



Robotic Surgery

Single port vs Multiport

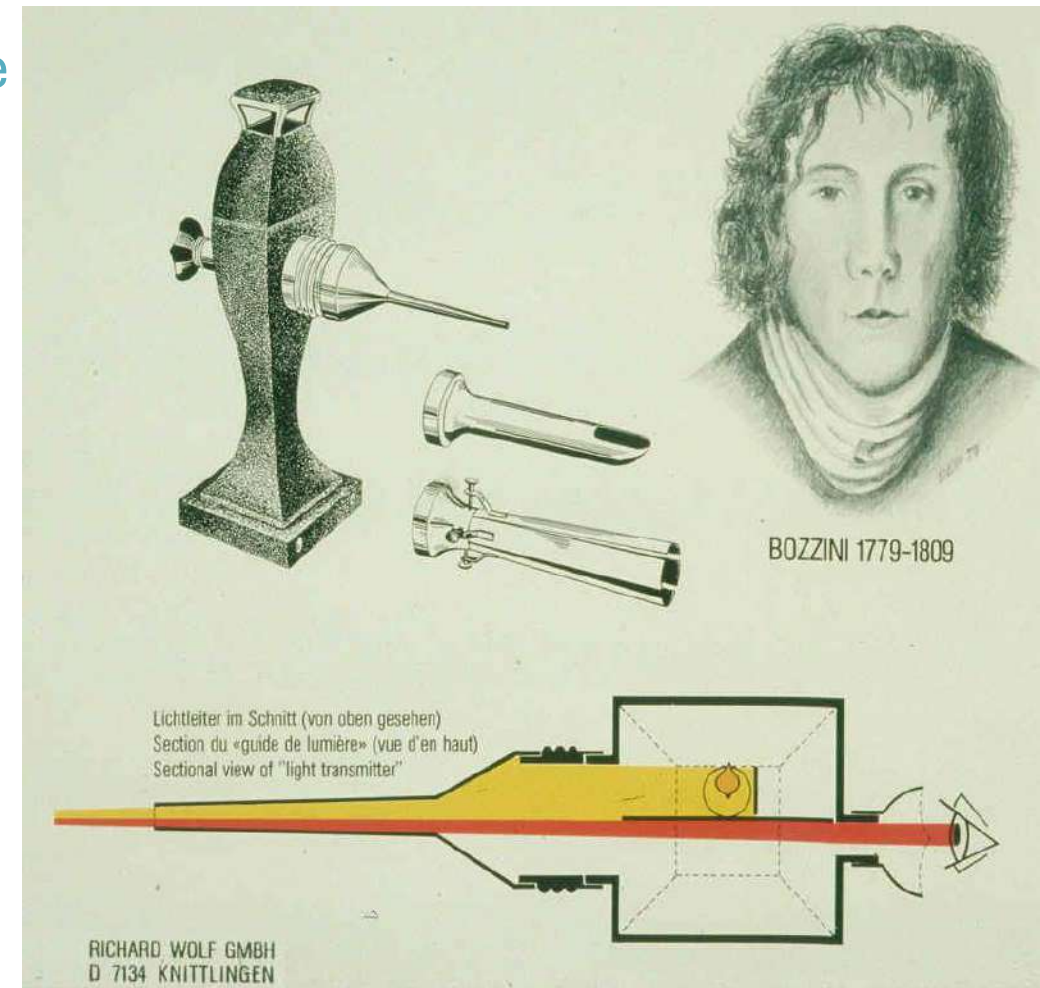
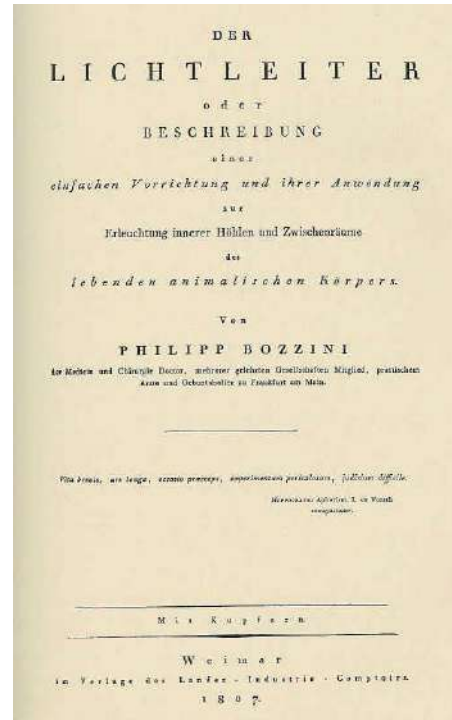
Patient tailored approach to select the right robotic tool

History of laparoscopy

Minimal invasive surgery though the past 220 years

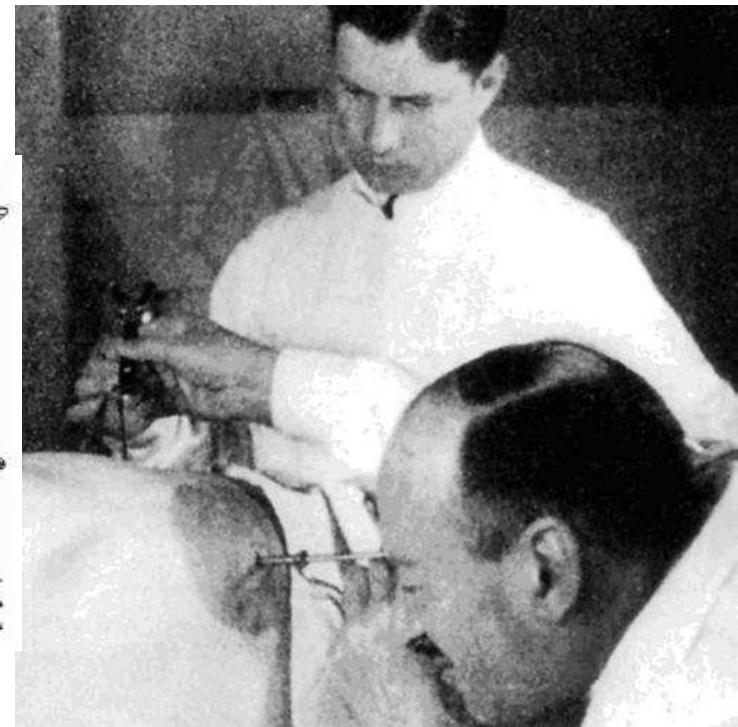
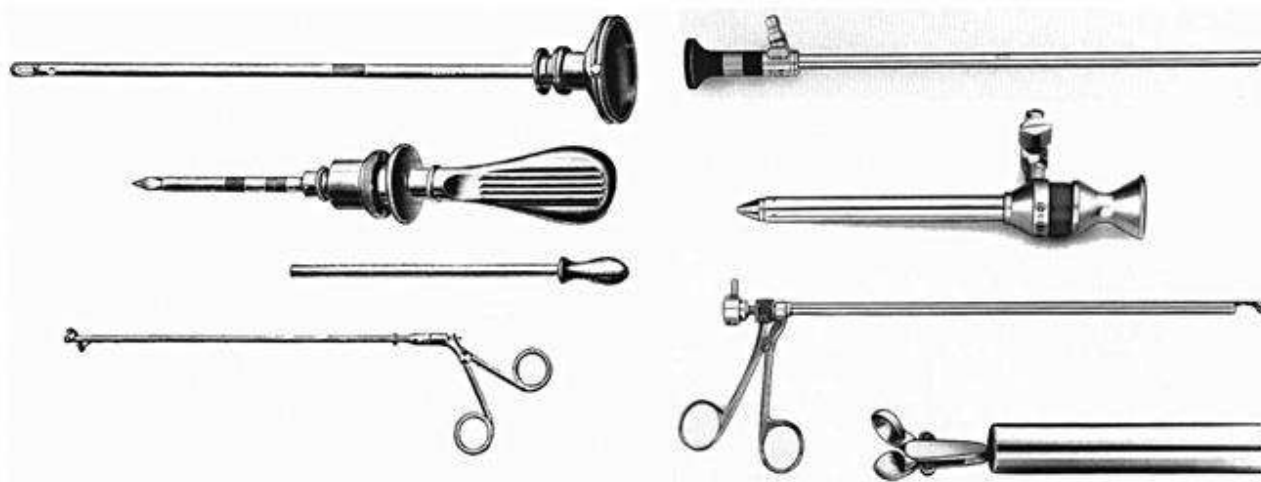
The first steps

- ✓ 1806: Philipp Bozzini (1773-1809)
 - ✓ Construction of the world's first endoscope
 - ✓ The Lichtleiter – the light conductor



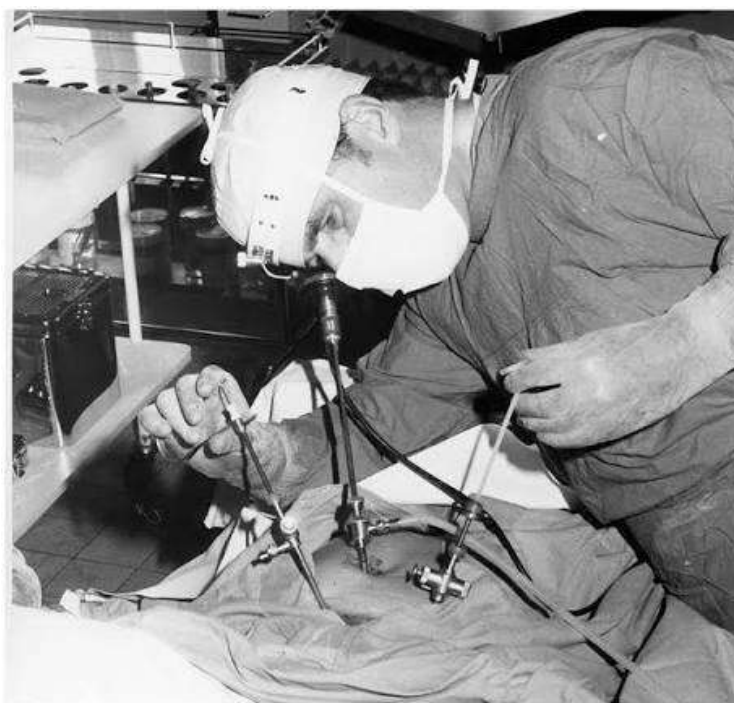
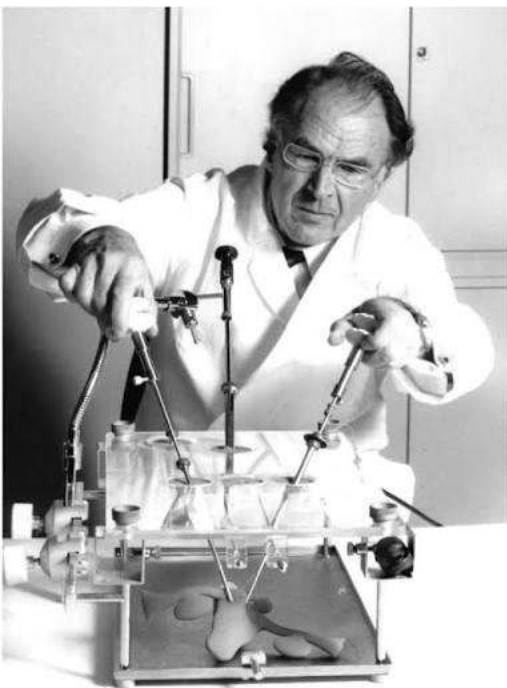
The first steps

- ✓ 1910: Hans-Christian Jacobaeus (1879-1937)
 - ✓ First (diagnostic) Laparoscopy and thorocoscopy in humans
 - ✓ Publication 'The Possibilities for Performing Cystoscopy in Examinations of Serous Cavities'



The first steps

- ✓ 13 september 1980: Kurt Semm (1927-2003)
 - ✓ The first laparoscopic appendectomy
 - ✓ Gynaecologist and toolmaker



