UGIRA
The Upper GI International Robotic Association

LANDESWEITE
QUALITÄTSKONFERENZ
IN RHEINLAND-PFALZ

ZUM THEMA MAGEN- UND PANKREASKARZINOM

MITTWOCH, DEN 6. NOVEMBER 2024

Neue Standards in der modernen Chirurgie beim Magen- und Kardiakarzinom

Peter Grimminger

Klinik für Allgemein-, Viszeral- und Transplantationschirurgie

JG|U UNIVERSITÄTSmedizin. MAINZ

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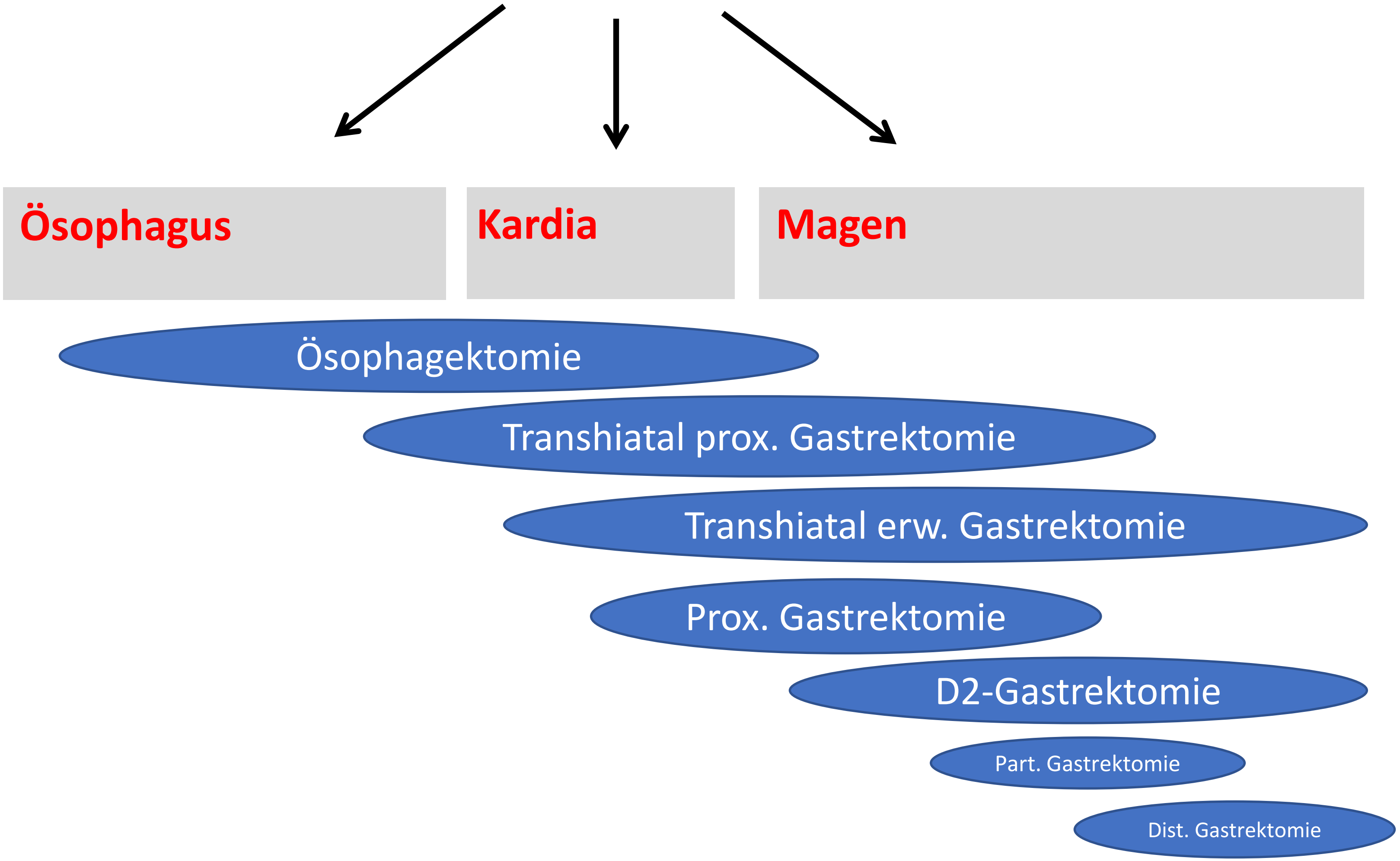
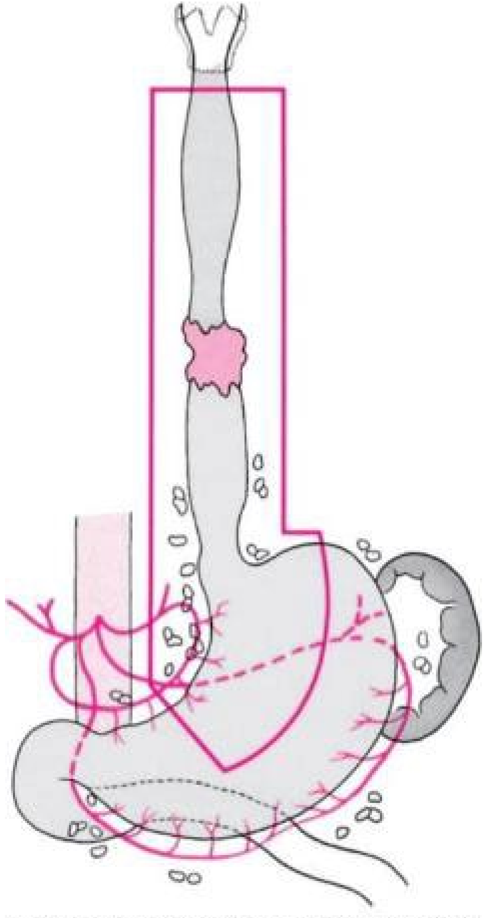
Zertifiziertes Viszeralonkologisches Zentrum für
Darmkrebs
Pankreaskrebs
Magenkrebs
Leberkrebs

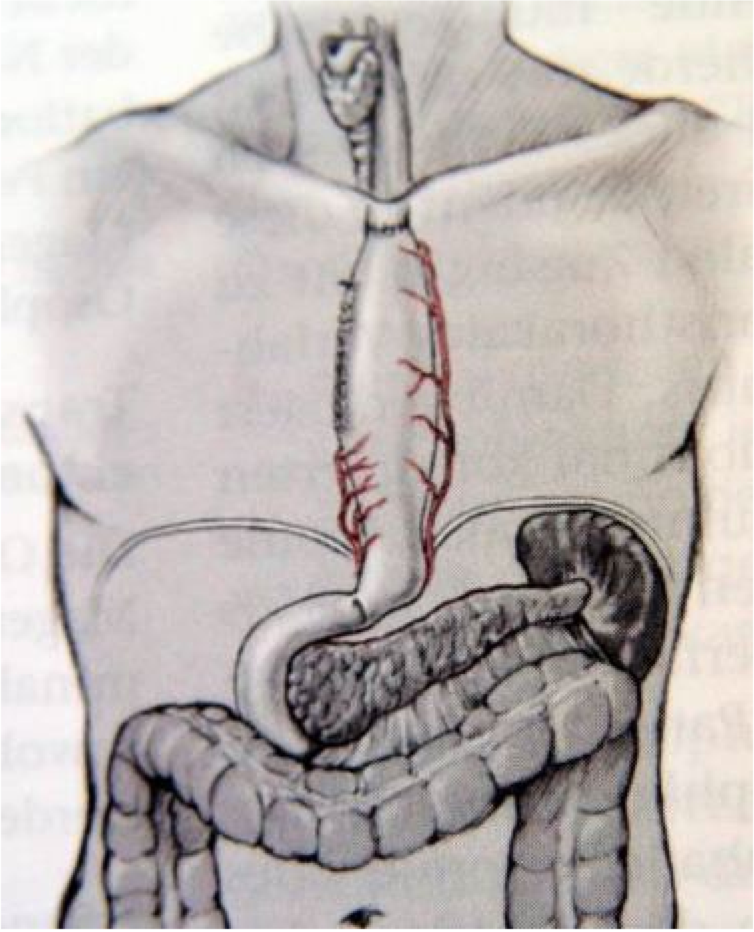
OP Prinzipien bei ösophagogastrischen Tumoren



OP Prinzip - Ösophagektomie



Aus Berchtold/Bruch/Trentz: Chirurgie. © 2006 Elsevier GmbH



OP Prinzip - Ösophagektomie

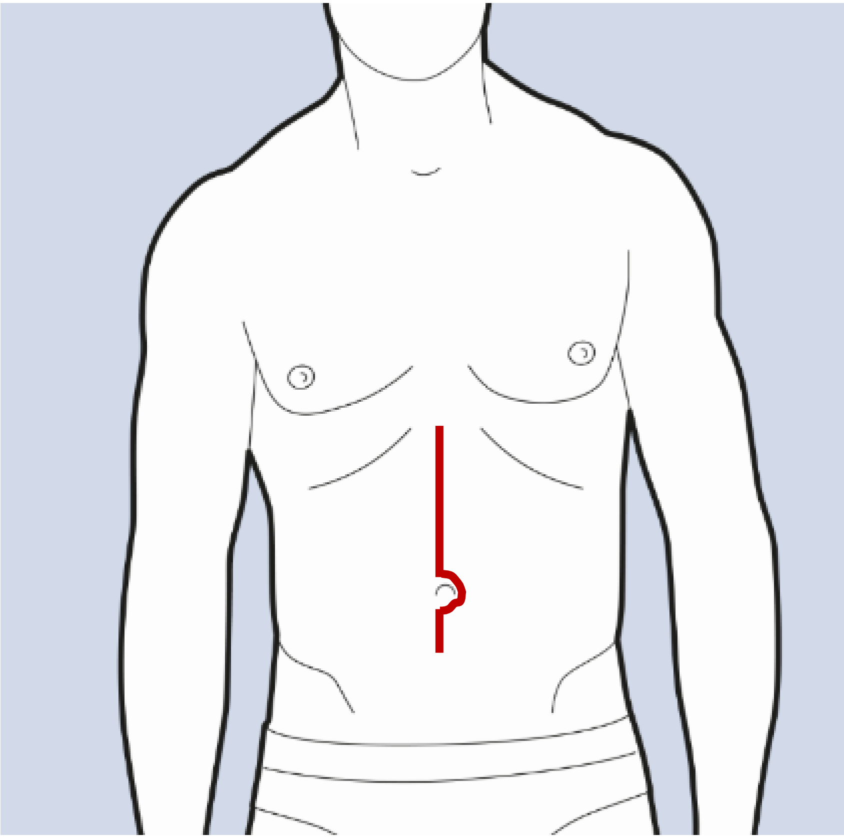
transthorakale Ösophagektomie & Magenhochzug

“minimally-invasive”

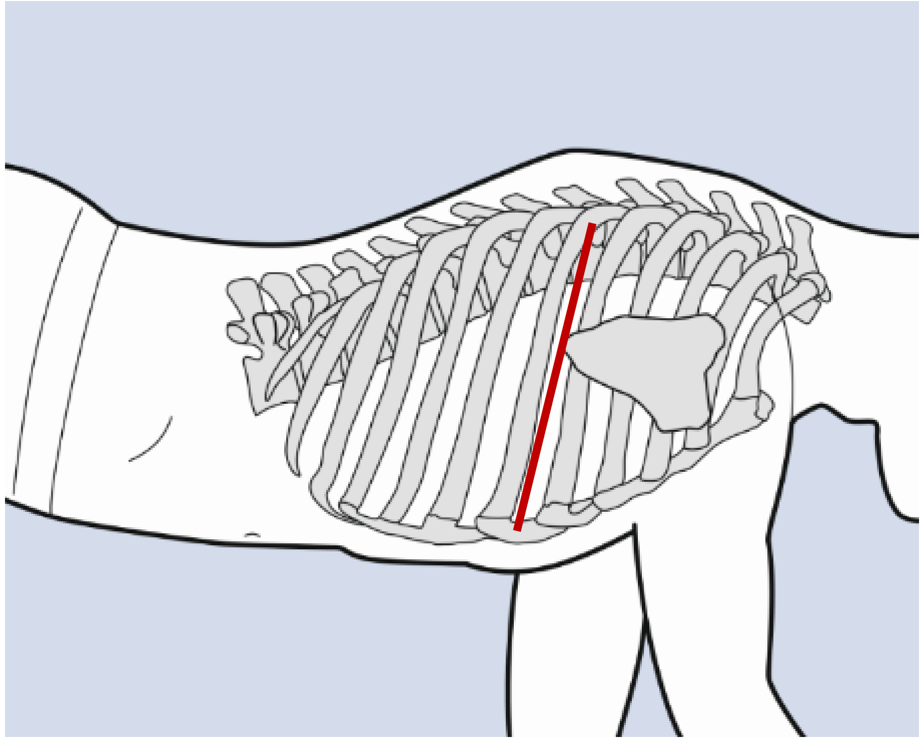
	offene OP	**Hybrid OP**	**Total minimal-invasive OP**
ABDOMEN -Gastrolyse -LAD	offen	MI	MI / robotic
THORAX -Ösophagektomie -LAD -Magenhochzug	offen	offen	MI / robotic

