

Tecniche innovative in chirurgia oncologica pediatrica
Chirurgia Mini-Invasiva e Robotica

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Policy

International Society of Paediatric Surgical Oncology (IPSO) Minimally Invasive Surgery (MIS) Guidelines

Israel Fernandez-Pineda[1], Simone de Campos Vieira Abib[2], Tristan Boam[1], Diego Aspiazu Salinas[3], Samer Michael[4], Justin Ted Gerstle[5], Steven Warmann[6], Jorg Fuchs[7], Alyssa Stetson[8], Gloria Gonzalez[9], Greg Tiao[8], Timothy B. Lautz[10], Rodrigo Chaves Ribeiro[11], Roshni Dasgupta[8], Jaime Shalkow-Klincovstein[12], Cristian Puerta[13], Andrew M. Davidoff[14], Marianna Cornet[15], Julien Grosman[15], Aurore Pire[15], Sabine Sarnacki[15], Thomas Blanc[15], Abdelhafeez H Abdelhafeez[16]

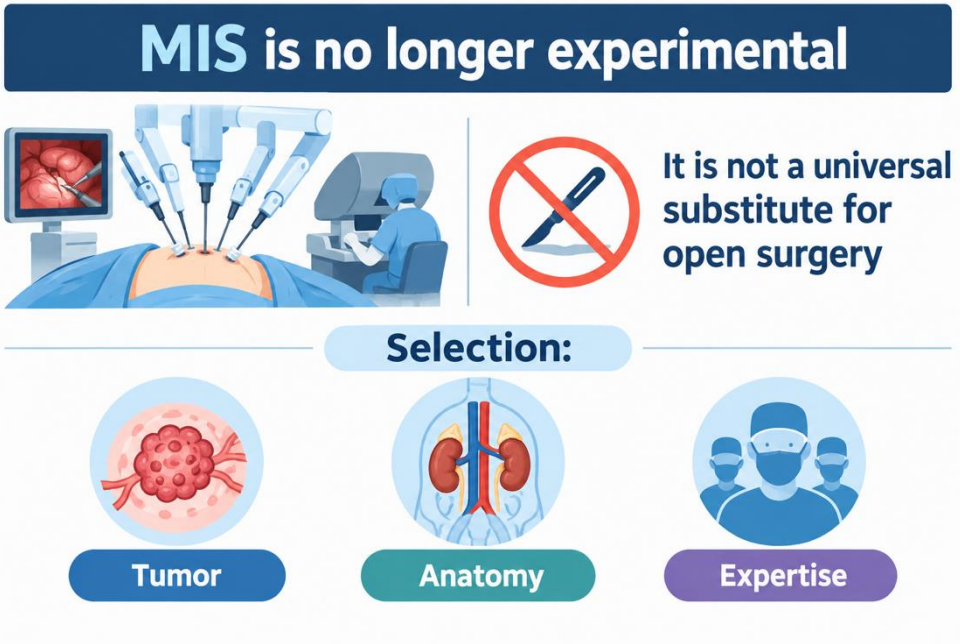
Why MIS in pediatric oncology

Potential benefit

- Less postoperative pain and morbidity
- Shorter hopitalization and faster recovery
- Early return to systemic treatment
- Ergonomics: better view and manipulation in narrow spaces
- Improved cosmesis

The non-negotiables

- Protocol-compliant resection
- No tumor spillage
- Adequate staging and lymphnode sampling
- Safe specimen extraction



What robotics changes – and what it does not

Robotics adds

- 3D magnified stable vision
- Wristed instruments / enhanced dexterity
- Motion scaling and tremor filtration
- Ergonomics for complex dissection
- Intracorporeal suturing / reconstruction
- Potentially better access to deep confined spaces

