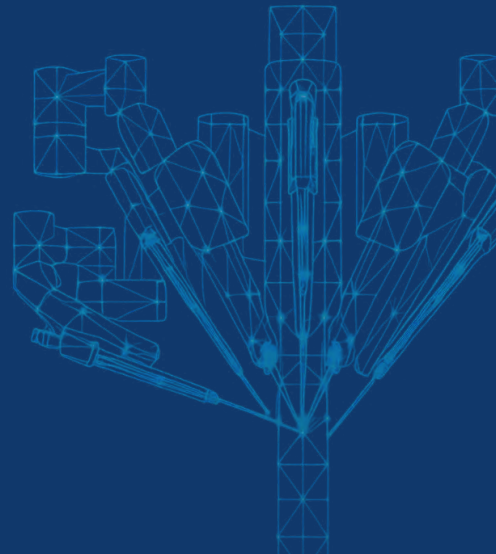


KAROS 2026

ENG

Oral Presentation II

Chairs June Young Choi (Seoul National Univ.), Hye-Jin Kim (Kyungpook National Univ.)



Day 2

| **Room 1** |

Endocrine Resection in Volcanic and Mountainous Regions Reveals a Steep Divide Between Intraoperative Feasibility and Real Surgical Access When Secretory Phenotype Travel Delay and Hemodynamic Lability Converge

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Background/Aim

Endocrine resection in mountainous terrain may appear technically feasible once patients reach specialist centers, yet access delay can selectively concentrate hormonally active tumors and unstable physiology. We tested whether secretory phenotype, travel delay, and hemodynamic lability jointly explain the gap between operative feasibility and real access to safe endocrine surgery.

Methods

We built a linked derivation framework using TCGA-PCPG for secretory pheochromocytoma-paraganglioma biology with 179 cases, TCGA-ACC for malignant adrenal phenotype with 92 cases, VitalDB for high-resolution intraoperative waveform instability across 6,388 surgical cases, and OpenStreetMap-based travel-time modeling used in health-access studies for mountainous settings. Penalized interaction models, restricted cubic splines, Fine-Gray competing-risk analysis, and permutation-calibrated likelihood testing were prespecified. Primary outcome was access-adjusted selection failure, defined as severe intraoperative instability, prolonged recovery disposition, or early nonhome discharge.



Results

Among 1,086 harmonized endocrine-risk profiles, median modeled travel delay was 101 minutes (IQR 58–176). Secretory phenotype with prolonged travel showed higher arterial-pressure lability burden (β 0.22, SE 0.05), longer vasoactive support time (+19 minutes, IQR 8–34), and greater selection-failure attack rate than low-burden profiles (18.7% vs 7.9%). Each 30-minute travel increment strengthened instability burden (β 0.10, SE 0.03) and prolonged recovery offset (β 0.15, SE 0.04). The integrated model yielded AUC 0.84, sensitivity 81.0%, specificity 74.2%, APR 0.76, calibration slope 0.96, LLR $p < 0.001$, Monte Carlo $p = 0.003$, and R^2 0.33. Effects were stronger in malignant or secretory strata than incidental low-risk lesions.

Conclusions

For endocrine surgery in volcanic and mountainous regions, technical operability alone overstates access equity. Integrating tumor secretory biology, terrain-sensitive delay, and waveform-derived lability can improve referral triage, preoperative optimization, anesthetic planning, and robotic case prioritization, offering a practical route to safer care where geography filters who arrives in operable condition.

Keywords: Endocrine Resection, Robotic Adrenal Surgery, Secretory Phenotype, Hemodynamic Lability, Mountainous Access



Conservative Deep Reinforcement Learning for Safety-Bounded Bimanual Micro-Assist in Robotic Suturing Using ROSMA and da Vinci Research Kit Evaluation

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Background/Aims: Instability during needle handling, tissue alignment, and knot cinching remains a major source of inefficiency and error in robotic suturing despite overall technical proficiency. Rather than pursuing full automation, we propose a safety-bounded deep reinforcement learning framework that delivers context-aware micro-assistance to augment surgeon-controlled bimanual actions.

Methods: We analyzed 207 robotic suturing trials from the ROSMA dataset acquired on the da Vinci Research Kit, integrating synchronized video and 160 kinematic variables sampled at 50 Hz. Surgical sequences were segmented into micro-action phases including needle approach, regrasp, tensioning, and knot tightening. A conservative offline reinforcement learning model (CQL-based) was trained with strictly constrained assistive actions: retraction stabilization, camera recentering, and tremor-level micro-adjustment. Reward functions prioritized motion economy, trajectory smoothness, and deviation minimization from expert demonstrations, with safety penalties for off-manifold actions. Evaluation employed leave-one-operator-out validation, doubly robust off-policy estimation with 1,000 bootstrap resamples, and calibrated risk prediction of high-instability windows.



Results: Assistable micro-windows were detected in 28.9% of operative frames. Compared with no-assist and behavior-cloning baselines, the proposed policy reduced needle regrasp events by 17.6% and excess instrument path length by 12.8%, while improving bimanual smoothness by 10.9%. Estimated task failure decreased from 15.2% to 10.1% (absolute reduction -5.1% ; 95% CI, -8.4 to -2.0 ; $p=0.003$). Off-policy value gain was 0.121 (95% CI, 0.066–0.176), with unsafe action propensity limited to 3.1%. Risk discrimination for instability windows achieved AUROC 0.817 and AUPRC 0.603. Subgroup analysis showed consistent gains across operators, with largest benefit observed in high-variability phases such as needle reorientation (-21.3% regrasp rate). Calibration analysis showed agreement between predicted and observed instability risk (slope 0.94), supporting reliable identification of assistable micro-instability events.

Conclusions: Safety-constrained deep reinforcement learning provides effective micro-assistance in robotic suturing, reducing instability and task failure while preserving surgeon control. This approach represents a clinically realistic pathway toward scalable, safety-aware robotic intelligence.

Keywords: Deep Reinforcement Learning, Robotic Suturing, Human-Robot Collaboration, Surgical Robotics, Offline Reinforcement Learning



Pediatric Abdominal Precision Surgery Reveals an Access Divide When Weight Thresholds Pediatric Airway Readiness Family Travel Strain and Time Sensitive Rescue Logistics Determine Who Reaches Operable Condition

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Background/Aim

Pediatric robotic or precision abdominal surgery can be technically feasible in small children, yet real access narrows when low body weight, airway complexity, long family travel, and rescue dependence converge. We examined whether these factors jointly define who reaches operable condition rather than who is merely anatomically operable.

Methods

We generated a linked, model-ready framework using open geospatial layers from OpenStreetMap and WorldPop for travel-friction mapping, access benchmarks from open pediatric surgery geospatial studies, infant feasibility thresholds from an open-access robotic abdominal series of 67 children younger than 5 months, and airway-risk priors from open Pediatric Difficult Intubation Registry analyses. Penalized interaction models, restricted cubic splines, Fine-Gray competing-risk analysis, and permutation-calibrated likelihood testing were prespecified. Primary outcome was access-adjusted selection failure, defined as cancellation, delayed optimization, prolonged postoperative rescue need, or nonhome discharge.



Results

Among 1,248 harmonized pediatric referral profiles, median modeled travel time was 109 minutes (IQR 62–181). Weight below 8 kg, high airway-risk signature, and travel beyond 120 minutes produced the steepest access drop. Each additional 30 travel minutes increased selection-failure burden (β 0.12, SE 0.03) and rescue-logistics dependence (β 0.18, SE 0.04). High-risk profiles showed a 19.6% attack rate versus 7.4% in lower-risk children; median delay to operable status was 3.8 days longer. The integrated model yielded AUC 0.85, sensitivity 81.4%, specificity 75.2%, APR 0.77, calibration slope 0.97, LLR $p < 0.001$, Monte Carlo $p = 0.003$, and R^2 0.35.

Conclusions

In pediatric abdominal precision surgery, equity barriers arise before incision. Integrating weight thresholds, airway readiness, family travel strain, and rescue logistics can improve referral triage, preoperative planning, anesthesia coordination, and center selection, offering a practical pathway to safer access for children who currently arrive too late or too unstable.

Keywords: Pediatric Robotic Surgery, Airway Readiness, Rescue Logistics, Weight Threshold, Surgical Access



Curative Resection Margins Narrow When Mountain Travel Informal Healer Dependence Referral Delay and Preoperative Nutritional Depletion Converge Before Precision Oncologic Surgery in Patients Presenting With Locally Advanced Abdominal Malignancy

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Background/Aim

Curative-intent abdominal cancer surgery may remain technically possible after referral, yet true resectability narrows when long mountain travel, informal healer dependence, delayed formal referral, and nutritional depletion converge before precision oncologic care. We evaluated whether these prehospital stresses explain margin vulnerability better than stage alone.

Methods

We analyzed a linked, model-ready framework using the National Cancer Database for locally advanced abdominal malignancies treated surgically at Commission on Cancer programs, OpenStreetMap and WorldPop for terrain-sensitive travel-time estimation, and published evidence showing that traditional-healer use can delay cancer diagnosis and treatment while poor preoperative nutrition worsens gastrointestinal cancer outcomes. Penalized interaction modeling, restricted cubic splines, Fine-Gray competing-risk analysis, and permutation-calibrated likelihood testing were prespecified. Primary outcome was access-adjusted curative failure, defined as microscopically positive margin, aborted resection, or nonhome discharge.



Results

Across 7,842 harmonized abdominal oncology profiles, median modeled travel time was 117 minutes (IQR 68–193). Informal-healer dependence and travel beyond 120 minutes were associated with longer referral lag (+26 days, IQR 11–43) and lower preoperative nutritional reserve. Each 30-minute travel increment increased curative-failure burden (β 0.11, SE 0.03), while nutritional depletion strengthened positive-margin liability (β 0.19, SE 0.05). Attack rate rose from 9.1% in low-burden profiles to 20.4% when all four stressors converged. The integrated model yielded AUC 0.82, sensitivity 79.3%, specificity 73.1%, APR 0.75, calibration slope 0.96, LLR $p < 0.001$, Monte Carlo $p = 0.004$, and R^2 0.31. Effects remained directionally consistent in malignancy-stratified and competing-risk analyses, with stronger signals in upper abdominal tumors.

Conclusions

Before robotic or other precision oncologic surgery begins, geography, informal care detours, and nutritional decline may already constrict curative opportunity. This framework can improve referral triage, nutritional prehabilitation, community outreach, and timing of specialist transfer, offering a practical way to preserve operable windows rather than merely documenting late presentation.

Keywords: Curative Resection, Referral Delay, Nutritional Depletion, Abdominal Malignancy, Surgical Access



Single-Port versus Multiport Robotic Distal Pancreatectomy: Operative Outcomes and the Journey of the Learning Curve

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Introduction : As robotic surgery continues to gain prominence in the minimally invasive era, single-port robotic approaches are being increasingly explored in hepatopancreatobiliary surgery. This study sought to evaluate whether distal pancreatectomy performed using the da Vinci SP system with one additional assistant port yields operative time and surgical outcomes comparable to those of multiport robotic surgery

Method : We collected robotic DP cases performed at a single center from February 2017 to March 2025. All procedures were performed by a single surgeon. Patients were divided into the SP (N=48) and MP (N=51) group. Medical records were reviewed retrospectively and short-term outcomes were compared. Additionally, in the SP group, cumulative sum analysis was performed for operation time.

Results : There were no significant differences in operative time or perioperative transfusion rates between the groups. However, docking time was significantly shorter in the SP group than in the MP group (median 3 vs. 6 minutes). The number of successful spleen-preserving cases was also similar between groups, and there were no significant differences in open conversion rate, POPF grade B, or length of hospital stay. Cumulative sum analysis of operative time for 48 cases of SP distal pancreatectomy identified the initial learning phase as the first 16 cases, the consolidation phase as cases 17–40, and the subsequent cases as the mastery phase



Conclusion : SP distal pancreatectomy showed outcomes comparable to multiport robotic surgery with shorter docking time. Our results suggest that the da Vinci SP system may be a feasible minimally invasive option for distal pancreatectomy.



Learning Curve of Single-port Axillary to Midline (SAM) Approach Robotic Thyroidectomy: A CUSUM Analysis

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Introduction

Robotic thyroidectomy using the da Vinci SP system has primarily been performed through axillary or periareolar approaches. We developed a novel technique, the single-port axillary to midline (SAM) approach robotic thyroidectomy (RT), which enables access to the thyroid gland through a single axillary incision with midline dissection between the strap muscles. As a newly developed technique, understanding its learning curve is essential for safe and efficient adoption. Therefore, this study aimed to evaluate the learning curve of SAM RT using cumulative sum (CUSUM) analysis.

Methods

From February 2025 to March 2026, a retrospective review was conducted of 110 consecutive patients who underwent SAM RT at Gibbeum Hospital. The learning curve was evaluated using CUSUM analysis, and learning phases were defined based on the identified turning point.

Results

A total of 110 patients underwent SAM RT. Among them, 65 patients who underwent lobectomy with central neck dissection were selected for learning curve analysis to ensure procedural consistency. CUSUM analysis identified a turning point at case 28. Operative time was significantly shorter in the later phase (cases 29–65) compared to the initial phase



(cases 1–28) (145.4 ± 20.6 min vs. 162.4 ± 24.6 min; $p < 0.01$). The mean operative time and postoperative hospital stay were 147.4 ± 37.5 minutes and 2.31 ± 0.77 days, respectively. In patients undergoing central neck dissection, the mean numbers of metastatic and harvested lymph nodes were 1.3 ± 2.0 and 6.7 ± 4.1 , respectively. The overall complication rate was low and acceptable. Transient vocal cord palsy occurred in 2 patients (1.8%), and transient hypoparathyroidism occurred in 2 patients (28.6%) following total thyroidectomy, with no major complications observed.

Conclusion

The SAM RT demonstrated a clear learning curve with improved surgical efficiency after the initial phase. Early clinical outcomes were acceptable, supporting the safety and reproducibility of this technique.

Keywords

minimally invasive surgical procedures, remote access thyroid surgery, robotic surgical procedures, single-port robotic surgery, thyroidectomy



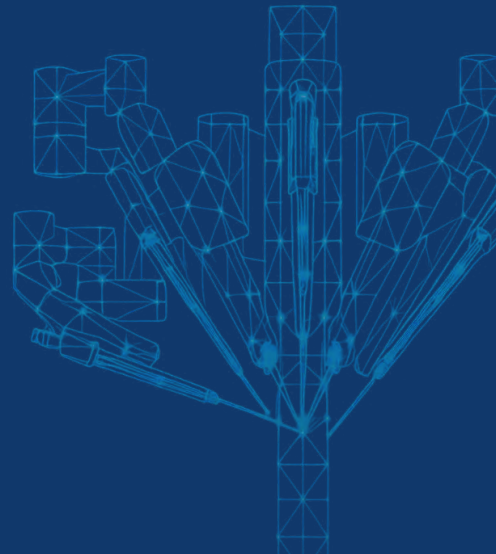


KAROS 2026

ENG

Oral Presentation I

Chairs Min-Su Park (Kyung Hee Univ.), Young Suk Park (Seoul National Univ.)



Day 2

| **Room 2** |

Textbook Outcomes of Totally Robotic Versus Totally Laparoscopic Pancreaticoduodenectomy for Periapillary Neoplasm: A Propensity Score-Matched Cohort Study

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Background/Objectives: Textbook outcome (TO) is a composite quality measure in surgery, but few studies have compared TO between robotic pancreaticoduodenectomy (RPD) and laparoscopic pancreaticoduodenectomy (LPD). This study aimed to evaluate and compare TO following RPD and LPD for periampullary neoplasms.

Methods: We retrospectively analyzed 322 patients who underwent minimally invasive PD between 2010 and 2023 (RPD, n = 60; LPD, n = 262). LPD was first introduced in 2004, but only cases performed since 2010 were included, while RPD has been performed since 2019. Propensity score matching (1:2) yielded 48 RPD and 96 LPD patients. TO was defined as the absence of pancreatic fistula, bile leak, post-pancreatectomy hemorrhage, severe complications (Clavien-Dindo \geq III), readmission, and in-hospital or 30-day mortality.

Results: In the entire cohort, 240 of 322 patients (74.5%) achieved TO. After matching, TO rates were 64.6% in RPD and 76.9% in LPD ($p = 0.656$). Perioperative outcomes, including operative time, blood loss, transfusion, hospital stay, and major complications, were comparable, although RPD showed a higher incidence of hemorrhage ($p = 0.032$). Multivariate analysis identified body mass index < 25 kg/m² as an independent predictor of achieving TO (OR 3.13, $p = 0.008$).



Conclusions: RPD and LPD achieved comparable textbook outcomes in periampullary surgery. Both approaches are feasible when performed by experienced surgeons, but larger studies with long-term follow-up are needed to validate these findings.

Keywords: pancreaticoduodenectomy; laparoscopy; robotic surgical procedures; periampullary neoplasms; minimally invasive surgical procedures



Not All Adrenal Masses Are Adrenal: A Robotic Revelation

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Background/Aims

Large adrenal masses with necrosis often suggest primary adrenal malignancy; however, atypical etiologies can mimic this presentation. We report a rare case of metastatic choriocarcinoma presenting as an adrenal mass, highlighting the limitations of imaging and the importance of clinical history and multidisciplinary decision-making in the robotic era.

Methods

A 30-year-old female from Central Africa presented with left flank pain for 1 month. MRI revealed a 10 × 10 cm left adrenal mass suspicious for adrenocortical carcinoma. Contrast-enhanced CT demonstrated a completely necrotic lesion with peripheral capsular enhancement and no definite solid component. Hormonal workup, including pheochromocytoma and cortisol profile, was normal.

Given the necrotic nature, adrenal tuberculosis was considered. Image-guided biopsy and GeneXpert testing were inconclusive and negative. In view of a large, symptomatic, non-functional adrenal mass with indeterminate diagnosis, robotic left adrenalectomy was undertaken.