OP Prinzip – offene Ösophagektomie

Abdomen

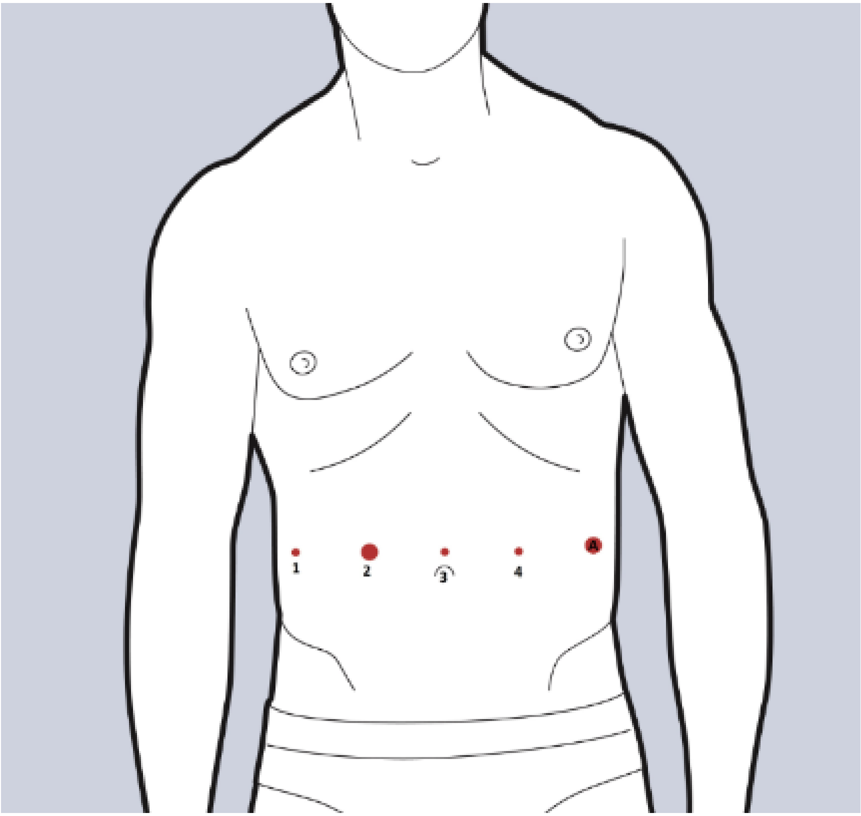


Thorax

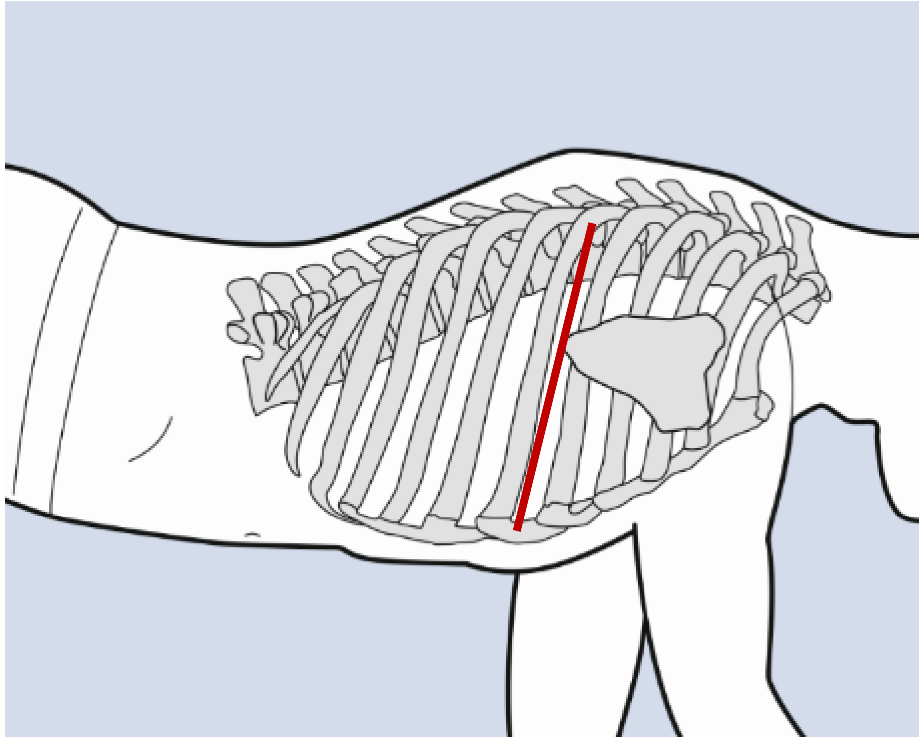


OP Prinzip – Hybrid Ösophagektomie

Abdomen

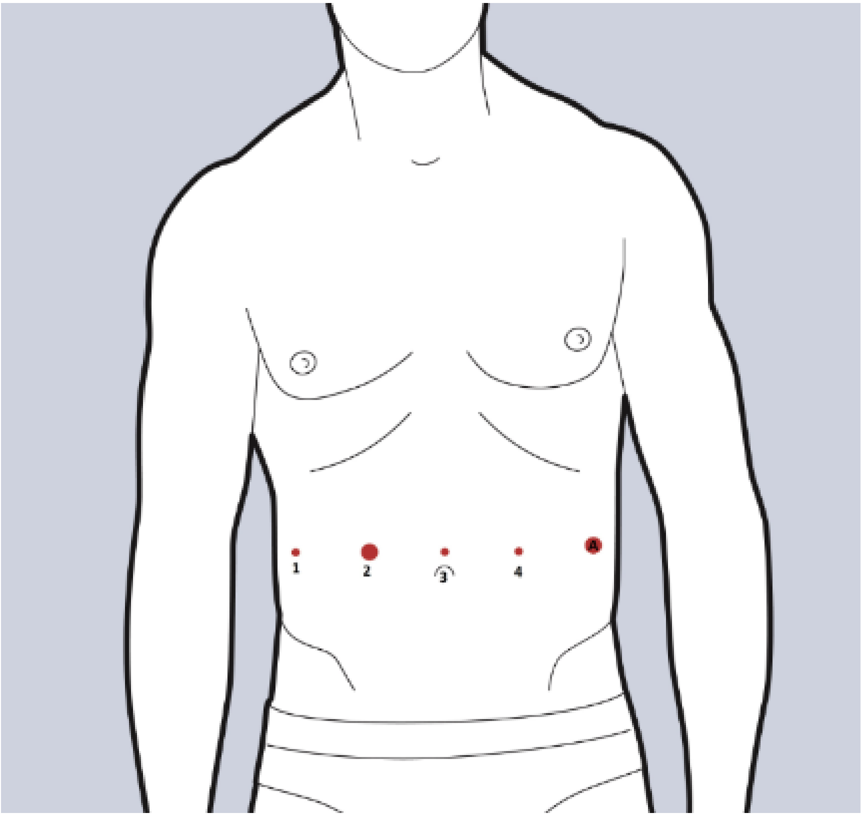


Thorax

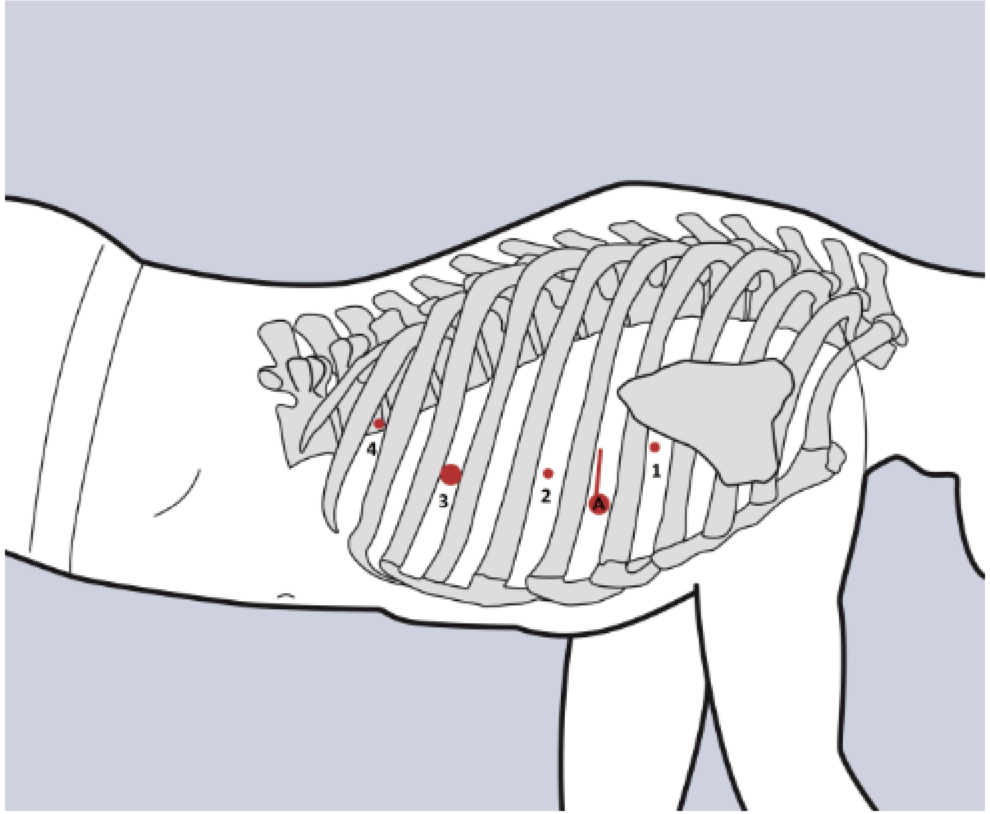


OP Prinzip – MI / robotische Ösophagektomie

Abdomen



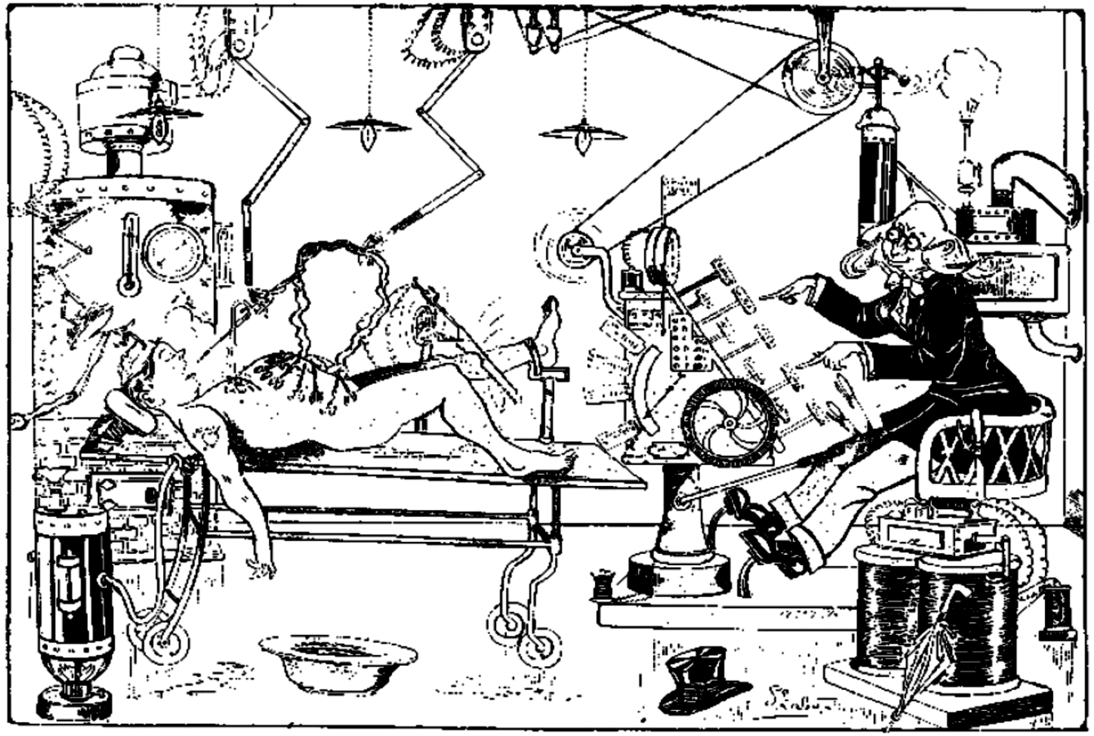
Thorax



Overview ROBOTIC –
general

Overview ROBOTIC –

Development in surgery



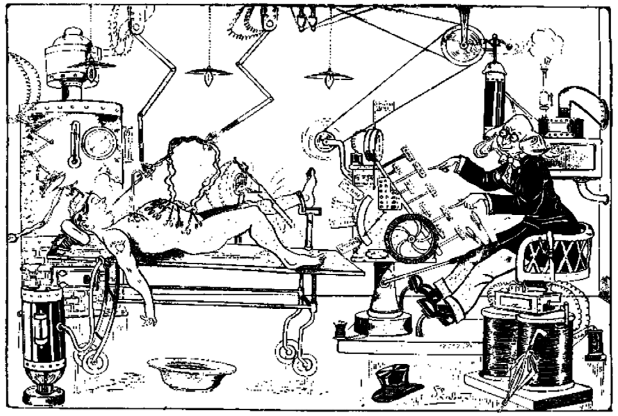
UNE SALLE D'OPÉRATIONS EN L'AN 2000

A French comic drawing from 1914 showing how the artist envisioned the operating room of year 2000

Overview ROBOTIC –

Development in surgery

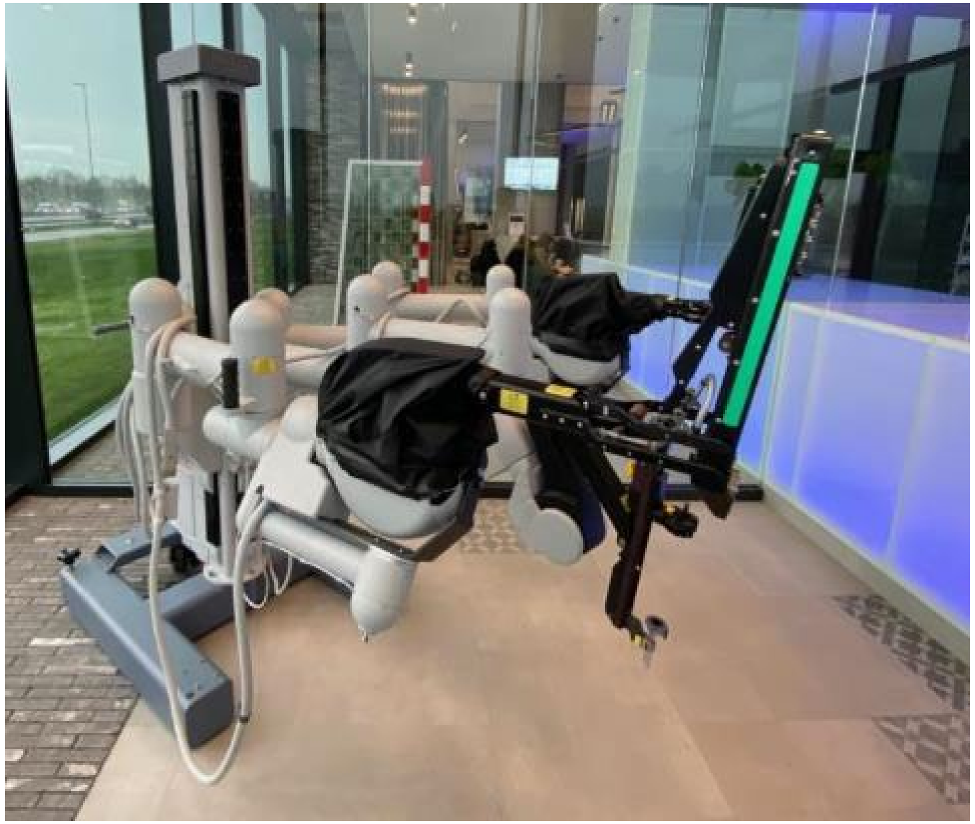
DaVinci S, 1999



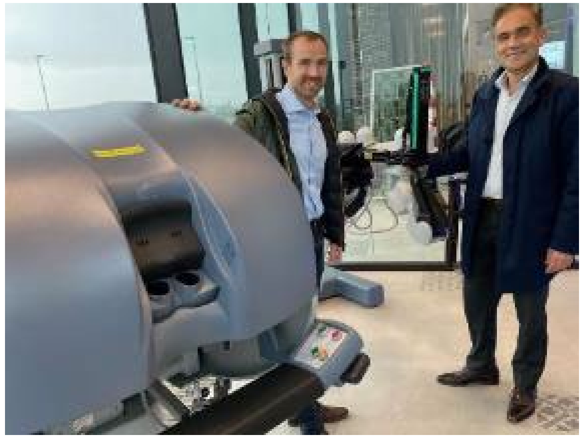
UNE SALLE D'OPERATIONS EN L'AN 2000

A French comic drawing from 1914 showing how the artist envisioned the operating room of year 2000

Overview ROBOTIC –
Development in surgery



ORSI - Gent



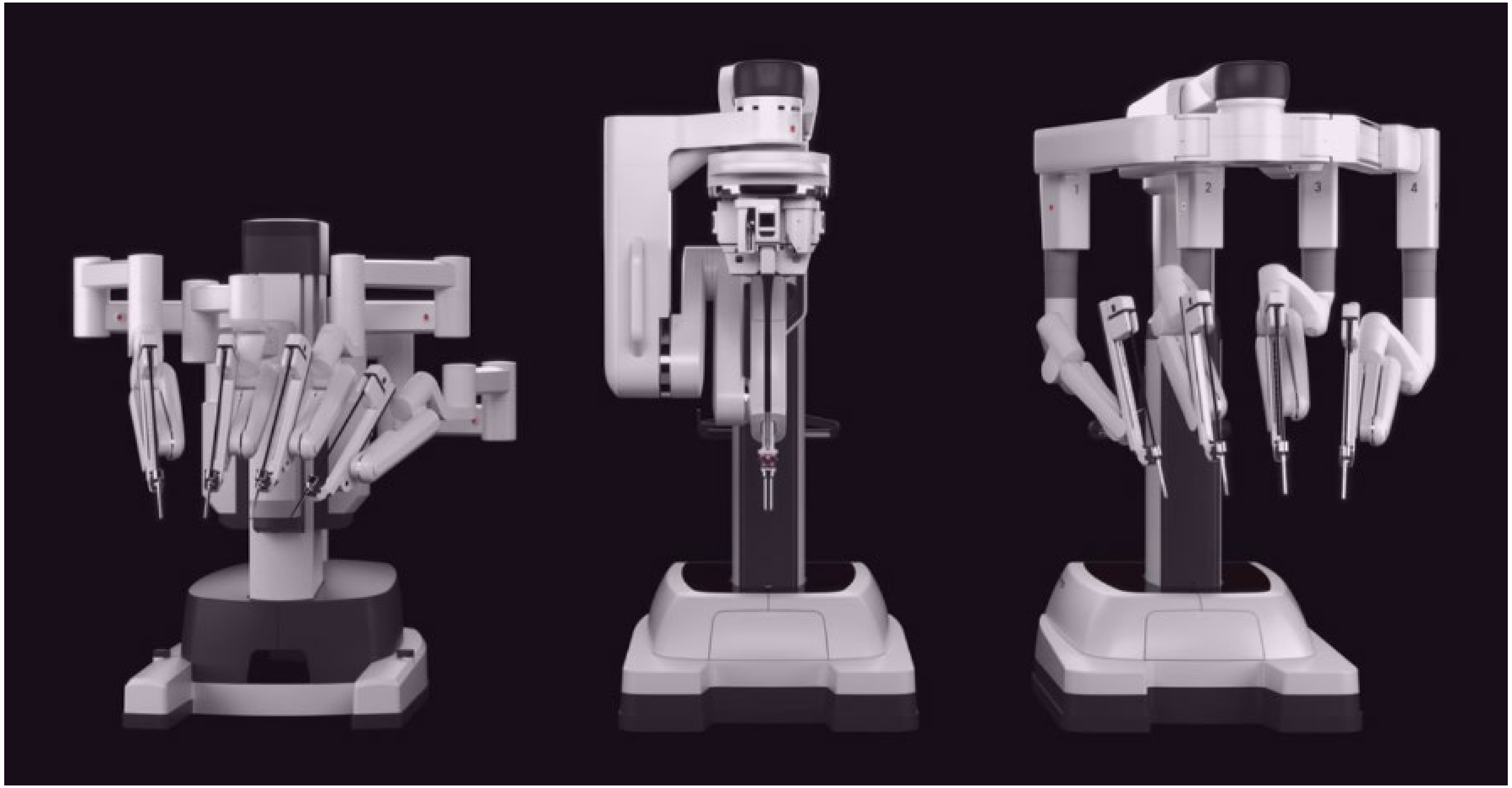
Overview ROBOTIC –

Development in surgery

The da Vinci S Surgical system.