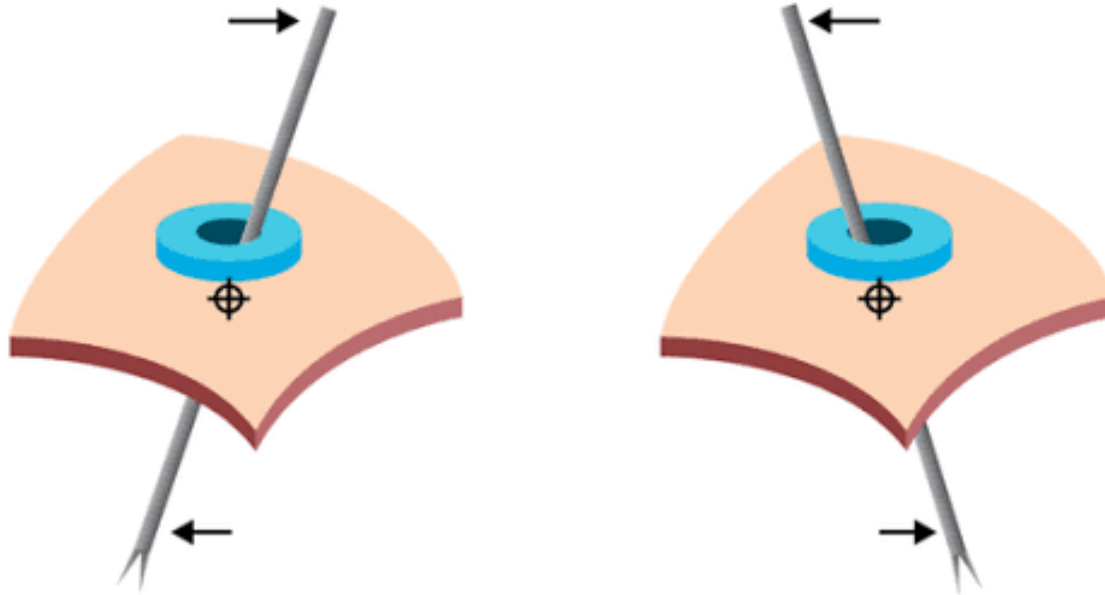
Pro

- Less post operative pain
- Smaller incisions/scar
- Detailed/enlarged view
- Less post-op infections
- Shorter hospital stay

Con

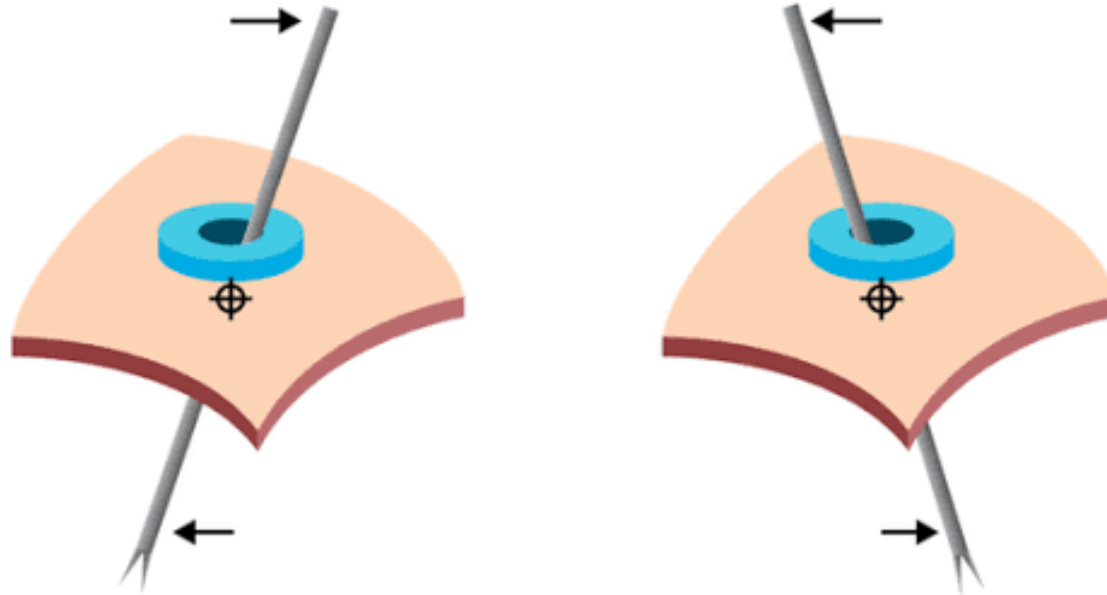
- Shoulder pain due to pneumoperitoneum
- Risk of blind injury
- Loss of depth perception
- Longer operative time
- Fulcrum effect

- The Fulcrum effect

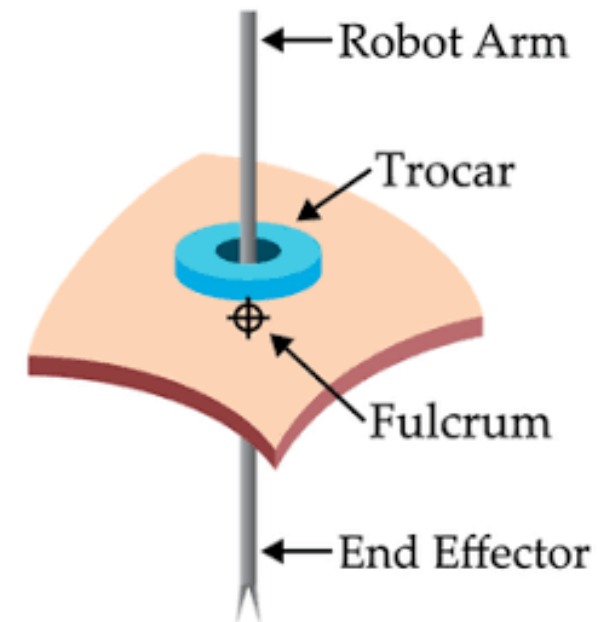


- Inverted Movement (Visuomotor Discordance)
- Force & Stiffness Distortion
- Movement Scaling
- Fatigue and Learning Curves

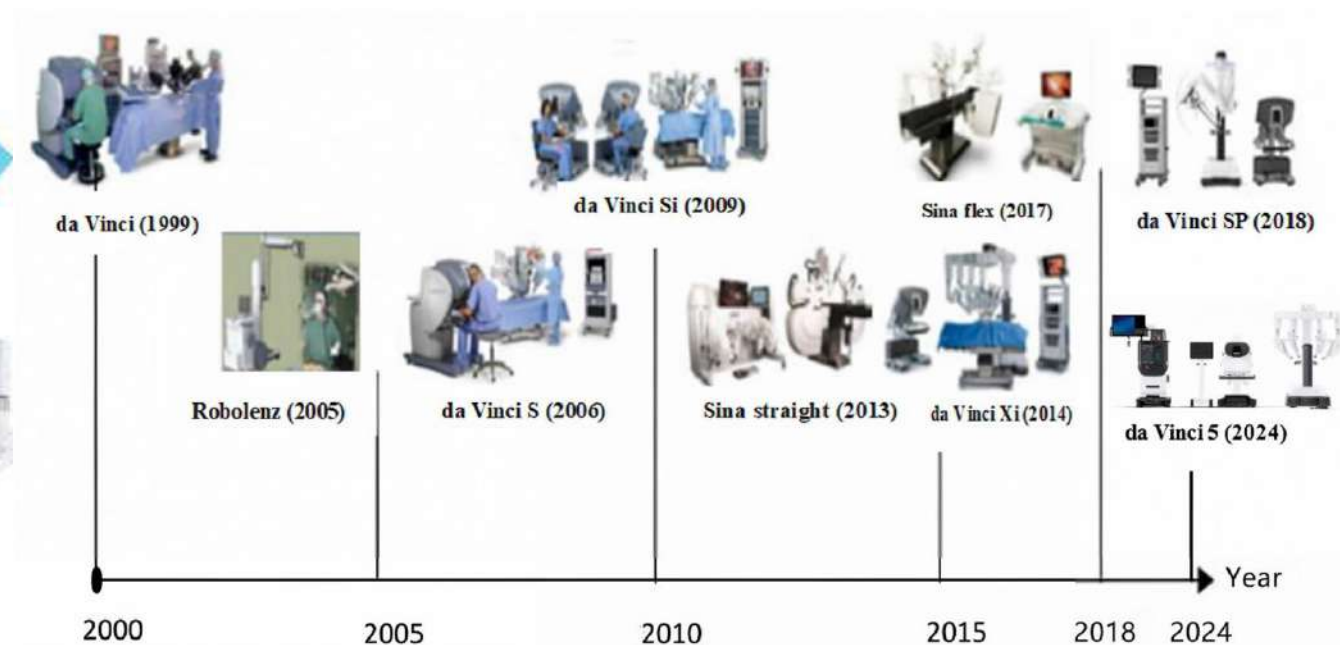
✓ The Fulcrum effect



✓ Solution: Robotic interface

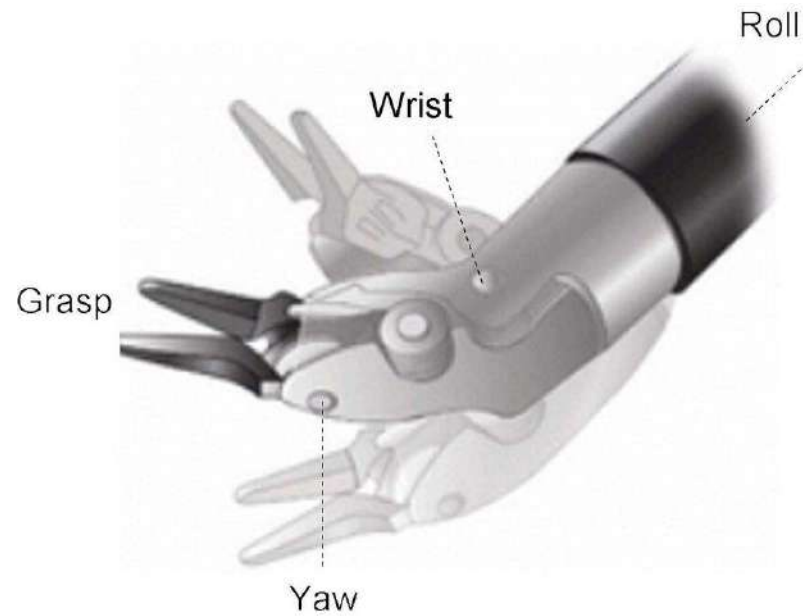


History of Robotic surgery



Robotic surgery systems

- ✓ 1999: Da Vinci Standard
 - ✓ First 3 arms, later 4 arms (2002)
 - ✓ 3D endoscope
 - ✓ Wrist movement: EndoWrist®
 - ✓ Master-Slave system with console



