MIGS 26

55TH GLOBAL CONGRESS ON MIGS

BOSTON, MASSACHUSETTS
NOVEMBER 13-16, 2026

Syllabus

PG-26212

Globalization of Single Port Robotic Surgery in Gynecology- The Next Generation

HONORARY CHAIR
Charles H. Koh, MD

SCIENTIFIC PROGRAM CHAIR
Nash S. Moawad, MD

PRESIDENT
Michael Hibner, MD, PhD



Table of Contents

Course Program: Course Description, Learning Objectives, Course Outline 3

Financial Disclosures 4

Advantages and Pitfalls of Converting to Single Port Robotics in Urogynecology- US Perspective
J. Yi 5

Single Port Robotics vNOTES- Why Transition from Laparoscopy? US and China Perspective
X. Guan 8

The Changing Landscape of Single Site Surgery in GYN Oncology- South Korea Perspective
H. Moon 14

Single Port Robotics Gynecologic Surgery in China- a Competitive Marketplace to Safely Advance Technology
X. Xue 19

Cultural and Linguistic Competency & Implicit Bias 35

PG-26212: Globalization of Single Port Robotic Surgery in Gynecology- The Next Generation

Chair: Johnny Yi
Co-Chair: Xiaoming Guan
Faculty: Xiaoming Guan, Hye-Sung Moon, Xiang Xue, Johnny Yi

Course Description

This course focuses on the impact of single port robotics in gynecology. As the next generation of minimally invasive gynecologic surgery, single port robotics offers less incisions and advancements in technology that allow surgeons to perform complex GYN, Urogyn and GYN Onc procedures. Single site laparoscopic surgery has had variable adoption around the world due to its steep learning curve. However, single port robotics platforms surpass these limitations, allowing for complex procedures to be rapidly performed with these new platforms. This course aims to showcase evidence-based outcomes of single port robotic platforms, including US data and data from South Korea, Japan and China. Further, novel technologies and platforms beyond those available in the US will be discussed.

Learning Objectives: *At the end of this course, the participant will be able to:* 1) Identify the benefits and pitfalls of applying single port robotics surgery technology with a focus on Urogynecology; 2) Recognize the different platforms available globally, and familiarize themselves with the Chinese experience, both abdominally and vNOTES; and 3) Identify the impact that single port robotic surgery has had on the surgical landscape in South Korea, transitioning from single site laparoscopy to robotics.

Course Outline

10:30 am	Welcome, Introduction and Course Overview	J. Yi
10:35 am	Advantages and Pitfalls of Converting to Single Port Robotics in Urogynecology- US Perspective	J. Yi
11:00 am	Single Port Robotics vNOTES- Why Transition from Laparoscopy? US and China Perspective	X. Guan
11:25 am	The Changing Landscape of Single Site Surgery in GYN Oncology- South Korea Perspective	H. Moon
11:50 am	Single Port Robotics Gynecologic Surgery in China- a Competitive Marketplace to Safely Advance Technology	X. Xue
12:15 pm	Discussion Questions & Answers	All faculty
12:30 pm	Adjourn	

ADA Statement: In accordance with the Americans with Disabilities Act (ADA), please contact CMEsupport@aagl.org should you require any special assistance.

Disclosure of Relevant Financial Relationships

As an ACCME-accredited provider, AAGL is responsible for ensuring that accredited education is fair, balanced, free of commercial bias, and supports safe, effective patient care. AAGL maintains control over all aspects of educational planning, content, faculty selection, delivery, and evaluation.

All individuals in a position to control educational content are required to disclose financial relationships with ACCME-defined ineligible companies within the past 24 months. AAGL identifies and mitigates all relevant financial relationships before individuals assume their respective roles. Educational content is also subject to independent peer review by individuals without relevant financial relationships.

Disclosure information and acknowledgment of any commercial support are provided to learners before the activity to promote transparency and maintain the independence and integrity of the education.

Asterisk (*) denotes no financial relationships with ACCME-defined ineligible companies to disclose.

PLANNER DISCLOSURES

The following members of AAGL have been involved in the educational planning and/or review of this course (listed in alphabetical order by last name).

PROFESSIONAL EDUCATION COMMITTEE

Harold Wu, MD* - Chairman
Adrian Balica, MD*
Jamal Mourad, DO – Proctor: Intuitive Surgical
Jude Okohue, MD*
Steven Radtke, MD*
Anna Reinert, MD*
Jean Uy-Kroh, MD*
Linda Bradley, MD, AAGL Medical Director*
Linda Michels, AAGL Executive Director*
Linda Bell, AAGL Admin Support*
Nancy Williams, COO, CME Consultants*

SCIENTIFIC PROGRAM COMMITTEE

Nash Moawad, MD, MS, Chairman – Consultant (ended 12/2024): Medtronic, Womed, Integra Life Sciences
Amani Harris, MD*
Ted Lee, MD – Advisory/Consultant: Johnson & Johnson, Regeneron Pharmaceuticals
Nucelio Lemos, MD, PhD – Speakers Bureau: Pfizer, Inc., Medtronic; Advisory Board: Knight Therapeutics, Vecfer Pharma
Mario Malzoni, MD*
Emad Mikhail, MD – Consultant: Johnson & Johnson
Hannah Palin, MD*
Megan Wasson, DO*
Michael Hibner, MD, PhD*
Jose "Tony" Carugno, MD*
Angela Chaudhari, MD - Consultant: Tag/Dream Medical, Johnson & Johnson; Speakers Bureau: Johnson & Johnson
Linda D. Bradley, MD, Medical Director*
Linda Michels, Executive Director, AAGL*

COURSE CHAIR DISCLOSURE

Johnny Yi, MD*

COURSE CO-CHAIR DISCLOSURE

Xiaoming Guan, MD, PhD*

FACULTY DISCLOSURES

The following faculty have agreed to support their presentations and clinical recommendations with the best available evidence from the medical literature (in alphabetical order by last name).

Xiaoming Guan, MD, PhD*
Hye-Sung Moon, MD PhD*
Xiang Xue, MD, PhD*
Johnny Yi, MD*

MITIGATION OF RELEVANT FINANCIAL RELATIONSHIPS

All relevant financial relationships have been mitigated.

Drs. Lee, Lemos, Mikhail, and Chaudhari's planning decisions, as part of the Scientific Program Committee (SPC), were peer reviewed by other planners on the SPC who had disclosed no financial relationships with ineligible companies, and found to be fair, balanced, and free of commercial bias. Dr. Moawad's financial relationships ended 12/2024, thus mitigating them. For most of his AAGL Professional Education Committee service, Dr. Mourad had no financial relationships to disclose. He recently disclosed a new relationship as a Proctor for Intuitive Surgical. Since then, he has not participated in activities involving control or influence over accredited educational content; therefore, no additional mitigation was necessary.

Advantages and Pitfalls of Converting to Single Port Robotics in Urogynecology

Johnny Yi MD Mayo Clinic Arizona

NOVEMBER 13-16, 2026 · BOSTON · #AAGL26

1

Financial Relationship Disclosures

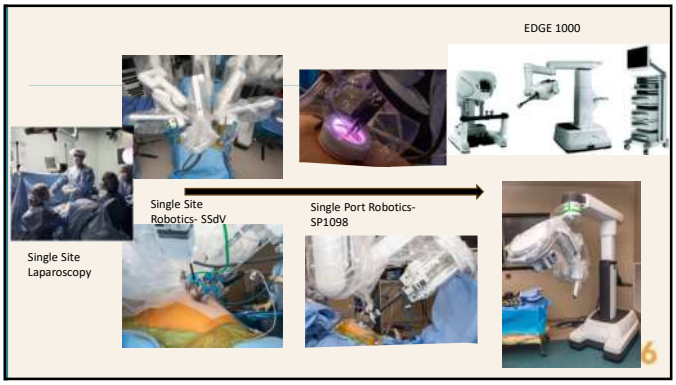
- I have no financial relationships to disclose
- Off label use of the single port robotic platform will be discussed. (off label for gyn surgery in the USA)

2

LEARNING OBJECTIVES

- Evaluate the current evidence of single port robotics in urogynecology/gynecology.
- Recognize the strengths and limitations that a new robotics platform offers.

3



4

Incision and Docking

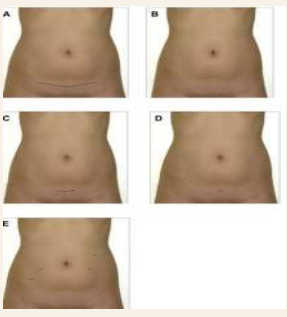
HOW-TO:
SINGLE-PORT (SP) ROBOTICS SETUP FOR GYNECOLOGY

ABENA BRUCE, MD
NATHAN PALLACE
JOHNNY YI, MD
MAYO CLINIC ARIZONA

Advantage #*- Faster incision and docking, can be performed by 1 surgeon.**

5



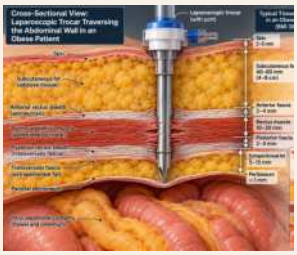


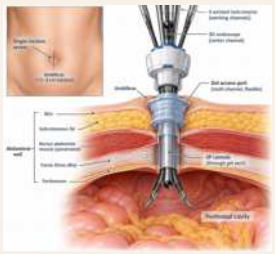
- Surgical scars can be different depending on the modality
- In MIS: cosmetic outcome is an important consideration

Goebel K, Goldberg JM. Women's preference of cosmetic results after gynecologic surgery. J Minim Invasive Gynecol. 2014;21(1):64-7.

6

Advantage #***- Less Abdominal Wall Trauma





Images created by ChatGPT

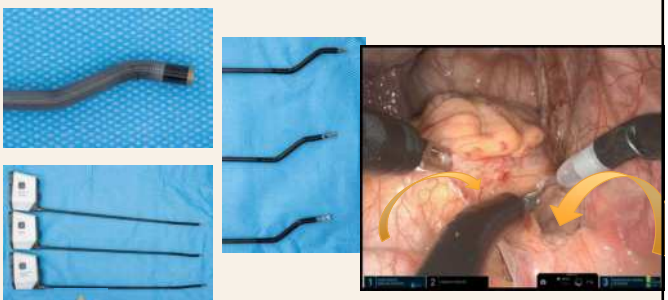
7

PSAS survey at 6 weeks

	Single port (N=7)	Multiport (N=46)
Has the scar been painful the past few weeks? Mean (SD)	6.0 (11.33)	24.2 (28.73)
Has the scar been itching the past few weeks? Mean (SD)	17.4 (32.27)	24.5 (27.19)
Is the scar color different from the color of your normal skin at present? Mean (SD)	30.0 (37.05)	72.0 (33.10)
Is the stiffness of the scar different from your normal skin at present? Mean (SD)	12.9 (21.82)	54.5 (33.86)
Is the thickness of the scar different than your normal skin at present? Mean (SD)	14.1 (21.13)	56.8 (32.89)
Is the scar more irregular than a normal scar at present? Mean (SD)	15.7 (23.54)	29.0 (30.24)
What is your overall opinion of the scar compared to the normal skin? Mean (SD)	11.9 (19.07)	54.4 (28.13)

Advantage #***- Smaller incisions, less bother, higher satisfaction

8



Advantage #***- Elbows allow for deeper, posterior pelvic surgery

9

Comparison of Perioperative and Postoperative Outcomes between Single-Port Robotic Sacrocolpopexy and Multi-Port Approaches

Table 2 Perioperative and postoperative outcome measures

From: Comparison of Perioperative and Postoperative Outcomes between Single-Port Robotic Sacrocolpopexy and Multi-Port Approaches

Advantage #***- Comparable outcomes to MP, shorter OR time, Hospitalization

10



Single Port Versus Multiport Robotic Hysterectomy With Sacrocolpopexy

Variable	Entire Cohort (N = 134)	SP (n = 66)	TNP (n = 68)	P
PACU MME	2 (0 to 39.2)	1 (0 to 10)	3.3 (0 to 39.2)	0.06
PACU pain score	3 (0 to 8)	2 (0 to 6)	4 (0 to 8)	<0.001
POD1 pain with rest	3 (0 to 7)	3 (0 to 7)	1 (0 to 1)	0.34
POD1 pain with activity	3 (0 to 10)	3 (0 to 10)	4 (3 to 5)	0.85