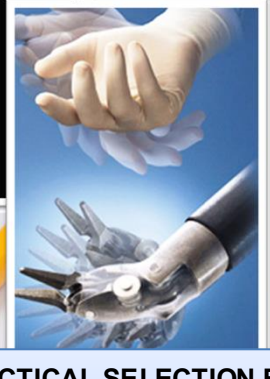
Robotics does NOT solve

- Poor patient selection
- Unfavourable biology/response
- Unsafe tumor handling
- Need for tactile palpation
- Need for en-bloc multivisceral resection beyond platform capability
- Lack of pediatric expertise or rescue capability







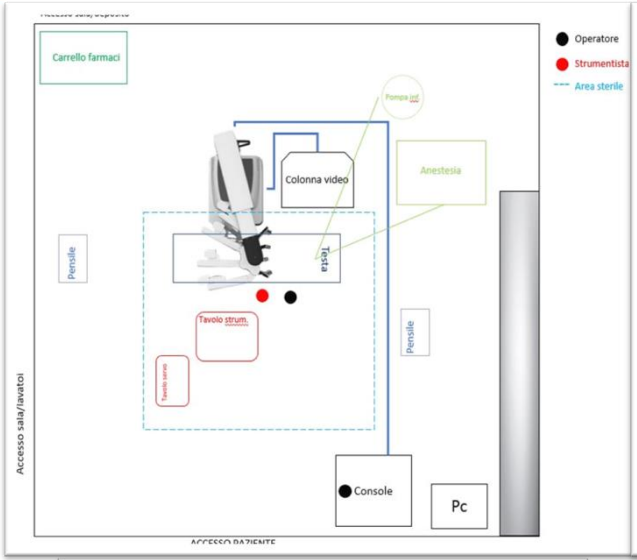


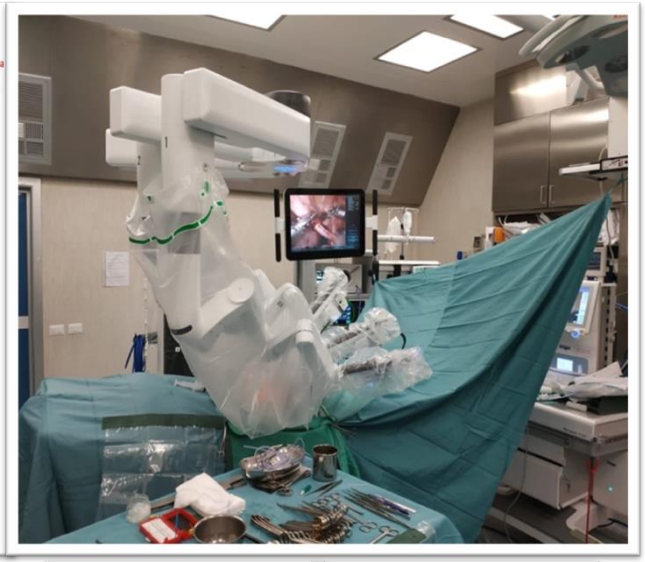


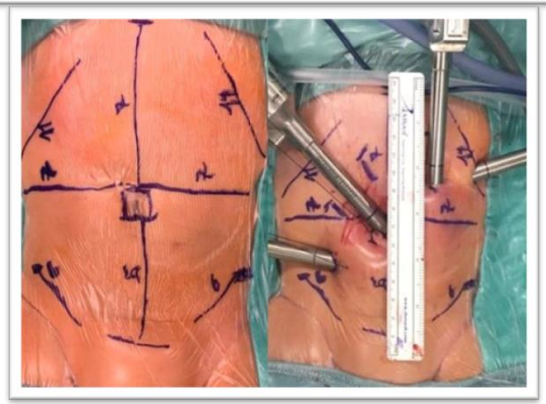


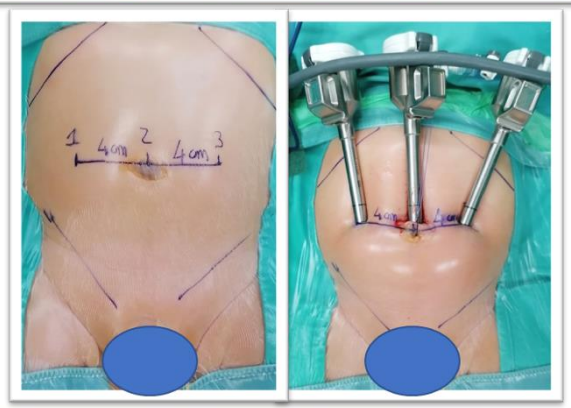
PRACTICAL SELECTION FILTERS

Tumor biology / protocol
Imaging-defined anatomy
Tumor size & working space
Expected surgical objective
Patient physiology
Team experience
Immediate conversion capability

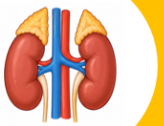

Carrello farmaci
Operatore
Strumentista
Area sterile
Colonna video
Anestesia
Pensile
Tenia
Tavolo strum.
Pensile
Console
Pc
Accesso sala/avatoi






1
4cm
2
4cm
3

Where MIS currently fits



