EWJMIS
ELECTRONIC WORLD JOURNAL OF MINIMALY INVASIVE SURGERY

#1

VOLUME 1 - ISSUE 1
MARCH 2012

# A novel permanent therapy for esophageal achalasia: Peroral endoscopic myotomy (POEM)

H.INOUE, MD / SE. KUDO, MD

ISSN 2258-4560


## Welcome to the PDF version of the eWJMIS

Click on the images within the different articles in order to view the media available.

IRCAD shapes up for a revolution in the learning experience, creating a vibrant multimedia iPad journal in synch with cutting-edge technologies for continuing medical education.

A new title, a new look, a new quarterly format —and, we hope, the best of IRCAD's heritage: with this inaugural issue, the editorial team launches a journal with a history and profile unique in the discipline. In this issue, we offer 14 original articles, including operative techniques, clinical cases, a focus on new technologies, and a cultural escape, marking out some of the directions in which we seek to move.

Find out more about our online journal which complements the IRCAD worldwide on-site learning experience (IRCAD France, IRCAD Taiwan, IRCAD América Latina) and our E-learning website, WeBSurg.

The creation of this journal has been possible by the joint efforts of IRCAD France, IRCAD Taiwan, and IRCAD América Latina.

We hope you will enjoy the top-notch functionalities and contents of the E-World Journal.

Sincerely yours

**Jacques Marescaux, MD, FACS, Hon FRCS, Hon JSES**
President of the IRCAD/EITS
WeBSurg Editor-in-Chief
E-WJMIS Editor-in-Chief

**Min-Ho Huang, MD, PhD**
President of Show Chwan Memorial Hospital
Founder of the AITS
E-WJMIS Editor-in-Chief

**Armondo Melani, MD**
Scientific Director of the AMITS
E-WJMIS Editor-in-Chief



# 1 Original Articles

Browse through original articles taken from the eWorld Journal of MIS

# 1.1. A novel permanent therapy for esophageal achalasia: peroral endoscopic myotomy (POEM)

**Haruhiro Inoue, MD**
Digestive Disease Center
Showa University
Northern Yokohama Hospital,
Japan

**Shin-ei Kudo, MD**
Digestive Disease Center,
Showa University
Northern Yokohama Hospital,
Japan



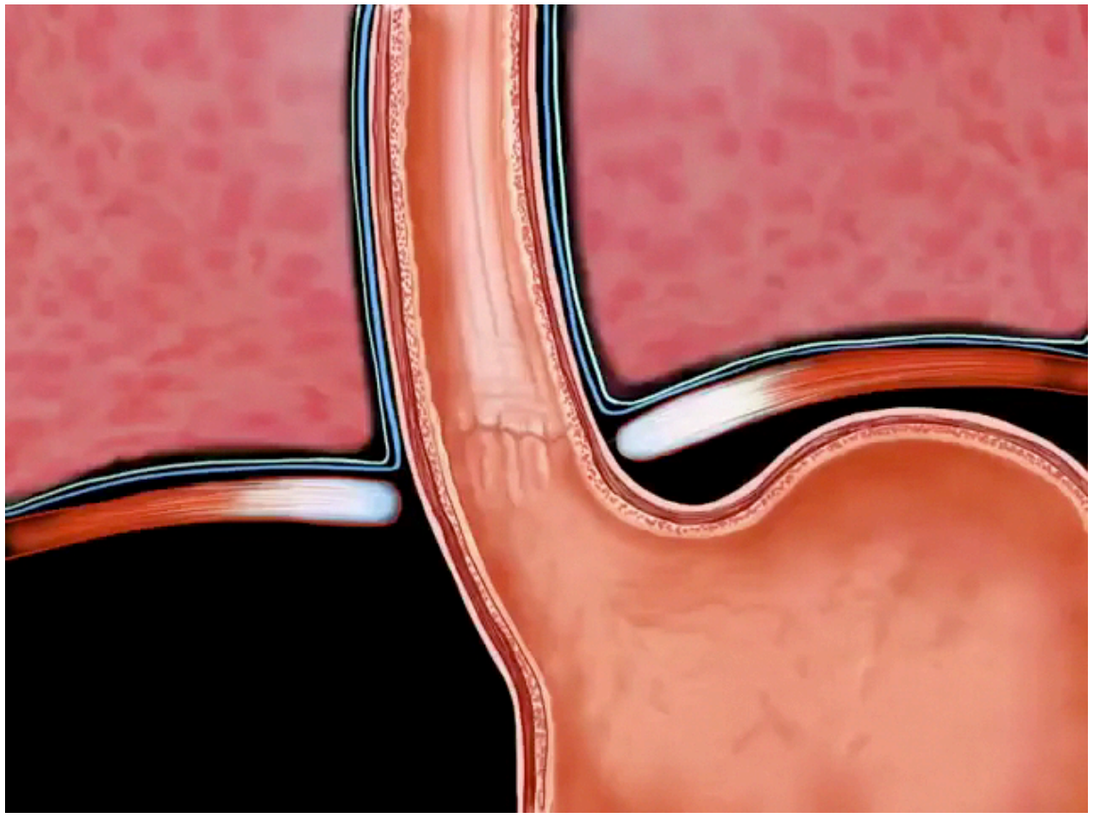
Achalasia is a long-lasting disease with typical symptoms: swallowing difficulty and chest pain. So far, medical treatments such as balloon dilatation and Botox injection are mainly applied, but their efficacy is just limited to the short term.

Laparoscopic myotomy has been performed as a standard procedure of choice expecting permanent cure. But in laparoscopic surgery, myotomy length is still limited and it usually demands at least five abdominal incisions to accomplish it.

We clinically developed a brand-new less invasive procedure of POEM (peroral endoscopic myotomy) in 2008 at Showa University Northern Yokohama Hospital [1-2] 💬.

Haruhiro Inoue, MD interviewed by Silvana Perretta

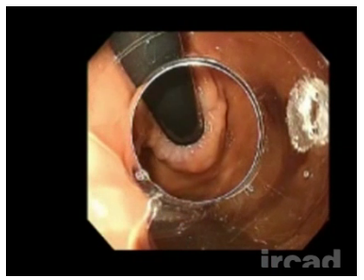
POEM requires no skin incision to perform myotomy completely. POEM is expected to offer total recovery from dysphagia and



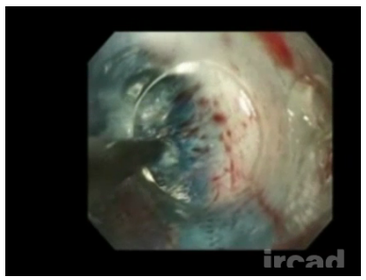
Peroral endoscopic myotomy (POEM)

dramatic relief from chest pain due to esophageal spasm. Eighty-seven consecutive cases have been treated with POEM so far (Feb 28, 2011). Any major complications that may occur (hematoma, mediastinal abscess, prolonged hospital stay, etc.) did not happen. Average hospital stay was 4.2 days. Resting pressure decreased from 31.2 mmHg to 12.5 mmHg on average. The Eckardt score was dramatically improved from 4.9 to 0.5 on average. Eighty-seven cases included 25 cases of sigmoid-type achalasia. POEM was effective for those cases. Five surgically failed patients received POEM. Symptom score was significantly improved.

We consider that POEM is effective in all stages of achalasia patients, and it may replace laparoscopic surgery for the treatment of esophageal achalasia.



Mucosal lift and tunnel



Tunnel

Myotomy

## References


1. Inoue H, Kudo SE. Per-oral endoscopic myotomy (POEM) for 43 consecutive cases of esophageal achalasia. Nippon Rinsho 2010 Sep;68(9):1749-52. ☞ PubMed

2. Inoue H et al. Per-oral endoscopic myotomy (POEM) for esophageal achalasia. Endoscopy 2011;42:265-271. ☞ PubMed

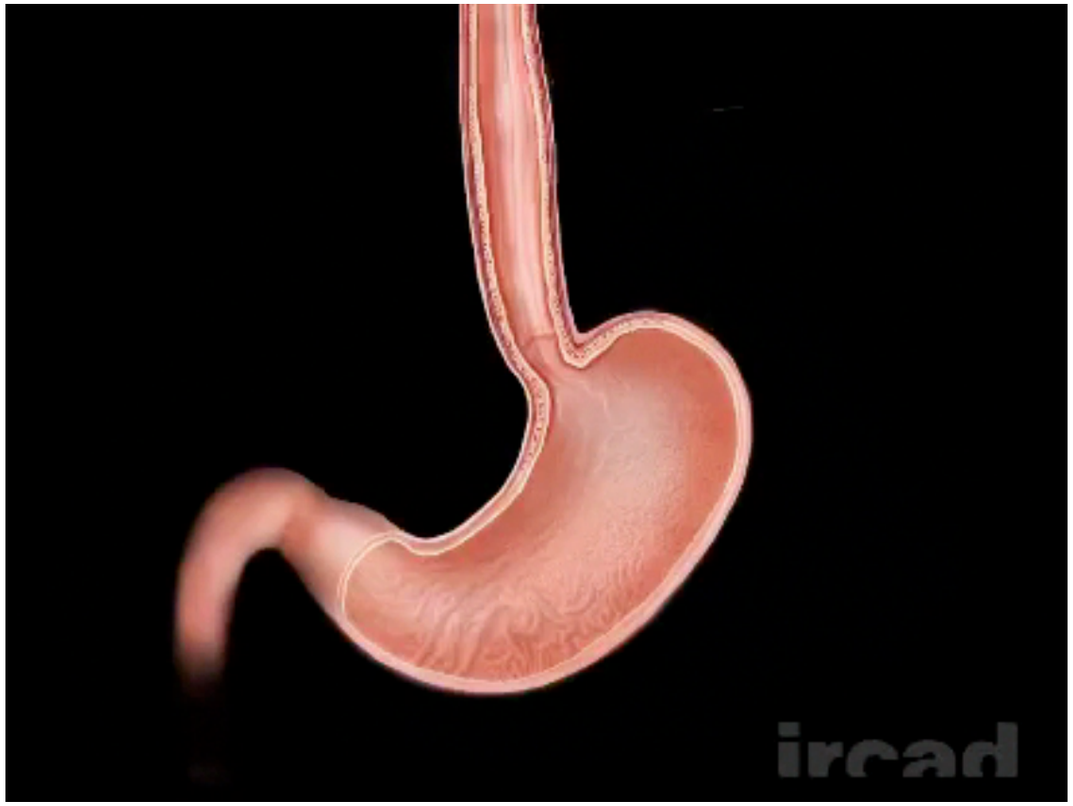
# 1.2. Transoral endoscopic inner layer esophagectomy

**Blair A. Jobe, MD**
Department of Cardiothoracic Surgery,
University of Pittsburgh,
Pittsburgh, Pennsylvania, USA



Esophageal resection is an accepted treatment for Barrett's esophagus with high-grade dysplasia and superficial invasive malignancy [1-2] 💬. However, despite its effectiveness in providing definitive and curative treatment, esophagectomy is associated with substantial morbidity [3-5] 💬.
As such, there has been a drive towards attempting esophageal preservation in patients with intramucosal neoplastic lesions in which lymphatic involvement is unlikely [6-7] 💬. The early success of recently introduced endoscopic approaches such as endoscopic resection and radiofrequency ablation has resulted in a demand for definitive treatments, which ultimately preserve the esophagus. The limitation of these techniques resides in an incomplete and inconsistent histological assessment of the affected luminal surface area. As such, patients require life-long


Blair A. Jobe, MD interviewed by Silvana Perretta



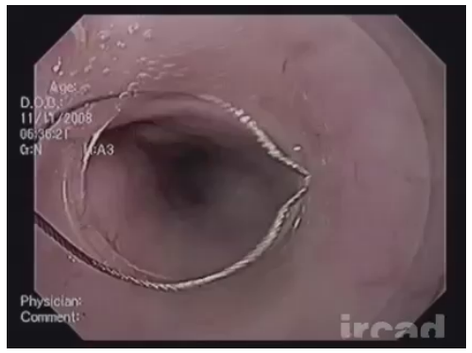

surveillance and subsequent interventions for undetected synchronous or metachronous lesions [9-10] 💬. While endoscopic submucosal dissection can provide an en bloc R0 resection, this technique is operator-dependent, limited by existing technology, cannot address circumferential disease and has a high risk of perforation [11-13] 💬. With all endoscopic techniques, there is a risk for stricture formation if ablation or resection depth enters into the submucosal layer or is extremely large (>3cm) [14-16] 💬.

Biologic scaffolds composed of xenogeneic extracellular matrix have been evaluated for their ability to facilitate non-inflammatory and normal tissue healing response in numerous anatomical sites, including the esophagus [17-18] 💬. In pre-clinical work, circumferential defects were repaired with minimal stricture formation and near normal restitution of the esophageal histomorphology (if host muscle was placed in contact to the ECM) [19] 💬.

The work presented herein highlights our approach to en bloc sleeve resection of the mucosa-submucosa complex over the entire length of the diseased esophagus, while preventing stricture formation with the co-localization of porcine bladder-derived extracellular matrix in the remaining muscularis propria tube. We present the rationale and technique development of transoral endoscopic esophagectomy and discuss the translation of this technique into humans.