Possible Advantage #***- Less Pain with SP compared to MP for SCP with Hyst

11

MP vs SP Hyst >250gm

Variable	SP (n = 21)	MP (n = 37)	p value
Operative outcomes			
Operation time (min)	181.2 ± 43.9	173.7 ± 46.6	0.574
Estimated blood loss (cc)	50 (0-300)	50 (0-500)	0.446
Additional port placement – n (%)	3 (14.3%)	0 (0.0 %)	0.077
Specimen extraction, morcellation – n (%)	15 (71.4 %)	7 (25.9 %)	0.003
Concurrent myomectomy – n (%)	18 (85.7 %)	23 (85.2 %)	1.000
Blood transfusion – n (%)	1 (4.8 %)	0 (0.0 %)	0.438
Intraoperative safety			
Intraoperative complication – n (%)	0 (0.0 %)	0 (0.0 %)	–
Organ injury – n (%)	0 (0.0 %)	1 (3.7 %)	1.000
Conversion to laparotomy – n (%)	0 (0.0 %)	0 (0.0 %)	–
Postoperative outcomes			
PACU maximum pain score	5.7 ± 2.3	5.2 ± 2.9	0.534
Postoperative complication, 30 d – n (%)	2 (9.5 %)	3 (11.1 %)	1.000
ED visit, 30 d – n (%)	0 (0.0 %)	2 (7.4 %)	0.497
Readmission, 30 d – n (%)	1 (4.8 %)	0 (0.0 %)	0.438
Reoperation, 30 d – n (%)	0 (0.0 %)	0 (0.0 %)	–
Same-day discharge – n (%)	19 (90.5 %)	24 (88.9 %)	1.000
Length of stay (days)	0 (0-2)	0 (0-1)	0.922

Uterine weight (g)	SP / MP, n	SP time, median (range)	MP time, median (range)	p value
250–499	10 / 13	165.5 (100–197)	164.0 (105–296)	0.927
500–699	4 / 5	180.0 (127–239)	135.0 (132–160)	0.413
700–999	3 / 5	224.0 (218–231)	203.0 (130–219)	0.071
≥1000	4 / 4	203.5 (163–258)	211.5 (201–257)	0.886

Possible Advantage #***- Comparable outcomes for complex hysterectomy

12

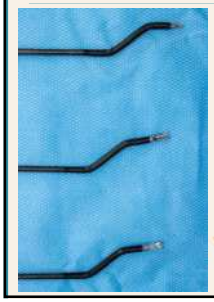
Cost $$$$

- Novel robotic platforms continue to increase in cost for implementation and use.
- Cost per platform estimated- XI $1.8-2M, DV5 $2-2.5M, SP $2M
- Huge investment and hospitals must make use of the platforms if purchasing

Limitation #1- Significant cost and new platform needed to incorporate SP into practice

13

Instrumentation



- No currently available Advanced Vessel Sealing device.
- No suture cut needle driver
- Stapler launched 2026.
- Docking globe limits laparoscopy and assisting.
- Grip strength inferior to XI and DV5 instruments
  - Force Bipolar grasper launched 2026.
- Limited range of motion
  - Extended reach instruments launched 2026.

Limitation #2- Instrumentation limited inherently due to single port access and unique articulation.

14

Instrumentation



- Single assistant access through umbilicus is limiting.
- Articulating lap instruments and suction devices augment assisting through single port.
- Flexible laparoscopic suction devices now commercially available.

15

Hernia Risk

Table 2 Intraoperative and postoperative complications and perioperative outcomes (*N* = 200)

From: Intraoperative Complications and Perioperative and Surgical Outcomes of Single-Port Robotics-Assisted Sacrocolpopexy

- 4 hernias identified in 200 cases of SP SCP; Shin et al
  - Prolapse patients may have higher risk of hernia due to connective tissue weakness
- Mayo Clinic Arizona experience- 4 hernias in 250 cases (not published)
- 1.4% hernia rate Ashmore et al; n=69

- **Close with delayed absorbable suture, consider permanent suture if pre-existing hernia**

Limitation #3- Potential incrased hernia rate



16

Conclusions

- Single port robotic sacrocolpopexy may offer benefits to the robotic surgeon with less pain, shorter operative time and hospitalization.
- Learning curve of a new device and cost may hinder the universal adoption of this platform for urogynecologic and reconstructive surgery.

17

References

- Ashmore, S., Kenton, K., Collins, S., Geynisman-Tan, J., Lewicky-Gaupp, C., & Mueller, M. G. (2024). Short-term outcomes of single port robotic hysterectomy with concomitant sacrocolpopexy. *J Robot Surg*, *18*(1), 260. https://doi.org/10.1007/s11701-024-02029-y
- Lee, S. R., Roh, A. M., Jeong, K., Kim, S. H., Chae, H. D., & Moon, H. S. (2021). First report comparing the two types of single-incision robotic sacrocolpopexy: Single site using the da Vinci Xi or Si system and single port using the da Vinci SP system. *Taiwan J Obstet Gynecol*, *60*(1), 60-65. https://doi.org/10.1016/j.tjog.2020.10.007
- Oh, S., Yi, J., Song, A. Y., Jee, J., Bae, N., & Shin, J. H. (2024). Intraoperative Complications and Perioperative and Surgical Outcomes of Single-Port Robotics-Assisted Sacrocolpopexy. *Int Urogynecol J*, *35*(7), 1521-1526. https://doi.org/10.1007/s00192-024-05796-2
- Shin, H. J., Yoo, H. K., Lee, J. H., Lee, S. R., Jeong, K., & Moon, H. S. (2020). Robotic single-port surgery using the da Vinci SP® surgical system for benign gynecologic disease: A preliminary report. *Taiwan J Obstet Gynecol*, *59*(2), 243-247. https://doi.org/10.1016/j.tjog.2020.01.012
- Nicole Whitmyre, Lauren Griebel, Skye Buckner-Petty, Kenneth H. Kim, Johnny Yi. (2023). Outcomes of single port robotic sacrocolpopexy compared with multi-port approaches, Intelligent Surgery, Volume 6, 2023, 21-24.
- Ashmore S, Sarkar P, Kenton K, Collins SA, Lewicky-Gaupp C, Mueller MG. Single Port Versus Multiport Robotic Hysterectomy With Sacrocolpopexy. Urogynecology (Phila). 2025 Sep 3. doi: 10.1097/SPV.0000000000001749. Epub ahead of print. PMID: 42149640.

18

Single-Port Robotic vNOTES

Why Transition from Laparoscopy? — US and China

Xiaoming Guan, MD, PhD
Baylor College of Medicine, Houston, Texas

Core thesis: preserve the vaginal natural-orifice advantage while restoring triangulation, dexterity, visualization, and surgeon ergonomics.

Evidence base: 2024–2026 RSP-vNOTES series, comparative cohorts, learning-curve data, technical reports, and China SP robotic experience

NOVEMBER 13–16, 2026 • BOSTON • #AAGL26

1

Disclosure

I have no financial relationships to disclose.

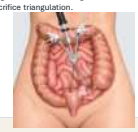
2

Why transition at all?

The question is not "robot versus laparoscopy" in isolation — it is which platform best supports a natural-orifice surgical strategy.

Laparoscopy

Excellent visualization and familiar anatomy, but abdominal trocar trauma remains and single-site/vNOTES straight instruments sacrifice triangulation.



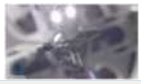
Laparoscopic vNOTES

Scarless abdominal access and favorable recovery; technical constraints include parallel instruments, collision, suturing difficulty, and demanding sidewall dissection.



Robotic SP vNOTES

A purpose-built single-port architecture: articulating camera + multiple articulating instruments through one cannula, aiming to restore intracorporeal triangulation and dexterity.



Transition = access innovation + platform innovation

3

Three technologies converged

Vaginal surgery, laparoscopy/NOTES, and robotics evolved separately — RSP-vNOTES is their convergence.

Vaginal route

Natural-orifice access; no abdominal incision



Endoscopic vision

Magnified view beyond direct vaginal line-of-sight



Robotic articulation

Wristed/curved instruments, tremor filtration, stable 3D view



RSP-vNOTES

4

What laparoscopy solved — and what it did not

Laparoscopy transformed gynecology, but trocar-based access and straight-tool geometry still define the operation.

- Reliable panoramic abdominal access and mature instrumentation
- Excellent for multi-quadrant surgery and complex pathology
- But **every abdominal port is still an abdominal wall incision**
- Single-incision laparoscopy reduces ports at the cost of triangulation and instrument crowding
- The vaginal route can eliminate visible abdominal incisions in selected patients

The transition target

Not "more technology." The target is to retain minimally invasive **outcomes while reducing access trauma and improving the surgeon's ability to perform complex dissection** through one natural-orifice port.

5

Why laparoscopic vNOTES is attractive

Evidence supporting vNOTES created the foundation for the robotic transition.

No visible abdominal scars

Reported advantages of the transvaginal natural-orifice route compared with transumbilical approaches in selected patients.

Reduced postoperative pain

Reported advantages of the transvaginal natural-orifice route compared with transumbilical approaches in selected patients.

Faster recovery / short stay

Reported advantages of the transvaginal natural-orifice route compared with transumbilical approaches in selected patients.

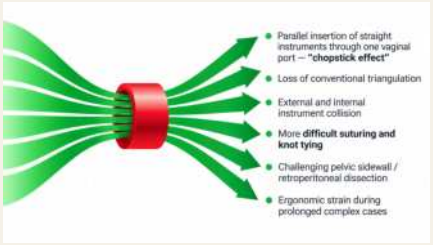
Avoidance of trocar-site hernia and wound infection

Reported advantages of the transvaginal natural-orifice route compared with transumbilical approaches in selected patients.

6

The laparoscopic vNOTES bottleneck

The access is elegant; the instrument geometry can be unforgiving.



Clinical consequence

The very cases that may benefit from a scarless route — deep endometriosis, adhesions, sacrocolpopexy, complex suturing — are also the cases most constrained by straight single-port instrumentation.

7

Video-Laparoscopic vNOTES: instrument crowding / suturing



8

Why robotics changes the equation

Robotics addresses the technical limitations of the single-port route rather than changing the route itself.

Visualization

Stable magnified 3D view; articulating camera on SP expands viewing angles.

Dexterity

Articulating instruments recreate intracorporeal triangulation from a single cannula.

Control

Tremor filtration, motion scaling, surgeon-controlled camera and multiple instruments.

Ergonomics

Console-based posture may reduce the physical burden of complex vaginal single-port surgery.

Complexity

Improved suturing and dissection may expand indications beyond straightforward hysterectomy.

9

Why a purpose-built single-port robot?

Multi-port robots can be adapted to vNOTES, but SP architecture better matches a single natural-orifice access point.

Feature	RMP/Xi vNOTES	RSP vNOTES
Robot entry	Multiple arms through vaginal port	Single cannula / one arm
Instrument geometry	Parallel entry; collision management	Curved/articulating instruments deploy internally
Camera	Rigid/standard robotic endoscope	Articulating SP endoscope
Instruments available	Typically 2 working instruments	Up to 3 articulating instruments
Workflow	Adapted multi-port platform	Designed for single-port surgery

10

US milestone: first da Vinci SP transvaginal hysterectomy

Baylor College of Medicine reported the inaugural RSP-vNOTES hysterectomy on November 11, 2023.

Technical milestone

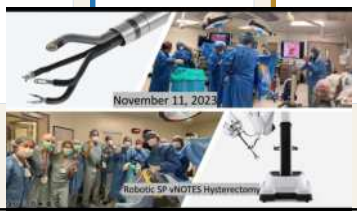
The SP platform delivered an articulating camera and three articulating instruments through one vaginal access port. The report standardized the procedure into ten steps.

Patient course

Same-day discharge; unremarkable postoperative course in the pioneering case.

Why it mattered

Demonstrated that a robot engineered for single-port surgery could be redirected from transumbilical use to a natural-orifice gynecologic approach.



11

Early US feasibility: 28-case RSP-vNOTES series

The initial clinical series moved beyond proof-of-concept into complex endometriosis practice.

Patients	28
Additional endometriosis resection	23 (82.1%)
Stage IV endometriosis	6 (21.4%)
Mean total OR time	188.7 min
Mean EBL	32.1 mL
Mini-laparotomy for specimen extraction	1 (1668-g uterus)

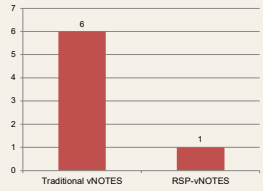
Interpretation

RSP-vNOTES was feasible across all stages of endometriosis in this early series. The extraction conversion was driven by uterine size/shape rather than failure of the vaginal robotic dissection.