Neurogenic tumors

- Selected abdominal/adrenal & posterior mediastinal lesions
- Robotic: particularly relevant



Renal tumors

- Highly selected post-neoadjuvant cases
- NSS > MIS
- Robotic: role evolving



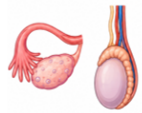
Mediastinal / Thoracic

- Selected neurogenic, thymic, germ-cell lesions
- Robotics increasingly attractive



Pulmonary metastases

- Selected peripheral nodules; localization (ICG)
- Thoracoscopy > robotics



Ovarian / Gonadal

- Diagnostic, staging, cystectomy / fertility-sparing selected cases
- Robotic: niche



Liver tumors

- Selected peripheral / favorable resections; biopsy & ablation
- Robotic: role evolving

Neuroblastoma: the test case for robotic oncology

Where MIS fits

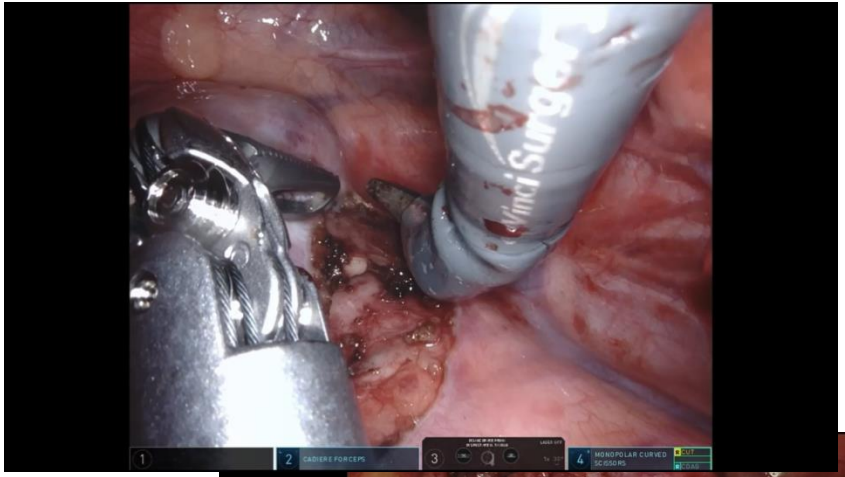
- Smaller-volume abdominal/adrenal tumors
- Favorable anatomy / limited vascular contact (IDRFs)
- Consider response to chemotherapy