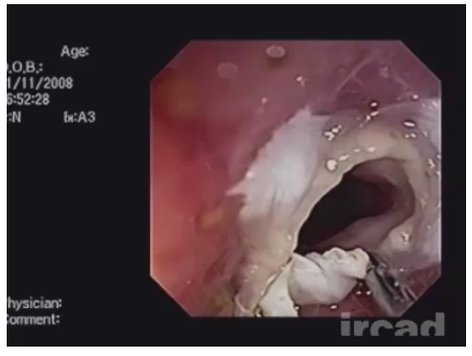

Diseased esophagus

## PORCINE MODEL

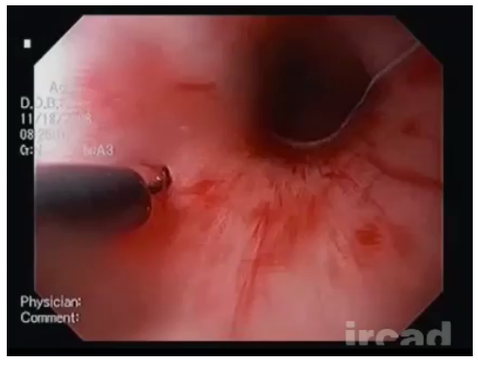


Proximal entry

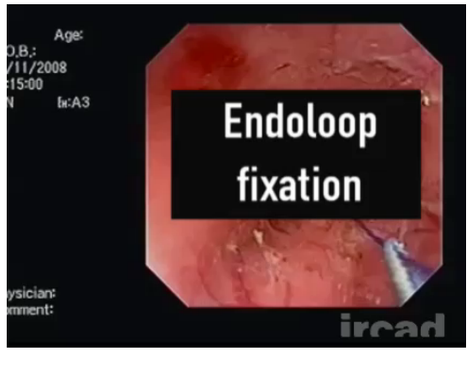

Mucosal stripping



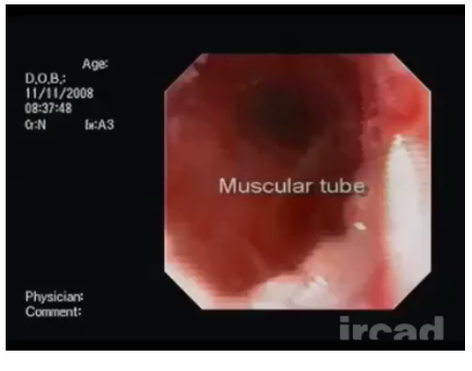
ESD collar




Distal mucosal amputation

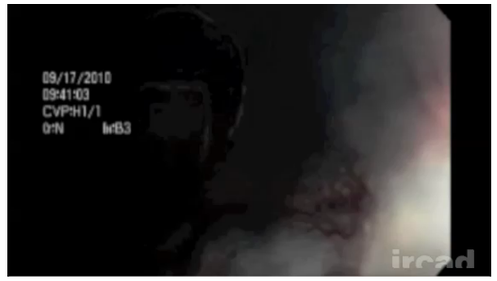



Preparation for stripping

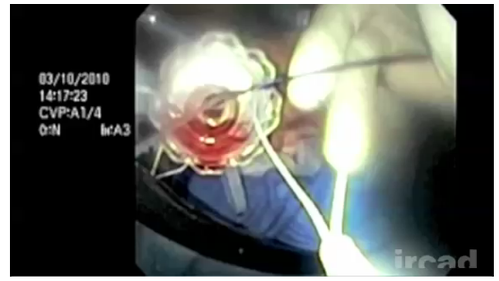



Final result

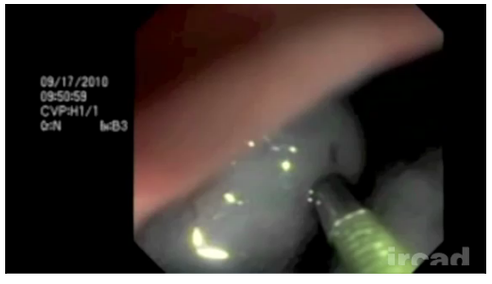
## HUMAN PROCEDURE



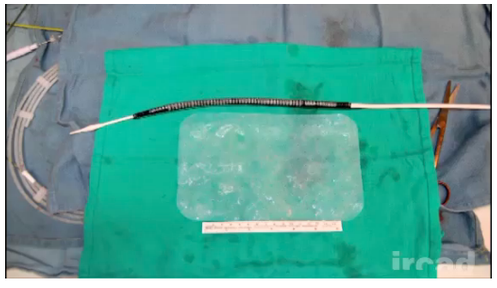
Distal target ESD



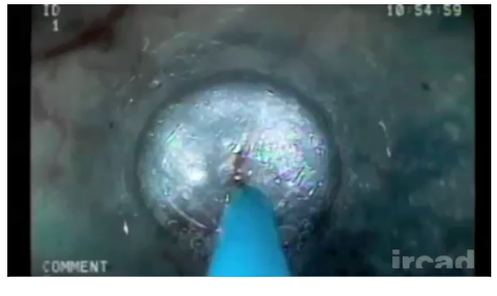
Secure and Skin



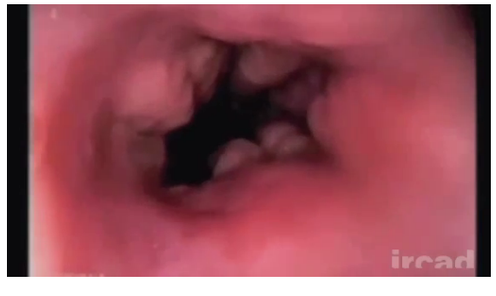
Inject hyaluronate Proximal cuff



ECM Placement



ESD tunnel



Follow-up endoscopy

## REFERENCES


1. DeMeester SR: New options for the therapy of Barrett's high-grade dysplasia and intramucosal adenocarcinoma: endoscopic mucosal resection and ablation versus vagal-sparing esophagectomy. Ann Thorac Surg 2008 Feb;85(2):S747-50. ☞ PubMed

2. Shaheen NJ, Sharma P, Overholt BF, Wolfsen HC, Sampliner RE, Wang KK, Galanko JA, Bronner MP, Goldblum JR, Bennett AE, Jobe BA, Eisen GM, Fennerty MB, Hunter JG, Fleischer DE, Sharma VK, Hawes RH, Hoffman BJ, Rothstein RI, Gordon SR, Mashimo H, Chang KJ, Muthusamy VR, Edmundowicz SA, Spechler SJ, Siddiqui AA, Souza RF, Infantolino A, Falk GW, Kimmey MB, Madanick RD, Chak A, Lightdale CJ: Radiofrequency Ablation in Barrett's Esophagus with Dysplasia. N Engl J Med 2009;360:2277-88. ☞ PubMed

3. Thomas P, Doddoli C, Neville P, Pons J, Lienne P, Giudicelli R, Giovannini M, Seitz JF, Fuentes P: Esophageal cancer resection in the elderly. Eur J Cardiothorac Surg 1996;10:941-6. ☞ PubMed

4. Ell C, May A, Pech O, Gossner L, Guenter E, Behrens A, Nachbar L, Huijsmans J, Vieth M, Stolte M: Curative endoscopic resection of early esophageal adenocarcinomas (Barrett's cancer). Gastrointest Endosc 2007;65:3-10. ☞ PubMed

5. Holscher AH, Bollschweiler E, Schneider PM, Siewert JR: Early adenocarcinoma in Barrett's oesophagus. Br J Surg 1997;84:1470-3. ☞ PubMed

6. Oh DS, Hagen JA, Chandrasoma PT, Dunst CM, Demeester SR, Alavi M, Bremner CG, Lipham J, Rizzetto C, Cote R, Demeester TR: Clinical biology and surgical therapy of intramucosal adenocarcinoma of the esophagus. J Am Coll Surg 2006;203:152-61. ☞ PubMed

7. Rice TW, Blackstone EH, Adelstein DJ, Zuccaro G, Jr., Vargo JJ, Goldblum JR, Murthy SC, DeCamp MM, Rybicki LA: Role of clinically determined depth of tumor invasion in the treatment of esophageal carcinoma. J Thorac Cardiovasc Surg 2003 May;125(5):1091-102. ☞ PubMed

8. Rice TW, Zuccaro G Jr., Adelstein DJ, Rybicki LA, Blackstone EH, Goldblum JR: Esophageal carcinoma: depth of tumor invasion is predictive of regional lymph node status. Ann Thorac Surg 1998;65:787-92. ☞ PubMed

9. Farrell JJ, Lauwers GY, Brugge WR: Endoscopic mucosal resection using a cap-fitted endoscope improves tissue resection and pathology interpretation: an animal study. Gastric Cancer 2006;9:3-8. ☞ PubMed

10. Ahmadi A, Draganov P: Endoscopic mucosal resection in the upper gastrointestinal tract. World J Gastroenterol 2008;14:1984-9. ☞ PubMed

11. Kakushima N, Yahagi N, Fujishiro M, Kodashima S, Nakamura M, Omata M: Efficacy and safety of endoscopic submucosal dissection for tumors of the esophagogastric junction. Endoscopy 2006;38:170-4. ☞ PubMed

12. Yoshinaga S, Gotoda T, Kusano C, Oda I, Nakamura K, Takayanagi R: Clinical impact of endoscopic submucosal dissection for superficial adenocarcinoma located at the esophagogastric junction. Gastrointest Endosc 2008;67:202-9. ☞ PubMed

13. Oyama T, Tomori A, Hotta K, Morita S, Kominato K, Tanaka M, Miyata Y: Endoscopic submucosal dissection of early esophageal cancer. Clin Gastroenterol Hepatol 2005;3:S67-70. ☞ PubMed

14. Kamler JP, Borsatto R, Binmoeller KF: Circumferential endoscopic mucosal resection in the swine esophagus assisted by a cap attachment. Gastrointest Endosc 2002;55:923-8. ☞ PubMed

15. Katada C, Muto M, Manabe T, Boku N, Ohtsu A, Yoshida S: Esophageal stenosis after endoscopic mucosal resection of superficial esophageal lesions. Gastrointest Endosc 2003;57:165-9. ☞ PubMed

16. Conio M, Sorbi D, Batts KP, Gostout CJ: Endoscopic circumferential esophageal mucosectomy in a porcine model: an assessment of technical feasibility, safety, and outcome. Endoscopy 2001;33:791-4. ☞ PubMed

17. Badylak SF, Tullius R, Kokini K, Shelbourne KD, Klootwyk T, Voytik SL, Kraine MR, Simmons C. The use of xenogeneic small intestinal submucosa as a biomaterial for Achilles tendon repair in a dog model. J Biomed Mater Res 1995;29:977-85. ☞ PubMed

18. Dejardin LM, Arnoczky SP, Ewers BJ, Haut RC, Clarke RB. Tissue-engineered rotator cuff tendon using porcine small intestine submucosa. Histologic and mechanical evaluation in dogs. Am J Sports Med 2001;29:175-84. ☞ PubMed

19. Badylak SF, Vorp DA, Spievack AR, Simmons-Byrd A, Hanke J, Freytes DO, Thapa A, Gilbert TW, Nieponice A. Esophageal reconstruction with ECM and muscle tissue in a dog model. J Surg Res 2005;128:87-97. ☞ PubMed

# 1.3. NOTES and rectal cancer

**Patricia Sylla, MD**
Massachusetts General Hospital,
Boston, Massachusetts, USA

With NOTES, complex abdominal procedures may be performed endoscopically using adapted tools. Colorectal surgery is at the forefront of this technological revolution given the central role of endoscopy. Over 20 years of published evidence on the safety of Transanal Endoscopic Microsurgery (TEM) support the notion that purposeful entry into the peritoneal cavity may be safe, granted adequate closure is achieved. This served as the basis for transanal rectosigmoid resection using TEM described in human cadavers in 2007 [1] 💬 .


Patricia Sylla, MD interviewed by Jacques Marescaux

The feasibility of pure transanal endoscopic rectosigmoid resection using TEM was investigated in swine cadavers and acute animals [2] 💬 . The safety of this approach was subsequently evaluated in a 2-week survival study using 20 swines comparing outcomes of pure transanal versus combined transanal and transgastric

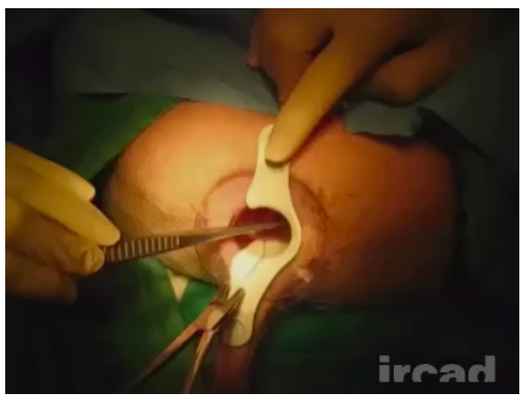
endoscospic rectosigmoid resection [3]. Transanal NOTES rectosigmoid resection with total mesorectal excision (TME) was assessed in human cadavers using the same technique and standard TEM, laparoscopic and endoscopic tools [4]. Lastly, the first transanal endoscopic resection using TEM and laparoscopic assistance was performed in a patient with a T2N2 mid-rectal cancer treated with preoperative chemoradiation [5].

In swines, circumferential en bloc resection of the rectosigmoid and its mesentery was performed using TEM followed by transanal specimen extraction and stapled colorectal anastomosis [2]. Combining transgastric and transanal endoscopic access overcame difficulties with visualization and permitted mobilization of additional colon [2-3]. In the survival study, an abdominal abscess and abdominal wall hematoma were found at necropsy in the combined group [3].

In human cadavers, full-thickness dissection of the rectum was initiated at the level of the anorectal ring. TME was completed in all cases and upon entry into the abdomen, a variable length of colon was mobilized due to limited maneuverability [4].In the first clinical case published to-date, these limitations were overcome by laparoscopic assistance [5] and TME was achieved with an intact mesorectum, 23 negative lymph nodes and negative margins [5].

Based on extensive experimental testing, NOTES transanal endoscopic rectosigmoid resection with TME is feasible and safe, and with laparoscopic assistance, may be used for rectal cancer in selected patients. Oncologic adequacy and long-term outcomes of this procedure require formal investigation.