12

Comparative evidence: RSP-vNOTES vs traditional laparoscopic vNOTES

135 hysterectomies: 79 traditional vNOTES vs 56 RSP-vNOTES.



Adjusted outcomes

After adjustment, no significant differences in hysterectomy time, total operative time, EBL, or postoperative pain. RSP-vNOTES patients more often underwent endometriosis-related concomitant procedures. Conversion difference (6 vs 1) did not reach statistical significance.

Signal: comparable perioperative performance despite greater procedural complexity in the RSP cohort.

11

13

Comparative evidence: RSP vs robotic multi-port vNOTES

383 patients: 291 RMP-vNOTES vs 92 RSP-vNOTES.

Perioperative outcomes

After adjustment: no significant differences in total operative time, port placement, hysterectomy time, EBL, conversion, pain, or complications.

Case complexity

RSP group had more endometriosis-related procedures including adhesiolysis, cystectomy, appendectomy, bowel shaving and oversewing.

Conversions

3/383 (0.8%) converted to abdominal robotics; all were associated with complex endometriosis.

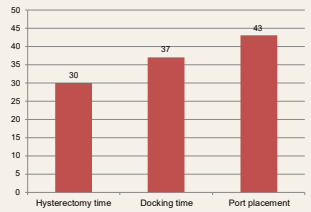
RSP did not simply reproduce RMP results — it supported a more single-port-native workflow.

12

14

Learning curve: transition is teachable

97 consecutive da Vinci SP vNOTES hysterectomies, December 2023–July 2025.



Key message

CUSUM analysis suggested hysterectomy performance stabilized around 30 cases, with docking and port-placement workflow stabilizing later. Prior experience in robotics, single-site surgery, and vNOTES likely matters.

13

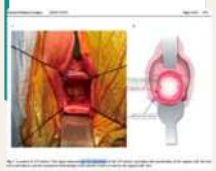
15

Port stability is not a minor detail

A single-port operation depends on one stable interface between the robot and patient.

4-P anchoring

122 RA-vNOTES hysterectomies using a four-point anchoring technique; median port placement time 5 min.



Observed problem

Only one gas-leak case; selected patients with prolapse or enlarged genital hiatus required additional perineal/labial suturing.



Transition lesson

Successful adoption requires standardizing access, anchoring, insufflation, assistant workflow, docking and conversion — not just console skills.

14

16

Video-4-P port anchoring and stable insufflation



17

Video-SP docking + articulating camera deployment



18

Where RSP-vNOTES may add the most value

The strongest rationale is not routine hysterectomy alone — it is extending the vaginal route into technically demanding surgery.

Deep / stage IV endometriosis

Published feasibility exists; evidence strength varies by indication.

Obliterated cul-de-sac / adhesions

Published feasibility exists; evidence strength varies by indication.

Pelvic sidewall dissection

Published feasibility exists; evidence strength varies by indication.

Bowel shaving / oversewing

Published feasibility exists; evidence strength varies by indication.

Sacrocolpopexy and complex suturing

Published feasibility exists; evidence strength varies by indication.

Selected oncologic staging procedures

Published feasibility exists; evidence strength varies by indication.

Lovell et al., 2024 review; Guan et al., JMIG 2024; Zhang et al., J Obstet Gynaecol 2025; Zhang et al., GMIT 2026

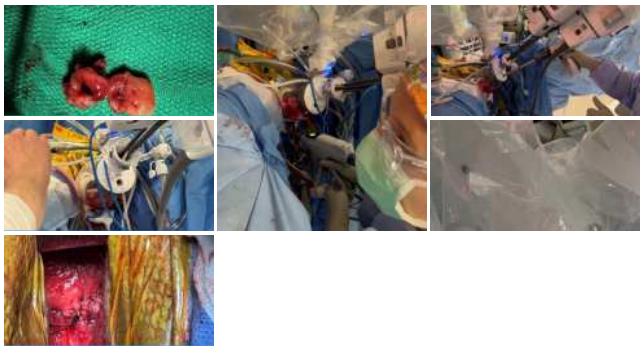
15

19

Video-Stage IV endometriosis / pelvic sidewall dissection



20



21

Endometriosis: a compelling transition use case

Complex endometriosis requires precise dissection, traction/countertraction, suturing, and access to multiple pelvic planes.

- RSP comparative cohorts contained more endometriosis-related concomitant procedures
- Stage IV disease and obliterated cul-de-sac have been treated through robotic vNOTES pathways
- Articulating instruments may improve pelvic sidewall and retroperitoneal reach
- A transvaginal platform can be combined with transumbilical access when disease extends beyond the vaginal working envelope

Important boundary

RSP-vNOTES is an access strategy, not a dogma. Diaphragmatic, upper-abdominal, very large specimen, or unsafe exposure may require a complementary abdominal route or conversion.

Guan et al., JMIG 2024; Yang et al., Cureus 2024; Guan et al., IJGO 2025.

16

22

Beyond the pelvis: hybrid thinking

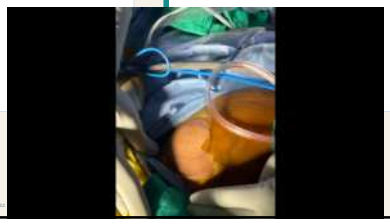
A single-port vaginal route can be part of a multi-field strategy.

Abdominal wall endometriosis

A 2025 two-case report described robotic resection using transumbilical single-site and SP-vNOTES strategies, including reorientation of the SP system to the anterior abdominal wall.

Practical implication

The transition from laparoscopy is not necessarily "all vaginal." The SP platform may enable flexible access planning based on disease location while minimizing the number of abdominal incisions.



Guan X et al. Int J Gynaecol Obstet. 2025. doi:10.1002/ijgo.70063

17

23

Oncology: feasibility, not yet equivalence

RSP-vNOTES is beginning to reach procedures beyond benign hysterectomy.

Granulosa cell tumor staging case

RSP-vNOTES hysterectomy, salpingo-oophorectomy and omentectomy; 130 min, EBL 50 mL, no perioperative complications in the reported case.

Potential

Reduced abdominal trauma and excellent visualization for selected staging steps.

Caution

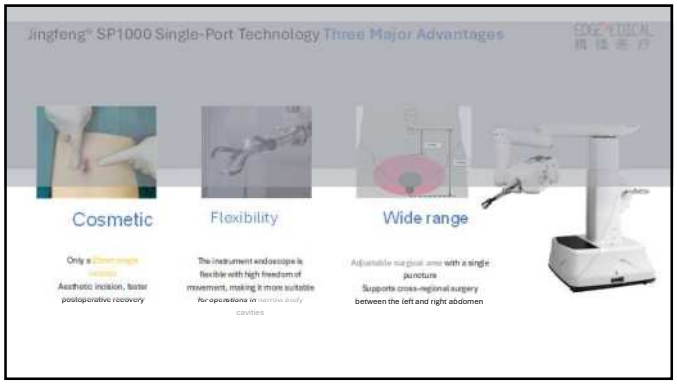
Single case evidence cannot establish oncologic equivalence, long-term recurrence outcomes, or broad indications.



Zhang C et al. J Obstet Gynaecol. 2025;45:2504279.

18

24



25



- Chinese Jingfen RSP vNOTES omenectomy

26

China: why the transition is strategically important

China is developing domestic single-port robotic platforms rather than relying on one imported architecture.

Chinese SP platforms

Published literature identifies Chinese single-port systems including SHURUI and EDGE SP1000, with early vNOTES experience in hysterectomy, cystectomy and prolapse surgery.

Clinical opportunity

High surgical volume + established laparoscopy + expanding robotics create a pathway to evaluate natural-orifice SP surgery at scale.

Research opportunity

Different robot architectures allow head-to-head study of access geometry, snake-arm behavior, ergonomics, cost, learning curves and indication expansion.

Yang et al., Cureus 2026; Zhang & Guan, Current updates on vNOTES Gynecology.

19 IRCAD26

27

China example: SHURUI snake-arm transvaginal sacrocolpopexy

A 2026 video article demonstrates how platform design can shape the vaginal operation.

Design feature

Semi-rigid snake-arm instrument enabled arcuate tunneling that conformed to pelvic anatomy.

Procedure

Stage IV prolapse: hysterectomy + BSO + transvaginal sacrocolpopexy + perineal reconstruction.

Reported outcome

Total operative time 150 min; technical report emphasized presacral visualization and instrumental range.

Zhang C, Huang Q, Basinda MS, Guan X. Gynecol Minim Invasive Ther. 2026;15:292-293.

20 IRCAD26

28

Shurui Single-Port Robot: Nickel-Titanium Alloy Material and Dual Continuum Mechanism

Advantages

Twenty nickel-titanium alloy thin rods are arranged circumferentially to work in coordination, enhancing the jaw's load-bearing capacity to at least 10N.





29

Video-China SHURUI sacrocolpopexy / snake-arm tunneling



Yang et al., Front Med 2025; Yang et al., J Robot Surg 2025; Lovett et al., 2026 review.

30

US vs China: two innovation pathways

The clinical goal is similar; the technology ecosystem is different.

Dimension	United States	China
Current literature	da Vinci Xi adaptation → da Vinci SP RSP-vNOTES	Domestic SP platforms + rapidly emerging case reports/series
Strength	Longitudinal single-center experience; comparative cohorts; learning-curve data	Platform diversity; engineering iteration; high-volume expansion potential
Representative platform	da Vinci SP	SHURUI snake-arm; EDGE SP1000 reported
Evidence need	Multicenter external validation, cost-effectiveness, comparative trials	Standardized outcomes, larger prospective cohorts, platform-specific learning curves
Shared priority	Patient selection, safe access, conversion strategy, training	Patient selection, safe access, conversion strategy, training

Synthesis of uploaded 2024-2026 literature.

21

31

What the literature does NOT yet prove

The transition should be evidence-led, not technology-led.

- No large randomized trial proving RSP-vNOTES superiority over conventional laparoscopy
- Most RSP-vNOTES evidence is retrospective and often single-surgeon / single-center
- Selection bias is substantial: uterine size, BMI, parity and case complexity differ between groups
- Cost-effectiveness and resource utilization remain incompletely characterized
- Long-term pelvic floor, sexual function, recurrence and oncologic outcomes need further study
- Results from expert innovators may not generalize directly to new programs

Yang et al., Front Med 2025; Yang et al., Obstet Surg 2020; Lovell et al., 2026 review.

22

32

A rational transition pathway

Adoption should progress from access mastery to complexity — with explicit conversion thresholds.



1. Vaginal surgery fundamentals
2. Laparoscopic vNOTES / single-site skills
3. Robotic vNOTES on familiar platform
4. RSP port + docking standardization
5. Routine RSP hysterectomy
6. Endometriosis / suturing / sidewall cases
7. Advanced hybrid, prolapse, selected oncology

Training principle: competence in vaginal access and complication management must precede expansion of indications.

Yang et al., Cureus 2026; Guan et al., J Robot Surg 2025 (4-P anchoring).

23

33

Take-home: why transition from laparoscopy?

A balanced literature-based conclusion

1. Preserve the route

vNOTES reduces abdominal access trauma and preserves the least-invasive vaginal route in appropriate patients.

2. Upgrade the mechanics

Single-port robotics restores articulation, triangulation, visualization and ergonomics that straight laparoscopic vNOTES instruments lack.

3. Expand — carefully

US data support feasibility, comparative safety and a measurable learning curve; China adds new SP architectures. But superiority over laparoscopy remains unproven and requires multicenter prospective study.

The best transition is selective: use the platform when it meaningfully improves access, precision, or procedural complexity — not simply because it is newer.

Literature synthesis: uploaded publications, 2022-2026.

25

34

References

1. Lovell DY, Yang Q, Guan X. A Review of Robotic vNOTES Surgery. J Sichuan Univ Med Sci. 2026.
2. Guan X, Lovell D, Sendukas E. Intelligent Surgery. 2024;7:1–6.
3. Guan X, Yang Q, Lovell DY. J Minim Invasive Gynecol. 2024. doi: 10.1016/j.jmig.2024.08.018.
4. Yang Q et al. Front Med. 2025;12:1614384.
5. Yang Q, Kohn J, Guan X. J Robot Surg. 2025;19:410.
6. Yang Q, Lovell DY, Guan X. Cureus. 2026;18:e102729.
7. Guan X et al. J Robot Surg. 2025;19:473.
8. Guan X et al. Int J Gynaecol Obstet. 2025. doi:10.1002/ijgo.70582.
9. Zhang C et al. J Obstet Gynaecol. 2025;45:2556279.
10. Zhang C, Huang Q, Basinda MS, Guan X. Gynecol Minim Invasive Ther. 2026;15:292–293.
11. Zhang & Guan. Current updates on vNOTES Gynecology. Cited in the source presentation.
12. Zhang et al. GMIT. 2026. Cited in the source presentation.