1999 Entwicklung in 10 Jahren 2009

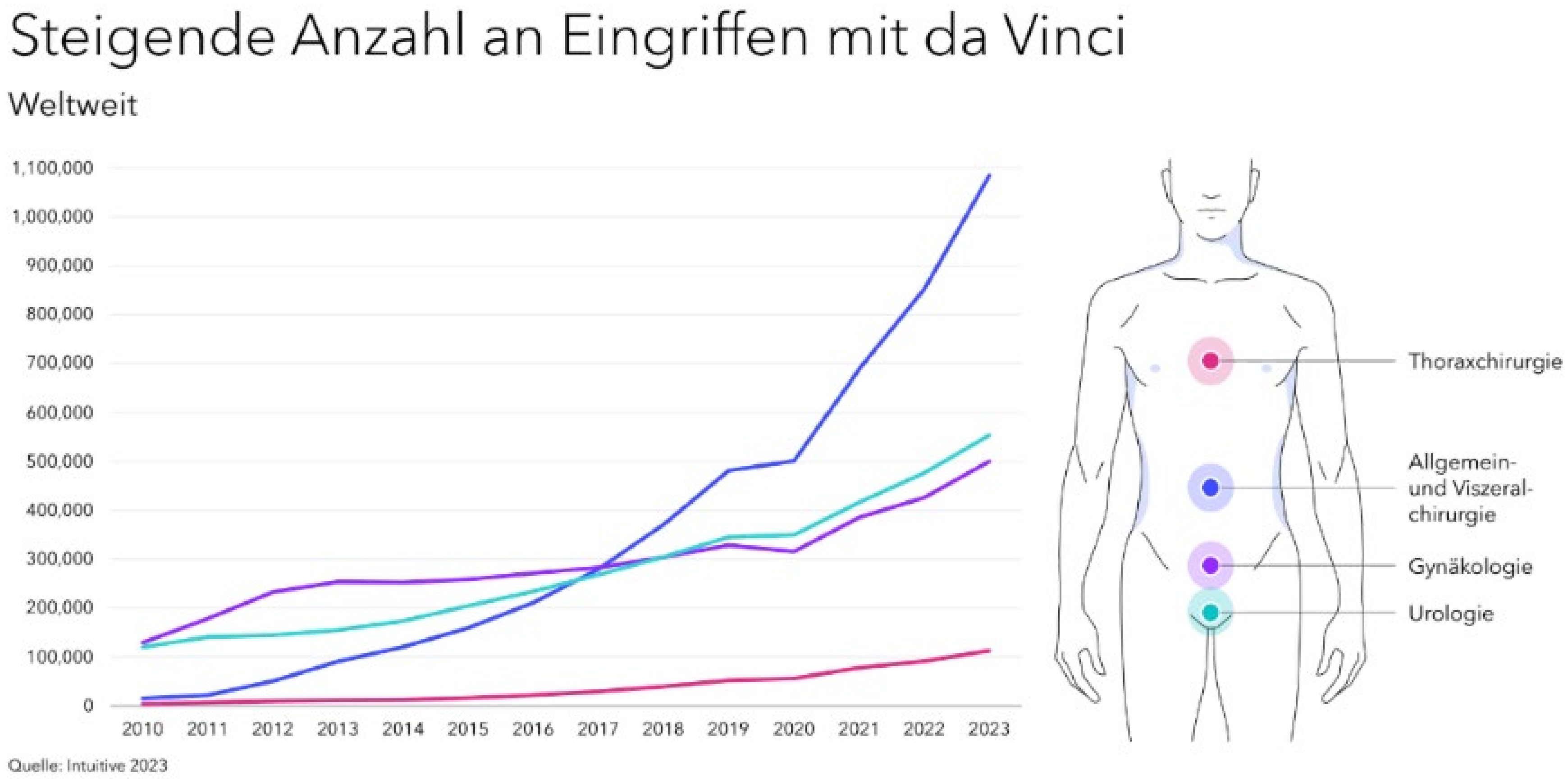
Overview ROBOTIC –
Development in surgery



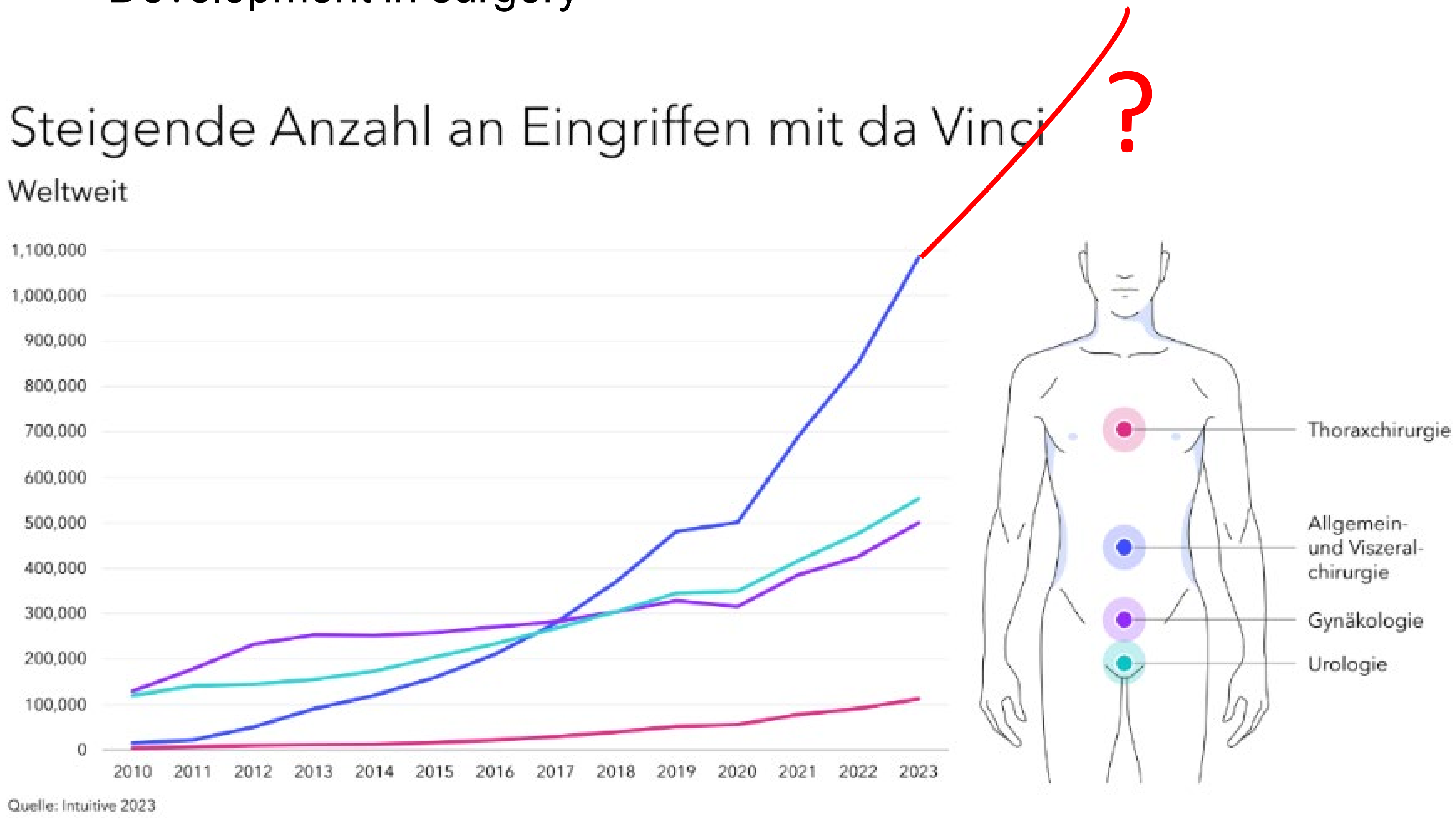
Entwicklung nach 20 Jahren

General-, Visceral- and Transplant Surgery
University of Mainz

Overview ROBOTIC –
Development in surgery

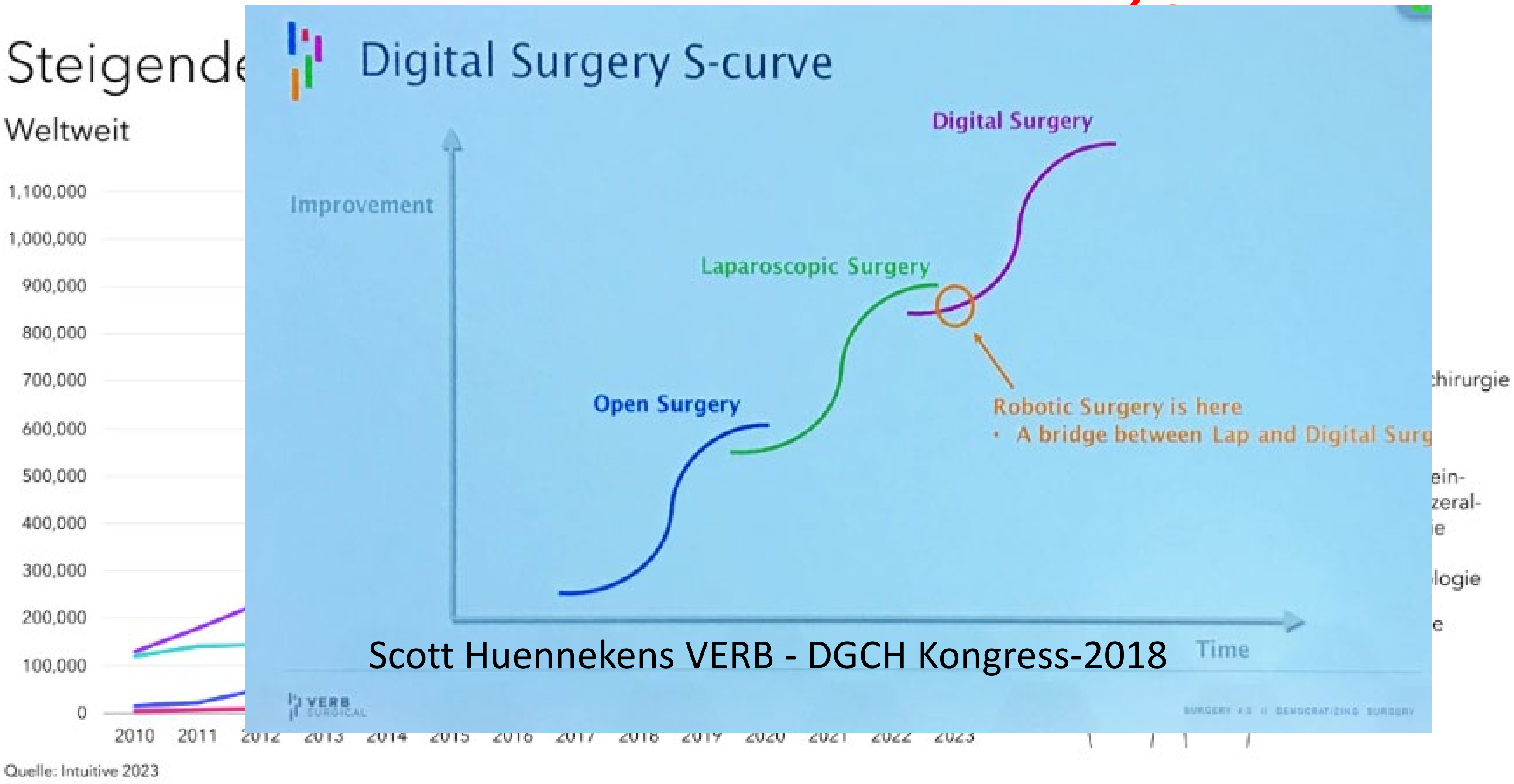


Overview ROBOTIC –
Development in surgery



Overview ROBOTIC –

Development in surgery



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Leberkrebs

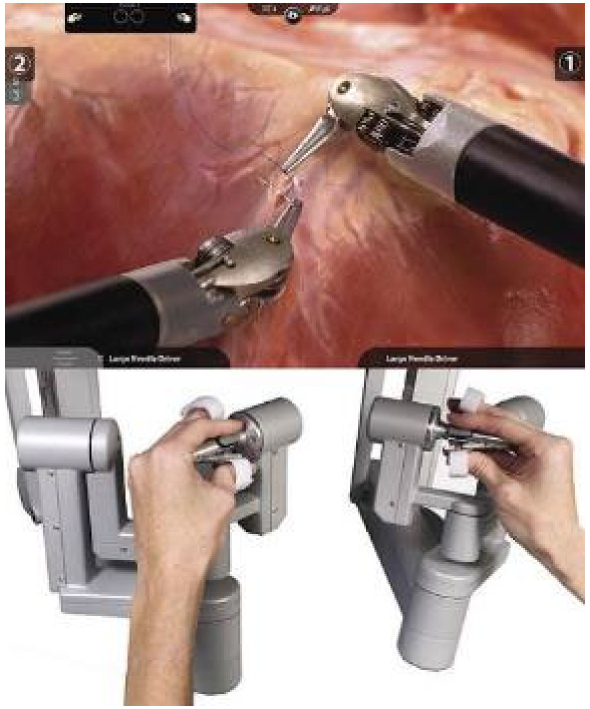
RAMIE – Was sind die Vorteile der Robotik?

- **Präzision & zeitgleich Schonung anderer Organe**
- Ergonomie intrakorporal und extrakorporal
- Internationalität (OP überall gleich und von überall möglich…)
- Standardisierung
- Beste Trainingsmöglichkeiten
- Digital assistant features (Stapling...)
- Größtes Zukunftspotential (AI + machine learning)

Vorteile der Robotik…

- Präzision
- Ergonomie - intrakorporal und ausserhalb des Körpers

Endo Wrist



Magnified vision

Comfort

Vorteile der Robotik…

- Internationalität (der Chirurg kann theoretisch von überall operieren…)
- Standardisierung
- Training

ESDE Minimally Invasive Esophagectomy
Fellowship Program – Mainz, Training Center

Case Observation Center
Robotic Surgery- „Upper GI-Tract“- Mainz
2018-2020

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Vorteile der Robotik…

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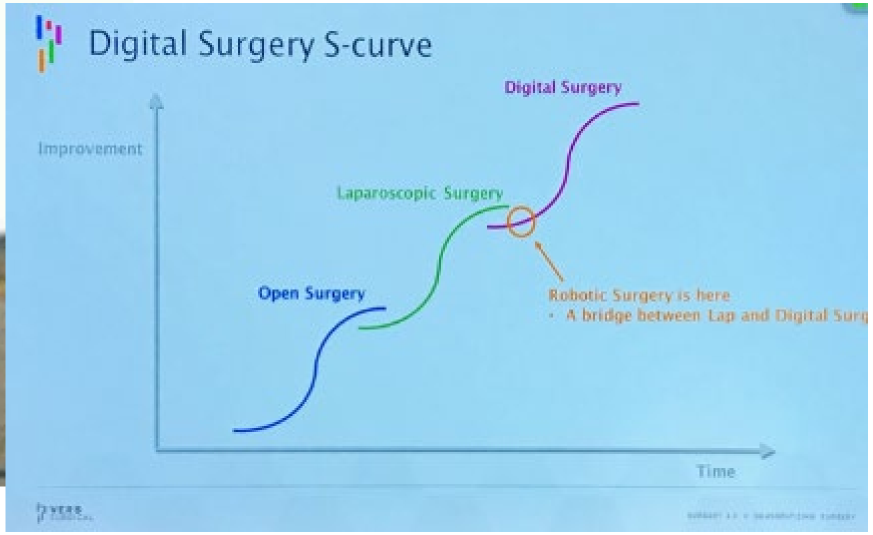
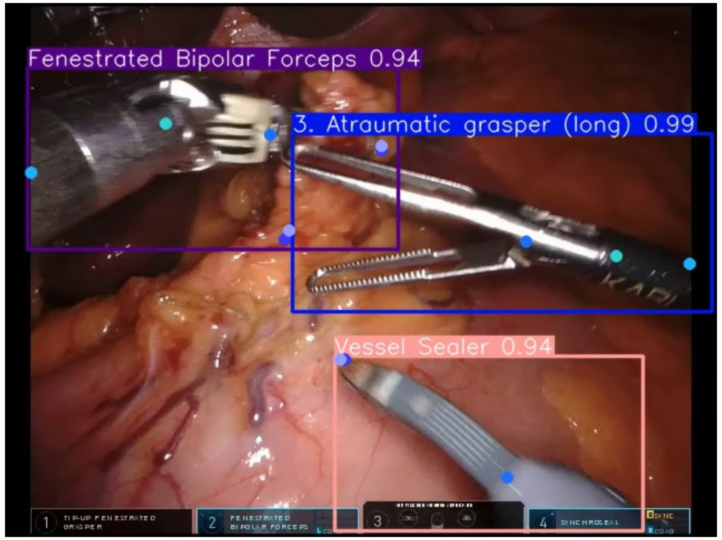
Vorteile der Robotik…

- Digitale Assistenzsysteme (Stapling…, Real-time-Bilderkennung…)
- Zukunftspotential (KI + Machine Learning)

Beispiel aus der Automobilindustrie – ESP



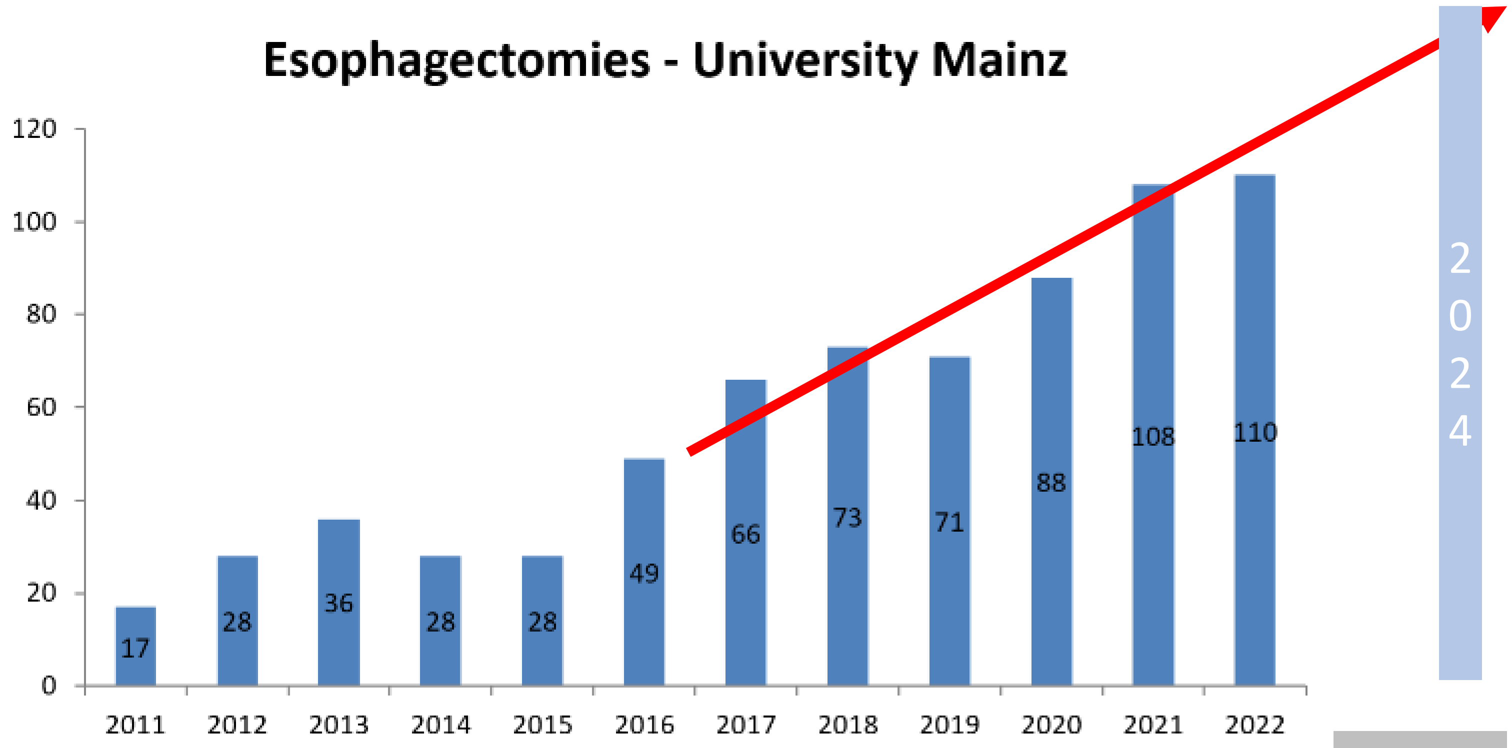
Scott Huennekens VERB - DGCH Kongress-2018