Procedure




Porcine model


Cadaver model

## References


1. Whiteford MH, Denk PM, Swanström LL. Feasibility of radical sigmoid colectomy performed as natural orifice translumenal endoscopic surgery (NOTES) using transanal endoscopic microsurgery. Surg Endosc 2007 Oct;21(10):1870-4. ☞ PubMed

2. Sylla P, Willingham FF, Sohn DK, Gee D, Brugge WR, Rattner DW. NOTES rectosigmoid resection using transanal endoscopic microsurgery (TEM) with transgastric endoscopic assistance: a pilot study in swine. J Gastrointest Surg 2008 Oct;12(10):1717-23. ☞ PubMed

3. Sylla P, Sohn DK, Cizginer S, Konuk Y, Turner BG, Gee DW, Willingham FF, Hsu M, Mino-Kenudson M, Brugge WR, Rattner DW. Survival study of NOTES rectosigmoid resection using transanal endoscopic microsurgery with or without transgastric endoscopic assistance in a swine model. Surg Endosc 2010 Aug;24(8):2022-30. ☞ PubMed

4. Sylla P, Kim MC, Dursun A, Sohn DK, Ajari I, Konuk Y, Turner B, Gee D, Brugge W, Rattner D. Completely NOTES rectosigmoid resection using Transanal Endoscopic Surgery (TEM): Experience in human cadavers. Poster presentation at the American Society of Colon and Rectal Surgeons, Minneapolis, MN, June 2010.

5. Sylla P, Rattner DW, Delgado S, Lacy AM. NOTES transanal rectal cancer resection using transanal endoscopic microsurgery and laparoscopic assistance. Surg Endosc 2010;24:1205-10. ☞ PubMed

# 1.4. Preoperative virtual neck exploration & intraoperative augmented reality for parathyroidectomy


**Jacopo D'Agostino, MD**
IRCAD - University of Strasbourg,
Department of Digestive and Endocrine Surgery,
France

**James Wall, MD, MSc**
IRCAD - University of Strasbourg,
Department of Digestive and Endocrine Surgery,
France

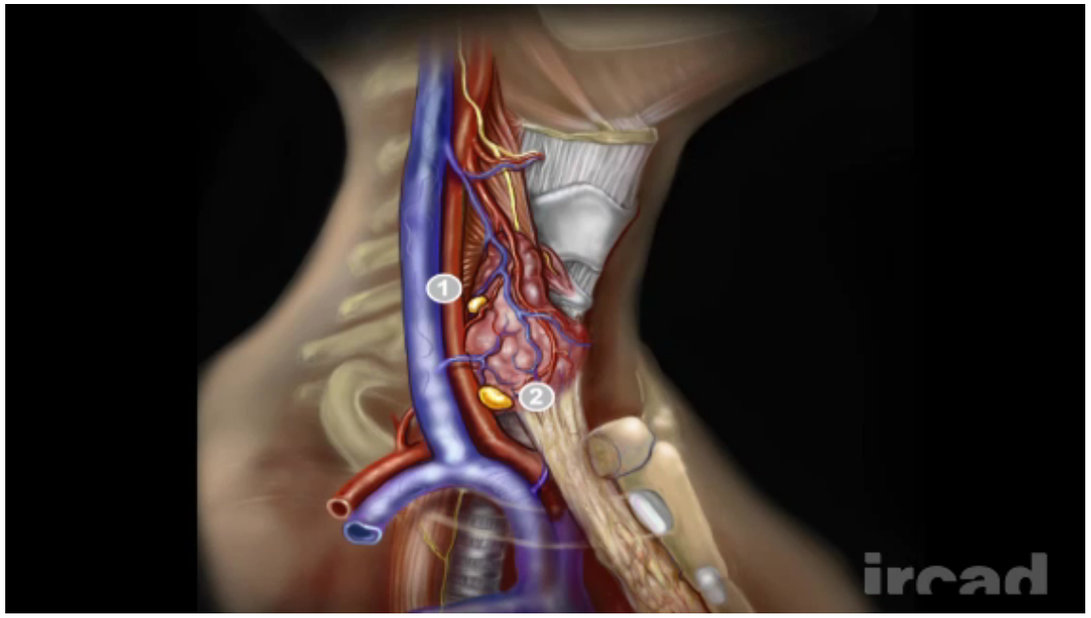
**Luc Soler, PhD**
IRCAD - University of Strasbourg,
Department of Digestive and Endocrine Surgery,
France

**Jacques Marescaux, MD, FACS,**
Hon FRCS, Hon JSES
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

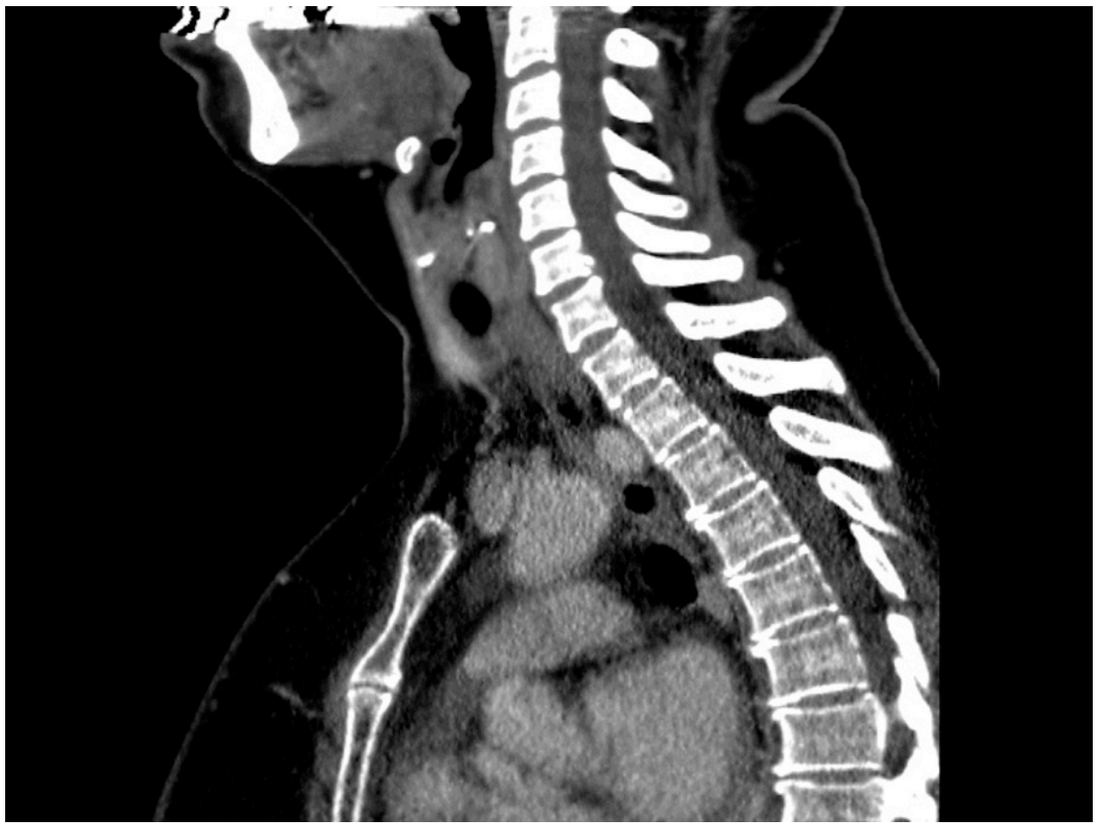



Primary hyperparathyroidism (PHPT) is a common endocrine disorder with complications including kidney stones, osteoporosis, cardiovascular disease and an overall lower health-related quality of life. Parathyroidectomy is an effective and durable treatment for PHPT.

Multiple imaging modalities have been reported for the localization of parathyroid adenomas including ultrasonography, Tc-99m sestamibi scan, CT scan and magnetic resonance imaging. CT scanners are becoming ubiquitous in the developed world due to their versatility and low inter-operator variability, but have not proven exceptional at localization of parathyroid adenomas without enhancements such as perfusion [1-3] 💬. 3D rendering may enhance the ability of standard CT to localize parathyroid




Our experience with the virtual neck exploration & intraoperative augmented reality



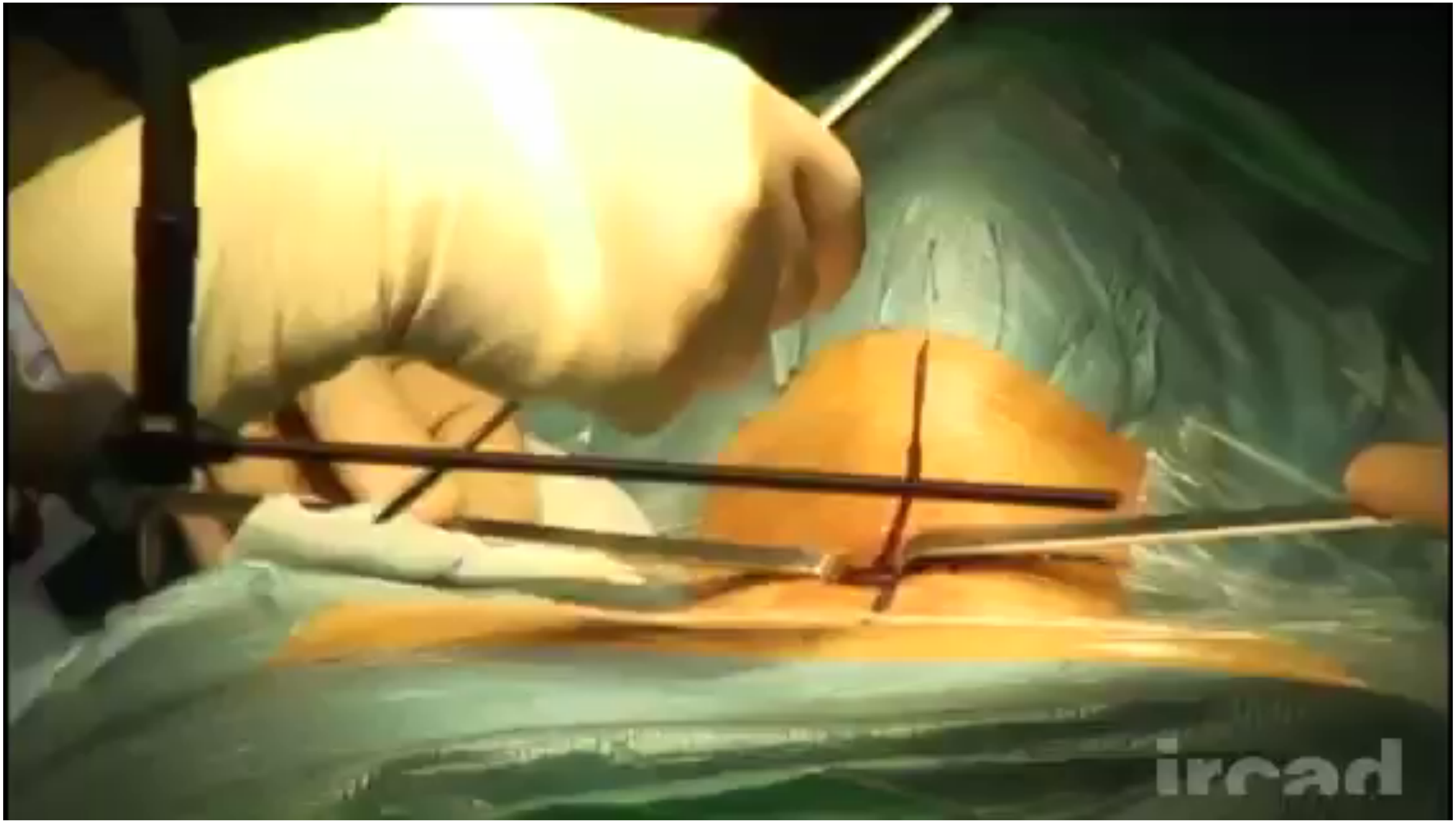
Axial, Sagittal and Coronal sections

pathology and enhance surgical dissection through augmented reality [4-5] .
Present 3D rendering from standard CT images to enable preoperative virtual neck exploration and intraoperative augmented reality.

Patients with primary hyperparathyroidism in our center undergo neck CT with contrast injection and 0.75mm slices. From these images, 3D rendering is performed using the 3D Virtual Patient Modeling (3D VPM) and VR-Render software, both developed at IRCAD. Rendering begins with automated algorithms to differentiate skin, trachea, lungs, bones, blood vessels and esophagus. A radiology technician in our group then views the axial, saggital and frontal views simutaneously. Suspicious parathyroid lesions are highlighted based on location, size, shape, Hounsfield units, visibility on at least two out of three planner images, and no correlation on any planer image with vascular or other known structures. The model is then used for a 3D preoperative neck exploration by the endocrine surgery group to finalize operative planning.

Tumor detection using preopertive virtual neck exploration has a higher sensitivity and similar specificity for parathyroid adenomas compared to ultrasound, sestamibi and standard CT scan at our center. Posterior adenomas are more easily detected in the saggital view, whereas anterior parathyroid glands are more easily detected in the frontal view.

3D rendering provides an excellent platform for preoperative virtual neck exploration with visualization of the patient-specific anatomy. This modality allows the surgeon to envision potential lesions and predict intraoperative difficulty due to anatomical variation. In addition, the virtual neck model can be further applied during the operation with image overlay creating an augmented reality for the operating surgeon.