26

35

The Changing landscape of single-site surgery in GYN Oncology –South Korea Perspectives

My Journey from Multiport to Single-Port Robotic Surgery

Hye-Sung Moon, MD, PhD
Director of Robotic Surgery Center
Division of Gynecologic Oncology · Ewha Womans University Seoul Hospital

NOVEMBER 13-16, 2026 · BOSTON · #AAGL26

1

Disclosure

"I have no financial relationships to disclose."

2

Objectives

- Why SP robotic surgery in Gynecologic cancer field in Korea

3

My Starting Point

- I was happy with Xi but, I prefer to do single-site robotic surgery.
- It was inconvenient with S-S platform of Xi/Si even though I had done almost 400 cases.

Exposure	Triangulation	Workflow	Versatility
Reliable	Familiar	Efficient	Proven

"Why do I need another robotic platform?"

4

My First Impression of SP

- Interesting technology, more excited … but, is it convenient?

- Limited triangulation?
- Instrument collision?
- Instrument power?
- Clinical utility (obese patient, Large uterus)
- Cancer surgery?

"Maybe good for simple cases."

5

Stage 1 — "Let's try an easy case."

My first SP hysterectomy was done in late 2018.

▶ **INSERT: First SP hysterectomy video (20 sec)**

- Different camera
- Different approach
- Different geometry
- Constant Xi comparison

6

The Turning Point

Don't fight the platform. Use its architecture.

Xi

- External triangulation
- Independent arms
- Familiar geometry

SP

- Single entry
- Internal triangulation
- Flexible camera + elbowed instruments

Different ≠ Inferior

7

The Camera Became an Instrument

The flexible camera changed my concept of exposure

▶ INSERT: Camera relocation video

Look around

Look behind

Look beyond

8

Stage 2 — "Maybe SP can do more."

Expanding indications

Hysterectomy → Myomectomy → Adnexal surgery → Large uterus → Oncology

▶ INSERT: SP myomectomy / traction clip

9

Complex Surgery Changed My Mind

Difficulty became the teacher

▶ Large myoma clip

▶ Deep pelvis clip

▶ Adhesion clip

Simple cases taught me the controls. Complex cases taught me SP surgery.

10

First report of SP gynecologic surgery in Korea

- **I published the article that thirty one-SP surgery was done in benign gynecologic disease in my Hospital (Taiwan J Obstet Gynecol, 2020).**

11

But I am a gynecologic oncologist.

Could I trust SP for cancer surgery?

This was the real question.

12

My First Oncology Step

For endometrial cancer

ICG → SLN mapping → SLN dissection → Hysterectomy

▶ INSERT: ICG sentinel lymph node mapping/dissection

Feasibility is encouraging; long-term oncologic evidence remains important.

13

What I Learned from SLN Surgery

- Exposure is not about the number of ports.

Camera relocation
Change the viewpoint

Instrument reassignment
Use the right arm for the task

Dynamic traction
Create—not inherit—the field

Create the surgical field you need.

14

Stage 3 — From Selected Cases to Routine Consideration

Simple → Challenging → Oncology → Routine consideration

Not “Can SP do it?”

“Is SP appropriate for this patient?”

15

SP Is Not Always the Answer

I still use Xi.

SP — often attractive
- Selected hysterectomy
- Endometrial cancer
- SLN mapping
- Selected large uterus
- Deep pelvic surgery

Xi / Multiport — often preferable
- Extensive multi-quadrant access
- Complex upper abdomen
- Multiple independent traction points

16

First report of SP gynecologic cancer surgery in Korea

- **In retrospective study, there were done SP endometrial cancer surgical staging (n=14), SP radical hysterectomy (n=3), and SP radical trachelectomy (Yonsei Med J. 2022).**

17

Our SP gynecologic cancer surgery in Ewha Hospital

Year \ Case	Endometrial cancer	Ovarian cancer	Cervical cancer	Total SP in GY cancer	Total SP in Benign GY disease
2019	1	0	0	1	174
2020	1	0	0	1	463
2021	5	0	0	5	505
2022	6	0	0	6	505
2023	23	0	0	23	352
2024	16	6	6	28	525
2025	29	6	2	37	607

18

Why SP is good for gynecologic cancer

- Lesser docking time
- Lesser learning curve
- Cobra action is very good to see the hidden space
- Easy switched image without position change
- More free space to do other procedures during the SP surgery
- Reduced port-related complication

But, the SP data analysis of oncologic outcome must be done to expand the SP cancer surgery in the future.

19

My Mindset Evolution

1	2	3	4	5
Skepticism	**Curiosity**	**Adaptation**	**Confidence**	**Selection**
Why do I need SP?	Maybe for simple cases.	SP is different.	I can use it for oncology.	Which platform is best?

The endpoint was not SP adoption. It was better platform selection.

20

SP Changed More Than My Incision

How I position the camera

How I create traction

How I think about triangulation

How I select patients

How I think about robotic surgery

21

SP Adoption Has Expanded Rapidly in Korea



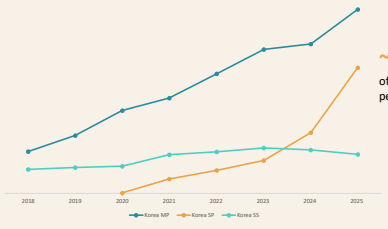
46%

of global SP procedures were performed in Korea

Source: Intuitive internal data. Korea metrics reflect 2024 year-end data; global share reflects Q4 2024.

22

SP Became a Major Platform in Korean Gynecologic Robotic Surgery



~36%

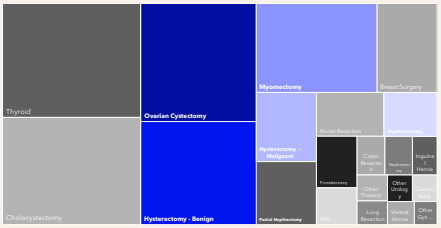
of Korea GYN robotic procedures were performed with SP in 2025

SP utilization expanded rapidly in Korean gynecology, while multi-port procedure volume also continued to grow.

23

Gynecology Was a Major Driver of Korea's SP Growth

- SP Procedure Growth Contribution



~43%

Major gynecologic procedures accounted for ~43% of Korea's SP procedure growth.

Source: Intuitive internal data. Procedure growth contribution reflects 2024 data; ~43% calculated from major GYN procedures shown.

24

Why Did SP Adoption Accelerate in Korea?

01	02	03	04	05
Established Single-Port Culture	**Patient Preference for Fewer Incisions**	**Technology Enabled Reproducibility**	**Expansion Across Procedures**	**Strong Surgeon-Led Adoption**
Strong foundation in single-incision surgery before robotic SP adoption	Demand for less-incisional surgical approaches	Articulation and flexible visualization improved triangulation, suturing, and ergonomics	Experience expanded from selected procedures to broader clinical applications	Early adopters refined techniques and accelerated peer-to-peer learning

SP adoption accelerated through the convergence of technology, clinical context, and surgeon-led learning.

25

What Comes Next?

The next generation is not about fewer ports.

Better platform selection	Better patient selection	Better surgical strategy
Choose deliberately	Match anatomy and procedure	Use each platform's strengths

Right platform · Right operation · Right patient

In oncology, enthusiasm for technology must remain balanced by evidence.

26

My changing perspective(1)

BEFORE

"Can SP do this operation?"

↓

NOW

"Which platform is better for this patient?"

27

My changing perspective(2)

Although SP surgery requires somewhat different surgical skills, the biggest change is not my surgical techniques

but, in my mindset.

Thank you

28

Acknowledgments

- I would like to acknowledge my co-author Ha Kyun Chang MD, phD and So Yun Park MD, phD (Dept of OB & GY, Ewha Womans University College of Medicine, South Korea) to their valuable contribution to this work.

29

References

- Robotic single-port surgery using the da Vinci SP® surgical system for benign gynecologic disease: A preliminary report. HJ Shin et al, Taiwan J Obstet Gynecol, 2020
- Da Vinci SP Single-Port Robotic Surgery in Gynecologic Tumors: Single Surgeon's Initial Experience with 100 Cases. YH Kwak et al, Yonsei Medical J, 2022

30

Single Port Robotics Gynecologic Surgery in China - A Competitive Marketplace to Safely Advance Technology

The Second Affiliated Hospital
of Xian Jiao Tong University, Xi'an, China
Xiang Xue MD PhD

NOVEMBER 13-16, 2026 · BOSTON · #AAGL26

1

Disclosure

- I have no financial relationships to disclose

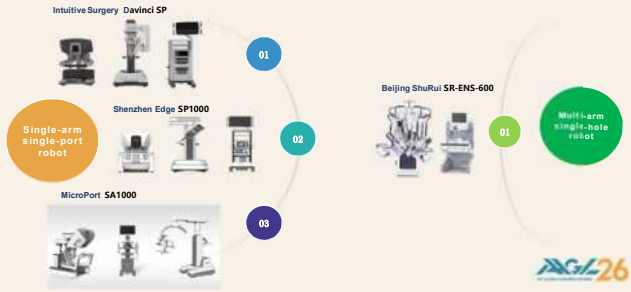
2

Objectives

- Describes the preliminary experience of the clinical application research of EDGE SP1000 and ShuRui flexible SP robot, the characteristics and advantages of the system.
- To demonstrate the limitations and solutions of the flexible SP robotic surgical system by surgical demonstration
- Describes the development prospects of SP1000 and Shurui flexible SP robot surgery system

3

The market situation of single-port robots



4

2023.11.24, Approved Gynecology


国家药品监督管理局
National Medical Products Administration
腹腔内窥镜单孔手术系统获批上市

5

EDGE Medical Surgical Robot: Flexible Single-port Robot SP1000

Chinese Single-port Robot: Smaller size, minimal surgery injury



Surgeon Console
High Definition 3D
Immersive Surgical Experience

Surgical Platform
Flexible instruments
Suspended single-arm structure

Imaging System
Flexible laparoscopy
Low image latency

6

Surgical Robot: Flexible Single-port Robot SP1000



Artistic
- Single incision of 25mm
- Faster postoperative recovery

Articulating
- Flexible instruments & scope
- better for narrow spaces

Advanced
- 4 in 1 trocar, quick docking
- Reduced surgical time

7

Edge single-port robot: Approved in multiple departments

SP1000 (2023年11月)

GYN

- Highly integrated, small in size, agile and convenient
- Single-incision, reducing the patient's surface trauma
- Multi-axis coordinated flexible instruments and endoscopes, with high flexibility



SP1000 (2024年9月)

Gyn, Uro, Gen Surgery

- A larger surgical area: Two directions - handling distant and nearby lesions; Four quadrants - covering top, bottom, left and right
- More powerful surgical instruments: SuperArm series of instruments; Designed specifically for narrow cavities



SP1000 (2026年3月)

Entire depart: Uro/ Gyn / Tho / Gen

- application throughout the entire: The entire department - exploration of cutting-edge disciplines; Innovative approaches, diverse options



8

SP1000: Expansion of more clinical departments

2023.11 SP1000 completed gynaecological registration

Success Rate 100% The entire procedure was using a robot No adverse events related to devices	**Complication Rate** 0% (Intraoperative) Within 1 week after surgery-5.17%; Within 1 month after surgery-3.51%	**Margin Positivity** 0% No residual lesions in any of the 13 cases of malignant tumours
Postoperative Pain Score 3.07±1.69 Using a visual analogue scale (VAS) Score 0 to 10 (maximum pain)	**Scar Satisfaction** 2.21±1.89 Subjective rating of surgical scar status Score 0 (good) to 9 (poor)	**Intraoperative Bleeding** 43.19±52.71 ml Total bleeding to the end of incision closure

9

SP1000: Surgical Area Expansion

1. Relocation function

Adjustable operation area (e.g. the left-upper to the right-upper abdomen)



2. Micromotion function

Ability to deal with tumours near the chest or abdominal wall



3. CRC fuction

Customised remote centres to ensure patient safety when expanding the surgical area





10

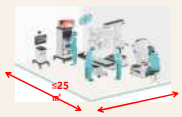
Single-arm integration: More flexible, lighter, and more convenient

Integrated design, no collision risk



Integrated box-type structure
- Simplification of aseptic management
- Zero collision incidents
- Optimize the surgical procedure

Compact, with low space requirements for the operating room



Compact in the shape of a refrigerator
- The volume of the patient platform is ≤ 2m³
- Installed in small and medium-sized operating rooms (25 square meters),
- Traditional multi-arm robots require a large operating room (≥40㎡)

Lightweight, easy to push



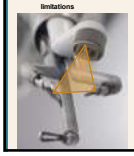
Lightweight ergonomic design
- The Platform weighs only 783kg
- Pushed by one hand, the required pushing force ≤50N
- The overall surgical efficiency has significantly improved.