Real-time-Bilderkennung

Veränderung der OP's im OGI Trakt

> 100 Speiresöhrenoperationen pro Jahr an der UMM (>97% total MIO)



Grimminger in Mainz

Klinik für Allgemein-, Viszeral- und Transplantationschirurgie

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OP Beispiele der **Präzisionsmedizin** am Ösophagus

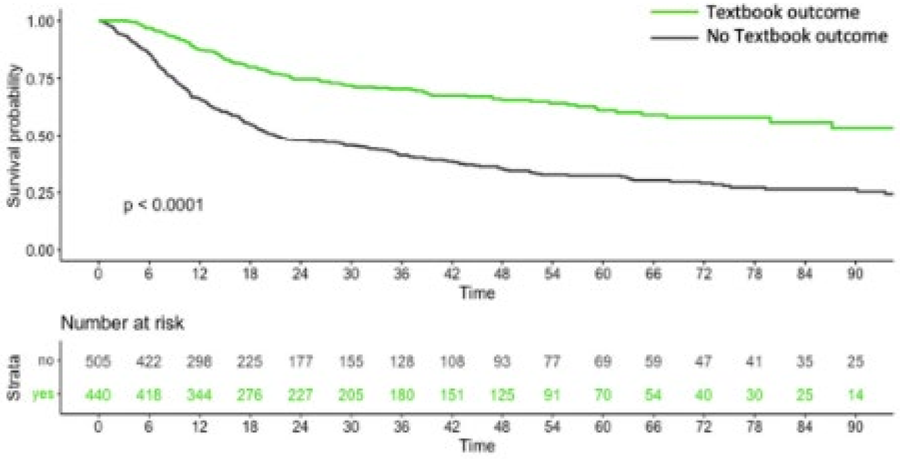
cancers

MDPI

Article

Incidence and Predictors of Textbook Outcome after Minimally Invasive Esophagectomy for Cancer: A Two-Center Study

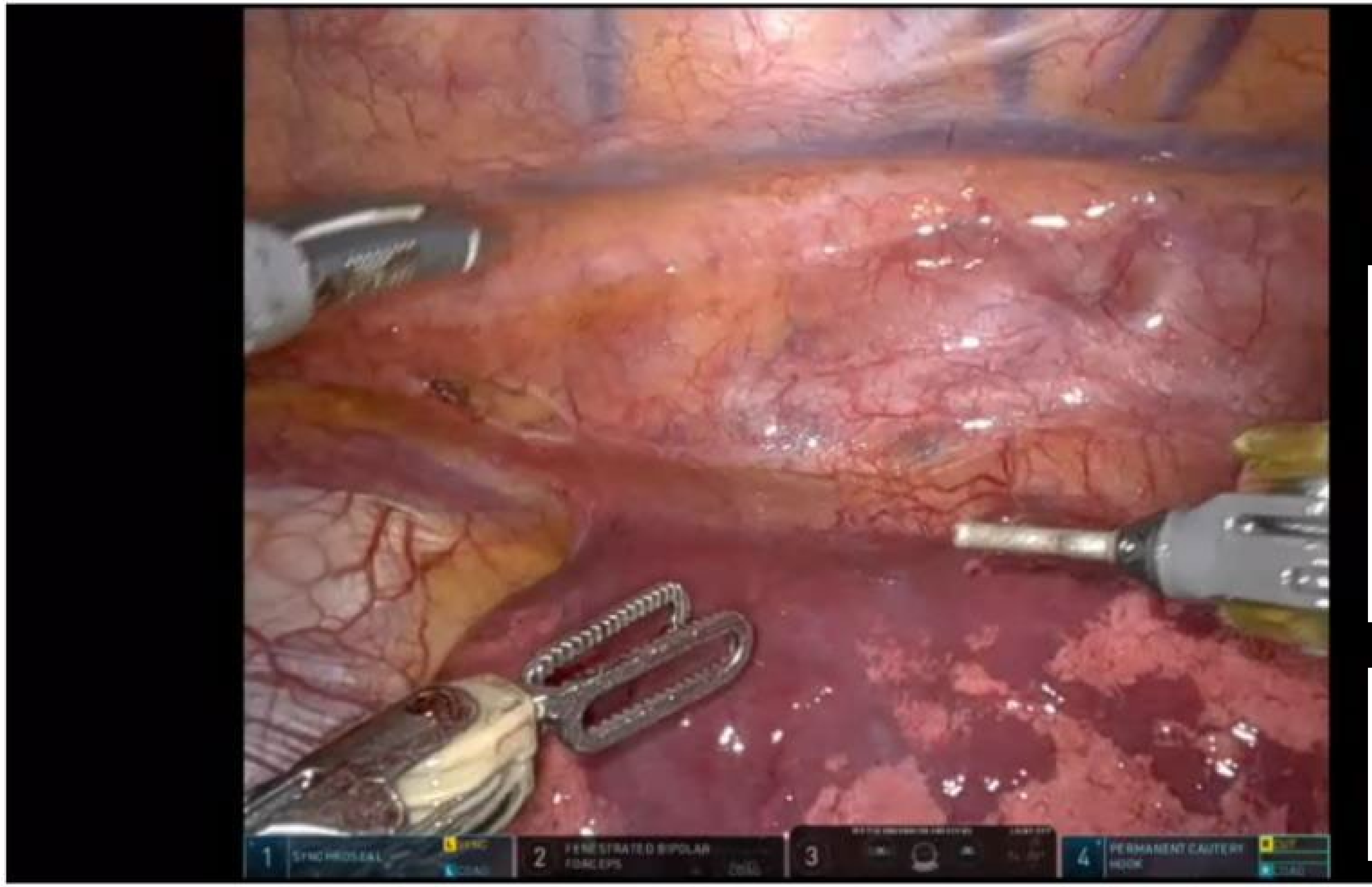
Evangelos Tagkalos [1,2,†], Peter Grimminger [2,†], Xing Gao [1], Chien-Hung Chiu [1], Eren Uzun [2], Hauke Lang [2], Yu-Wen Wen [3] and Yin-Kai Chao [1,*]



Authors (Year of Publication)	Study Design	Sample Size	Minimally Invasive Surgery, *n* (%)	RE, *n* (%)	TBO Rate	Survival Impact
Busweiler et al. (2017) [11]	Nationwide study	2748	1347 (49%)	N/A	29.7%	N/A
Van der Werf et al. (2019) [12]	Nationwide study	4414	2595 (58.8%)	N/A	33%	Yes
Bolger et al. (2021) [20]	Single-center study	269	130 (48.3%)	N/A	32.3%	Yes
Kalff et al. (2021) [7]	Two-center study	1065	676 (63.5%)	N/A	30.7%	Yes
Current study	Two-center study	945	945 (100%)	408 (43.2%)	46.6%	Yes

Abbreviations: RE, robotic esophagectomy; TBO, textbook outcome; N/A, not available.

Robotisch-ass. - Lymphadenektomie beim Ösophagus CA - Beispiel 2-Feld LAD



Diseases of the Esophagus (2020) 33, 1–4

DISEASES OF THE ESOPHAGUS

ISDE

Original Article

Innovative fully robotic *4-arm* Ivor Lewis esophagectomy for esophageal cancer (RAMIE4)

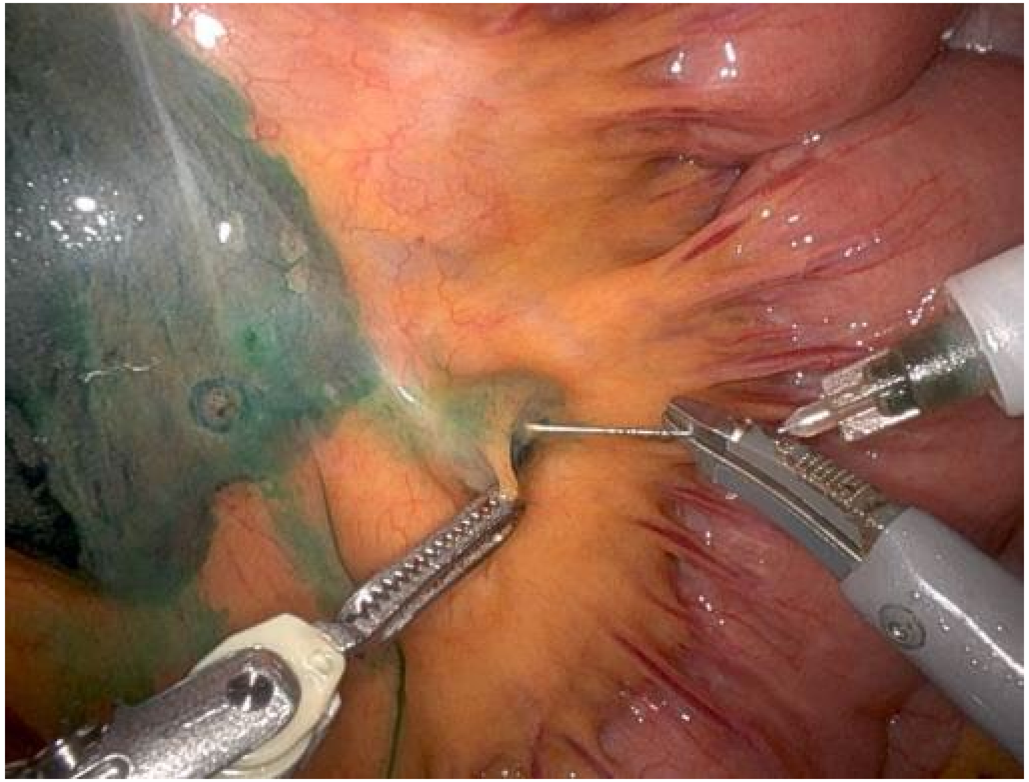
P. P. Grimminger, E. Hadzijusufovic, B. Babic, P. C. van der Sluis, H. Lang

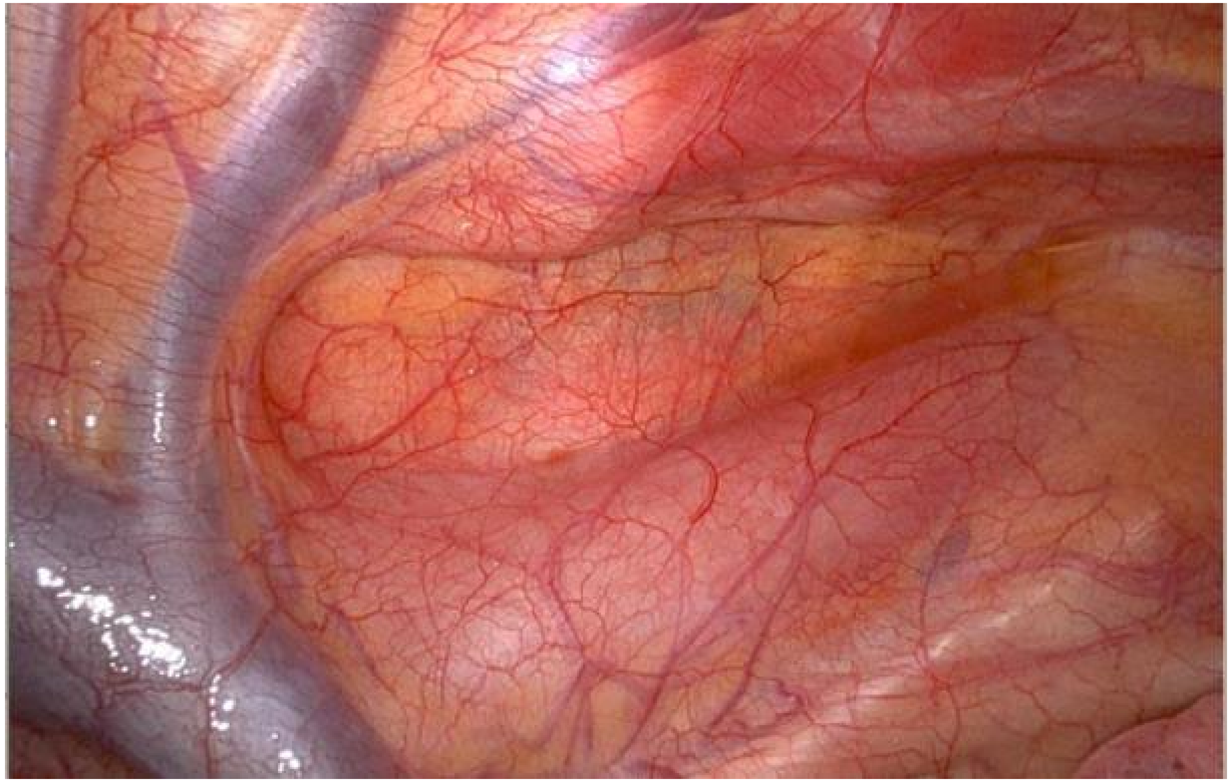
Department of General, Visceral and Transplant Surgery, University Medical Center of the Johannes Gutenberg University, Mainz, Germany

The da Vinci Xi *Robotic Four-Arm* Approach for Robotic-Assisted Minimally Invasive Esophagectomy

Peter Philipp Grimminger[1] Edin Hadzijusufovic[1] Jelle Piet-Hein Ruurda[2] Hauke Lang[1] Richard van Hillegersberg[2]

ICG Fluoreszenz Surgery:
the Mainz Experience





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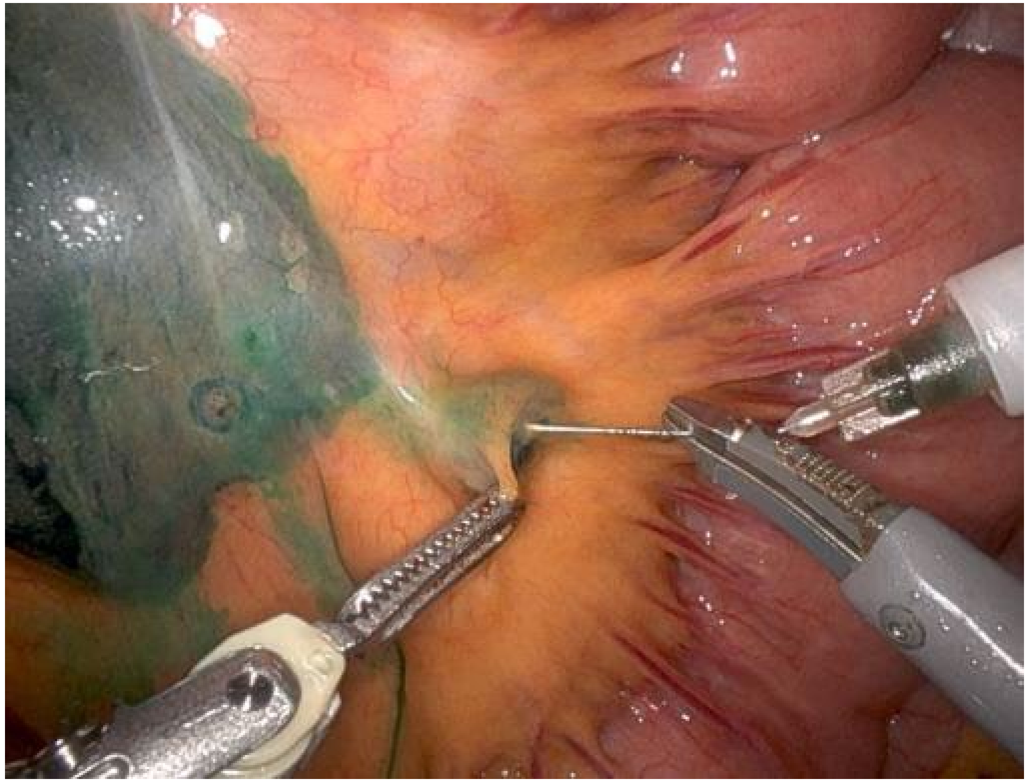
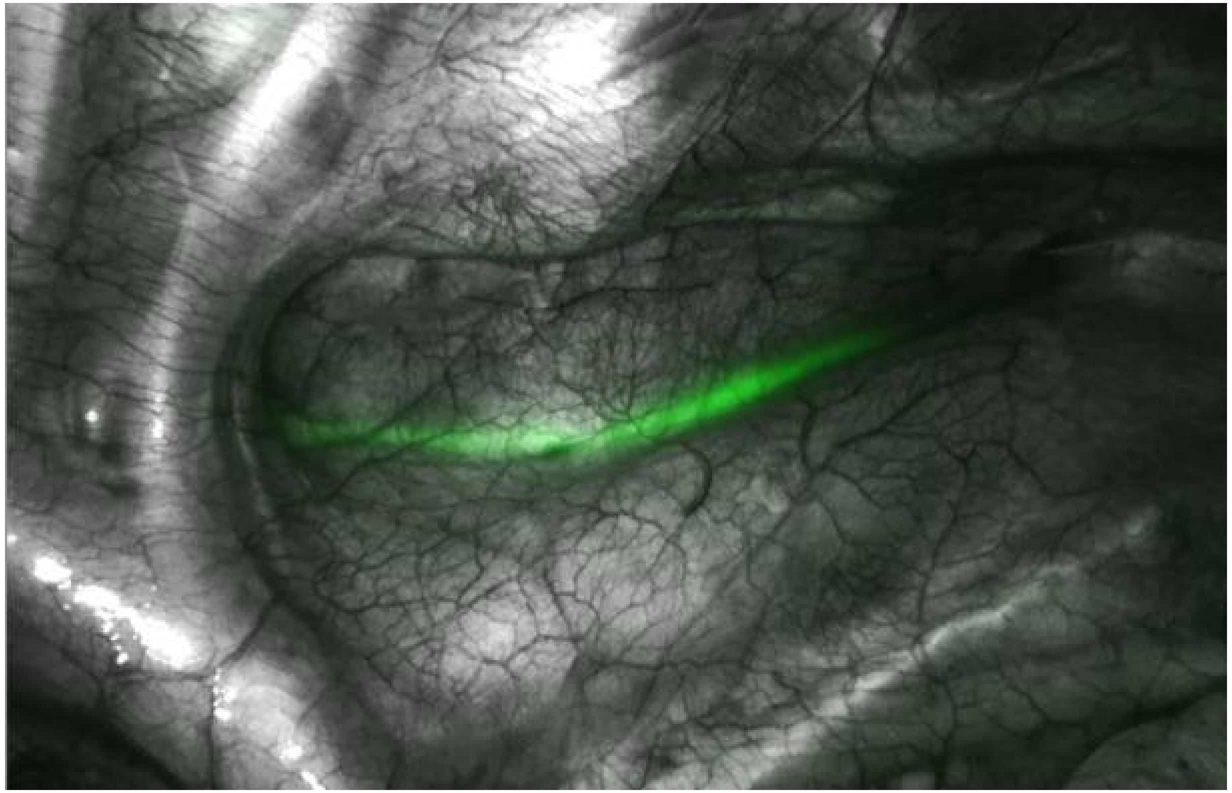
ICG Fluoreszenz Surgery:
the Mainz Experience