Clinical case: Video-assisted parathyroidectomy

## References


1. Rodgers SE, Hunter GJ, Hamberg LM, et al. Improved preoperative planning for directed parathyroidectomy with 4-dimensional computed tomography. Surgery. Dec 2006;140(6):932-940; discussion 940-931. ☞ PubMed

2. Mortenson MM, Evans DB, Lee JE, et al. Parathyroid exploration in the reoperative neck: improved preoperative localization with 4D-computed tomography. J Am Coll Surg. May 2008;206(5):888-895; discussion 895-886. ☞ PubMed

3. Starker LF, Mahajan A, Bjorklund P, Sze G, Udelsman R, Carling T. 4D Parathyroid CT as the Initial Localization Study for Patients with De Novo Primary Hyperparathyroidism. Ann Surg Oncol. 2011 Jun; 18(6):1723-8. Epub 2010 Dec 24.. ☞ PubMed

4. Marescaux J, Rubino F, Arenas M, Mutter D, Soler L. Augmented-reality-assisted laparoscopic adrenalectomy. JAMA. Nov 10 2004;292(18):2214-2215. ☞ PubMed

5. Mutter D, Dallemagne B, Bailey C, Soler L, Marescaux J. 3D virtual reality and selective vascular control for laparoscopic left hepatic lobectomy. Surg Endosc. Feb 2009;23(2):432-435. ☞ PubMed

# 1.5. Laparoscopic hernia repair - TAPP or TEP

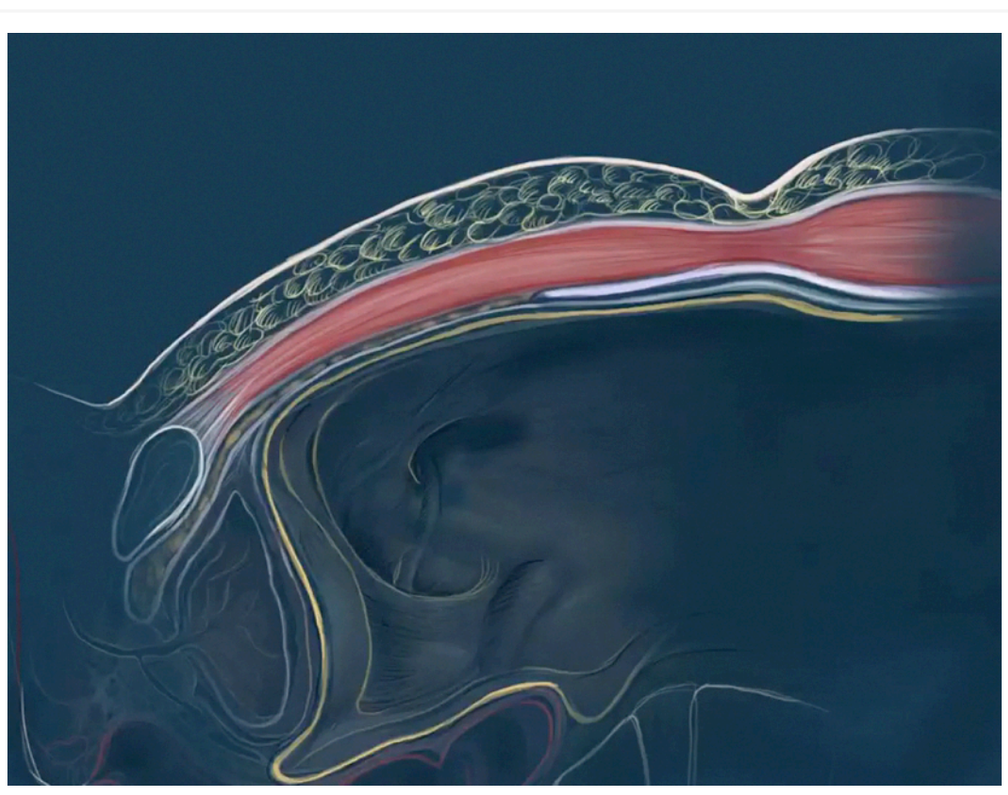
**Michael Bailey, MD**
University of Surrey,
Guildford, UK

There is only one randomised control trial (RCT) and 8 non-randomised RCTs comparing TAPP with TEP. The EU Hernia Trialists Collaboration (Br J Surg 2000:87;860-867) performed a systematic review of 34 RCTs comparing laparoscopic (TAPP and TEP) with open methods of groin hernia repair. The National Institute for Clinical Excellence (NICE) systematic review (September 2004) of 37 RCTs compared laparoscopic (TAPP and TEP) with open mesh repairs in 5560 patients. The Cochrane Collaboration in 2007 systematic review of 1 RCT and 8 non-randomised RCTs compared TAPP with TEP.


Michael Bailey, MD, FRCS interviewed by Bernard Dallemagne

**The RCTs of laparoscopic versus open considered the following:**

- Is the technique safe?
- Is the repair secure?
- Are long-term morbidity rates better?
- Do patients return to normal activities earlier?
- Are there any additional benefits?



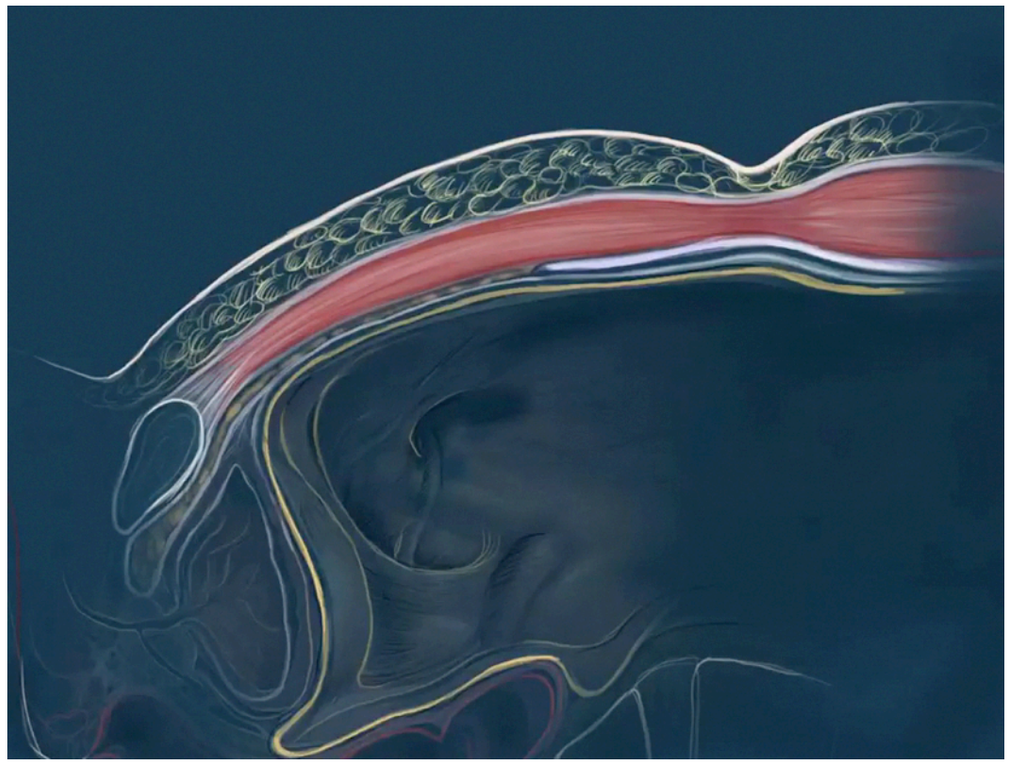
TAPP

**Safety**

The EU study indicated injuries per 1000 patients were TAPP 7.3, TEP zero, Open 1.1. NICE concluded TEP and TAPP produced fewer wound infections and haematoma; vascular injuries were 0.13% in TAPP and zero in TEP and Open. Visceral injuries were TAPP 0.79%, TEP 0.16% and Open 0.14%. The conclusion was that TEP was safer than TAPP.

**Security of the repair**

EU trial [1] 💬 10 RCTs recurrence rate 2% in TAPP, 2.1% in Open. In 4 RCTs of TEP versus Open mesh recurrence was 2.2% and 1.4% respectively. The overall Laparoscopic recurrence rate was



TEP

2.3% and Open 2.9%. The NICE study of recurrence in 15 RCTs was TAPP 2.5%, Open 2.1%. In 13 RCTs, recurrence in TEP was 2.3% and Open 1.3%. The overall conclusion of these studies was no significant difference in recurrence in TEP, TAPP or Open.

**Chronic pain**

Coala Trial Group [2] in 994 patients TEP 2%, Open 14% ($p<0.001$). NICE appraisal in 8 RCTs showed a recurrence rate (RR) of 0.72 in favour of TAPP versus Open and in 4 RCTs a RR of 0.72 for TEP compared with Open. The conclusion in all of these trials confirmed a significant reduction in chronic pain. Persistent numbness is also significantly reduced (RR 0.26) in 8 RCTs of TAPP versus Open and 4 RCTs TEP versus Open (RR 0.67) in the NICE appraisal. In 2 RCTs TAPP versus Open, the numbness reduction was maintained at 5 years [3] .

**Return to normal activities**

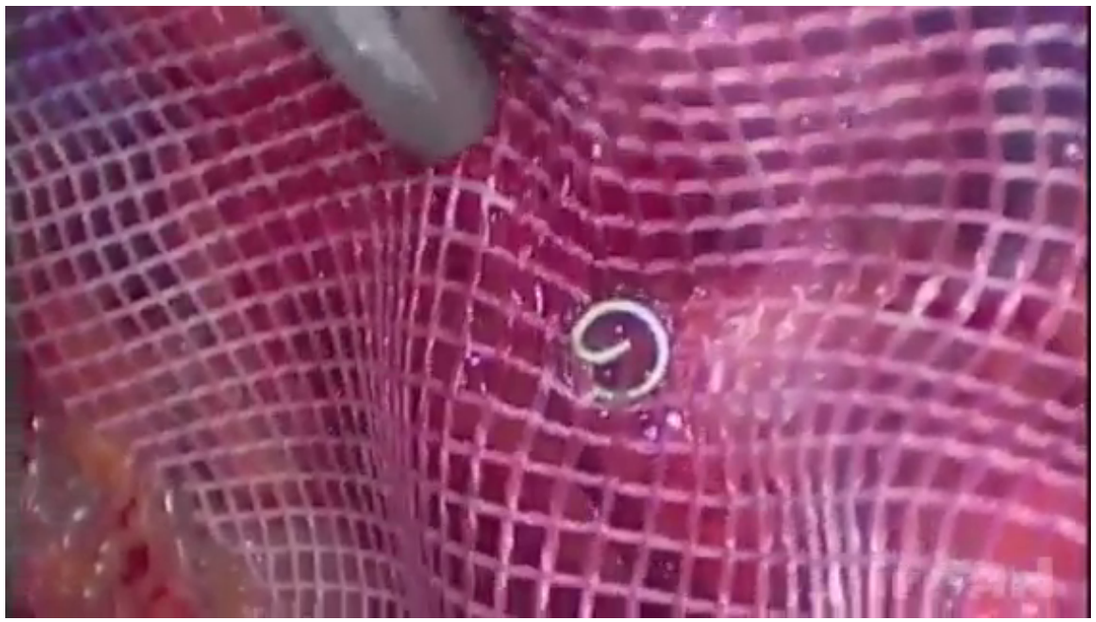
29 RCTs and in 25 of these reported an earlier return to normal activities or work (Sign test $p<0.001$). Coala Trial Group in 1997 TEP versus Open normal activities 6 days versus 10 days, work 14 days versus 21 days and athletic activities 24 days versus 36 days ($p<0.001$ in all groups). NICE appraisal 2004 meta-analysis of 7 RCTs TAPP versus Open RR of 0.66 in favour of TAPP ($p=0.00001$) and meta-analysis of 5 RCTs TEP versus Open RR of 0.49 ($p=00001$) in favour of TEP.

**Additional benefits**

Bilateral herniae: Laparoscopic approach through the same 3 small incisions, the cost of an additional mesh, relatively small increase in operating time and no increase in postoperative pain or recovery; also the opportunity to repair occult contralateral herniae.

**Is it cost-effective?**

Re-analysis of MRC Laparoscopic Groin Hernia Trial considered that TEP and TAPP is a cost-effective alternative to open flat mesh hernia (OFM). The overall conclusion of laparoscopic versus open is that in laparoscopic repair there is less pain, quicker recovery, less chronic pain and numbness, low recurrence, fewer complications and overall cost-effectiveness to society. There is no statistical difference between TAPP and TEP in terms of length of



TEP repair, right indirect inguinal hernia

operation, haematoma formation, length of stay, return to usual activity or recurrence rates. However in TAPP, there is a higher incidence of port site herniae and visceral injuries.

## References


1. EU Hernia Trialists Collaboration. Laparoscopic compared with open methods of groin hernia repair: systematic review of randomized controlled trials. Br J Surg 2000;87:860-7. ☞ PubMed

2. Liem MS, van der Graaf Y, van Steensel CJ, Boelhouwer RU, Clevers GJ, Meijer WS, Stassen LP, Vente JP, Weidema WF, Schrijvers AJ, van Vroonhoven TJ. Comparison of conventional anterior surgery and laparoscopic surgery for inguinal-hernia repair. N Engl J Med 1997;336:1541-7. ☞ PubMed

3. Heikkinen T, Bringman S, Ohtonen P, Kunelius P, Haukipuro K, Hulkko A. Five-year outcome of laparoscopic and Liechtenstein hernioplasties. Surg Endosc 2004;18:518-22. ☞ PubMed

4. Douek M, Smith G, Oshowo A, Stoker DL, Wellwood JM. Prospective randomised controlled trial of laparoscopic versus open inguinal hernia mesh repair: five year follow up. BMJ 2003;326:1012-3. ☞ PubMed

# 2 Operative Techniques

Keep abreast of changes in surgical techniques and emerging technologies to offer patients the most up-to-date procedures.