11

SP1000 Three core technologies -- to explore a larger surgical area

The technical bottleneck of single-port: the limitation of surgical range

- Lateral limitations: The "operating triangle" formed by instruments and endoscopes has limited area, making it difficult to cover a large area of the surgical field.
- Vertical Restrictions: Serpentine arm configuration, joint restrictions on exercise equipment, and the presence of ineffective distances.
- Horizontal area and vertical depth restrictions, overall surgical scope limitations





Agile Arm Technology - Expanding Surgical Range Laterally

The surgeon can independently control the movement of the arm to make horizontal adjustments to the surgical area.



Concealed sleeve technique -- to improve the longitudinal range of surgery

The support device was semi-hidden in the cannula, and the operation depth was extended from 12cm-24cm to 7-27cm



Zero pressure anchor technology - extreme extension of longitudinal range

Supports cannula retraction or advancement, and always maintains zero pressure on the patient's incision. Operating depth limit is extended to 0cm-34cm.



12

Relocation function-- Adjustment of surgical area





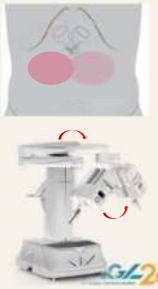
13

SP1000 Core Technology No. 1: Smart Arm Technology (Relocation function)

Smart Arm Technology

- Some procedures require more extensive lateral processing area, such as radical gastrectomy involving the left and right upper abdomen
- The smart arm technology supports the surgeon to adjust the horizontal area independently, and expand the surgical range laterally without the assistance of an assistant





14



Relocation 1



Relocation Function 2

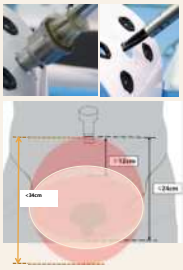


Cobra mobile camera1+Relocation

15

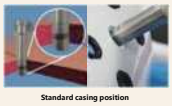
CRC fuction -- Maximum depth range



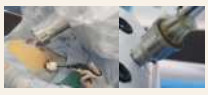


16

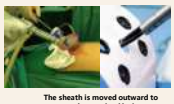
SP1000 Core Technology No. 2: Zero-Pressure Anchor Technology



Standard casing position



The cannula was pushed inside to treat the deep lesions

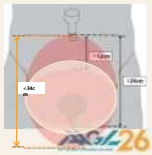


The sheath is moved outward to treat the proximal lesion.

Supports Longitudinal Depth Limit Extension



- When the sheath is pushed in or pulled out, the zero-pressure anchor point technology supports adjusting the "zero-pressure" position between the sheath and the patient, avoiding tissue damage at the contact position and ensuring the safety of the patient during the procedure.
- Further safely and effectively extend the longitudinal depth range (limit position up to 0cm-34cm)



17

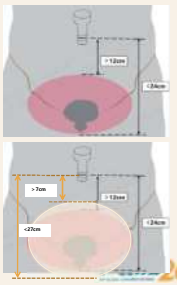


Adjust the Trocar Depth

18

Micromotion function -- Extended operating depth





19

SP1000 Core Technology No. 3: Concealed Sleeve Technology

Conventional SP Technology

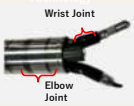
The wrist and elbow joints should be exposed to operate



Longitudinal lesions were 10-24cm deep, and lesions close to the body surface could not be treated

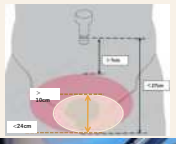
Concealment Technology

Operated partially concealed within the casing.



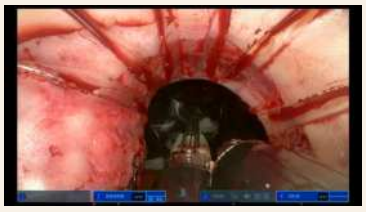
Enhance the ability to treat proximal lesions

Vertical lesion depth of 7-27cm





20



Concealed sleeve technique

21

Single-Port SP1000: Exploring Natural Orifice Surgery



The exploration of SP transvaginal hysterectomy

- Advantages of operating in confined spaces and with flexible arms, reduce the stimulation to the pelvic organs, fast postoperative recovery and reduced postoperative pain.
- The advantages of performing surgery through natural orifices include:reducing complications associated with trocar puncture,and there are no scars on the abdominal incision.



SP1000 has performed 3 cases of single-port robot-assisted+NOTES ovarian tumor resection

22

Fine endoscopy: Multiple imaging modes within a narrow cavity





Three shooting modes:
Rotation, Zoom In, Zoom Out



Endoscopic posture:
Front-back extension and retraction



Endoscopic posture:
Posterior rotation



Endoscopic posture:
Front end rotation

23



A demo box camera movement







Cobra mobile camera

24



The simulation box demonstrates the operating distance



Visual field of early SP robotic total hysterectomy

25



The SP robot puncture hole and port have been established and installed.

26



SP robot hysterectomy 1



Flexible SP robotic myomectomy

27



SP1000 T RL Hysterectomy 2

28



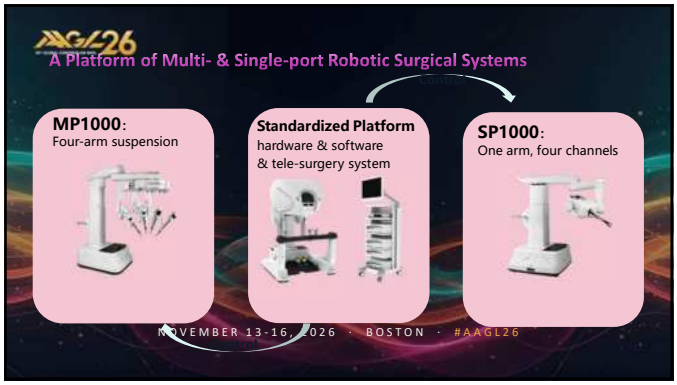
Special suction tube for SP robot

29

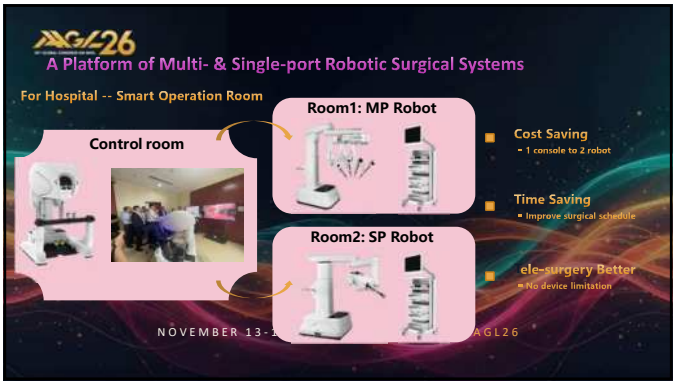


SP1000 Para aortic Lymphadenectomy(Animal experiments)

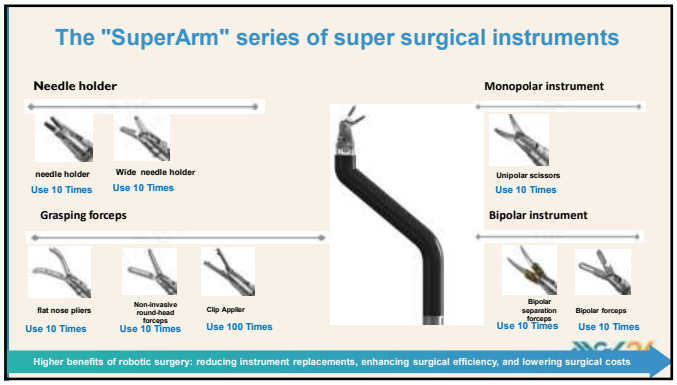
30



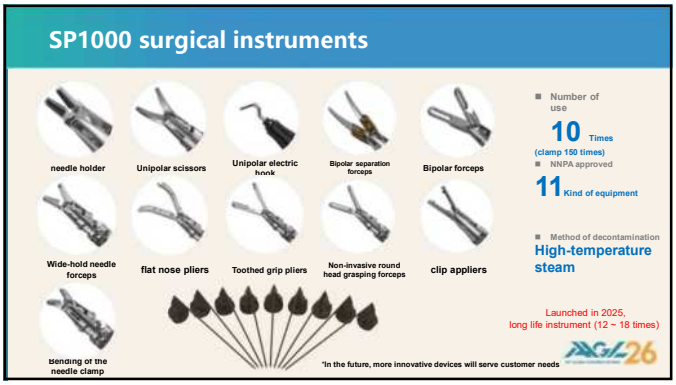
31



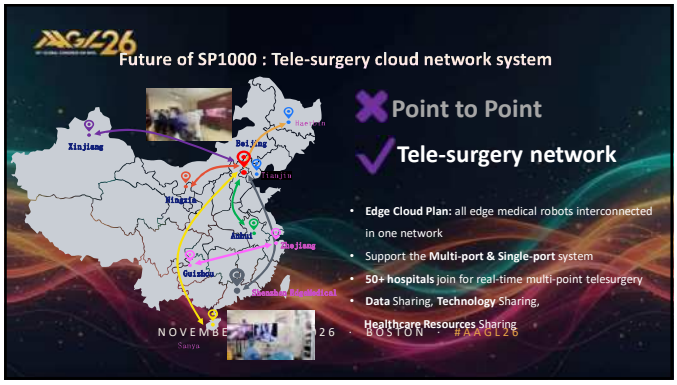
32



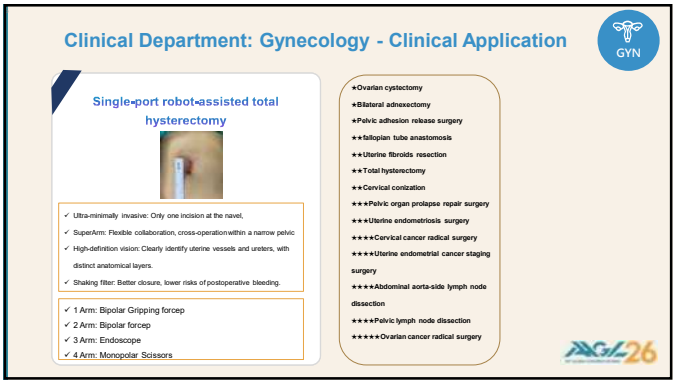
33



34



35



36

Exploration of Frontier Sciences: Innovative Approaches

GYN
- Natural orifice total hysterectomy and bilateral salpingectomy*
- Natural orifice total hysterectomy and bilateral adnexectomy*

URO
- Bladder prostate cancer radical surgery*
- Extraperitoneal prostate cancer radical surgery*
- Partial nephrectomy*
- Adrenal tumor resection*
- Retroperitoneal adrenal tumor resection*

GEN
- Transanal rectal cancer radical surgery*
- Distal pylorus-preserving gastrectomy for gastric cancer*

THO
- Intercostal anterior mediastinal tumor resection*
- Intercostal posterior mediastinal tumor resection*
- Intercostal lobectomy*

H&N
- Axillary thyroid cancer radical surgery*
- Subtotal thyroid resection posterior to the sternum*
- Parotid gland tumor resection*
- Oral cavity and pharynx tumor resection*
- Enlarged resection of tonsillar cancer*

BRE
- Axillary breast gland resection with prosthesis implantation *



All of the above are single-port specialized surgical procedures.

37

Via natural orifice: vagina

Single-port robot-assisted transvaginal total hysterectomy



- ✓ Ultra-minivasive:Via a single transvaginal portal, no abdominal incisions.
- ✓ Superarm: The narrow transvaginal approach enables precise dissection.
- ✓ High-definition visualization: Clear visualization of pelvic organs, including uterine vessels, the bladder, and the rectum.
- ✓ Vibration filtering: Ensures stable hemostasis, dissection, and suturing maneuvers, resulting in minimal intraoperative blood loss.