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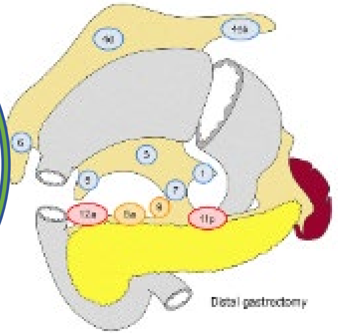
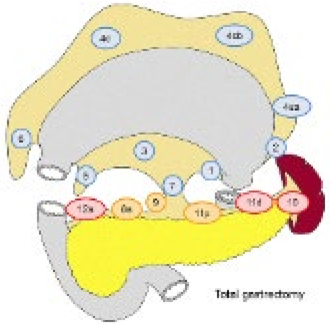
OP Prinzipien - Magenchirurgie

<u>**Modulare**</u> onkologische Magenchirurgie

Luminales OP Ausmaß





Lymphadenektomie

D2 → D2+/D3

Rekonstruktion

BII (+Braun)

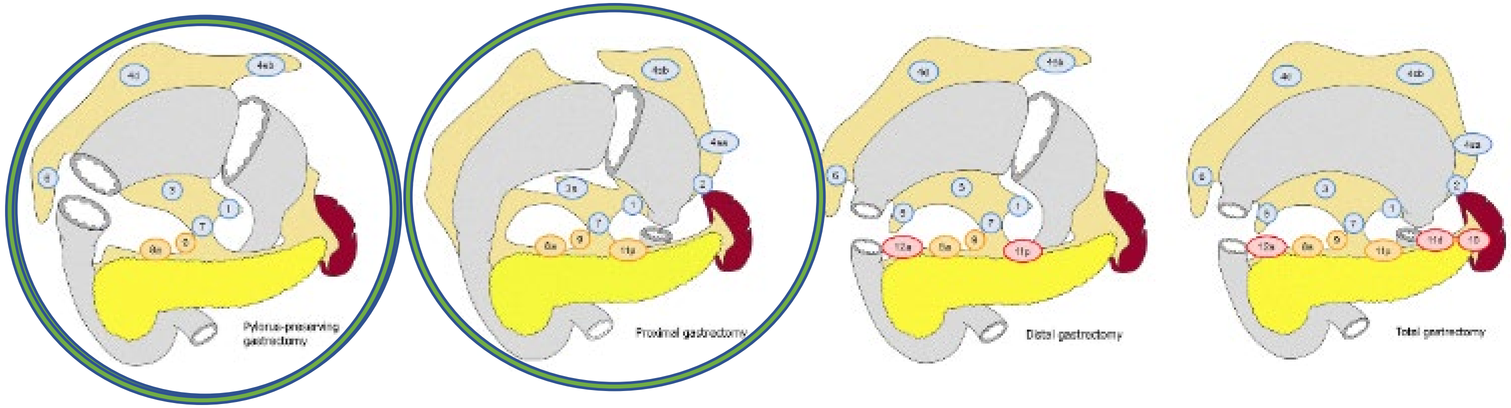
Roux-Y

Fig.: Kodera, Sano, Japanese Gastric cancer Treatment Guidelines, 2014

OP Prinzipien - Magenchirurgie

Modulare onkologische Magenchirurgie

Luminales OP Ausmaß



Lymphadenektomie

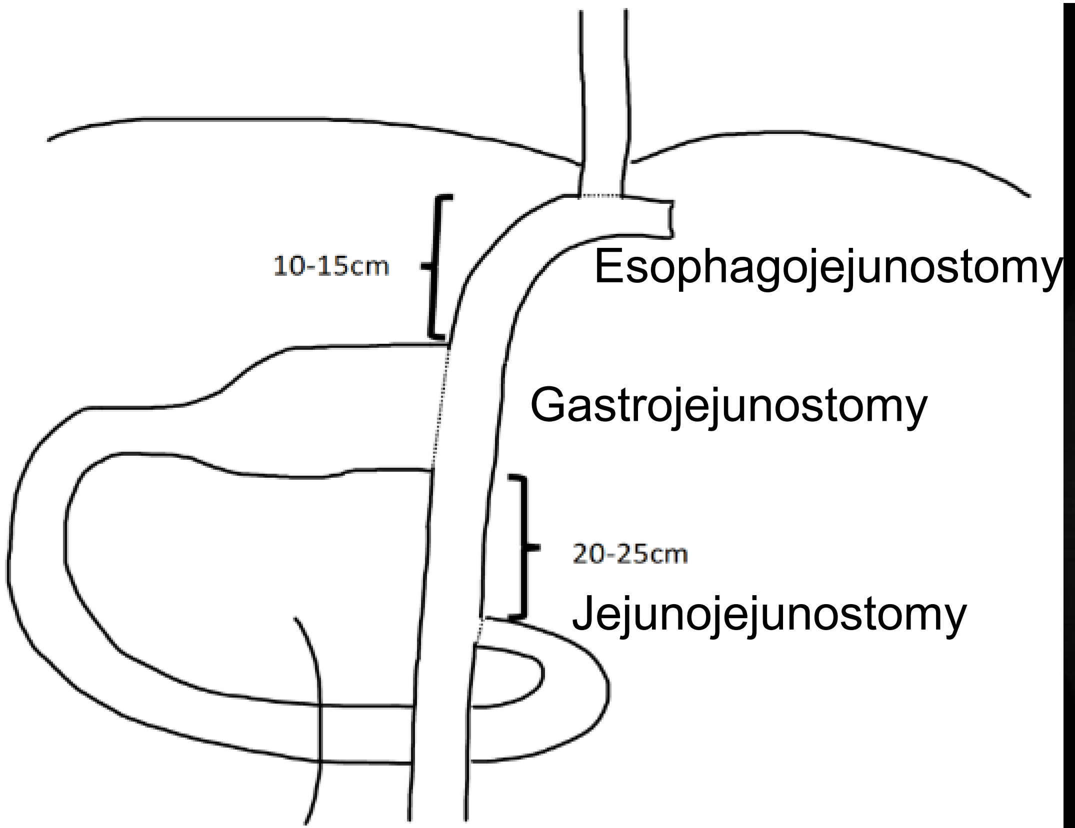
(D1) → D1+ → D2 → D2+/D3

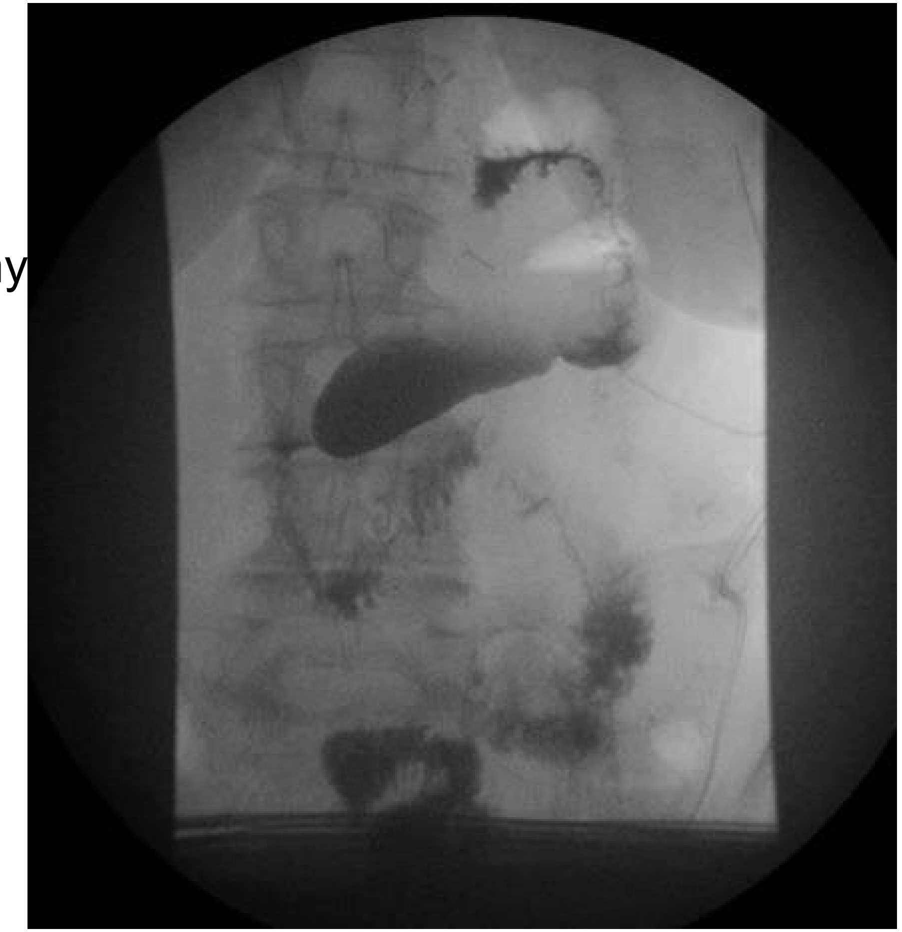
Rekonstruktion

Gastrogastrostomy | Double Tract | BI | BII (+Braun) | (Uncut Roux-Y) | Roux-Y

Fig.: Kodera, Sano, Japanese Gastric cancer Treatment Guidelines, 2014

Proximal Gastrektomie & Double-Tract





Berlth, Grimminger et al. ALES 2021

Aktuelle Entwicklungen…

2024 April

Klinik für Allgemein-, Viszeral- und Transplantationschirurgie

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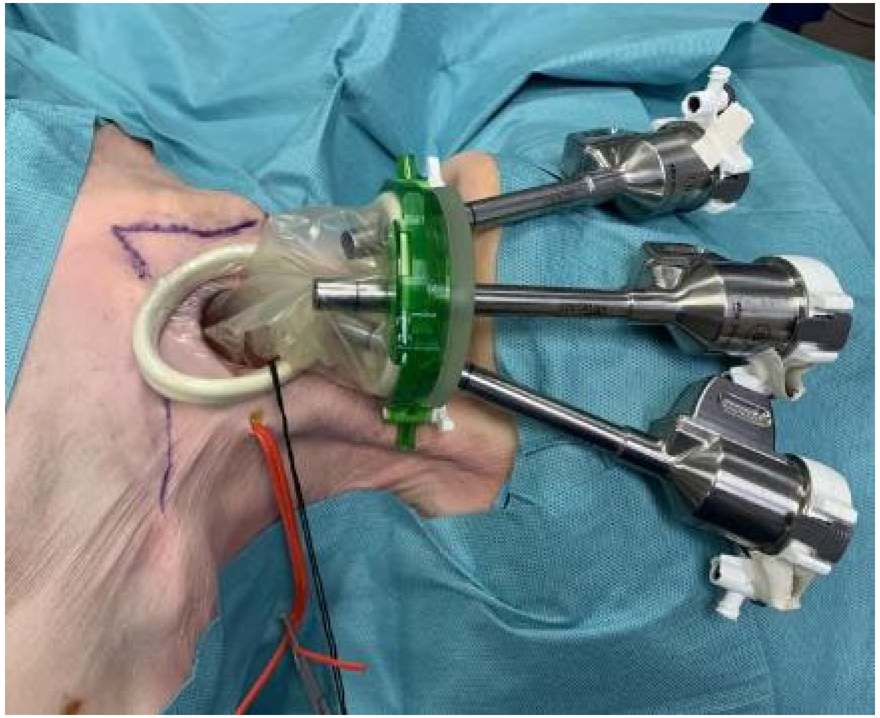
Introduction of RACE procedure

2018



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applied sciences

MDPI

Article

Feasibility of Transcervical Robotic-Assisted Esophagectomy (TC-RAMIE) in a Cadaver Study—A Future Outlook for an Extrapleural Approach

Peter Philipp Grimminger [1,*], Pieter Christiaan van der Sluis [1], Hubert Stein [2], Hauke Lang [1], Richard van Hillegersberg [3] and Jan-Hendrik Egberts [4]

1 Department of General-, Visceral- and Transplant Surgery, Medical Center of the Johannes Gutenberg University, 55131 Mainz, Germany
2 Department of Global Clinical Development, Intuitive Surgical, Sunnyvale, CA 94086, USA
3 Department of Surgery, University Medical Center, 3584 CX Utrecht, The Netherlands
4 Department for General, Visceral, Thoracic, Transplantation and Pediatric Surgery, University Hospital Schleswig Holstein, 24105 Kiel, Germany
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Received: 26 July 2019; Accepted: 19 August 2019; Published: 1 September 2019

check for updates

Abstract: In recent years, the evolution of advanced robotic medical systems has increased rapidly. These technical developments have led to advanced robotic systems, such as the da Vinci Xi, which allows superior controlled complex procedures and innovative surgical strategies. In esophageal surgery, the robotic-assisted minimally invasive esophagectomy (RAMIE) procedure is being developed and carried out with increasing frequency at centers worldwide. Recently, a new single port robotic system was introduced (da Vinci Single Port (SP)), which may allow for the exploration of new routes, such as transcervical robotic assisted minimally invasive esophagectomy (TC-RAMIE). This approach avoids opening the pleura by entering the mediastinum through the jugular window. In this report, we describe the technical steps of the TC-RAMIE using the new da Vinci SP system and compare it to the da Vinci Xi system.

Keywords: DaVinci; transcervical; robotic esophagectomy; esophageal cancer

Diseases of the Esophagus (2020)33,1–6
DOI: 10.1093/dote/doaa052

DISEASES OF THE ESOPHAGUS

ISDE The International Society for Diseases of the Esophagus

Supplement Article

Robot-assisted cervical esophagectomy: first clinical experiences and review of the literature

Philip Wai-yan Chiu,[1,*] Eline Marieke de Groot,[2] Hon-chi Yip,[1] Jan-Hendrik Egberts,[3] Peter Grimminger,[4] Yasuyuki Seto,[5] Ichiro Uyama,[6] Pieter Christiaan van der Sluis,[2] Hubert Stein,[7] Rubens Sallum,[8] Jelle P. Ruurda,[2] Richard van Hillegersberg,[2]

[1]Division of Upper GI and Metabolic Surgery, Department of Surgery, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong, China, [2]Department of Surgery, University Medical Center Utrecht, Utrecht, The Netherlands, [3]Department for General, Visceral-, Thoracic-, Transplantation-, and Pediatric Surgery, University Hospital Schleswig Holstein, Kiel, Germany, [4]Department for General, Visceral-, Transplant Surgery, University Medical Center of the Johannes Gutenberg University, Mainz, Germany, [5]Department of Gastrointestinal Surgery, The University of Tokyo Hospital, Tokyo, Japan, [6]Department of Surgery, Fujita Health University, Toyoake, Japan, [7]Department of Global Clinical Development, Intuitive Surgical Inc., Sunnyvale CA, USA, and [8]Departament of Gastroenterological Surgery, University of São Paulo, São Paulo, Brazil

SUMMARY. **Pulmonary complications, and especially pneumonia, remain one of the most common complications after esophagectomy for esophageal cancer. These complications are reduced by minimally invasive techniques or by avoiding thoracic access through a transhiatal approach. However, a transhiatal approach does not allow for a full mediastinal lymphadenectomy. A transcervical mediastinal esophagectomy avoids thoracic access, which may contribute to a decrease in pulmonary complications after esophagectomy. In addition, this technique allows for a full mediastinal lymphadenectomy. A number of pioneering studies have been published on this topic. Here, the initial experience is presented as well as a review of the current literature concerning transcervical esophagectomy, with a focus on the robot-assisted cervical esophagectomy procedure.**

KEY WORDS: **robotics, esophagectomy, transcervical, minimally invasive esophagectomy, MIE, RAMIE, Da Vinci.**

Diseases of the Esophagus (2021)00,1–9
DOI: 10.1093/dote/doaa128

DISEASES OF THE ESOPHAGUS

ISDE The International Society for Diseases of the Esophagus

Original Article

Surgical anatomy of the upper esophagus related to robot-assisted cervical esophagectomy

Thilo Wedel,[1] Tillmann Heinze,[1] Thorben Möller,[2] Richard Hillegersberg, van[3] Ronald L. A. W. Bleys,[4] Teun J. Weijs,[4] Pieter Christian Sluis, van der[5] Peter P. Grimminger,[6] Rubens A. Sallum,[7] Thomas Becker,[2] Jan-Hendrik Egberts[2]

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SUMMARY. Robot-assisted cervical esophagectomy (RACE) enables radical surgery for tumors of the middle and upper esophagus, avoiding a transthoracic approach. However, the cervical access, narrow working space, and complex topographic anatomy make this procedure particularly demanding. Our study offers a stepwise description of appropriate dissection planes and anatomical landmarks to facilitate RACE. Macroscopic dissections were performed on formaldehyde-fixed body donors (three females, three males), according to the surgical steps during RACE. The topographic anatomy and surgically relevant structures related to the cervical access route to the esophagus were described and illustrated, along with the complete mobilization of the cervical and upper thoracic segment. The carotid sheath, intercarotid fascia, and visceral fascia were identified as helpful landmarks, used as optimal dissection planes to approach the cervical esophagus and preserve the structures at risk (trachea, recurrent laryngeal nerves, thoracic duct, sympathetic trunk). While ventral dissection involved detachment of the esophagus from the tracheal cartilage and membranous part, the dorsal dissection plane comprised the prevertebral compartment harboring the thoracic duct and right intercosto-bronchial artery. On the left side, the esophagus was attached to the aortic arch by the aorto-esophageal ligament; on the right side, the esophagus was bordered by the azygos vein, right vagus nerve, and cardiac nerves. The stepwise, illustrated topographic anatomy addressed specific surgical demands and perspectives related to the left cervical approach and dissection of the esophagus, providing an anatomical basis to facilitate and safely implement the RACE procedure.