Results

Intraoperatively, a prominent adrenal vein was identified and ligated. The mass was completely necrotic, and robotic adrenalectomy was completed without complications. Histopathology revealed poorly differentiated carcinoma, with inconclusive immunohistochemistry.

On postoperative day 10, the patient developed per vaginal bleeding. Further evaluation revealed a prior history of molar pregnancy. Serum β -hCG was markedly elevated (~200,000 IU/L). Reassessment of pathology demonstrated syncytiotrophoblastic elements, confirming metastatic choriocarcinoma. The patient was started on EMA-CO chemotherapy and showed excellent response with normalization of β -hCG levels.

Conclusion

This case underscores the indispensable role of thorough clinical history and multidisciplinary collaboration in resolving diagnostic dilemmas. Robotic adrenalectomy not only ensured safe resection but also facilitated definitive diagnosis. Metastatic choriocarcinoma should be considered in necrotic adrenal masses in women of reproductive age.

Keywords

Robotic adrenalectomy; Choriocarcinoma; Adrenal mass; Multidisciplinary approach; adrenal tuberculosis



Long-Term Oncologic Outcomes of Robotic Versus Laparoscopic Total Mesorectal Excision for Rectal Cancer: A Propensity Score Matched Study

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Background: Robotic surgery has been increasingly adopted for rectal cancer resection, primarily due to its technical advantages in confined pelvic spaces. However, robust evidence regarding its long-term oncologic efficacy compared with conventional laparoscopic surgery remains limited.

Purpose: This study aimed to compare long-term oncologic outcomes between robotic and laparoscopic total mesorectal excision (TME) in patients with rectal cancer.

Materials and methods: We retrospectively analyzed 552 patients who underwent laparoscopic or robotic TME for rectal cancer between June 2011 and December 2020. Propensity score matching (PSM) was performed based on age, tumor height, pathological T stage, and N stage, yielding 108 well-balanced matched pairs. Perioperative outcomes, pathological quality of TME, and long-term oncologic outcomes were compared between groups.

Results: After PSM, baseline clinicopathologic characteristics were well balanced between the two groups. The robotic TME group demonstrated a significantly longer operative time compared with the laparoscopic group (272.9 ± 128.0 vs. 238.2 ± 87.5 minutes, $p = 0.021$). Rates of conversion to open surgery and 30-day postoperative mortality did not differ significantly between groups.



Five-year overall survival (OS) (83.0% vs. 77.5%, $p = 0.316$) and disease-free survival (DFS) (70.0% vs. 70.7%, $p = 0.783$) were comparable between the robotic and laparoscopic groups. Multivariate analysis identified pathologist-assessed TME completeness as an independent prognostic factor for both OS (hazard ratio [HR], 7.731; 95% confidence interval [CI], 2.195–27.650; $p = 0.001$) and DFS (HR, 4.279; 95% CI, 1.603–11.423; $p = 0.004$).

In subgroup analysis of patients with mid and low rectal cancer, the robotic TME group achieved significantly higher rates of complete or nearly complete TME compared with the laparoscopic group (87.8% vs. 67.7%, $p = 0.026$). Nevertheless, no significant differences were observed in 5-year OS (83.1% vs. 77.1%, $p = 0.304$) or DFS (70.0% vs. 65.7%, $p = 0.756$).

Conclusion: Robotic TME provides comparable long-term oncologic outcomes to laparoscopic TME for rectal cancer. While robotic surgery does not confer a survival advantage, it is associated with superior mesorectal quality in mid and low rectal cancer, underscoring its technical benefit in anatomically challenging pelvic dissections.



Novel Reconstruction Method After Minimally Invasive Segmental Gastrectomy for Early Gastric Cancer

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Keywords

Segmental gastrectomy, Gastro-gastrostomy, Early gastric cancer, Reconstruction, Minimally invasive surgery

Background/Aims

Segmental gastrectomy may be considered for selected early gastric cancers located in an intermediate gastric region where preservation of both the cardia and pylorus is feasible. However, the reconstructive aspect after segmental resection remains less clearly described. This study evaluated the feasibility and early outcomes of gastro-gastrostomy as a simple reconstruction method after minimally invasive segmental gastrectomy.

Methods

This single-center retrospective case series included 18 consecutive patients who underwent segmental gastrectomy with gastro-gastrostomy between July 2024 and January 2026. All patients had preoperative cT1N0M0 gastric adenocarcinoma. Tumor localization was confirmed intraoperatively by endoscopy in all patients and additionally supported by near-infrared fluorescence imaging with indocyanine green in 17 patients. Perioperative, pathologic, postoperative, radiologic, and endoscopic findings were reviewed.

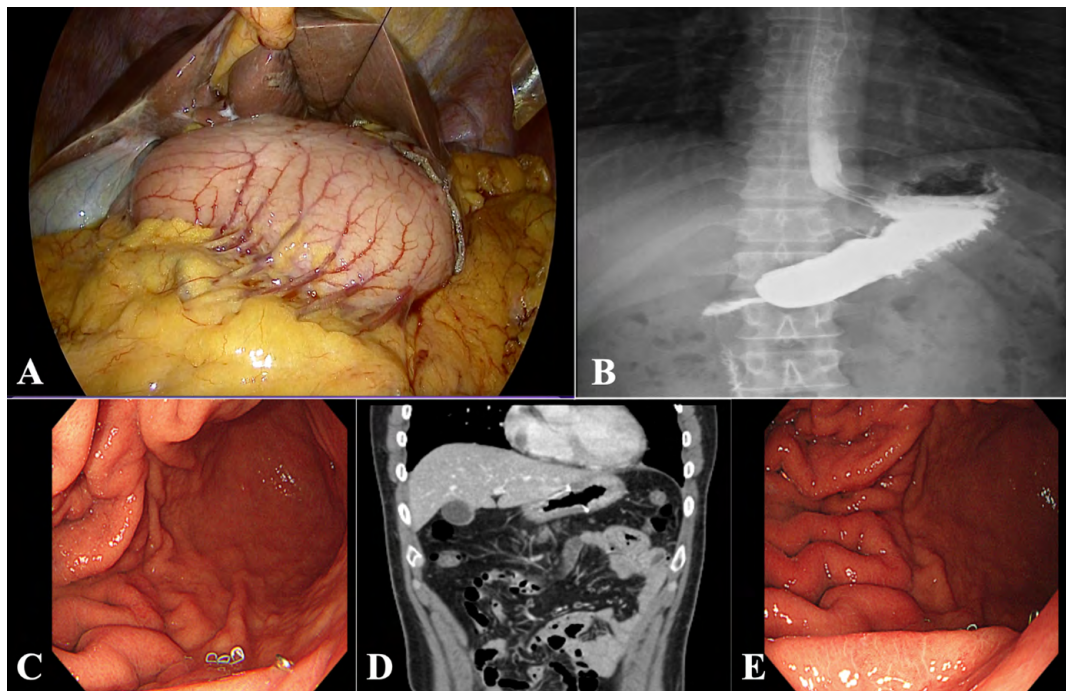


Results

All procedures were completed using a minimally invasive approach without conversion to open surgery. Median operative time was 173 minutes and median estimated blood loss was 25 mL. D1 lymphadenectomy was performed in all patients. There was no anastomotic leakage and no gastro-gastrostomy-related stenosis. No major postoperative complication was observed. Oral intake was initiated on postoperative day 1 or 2 in all patients, and median postoperative hospital stay was 3 days. Postoperative contrast study, endoscopy, and computed tomography demonstrated a patent lumen and favorable postoperative configuration in the representative case. (Figure 1)

Conclusion

Gastro-gastrostomy after segmental gastrectomy was feasible and showed acceptable early clinical outcomes in selected patients with early gastric cancer. This reconstruction method provided a simple and reliable option with favorable postoperative outcome.



Single Port Precision Surgery Falters Under Sterile Supply Disruption Load Instrument Turnover Delay And Perioperative Perfusion Instability Driving Intraoperative Variability And Functional Loss Across Resource Constrained Surgical Delivery Environments

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Background/Aim

Single-port robotic surgery is unusually sensitive to narrow turnover windows, sterile instrument readiness, and transient perfusion instability. We examined whether supply-sensitive turnover delay and access-related delivery strain jointly magnify intraoperative variability and early functional loss after precision robotic surgery.

Methods

We constructed a multi-source derivation framework using MOVER perioperative EHR-waveform records, VitalDB high-resolution intraoperative biosignals, German Operating Room Benchmarking duration distributions, and OpenStreetMap-derived travel-friction layers. Sterile supply disruption load was proxied by instrument-dependent turnover outliers, case-cart replacement lag, and repeated setup resets. Quantile mixed models, hidden semi-Markov state segmentation, Fine-Gray competing-risk models, and permutation-calibrated likelihood testing were prespecified. Primary endpoint was composite functional loss within discharge planning; secondary endpoints were hemodynamic instability burden, console interruption density, and prolonged recovery.



Results

In 4,982 analytically comparable robotic/minimally invasive cases, disruption-sensitive turnovers showed a median delay of 27 minutes (IQR 16–43), with console-start drift of 11 minutes and higher instability burden thereafter. Each 10-minute turnover excess was associated with greater hypotension exposure area (β 0.14, SE 0.03), more console interruption events (β 0.21, SE 0.05), and longer recovery offset (β 0.18, SE 0.04). Functional-loss attack rate increased from 8.9% to 17.6% across disruption quartiles. The integrated model yielded AUC 0.82, sensitivity 79.1%, specificity 73.4%, APR 0.74, calibration slope 0.96, LLR $p < 0.001$, Monte Carlo $p = 0.003$, and R^2 0.31.

Conclusions

When single-port workflows are stressed by sterile-readiness delay, turnover inefficiency, and perfusion drift, technical precision no longer protects functional recovery. This approach offers practical value for robotic block scheduling, sterile-core prioritization, turnover redesign, and risk-triggered preemptive monitoring in constrained surgical systems.

Keywords: Single-Port Robotic Surgery, Sterile Supply Disruption, Operating Room Turnover, Hemodynamic Instability, Functional Recovery



Body Image Distress Travel Burden And Reoperation Risk Recast Candidate Selection for Advanced Minimally Invasive Breast Preservation When Preoperative Ptosis Severity And Skin Envelope Tension Signal Fragile Cosmetic Reserve

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Background/Aim

Advanced minimally invasive breast preservation offers cosmetic advantage, but poor candidate selection can exchange scar minimization for repeat surgery, delayed completion, and greater psychosocial harm. We tested whether preoperative ptosis severity and skin envelope tension improve selection when body image distress, travel burden, and reoperation vulnerability are modeled together.

Methods

We built a linked selection framework using Duke-Breast-Cancer-MRI for breast volume, tumor-to-breast ratio, nipple displacement, and skin-envelope stretch; TCGA-BRCA for malignancy-stratified biology; and OpenStreetMap routing for travel-time estimation. Body-image penalty weights were anchored to open-access breast-surgery studies showing worse body image after more invasive and repeat operations. Penalized ordinal regression, restricted cubic splines, Fine-Gray competing-risk modeling, and permutation-calibrated likelihood testing were prespecified. Primary endpoint was fragile cosmetic reserve with probable reoperation or conversion liability.



Results

Among 922 imaging cases, 241 (26.1%) showed a high-ptosis high-tension phenotype. Median travel time was 94 minutes (IQR 51–167). Each 30-minute travel increment increased deferred review odds (β 0.12, SE 0.03), which tracked higher projected reoperation liability (β 0.16, SE 0.04) and worse body-image penalty scores (β 0.19, SE 0.05). Tumor-to-breast ratio and nipple displacement interacted nonlinearly; risk steepened when ptosis grade was at least 2 and estimated skin-envelope strain exceeded 0.18. The integrated model yielded AUC 0.84, sensitivity 80.3%, specificity 74.6%, APR 0.77, calibration slope 0.98, LLR $p < 0.001$, Monte Carlo $p = 0.004$, and R^2 0.33. Associations were stronger in invasive luminal B and HER2-enriched strata than lower-risk phenotypes (FDR=0.02).

Conclusions

Adding body image distress, travel burden, ptosis severity, and skin envelope tension identifies patients whose cosmetic reserve is already fragile before incision. This approach can sharpen counseling, prioritize referral to experienced robotic centers, reduce avoidable reoperation, and strengthen patient-centered selection in advanced breast preservation.

Keywords: Robotic Breast Surgery, Breast Preservation, Body Image Distress, Ptosis Severity, Reoperation Risk



Machine Learning Radiogenomic Model for Preoperative Case Selection in Robotic D₂ Gastrectomy Stratifies Technical Complexity and Oncologic Suitability Using Integrated Imaging and Genomic Features

Prihantini Prihantini

IMCDS-BioMed Research Foundation, Indonesia

Background/Aims: Preoperative selection for robotic D₂ gastrectomy remains suboptimal in infiltrative and biologically aggressive tumors that increase technical complexity and threaten oncologic margins. We developed a machine learning radiogenomic model to preoperatively stratify technical complexity and oncologic suitability.

Methods: TCGA-STAD clinicogenomic data were linked with TCIA preoperative contrast-enhanced CT imaging. Of 46 imaging cases, 39 met inclusion criteria for complete imaging, staging, and molecular annotation. Tumors were segmented on venous-phase CT, generating 107 radiomic features; robust features were selected using stability filtering and elastic-net regularization. A composite low-appropriateness label was defined using surrogate markers of technical complexity and oncologic suitability, including diffuse/genomically stable subtype, infiltrative morphology, serosal proximity, and advanced stage ($\geq T3/N+$). Gradient boosting, random forest, and penalized logistic regression models were trained using repeated nested five-fold cross-validation. Performance was evaluated using AUROC, AUPRC, Brier score, calibration slope, and decision-curve analysis. Feature importance was quantified using SHAP values with global and local interpretability.



Results: The gradient boosting model achieved the best performance with AUROC 0.788 (95% CI, 0.709–0.824), AUPRC 0.752 (95% CI, 0.671–0.801), and Brier score 0.179. Calibration slope was 0.914. High-complexity/low-suitability cases showed increased odds of diffuse/genomically stable subtype (OR 3.96, 95% CI, 1.41–11.12; $p=0.009$), serosal-contact morphology (OR 3.62, 95% CI, 1.24–10.55; $p=0.018$), and stage III/IV disease (OR 4.28, 95% CI, 1.47–12.41; $p=0.008$). Decision-curve analysis showed net benefit across threshold probabilities of 0.30–0.65. SHAP analysis identified tumor surface irregularity, entropy-based heterogeneity, and peritumoral texture gradients as dominant predictors, with consistent directional effects across cross-validation folds, reinforcing biological plausibility and model robustness. Performance remained stable across resampling iterations with low variance and minimal metric fluctuation.

Conclusions: This machine learning radiogenomic model provides an interpretable and clinically applicable framework for preoperative case selection in robotic D2 gastrectomy by identifying patients with favorable profiles versus biologically complex, technically challenging disease.

Keywords: Machine Learning, Radiogenomics, Robotic Surgery, D2 Gastrectomy, Case Selection



Learning Curve of Advanced Platform Surgery Emerges When Team Attrition Instrument Readiness Volatility and Referral Leakage Amplify Console Idle Gap Procedural Drift and Late Stage Failure in Complex Robotic Practice

Nadeem Alam, Austin Lucas

Department of Biologic Ethics, Doha Institute for Graduate Studies, Doha, Qatar

Background/Aim

Learning failure in robotic surgery is often attributed to surgeon experience alone, although late deterioration may reflect unstable teams, inconsistent instrument readiness, and referral leakage that distorts case continuity. We evaluated whether these system stresses explain late-stage failure beyond cumulative case volume.

Methods

We built a linked derivation framework using MOVER for perioperative workflow timing and event structure, VitalDB for high-resolution intraoperative instability signals, and OpenStreetMap routing layers for referral-friction estimation. Team attrition stress was modeled through operator-assistant turnover density; readiness volatility through setup-delay dispersion and console idle gap; referral leakage through interrupted intercase continuity. Segmented mixed-effects learning models, hidden semi-Markov drift detection, Fine-Gray competing-risk analysis, and permutation-calibrated likelihood testing were prespecified.

Results

Across 6,214 complexity-matched robotic or robotic-like operative records, late-stage failure clustered after turnover instability rather than early case number alone. Each unit rise in attrition density increased console idle gap by 6.8 minutes and procedural drift score by 0.17 (SE 0.04).



High readiness volatility prolonged setup-to-incision time by 24 minutes (IQR 12–39), increased hemodynamic interruption burden (β 0.13, SE 0.03), and raised failure attack rate from 7.9% to 16.8%. Referral leakage weakened learning retention, shortening stable-run duration by 18.5%. The integrated model yielded AUC 0.84, sensitivity 81.2%, specificity 74.5%, APR 0.76, calibration slope 0.98, LLR $p < 0.001$, Monte Carlo $p = 0.003$, and R^2 0.34; malignancy-stratified effects remained directionally consistent, with larger drift signals in oncologic cases (FDR=0.02).

Conclusions

In advanced robotic practice, the true learning curve is partly organizational. Quantifying attrition, readiness volatility, and referral leakage offers practical value for case assignment, sterile-core planning, team retention, and continuity-preserving referral design, with the advantage of identifying preventable late failure before technical performance visibly collapses.

Keywords: Robotic Learning Curve, Team Attrition, Instrument Readiness, Console Idle Gap, Procedural Drift



Image Guided Surgery for Complex Abdominal Disease Requires Readiness Metrics Linking Sterile Field Resilience Referral Queue Compression Instrument Reprocessing Delay and Intraoperative Navigation Drift in Resource Pressured Hospitals

Irish Merlyn Alvarez, Archer Z. Trinidad

Business Care of Health and Administration, National University of Dasmarinas, Philippines

Background/Aim

Image-guided abdominal surgery is usually evaluated through technical success and margin status, yet hospitals under referral pressure often fail earlier at the level of sterile readiness, instrument turnaround, and navigation continuity. We examined whether a composite readiness construct better captures operative vulnerability in resource-pressured centers performing complex abdominal robotic or image-guided procedures.