- ✓ 1 Arm: Bipolar Forceps
- ✓ 2 Arm: Endoscope
- ✓ 3 Arm: Bipolar Forceps
- ✓ 4 Arm: Monopolar Scissors

★★★ Transvaginal sentinel lymph node biopsy
★★★★★ Transvaginal total hysterectomy
★★★★★ Transvaginal radical cervical cancer resection
★★★★★ Transvaginal radical endometrial cancer resection

1. Overcoming the traditional pain points of gynecological surgeries such as "poor surgical field, restricted operation, andInsufficient anatomical accuracy",
2. achieving the integration of "complete tumor removal + function preservation + zero incision on the body surface"

Unique advantages: Especially suitable for natural orifice surgeries

38

EDGE Medical SP1000 Clinical Studies

Chinese Journals: 5 ; English Journals: 4

时间	医院	发表期刊	论文名称
2020.11	中山大学肿瘤防治中心	[JOURNAL OF ENDOUROLOGY]	[Robot-Assisted Nephrectomy Using the Newly Developed EDGE SP1000 Single-Port Robotic Surgical System:A Feasibility Study in Porcine Model]
2021.10	中山大学附属第六医院	[Gastroenterology Report]	[First preclinical experience with the newly-developed EDGE SP1000 single-port robotic surgical system-assisted transanal total mesorectal excision]
2021.12	武汉大学中南医院	[Surgical Endoscopy]	[Preclinical evaluation of the new EDGE SP1000 single-port robotic surgical system in gynecology: minimal access surgery]
2022.10	四川大学华西第二医院	[中华腔镜外科杂志]	[国产单孔机器人经阴道子宫切除术：初步经验和体会]
2022.04	武汉大学中南医院	[中华妇幼外科杂志]	[EDGE SP1000腹腔镜手术机器人协助宫颈切除术]
2022.06	南开大学附属第一医院（中心人民医院东院区）/天津市中心妇产科医院	[机器人外科学杂志]	[国产单孔机器人辅助腹腔镜下经脐部切除结肠癌术后pT4b一例]
2022.09	四川大学华西第二医院	[International Journal of Medical Robotics and Computer Assisted Surgery]	[Single-port robotic surgery using the EDGE SP1000 surgical system in gynecology: Initial experience of a single institution]
2022.10	西安交通大学第二附属医院	[中华腔镜外科杂志]	[可视单体机器人协助宫颈癌根治术]
2022.11	国家癌症中心、国和肿瘤临床医学研究中心、中国医学科学院肿瘤医院、中国医学科学院北京协和医院	[浙江大学学报(医学版)]	[国产腹腔单孔腔镜手术机器人辅助气管隆突肿瘤切除术的初步探索]

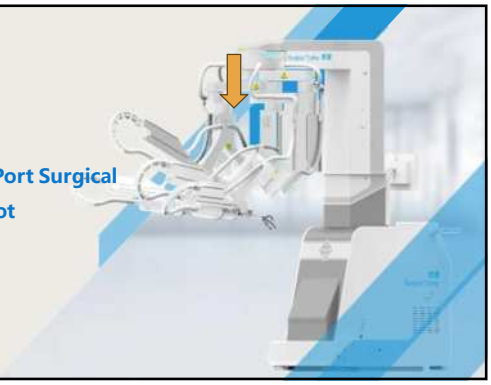


Published in English Journals

Published in Chinese Journals

39

Shurui Single-Port Surgical Robot



40

First single-port surgical robot approved by NMPA in China

国家药品监督管理局 National Medical Products Administration

- 2023.6, Approved Urology
- 2024.2, Approved Gynecology (benign + malignant)

受理号	XZSK-2023-236
标题	腹腔内窥镜单孔手术系统获批上市
发布日期	2023-06-20

腹腔内窥镜单孔手术系统获批上市

国内首个内窥镜单孔手术系统、国际首创技术、填补国内空白

41

Key Technologies: Drive Technology for Coupled Continuum Mechanism



Nickel Titanium Alloy coupled continuous body (high load-bearing capacity)

Made of nickel-titanium alloy, with exceptional flexibility



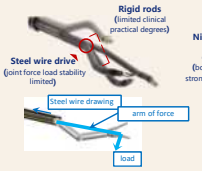
Twenty nickel-titanium alloy fine rods are arranged in a circular pattern to work together as a whole.
To improve the safety of surgical procedures
The load capacity of the lifting clamp can reach 10N

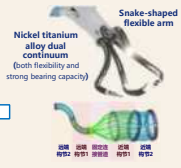


42

New Exclusive Technology - ShuRui Technology Opens a New Era of SP Technology

- **Drive technology for dual-continuum manipulator, balancing the load and flexibility of the robot arm.**







The Working Principle of Coupled Continuum Mechanism



Steel wire driven type

The Others SP is a wire-driven robot that can only pull and not push. It has a single wire with a large torque, and the force load is up to 7N, which is relatively weak.

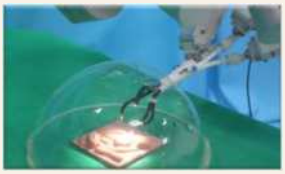
The dual continuum

More than 20 ultra-elastic Nitinol alloy structure bone can be pushed and pulled, with high hardness and the highest load capacity of 10N

Force load and accuracy (500g weight)

43

The endoscope is highly flexible.



The endoscope is flexible and can be rotated.
Full circumference 90° flexible movement, wide field of vision



Endoscopic Cobra Mode
Can be raised, across the obstacles ahead, to observe

44

Diamond layout can meet all directions of traction

Shurui SP Surgical Robotic System

Arm 3: endoscope,
Arm 2: bipolar instruments,
Arm 4: monopolar instruments,
Arm 1: forceps (can be switched to left or right hand control)



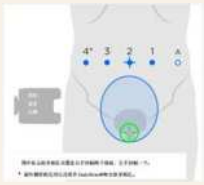


Sheath with a diameter of 2.5cm available.

1.5cm is under development

The robotic arm layout of a Multiple arms robot

Arm2: endoscope
Arm1: bipolar instruments
Arm3: monopolar instrument
Arm4: forceps



45

The external robotic arm is fixed, does not move or fight during the operation, and can move as a whole



The positioning arm moves as a whole, making it safer and more convenient to switch the surgical field during the operation.
Reached in any direction in space, which drives the serpentine surgical arm to easily switch the surgical area and increase the coverage of the surgical field

46

Multiple puncture hole level operations

Operating range, force load, instrument angle, field of view



Straight-bar multi-joint single-hole robot

- Horizontal: 9 cm
- At least 12 cm must be extended to enable operation
- Visual field boundaries
- The transformation of the surgical area requires repeated movement of the positioning arm.