KEY WORDS: cancer, esophageal cancer, surgery.

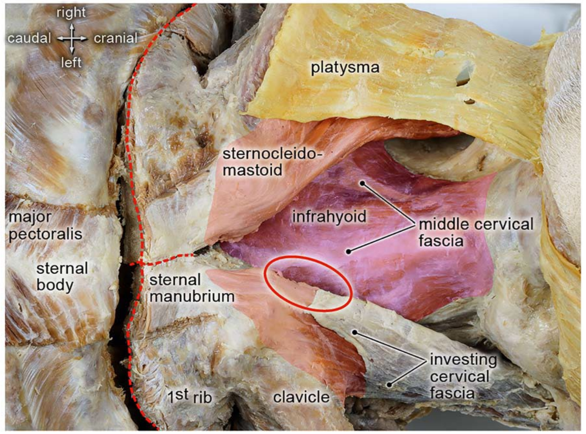

Fig. 1 Anterior cervical region. Themusculofascial layers are highlighted. Dotted red lines indicate transection lines of the ribcage and superior thoracic aperture. Red circle indicates incision site/trocar position for surgical approach to the cervical esophagus.

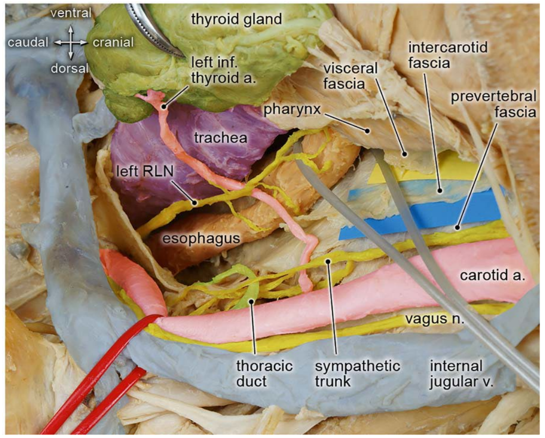

Fig. 3 Cervical esophagus, left cranio-lateral view. The left-sided esophagus (gray vessel loop) is exposed to follow the left recurrent laryngeal nerve (RLN) along the tracheoesophageal groove. The RLN has small branches leading to the esophagus and is crossed dorsally by the left inferior thyroid artery. The thoracic duct is crossed by the left sympathetic trunk and curves toward the left venous angle. The visceral (yellow strip), intercarotid (blue strip), and vertebral fasciae are partially preserved.

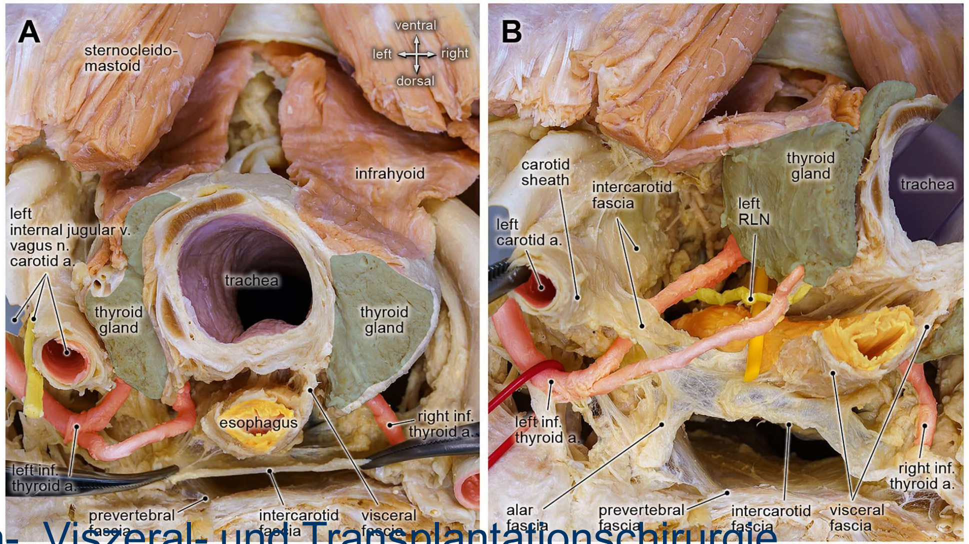

Fig. 5 Cervical esophagus, cranial view, transverse section at the level of the first tracheal cartilage. (A) The esophagus is partially detached from the trachea to expose the visceral fascia enveloping both organs. The intercarotid fascia is brought under tension by two clamps. (B) Retraction of the carotid artery exposes both the intercarotid fascia and alar fascia. The branches of the left inferior thyroid artery (red vessel loop) perforate the intercarotid fascia and ventrally cross the left recurrent laryngeal nerve (RLN, yellow indicator).

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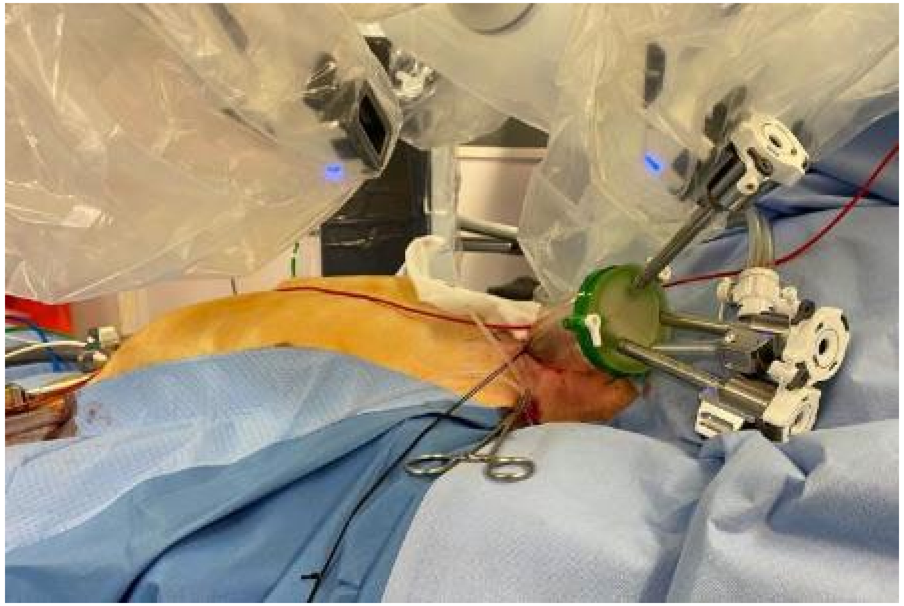
Established the **RACE** procedure in Mainz
…using da Vinci Xi




2020 OP in Mainz – 1. RACE

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Robotic Surgery: the Mainz Experience

RACE – Xi vs. Single-Port DaVinci

Trans-Cervical Esophagectomy

Simultaneous cadaver training with **Xi vs. SP DaVinci**

in Germany 2021

TC- RAMIE
X und SP da Vinci *simultan*

Original Thoracic

Transcervical (SP) and Transhiatal DaVinci Robotic Esophagectomy: A Cadaveric Study

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Thorac Cardiovasc Surg

Abstract

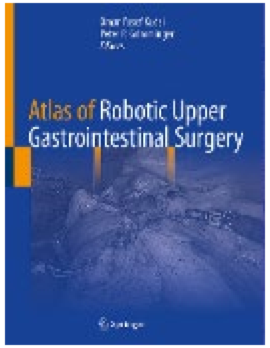
Background This is a preclinical cadaveric study to investigate the feasibility of a fully robotic McKeown esophagectomy in simultaneous rendezvous technique using the DaVinci X for transhiatal dissection and the DaVinci single port (SP) for transcervical dissection.

Methods Two transcervical esophagectomies with the DaVinci SP surgical system were performed as training procedures. In the third transcervical cadaveric procedure, the DaVinci SP was installed for the transcervical approach and the DaVinci X surgical system for the abdominal transhiatal phase. Primary outcomes were operating time and lymphadenectomy.

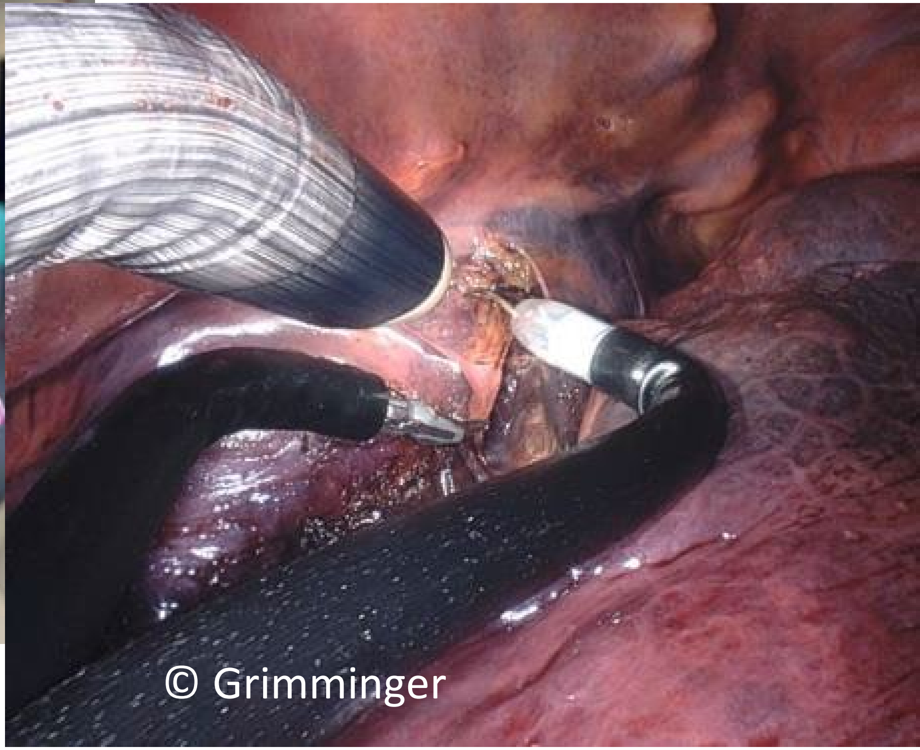
Results The mobilization of the esophagus was successfully completed in 118 minutes by using the DaVinci SP for the transcervical phase and the DaVinci X for the transhiatal abdominal phase simultaneously. In total 18 lymph nodes were dissected in the thorax; 3 were located paratracheal right, 3 paratracheal left, 4 subcarinal, 4 para-aortic, 2 para-esophageal upper mediastinal, and 2 paraesophageal middle mediastinal.

Conclusion This preclinical study demonstrated that a fully robotic McKeown esophagectomy in simultaneous rendezvous technique using the DaVinci X for transhiatal dissection and the DaVinci SP for transcervical dissection was feasible with adequate lymphadenectomy in a cadaver model. Future research will elucidate the indications for the use of the fully robotic transhiatal and transcervical esophagectomy.

Keywords
- minimally invasive surgery
- esophageal surgery
- robotic



2024 April



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2024 April – SP RACE

Accepted Manuscript

Submission Date: 2024-06-09
Accepted Date: 2024-08-05
Accepted Manuscript online: 2024-08-29

The Thoracic and Cardiovascular Surgeon

Single-Port daVinci Robot-Assisted Cervical Esophagectomy (SP-RACE) – How to Do It

Edin Hadzijusufovic, Vladimir J Lozanovski, Eva-Verena Griemert, Luca Bellaio, Hauke Lang, Peter P Grimminger.

Affiliations below.

DOI: 10.1055/a-2405-2708

Please cite this article as: Hadzijusufovic E, Lozanovski V J, Griemert E-V et al. Single-Port daVinci Robot-Assisted Cervical Esophagectomy (SP-RACE) – How to Do It. The Thoracic and Cardiovascular Surgeon 2024. doi: 10.1055/a-2405-2708

Conflict of Interest: Peter P. Grimminger is proctor for Intuitive Surgical. All other authors declare no conflicts of interest.

Trial registration: N.A., N.A.

Abstract:
Minimally invasive esophagectomies, including robot-assisted procedures, have demonstrated superiority over traditional open surgery. Despite the prevalence of transhiatal and transthoracic approaches, cervical access is less common in minimally invasive esophageal surgery. Advancements in robotic systems, such as the daVinci Single-Port (SP), now enable controlled transcervical extrapleural mediastinoscopic access, potentially reducing pulmonary complications and extending surgical options to patients with comorbidities. The daVinci SP Robot-Assisted Cervical Esophagectomy (SP-RACE) employs a single port and laparoscopic approach, demonstrating feasibility with comparable lymphadenectomy and recurrent nerve palsy rates to transthoracic methods. This technique, performed for the first time in Europe at the University Hospital Mainz, involves a transcervical SP-phase that allows for effective mediastinal dissection and esophageal mobilization. Despite technical challenges due to limited space, robotic systems enhance controlled access and eliminate arm collision. The daVinci SP platform's advantages include improved triangulation, fewer interferences, and better control of instruments in confined spaces. This novel approach shows promise for patients with high esophageal tumors and those unsuitable for transthoracic surgery, warranting further investigation into its clinical utility and reproducibility.

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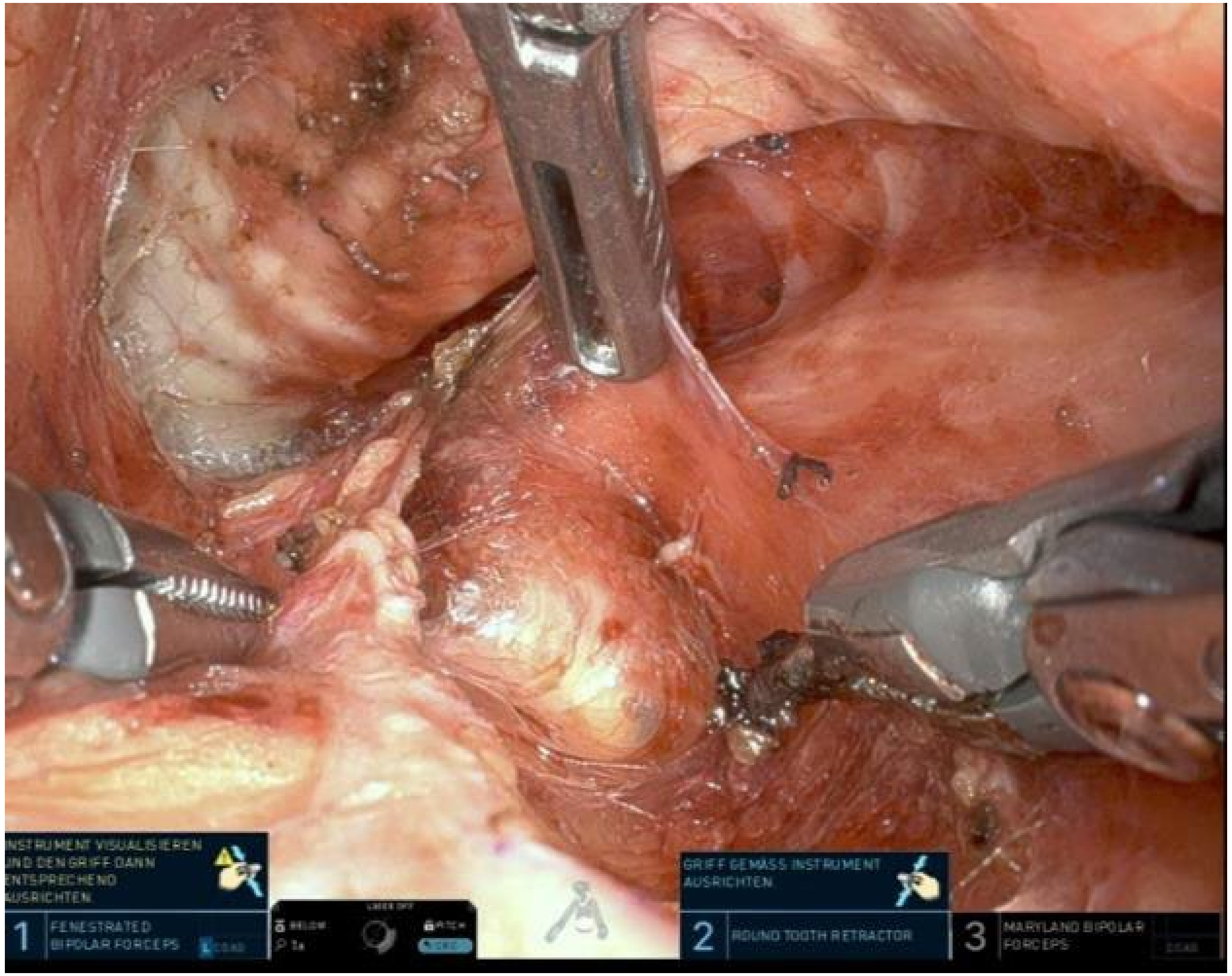