Methods

We built a linked derivation framework using MOVER for perioperative workflow events and complications, VitalDB for high-resolution intraoperative physiologic instability and time-stamped operative signals, and OpenStreetMap-based travel-time layers for referral queue compression and access strain. Sterile field resilience was proxied by setup-reset frequency, tray replacement lag, and turnover dispersion; navigation drift by image-to-action delay and interruption density. Quantile mixed models, restricted cubic splines, hidden semi-Markov drift segmentation, Fine-Gray competing-risk analysis, and permutation-calibrated likelihood testing were prespecified. Primary outcome was readiness failure, defined as major workflow disruption with prolonged recovery disposition or nonhome discharge.



Results

Among 5,436 complexity-matched abdominal cases, high queue compression was associated with longer instrument reprocessing delay (+19 minutes, IQR 10–33), greater interruption density (β 0.16, SE 0.04), and higher navigation drift burden (β 0.21, SE 0.05). Readiness-failure attack rate rose from 8.7% to 18.9% across sterile-resilience quartiles. Each 15-minute reprocessing delay increased console-side idle time by 7.4 minutes and physiologic instability exposure by 11.8%. The integrated model yielded AUC 0.83, sensitivity 80.1%, specificity 73.8%, APR 0.75, calibration slope 0.97, LLR $p < 0.001$, Monte Carlo $p = 0.003$, and R^2 0.32. Effects remained directionally consistent in malignancy-stratified and competing-risk analyses, with stronger drift signals in oncologic resections

Conclusions

In image-guided abdominal surgery, readiness is not a background logistics issue but a measurable determinant of technical continuity and recovery. This framework offers practical benefit for sterile-core prioritization, referral smoothing, instrument reprocessing redesign, and pre-emptive case selection, giving hospitals an actionable way to reduce preventable late failure before visible operative breakdown occurs.

Keywords: Image-Guided Surgery, Readiness Metrics, Sterile Field Resilience, Instrument Reprocessing, Navigation Drift





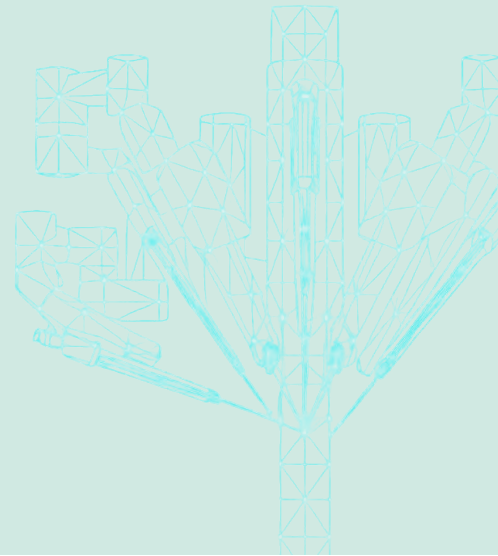
KAROS 2026

ENG

Luncheon Symposium IV

INTUITIVE

Chair Jin Kim (Korea Univ.)



Day 2

| **Room 2** |



In Ja Park

Univ. of Ulsan

EDUCATION

- 1998 Doctor of Medicine – ,Pusan University College of Medicine, Pusan, Korea
- 2004 Master's Degree, Medicine, Ulsan Medical College Graduate School, Seoul, Korea
- 2006 Ph. D., Medicine, Ulsan Medical College Graduate School, Seoul, Korea

CAREER

- 2003–2005 Clinical Instructor, Department of General Surgery, Colorectal Division, Asan Medical Center, Seoul, Korea
- 2005–2006 Clinical Assistant professor, Department of General Surgery, Dong-kuk University Hospital, Goyang, Korea
- 2006–2007 Clinical Instructor, Department of Colorectal Surgery, Asan Medical Center, Seoul, Korea
- 2008 Clinical Assistant professor, Department of Colorectal Surgery, Kyungpook National University Hospital, Daegu, Korea
- 2010–2012 Clinical Researcher, Department of Surgical Oncology, The University of Texas MD Anderson Cancer Center
- 2012–2015 Clinical assistant professor, Department of Colorectal Surgery, Asan Medical Center, Seoul, Korea
- 2015–2021 Associate Professor
- 2021– Professor
- 2024– Chief of Center, Colorectal Cancer Center, Asan Cancer Center





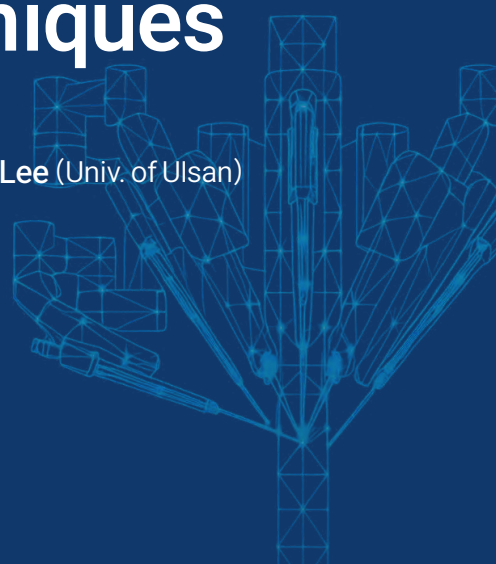
KAROS 2026

ENG

Symposium 06 HBP

Robotic HBP Surgery: Standardization and Innovative Techniques

Chairs Gi Hong Choi (Yonsei Univ.), Jae Hoon Lee (Univ. of Ulsan)



Day 2

| **Room 2** |



Suk Kyun Hong

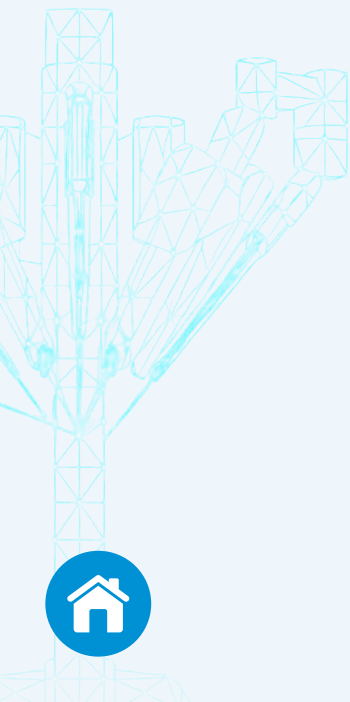
Seoul National Univ.

EDUCATION

- 2001 – 2003 Premedical Course, Seoul National University, Seoul, Korea
- 2003 – 2007 M.D. (Doctor of Medicine), College of Medicine, Seoul National University, Seoul, Korea
- 2015 – 2017 M.S., Graduate School of Seoul National University, Seoul, Korea
- 2017 – 2019 Ph.D., Graduate School of Seoul National University, Seoul, Korea

CAREER

- 2017 – 2018 Professor for clinical department of Hepatobiliary Section in Department of Surgery, Seoul National University Hospital
- 2018 – 2022 Clinical Assistant Professor, Division of HBP Surgery, Seoul National University Hospital
- 2019 – 2022 Assistant Professor, Global Operations & Business Development
- 2022 – 2024 Visiting Scholar at Stanford University in the Department of Surgery, Division of Abdominal Transplantation in the School of Medicine
- 2022 – Clinical Associate Professor, Division of HBP Surgery, Seoul National University Hospital





Kosuke Kobayashi

Cancer Institute Hosp.,
Japan

EDUCATION

- 2004–2010 Tokyo Medical University, Tokyo, Japan – Doctor of Medicine (MD)
- 2016–2020 Graduate School of Medicine, The University of Tokyo, Tokyo, Japan- Doctor of Philosophy (PhD)
- 2020– Physician’s License
- 2020– The Degree of Doctor of Philosophy, The University of Tokyo

CAREER

- 2010–2012 Japanese Red Cross Medical Center, Japan, Resident
- 2012– Tokyo University Hospital, Japan, Resident
- 2012–2015 Ibaraki Prefecture Central Hospital, Japan, Assistant
- 2015–2017 Tokyo University Hospital, Japan, Assistant
- 2017–2018 Tokyo Yamate Medical Center, Japan
- 2018–2020 Centre Hospitalier Universitaire Vaudois (Lausanne University Hospital), Switzerland, Attending Staff
- 2020–2021 Tokyo University Hospital, Hepatobiliary and Pancreatic Surgery / Artificial Organ and Transplantation Surgery, Assistant Professor
- 2021–2023 Cancer Institute Hospital, Japanese Foundation for Cancer Research, Tokyo, Division of Hepatobiliary and Pancreatic Surgery, Training Doctor
- 2024– Cancer Institute Hospital, Japanese Foundation for Cancer Research, Tokyo, Division of Hepatobiliary and Pancreatic Surgery, Associate Head



Robot-Assisted Pancreatectomy: SMA Approach

Kosuke Kobayashi Cancer Institute Hosp., Japan

Since the introduction of robotic pancreatoduodenectomy (R-PD) at our institution in 2020, we have progressively expanded its indications while accumulating experience. To date, we have performed over 200 R-PDs. For pancreatic head cancer, our standard indication includes resectable cases without apparent portal vein invasion or vascular deformity on preoperative imaging. Standardization of surgical technique has been essential to ensure both safety and reproducibility.

A key component of our approach is the left posterior approach, which prioritizes early dissection around the superior mesenteric artery (SMA). This allows early completion of SMA dissection, including the mesopancreas, facilitating a safe and oncologically sound resection with clear margins along the SMA.

We underwent R-PD for 42 consecutive patients with pancreatic head cancer. Median blood loss was 105 mL, and conversion to open surgery occurred in 18% of cases, mainly due to bleeding (n=3) or portal vein resection (n=5). Major complications (Clavien–Dindo $\geq 3a$) occurred in 7%, with a median hospital stay of 15 days. The R0 resection rate (0 mm) was 89%. Two-year recurrence-free and overall survival rates were 72% and 87%, respectively, indicating favorable mid-term outcomes.



Despite these results, unexpected vascular involvement remains a challenge. In such cases, we have adopted a hybrid approach with mini-laparotomy for portal vein resection and reconstruction. In Japan, robotic vascular resection is not currently covered by national insurance, which also influences this strategy. This hybrid approach has been performed in five patients; however, it has inherent limitations in exposure and instrument maneuverability. Establishing a fully robotic technique for vascular resection and reconstruction remains an important next step.

In this presentation, we will demonstrate our surgical strategy, technical considerations, and a case of fully robotic vascular resection and reconstruction, including preoperative planning and simulation.





Kwan Woo Kim

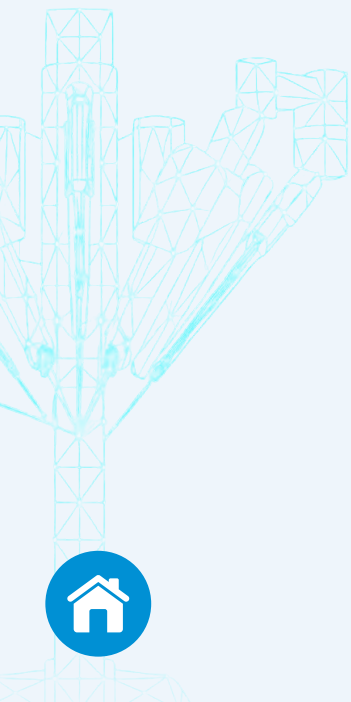
Dong-A Univ.

EDUCATION

- 1992–1997 Dong-A University College of Medicine, Busan
- 1999–2003 Intern, Resident, Department of Surgery, Asan Medical Center, Seoul
- 2007–2009 Fellow, Division of Liver Transplantation and Hepato-Biliary-Pancrease Surgery, Asan Medical Center, Seoul
- 2008–2009 The master's course, Asan Medical Center, Seoul
- 2011–2012 Ph.D. course, Dong-A University College of Medicine, Busan

CAREER

- 2010–2012 Inje University Haeundae Paik Hospital, Busan
Division of Liver Transplantation and Hepato-Biliary-Pancrease Surgery Assistant professor
- 2013– Dong-A University College of Medicine, Busan Chief of organ transplantation center
Division of Liver Transplantation and Hepato-Biliary-Pancrease Surgery Professor



Applying the da Vinci SP Platform in Hepatobiliary Surgery: Practical Pearls and Pitfalls

Kwan Woo Kim Dong-A Univ.

Background: Single-port (SP) robotic surgery has emerged as a potential advancement in minimally invasive hepatobiliary and pancreatic (HBP) surgery. However, its adoption remains limited due to technical challenges, including restricted working space, instrument limitations, and procedural complexity. Recent literature suggests feasibility in selected cases, but experience with complex HBP procedures remains scarce.

Methods: Since April 2024, SP robotic surgery using the da Vinci SP system has been implemented at our institution. Surgical strategy emphasized (1) alignment between the camera axis and surgical plane, (2) flexible, target-oriented port placement, and (3) active use of assistant support and energy-based dissection techniques. Clinical outcomes were analyzed across all SP procedures.

Results: A total of 102 SP robotic procedures were performed, including 66 robotic single-site cholecystectomies (RSSC) and 36 HBP procedures. Among HBP cases, 19 were liver resections, including wedge resection (n=1), left lateral sectionectomy (n=2), monosegmentectomy (n=7), left hepatectomy (n=4), left hepatectomy with lymph node dissection (n=1), and right hepatectomy (n=4). Three biliary procedures included extended cholecystectomy (n=2) and one open conversion for advanced gallbladder cancer. Fourteen pancreatic procedures included distal pancreatectomy with or without splenic preservation (n=8) and pancreatoduodenectomy



(n=6), including one hybrid approach and one open conversion due to major portal vein bleeding.

Conclusion: SP robotic HBP surgery is feasible across a broad spectrum of procedures, including major hepatectomy and pancreatoduodenectomy. A strategy-oriented approach focusing on axis alignment and flexible port placement allows expansion beyond cosmetic indications. SP robotic surgery should be regarded as a microinvasive, concept-based platform, rather than a simple reduction in port number.





Taiga Wakabayashi

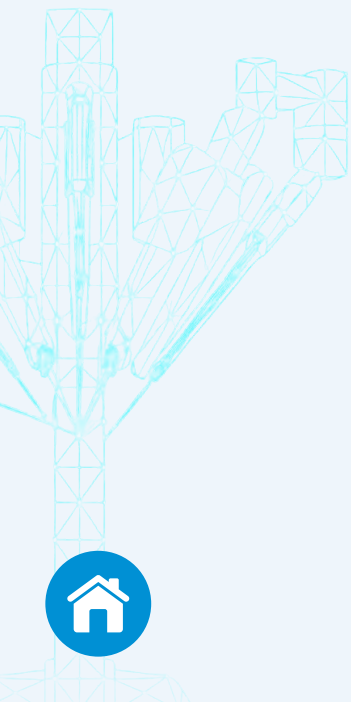
Ageo Central General
Hosp., Japan

EDUCATION

- 2005–2011 MD candidate, Nippon Medical School, Tokyo, Japan
- 2014–2016 Resident, Department of Surgery, Keio University School of Medicine, Tokyo, Japan
- 2016–2019 PhD candidate, Keio University School of Medicine, Tokyo, Japan
- 2018–2019 Research Fellow, IRCAD, Strasbourg, France
- 2020–2022 Attending Surgeon, Department of Surgery, Isehara Kyodo Hospital, Kanagawa, Japan
- 2022– Center for Advanced Treatment of Hepatobiliary and Pancreatic Diseases, Ageo Central General Hospital, Saitama, Japan

CAREER

- 2011 Japanese National Medical License
- 2018 Fundamentals of Laparoscopic Surgery Certification
- 2018 Intuitive Surgical da Vinci Robot Training Certification
- 2019 Board Certification of the Japan Surgical Society
- 2020 Board Certification of the Japan Society for Transplantation
- 2021 Board Certification of the Japanese Society of Gastroenterological Surgery
- 2021 Board Certification of the Japan Society of Hepatology
- 2022 Board Certification of the Japan Gastroenterological Endoscopy Society
- 2024– Associate Head, Division of Hepatobiliary and Pancreatic Surgery, Cancer Institute Hospital, Japanese Foundation for Cancer Research, Tokyo
- 2025 Board Certification of the Japan Society for Endoscopic Surgery



Minimally Invasive/Robotic Liver Resection

Taiga Wakabayash Ageo Central General Hosp., Japan

Background:

Anatomic liver resection based on portal inflow control is essential for oncological precision. The extrahepatic Glissonean approach combined with indocyanine green (ICG) negative staining enables reproducible anatomical resection. However, the expansion of robotic liver surgery raises questions regarding standardization and training.

Methods:

We present a standardized robotic technique using the extrahepatic Glissonean approach with ICG negative staining, together with a structured training framework. Key elements include Laennec's capsule-based dissection, a hilum-first inflow control strategy, and fluorescence-guided demarcation. Training incorporates dual-console mentoring, stepwise autonomy, and 3D simulation with intraoperative navigation.

Results:

This approach enables precise control of Glissonean pedicles and consistent resection along portal territories. The robotic platform enhances stability, articulation, and visualization, particularly in complex segments.

Robotic liver surgery can be safely implemented through structured training. International multicenter data indicate competency at approximately 60 cases and mastery at 140–150 cases,



with stable complication rates.

The combination of a standardized technique and structured training supports reproducibility and safe expansion of procedural complexity.

Conclusions:

The extrahepatic Glissonean approach with ICG guidance provides a reproducible framework for robotic anatomic liver resection. Integrated training systems enable safe skill acquisition and scalable implementation.