47

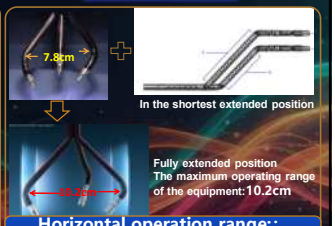
Operational space comparison

SHURUI SP



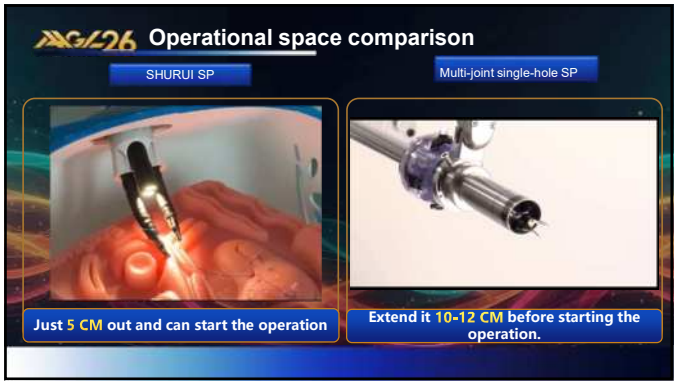
Horizontal operation range:22cm

Multi-joint single-hole SP

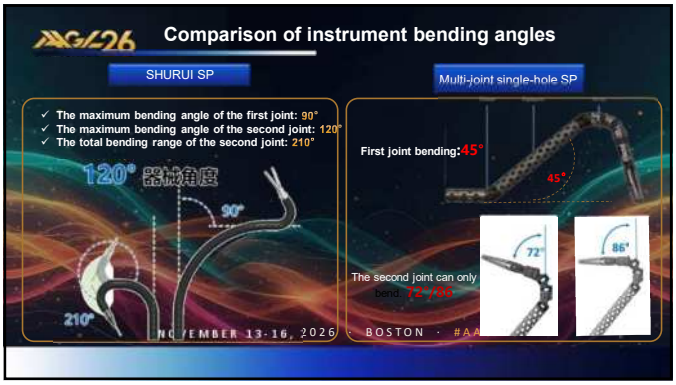


Horizontal operation range:: 10.2cm

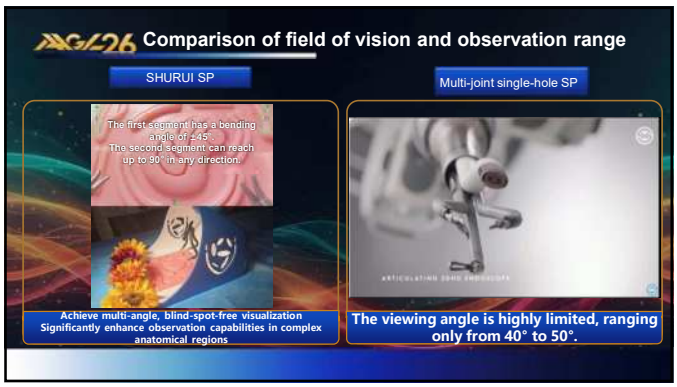
48



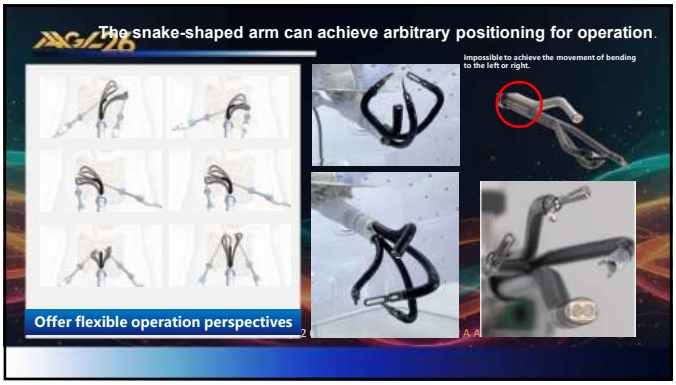
49



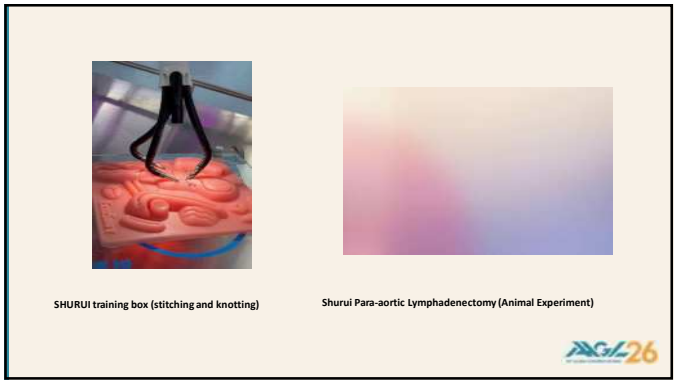
50



51



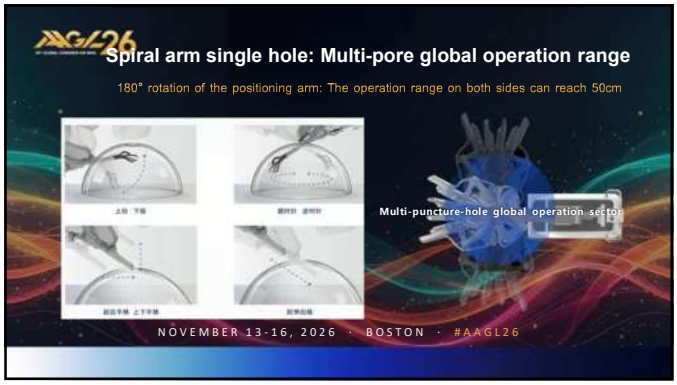
52



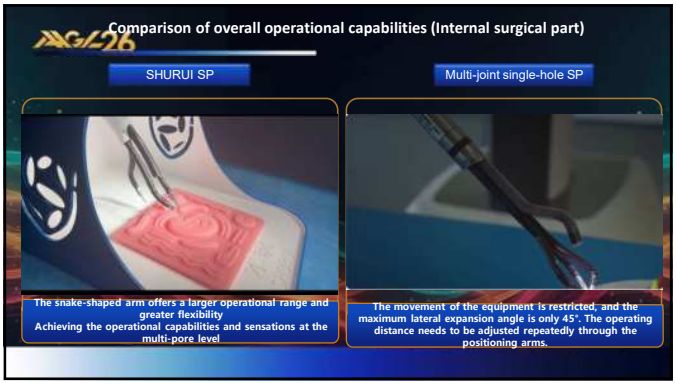
53



54



55



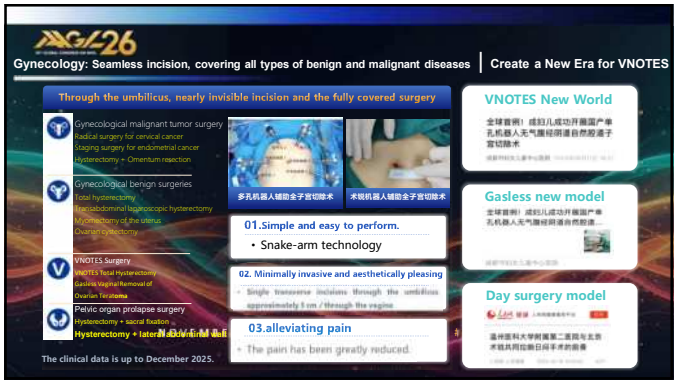
56



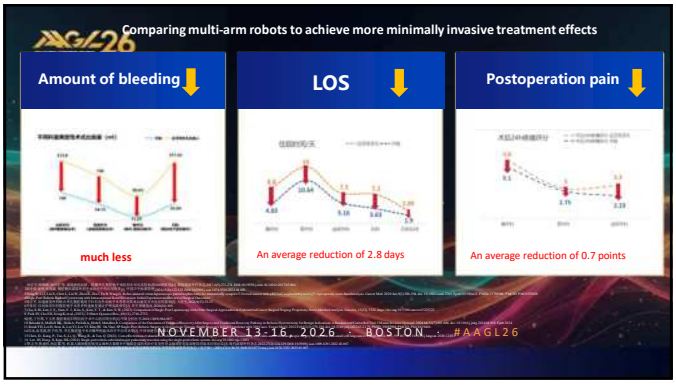
57



58



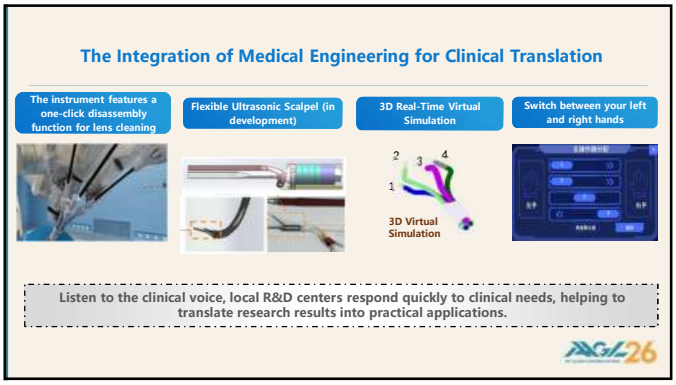
59



60



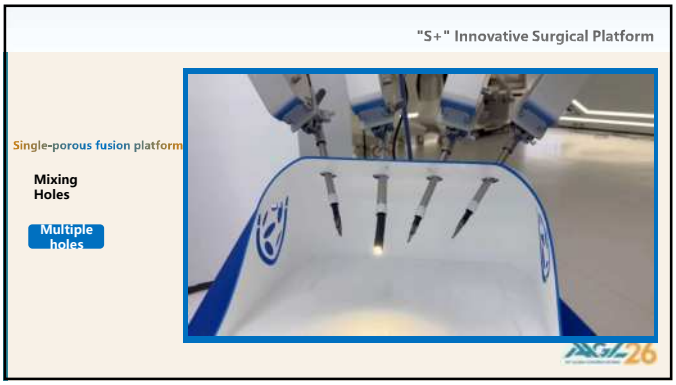
61



62



63



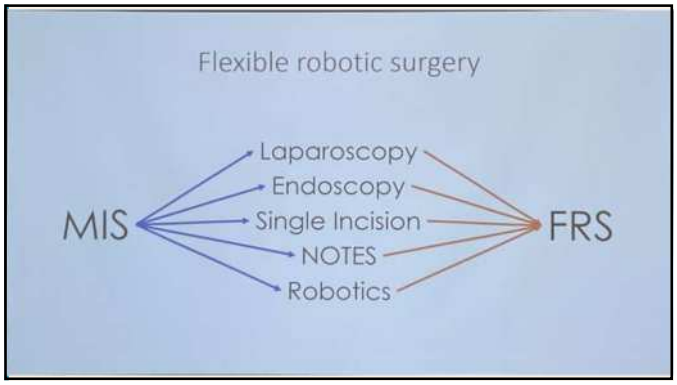
64



65



66



67

Principles of Online Remote Surgery

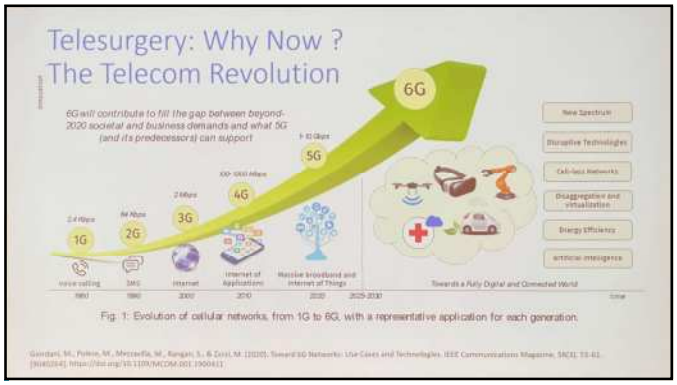
Remote surgical network architecture

The remote surgical network architecture includes doctor sites, secure cloud/fiber optic transmission, and patient sites, enabling real-time high-definition video and tactile feedback transmission.

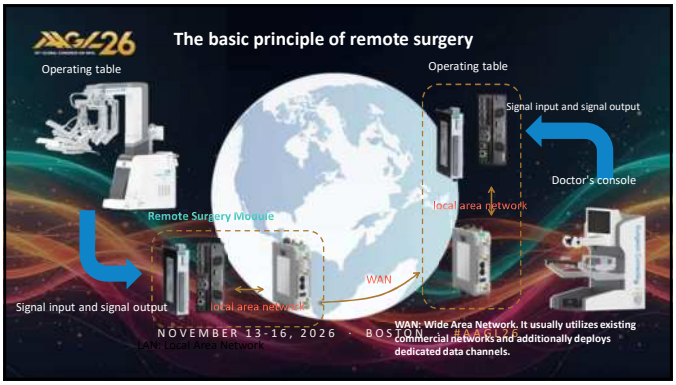
Low latency and high bandwidth requirements

The network architecture needs to meet latency of less than 20 milliseconds and a bandwidth of at least 100Mbps to ensure real-time interaction and high-definition image quality for remote surgery.

68



69

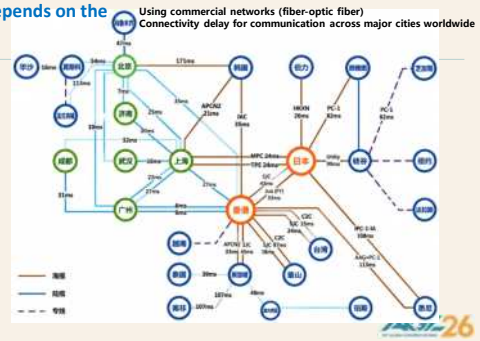


70

The delay mainly depends on the wide area network.

For example:
Guangzhou to Hong Kong
At least 6 ms
Hong Kong to Singapore
At least 33 ms

Guangzhou to Singapore
6ms+33ms=39ms



71

Remote surgical concept validation

Animal experiment verification

In animal experiments, the feasibility of remote surgical technology was verified by successfully performing hysterectomy surgery through remote operation of robots.

Clinical case application

In clinical cases, remote surgical technology was successfully used to complete uterine fibroid resection, further demonstrating the effectiveness of this technology in complex surgeries.

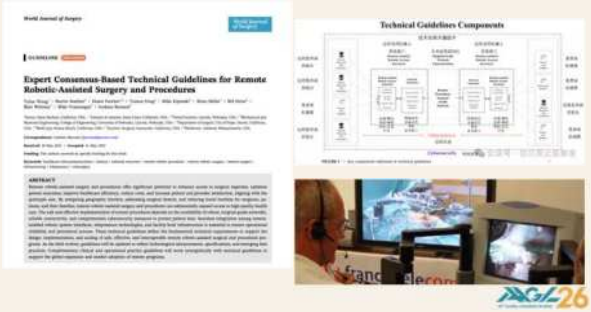


72



The world's first and only system that has achieved comprehensive coverage of remote surgeries through a variety of communication methods, including dedicated lines, 5G networks, conventional networks, high-orbit satellites, and low-orbit satellites, and has received approval for commercial deployment.

73



74

Chinese enterprises have completed the NMPA registration for the 5G-enabled remote surgery indications.

- **Minimally Invasive Tumai® (China Medical Device Registration No. 20223010108): Registered on April 21, 2025**
  Tumai is also the only surgical robot system globally that has received IDE approval from the US FDA and can conduct remote surgical clinical research within its regulatory framework.

- **Jinfeng Yun® (China Medical Device Registration No. 20223011623): Registered on November 17, 2025**
  "This product is controlled by doctors using the master-slave control system for minimally invasive surgical instruments, and is used in urology, general surgery, gynecology, and thoracic surgery laparoscopic surgeries. When equipped with a remote communication workstation, it can be used for urology, general surgery, gynecology, and thoracic surgery remote lung laparoscopic surgeries."

75

The enterprises that have carried out clinical remote surgery practices

- **Kangduo Robot:**
  Although it has not been separately registered for remote surgery, it has completed large-scale clinical verification of 5G remote surgery.

- **ShuRui Robot:**
  Focusing on the single-port technology route, its single-port laparoscopic surgical robot is the first of its kind in China to be approved for market listing. In terms of clinical practice, Yuren has successively completed the world's first single-port robotic cross-ocean remote animal experiment (Shanghai - United States, 13,000 km)

76

Core variable

- **The authenticity and scalability of clinical implementation:**
  From the current situation, remote surgical systems compatible with 5G have gradually entered various medical institutions at all levels, generating traceable surgical data. They cover multiple core departments such as urology, general surgery, gynecology, and thoracic surgery, with a prominent proportion of high-difficulty surgeries, fully verifying the clinical feasibility of 5G remote technology.
  This constitutes the core data support for domestic remote surgeries. Chinese enterprises have completed the "registration - clinical trial - policy" full cycle in the 5G remote field, and have accumulated over 1,600 cases of clinical data.

- **Objectivity: Currently, there are still significant shortcomings in remote surgeries.**
  The national cumulative data is not equal to single-point scalability. Currently, no hospital in China has achieved the regular and stable implementation of 5G remote surgeries exceeding 100 or 1,000 cases in a single hospital. Most of the implemented hospitals are only at the level of individual cases or a few dozen cases, far from meeting the standards for large-scale diagnosis and treatment.

77

Policy support and clinical norms

- **The National Healthcare Security Administration has issued the "Guidelines for Project Establishment of Medical Services Related to Surgery and Therapeutic Auxiliary Operations (Trial)".**
  A separate "Remote Surgical Auxiliary Operation Fee" has been established;
  The accessibility of 5G remote surgery technology has been enhanced, helping equipment expand its clinical coverage;
  A "Policy of Reducing Revenue Based on Insufficient Data" has been established, requiring medical institutions to preserve and upload medical data and equipment operation records of 5G remote surgeries to ensure the traceability of surgical quality and provide a guarantee for the standardization competition of 5G remote surgeries.

- **The authoritative experts have reached a consensus on the three core specialties, and have defined the operation norms and safety standards for the standardized implementation of 5G remote surgeries:**
  "The Chinese Expert Consensus on 5G Remote-Controlled Robot-Assisted Hepatobiliary and Pancreatic Surgery (2025 Edition)" sets the comprehensive delay safety threshold at 200ms, and 5G networks can stably achieve a delay of ≤50ms, meeting the requirements of complex surgeries;
  "The Chinese Expert Consensus on Remote-Controlled Robot-Assisted Gynecological Surgery (2025 Edition)" includes over 20 surgical procedures within the scope of 5G remote application;
  "The Remote Robot Surgery Operation Guide (2025 Edition)" standardizes core requirements such as network packet loss rate and local takeover team configuration, providing unified standards for the equipment development and clinical application of 5G remote surgeries, and regulating the industry competition order.