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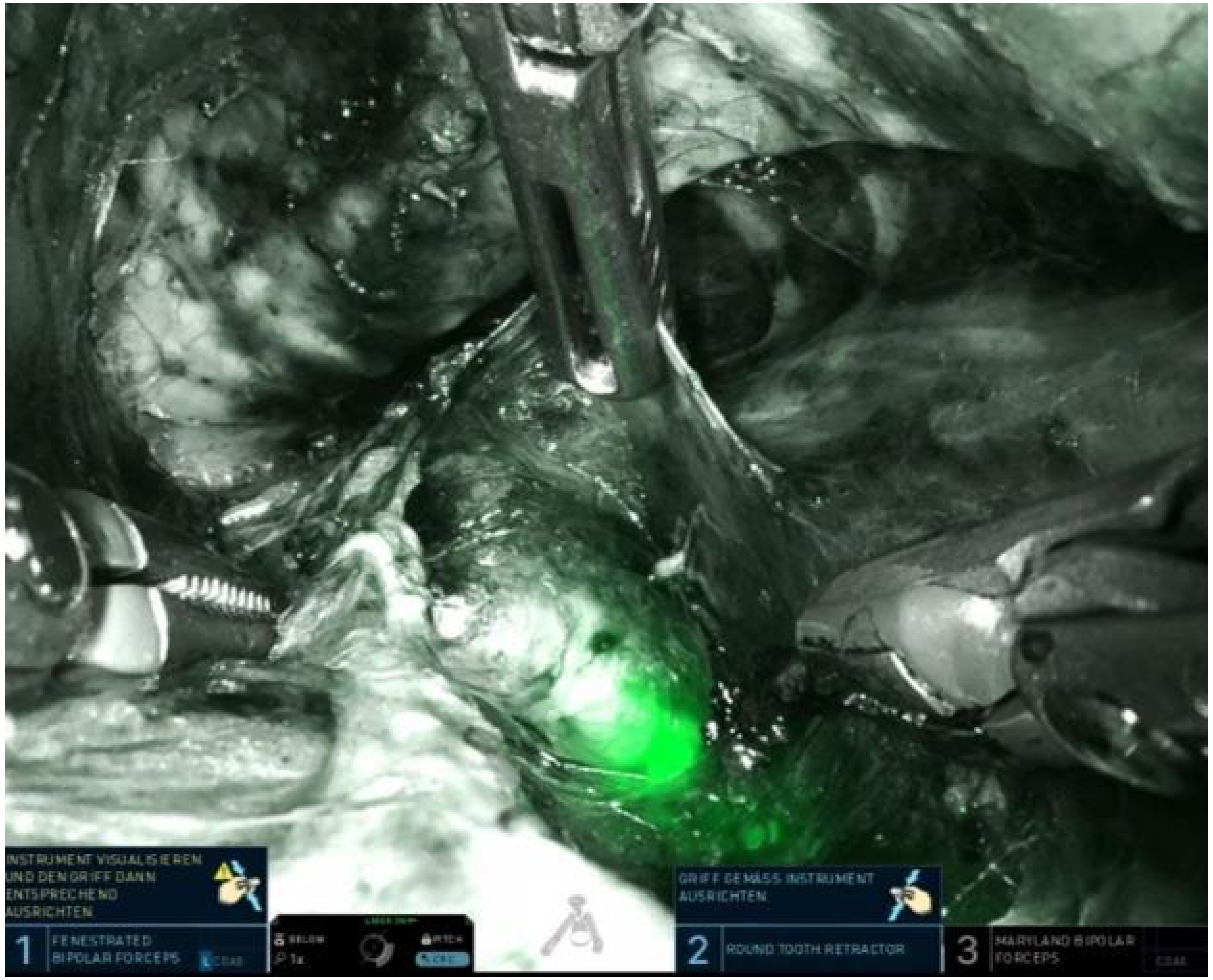

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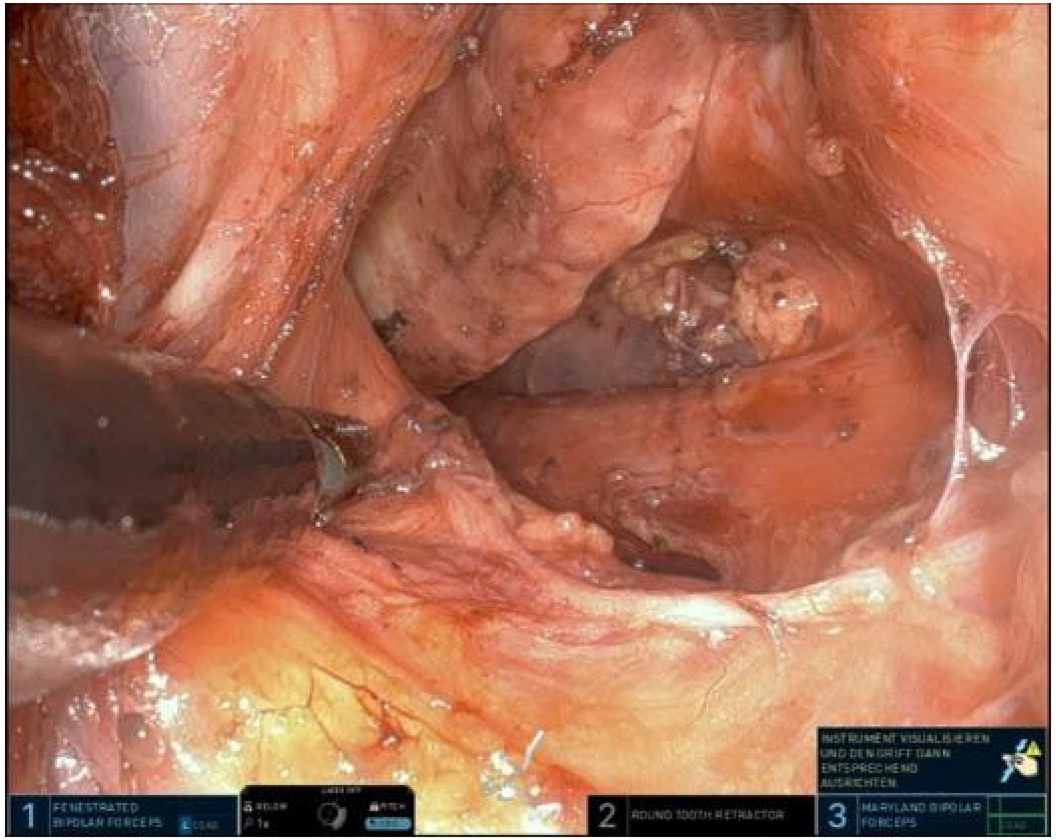

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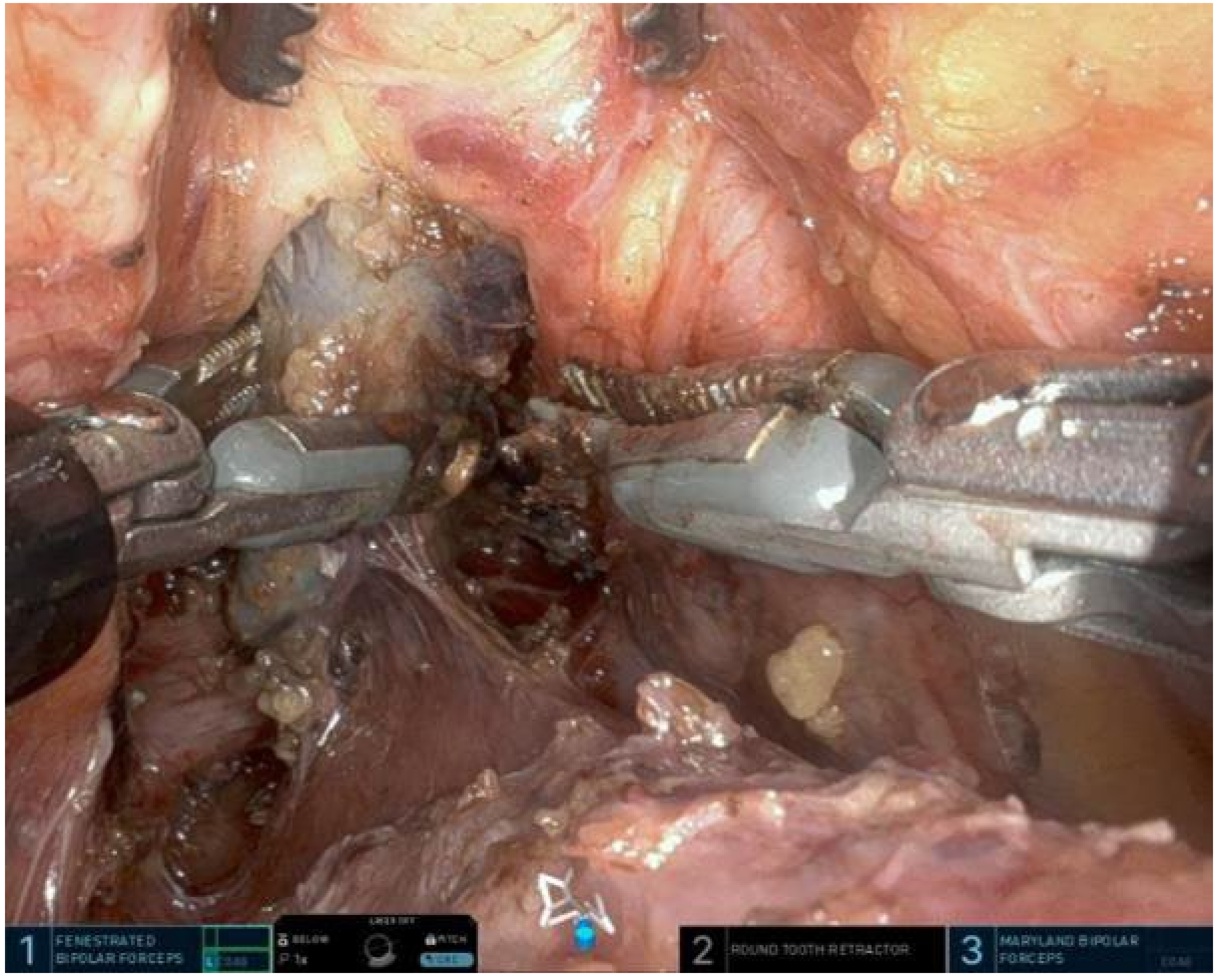

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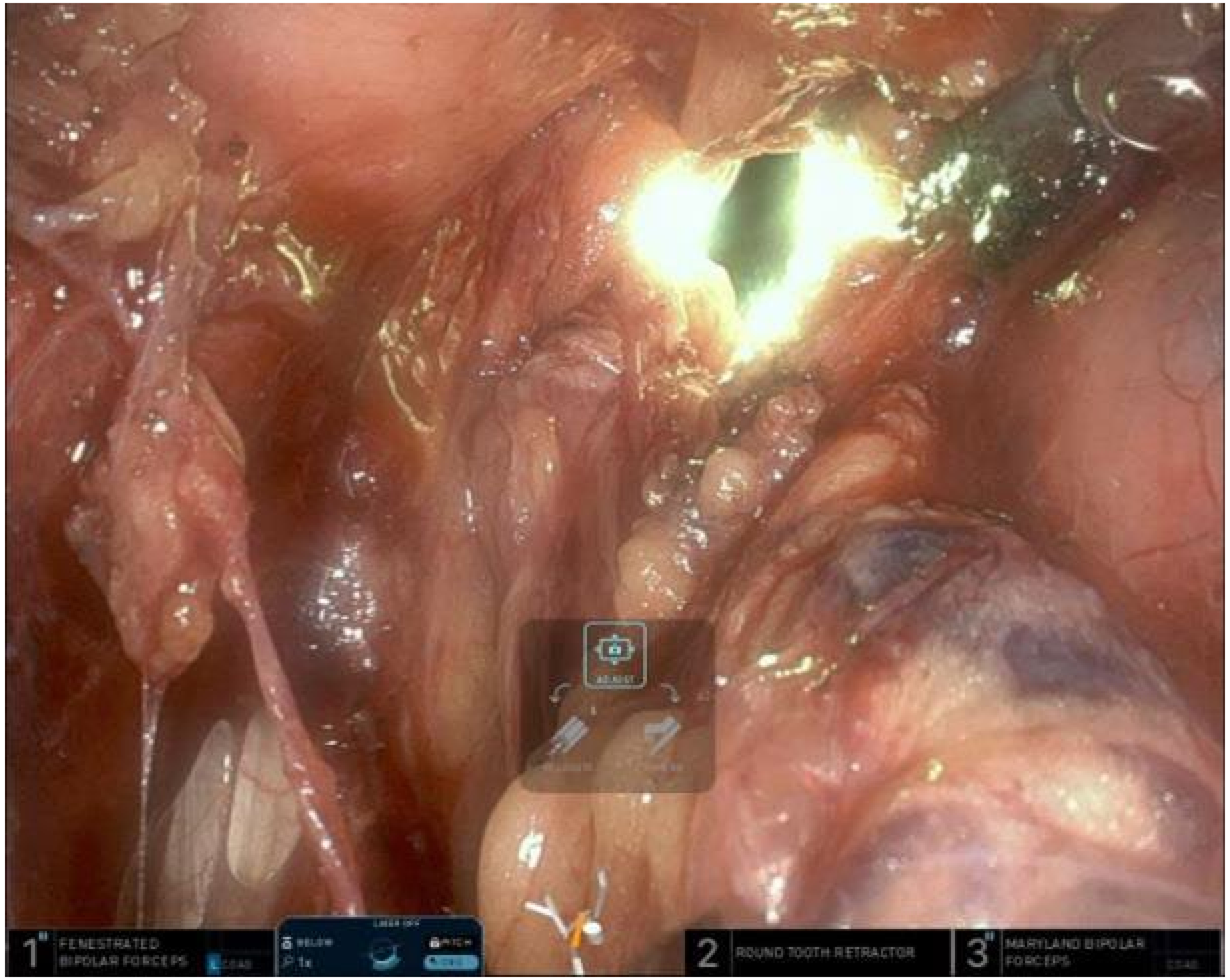

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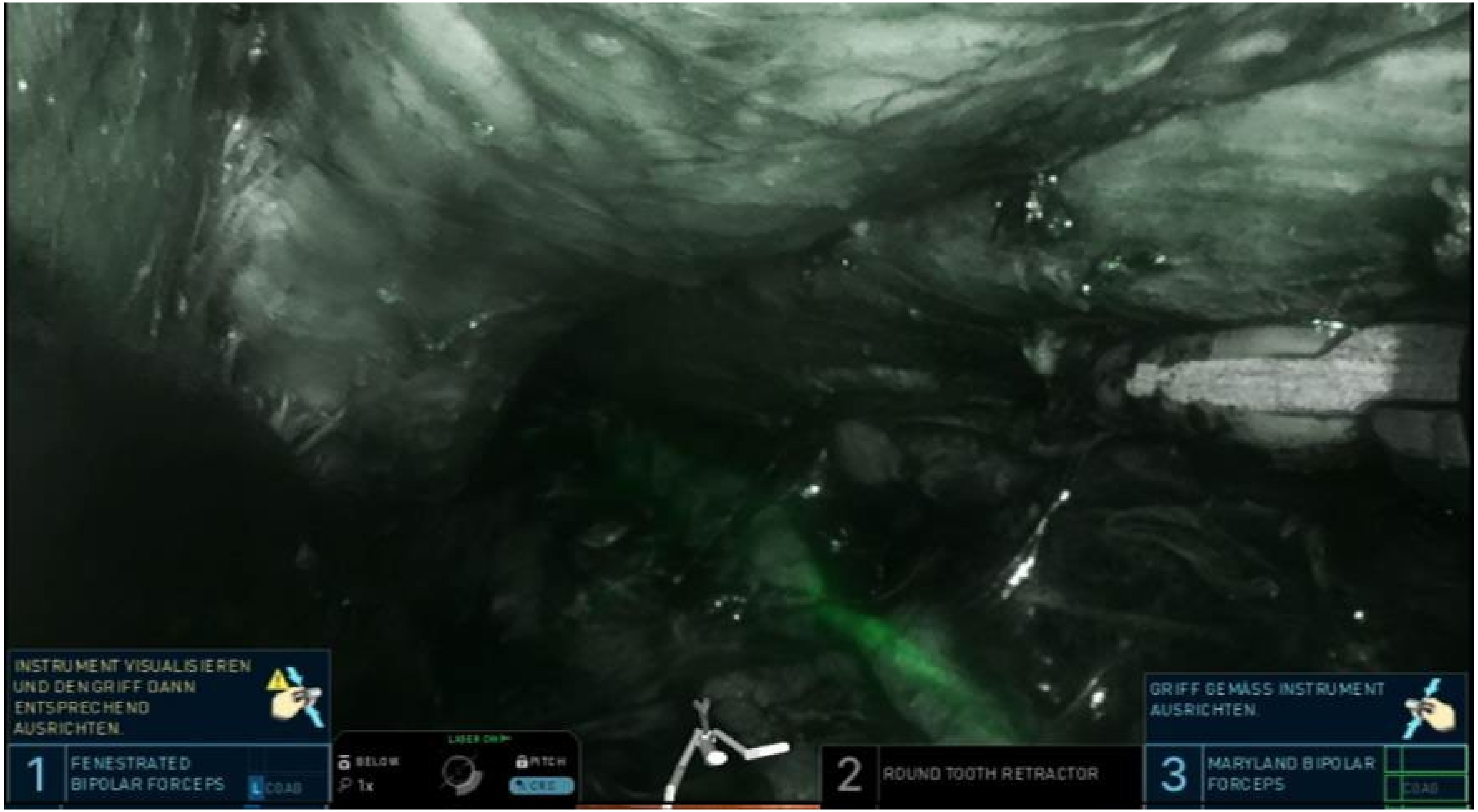