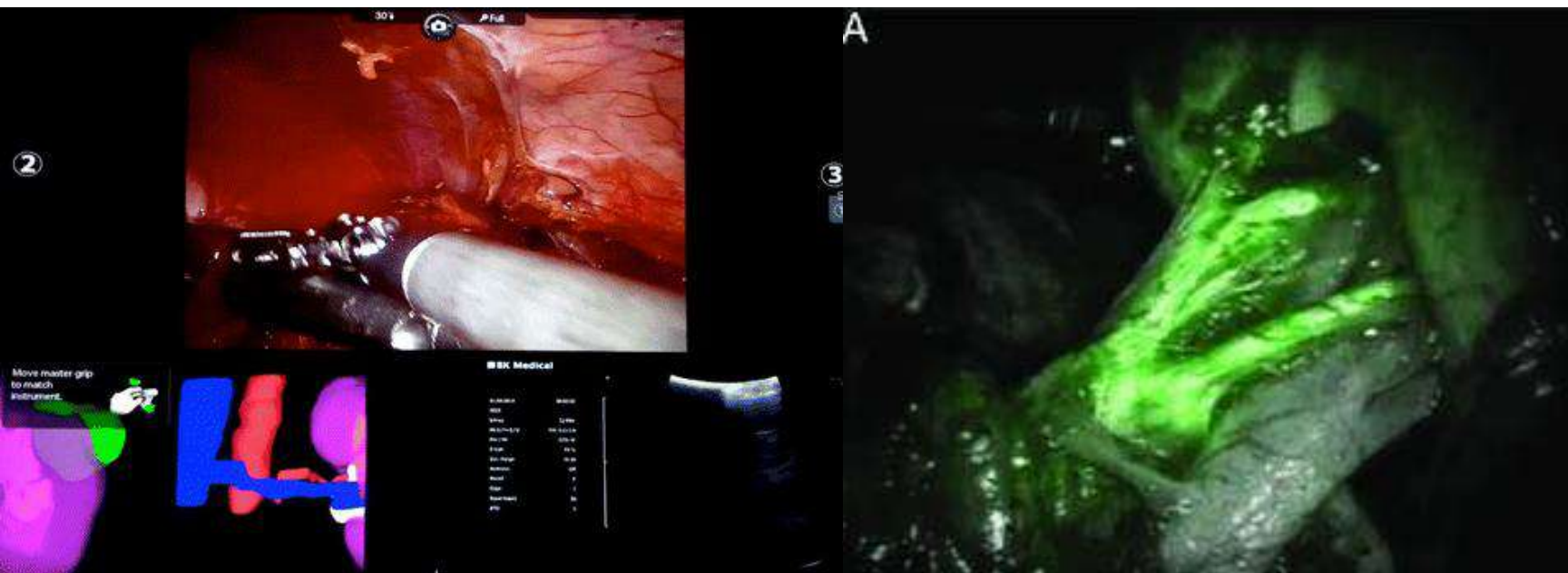
Robotic surgery systems

- ✓ 2006: Da Vinci S-HD
 - ✓ High Definition 3D endoscope
 - ✓ Simplified setup
 - ✓ Interactive touch screen



Robotic surgery systems

- ✓ 2009: Da vinci Si
 - ✓ Large worldwide dissemination of robotic surgery
 - ✓ Dual console
 - ✓ Tile pro®
 - ✓ Fire-Fly®: fluorescent imaging



Robotic surgery systems

✓ 2014: Da Vinci Xi

- ✓ More versatile patient cart system
 - ✓ Less instrument collisions
- ✓ Multiquadrant surgery
- ✓ 8mm endoscope
- ✓ Automated docking



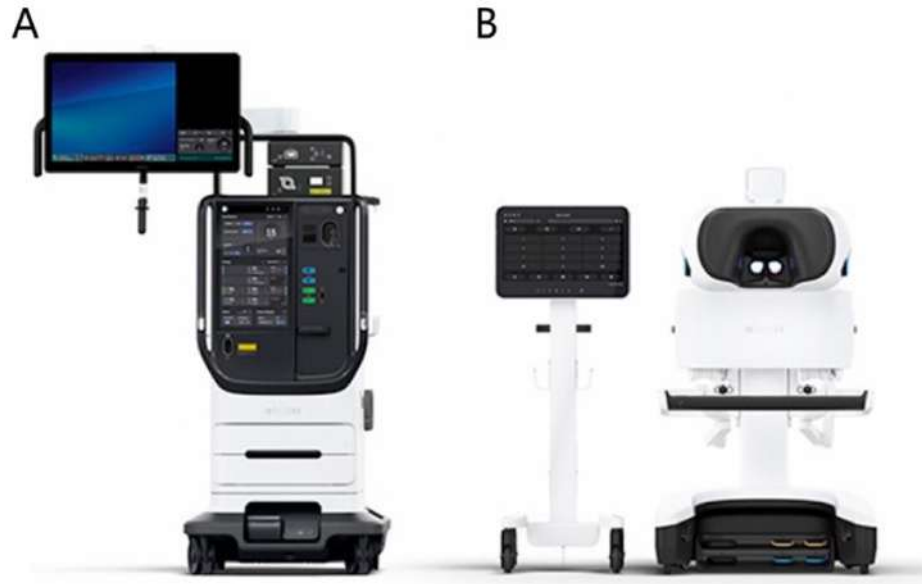
Robotic surgery systems

- ✓ 2018: Da Vinci Single Port (SP)
- ✓ 1 port: 2,5cm
- ✓ Fully articulating 3D HD endoscope



Robotic surgery systems

- ✓ 2024: Da Vinci 5
 - ✓ Force Feedback instruments
 - ✓ 10000x computing power
 - ✓ Advanced data analytics
 - ✓ Telepresence®



Single Port Laparoscopy

Why making it yourself difficult by operating through a single small incision?

Single Port Laparoscopy

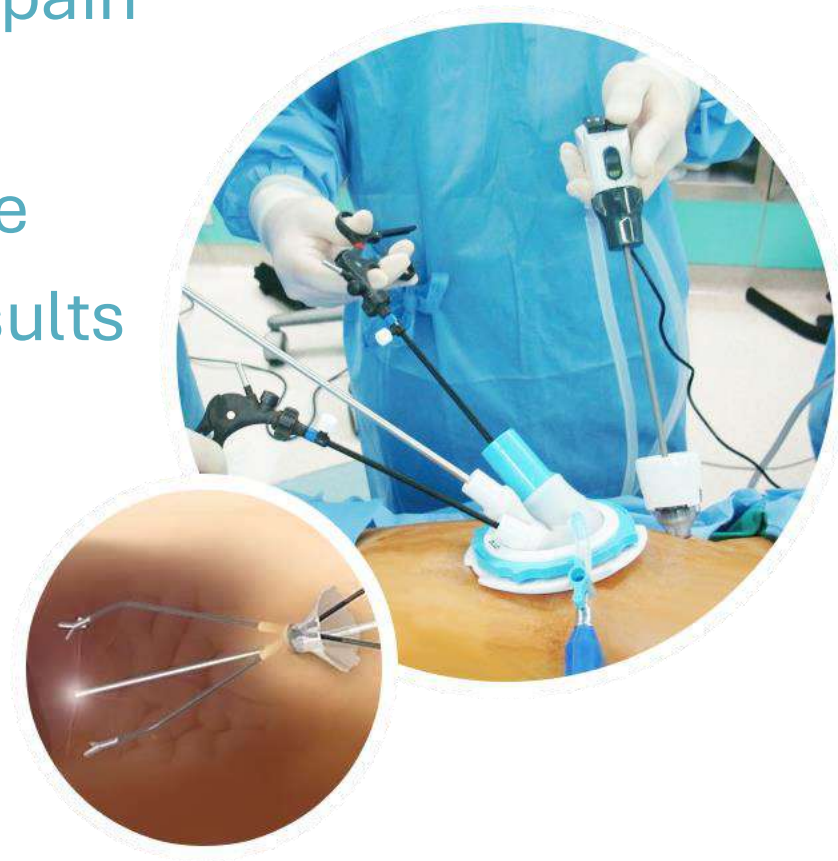
- ✓ SPL or LESS (laparo-endoscopic single-site surgery)
- ✓ Since 1990ies
- ✓ One incision, specialised port and instruments



Single Port Laparoscopy

PRO

- ✓ Less postoperative pain
- ✓ Less blood loss,
- ✓ Faster recovery time
- ✓ Better cosmetic results



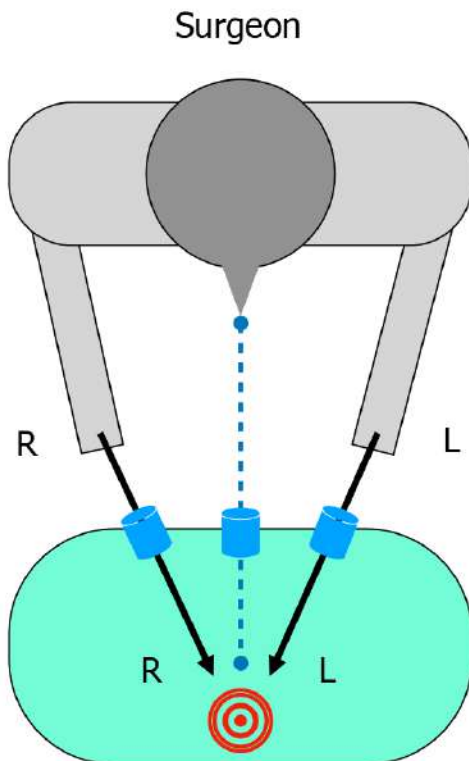
CON

- Steep learning curve
- Higher complication rate
- Specialised instruments
- Longer operating time
- Not suitable for all types of surgery

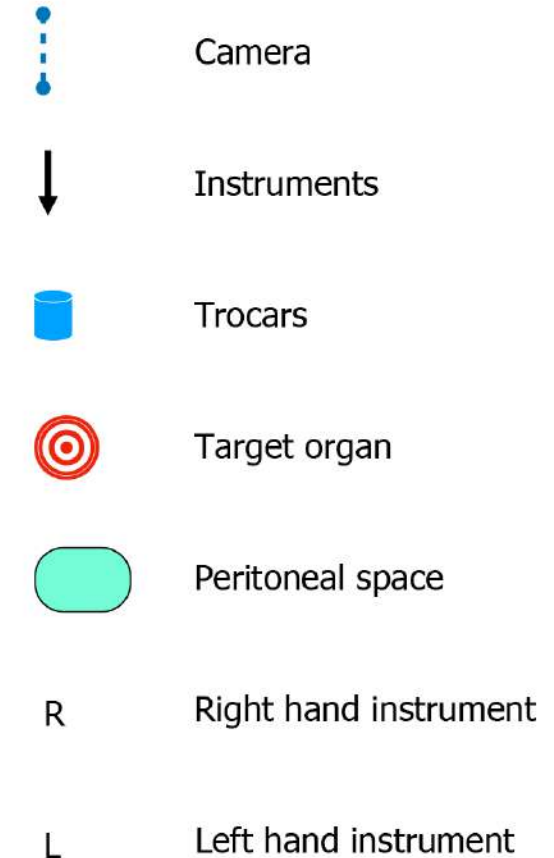
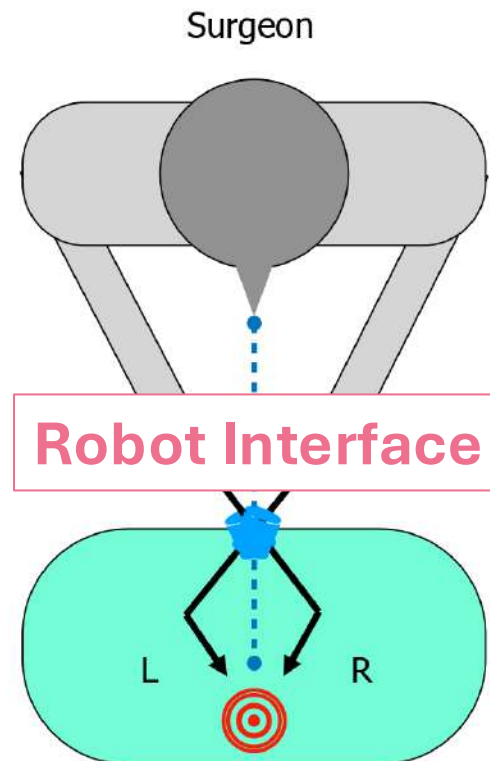
Single Port Laparoscopy