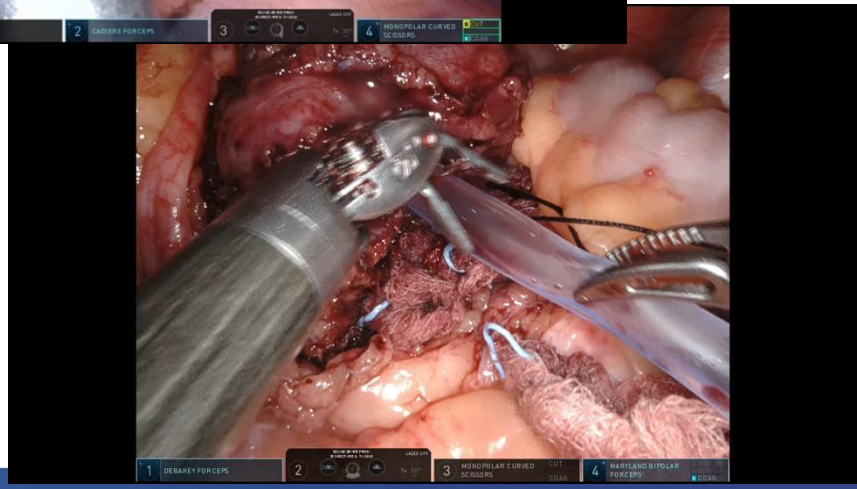
Where robotics may add value

Precise dissection around renal hilum, aorta and celiac region

Thoracic apex – deep pelvis

Potentially expands MIS beyond conventional laparoscopy





Wilms & Renal tumors

Selected MIS scenario

- Nephrectomy vs NSS?

  NSS > MIS …but robotic NSS fits the best

- Response to preoperative chemotherapy?
- Rupture / spillage risk?
- No renal-vein / IVC thrombus
- No extra-renal invasion
- Lymphnode sampling
- Protected specimen extraction

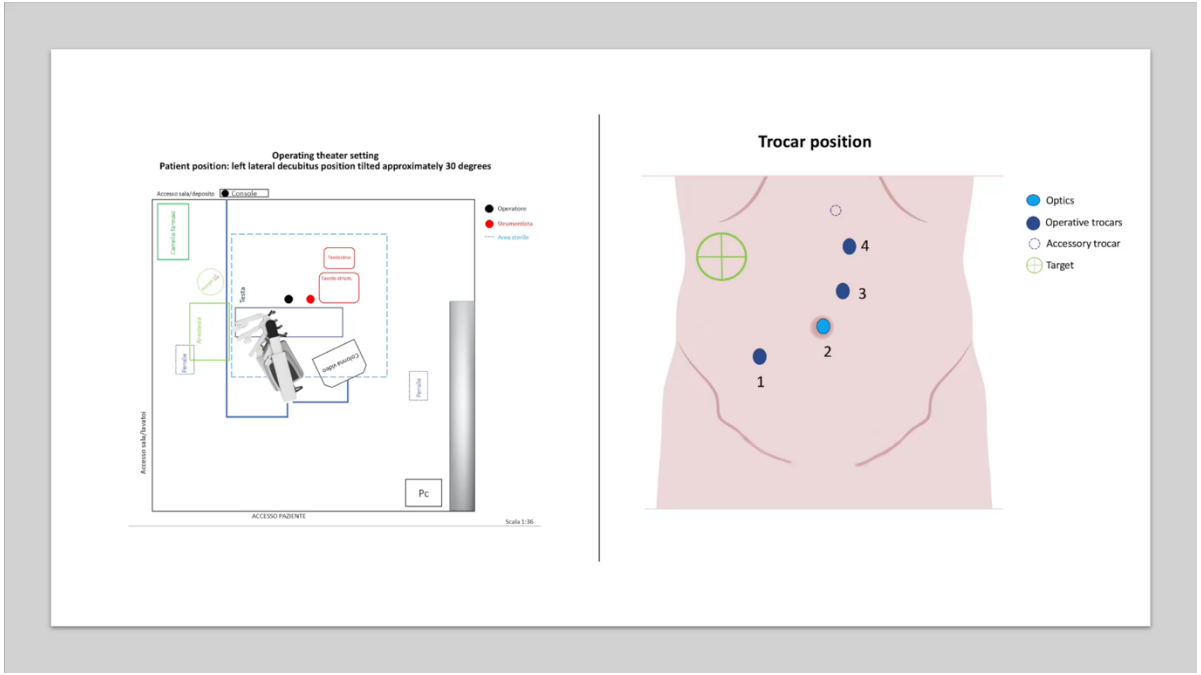
Attention please!