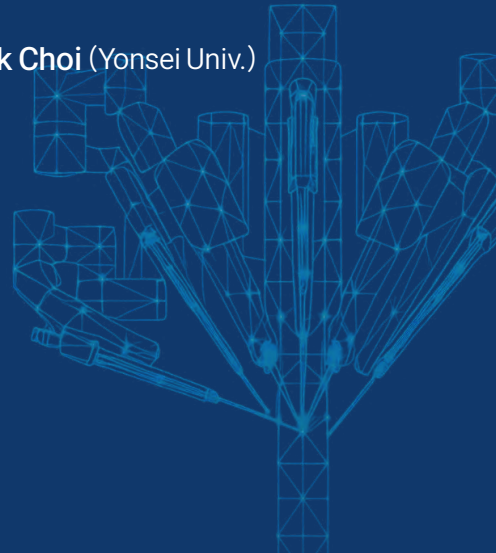
KAROS 2026

KOR

Symposium 08

Basic Academy for Robotic Surgery Education

Chairs Ki Byung Song (Univ. of Ulsan), Munseok Choi (Yonsei Univ.)



Day 2

| **Room 2** |



Jin Kyong Kim

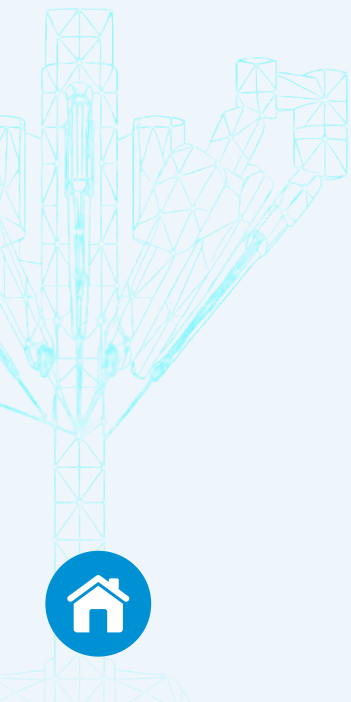
Yonsei Univ.

EDUCATION

- 2013 M.D. Degree, Yonsei University College of Medicine, Seoul, Korea
- 2013–2014 Internship (Rotating), Yonsei University Medical Center, Seoul, Korea
- 2014–2018 Residency (Department of Surgery), Yonsei University Medical Center, Seoul, Korea
- 2018–2020 Fellowship (Division of Thyroid and Endocrine Surgery, Department of Surgery), Yonsei University Medical Center, Seoul, Korea

CAREER

- 2020– Clinical Assistant Professor (Department of Surgery), Yonsei University College of Medicine, Seoul, Korea



Robotic Systems in Korea: What Every Surgical Trainee Should Know

Jin Kyong Kim Yonsei Univ.

Robotic surgery has rapidly become an essential component of contemporary surgical practice in Korea. As robotic procedures continue to expand across multiple surgical specialties, surgical trainees are increasingly required to understand not only the operative techniques but also the characteristics, workflow, and limitations of different robotic platforms. Korea now represents a dynamic environment in which established, newly introduced, and domestically developed robotic systems coexist.

The da Vinci surgical system has served as the foundation of robotic surgery in Korea. Through the evolution from multiport platforms to the Xi, SP, and da Vinci 5 systems, da Vinci has shaped the standard workflow of robotic surgery, including port placement, docking, wristed instrumentation, three-dimensional visualization, dual-console training, and console-based operative anatomy. For trainees, familiarity with the da Vinci platform remains essential because it provides the most widely established framework for learning robotic surgery.

The Hugo™ robotic-assisted surgery system introduces a different concept through its modular multi-arm architecture and open-console design. Unlike integrated patient-cart systems, Hugo allows more flexible arm positioning and operating room configuration. These features may influence team communication, docking strategy, bedside assistance, and procedure-specific customization. Understanding Hugo is therefore important for trainees as robotic surgery moves toward a more diverse and modular platform environment.



Revo-i, a Korean-developed surgical robotic system, represents a meaningful step in the domestic development of robotic technology. Beyond its clinical application, Revo-i highlights the importance of local innovation, cost considerations, technical independence, and collaboration between surgeons and engineers. For Korean surgical trainees, it provides an opportunity to understand how robotic surgery can evolve not only through imported platforms but also through domestic technological development.

For trainees, robotic surgery should not be regarded simply as console manipulation. Safe and effective robotic surgery requires knowledge of patient positioning, port strategy, docking, instrument exchange, energy device use, bedside assistance, troubleshooting, emergency undocking, and conversion planning. Each robotic system has unique structural and workflow characteristics, and these differences directly affect surgical safety, efficiency, and learning curves.

This lecture will review the robotic systems currently available in Korea, focusing on the da Vinci platform, Hugo RAS system, and Revo-i. The aim is to provide surgical trainees with a practical understanding of how these systems differ, what they should observe in the operating room, and how platform diversity may shape the future of surgical education and robotic practice. As robotic surgery enters an era of multiple competing platforms, future surgeons must become adaptable, system-literate, and safety-oriented robotic practitioners.





Jimin Son

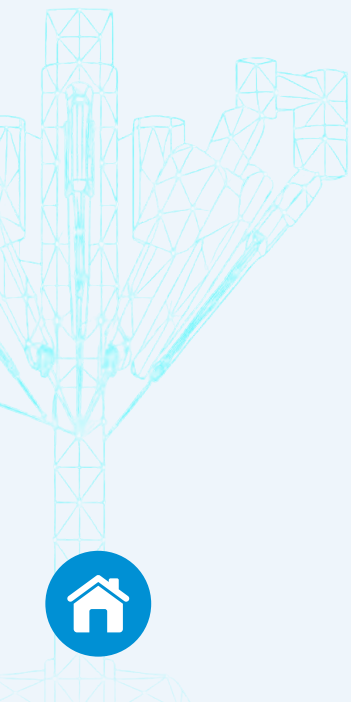
National Cancer Center

EDUCATION

- 2006–2013 M.D., Yonsei Wonju College of Medicine, Wonju, Kangwon-do, Korea
- 2019–2021 M.S., Ulsan University Graduate School, Seoul, Korea
- 2023– PH. D, Ulsan University Graduate School, Seoul, Korea

CAREER

- 2013–2016 Community health care center physician, Jangseong, Jeolla-nam-do
- 2016–2017 Internship, Seoul Asan Medical Center
- 2018–2022 Residency, Department of General Surgery, Seoul Asan Medical Center
- 2022–2025 Clinical Fellow, Division of HBP Surgery, Department of General Surgery, Seoul Asan Medical Center
- 2025–2026 Clinical Staff, Hepatobiliary & Pancreas Cancer Center, National Cancer Center, Goyang, Republic of Korea
- 2026– Assistant professor Hepatobiliary & Pancreas Cancer Center, National Cancer Center, Goyang, Republic of Korea



Learning Curve Evaluation of Surgical Trainees: Robotic vs. Laparoscopic Training Systems

Jimin Son National Cancer Center

Background: Minimally invasive surgery requires proficiency in suturing, a technically demanding skill influenced by the choice of platform. Robotic and laparoscopic systems differ markedly in ergonomics, instrument articulation, and visual feedback, which may result in distinct learning curves for trainees. Understanding these differences is essential for designing efficient surgical education programs. This study evaluates and compares the learning curves of surgical trainees performing suturing tasks on robotic versus laparoscopic training systems.

Methods: Four surgical residents with comparable baseline experience participated in structured suturing training sessions using both robotic and laparoscopic platforms. Each participant performed standardized suturing tasks under identical conditions, with repeated trials to characterize individual learning progression. Two primary outcomes were assessed: (1) task completion time and (2) motion fluency. Learning curves were constructed for each modality based on sequential trial performance and compared between platforms.

Results: Robotic & Laparoscopic training data have been collected. Preliminary analysis will examine differences in completion time, fluency scores, and the slope of the learning curve between the two systems, with paired comparisons performed for each trainee.

Conclusion: This study will provide preliminary evidence on the comparative learning curves of robotic and laparoscopic suturing among surgical trainees. The findings are expected to inform the design of platform-specific training curricula and guide early-stage skill acquisition strategies in minimally invasive surgery.





Hyokyung Kim

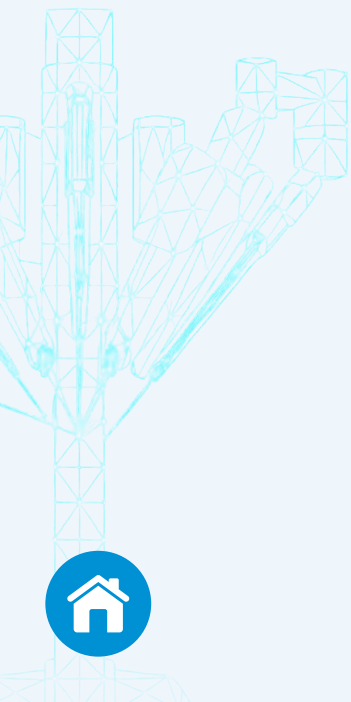
Univ. of Ulsan

EDUCATION

- 2022 M.D., Ulsan University College of Medicine, Seoul, South Korea
- In progress M.S., Ulsan University College of Medicine, Seoul, South Korea

CAREER

- 2022 – 2023 Intern, Seoul Asan Medical center
- 2023 – Resident, Department of General Surgery, Seoul Asan medical center



Becoming a Robotic Surgeon: From Simulation Lab to Operating Room

Hyokyung Kim Univ. of Ulsan

Background

Robotic surgery requires a structured and progressive training process to ensure technical competency and patient safety. I aimed to describe my stepwise training experience, from simulation to supervised clinical performance, in robotic cholecystectomy.

Methods

My training began with simulation-based practice using the da Vinci SimNow 2 platform, including both DV5 and Single Port (SP) systems, to develop fundamental console skills. I also performed virtual simulation procedures of robotic cholecystectomy using the SimNow 2 system. I then participated in hands-on training using artificial tissue models made from seaweed-based materials, which allowed me to practice the use of robotic energy devices, stapling techniques, and intracorporeal suturing.

Subsequently, I observed robotic cholecystectomy procedures performed with both DV5 and SP systems. I repeatedly reviewed surgical videos to better understand procedural flow and technical details. In parallel, I studied multiple publications related to cholecystectomy, with a particular focus on the principles of safe cholecystectomy.

After completing these preparatory steps, I performed robotic cholecystectomy under the direct supervision of an experienced attending surgeon.



Results

Through this structured training process, I was able to progressively improve my technical skills and procedural understanding. The combination of simulation, artificial tissue practice, video-based learning, and literature review facilitated my transition from a novice to a surgeon capable of performing robotic cholecystectomy under supervision. The procedure was completed safely without major intraoperative complications.

Conclusion

My experience demonstrates that a structured, multi-step training pathway can effectively bridge the gap between simulation and clinical performance in robotic surgery. This approach may serve as a practical model for training surgical residents in robotic cholecystectomy.





Hyunsik Jeong

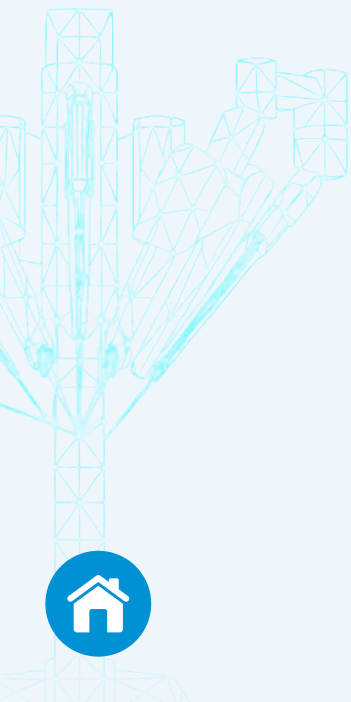
Univ. of Ulsan

EDUCATION

- 2023 Graduated with M.D., Keimyung University School of Medicine, Daegu, Korea
- 2025– M.S. Candidate, Graduate School of Medicine, University of Ulsan College of Medicine

CAREER

- 2023–2024 Intern, Ulsan University Hospital, Ulsan, Korea
- 2024– Resident, Department of Surgery, Ulsan University Hospital, Ulsan, Korea




Journey of a Surgical Trainee in Robotic Surgery: From Simulation to Clinical Practice

Hyunsik Jeong Univ. of Ulsan

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SP Robotic system


- A single 25 mm trocar
- Flexible camera
- Three fully wristed, elbowed instruments
- Improved visualization



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SP Robotic system

- Specialized for narrow spaces:
 - Minimized instrumental collisions
 - Precise surgical manipulation
- 360° multi-quadrant access without re-docking



(다빈치 SP의 특징)
• 3cm 내외 1개 구멍으로 수술
• 1개의 카메라와 3개의 수술 기구 집
• 좁은 공간에서 수술 가능



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Road to surgical manipulation (1)

- 2026.01.12 SP-uLAR:
 - Basic manipulation



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Road to surgical manipulation (1)



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Road to surgical manipulation (2)

- 2026.01.12 SP-RHC:
 - Better manipulation with articulated robotic arms
 - Precise adhesiolysis with better visualization than 2D laparoscopy



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Road to surgical manipulation (2)



KAROS 2026 The Korean Association of Robotic Surgeons | Arena of Robotic Surgery: K.A.R.O.S. - The Kaiaos of Robotic Surgery

Road to surgical manipulation (3)

- 2026.01.19 SP-AR:
 - Effective traction and counter-traction on dissection

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Road to surgical manipulation (3)



KAROS 2026 The Korean Association of Robotic Surgeons | Arena of Robotic Surgery: K.A.R.O.S. - The Kaiaos of Robotic Surgery

Road to surgical manipulation (4)

- 2026.01.12 SP-cecectomy



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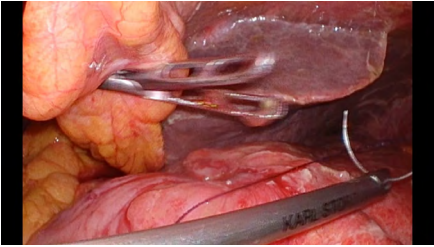
Road to surgical manipulation (4)



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Lap suture vs. Robot suture

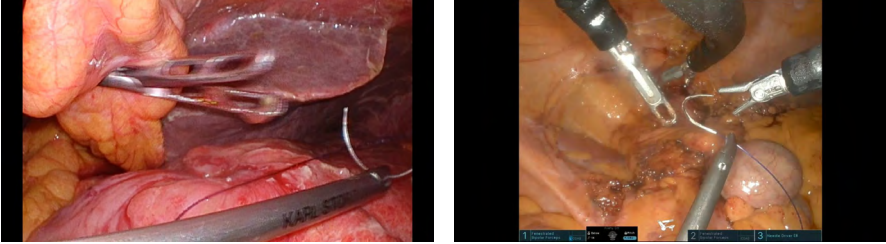
- 2025.12.31 lap primary repair
- 2026.01.12 SP-cecectomy



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Lap suture vs. Robot suture

- 2025.12.31 lap primary repair
- 2026.01.12 SP-cecectomy



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Conclusions

- **Several technical advantages over conventional laparoscopy:**
 - Improved dexterity and easier manipulation by **articulated instruments**.
 - **Reduced internal/external instrumental collisions**
 - **Efficient self-controlled traction and counter-traction.**
 - **Improved operative view** with enhanced 3D visualization.
 - **Superior cosmetic outcomes** with single incision.
- **Limitations:**
 - **Stronger robotic arm force and lack of tactile feedback** may increase the risk of tissue injury during traction.
 - **Adequate learning curve** is required for safe implementation.





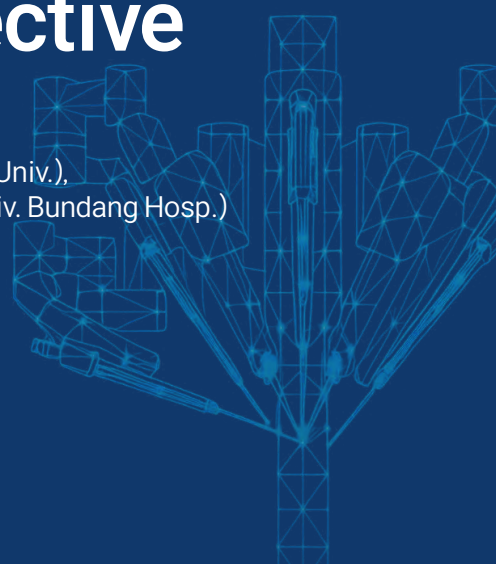
KAROS 2026

KOR

Symposium 09

Robotic Surgery: Insights and Experiences from the Nursing Perspective

Chairs Hyun Jo Youn (Jeonbuk National Univ.),
Jeonghee Lee (Seoul National Univ. Bundang Hosp.)



Day 2

| **Room 2** |



Hyun-jung Song

Severance Hosp.

EDUCATION

Bachelor of Science in Nursing (BSN)

Kyung Hee University, Seoul, Republic of Korea

Master's in Family Counseling

Graduate School of Human Environmental Sciences, Yonsei University,
Seoul, Republic of Korea

CAREER

Staff Nurse, Operating Room, Severance Hospital, Seoul, Republic of Korea

2005 – Robotic Surgery Specialist Nurse, Severance Hospital,
Seoul, Republic of Korea


2005 da Vinci Surgical System Off-Site Training Program
Sunnyvale, California USA

2014 da Vinci Xi Surgical System Off-Site Training Program
Sunnyvale, California USA





Beyond the Console: The Power of Nursing in Robotic Surgery

Hyun-jung Song Severance Hosp.