✓ Differences between Single port and multiport laparoscopy

Multitrocar laparoscopy



Single port laparoscopy

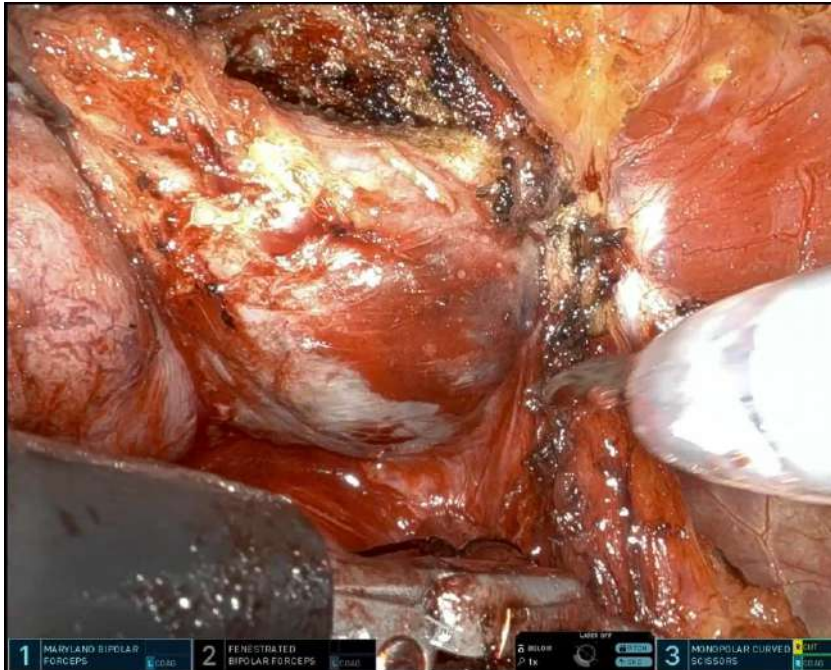




Single Port Robotic Surgery

As a solution to the problems associated with (Single Port) Laparoscopy

Goals of Single Port Robotic Surgery



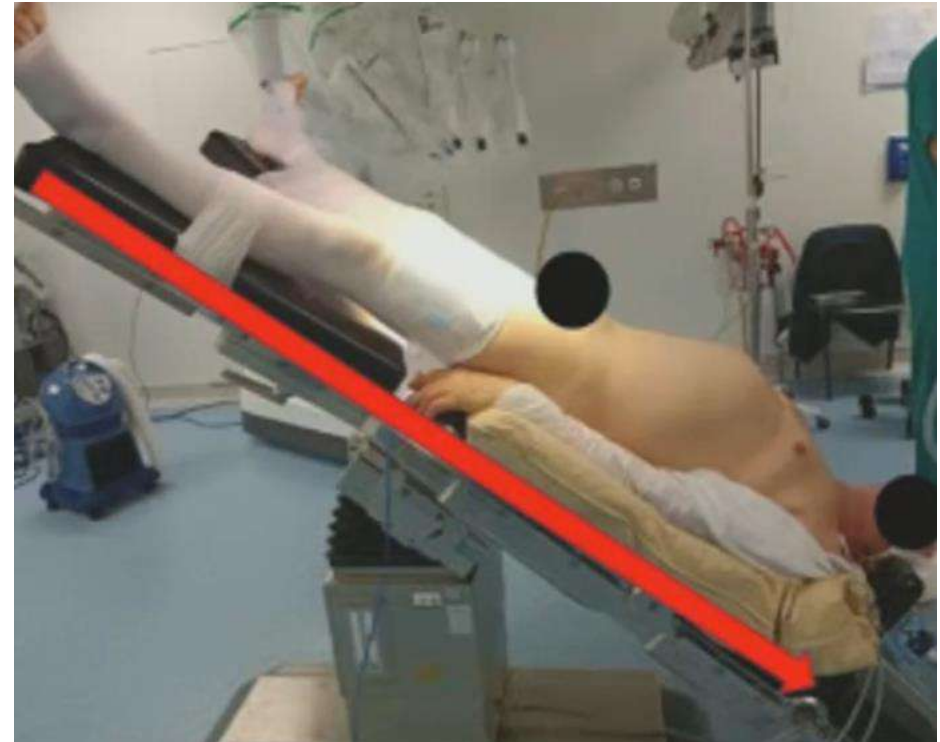
- ✓ Reducing the risk of positioning injuries
- ✓ Reducing the risk of access injuries
- ✓ Improving access in small spaces
- ✓ Improving cosmetic outcomes
- ✓ Reducing pain
- ✓ Accelerating return to activities of daily living (ADLs)

Reducing the risk of positioning injuries

**Flexed lateral decubitus position
(Partial) Nephrectomy**



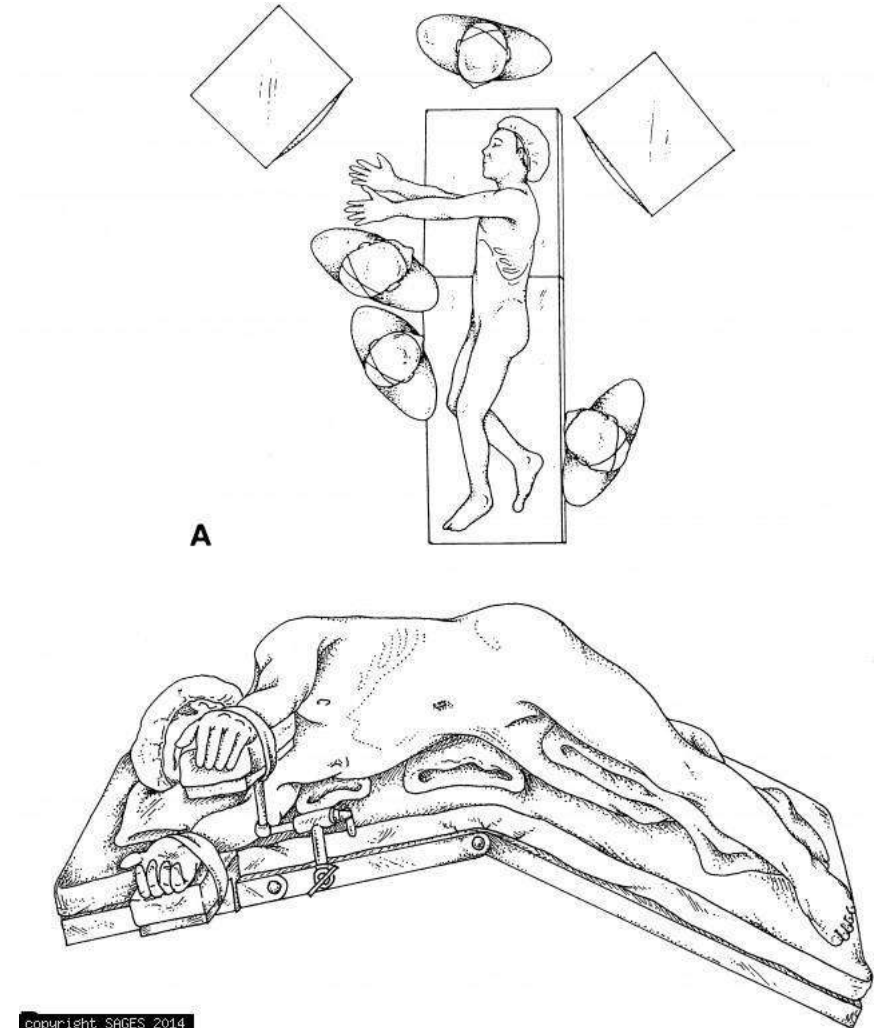
**Steep Trendelenburg (30-45°)
Prostatectomy, pelvic surgery**



Reducing the risk of positioning injuries

Flexed lateral decubitus position (Partial) Nephrectomy

- Neuropraxia
 - Brachial plexus injury, Peroneal nerve injury, Ulnar nerve injury.
- Rhabdomyolysis and Compartment Syndrome
- Skin and Tissue Necrosis
 - Decubitus wounds
- Cardiorespiratory Effects
 - CO₂ +impaired venous return



Reducing the risk of positioning injuries



Steep Trendelenburg (30-45°)

Prostatectomy, pelvic surgery

- Neuropraxia
 - Brachial plexus injury, Peroneal nerve injury, Ulnar nerve injury.
- Ocular (Eye) Complications
- Lower Extremity Compartment Syndrome (Lithotomy position)
- Respiratory problems
 - Laryngeal Edema, Atelectasis
- Cardiovascular
 - Increased Intracranial & Central Venous Pressure

Reducing the risk of positioning injuries

Flexed lateral decubitus position (Partial) Nephrectomy

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Steep Tredelenburg (30-45°) Prostatectomy, pelvic surgery

- Neuropraxia
 - Brachial plexus injury, Peroneal nerve injury, Femoral & Obturator Nerve Injury, Ulnar nerve injury.
- Ocular (Eye) Complications
- Lower Extremity Compartment Syndrome (Lithotomy position)
- Respiratory problems
 - Laryngeal Edema, Atelectasis
- Cardiovascular
 - Increased Intracranial & Central Venous Pressure

Up to 6-7%!

Up to 1-1,5%!

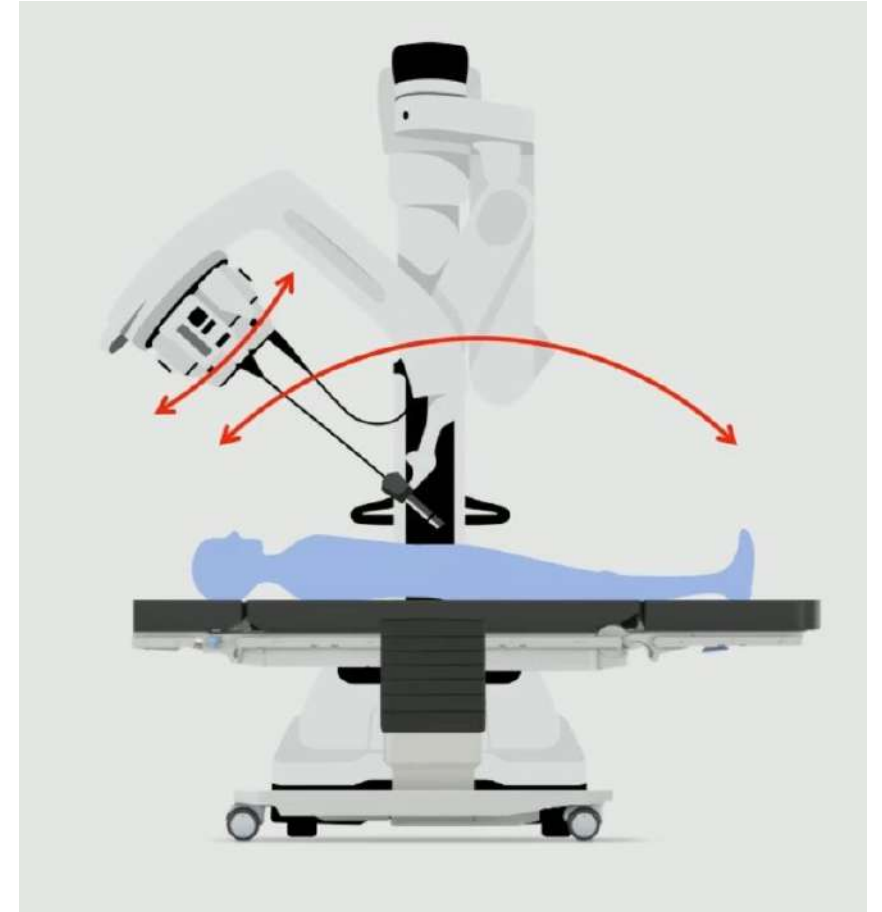
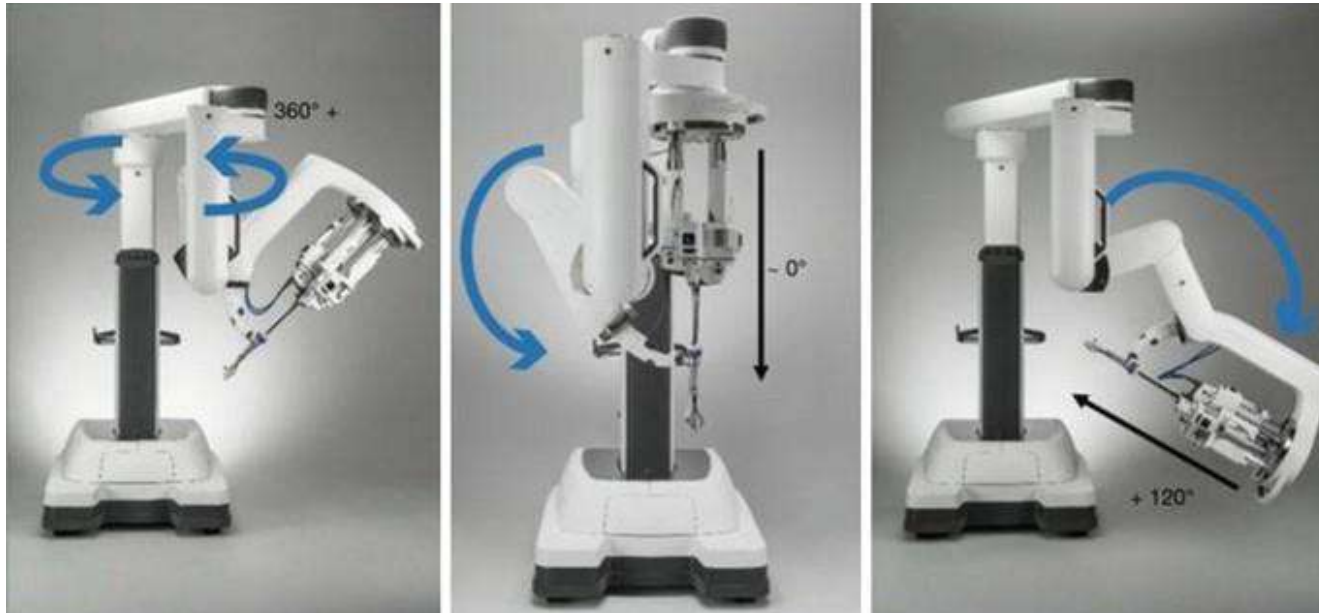
Reducing the risk of positioning injuries