✓ WT

✓ CMN

✓ RCC – CCSK

X MRTK



Mediastinal / thoracic tumors

Mediastinal / thoracic

Selected posterior mediastinal neurogenic tumors

Selected thymic / germ-cell lesions

Small, accessible masses with safe planes

Robotic advantage: 3D vision + wristed dissection in a confined space (thoracic apex)

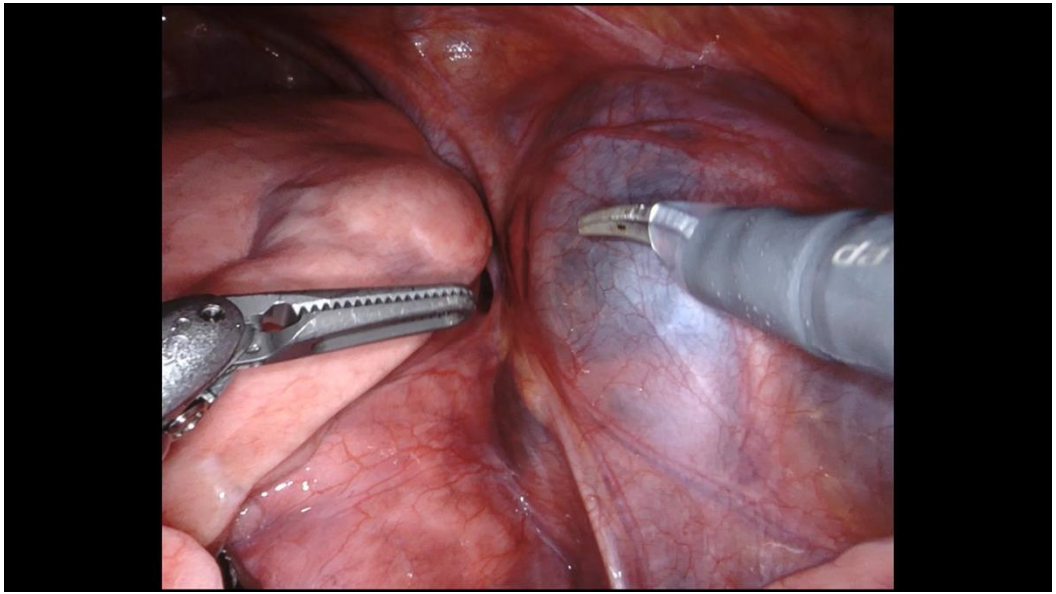
Avoid MIS when…

Large/invasive mass

Great-vessel, tracheal or esophageal encasement

Central pulmonary lesions near hilum

Severe cardiopulmonary compromise / inability to tolerate one-lung ventilation



Anticipate complications!



Robot-assisted versus conventional minimally invasive surgery in the treatment of paediatric neuroblastoma: a single-centre retrospective study

Avanzini S, Reali S, et al. Pediatr Surg Int. 2026

AIM

To describe the evolution of clinical practice and technological transition within a high-volume pediatric oncology center

METHODS

Retrospective cohort study 2008–2025
MIS (Lap / Robotic) NB resection

MAIN RESULTS

84 children
- 38 Laparoscopy
- 46 Robotic

35% IDRF-positive at surgery
- 8% Laparoscopy
- 57% Robotic

Conversion rate: 13% (1 urgent)
- 2,6% Laparoscopy
- 22% Robotic

Conventional Laparoscopy IDRF	Robotic surgery IDRF
Sublavian vessels:1*	Infiltrating T9-T12: 4
Iliac vessels:1	Hepato duodenal ligament:1
Infiltration of other organs:1	Renal pedicle: 9 (4*)
	Iliac vessels: 2 (1*)
	Sciatic notch: 1
	Spinal canal invasion: 3
	Duodeno-pancreatic block: 1
	Infiltration of other organs: 1
	Aorta / IVC: 2 (1*)
	SMA: 1*