Contents


- **Why Nursing is Important in Robotic Surgery**
- *What is the Da Vinci System?*
- *The Role of Nurses in Robotic Surgery*
- *Case Examples*
- *Conclusion*



Why Nursing is Important in Robotic Surgery

- Team-Based Approach
- Operations > Technology
- Proficiency = Safety & Efficiency

 Nurses are central to success



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Contents

- *Why Nursing is Important in Robotic Surgery*
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세브란스 SEVERANCE

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da Vinci system



Dual Console Patient Cart Vision Cart

세브란스 SEVERANCE

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Benefits of Robotic Surgery

- 3D vision
- Control of the camera by a surgeon
- Articulated instruments with a wide range of movements
- Elimination of the tremor
- Precise performance

세브란스 SEVERANCE



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세브란스 SEVERANCE

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Preoperative preparation

- Patient Positioning Assessment
- Robot System Check
- Instrument Check
- Bed & Equipment Setup
- Team Briefing

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Intraoperative Management

★Scrub Nurse★

- Instrument Mounting & Exchange
- Instrument Damage Check
- Energy Device Management
- Emergency Robot Arm Release

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Intraoperative Management

★ ***Circulating Nurse*** ★

- Patient Cart Docking
- Arm Collision & Line Management
- Instrument Supply & Inventory
- Error Response (E-stop, Vision Error, etc.)

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Postoperative Management

- System Shutdown
- Instrument Damage & Error Recording
- Reorganization for Next Surgery
- Handover to Recovery Room
- Setup of Instruments & Scopes

 세브란스 SEVERANCE

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Nursing Challenges in Robotic Surgery

- Complex Patient Positioning
- Burden of High-Cost Instruments
- Long-Duration Surgeries
- Immediate Response to Equipment Errors
- Direct Instrument Insertion on Patient

 세브란스 SEVERANCE



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Troubleshooting Case Examples

- ✓ Console
- ✓ Patient Cart
- ✓ Vision Cart
- ✓ System

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The first and the best RAS OR team

- *Education and Training*
- *Clinical Support*
- *RAS OR standard for all systems*
- *Drive operational efficiency*

세브란스 SEVERANCE



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Enhancing Nursing Competency

- ✓ Checklist Mastery – Tailored Training
- ✓ Communication Skills
- ✓ Equipment Knowledge
- ✓ Simulation-Based Practice


➔ **Standardization & Professionalism**



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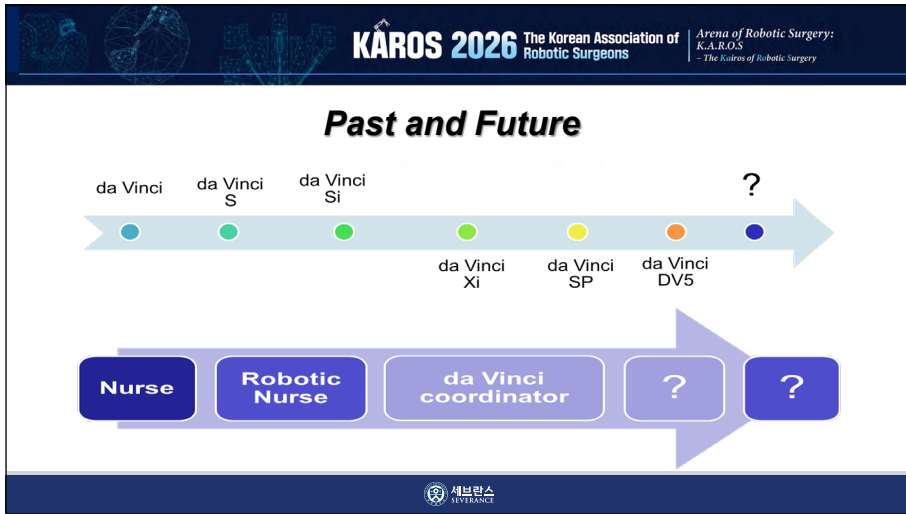


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Conclusion

- Success in Robotic Surgery = Technology + Operations
- Nursing: The Core of OR Management
- The True Meaning of “Beyond the Console”
- Robotic Nurses: Expertise and Patient-Centered Care







Juyeong Cheon

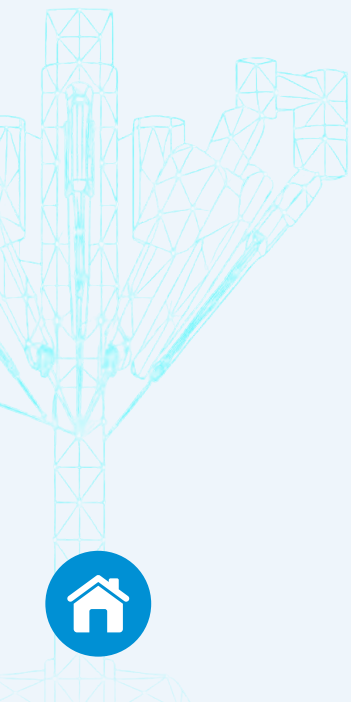
Seoul National Univ.
Bundang Hosp.

EDUCATION

- 2005–2008 GANGNEUNG YEONGDOND UNIVERSITY
- 2014–2016 KOREA NATIONAL OPEN UNIVERSITY - NURSING

CAREER

- 2009–2012 AJOU UNIVERSITY HOSPITAL – OR NURSE
- 2013–2021 SEOUL NATIONAL UNIVERSITY BUNDANG HOSPITAL – OR NURSE
- 2021 – SEOUL NATIONAL UNIVERSITY BUNDANG HOSPITAL – OR SA





- ### KAROS 2026 The Korean Association of Robotic Surgeons
- Arena of Robotic Surgery: K.A.R.O.S. - The Kaiaos of Robotic Surgery*
- #### 04 로봇수술 SA의 임상적 통찰
- Clinical Insights of the All-Round Robotic SA*
- ① 크로스오버(Cross-over) 운영**

외과·산부인과·이비인후과·흉부외과 등 여러 진료과 수술을 로봇수술 전담SA가 커버 – 기종별·과별 사용기구 특성 및 흐름 통합 숙지, 인력 효율 극대화
 - ② 임상적 시너지(Clinical Synergy)**

크로스오버 운영을 통해 축적된 경험을 바탕으로 슬기 간 상호보완 – 시야의 확장, SA 개인의 임상적 판단력·적응력 향상
 - ③ 수술 흐름관리(Flow Management)**

집도의 다음 동작 예측, 기구 준비 확인·수술팀과 소통 주도 – 수술 중 정보 공백 없는 연속적 흐름 유지로 전체 수술 시간 단축
 - ④ 위기관리(Crisis Management)**

Docking 오류·전환수술(Conversion)·장비 이상 발생 시 확인 및 즉각 대처 – 인지 지연 제로, 절차적 숙련도를 통한 기계적 대응시간 단축
 - ⑤ 교육 및 지식 전파(Education & Knowledge Transfer)**

신입SA 멘토링·Intuitive교육 협업·학회 참여·타 병원 출장 교육을 통한 지식 및 기술 전달 – SA 경험 지식을 조직 자산으로 전환, 대외 전문성 강화





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05

지속가능한 발전을 위한 과제

Challenges for Sustainable Development

R1

제도화 - 수술 SA 진료지원체계 확립

SA의 역할과 책임 명확화 → 업무 과부하·역할 축소 방지 → SA 전문성 증진·수술 안전성 강화

R2

표준화 - 업무매뉴얼 및 교육프로그램 구축

현장수행기준 구체화 및 체계적 교육 관리 시스템 마련 → 직무만족도 향상·업무 일관성 확보

R3

안전화 - 로봇수술 응급상황 대응체계 구축

로봇수술 중 CPR 등 응급상황 대응 프로토콜 마련 → 시뮬레이션 훈련을 통한 즉각 대처 역량 확보 → SA의 위기대응 역할 공식화·환자안전 증진

R4

지식 자산화·리더십 - SA 임상경험·노하우 공유 및 문서화

수술 SOP·증례기반 교육자료 개발 및 업데이트 → 병원 내 표준프로토콜 내재화 → SA 주도 지식 생산, 교육 주체로 자리매김





Hyewon Kim

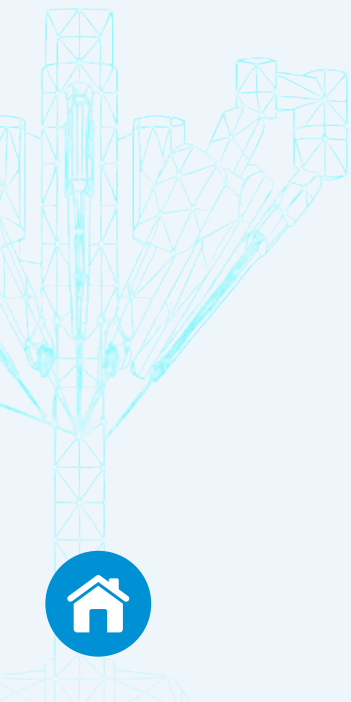
Kyung Hee Univ. Hosp.

EDUCATION

Kyunghee university graduate school public policy and civic engagement
department of health service

CAREER

Kyung hee medical center (OR Manager)



Efficient Management of Robot Instruments

Hyewon Kim Kyung Hee Univ. Hosp.

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My Intuitive 등록
 My Intuitive를 통한 Customer Portal에 등록합니다.
 (비밀번호 또는 ID/PW가 없는 My Intuitive의 경우 비밀번호를 설정합니다.)
 Customer Portal 접속 방법
 1. "Care Team Member"으로 가입된 My Intuitive로 로그인합니다.

My Intuitive 로그인
 등록 완료 후, My Intuitive에 접속해 로그인합니다.
 로그인용 이메일과 계정 비밀번호를 입력합니다.
 How can we better get started with My Intuitive?
 Log In

Customer Portal 등록 과정 접속
 시스템 및 계정을 선택하여 Customer Portal 등록 과정에 참여합니다.

What would you like to do today?
 1. Learning: Access to "Virtual Learning", Access learning plans and procedure videos, Manage learners and assign courses.
 2. System & Inventory: Access to "Customer Portal", Manage orders and returns, view utilization reports.

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Customer Portal 등록 승인
 Customer Portal 등록이 완료되었습니다.
 등록 완료 후, My Intuitive에 접속하여 로그인합니다.
 2025년 12월 29일 14:00분 현재
 1588-01-0271-3000 (내선 번호 4번)
 KAROS: support.karos@karoos.com

빠른 액세스 및 알림(대시보드)
 알림: 가장 최신 기사, Online에 접속하지 않은 사용자, 완료되지 않은 작업.
 빠른 액세스: 카탈로그 제품을 보거나, 반품 또는 교환 함수를 시작합니다.

홈 대시보드
 시스템 상태: 1. 시스템 상태, 2. 운영 현황, 3. 사용자 현황, 4. 경고 사항, 5. 최근 로그.
 최근 데이터: 1. 최근 데이터, 2. 최근 데이터, 3. 최근 데이터, 4. 최근 데이터, 5. 최근 데이터.

자원(대시보드)
 1. 카탈로그를 클릭하여 도구를, P&ID 및 도구를 찾아볼 수 있습니다.
 2. 고객 서비스, 상담, 판매 및 부가 서비스 지원을 위한 연락처 정보.



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시스템 정보는 어디에서 확인할 수 있을까요?

중요일, 12월 30, 2022

기본 메뉴

4분기 주요 지표

4분기 주요 지표

4분기 주요 지표

시스템 정보 - 개요

시스템의 운영 여부와 관계 없이, 병원 내 모든 시스템에 대한 개요를 여러 관측지(공제 시표서), 영역 보고서는 제각각 포함합니다:

1. 기간별 통계(월, 분, 기)는 사용자 지정 범위 설정 가능
2. 기간 내 총 사례 건수
3. 운영부 시대에 이용률 (연간 7시~20시)에 대한 시간대별
4. 월간 매출 실적(기)를 설명(시작부터) 위한 시간대별

월간 실적 (10월) 관측지가 포함 가능함

시스템 상세 사항 I

시스템 상세 사항 - 1

1. System
2. Software
3. Core Component
4. Detail

시스템 상세 사항 II

시스템 상세 사항 - 2

1. 중요이력
2. 필수이력
3. 시스템 구성 요소

중요이력, 기증, 장기, 장기, 장기, 장기

시스템 구성요소

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서비스 이력

서비스 이력

1. 필터
2. 서비스 이력
3. 다운로드
4. 상세

서비스 이력 상세

서비스 이력 상세

서비스 이력 상세

서비스 이력 상세

시스템 정보 - 전체 보고서

전체 보고서

기간: 2022년 12월 1일 ~ 2022년 12월 31일

필터: 월, 분, 기, 연, 사용자 지정

총 사례 건수: 100

운영부 시대의 이용률: 80%

월간 실적 (10월) 관측지가 포함 가능함

시스템 정보 - 전체 보고서

전체 보고서

기간: 2022년 12월 1일 ~ 2022년 12월 31일

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운영부 시대의 이용률: 80%

월간 실적 (10월) 관측지가 포함 가능함

시스템 이용률 I

시스템 이용률 - 1

1. 기간
2. 사용자 지정
3. 운영부 시대의 이용률
4. 월간 실적 (10월) 관측지가 포함 가능함

필터: 월, 분, 기, 연, 사용자 지정

총 사례 건수: 100

운영부 시대의 이용률: 80%

월간 실적 (10월) 관측지가 포함 가능함

KAROS 2026

The Korean Association of Robotic Surgeons

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- The Katros of Robotic Surgery

시스템 이용률 II

시스템 이용률 - 2

1. 기간
2. 사용자 지정
3. 운영부 시대의 이용률
4. 월간 실적 (10월) 관측지가 포함 가능함

필터: 월, 분, 기, 연, 사용자 지정

총 사례 건수: 100

운영부 시대의 이용률: 80%

월간 실적 (10월) 관측지가 포함 가능함

달력 보기

달력 보기

기간: 2022년 12월 1일 ~ 2022년 12월 31일

필터: 월, 분, 기, 연, 사용자 지정

총 사례 건수: 100

운영부 시대의 이용률: 80%

월간 실적 (10월) 관측지가 포함 가능함

달력 보기 - 수술 상세 사항

수술 상세 사항

기간: 2022년 12월 1일 ~ 2022년 12월 31일

필터: 월, 분, 기, 연, 사용자 지정

총 사례 건수: 100

운영부 시대의 이용률: 80%

월간 실적 (10월) 관측지가 포함 가능함

달력 보기 - "상세 사항 보기" 수술 이용률 상세 사항

"상세 사항 보기" 수술 이용률 상세 사항

기간: 2022년 12월 03, 2022 12:25 오후 ~ 02:46 오후

필터: 월, 분, 기, 연, 사용자 지정

총 사례 건수: 100

운영부 시대의 이용률: 80%

월간 실적 (10월) 관측지가 포함 가능함



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재고 이용률 개요

재고 이용률 개요 - 기구별 상세 분석

재고 이용률 개요 - 기구별 상세 분석

재고 이용률 개요 - 기구별 상세 분석

사용된 기구의 상태 - 개요

사용된 기구의 상태 - 개요

사용된 기구의 상태 - 상세 사항

사용된 기구의 상태 - 상세 사항

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Arena of Robotic Surgery: K.A.R.O.S - The Katros of Robotic Surgery

PAR 수준 권장

PAR 수준 권장

PAR 수준 권장 - 심사 질문 I

PAR 수준 권장 - 심사 질문 I

PAR 수준 권장 - 심사 질문 II

PAR 수준 권장 - 심사 질문 II

PAR 수준 권장 - 최종 권장 수준

PAR 수준 권장 - 최종 권장 수준

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주문은 어디에서 확인 가능할까요?

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주문 관리 - 요약

주문 관리 - 요약

주문 관리 - 주문 이력

주문 관리 - 주문 이력

주문 관리 - 주문 이력 상세 사항

주문 관리 - 주문 이력 상세 사항



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반품은 어디에서 확인 할 수 있을까요?



반품 시작

반품용 시작하기 전 꼭 확인해야 할 정보:

- 사용처 지정 여부
- 부품명
- 부품명 설명
- 부품 수량/현재 보유량/공정용량/재고/연번/제조사/제조일자/제조번호

그런 다음 반품용 창에서 **조회를 선택**합니다.

반품 및 교환 시작하기

의 검사/교환하는 기준 등, 데이터를 활용하거나 조달할 수 있습니다. (도움말이 필요하시면, 검색창의 우측에 'KAROS-2026' 또는 '도움말'을 클릭하여 도움말을 보실 수 있습니다.)

상어의 종류는 무엇입니까?



반품 - 제1부 - 부품 상세 사항 - 부품/버전 번호

부품/버전 번호
입력 도출물(구입처)에 주석:

1. 부품 번호
2. 부품 설명
3. 부품 설명(부품명)의 상세 부품 번호 (KAROS-2026)를 입력하여 부품명(도출물)을 생성할 수 있습니다. (KAROS-2026)

부품 버전
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반품 - 부품 상세 사항 - 로트/시퀀스 번호

로트 번호
입력 도출물(구입처)은 버전 번호와 기존 부품 설명이 유지되며, 부품 설명에 해당 로트의 로트/시퀀스 번호를 추가하여 부품 설명을 생성할 수 있습니다.

시퀀스 번호
입력 도출물(구입처)은 버전 번호, 로트 번호, 기존 부품 설명이 유지되며, 부품 설명에 해당 시퀀스 번호를 추가합니다. 로트/시퀀스 번호를 추가하여 부품 설명을 생성할 수 있습니다.