- SP robot allows a supine position for most types of surgery
 - Dorsal recumbent
- No lithotomy position
- No flexed lateral decubitus
- No steep trendelenburg
- Good vascular access for anesthesiology



Reducing the risk of positioning injuries

- +120° of anatomical access
- 360° visibility and maneuverability



Reducing the risk of access injuries

Multiport Robotic Access

- Use of Verress Needle vs open introduction
 - 629 trocar injuries/3y: 32 deaths
- 8mm incisions, small
 - Multiplied by 4-5
 - 1 longer incision for extration



Single Port Robotic access

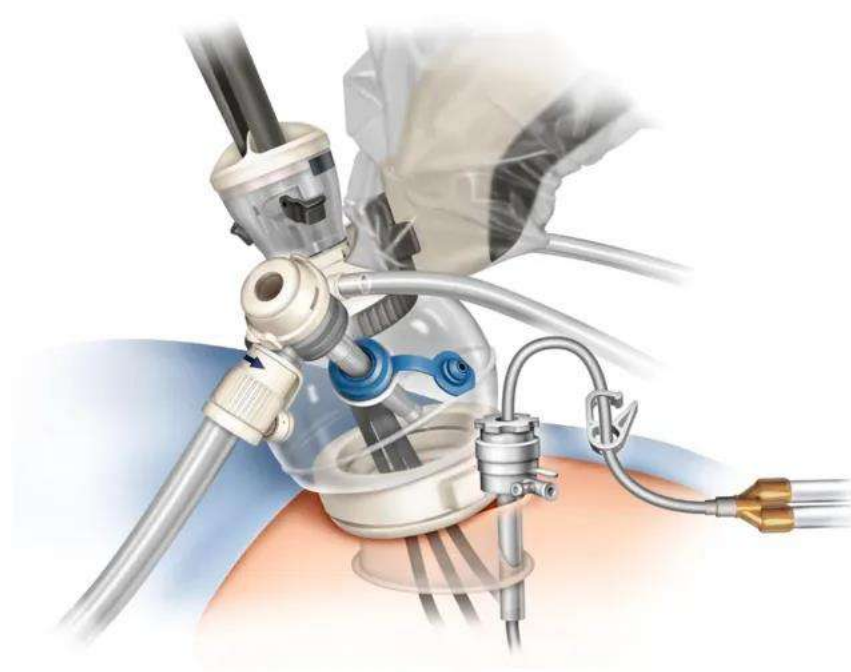
- Open introduction
- 25mm trocar use of a Single Port Acces (4-10cm incision)
 - 1 incision
 - Longer incision allows you to view intra abdominal structures



Reducing the risk of access injuries

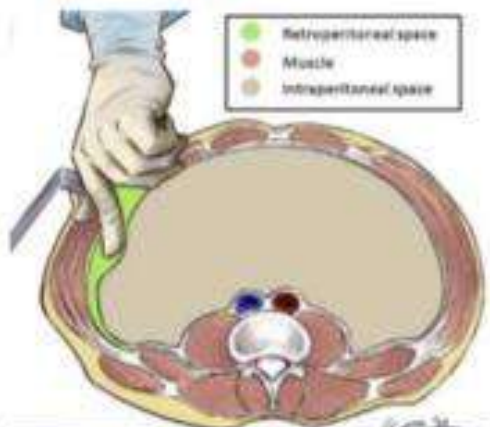


Single Port Robotic access



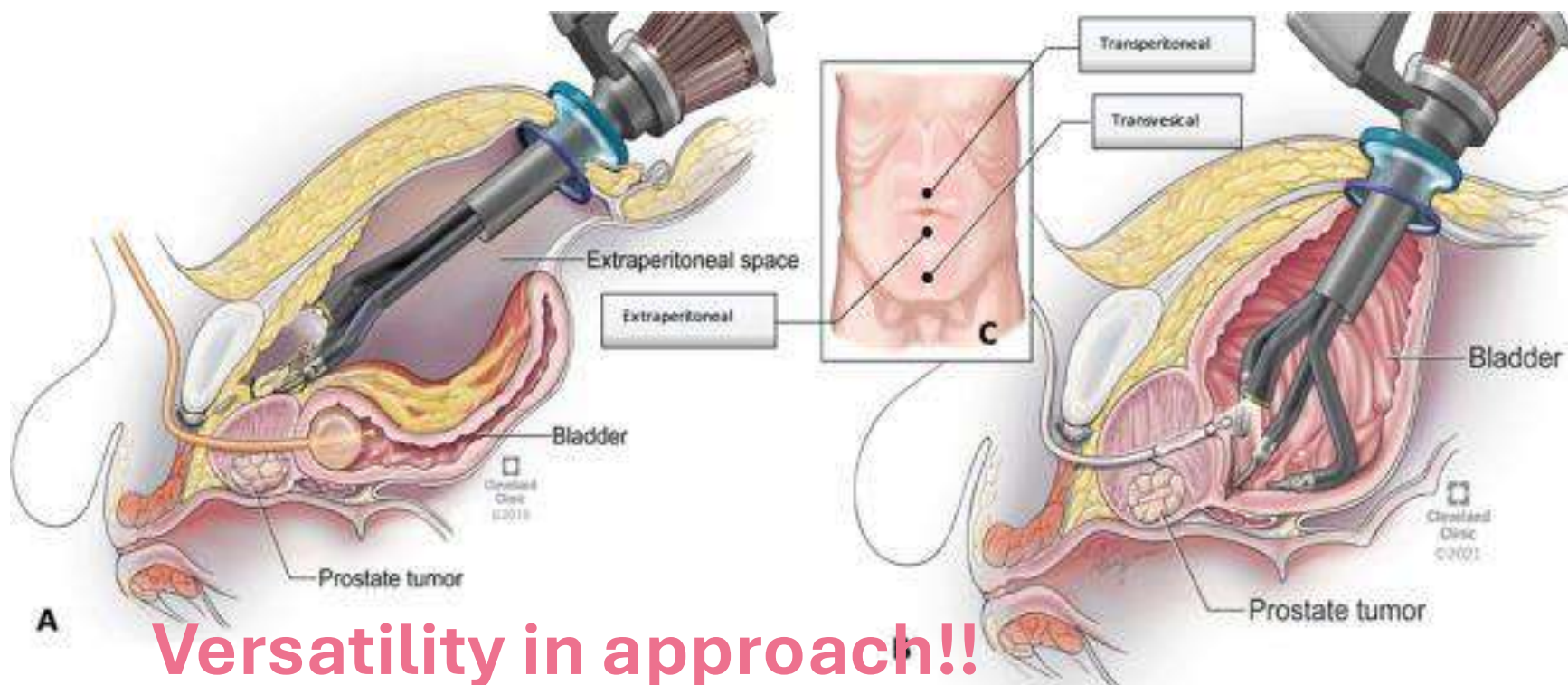
Plus one/side cart setup

Reducing the risk of access injuries



Single Port Robotic access

- Use of extraperitoneal access

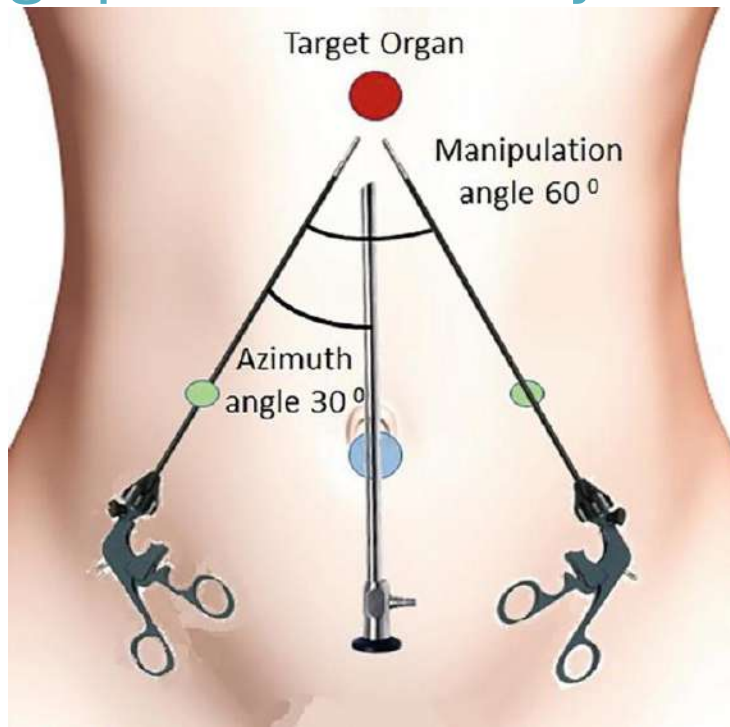


Versatility in approach!!