# 2.1. Robot-assisted (Da-Vinci System SiHD system) total thyroidectomy from a single axillary access (RATT)

**Paolo Miccoli, MD**
Università degli Studi di Pisa, Italy

**Michele Minuto, MD**
Università degli Studi di Pisa, Italy



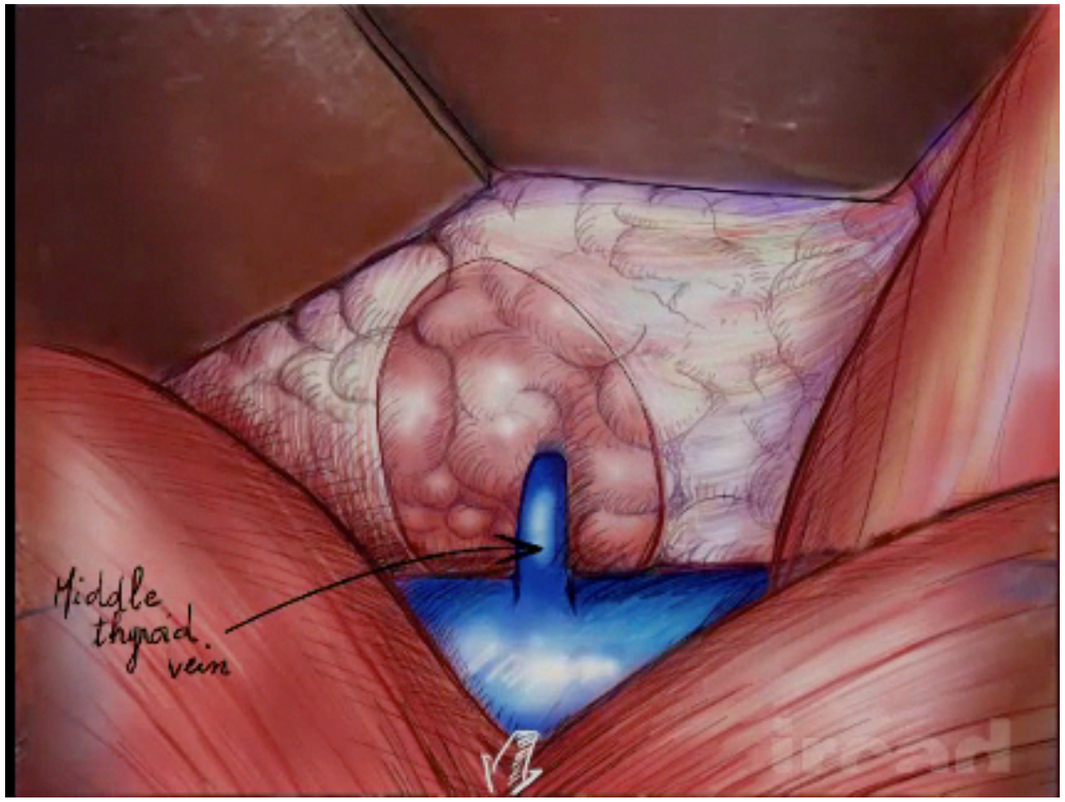
The axillary approach to the thyroid gland was described by Eastern authors. The objective was to avoid an undesired scar in the neck. In Western countries, although the goal is to minimize the incisions, this approach has never been developed until it has been clear that the axilla represents the only way to apply the robotic technology to the thyroid, due to the spaces required by the instruments.

Paolo Miccoli, MD interviewed by Jacques Marescaux

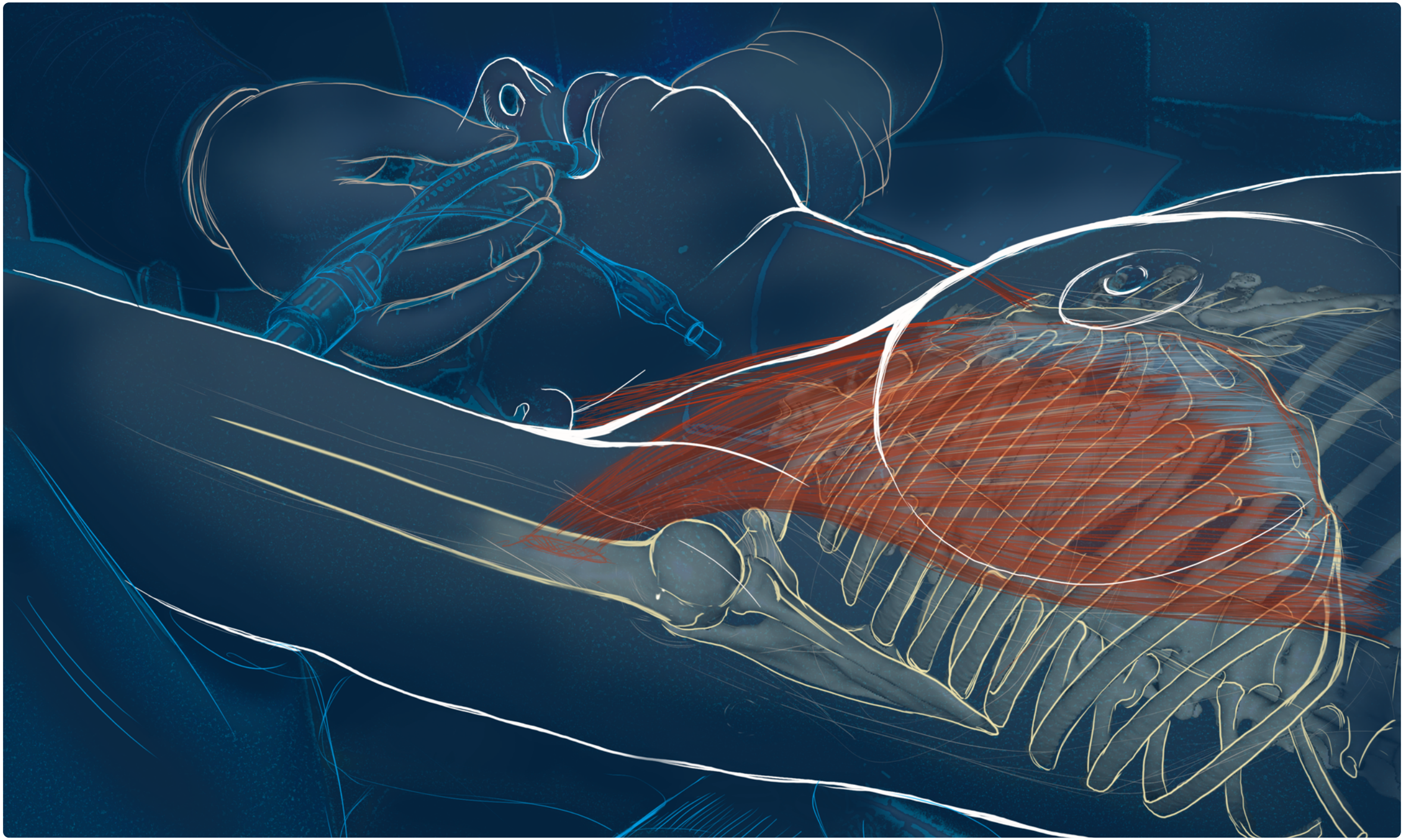
The patient is positioned supine, with the arm extended upward and the head slightly hyper-extended, to obtain the shortest distance from axilla to neck. The incision is 6 to 8cm in length, on the lateral edge of the pectoralis muscle. A subcutaneous plane is followed until the two heads of the sternocleidomastoid muscles are encountered, and the space between them is opened. The

neck is entered by dissecting the internal jugular vein, retracting it downward. The thyroid lobe is then identified, and the strap muscles dissected from it. The robotic instruments are then introduced, once the operative space has been achieved using a specific external retractor. The instruments needed are: a 30-degree camera, an ultrasonic energy device, and two Maryland forceps. The robot-assisted lobectomy starts with the dissection of the upper pedicle, and of the inferior vessels, and then ends with the identification of the inferior laryngeal nerve and the parathyroid glands. The use of the 30-degree endoscope allows to perform the contralateral lobectomy, staying very close to the thyroid lobe to identify the inferior laryngeal nerve and the parathyroid glands. Thyroidectomy can be completed by a thorough central neck dissection.

A safe and thorough RATT can be performed with two main advantages: the endoscopic magnification, which allows for an oncologically radical operation, and the absence of scar in the neck.




Operative technique



# 2.2. Video-assisted exploration of the four parathyroid glands for primary hyperparathyroidism

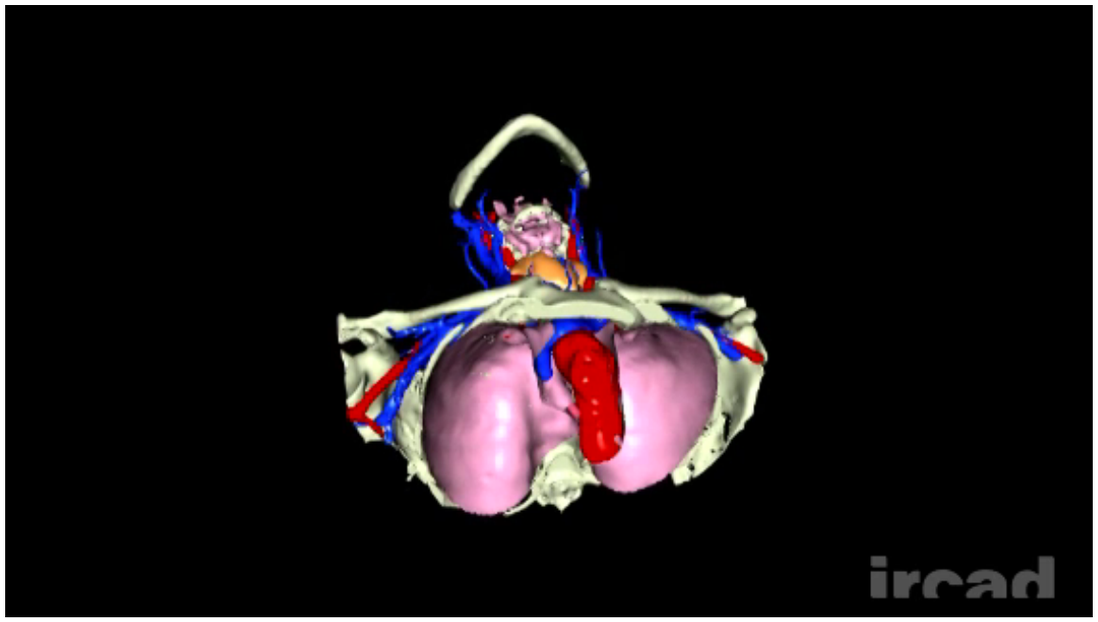
**Michel Vix, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Jacques Marescaux, MD, FACS,**
Hon FRCS, Hon JSES
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France



The presence of a single parathyroid adenoma accurately located using preoperative imaging is the best indication for minimally invasive surgery when dealing with primary hyperparathyroidism. It is certainly possible to search for several glands that may be suspicious of adenoma, but an extensive experience in video-assisted cervical surgery is required to find the anatomical structures allowing to explore the four parathyroid locations.
A 75-year-old obese woman is diagnosed with hypercalcemia, hypophosphoremia and a high level of PTH during a work-out for joint pain.

Surgical Anatomy - Axial images




3D Reconstruction

Preoperative imaging includes a 3D-reconstructed cervico-mediastinal CT-scan. A computer program developed at the IRCAD-Strasbourg, named VrAnat™, Vr planning™, is used for that purpose. This 3D virtual reconstruction demonstrates three suspicious images respectively located at the right superior parathyroid territory, at the right latero-esophageal area, and at the left inferior parathyroid territory. A video-assisted cervical exploration, guided by this reconstruction, is decided upon. The objective is to find the three suspicious images and to explore the four parathyroid glands.

A 3cm median incision is carried out 2cm above the sternal notch. The right thyrotracheal groove is reached through a dissection performed laterally to the strap muscles and medially to the omohyoid muscle. A complete dissection of the lateral aspect of the thyroid lobe is obtained using blunt dissection and small instruments under endoscopic vision, which is provided by a 30-degree, 5mm scope (Storz, Tüttlingen, Germany). The recurrent laryngeal nerve is identified.

Dissection is now carried on above the inferior thyroid artery. It allows to rapidly identify a superior parathyroid adenoma, which will be resected. It exactly matches with one of the suspicious images.

Dissection is pursued anterior to the intersection between the artery and the nerve so as to find the right inferior parathyroid, which is healthy, underneath the capsule.

The latero-esophageal image is now searched for. It is nothing but an anthracosic lymph node.

The left side is approached by dissecting the left jugulocarotid gutter. The left recurrent nerve is identified. The left inferior parathyroid is identified and looks healthy. The suspected image is nothing else but a nodule of the apex of the thyrothymic ligament. The left superior parathyroid, which is healthy, can be finally identified in a strictly orthotopic position, although partially hidden behind a Zuckerkandl's nodule.

This cervical exploration has led to the dissection and visualization of the four parathyroid lobes in compliance with classical parathyroid surgery principles.