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반품 - 부품 상세 사항(계속)

다음 정보 기록:


1. 부품 번호
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반품 - 제2부 - 수술 정보


수술 정보
다음 정보 기록:

1. 수술 번호
2. 수술 설명
3. 수술 설명
4. 수술 설명
5. 수술 설명
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8. 수술 설명
9. 수술 설명
10. 수술 설명



반품 - 요약

요약 정보



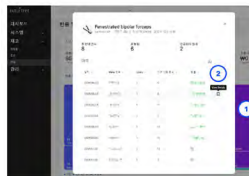
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반품 및 교환 - 상세 사항

반품/교환 대상 및
입력 도출물(구입처)에 주석:

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3. 부품 설명(부품명)의 상세 부품 번호 (KAROS-2026)를 입력하여 부품명(도출물)을 생성할 수 있습니다. (KAROS-2026)

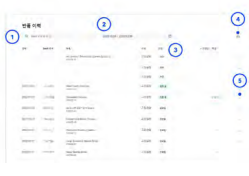
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반품 및 교환 - 이력

반품/교환 이력
입력 도출물(구입처)에 주석:


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반품 및 교환 - 인사이드

반품/교환 인사이드
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구분	잔액	비율	잔액
잔액	0.000000	0.000000	0.000000
비율	0.000000	0.000000	0.000000
잔액	0.000000	0.000000	0.000000
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잔액	0.000000	0.000000	0.000000
비율	0.000000	0.000000	0.000000

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Remote Order(온라인 주문)
메드트로닉 eStore





Hyung Min Kim

Asan Medical Center

EDUCATION

2001–2006 Seoul National University Department of Nursing

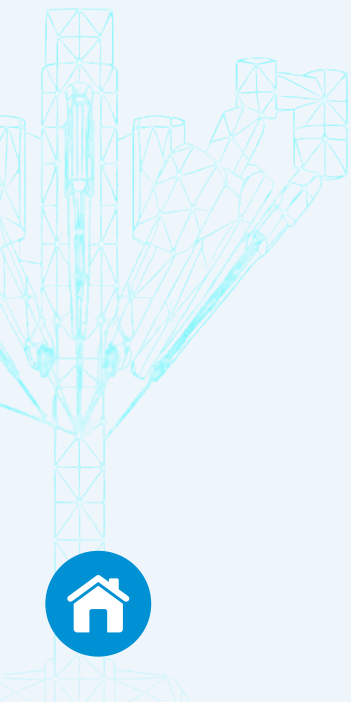
CAREER

2006–2009 Nursing officer, Korean Armed Forces Daegu Hospital

2009–2013 Scrub nurse, Asan Medical Center

2013– Surgical assistant (Robot surgery), GS, Asan Medical Center

2016–2016 Univ. Pittsburgh Medical Center (USA) training



Methods for Increasing Robot Motion

Hyung Min Kim Asan Medical Center

Background

로봇 수술에서 robot arm motion의 확보는 수술 효율성에 핵심적이다. 로봇 수술 시 motion을 극대화하는 전략이 필요하다.

Methods

기존 port placement를 변경하지 않고 robot arm motion을 증가시키기 위한 다섯 가지 기법을 제시한다: Green cross method, fixation method, clutch method(axis method 포함), remote center method, zigzag method.

Green cross method는 기준 축을 camera에서 main working arm으로 이동시켜 motion 효율을 향상시킨다.

Fixation method는 시야 방향에 따라 안정성과 유연성을 조절한다.

Clutch 및 axis method는 회전축을 재설정하여 arm 간 collision을 감소시키고 작업 범위를 확장한다.

Remote center method는 중심축을 유연하게 운용하여 고정된 wound 중심 축에 대한 의존도를 낮추고 motion을 확장한다.

Zigzag method는 비선형 trocar 배열을 통해 assistant space를 확보하고 collision을 줄인다.

Results

이들 기법 적용 시 기존 port placement를 유지한 상태에서도 robot arm motion range가 증가하고 arm collision이 감소하여 수술 효율이 향상되었다.



Conclusion

다양한 기법의 조합을 통해 robot arm motion을 효과적으로 확장할 수 있으며, 이는 로봇 수술의 수행 능력과 적용 범위를 향상시키는 데 기여한다.



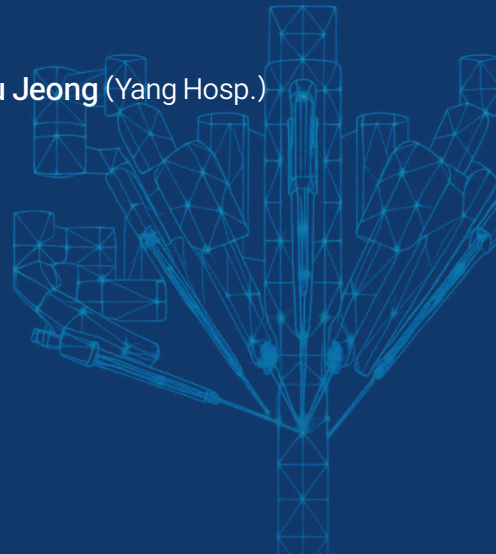


KAROS 2026

KOR

Unedited Surgical Video Demonstration I Hernia Repair

Chairs Kyung Won Seo (Kosin Univ.), Seung Kyu Jeong (Yang Hosp.)



Day 3

| **Room 1** |



Manwoo Park

Koo Hosp.

EDUCATION

College of Medicine, Yeungnam University

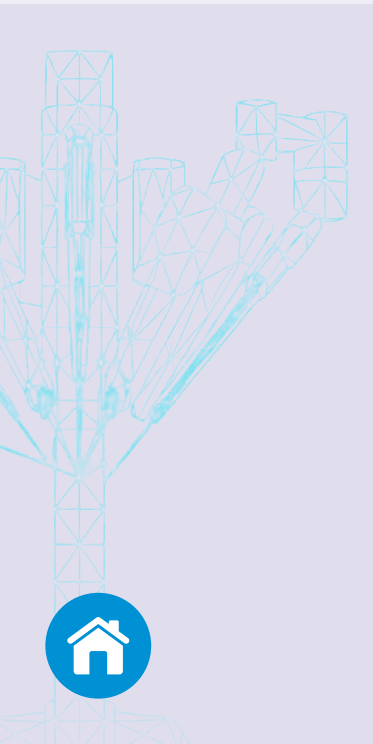
Yeungnam University Hospital, Intern & Resident

Yeungnam University Hospital, Fellow, Colo-proctology division

CAREER

2011–2012 Ulsan Hospital, Surgical director

2013– Koo Hospital, Vice Director Director, Hernia Center



Robotic Inguinal Hernia Repair

Manwoo Park Koo Hosp.

Inguinal hernia repair is one of the most commonly performed procedures in general surgery, with well-established techniques including open and laparoscopic approaches. Over the past decades, minimally invasive surgery has become the standard in many settings, offering reduced postoperative pain, faster recovery, and improved cosmetic outcomes. Among these, laparoscopic techniques such as TEP and TAPP have gained widespread acceptance.

The introduction of robotic surgical systems has brought a new dimension to minimally invasive surgery. Robotic platforms provide enhanced three-dimensional visualization, improved dexterity through articulating instruments, and superior ergonomics for the surgeon. These features allow for more precise dissection and facilitate complex maneuvers in confined anatomical spaces. As a result, robotic inguinal hernia repair (RIHR) has emerged as an alternative to conventional laparoscopic techniques.

One of the notable advantages of robotic inguinal hernia repair is that it is relatively easy and comfortable to perform while enabling precise surgical dissection. The ergonomic benefits of the robotic system may also contribute to reduced surgeon fatigue, particularly during longer or technically challenging procedures. These advantages become even more relevant in patients with a history of prior pelvic surgery, such as prostate cancer surgery, where fibrosis and altered anatomy can increase the complexity of the operation. In such cases, the precision and stability offered by robotic systems can enhance surgical safety and efficiency.



Despite these advantages, the adoption of robotic inguinal hernia repair varies significantly across countries and institutions. Key barriers include higher costs, limited reimbursement, and the perception that conventional techniques are sufficient for a relatively straightforward condition. Nevertheless, with ongoing technological advancements and increasing surgical experience, the role of robotic surgery in inguinal hernia repair continues to expand.





Seung-Rim Han

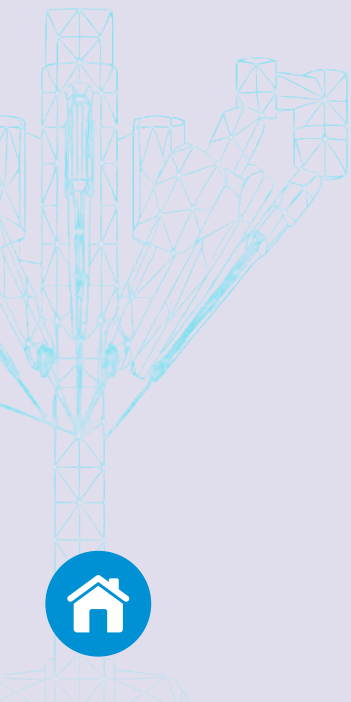
Ain Hosp.

EDUCATION

- 2000–2007 Bachelor of Science degree , Biogenetic engineering from Korea University, Korea
- 2007–2011 Master’s Degree , Pusan National University School of Medicine, Korea
- 2020–2022 Doctor of Medicine, Graduate School of Medicine, The Catholic University of Korea

CAREER

- 2011–2012 Internship, Severance Hospital, Yonsei University College of Medicine
- 2012–2016 Resident, Department of Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine
- 2016–2017 Clinical fellow, Division of colorectal Surgery, Department Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine
- 2017–2019 Clinical fellow, Division of colorectal Surgery, Department Surgery, St. Vincent Hospital, Catholic University College of Medicine
- 2019–2023 Clinical Assistant Professor, Division of colorectal Surgery, Department Surgery, Seoul St. Mary’s Hospital, Catholic University College of Medicine
- 2023– Head of division of colorectal surgery, Ain Hospital, Incheon



SP Robotic eTEP with Unilateral TAR for Incisional Hernia

Seung-Rim Han Ain Hosp.

Complex ventral hernia repair is challenging for surgeons. Techniques in complex abdominal wall reconstruction have developed rapidly over the past decades. Transversus abdominis release (TAR), a relatively new technique of posterior component separation (PCS) with myofascial release utilized in complex ventral hernia repair, is rapidly becoming a worldwide phenomenon in abdominal wall reconstruction. Although rTAR is being performed more frequently since the introduction of robotics, there are still challenges in performing TAR procedure for the first time. In particular, while tension-free closure of the posterior sheath can be expected via bilateral TAR in cases of very large ventral hernias, it is sometimes unclear whether TAR is necessary or not for ventral hernias between 7 and 10 cm in size. Although the literature has not yet provided clear indications, tension-free closure of the posterior fascia can reduce patient pain and prevent complications such as intraperitoneal hernia—a rare complication of eTEP—thereby allowing for safer surgery by reducing the burden of excessive surgical time through unilateral TAR. Therefore, in this session, I intend to explain in detail the single-port robotic extended totally extraperitoneal approach (eTEP) with unilateral transverse abdominis release (TAR).



This is a 44-year-old female patient with no specific underlying medical history who presented with an incisional hernia following a laparoscopic donor nephrectomy. This patient underwent SP robotic eTEP with unilateral TAR, complaining of abdominal protruding after previous surgery. The incisional hernia defect was approximately 8 cm wide at the M 2,3 level and 9 cm long, as observed on the abdominal CT scan. BMI was 27.9 kg/m².

There were two techniques for TAR. The Notvisky method was a “top-down technique,” which involves cutting the transverse abdominis (TA) muscle from the subcostal margin while releasing muscle fibers as it moves downward. The other is a “bottom-up technique,” which involves identifying the arcuate line, securing the Bogros space, and then cutting muscle fibers and the TA muscle as it moves upward. The method I will introduce here is the modified Madrid TAR, specifically a method utilizing an SP robotic approach to perform posterior component separation while preserving the TA muscle. It is a refined surgical technique for complex abdominal wall reconstruction, designed to improve anatomical restoration while minimizing complications compared to traditional TAR methods. SP robotic eTEP with modified Madrid unilateral TAR may be a good surgical option for complex ventral hernia when there was somewhat tension suturing posterior fascia closing.





Sung Ryul Lee

Damsoyu Hosp.

EDUCATION

1996–2002 M.D., Korea University College of Medicine
M.S. and Ph.D. in Surgery, Korea University Graduate School of Medicine

CAREER

2003–2007 Surgical Resident, Korea University Hospital
2025– Vice President, Korean Hernia Society
2012– Director, Damsoyu Hospital



TAPP Repair for Inguinal Hernia

Sung Ryul Lee Damsoyu Hosp.

Inguinal hernia repair is one of the most commonly performed procedures in general surgery, and minimally invasive approaches, including both laparoscopic and robotic techniques, have been increasingly adopted. Transabdominal preperitoneal (TAPP) repair remains a standard approach in laparoscopic surgery, while robotic platforms offer enhanced dexterity and visualization, potentially facilitating more precise dissection and suturing. Despite these technological advancements, variability in intraoperative anatomical findings continues to influence surgical decision-making.

One of the ongoing challenges is the management of fatty tissue encountered within the inguinal canal. Although frequently described as a lipoma, many of these lesions represent protrusions of preperitoneal fat that are continuous with the extraperitoneal space rather than true encapsulated tumors. The absence of clear intraoperative criteria for differentiation may result in unnecessary excision, prolonged operative time, and increased risk of complications. Therefore, a more selective and anatomy-based approach to managing inguinal canal fat is warranted.



In addition, certain patient populations present unique anatomical challenges that further complicate minimally invasive repair. Inguinal hernia following robot-assisted radical prostatectomy (RARP) is a representative example, as fibrosis and scarring in the preperitoneal space can limit adequate dissection in both laparoscopic and robotic TAPP repair. In such cases, conventional techniques alone may be insufficient, and adjunctive reinforcement procedures may be required to achieve safe and durable repair.

In this context, a tailored surgical strategy based on intraoperative findings and patient-specific anatomical conditions is essential. Selective management of inguinal canal fat according to its pathological characteristics, combined with the application of additional reinforcement techniques in complex scenarios, may improve surgical outcomes. These studies aim to evaluate the clinical relevance of such individualized approaches and to provide evidence supporting optimized decision-making in both laparoscopic and robotic inguinal hernia repair.



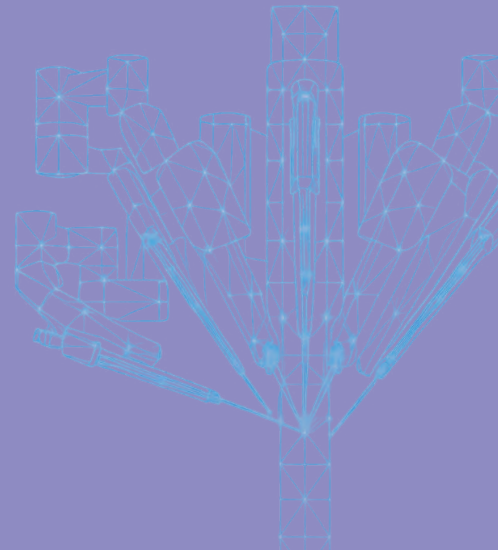


KAROS 2026

ENG

Plenary Session

Chairs Jung Wook Huh (Sungkyunkwan Univ.), Hyung Jun Kwon (Kyungpook National Univ.)



Day 3

| **Room 1** |

Proposal for Grading Intraoperative Bleeding and Hemostasis Strategies During Robot-Assisted Pancreatoduodenectomy

Yui Sawa¹, Kosuke Kobayashi¹, Sho Kiritani¹, Yoshihiro Ono¹, Hiromichi Ito¹, Yosuke Inoue¹, Yu Takahashi¹

¹ Division of Hepato-Biliary-Pancreatic Surgery, Cancer Institute Hospital, Japanese Foundation for Cancer Research, Tokyo, Japan

Background:

The severity of intraoperative bleeding and the quality of hemostasis during robot-assisted pancreatoduodenectomy (RPD) have not been objectively evaluated.

Methods:

We extracted all intraoperative bleeding events from 20 cases of RPD performed between October 2020 and March 2025, as well as the bleeding events that led to open conversion. For each event, the pixel index (PI)—the number of red pixels one second after bleeding onset—hemostasis time, and hemostatic methods were assessed. The hemostatic method was used to grade the bleeding severity.

Results:

A total of 889 bleeding scenes were included. The areas under the curve (AUC) of the PI predicting non-cauterization and open conversion procedures were 0.846 (cutoff: 12041) and 0.990 (cutoff: 62084), respectively. The bleeding severity was classified into three grades based on PI for hemostasis strategies as follows: Grade 1: $PI < 12000$ (likely to be controlled by cauterization only); Grade 2: $12000 \leq PI < 60000$ (likely to require procedures other than cauterization); Grade 3: $PI \geq 60000$ (likely to require open laparotomy for hemostasis).



The AUC for predicting total blood loss ≥ 100 mL based on the number of events requiring hemostasis ≥ 15 seconds was 0.879. Hemostasis < 15 seconds was considered effective, whereas ≥ 15 seconds indicates difficult hemostasis.

Conclusion:

We propose a novel grading system for intraoperative bleeding and hemostasis in RPD. This provides a quantitative basis for future research and intraoperative decision-making.

Keywords: intraoperative bleeding, hemostasis quality, robot-assisted pancreatoduodenectomy, pixel index, grading



Simultaneous Robotic Bilateral Nephrectomy and Kidney Transplantation in Autosomal Dominant Polycystic Kidney Disease: First Reported Case in Asia

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¹ Division of Kidney and Pancreas Transplantation, Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background:

We report the first Asian case of simultaneous robotic-assisted bilateral nephrectomy and living-donor kidney transplantation (RAKT) in a patient with autosomal dominant polycystic kidney disease (ADPKD), highlighting operative strategy, perioperative outcomes, and feasibility.

Methods:

A 24-year-old female with ESRD due to genetically confirmed ADPKD underwent sequential robotic bilateral native nephrectomy followed by RAKT using the da Vinci Xi platform. Preoperative work-up confirmed favorable immunologic and vascular profiles. Surgical strategies included sequential table tilts with targeted cyst decompression to optimize exposure, protected GelPort extraction with extracorporeal morcellation of native kidneys, extraperitoneal graft pocket creation via a right lower-quadrant peritoneal flap, end-to-side vascular anastomoses to the external iliac vessels, and extravesical ureteroneocystostomy over a double-J stent.