Improving access in small spaces

Multiport Robotic Surgery

- Need for triangulation
- Big space necessary



Single Port Robotic Surgery

- Allows to work in a tunnel
- Tennis ball size space

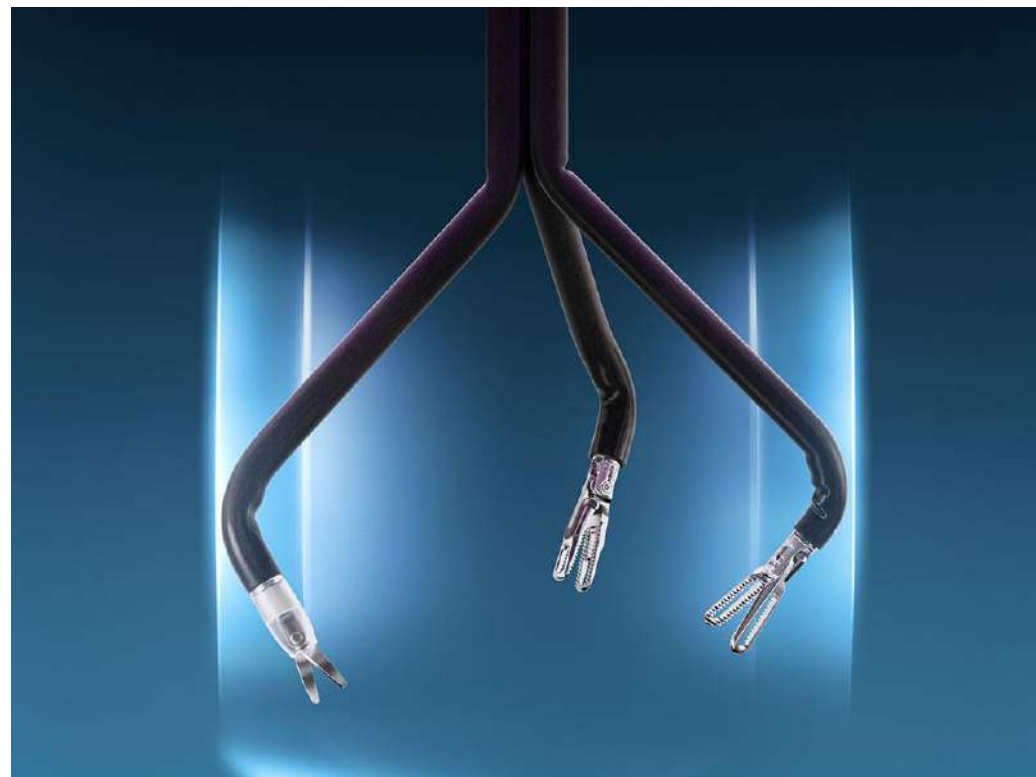


Improving access in small spaces

Need for a flexible camera

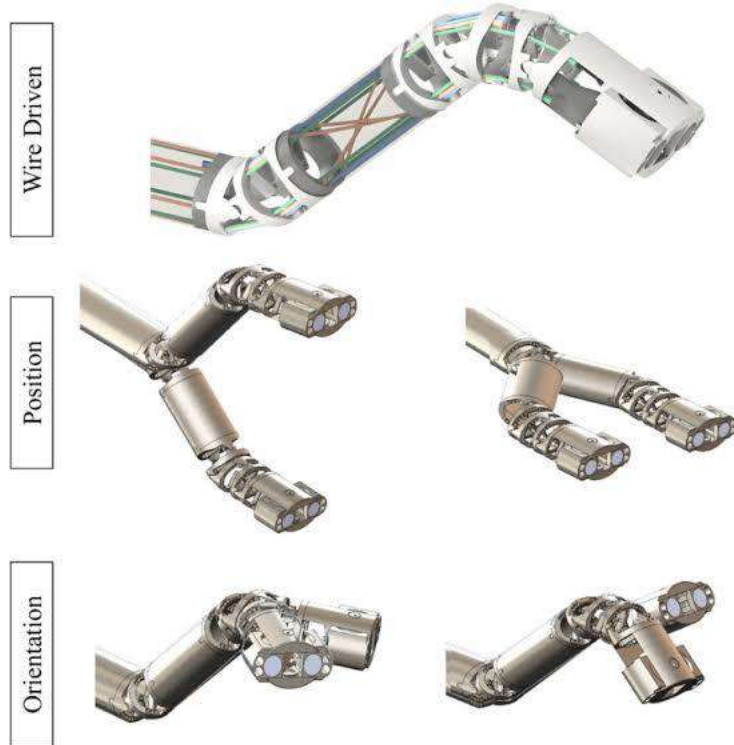


Need for flexible instruments



Improving access in small spaces

Need for a flexible camera

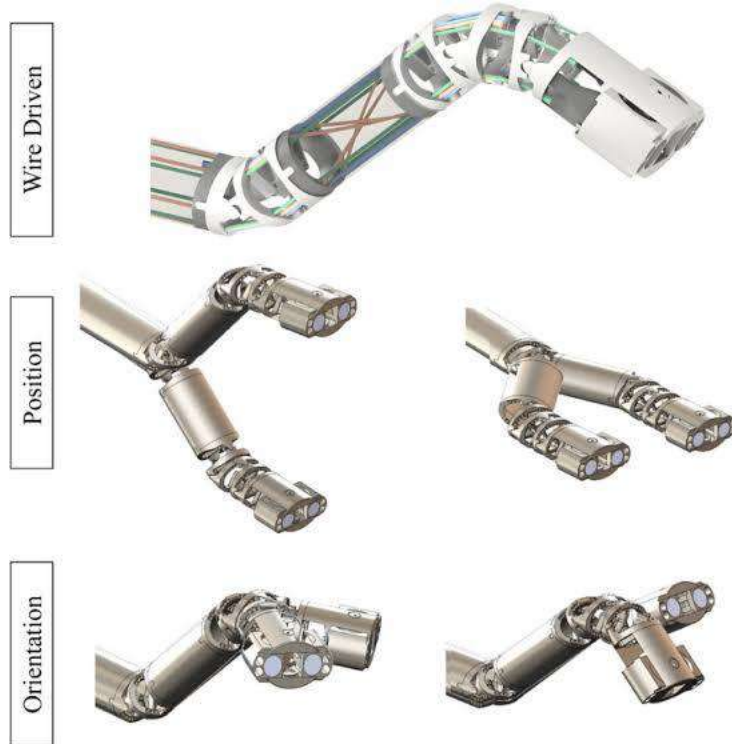


Need for flexible instruments



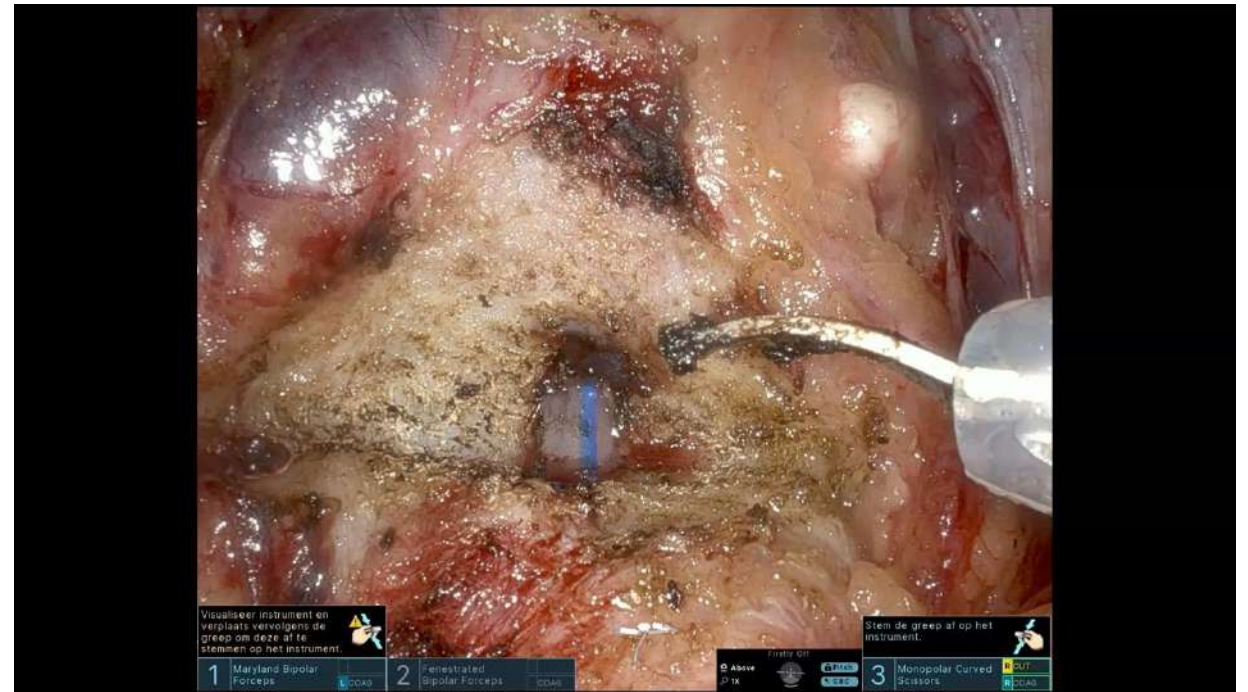
Improving access in small spaces

Need for a flexible camera



Better visualisation

- Maneuverability of the camera
- Use of Cobra position



Improving cosmetic outcomes

Multiport Robotic Surgery



Single Port Robotic Surgery



Improving cosmetic outcomes

Multiport Robotic Surgery



Single Port Robotic Surgery



Reducing pain

- ✓ Eight meta-analyses, pooled data shows:
 - ✓ Significantly shorter hospital stay
 - ✓ Smaller incision length
 - ✓ **Reduced postoperative pain**
 - ✓ **Lower opioid requirements**
 - ✓ Up to 50% reduction in post-op opioid use (Mayo Clinic)
 - ✓ Greater feasibility for ambulatory or same-day discharge pathways.

Comparative Study > J Robot Surg. 2026 Aug 11;20(1):821. doi: 10.1007/s11701-026-03793-9.

Single-port vs. multi-port robotic radical prostatectomy: an umbrella review of meta-analyses

Lalit Kumar ^{# 1}, Atanu Kumar Pal ^{# 2}, Yuhong Yuan ³, Rudra Prasad Ghorai ⁴, T A Kishore ⁵, Mahesh R Khairnar ⁶, Eleanor Burton ⁷, Abhinav Sidana ⁸, Sumit Saini ⁹

Reducing pain

✓ How?

- ✓ Fewer Abdominal Wall Traumas.
- ✓ Elimination of the Multi-Port "Torque"
 - ✓ Multiple pivot points of the trocars vs 1
- ✓ Extraperitoneal and Retroperitoneal Pathways
 - ✓ Avoiding peritoneal irritation
 - ✓ Avoiding intraperitoneal CO₂ and diaphragmatic irritation: less shoulder pain!
 - ✓ No manipulation of the bowel

Accelerating return to ADLs

- ✓ Less pain = shorter Length Of Stay
 - ✓ 336/485pt SP RALP: same day discharged: 69,3%.
 - ✓ Association with younger pt, absence of comorbidity, lower IPSS
 - ✓ US setting
- ✓ Less ileus: faster normal diet
- ✓ General advise: 2w no heavy lifting

> BJU Int. 2025 Feb;135(2):249-259. doi: 10.1111/bju.16483. Epub 2024 Jul 25.

Predictors for selection of outpatient single-port robot-assisted laparoscopic radical prostatectomy

Nicolas A Soputro¹, Roxana Ramos-Carpinteyro¹, Jaya S Chavali¹, Adriana M Pedraza¹,
Carter D Mikesell¹, Jihad Kaouk¹

Evidence on Single Port Robotic Surgery

Is it safe? Is it feasible? What about oncologic and functional outcome?

Perioperative complications

- Single Center study 804 pt
- RALP
- 484 SP vs 322 MP

✗ Differences

- Lower Blood loss (100ml vs 200ml, $p < 0,05$)
- Longer operating time SP (avg 23min)
- More lymphocoele with SP eLAD
 - Fenestration is solution: 8%=>2%
- More prior abdominal surgery SP
- Less Ventral hernia, less ileus

✓ Similarities

- 90d post-op complications, minor and major (SP 14,5% vs MP 14,6%)
- Readmissions (SP 5,2% vs MP 5.3%)

Comparative Study > J Endourol. 2024 May;38(5):450-457. doi: 10.1089/end.2023.0652.

Epub 2024 Apr 1.

Perioperative Complications of Single-Port and Multiport Robotic Radical Prostatectomy: A Single Institutional Comparison Analysis

Nicolas A Soputro¹, Jaya S Chavali¹, Roxana Ramos-Carpinteyro¹, Carter Mikesell¹,
Adriana M Pedraza¹, Jihad H Kaouk¹

Functional outcomes SP vs MP

- 50 SP versus 100 MP
 - Single surgeon
 - <50ml, no eLAD
- Similar continence rates
 - single-pad continence dates (30.5 vs. 51.9 days, $p = 0.145$)
 - zero-pad continence dates (105.5 vs. 146.2 days, $p = 0.210$)
 - 90-day single-pad continence rate was 92% vs. 82% ($p = 0.142$, 52% vs. 56% in zero-pad continence)
 - Similar oncologic outcome
 - margin positivity (14.7% vs. 11.7% in pT2, $p = 0.812$)

Comparative Study > J Robot Surg. 2024 May 8;18(1):205. doi: 10.1007/s11701-024-01950-6.