Clinical case
75-years-old woman
Joint pain
Hyper Calcemia : 3,10 mmol/l
Hypophosphoremia
PTH 150 pg/ml
ircad

## References

1. Berti P, Materazzi G, Picone A, Miccoli P. Limits and drawbacks of video-assisted parathyroidectomy. Br J Surg 2003;90:743-7.
☞ PubMed

2. Miccoli P, Materazzi G, Baggiani A, Miccoli M. Mini invasive video assisted surgery of the thyroid and parathyroid glands: a 2011 update. J Endocrinol Invest 2011 Jun;34(6):473-80. Epub 2011 Mar 2 2 .
☞ PubMed

# 2.3. Laparoscopic-assisted distal gastrectomy with D2 lymph node dissection

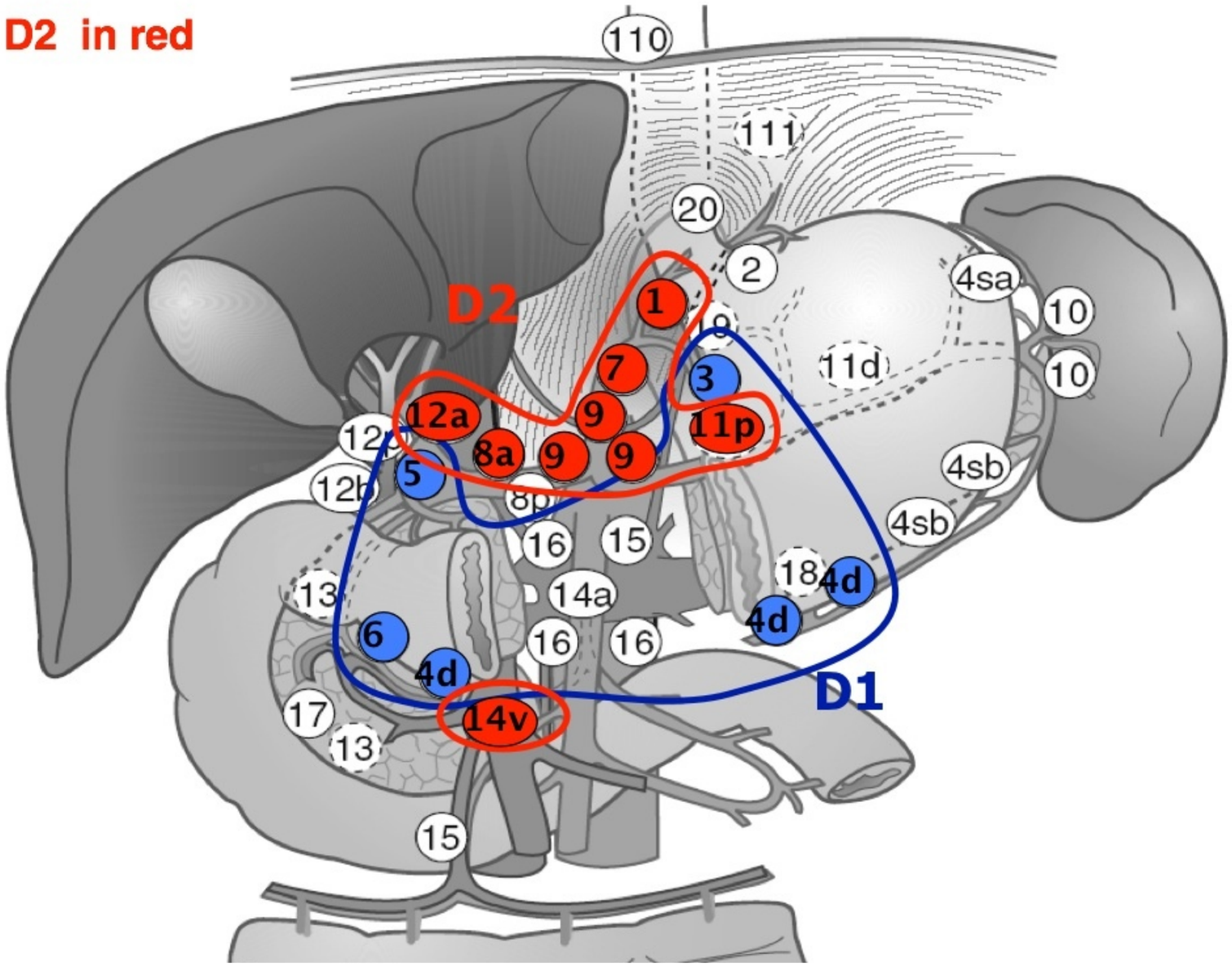
**Han-Kwang Yang, MD**
Seoul National University
Cancer Research Institute,
South Korea

We present a laparoscopic-assisted distal gastrectomy with **D2 lymph node** dissection for gastric cancer.

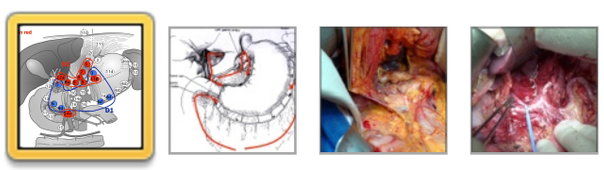
**Total omentectomy** starts from the middle of the stomach toward the left side of the patient, while preserving the vasa rectae and keeping the colonic wall away from the energy-based device. After careful dissection and division of left gastroepiploic vessels with caution to the spleen, the lymph node dissection of **station No. 4Sb** can be achieved safely. The greater curvature can be easily freed after the vascular division using an energy-based device. By preserving the mesocolonic vessels cautiously, sufficient mobilization and exposure of the transverse colon and of the duodenum are required to approach **station No. 6** safely.

Once the right gastroepiploic vessels have been identified and ligated after careful dissection along the right colic artery toward


Han-Kwang Yang, MD interviewed by Jacques Marescaux

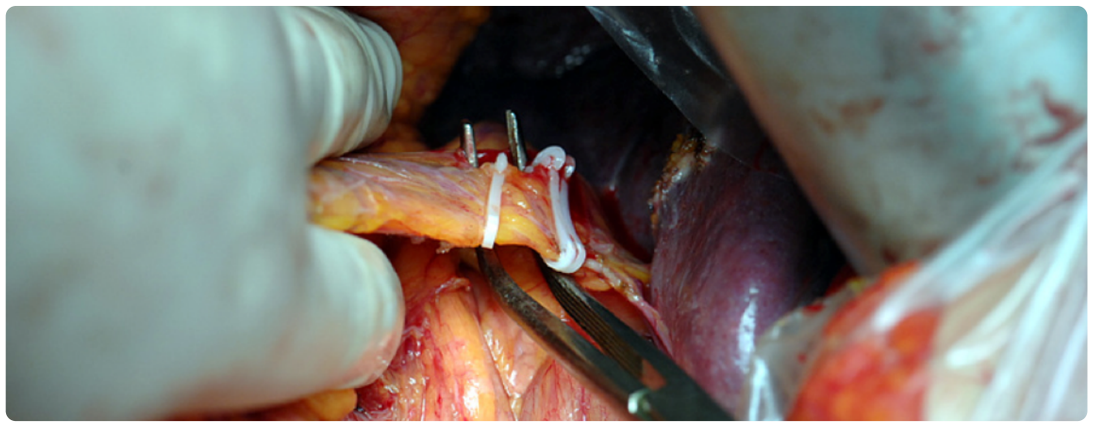



D2 lymph node dissection for gastric cancer



the gastrocolic trunk, lymph nodes around station No. 6 can be dissected meticulously paying attention not to injure the duodenum or the pancreas. The sufficient mobilization of the posterior duodenal wall from the gastroduodenal artery and the common hepatic artery could be useful to approach the suprapancreatic area. Once the right gastric artery has been identified, lymph nodes around station No. 5 can be resected en bloc with those around **station No. 12** at the hepatoduodenal ligament.

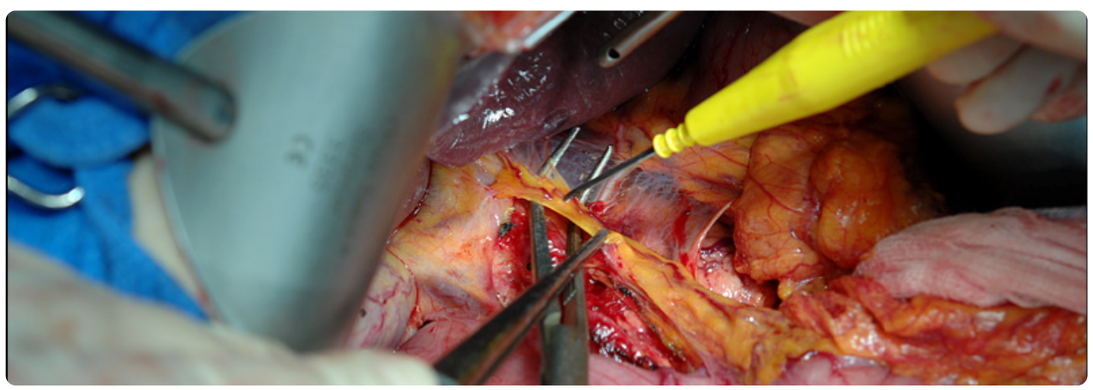
For a complete D2 lymph node dissection, we usually start to dissect the **suprapancreatic area** toward the splenic artery No. 11p. After the meticulous dissection of No. 11p as far as the middle portion of the splenic artery, the lymph nodes around the common hepatic artery No. 8a and the left gastric artery No. 7 can be dissected sequentially. The consecutive dissection around the celiac trunk No. 9 can be performed after division of the left gastric artery using double endoclips. Finally, the right paracardial and the lesser curvature area should be completely dissected for the



The lymph node dissection of station No. 4Sb can be achieved safely

1 sur 16

lymph nodes around stations No. 1 and No. 3.
Energy-based devices should be handled with great caution to avoid thermal damage to adjacent tissues, which may induce intraoperative vessel injury as well as postoperative pseudo-aneurysm.
For the well-trained surgeon, laparoscopic distal gastrectomy with D2 lymph node dissection can be a safe and feasible procedure.



lymph nodes around station No. 5 can be resected en bloc with those around station No. 12 at the hepatoduodenal ligament

1 sur 12


Laparoscopic-assisted distal gastrectomy

# 3 Clinical Cases

Clinical cases, continuing medical education

# 3.1. Laparoscopic excision of a horseshoe-shaped leiomyoma of the lower esophagus

**Bernard Dallemagne, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Federico Costantino, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

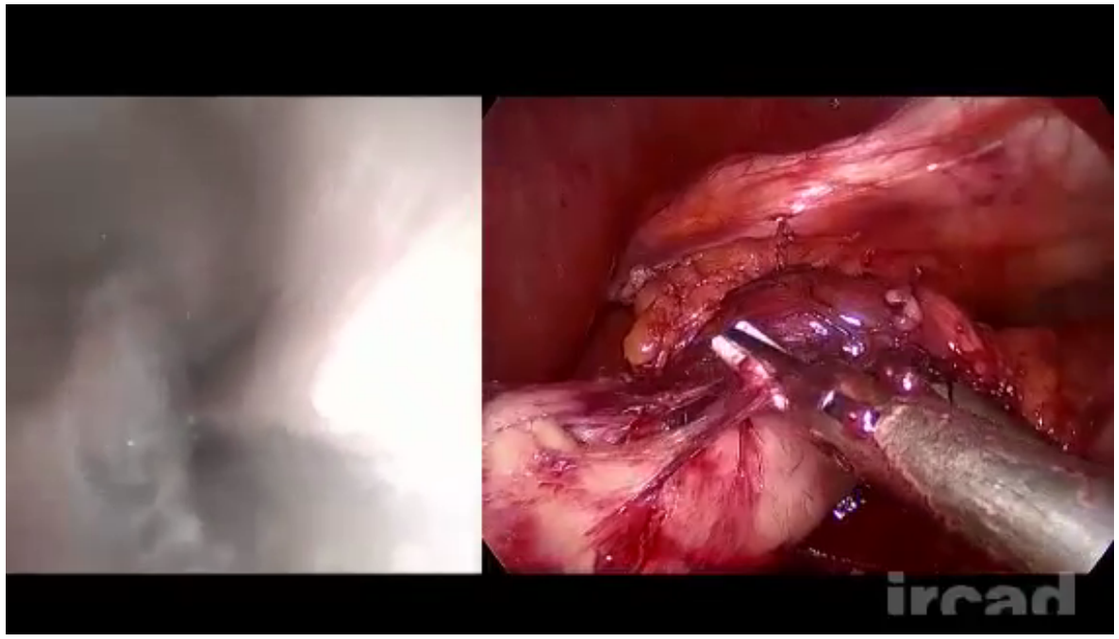
**Silvana Perretta, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Jacques Marescaux, MD, FACS,**
Hon FRCS, Hon JSES
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France



Esophageal leiomyomas are approximately 50 times less common than carcinomas, but they represent 80% of benign tumors of the lower esophagus.

An esophageal leiomyoma can be enucleated safely and effectively through minimally invasive surgery. The laparoscopic approach is a conventional option for this kind of tumor (located near or at the esophagogastric (EG) junction). Laparoscopic transhiatal enucleation is a safe and feasible procedure. This video demonstrates all the technical details of a laparoscopic excision of a large horseshoe-shaped leiomyoma of the lower esophagus. A conventional port placement is used to approach the hiatal region.




Operative technique

# 3.2. Incidental esophageal leiomyoma during reflux surgery: what to do?


**Bernard Dallemagne, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Silvana Perretta, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

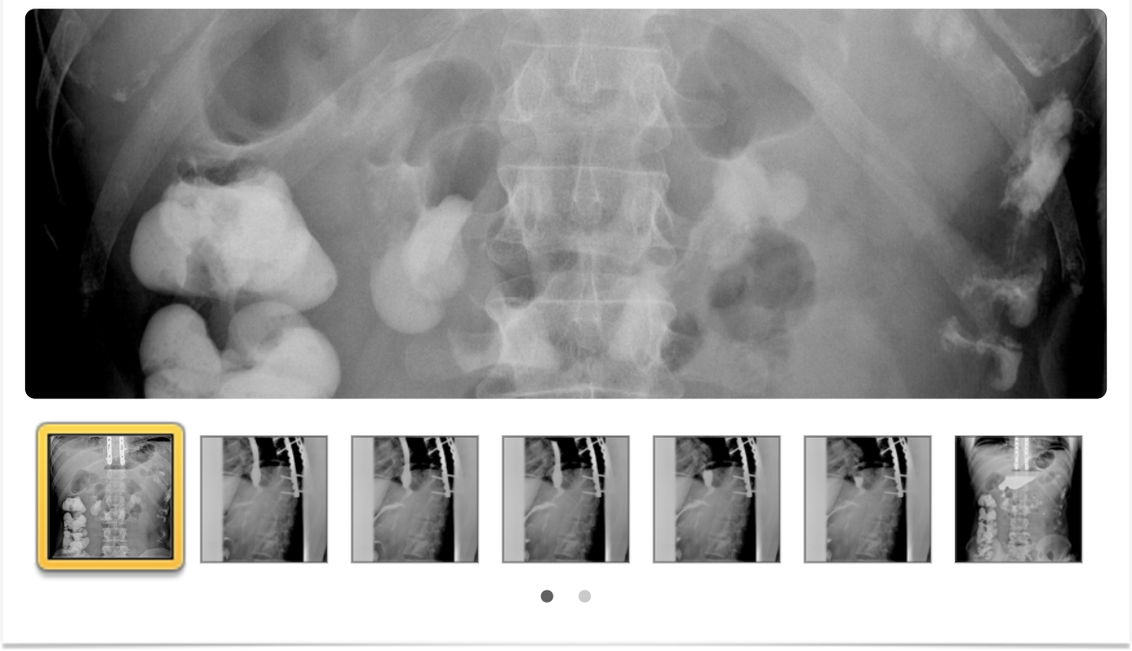
**Jacques Marescaux, MD, FACS,**
Hon FRCS, Hon JSES
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