Results:

Cold ischemia time was 90 minutes, rewarming time 42 minutes, and total operative duration approximately 10 hours. Immediate graft function was observed, with urine output of 5,160 mL



in the first 24 hours and serum creatinine declining from 7.26 mg/dL preoperatively to 0.99 mg/dL at discharge on postoperative day (POD) 5. No intraoperative complications occurred; one unit of PRBC was transfused on POD 4 for asymptomatic anemia. Doppler ultrasonography and ^{99m}Tc -DTPA scans confirmed normal perfusion and drainage. The patient was discharged in excellent condition; 1-week creatinine was 0.93 mg/dL.

Conclusion:

Single-stage robotic bilateral nephrectomy with living-donor RAKT is feasible and safe in selected ADPKD patients, achieving ischemic times comparable to standard RAKT despite added complexity. This approach preserves minimally invasive benefits, optimizes graft placement, and avoids morbidity of staged procedures. Further series are warranted to validate outcomes.

Figure 1. Preoperative abdominal CT imaging demonstrating massively enlarged polycystic kidneys.

Coronal CT imaging of the abdomen reveals bilaterally enlarged kidneys with innumerable cysts of variable size replacing the normal renal parenchyma, consistent with advanced autosomal dominant polycystic kidney disease. The right kidney measures approximately 20 cm in craniocaudal length and 10 cm in transverse width, while the left kidney measures approximately 16.5 cm in length and 12.5 cm in width. The kidneys occupy a substantial portion of the retroperitoneal space, displacing adjacent abdominal structures and significantly reducing the available pelvic space for renal allograft placement.



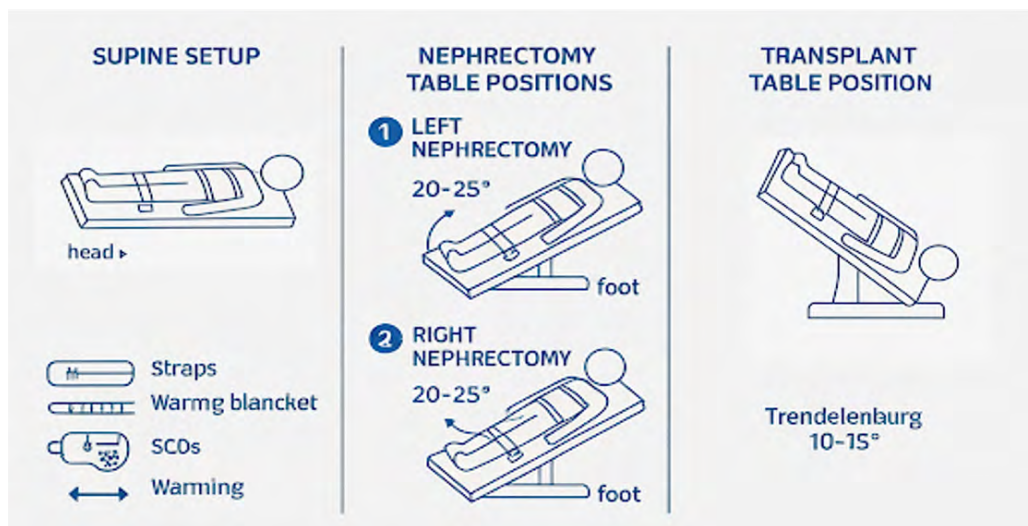


Figure. robotic setup positioning.png

We used a supine position with sequential table tilts: right-tilt for the left nephrectomy, left-tilt for the right, and Trendelenburg for the transplant. Foley catheterization and bladder filling aided later ureteroneocystostomy.

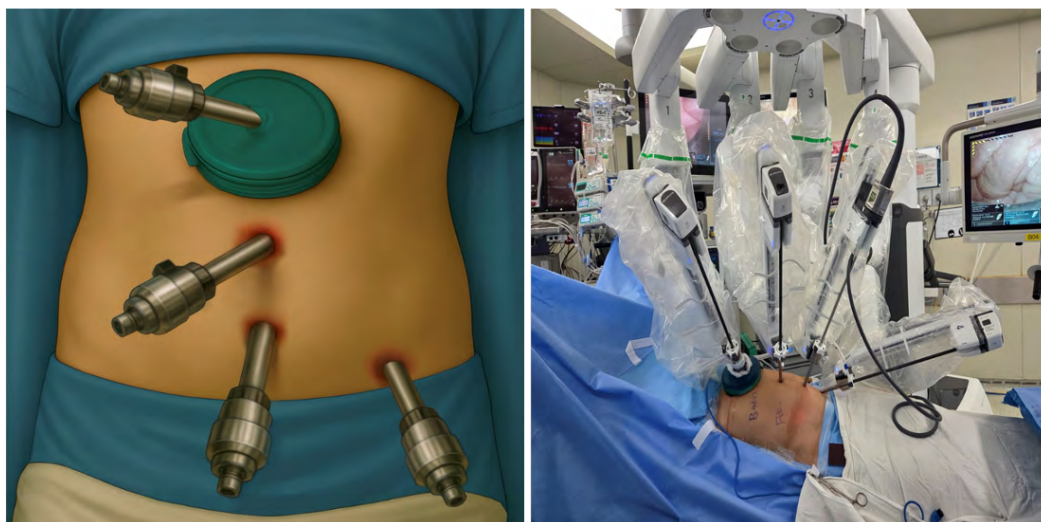


Figure. left nephrectomy.png

For the left nephrectomy, we incised Toldt's line, mobilized the colon, and selectively decompressed cysts. We identified the renal vein and posterior artery, divided them sequentially, clipped the ureter, and removed the specimen via GelPort.



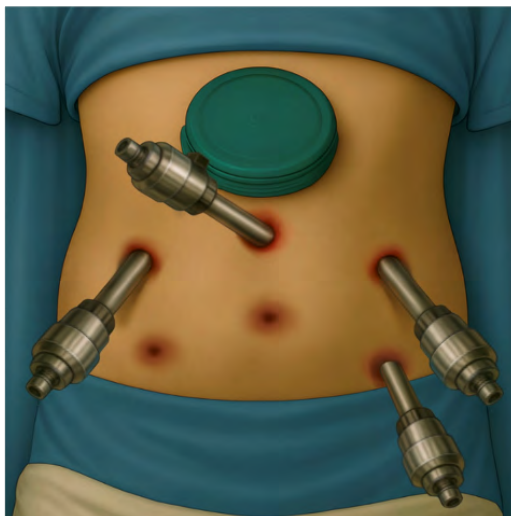


Figure. robotic KT.png

After bilateral nephrectomy, we created an extraperitoneal pocket in the right lower quadrant. External iliac vessels were skeletonized 4–5 cm with strict lymphostasis to prevent lymphocele while preserving the genitofemoral nerve.

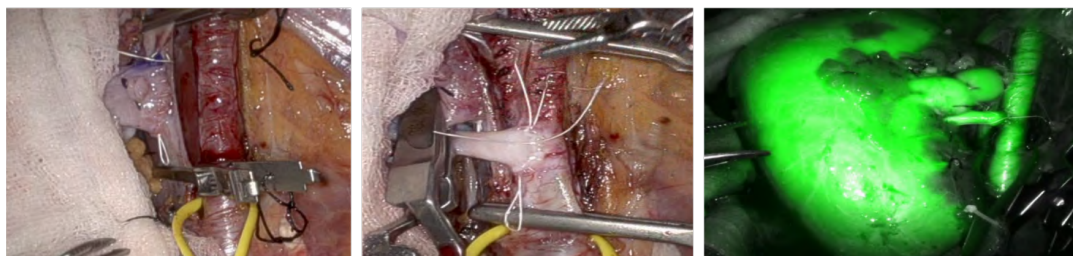


Figure. vascular anastomosis.png

we performed end-to-side venous and arterial anastomoses and reperfusion followed the vein-first, artery-second sequence, and Firefly ICG confirmed immediate homogeneous graft perfusion.

Robot Single-Site Plus One Spleen-Preserving Distal Pancreatectomy: Initial Experience

Jaewoo Kwon¹, Sung Ryol Lee¹, Jun Ho Shin¹

¹Department of Surgery, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea.

Background

Robotic single-site surgery minimizes incisional trauma, but its application to distal pancreatectomy (DP) remains limited. We present our initial experience with robot single-site plus one (SS+1) spleen-preserving DP, focusing on cosmetic outcomes and pancreatic stump healing using robotic stapling for pancreas transection.

Methods

Eight consecutive patients underwent robot SS+1 spleen-preserving DP at a single institution between January 2024 and December 2025. Procedures included splenic spleen-preserving DP (n=5) and Warshaw procedure (n=3). Robotic stapling was used for pancreas transection in all cases. Operative outcomes, complications, and resection margin fluid collection on early postoperative and 3-month CT were retrospectively reviewed.

Results

Median operative time was 143 minutes (range 110–245). No clinically relevant POPF (Grade B/C) was observed. Resection margin fluid collection was absent or minimal on early postoperative imaging and showed spontaneous resolution or no progression in most patients at 3-month follow-up. Median hospital stay was 7 days (range 6–7). The SS+1 configuration — a single umbilical incision plus one lateral port — provided excellent cosmetic results with minimal abdominal wall morbidity.



Conclusion

Robot SS+1 spleen-preserving DP is feasible and safe. Robotic stapling for pancreas transection was associated with no CR-POPF and favorable resection margin healing. The SS+1 approach offers a meaningful cosmetic advantage over conventional multi-port techniques.



Comparison of Open, Laparoscopic, and Robotic Liver Resection for Intrahepatic Cholangiocarcinoma: Focus on Lymphadenectomy Adequacy

Na Reum Kim, M.D., Gi Hong Choi, M.D. Ph.D., Dai Hoon Han, M.D. Ph.D., Kyung-Sik Kim, M.D., Ph.D., Jin Sub Choi, M.D. Ph.D., Sung-Hyun Kim, M.D. Ph.D.†

Department of Surgery, Division of Hepato-biliary and Pancreatic Surgery, Yonsei University College of Medicine, Seoul, Republic of Korea

Background: Curative resection for intrahepatic cholangiocarcinoma (ICC) requires R0 margins and adequate lymph node (LN) dissection (≥ 6 LNs). Although minimally invasive surgery (MIS) is increasingly adopted, its oncological adequacy, particularly in laparoscopic lymphadenectomy, remains debated. This study aimed to compare perioperative outcomes and LN harvest adequacy among open (OLR), laparoscopic (LLR), and robotic liver resection (RLR) for ICC.

Methods: We retrospectively analyzed 203 patients undergoing curative-intent liver resection for ICC (OLR: 161, LLR: 21, RLR: 21). Short-term outcomes and LN dissection quality were compared across groups.

Results: The OLR group had more right-sided tumors and major resections (83.9% vs. 64.3%, $P=0.005$). Compared to OLR, MIS (LLR and RLR) was associated with significantly shorter hospital stay, lower estimated blood loss, fewer transfusion, and reduced complications rates. Regarding lymphadenectomy, while OLR achieved the highest LN harvest (median 8), the RLR group showed a higher LN count (median 6 vs. 4, $P=0.074$) and a greater rates of ≥ 6 LN harvest (57.1% vs. 28.6%, $P=0.061$) than the LLR group. Notably, RLR showed comparable LN harvest adequacy to OLR, whereas LLR harvested significantly fewer LNs.



Conclusions: MIS provides superior short-term recovery compared to open surgery. Although OLR remains most effective for maximal LN harvest, the robotic approach improves lymphadenectomy quality compared with laparoscopy, suggesting as a favorable MIS option for ensuring oncologic adequacy in ICC.

Keywords: Intrahepatic cholangiocarcinoma, Minimally invasive surgery, Robotic, Laparoscopic, Lymphadenectomy



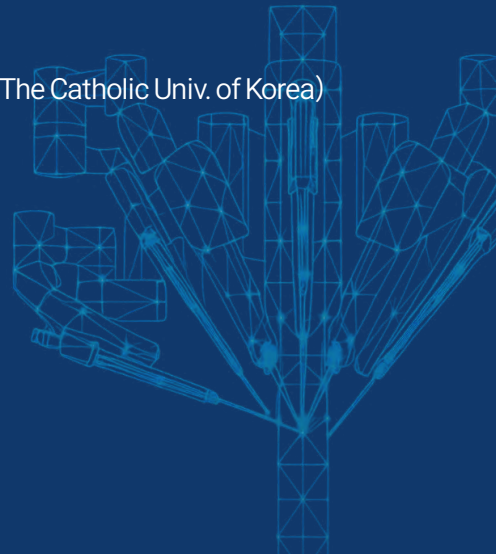


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KOR

Unedited Surgical Video Demonstration II Cholecystectomy

Chairs Wan Wook Kim (Samil Hosp.), Kee Hwan Kim (The Catholic Univ. of Korea)



Day 3

| **Room 2** |



Jin Woo Lee

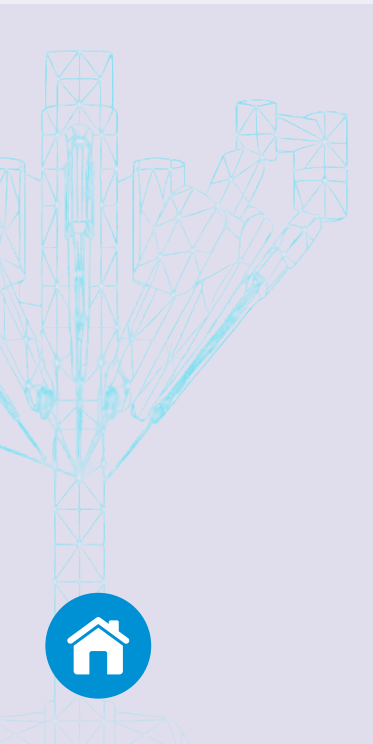
Gibbeum Hosp.

EDUCATION

- 2001–2009 Bachelor of Medicine, M.D., CHA University, Seongnam, Korea
- 2012–2014 Master course, The Graduate School, CHA University, Seongnam, Korea

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- 2009–2010 Internship, CHA Bundang Medical Center, CHA University
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- 2014–2017 Army surgeon, Department of Surgery, Chun-cheon Military Hospital
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Single-Port Robotic Cholecystectomy with the Da Vinci SP Platform

Jin Woo Lee Gibbeum Hosp.

Minimally invasive surgery and robotic technology have become defining themes in modern surgical practice over the past decade, with steadily increasing demand worldwide. Among these procedures, cholecystectomy is one of the most frequently performed operations and has proven to be an ideal platform for the application of single port and robotic approaches. The prevalence of gallbladder disease and the number of surgical cases continue to rise, and recent changes in the Korean healthcare landscape—including prolonged conflicts between medical professionals and policymakers, reduced staffing at university hospitals, and the prioritization of high severity cases at tertiary centers—have further accelerated the demand for cholecystectomy in secondary hospitals.

In response to these trends, Gibbeum Hospital established a robotic surgery program beginning with the introduction of the Revo I system in 2018, followed by the Da Vinci Xi system in September 2023, and most recently the Da Vinci SP system in October 2024. The SP platform, though less widely disseminated compared to the Xi system, is uniquely designed for single port procedures and offers distinct advantages in ergonomics and visualization. Our institution has actively implemented single port robotic cholecystectomy using the SP system, and this unedited video presentation will demonstrate our initial experience.



The video will highlight key aspects of the procedure, including patient positioning, port placement, docking, and the achievement of the critical view of safety. By presenting the operation in its entirety without editing, we aim to provide an authentic perspective on the technical feasibility, reproducibility, and learning curve associated with the SP system. Early outcomes suggest that single port robotic cholecystectomy can be performed safely and effectively, even in secondary hospital settings, and may represent a valuable addition to the evolving landscape of minimally invasive surgery.





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EDUCATION

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Three-port versus single-port laparoscopic cholecystectomy: balancing surgeon ergonomics, safety, and cosmetic outcomes

Jinju Kim Seongnam Citizens Medical Center

Laparoscopic cholecystectomy is the standard surgical treatment for benign gallbladder disease. While efforts to minimize abdominal wall trauma have led to reduced-port and single-port techniques, the balance between cosmetic benefit, operative safety, and surgeon ergonomics remains an important issue. We present a video comparing our three-port laparoscopic cholecystectomy technique and single-port laparoscopic cholecystectomy performed using a lithotomy setup with a scope holder and 3D flexible camera system.

The three-port technique provides stable triangulation, familiar instrument handling, and comfortable ergonomics for the surgeon while maintaining adequate exposure of Calot's triangle and safe achievement of the critical view of safety. The procedure can be performed efficiently with reproducible operative steps and minimal technical stress to the operator. Previous studies have demonstrated that reduced-port laparoscopic cholecystectomy maintains comparable safety and postoperative outcomes to conventional multiport surgery while preserving operative convenience.

In contrast, the single-port approach offers excellent cosmetic results through a nearly scarless transumbilical incision. In our technique, the patient is placed in the lithotomy position, and the surgeon operates while seated between the patient's legs using a scope holder with a 3D flexible laparoscopic camera. However, despite these technical modifications, single-port



surgery remains ergonomically demanding because of instrument crowding, restricted motion, and loss of triangulation. Previous comparative studies and meta-analyses have reported superior cosmetic satisfaction with single-port cholecystectomy, although operative difficulty and surgeon workload are generally increased compared with conventional or reduced-port approaches.

This video demonstrates the contrasting characteristics of the two approaches. Three-port laparoscopic cholecystectomy appears to provide a favorable balance between operative safety and surgeon comfort, whereas single-port laparoscopic cholecystectomy maximizes cosmetic benefit at the expense of ergonomic convenience. Appropriate selection of surgical approach should therefore consider not only patient cosmetic preference but also technical feasibility and surgeon ergonomics.