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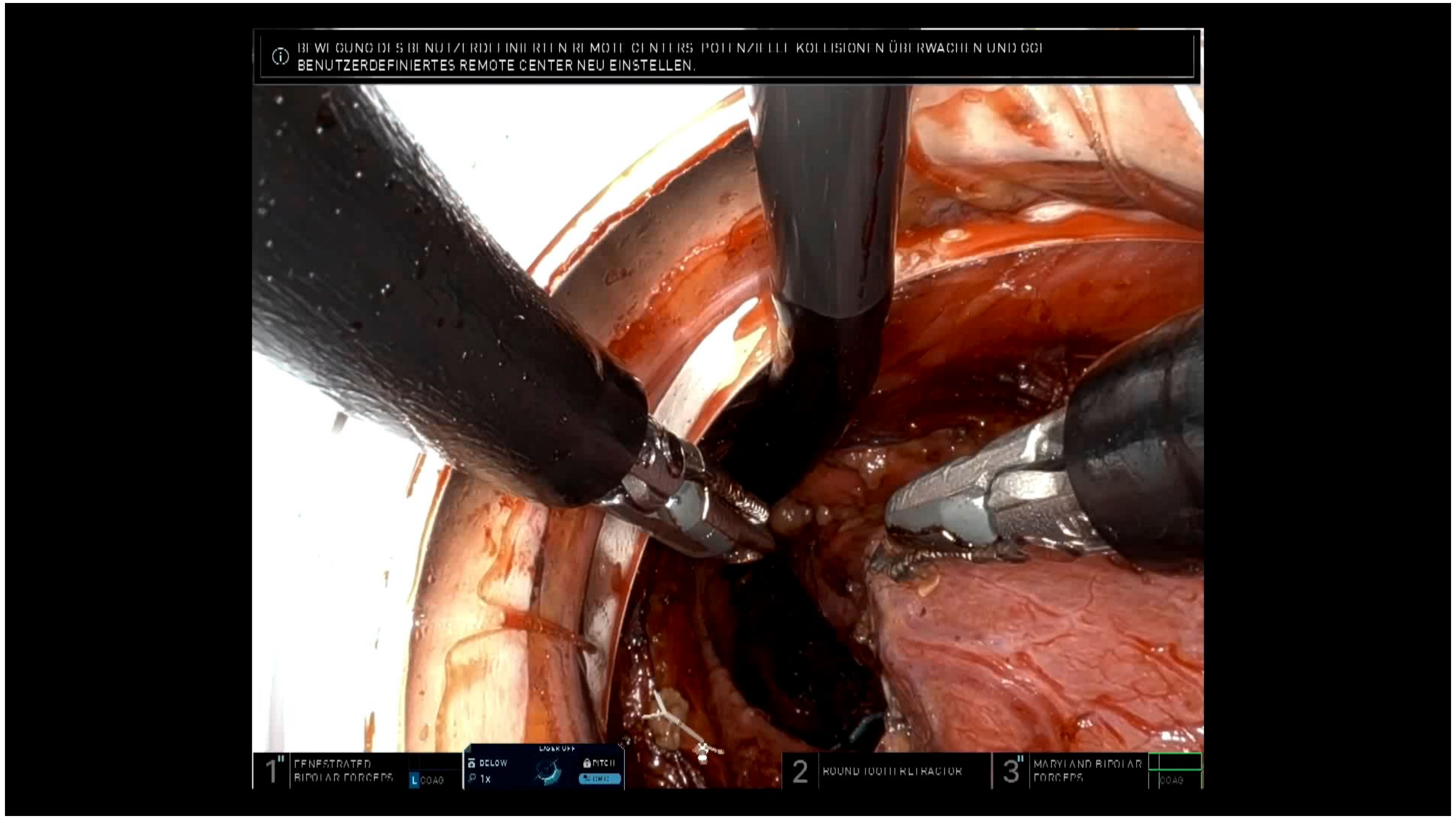

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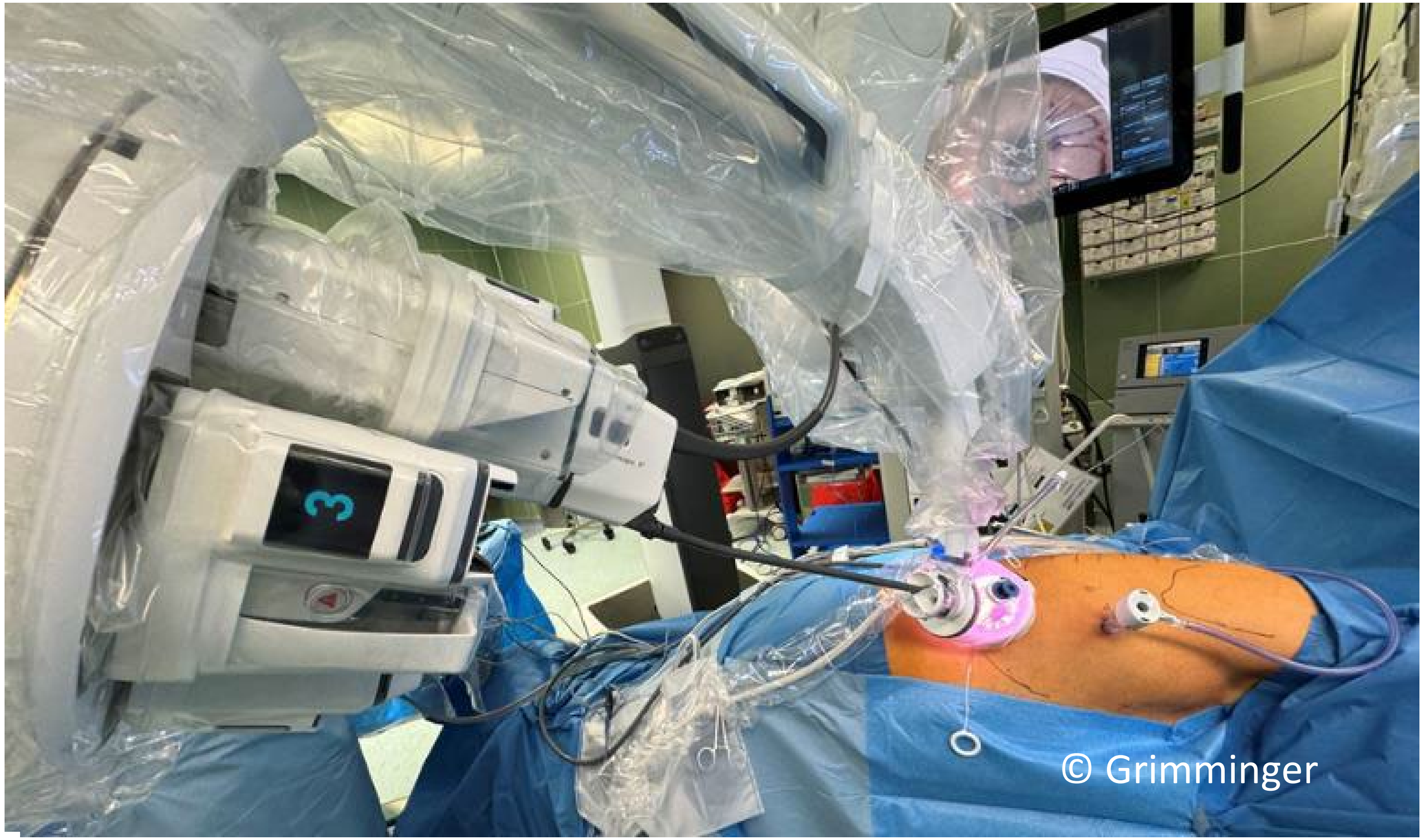
2024 April – subcostal SP RAMIE



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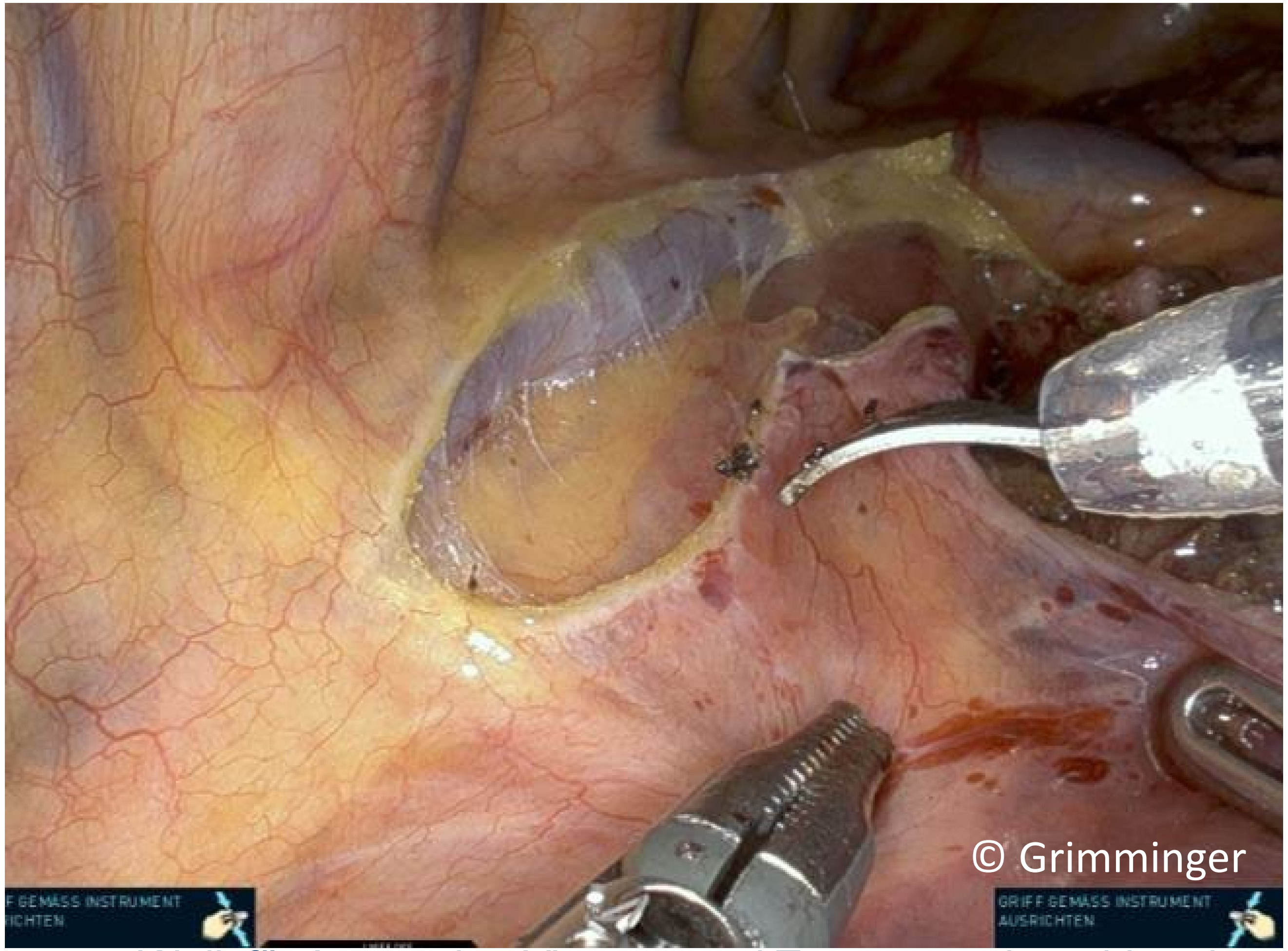
2024 April – subcostal SP RAMIE



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2024 April – subcostal SP RAMIE

Robotic Esophagectomy

RAMIE

Ivor Lewis

Mc Keown

Robotic Esophagectomy

RAMIE

Ivor Lewis

Mc Keown

SP-SC-RAMIE

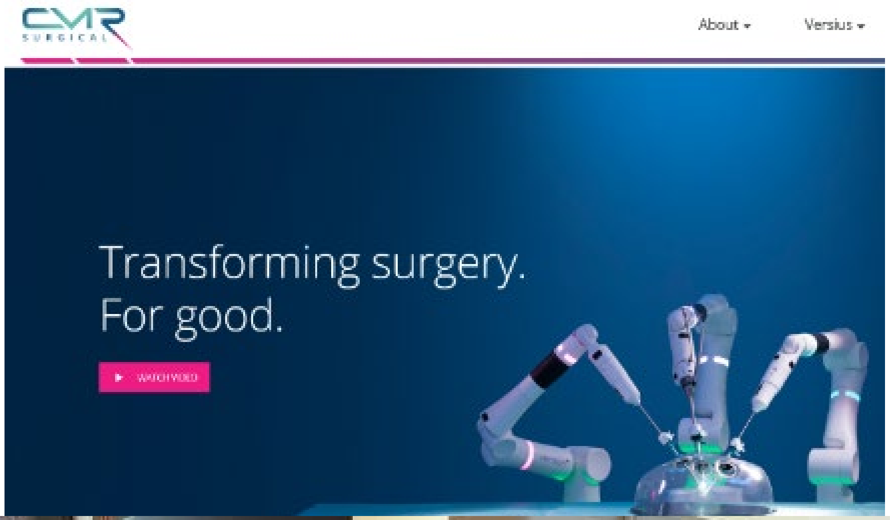
Ivor Lewis

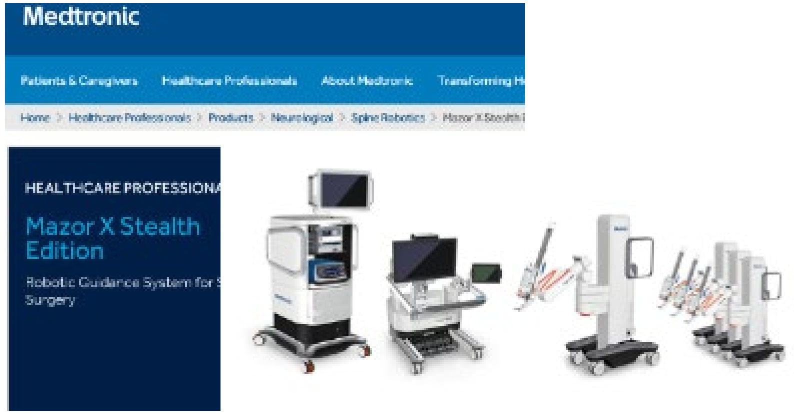
SP-RACE

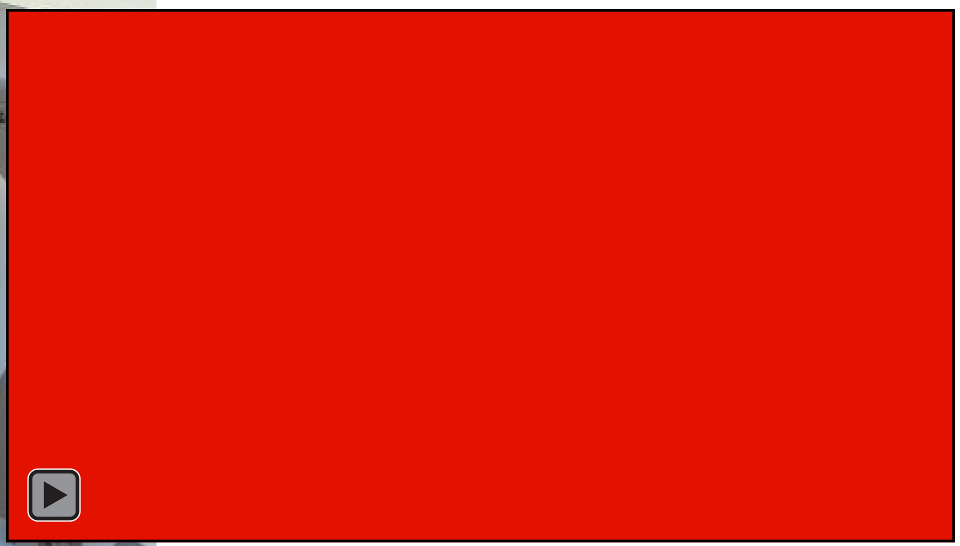
Mc Keown (no thorax acc.)

Weitere Zukunftsausblicke…

Mehr Robotische Systeme kommen…und gehen…







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Zusammenfassung

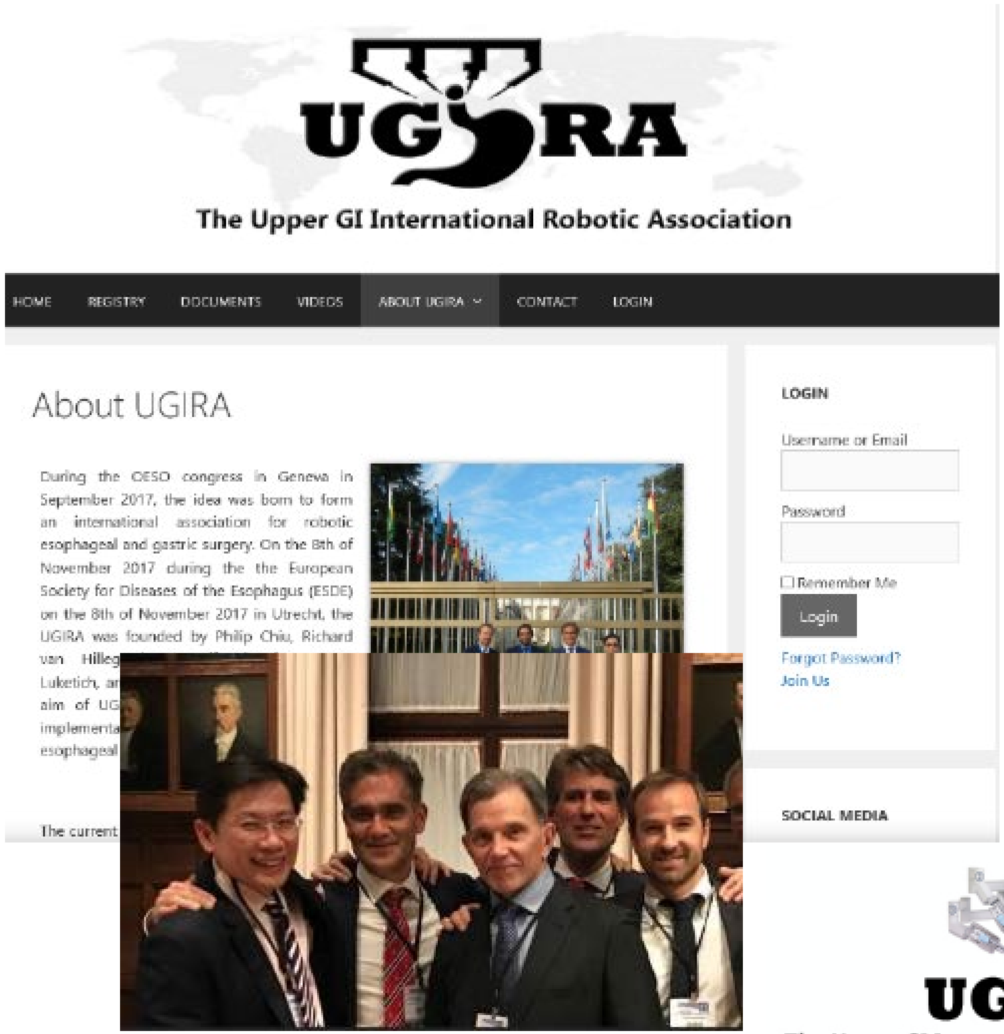
…**mit da Vinci SP** wird RACE in Zukunft ein Thema, da onkolgische Resektionen **ohne onkologische Limitation,** jedoch bei konstanter beidseitiger Ventilation durchgeführt warden kann.

… **SP subcostal RAMIE** ist eine vielversprechende *„schmerzlose“* Prozedur, beosnders für distale Ösophagustumore.

… das SP System ermöglicht neuartige minimal-invasive “**access options”** die sich ggf. mit den bestehenden multiport Prozeduren kombinieren lassen.

Die Entwicklung neuer bzw. neuartiger robotischen Plattformen und die dazugehörige **Software bleibt spannend…**

Case Observation Center
for robot-assisted upper-GI surgery



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