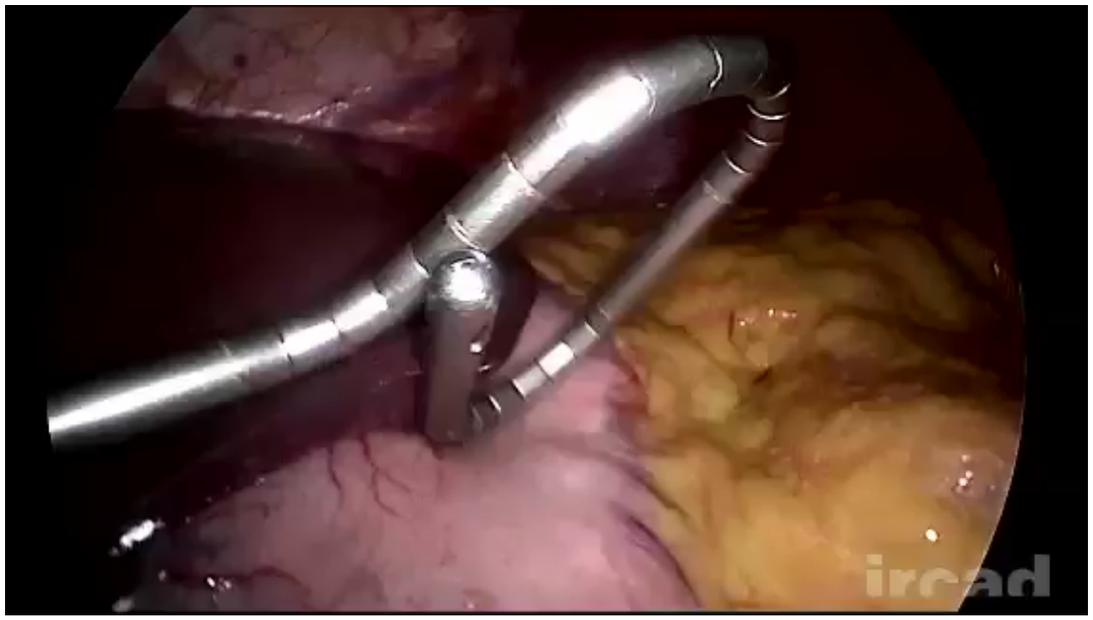



Esophageal leiomyomas probably account for 70% of all benign tumors of the esophagus [1-4] 💬. Surgical removal is indicated for symptomatic patients or for a tumor with a progressive increase in size [2] 💬.

This is the case of 36-year-old man, in whom an incidental leiomyoma of the distal esophagus was discovered at laparoscopic fundoplication for GERD. Due to the incidental finding of a large periesophageal mass, the surgeon elected to perform a partial posterior fundoplication instead of the planned 360-degree wrap with the goal to surgically re-explore the patient after further diagnostic testing. Also, the surgeon felt uncomfortable enucleating the lesion transhiatally.

Three months postoperatively the patient underwent a second operation by a multidisciplinary team of both gastro-intestinal and thoracic surgeons. At preoperative MRI the lesion was acknowledged as a probable leiomyoma. The second surgical






exploration failed due to dense adhesions between the stomach and the left liver. Here we show the third hiatal surgical exploration. Only minor adhesions were found and the access to the esophageal hiatus was therefore straightforward. The opening of the esophageal hiatus soon allowed for the visualization of a 3x4 cm lesion likely originating from the posterior esophageal wall. The macroscopic feature is that of a leiomyoma. The cleavage plane between the lesion and the esophagus is created with gentle blunt dissection. The stalk of the tumor, at the level of the cardia on the posterolateral right esophageal wall is selectively divided without entering the esophageal lumen. The muscular layer of the esophagus is then reapproximated to prevent outpouching. After crural closure, a short floppy Nissen fundoplication is built. The specimen is extracted through the 12mm camera port using an extraction bag. The pathology examination confirmed the diagnosis of leiomyoma. The upper gastrointestinal series performed on postoperative day one revealed no leakage and the patient was started on a liquid diet on day 1.

At least 50% of patients with esophageal leiomyoma remain asymptomatic, and these tumors are usually discovered as incidental findings during endoscopic examination of the upper gastrointestinal tract for unrelated reasons. In this patient the tumor was discovered at the time of surgery. In such a case we recommend either to postpone surgery whenever there is a significant doubt about the nature of the lesion, to fully study the patient and to optimize therapy, or to proceed to the excision of the tumor. Whenever the diagnosis is unclear no further surgical steps such as fundoplication should be carried out. For tumors of lower-mid esophagus, we prefer a laparoscopic transhiatal approach which is less invasive than the thoracoscopic approach.

## References


1. Esophageal leiomyoma: a 40-year experience. Mutrie CJ, Donahue DM, Wain JC, Wright CD, Gaissert HA, Grillo HC, Mathisen DJ, Allan JS. Ann Thorac Surg. 2005 Apr;79(4):1122-5. ☞ PubMed

2. Surgical therapy of esophageal leiomyoma. Bonavina L, Segalin A, Rosati R, Pavanello M, Peracchia A. J Am Coll Surg. 1995 Sep; 181(3):257-62. ☞ PubMed

3. Minimally invasive enucleation of esophageal leiomyoma. Zaninotto G, Portale G, Costantini M, Rizzetto C, Salvador R, Rampado S, Pennelli G, Ancona E. Surg Endosc. 2006 Dec;20(12):1904-8. ☞ PubMed

4. Minimally invasive resection of benign esophageal tumors. Kent M, d'Amato T, Nordman C, Schuchert M, Landreneau R, Alvelo-Rivera M, Luketich J. J Thorac Cardiovasc Surg. 2007 Jul;134(1):176-81. ☞ PubMed

# 3.3. Round table: facing mishaps around the hiatus

**Bernard Dallemagne, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Lee Swanström, MD, FACS**
Legacy Health System,
The Oregon Clinic,
Portland, Oregon, USA

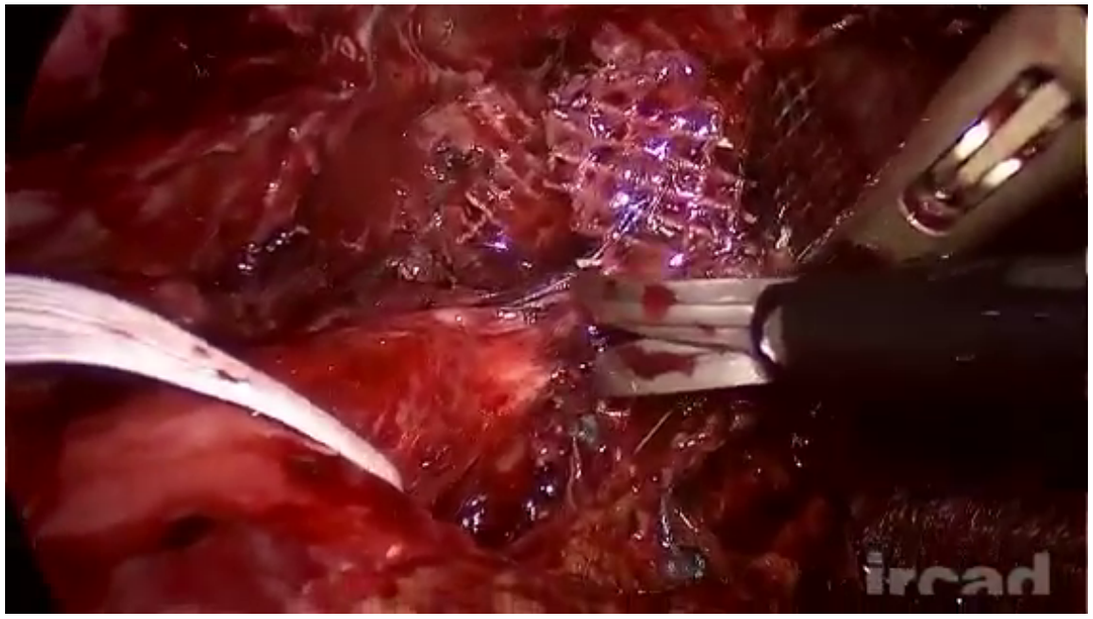
**Nathaniel J. Soper, MD**
Northwestern University Feinberg
School of Medicine,
Chicago, Illinois, USA



Laparoscopic hiatal hernia repair has a recurrence rate [1-10] up to 66%. Mesh reinforcement for crural repair may reduce this risk. Complications related to prosthetic hiatoplasty for hiatal hernia repair are more common than previously reported. The use of prosthetic materials has been associated with esophageal stricture, erosion, and perforation [12-17]. Contributing factors include infection, ischemia and ongoing friction between the mesh and the esophagus. The risk of erosion with synthetic mesh is reported in 2.3% of prosthetic hiatal reinforcement. Biomaterial grafts were introduced with the promise to provide the benefits of a reinforced crural repair while minimizing these risks [10]. The aim of this round table is to discuss three emblematic complications related to the use of both synthetic and biological mesh hiatal reinforcement.

**Case 1: Synthetic mesh**

A 50-year-old woman presented with severe dysphagia and important weight loss one year after open redo Nissen fundoplication with prosthetic crural repair for recurrent GERD and paraesophageal hernia. At re-operation, important esophageal stenosis and angulation were found arising from the keyhole-shaped polypropylene mesh with pseudo-diverticular dilatation of the distal esophagus. The esophagus was freed from the dense fibrotic capsule surrounding the prosthesis, and a myotomy was performed.

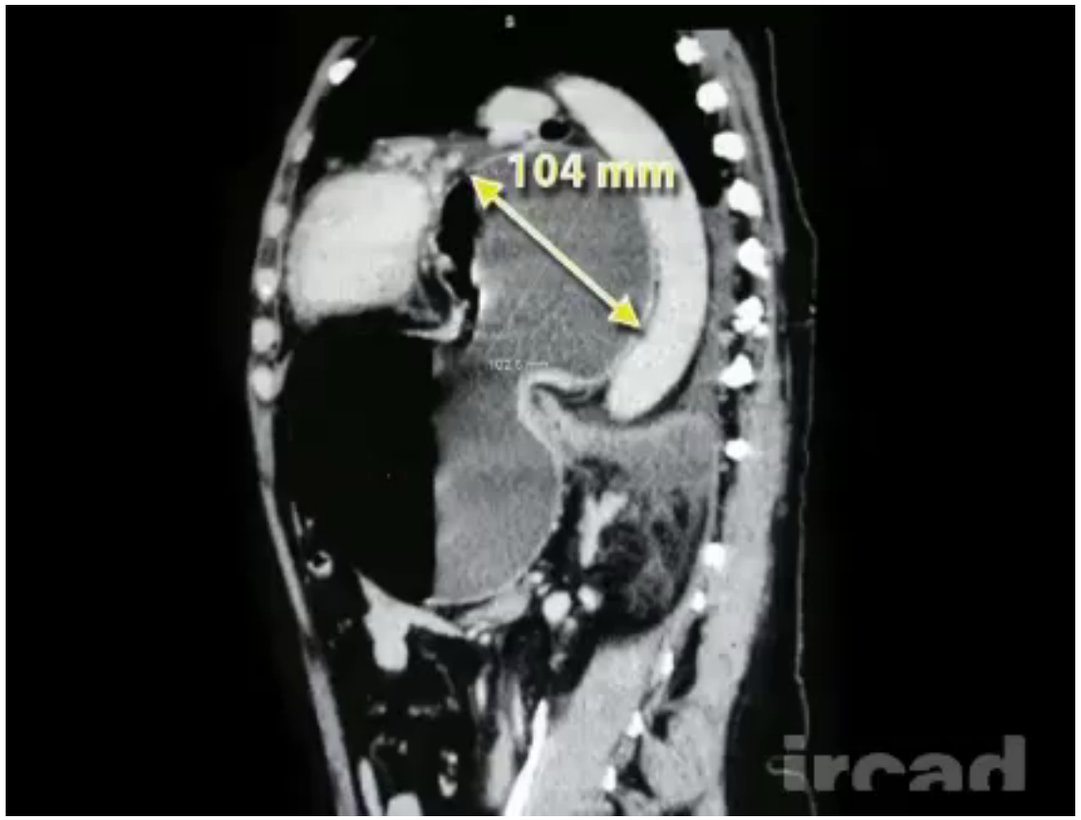



Synthetic mesh surgical video


Expert panel: Complication of synthetic mesh

**Case 2: Biological mesh**

A 61-year-old woman presented to the emergency room for an incarcerated type III hiatal hernia. A laparoscopic partial posterior fundoplication with U-shaped biological mesh (Surgisis™) reinforcement was performed as an emergency. A second operation was carried out 5 months after the first intervention for severe persistent dysphagia. At re-operation, there was severe scarring around the esophagus, arising from the mesh, with narrowing of the GE junction. The mesh was partially removed to free the esophagus and enlarge the hiatus.