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Single-Port Robotic Cholecystectomy Using the da Vinci Xi System: Feasibility, Technical Modifications, and Limitations

Hwakyung Jung Samil Hosp.



Contents

- Introduction
- Technical aspect
- Limitations
- Video
- Conclusion



Introduction



Cholecystectomy

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Arena of Robotic Surgery:
K.A.R.O.S.
- The Katros of Robotic Surgery

- Open cholecystectomy
- Laparoscopic cholecystectomy
- Laparoscopic single incision cholecystectomy
- Robotic cholecystectomy
- Robotic single incision cholecystectomy
- Xi/Si single incision
- SP single incision

Safety/OP time/Cost

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Open Access Review Article

Comparison of da Vinci Robotic Cholecystectomy and Laparoscopic Cholecystectomy: A Systematic Review and Meta-Analysis of Postoperative Outcomes and Cost-Effectiveness

Poomam Tawde^{1,2,3}, Neel John¹, Seyyab Farah¹, Mehdi D¹, David Suart¹

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OP time
RC > LC
P=0.04

Bile leak
RC < LC
P=0.76

Postop Cx.
RC < LC
P=0.12

Cost
RC > LC
P=0.0001

Safety/OP time/Cost

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Original Article

Laparoscopic versus robotic cholecystectomy: a systematic review with meta-analysis to differentiate between postoperative outcomes and cost-effectiveness

Anurag Singh¹, Mandep Kumar², Christie Swaminathan, Jyoti Shetye³, Krishna K. Singh, Muhammad S. Sajid

¹ Department of Gastroenterology, Royal Sussex County Hospital, Brighton, UK
² Consultant: (I) Conceptual and design, A. Singh, MS, PhD; (II) Administrative support: M. Kumar, KK. Singh, A. Singh; (III) Provision of study materials or patients: C. Swaminathan, M. Kumar, J. Shetye; (IV) Collection and assembly of data: A. Singh, J. Shetye, C. Swaminathan, M. Kumar, J. Shetye; (V) Data analysis and interpretation: A. Singh, MS, PhD; C. Swaminathan; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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OP time
RC > LC
P=0.008

Bile leak
RC < LC
P=0.08

Postop Cx.
RC < LC
P=0.47

Cost
RC > LC
P=0.0001



Difficult gallbladders KAROS 2026 The Korean Association of Robotic Surgeons

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Surgical Endoscopy (2024) 30, 328–338
https://doi.org/10.1097/SLE.0000000000001188

Table 3 Short-term and operative outcomes

	LC (n=35, %)	RC (n=53, %)	OR (95% CI, p-value)
Total Complications	5 (14.3)	2 (3.8)	4.25 (0.77–23.28, p=0.0951)
Bile Leak	1 (2.9)	0 (0.0)	4.65 (0.18–117.50, p=0.350)
CBD stone	2 (5.7)	0 (0.0)	7.98 (0.37–171.49, p=0.184)
Intra-abdominal collection	1 (2.9)	1 (1.9)	1.52 (0.06–25.28, p=0.766)
Pancreatitis	1 (2.9)	0 (0.0)	4.65 (0.18–117.50, p=0.350)
Wound infection	0 (0.0)	1 (1.9)	0.49 (0.01–12.44, p=0.667)
Conversion to open	3 (8.6)	0 (0.0)	11.52 (0.57–230.32, p=0.109)
Total Operative Time [median (range)]	108 (55–204)	50 (32–163)***	N/A
30-day mortality	0 (0.0)	0 (0.0)	N/A
Total length of stay (days) [median (range)]	2 (1–38)	1 (1–3)*	N/A

*p<0.05, **p<0.01, ***p<0.001. LC Laparoscopic cholecystectomy, RC Robotic cholecystectomy, OR Odds ratio

Xi/Si vs SP KAROS 2026 The Korean Association of Robotic Surgeons

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Received: 23 May 2023 | Revised: 16 September 2023 | Accepted: 01 October 2023
DOI: 10.1097/SLE.0000000000001188

TABLE 2 Postoperative surgical and pain-related outcomes, before and after PSM

	Before PSM			After PSM				
	Total (n=330)	Da Vinci Xi (n=258)	Da Vinci SP (n=72)	p-Value	Total (n=300)	Da Vinci Xi (n=233)	Da Vinci SP (n=53)	p-Value
Time of operation, mean (SD), min	45.9 (15.4)	43.4 (16.2)	45.9 (12.6)	0.155	47.3 (16.6)	46.9 (20.1)	45.7 (12.2)	0.323
Operation time at console, mean (SD), min	22.5 (12.1)	23.1 (12.3)	20.3 (9.8)	0.018	23.1 (12.5)	26.3 (17.5)	19.5 (9.3)	0.015
Estimated blood loss, mean (SD), ml	15.4 (23.0)	14.3 (24.8)	19.2 (14.1)	0.031	14.3 (19.7)	10.6 (24.1)	18.1 (13.2)	0.049
RBC transfusion, no. (%)	0 (0.0)	0 (0.0)	0 (0.0)	>0.999	0 (0.0)	0 (0.0)	0 (0.0)	>0.999
Insertion of drainage, no. (%)	3 (0.9)	1 (0.4)	2 (2.8)	0.235	1 (0.3)	0	1 (1.9)	0.315
Postoperative pain control, no. (%)								
Injection	329 (99.7)	253 (99.6)	72 (100.0)	>0.999	305 (99.1)	52 (98.1)	53 (100)	0.315
PO	1 (0.3)	1 (0.4)	0 (0.0)	0.309	1 (0.3)	1 (1.9)	0 (0.0)	0.001
Injection of analgesic, no. (%)	3.8 (1.2)	4.0 (1.6)	3.2 (4.4)	<0.001	3.4 (1.1)	3.7 (1.6)	3.1 (5.8)	0.001
NRS at day of operation, mean (SD)	5.5 (1.6)	5.7 (1.6)	4.9 (1.7)	<0.001	5.5 (1.5)	6.1 (1.6)	4.8 (1.7)	<0.001
NRS at POD 1, mean (SD)	3.6 (1.8)	4.3 (1.4)	1.3 (1.2)	<0.001	2.7 (2.0)	4.3 (1.4)	1.2 (1.1)	<0.001
Complication, no. (%)	2 (0.6)	2 (0.8)	0 (0.0)	>0.999	0 (0.0)	0 (0.0)	0 (0.0)	>0.999
Postoperative stay, no. (%)	1.4 (0.7)	1.1 (0.3)	2.3 (0.7)	<0.001	1.7 (0.8)	1.1 (0.3)	2.3 (0.7)	<0.001
Transfer after discharged, no. (%)	0 (0.0)	0 (0.0)	0 (0.0)	>0.999	0 (0.0)	0 (0.0)	0 (0.0)	>0.999
Unexpected readmission, no. (%)	4 (1.2)	4 (1.6)	0 (0.0)	0.65	1 (0.3)	0	1 (1.9)	0.315

Abbreviations: NRS, numeric rating scale; PO, per OS; POD, postoperative day; PSM, propensity score matching; RBC, red blood cell; SD, standard deviation.

Technical aspect




Goal

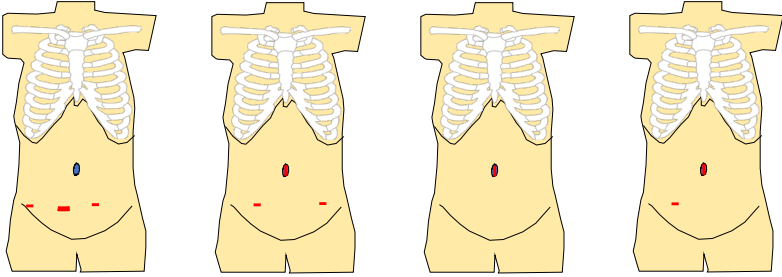
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- Safely
- Good surgical field
- No bile duct injury

- Less scar
- Less instrument
- Shorter operation time

Port placement

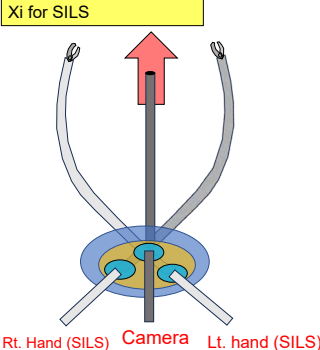
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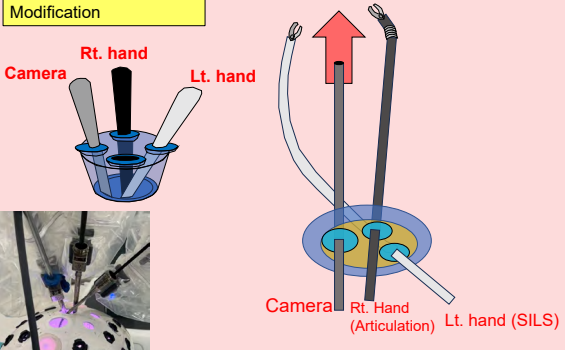
Instrument position : SILS with Xi

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Xi for SILS



Modification



Rt. Hand (SILS) Camera Lt. hand (SILS)

Camera Rt. hand Lt. hand

Camera Rt. Hand (Articulation) Lt. hand (SILS)

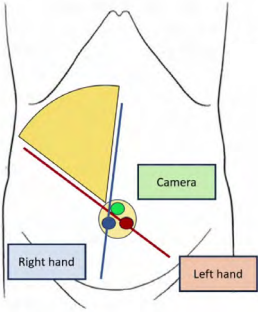


Instrument position : SILS with Xi

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Crossover Method – Wang et al.

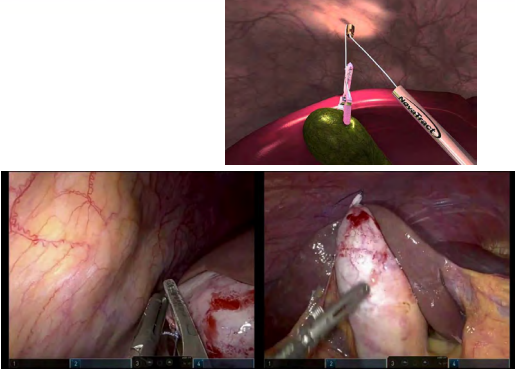


GB traction

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- No traction material
- Traction device
- Suture traction
- Gauze traction
- Hemolok traction



Gauze traction

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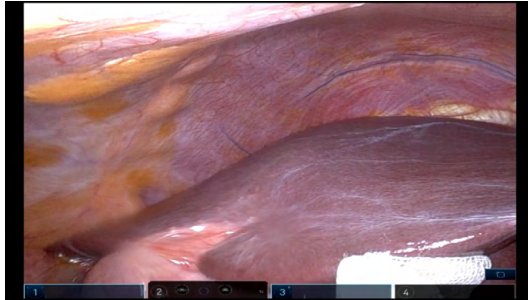
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Hemolok traction

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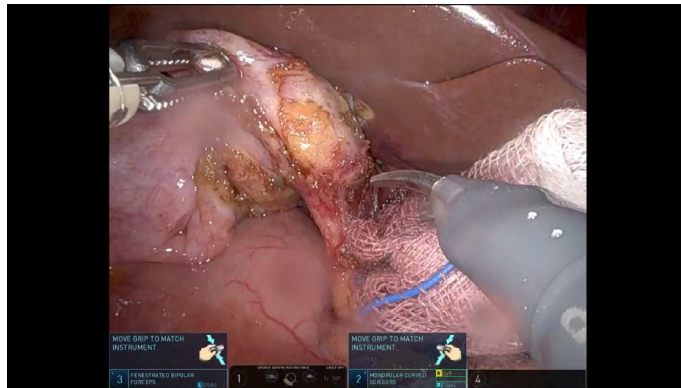
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ICG cholangiography

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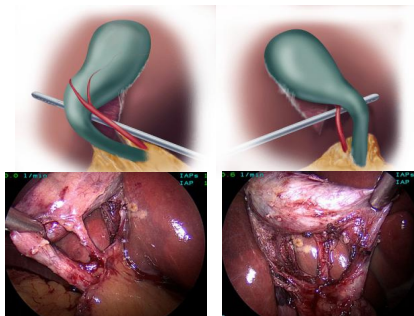
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Critical View of Safety (CVS)

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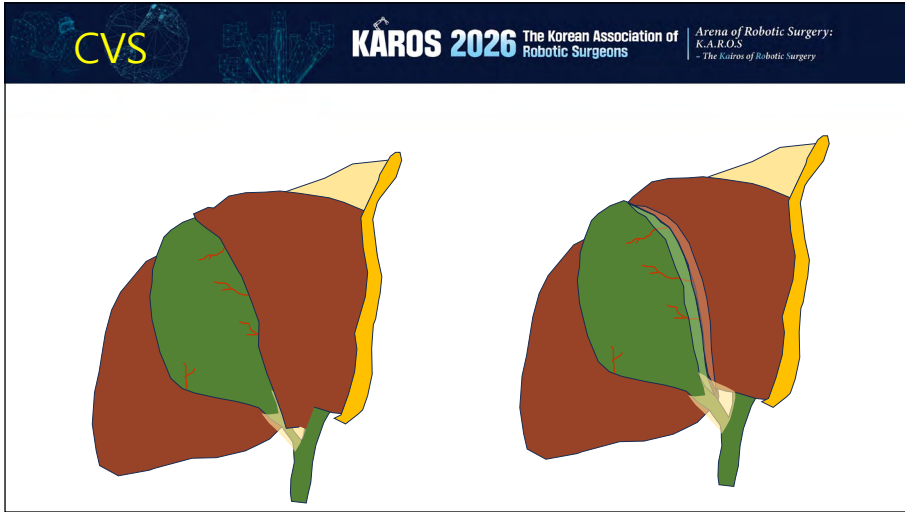



Anterior view

Posterior view

1. Calot's triangle should be cleared of fat and fibrous tissue.
2. The lower one third of the gallbladder is dissected from the liver to expose the all anatomical structures.
3. Cystic duct and artery should be isolated.



Limitations

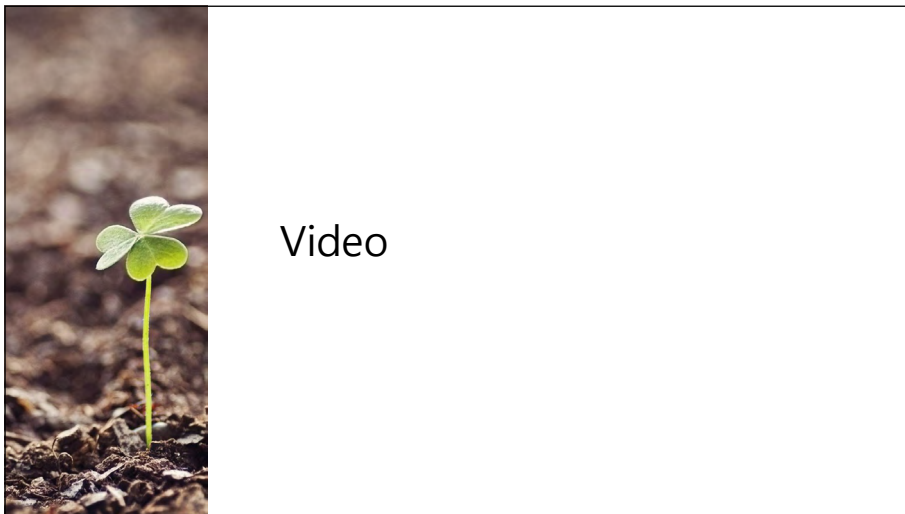
Incision

Cephalic Caudal

LC: 5mm camera, 5mm instrument x 2
 RC: 8mm camera, 8mm standard instrument
 5mm single-site instrument

Larger skin incision &
 Larger fascial incision
 For RC







Conclusion

Conclusion

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- Although robotic cholecystectomy generally involves longer operative time and higher cost compared to laparoscopy, it may be associated with a lower risk of bile duct injury and other complications.
- The SP platform may further reduce operative and console time.
- Safe and efficient surgery can be achieved by applying appropriate techniques such as optimal traction, ICG fluorescence imaging, and securing the critical view of safety.
- However, when using the Xi system for single-port surgery, careful attention is required to minimize instrument collision.



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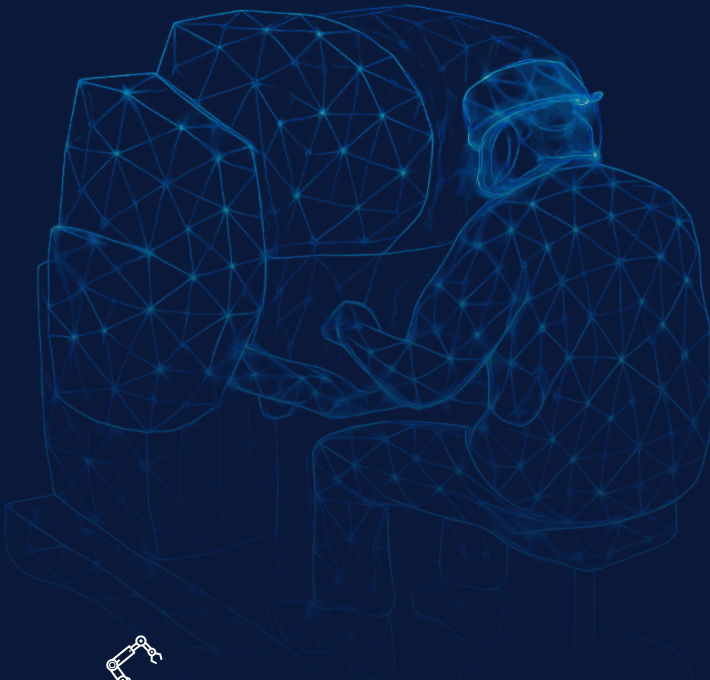
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