TECHNOLOGICAL TRANSITION

Explore and expand the boundaries of minimally invasive surgery

Offer MIS to IDRF-positive patients who, according to previous criteria, would probably have undergone an open procedure

System	Complication	Short-intermediate	Long term	Infrastructure needed
Vascular	• Primary haemorrhage • Secondary Haemorrhage • Vascular recontruction	✓		Vascular surgeon, blood transfusion
Chyle	• Chylous fistula	✓		TPN, octreotide, IR drainage
Renal	• Atrophy	✓	✓	Nephrology, dialysis
Respiratory	• Pleural effusion • Atelectasis, pneumonia	✓		ICU, invasive/non invasive ventilation
Gastrointestinal	• Bowel obstruction • Diarrhoea	✓	✓	Surgery
Hepatobilary	• Biliary obstruction • Bile leak • Pancreatic leak/fistula	✓		IR, hepatobiliary surgery
Endocrine	• Adrenal insufficiency	✓	✓	Endocrinology, ICU
Neurology	• Phrenic nerve • Brachial plexus • Spinal cord ischaemia • Lumbosacral plexus	✓	✓	Neuromonitoring, neurosurgery, rehabilitation

Calibrate complexity with infrastructure Facilities

Referral to Reference Centre

New technologies: from “less invasive” to “more precise”

Fluorescence

- ICG for anatomy/perfusion
- Tumor-targeted fluorescence is emerging
- Potential role in localization and margin assessment (parenchymal sparing)



Miniaturized robotics

- Smaller instruments
- Improved port spacing
- Pediatric-specific platforms
- Potential expansion to smaller children



AI / data

- Automated image interpretation
- Risk prediction
- Procedure planning
- Outcome registries



Image-guided surgery

- 3D reconstruction
- Virtual planning
- Preoperative localization of pulmonary nodules
- Navigation integrating imaging with the operative field



Take Home

MIS is a clinical strategy, not a surgical ideology

Open surgery remains the reference when oncologic safety, staging or technical control is at risk

Robotics is most compelling where conventional laparoscopy is technically constrained

Neuroblastoma is currently the most developed field for robotic oncology, but selection is critical

Protocol → imaging → anatomy → surgical objective → platform → rescue plan

References

1. Fernandez-Pineda I, et al. International Society of Paediatric Surgical Oncology (IPSO) Minimally Invasive Surgery Guidelines. ecancer. 2026;20:2076. doi:10.3332/ecancer.2026.2076.

2. Fernandez-Pineda I, Abib SCV. General principles of minimally invasive surgery in paediatric surgical oncology. ecancer. 2025.

3. Warmann SW, Fuchs J. Minimally invasive surgery in paediatric nephroblastoma. ecancer. 2025.

4. Shalkow-Klincovstein J, Puerta C, Davidoff AM. The role of minimally invasive surgery in paediatric mediastinal masses and thoracic tumours. ecancer. 2025.

5. Lautz TB, Ribeiro RC. Role of minimally invasive surgery in paediatric pulmonary metastatic disease. ecancer. 2025.

6. Stetson A, Gonzalez G, Tiao GM. The role of MIS in the management of paediatric liver tumours. ecancer. 2025.

7. Stetson A, Dasgupta R. Ovarian neoplasms — the role of minimally invasive surgery. ecancer. 2025.

8. Blanc T, et al. Robotic Surgery in Pediatric Oncology: Lessons Learned from the First 100 Tumors—A Nationwide Experience. Ann Surg Oncol. 2021.

9. Svetanoff WJ, et al. Robotic-assisted Pediatric Thoracic and Abdominal Tumor Resection: An Initial Multicenter Review. J Pediatr Surg. 2024.

10. Avanzini S, et al. Development of a new score based on Image Defined Risk Factors to standardize surgical risk in neuroblastoma resection. J Pediatr Surg. 2025.


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