Faster both in operative time and functional recovery by the extraperitoneal daVinci SP-based robot-assisted radical prostatectomy: a propensity score matching analysis compared to transperitoneal multiport counterpart

Oncologic outcomes SP vs MP

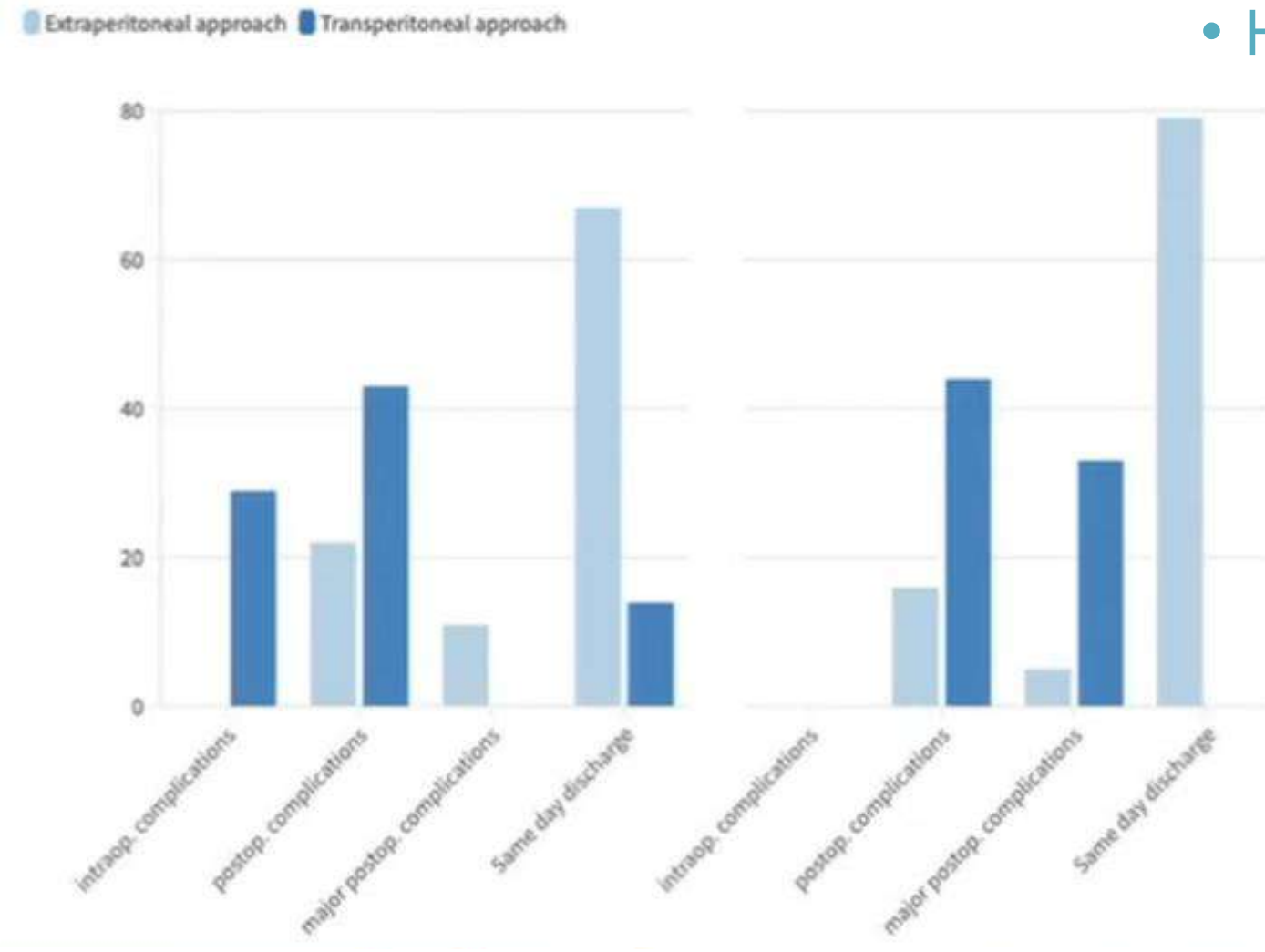
- 169 pt: SP 85 vs MP 84
- Single Surgeon
- eLAD included
- Similar 1-year biochemical recurrence-free survival rates among both groups ($P = 0.38$)
- Approach is NOT an independent predictor of biochemical recurrence (Univariate Cox, $P = 0.39$)
- Less lymph node yield
 - 2 vs 6 ($P < 0,001$)

> Urol Oncol. 2024 Nov;42(11):370.e15-370.e21. doi: 10.1016/j.urolonc.2024.06.007.
Epub 2024 Jul 14.

Pathologic and Short-Term Oncologic Outcomes of Prostate Cancer Patients Following Transvesical Robot-Assisted Radical Prostatectomy

Tarik Benidir ¹, Ethan L Ferguson ¹, Zaeem Lone ¹, Nicolas A Soputro ¹,
Roxana Ramos-Carpinteyro ¹, Christopher J Weight ¹, Jihad Kaouk ²

SP in Complex cases



• Highlights EP approach

- Lower intra-op complications
- Lower post-op complications
 - Minor AND major
- More same day discharge (US)
- No/Less trendelenburgh
- Less operation time in a hostile abdomen

(Relative) Contra-indications for SP

- Radical or partial nephrectomy
 - High BMI with extensive perinephric fat
 - Complex upper pole tumors
- Radical prostatectomy
 - Hostile extraperitoneum
 - (Bilateral) pre-pertoneal hernia surgery with mesh
 - Large prostates >70ml
 - Especially large medial lobes
 - ? Focal therapies
 - Radiotherapy and HIFU

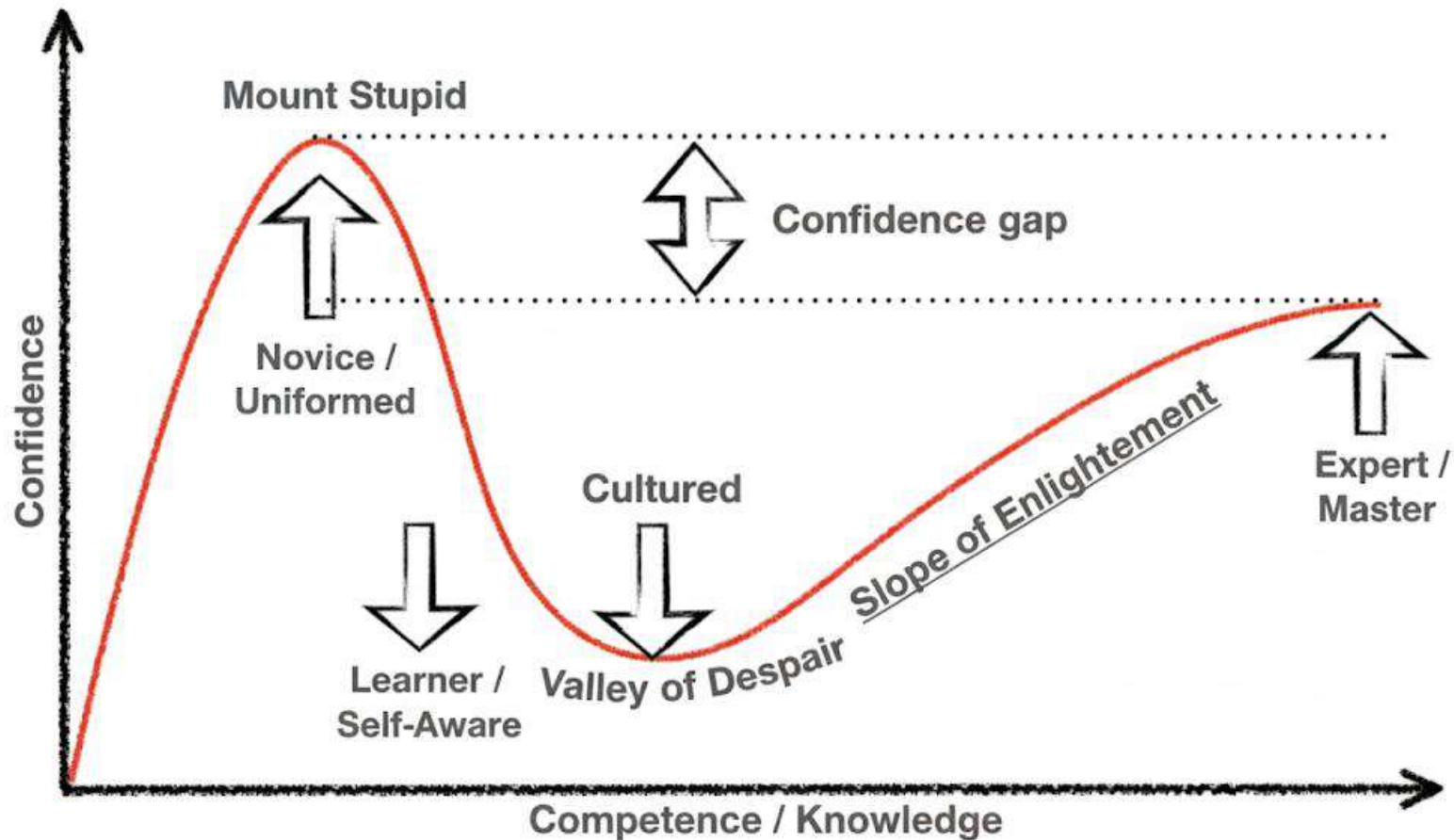


BMI is not a contra-indication for SP

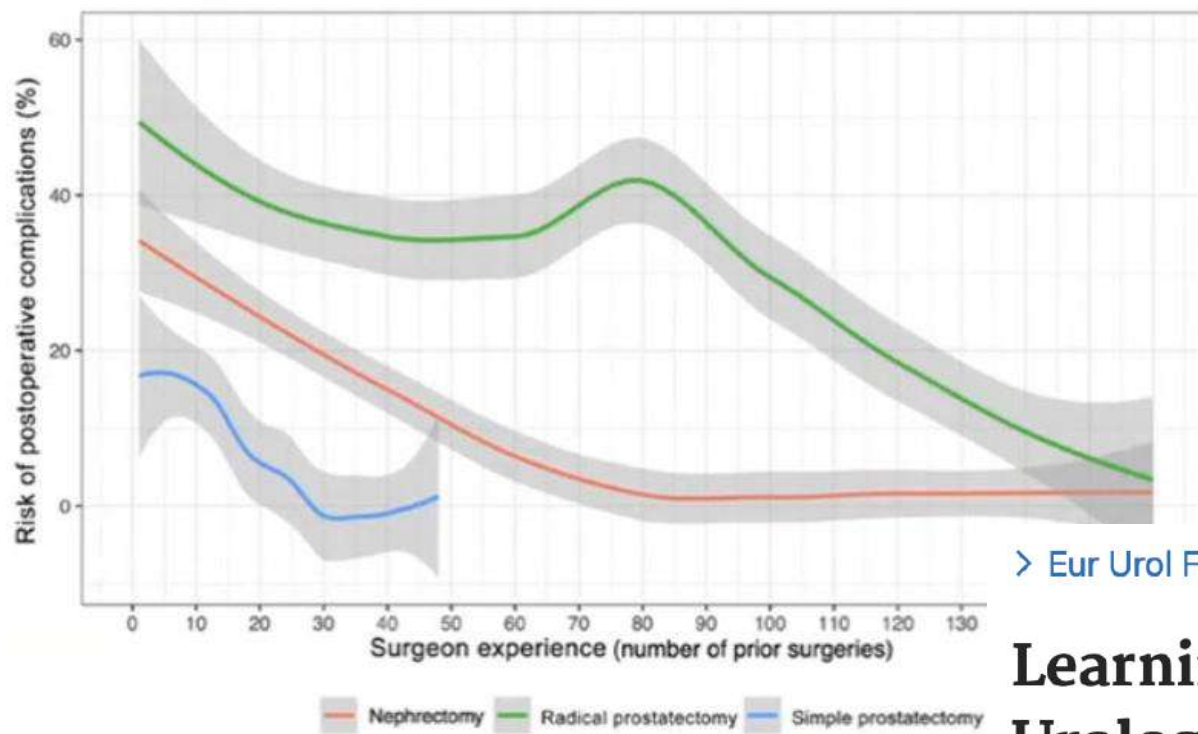
- Acces depends on fixed landmarks
 - LAA: SIAS
 - eRALP: 10cm above pubic bone
- Comfortable position for pt
- Fewer incisions=less infections
- Visceral/mesenteric fat eliminated by extraperitoneal approach
- Pannulus is manageable



Learning curve Single Port Robotics



Learning curve Single Port Robotics



- To achieve 6% complication rate

- SP RALP: 150 cases
- SP nephrectomy: 70

> Eur Urol Focus. 2025 Jan;11(1):136-141. doi: 10.1016/j.euf.2024.09.005. Epub 2024 Sep 20.