78

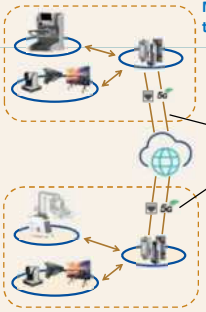
The three core application scenarios

- The interconnection and collaboration between the medical alliance and its members:
- Cross-regional cooperation
- Interdisciplinary and borderless medical treatment across multiple hospital districts:

The common focus of these three application scenarios is that 5G remote technology is moving from "being able to perform surgeries" to "solving real medical problems". This is precisely where the significant competitiveness of domestic equipment lies.

79

Minimum network requirements for remote surgery using the ShuRui SP system



- **Minimum network bandwidth:**
  In normal mode, the network bandwidth shall not be less than 40 Mbps; in error-resistant mode, the network bandwidth shall not be less than 20 Mbps.
- **Maximum network round-trip delay:**
  The maximum allowable value is 230 ms.
- **Maximum network jitter (without out-of-order transmission):**
  The maximum allowable value is ±30 ms.
- **Maximum network packet loss rate:**
  The maximum allowable value is 0.4%.

80

Name of the unit	Type of surgery	Key data	Technical features	Network indicators
301 General Hospital	1. Cervical precancerous lesion (CIN3/CIN grade III): Total hysterectomy with bilateral salpingectomy and pelvic adhesion lysis 2. Endometrial cancer: Single-port robotic staging surgery (complete lymph node dissection for malignant tumors)	Success rate: 100% (30 cases) – Average operation time: 105.6 ± 54.78 minutes – Average blood loss: 152.5 ± 139.01 milliliters – Postoperative recovery: Average hospital stay of 5.35 days – Technical validation: By 2024, 2,000 kilometers of cross-regional surgeries were completed, with the JP Robot System	5G remote collaboration, JP robot system, verification of the feasibility of multi-point remote and two-way operatio.	Latency is 20.381 – 63.781 ms, and the stability meets the standard.
HuaXi Second University Hospital, Sichuan University	Multiple uterine fibroids: Total hysterectomy + Bilateral salpingectomy (The world's first single-port remote surgery) 2. Endometrial cancer: Single-port robotic staging surgery (High-altitude operation for malignant tumors)	Uterine fibroids case: 90 minutes, with blood loss < 60 mL. Stay H: 24 hours – Malignant tumor case (December 2024): operation 1 hour and 45 minutes, with blood loss of 20 mL, and remote operation was successfully conducted at an altitude of over 3,000 meters.	The domestic Jinfang single-arm single-port robot has achieved stable transmission at high altitudes (3,000 meters).	Latency 40 ms, malignant tumors 87 ms, and the transmission is stable across high altitudes.
Fudan University Obstetrics and Gynecology Hospital	Multiple uterine fibroids with anemia: (The first domestic TuWS0 four-arm robot remote surgery in East China, 2,000 kilometers cross-regional operation)	Surgical duration: Approximately 2 hours – Technological innovation: Integration of AI-assisted positioning to enhance the precision of anatomical dissection and reduce intraoperative bleeding (estimated at 30-50 ml) – Clinical value: Completion of a 2,000-kilometer surgical operation from Shanghai to Ningxia in 2024	5G + AI Ultra-Remote Collaboration	Latency < 20 ms (conventional index of TumaiS system)

81

Name of the unit	Type of surgery	Key data	Technical features	Network indicators
Jiangsu Provincial People's Hospital	Recurrent uterine fibroids: Total hysterectomy (single-port, with the entire Xinjiang Kizilas team participating in the training)	– Surgery time: 84beta – Intraoperative blood loss was minimal – Technical collaboration: In 2024, a remote surgery between Jiangsu and Xinjiang was completed, promoting the allocation of high-quality resources to border areas.	5G remote single-port robot, establishing a "central hospital - primary hospital" collaboration model	Latency < 100 ms
Shanghai Changzheng Hospital	Ovarian serous cystadenofibroma: Single-port robotic bilateral adnexectomy (Kangduo robot, exploring the application of single-port technique in benign tumors))	– Surgery duration: 90 minutes Intraoperative blood loss: 30 ml – Postoperative recovery: Discharged after 2 days	Kangdo robot explores the application of single-port technology in benign tumors.	Latency 105 to 111 ms, the packet loss rate is 0.08%, and the operation is smooth without any lag.
The Second Affiliated Hospital of Nanjing Medical University	Pelvic organ prolapse: Snake-arm single-port robot vHUNS sacral fixation surgery (the world's first snake-arm single-port surgery)	Surgical duration: About 1.5 to 2 hours – Technical advantages: 3D naked-eye vision, 360° operation with snake-arm, no incision on the body surface, hospital stay of 3 days	he world's first vHUNS surgery using a snake-arm single-port robot	Latency < 50 ms

82

New Application Chapter: Global Breakthroughs in Single-Port and Remote Surgery

Remote network and communication security requirements



Remote surgery safety measures:

Network stability: **Conduct 48-hour network monitoring** before the operation to ensure no delay.

Emergency plan: **Switch to the local system within 5 minutes** to ensure the operation does not stop.

Transfer plan: In case of problems during the operation, **switch to traditional laparoscopic surgery within 3 minutes.**

Innovative breakthroughs in the application of domestic single-port robots:

Benefit of single-port technology: Through remote technology, it breaks the geographical restrictions, promotes the distribution of medical resources, and benefits patients.

Technical guarantee: Provide **full-process visual monitoring** and **ultra-low latency** to ensure the accuracy of the operation.

83



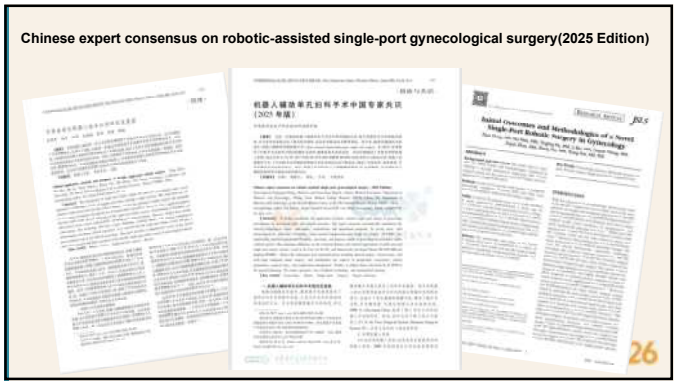
84



85



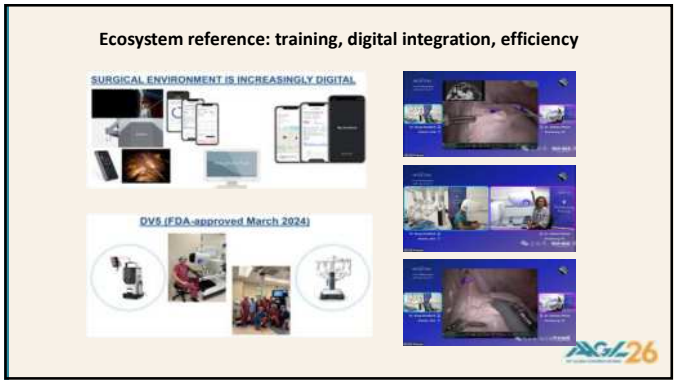
86



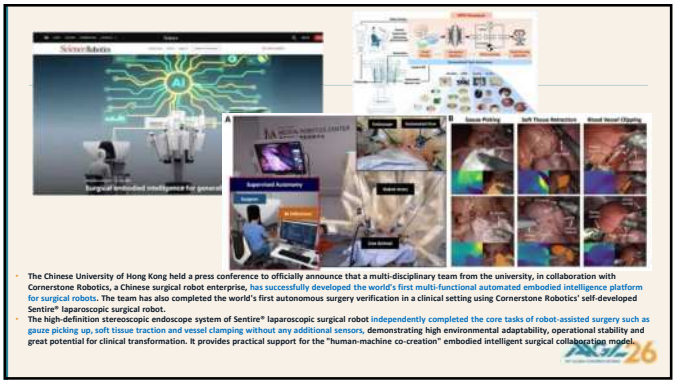
87



88



89



90

- From equipment - platform - data - network
- From experience-driven to data-driven
- From robotic tools to surgical operation ecosystems
  Physician training system
  Surgical path standards
  Hospital collaboration network
  Data and experience accumulation

How can the surgery be completed more effectively

91

Conclusion

- As an innovative surgical platform, the flexible single-port laparoscopic robot has unique advantages. With the help of this system, single-port surgery can be performed more easily, even through the natural orifice.
- Design and use of all kinds of special robot platform function, increase the range of the camera platform and device movement, expand the surgical field and scope, and strengthen the efforts of flexible equipment and flexibility is an important point to overcome their limitations.
- As a new generation of minimally invasive surgery platform, flexible single-port robot has broad prospects for future development. Including in remote robot surgery。
- Clinical research on flexible single-port robot-assisted laparoscopic surgery should be strengthened.Special attention is on how to use the robot surgery data and ecosystem.

92

Robot-Assisted Surgery Training Program in my hospital

The First Robot-Assisted Surgery Training Program (2022)	The Second Robot-Assisted Surgery Training Program (2023)	The Third Robot-Assisted Surgery Training Program (2024)	The Fourth Robot-Assisted Surgery Training Program (2025)



93

CULTURAL AND LINGUISTIC COMPETENCY & IMPLICIT BIAS

The California Medical Association (CMA) outlines standards for Cultural Linguistic Competency and Implicit Bias in CME. The goal of the standards is to support the role of accredited CME in advancing diversity, health equity, and inclusion in healthcare. These standards are relevant to ACCME-accredited, CMA-accredited, and jointly accredited providers located in California. AAGL is ACCME-accredited and headquartered in California.

CMA developed the standards in response to California legislation (Business and Professions (B&P) Code Section 2190.1), which directs CMA to draft a set of standards for the inclusion of cultural and linguistic competency (CLC) and implicit bias (IB) in accredited CME.

The standards are intended to support CME providers in meeting the expectations of the legislation. CME provider organizations physically located in California and accredited by CMA CME or ACCME, as well as jointly accredited providers whose target audience includes physicians, are expected to meet these expectations which began on January 1, 2022. AAGL has been proactively adopting processes that meet and often exceed the required expectations of the legislation.

CMA CME offers a variety of resources and tools to help providers meet the standards and successfully incorporate CLC & IB into their CME activities, including FAQ, definitions, a planning worksheet, and best practices. These resources are available on the CLC and IB standards page on the CMA website.

Important Definitions:

Cultural and Linguistic Competency (CLC) – The ability and readiness of health care providers and organizations to humbly and respectfully demonstrate, effectively communicate, and tailor delivery of care to patients with diverse values, beliefs, identities and behaviors, in order to meet social, cultural and linguistic needs as they relate to patient health.

Implicit Bias (IB) – The attitudes, stereotypes and feelings, either positive or negative, that affect our understanding, actions and decisions without conscious knowledge or control. Implicit bias is a universal phenomenon. When negative, implicit bias often contributes to unequal treatment and disparities in diagnosis, treatment decisions, levels of care and health care outcomes of people based on race, ethnicity, gender identity, sexual orientation, age, disability and other characteristics.

Diversity – Having many different forms, types or ideas; showing variety. Demographic diversity can mean a group composed of people of different genders, races/ethnicities, cultures, religions, physical abilities, sexual orientations or preferences, ages, etc.

Direct links to AB1195 (CLC), AB241 (IB), and the B&P Code 2190.1:

Bill Text – AB-1195 Continuing education: cultural and linguistic competency.
Bill Text – AB-241 Implicit bias: continuing education: requirements.
Business and Professions (B&P) Code Section 2190.1

CLC & IB Online Resources:

Diversity-Wheel-as-used-at-Johns-Hopkins-University-12.png (850×839) (researchgate.net)
Implicit Bias, Microaggressions, and Stereotypes Resources | NEA
Act, Communicating, Implicit Bias (racialequitytools.org)
https://www.contemporaryobgyn.net/view/overcoming-racism-and-unconscious-bias-in-ob-gyn
https://pubmed.ncbi.nlm.nih.gov/34016820/
https://hr.ucdavis.edu/departments/learning/certificate/implicit-bias
https://pmc.ncbi.nlm.nih.gov/articles/PMC7011228/