Learning Curve for Single-port Robot-assisted Urological Surgery: Single-center Experience and Implications for Adoption

Antony A Pellegrino¹, Francesco Pellegrino², Donato Cannoletta³, Ruben Sauer Calvo⁴, Juan Torres Anguiano⁴, Luca Morgantini⁴, Alberto Briganti², Francesco Montorsi², Simone Crivellaro⁴

Single Port Robotics in Bruges

- Longer OR time: +16 min ($p=0,04$)
 - Longer Console time +26min
 - Shorter induction: -3min
 - *Shorter docking: -3 min (trend)*
 - Shorter closing time: -10 min
- Larger prostate volume & SP
 - A/w longer stay ($p=0,006$)
 - A/w longer OR time ($p=0,038$)
- Shorter Hospital stay ($p= 4,6 \times 10^{-8}$)
 - SP: Median 32h (one night)
 - MP: Median 79h (3 night)

Parameter	SP gemiddelde	MP gemiddelde	p-waarde	Significant?
Inductie duur (min)	12,4	15,3	0,0235	✓ Ja
Chirurgische duur (min)	184,7	169,6	0,0177	✓ Ja
Docking (min)	12,6	15,5	0,0530	✗ Nee
Console tijd (min)	148,7	121,0	0,000053	✓ Ja
Total active time (min)	133,8	108,5	0,000038	✓ Ja
Sluittijd (min)	22,9	32,8	0,000009	✓ Ja
Totale tijd in/out (min)	216,3	200,6	0,0413	✓ Ja

Cost of Single Port Robotics

- Additional cost versus MP
 - RALP: + 36,5%
 - RAPN: + 39%
- Driven by higher instrument cost: 1041 – 1619 € per case

Cost Differential	
Monopolar Scissors	+\$240
Maryland Bipolar	+\$200
Needle Driver	+\$230
Non-energized Grasper	+\$215
Draping	+\$207
Trocars	+\$78 - 728
NET ADD'L COST	\$1,170 - \$1,820

	RALP		RAPN	
	Xi	SP	Xi	SP
Cases	290	102	223	20
Total Cost	\$658,630	\$316,228	\$518,803	\$64,663
Mean Cost per Case	\$2,271	\$3,100	\$2,326	\$3,233
Cost Differential	-	+36.5%	-	+39%

Cost of Single Port Robotics

Unpublished clinical outcomes with estimated cost savings - single surgeon experience

Dr. Frederic Baekelandt: Surgeon's own da Single Port Vinci data vs Multi Port data
RALP surgery



Dr. Baekelandt provided data for RALP SP da Vinci: period Q1 2025-2026 integrating , MP
Outcome measures reported in this presentation are selected based on the surgeon's interests and availability of relevant data.

Cost of Single Port Robotics

- Additional cost versus MP
 - RALP: + 36,5%
 - RAPN: + 39%
- Driven by higher instrument cost: 1041 – 1619 € per case
- Compensated by a shorter hospital stay: - 1061 €
 - Belgian Setting

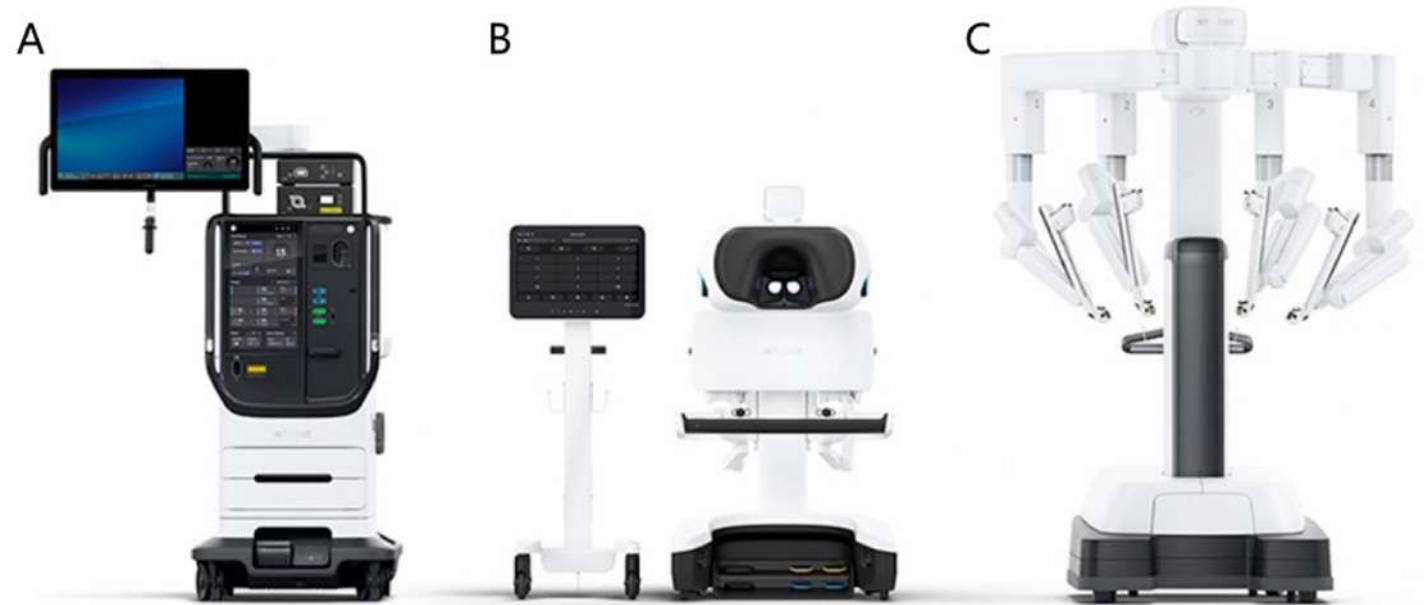


Multiport Robot anno 2026

The value of the Da Vinci 5 robot

Da Vinci 5 system

- ✓ Force Feedback instruments
- ✓ 10000x computing power
- ✓ Advanced data analytics
- ✓ Telepresence
- ✓ Surgeon ergonomics



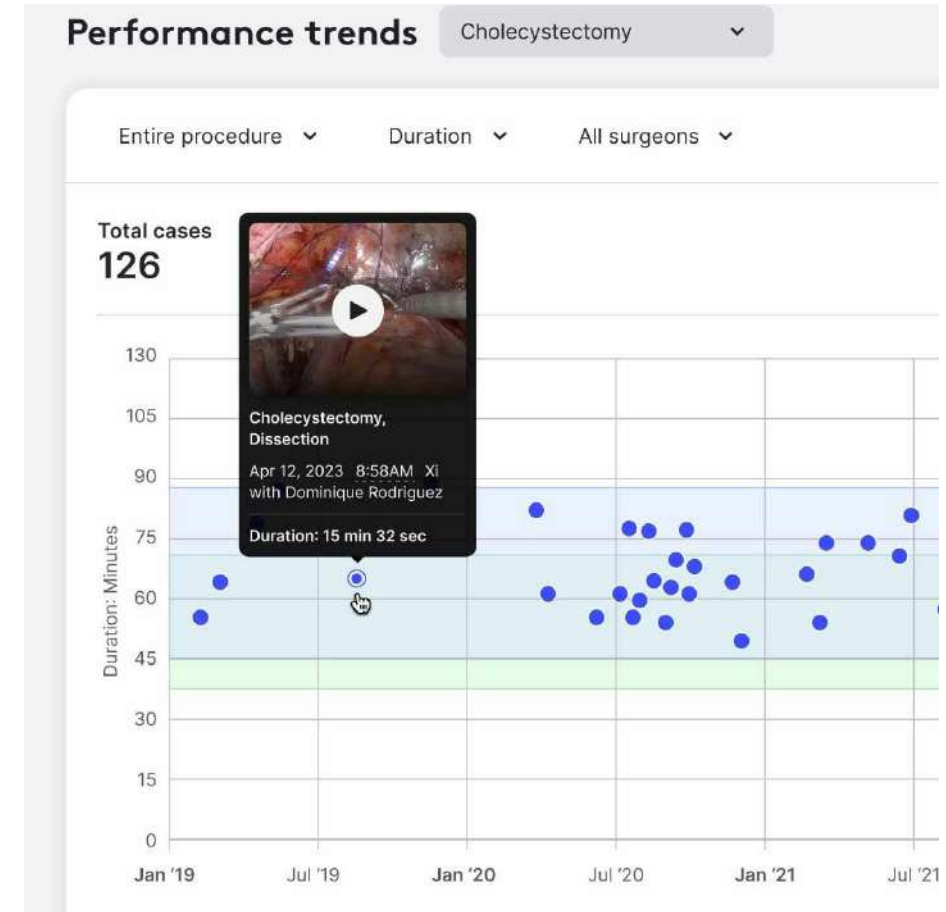
Da Vinci 5: Force Feedback instruments

- 1000x measurements per second of push, pull & directional forces
- 43% less force applied to tissues (ex vivo test)
 - Important for ex. Neurovascular bundle dissection: Erections!
- Per-operative feedback in joysticks, Post-operative feedback: Learning!



Da Vinci 5: Computing and Analytics

- 10000x computing power than iX system
- Use of AI for Case Insights®
 - Case analysis with advanced metrics
 - Segmented video review
 - Historical video analysis
- Framework to build new peroperative technologies to assist the surgeon



Da Vinci 5: Telepresence[®]

- Enable real time observation, collaboration and mentoring
- Helps to decrease learning curve with telepresence guidance of an experienced surgeon



Da Vinci 5: Surgeon Ergonomics

- Study 2017: Questionnaire
>400 surgeons
- 56,1% physical discomfort
 - Lower back stiffness a/w higher case volume
 - Neck stiffness
 - Finger fatigue
 - Eye problems a/w longer years of robotics

> [Surg Endosc.](#) 2017 Apr;31(4):1697-1706. doi: 10.1007/s00464-016-5160-y. Epub 2016 Aug 11.

Surgeons' physical discomfort and symptoms during robotic surgery: a comprehensive ergonomic survey study

G I Lee ¹, M R Lee ², I Green ³, M Allaf ⁴, M R Marohn ²

Da Vinci 5: Surgeon Ergonomics

- Lower back & neck stiffness
 - Flexible viewer with more degrees of freedom
- Eye problems
 - Updated Da Vinci Vision[®] system
 - 4x better resolution
 - Better true color
 - Better 3D imaging



Conclusion

Selecting the right patient for the optimal robotic tool

General considerations

Multiport Robotic System

- ✓ Large patients, lots of abdominal space
- ✓ Cosmesis less important
- ✓ Transperitoneal approach

Single Port Robotic System

- ✓ Smaller patients, less abdominal space
- ✓ Cosmesis of high importance
- ✓ Extraperitoneal approach, natural orifice surgery (ex. Hostile abdomen)

Radical prostatectomy considerations

Multiport Robotic System

- ✓ Transperitoneal approach
- ✓ Big prostates, prominent medial lobes
- ✓ Extended LAD

✗ Hostile abdomen: multiple (open) abdominal surgeries

Single Port Robotic System

- ✓ Extraperitoneal approach, transvesical approach
- ✓ Prostate volume <75ml
- ✓ LAD: fenestration!

✗ Hostile extraperitoneum: (bilateral) preperitoneal mesh

Partial Nephrectomy patients

Multiport Robotic System

- ✓ (very) Large tumors
- ✓ Anterior tumors
- ✓ Upper pole tumor
- ✓ Lots of perinephric fat
- ✓ Complex cases
 - ✓ Cooling
 - ✓ Very endophytic (deep) tumor

Single Port Robotic System

- ✓ <5cm tumors
 - ✓ (tennis ball working space!)
- ✓ Posterior tumor
- ✓ Lower-middle pole tumors
- ✓ High BMI without too much perinephric fat (ex. large belly)
- ✓ Hostile abdomen

Bedankt namens
Urologie Brugge!

Vragen?

Bijkomende vragen kunnen worden
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