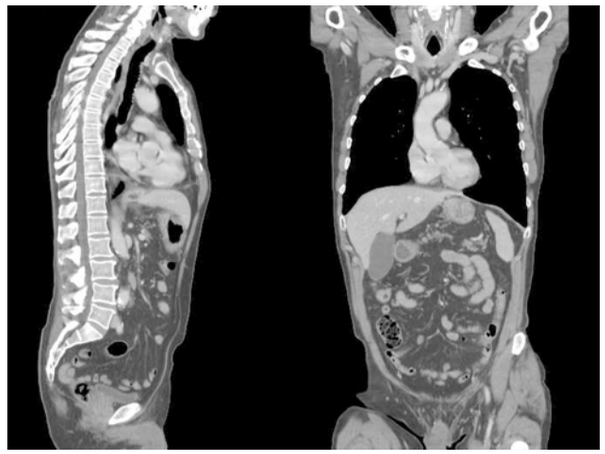



Biological mesh surgical video


Expert panel: Complication of biological mesh

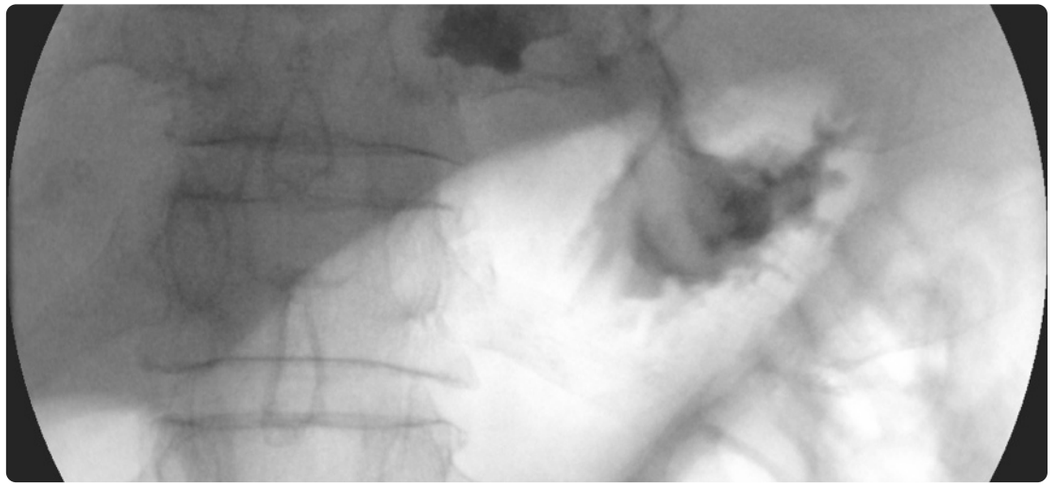
**Case 3: mesh migration**

A 70-year-old man presented with new-onset dysphagia and weight loss seven months after a Nissen-Rossetti fundoplication with hiatal hernia prosthetic mesh repair (Parietex™, Covidien Surgical, France). Esophago-gastro-duodenoscopy (EGD) showed mesh erosion into the esophageal wall at the gastroesophageal junction (GEJ). After failure of Argon Plasma Coagulation (APC) ablation, the patient was referred to our center.



Surgical Anatomy

The CT-scan revealed a small cavity lateral to the GEJ. A second attempt at APC failed. The mesh was grasped with a foreign body forceps and secured with a polipectomy snare. Strong traction in retroflexion allowed to remove the majority of the mesh. A residual piece secured by a suture was excised using endoscopic scissors. Fluoroscopy showed a small peri-esophageal cavity. A 12cm x 22mm covered self-expanding metal stent (SEMS) (HANAROSTENT®) was delivered to seal the cavity and prevent stenosis. After a normal swallow study performed the next day, the

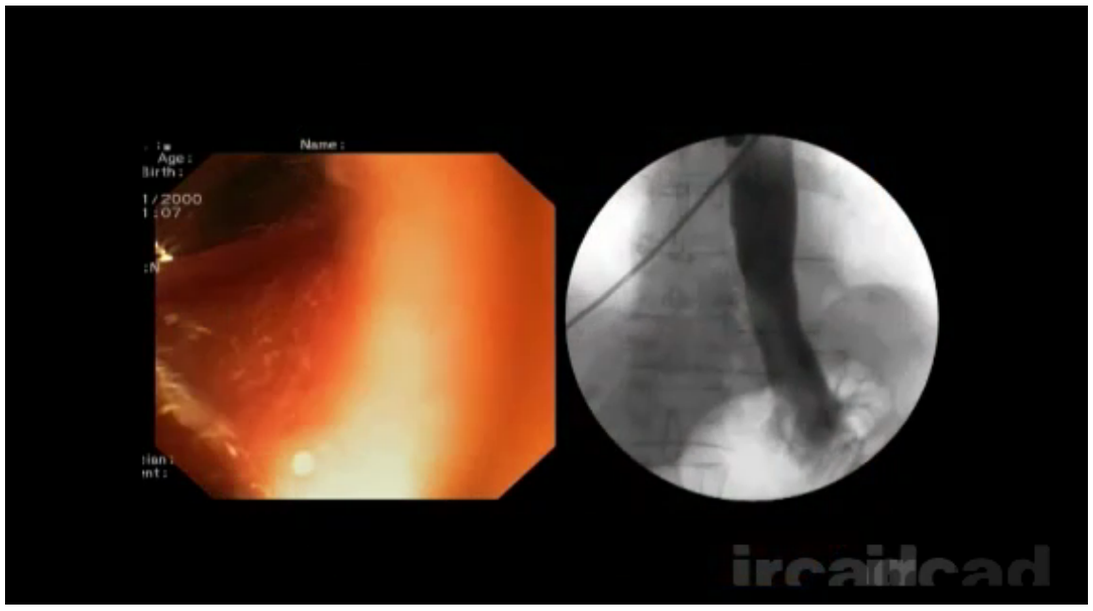


1 sur 15

patient resumed a liquid diet. Five weeks later, at SEMS removal, endoscopy showed a decreased cavity volume. A new SEMS was


Expert panel: Dealing with intra-esophageal mesh migration

placed for 5 additional weeks. At removal, there was no stricture and no residual cavity. The patient was symptom-free at three months.




Hiatus mesh migration surgical video

Mesh reinforcement may reduce but not suppress the risk of recurrence in the setting of large paraesophageal hernia, and is obviously not the single factor responsible for recurrence. In addition, meshes can lead to significant complications with devastating consequences. The use of biological meshes does not protect against the risk of severe inflammation and scarring around the esophagus.

## References

1. Laparoscopic repair of paraesophageal hernia. Long-term follow-up reveals good clinical outcome despite high radiological recurrence rate. Dallemagne B, Kohnen L, Perretta S, Weerts J, Markiewicz S, Jehaes C.Ann Surg. 2011 Feb;253(2):291-6. ☞ PubMed

2. Morino M, Giaccone C, Pellegrino L, Rebecchi F. Laparoscopic management of giant hiatal hernia: factors influencing long-term outcome. Surg Endosc 2006; 20(7):1011-6. ☞ PubMed

3. Champion JK, Rock D. Laparoscopic mesh cruroplasty for large paraesophageal hernias. Surg Endosc 2003; 17(4):551-3. ☞ PubMed

4. Rathore MA, Andrabi SI, Bhatti MI, et al. Metaanalysis of recurrence after laparoscopic repair of paraesophageal hernia. JSLS 2007; 11(4):456-60. ☞ PubMed

5. Frantzides CT, Madan AK, Carlson MA, Stavropoulos GP. A prospective, randomized trial of laparoscopic polytetrafluoroethylene (PTFE) patch repair vs simple cruroplasty for large hiatal hernia. Arch Surg 2002; 137(6):649-52. ☞ PubMed

6. Muller-Stich BP, Holzinger F, Kapp T, Klaiber C. Laparoscopic hiatal hernia repair: long-term outcome with the focus on the influence of mesh reinforcement. Surg Endosc 2006; 20(3):380-4. ☞ PubMed

7. Johnson J, Carbonell A, Carmody B, et al. Laparoscopic mesh hiatoplasty for paraesophageal hernias and fundoplications. Surgical Endoscopy 2006; 20(3):362-366. ☞ PubMed

8. Granderath FA, Carlson MA, Champion JK, et al. Prosthetic closure of the esophageal hiatus in large hiatal hernia repair and laparoscopic antireflux surgery. Surg Endosc 2006; 20(3):367-79. ☞ PubMed

9. Johnson J, Carbonell A, Carmody B, et al. Laparoscopic mesh hiatoplasty for paraesophageal hernias and fundoplications. Surgical Endoscopy 2006; 20(3):362-366. ☞ PubMed

10. Granderath FA, Carlson MA, Champion JK, et al. Prosthetic closure of the esophageal hiatus in large hiatal hernia repair and laparoscopic antireflux surgery. Surg Endosc 2006; 20(3):367-79. ☞ PubMed

11. Oelschlager BK, Pellegrini CA, Hunter J, et al. Biologic prosthesis reduces recurrence after laparoscopic paraesophageal hernia repair: a multicenter, prospective, randomized trial. Ann Surg 2006; 244(4): 481-90. ☞ PubMed

12. Zugel N, Lang RA, Kox M, Huttl TP. Severe complication of laparoscopic mesh hiatoplasty for paraesophageal hernia. Surg Endosc 2009 Nov;23(11):2563-7. ☞ PubMed

13. Tatum RP, Shalhub S, Oelschlager BK, Pellegrini CA. Complications of PTFE mesh at the diaphragmatic hiatus. J Gastrointest Surg 2008; 12(5):953-7. ☞ PubMed

14. Stadlhuber R, Sherif A, Mittal S, et al. Mesh complications after prosthetic reinforcement of hiatal closure: a 28-case series. Surgical Endoscopy 2009 Jun;23(6):1219-26. ☞ PubMed

15. Targarona EM, Bendahan G, Balague C, et al. Mesh in the hiatus: a controversial issue. Arch Surg 2004; 139(12):1286-96; discussion 1296. ☞ PubMed

16. Rumstadt B, Kahler G, Mickisch O, Schilling D. Gastric mesh erosion after hiatoplasty for recurrent paraesophageal hernia. Endoscopy 2008; 40 Suppl 2:E70. ☞ PubMed

17. Griffith PS, Valenti V, Qurashi K, Martinez-Isla A. Rejection of goretex mesh used in prosthetic cruroplasty: a case series. Int J Surg 2008; 6(2):106-9. ☞ PubMed

# 3.4. Radiological endoscopic trans-Kehr rendezvous technique for residual choledocholithiasis in a patient with giant juxtapapillary duodenal diverticulum


**Gianfranco Donatelli, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Federico Costantino, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Silvana Perretta, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Jacques Marescaux, MD, FACS,**
Hon FRCS, Hon JSES
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France




**Case presentation**

An 89-year-old woman was admitted to the emergency room for fever, right epigastric pain, and jaundice.

A CT-scan showed both cholelithiasis and choledocholithiasis associated with intra- and extra-hepatic bile duct dilatation.

A juxtapapillary duodenal diverticulum was also noted.

Surgical Anatomy

## Management options

1. Repeated ERCP/ES (endoscopic sphincterotomy)
2. Laparoscopic cholecystectomy and CBD exploration by either the transcystic approach or choledochotomy
3. Intraoperative ERCP/ES
4. Open common bile duct exploration
5. Postoperative ERCP/ES

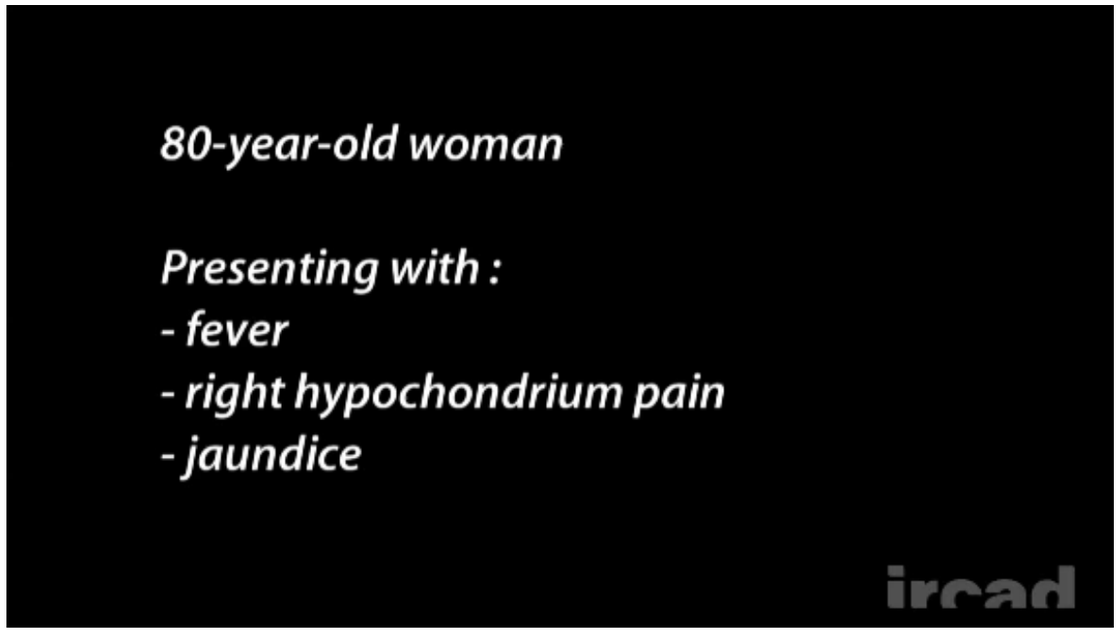
**All options are possible and reported in the literature.**

CBD exploration at laparoscopic cholecystectomy can be performed by either a transcystic approach or choledochotomy [1-3] .

The transcystic approach is preferable over the transcholedochal approach in case of smaller stones < 6mm or smaller bile duct < 6-10mm because of higher success rate and fewer complications [4] .

ERCP and ES before, during or after laparoscopic cholecystectomy show similar efficacy, morbidity and mortality as compared to that of laparoscopic CBD exploration [5-6] .

Intraoperative ERCP is a single-stage option to intraoperative CBD exploration. Difficult ampullary cannulations can be facilitated by the operative placement of a guidewire through the cystic duct into the duodenum. Pancreatitis is a concern but when combined with laparoscopy, the injection of contrast in the pancreatic duct is avoided and excellent short-term results have been reported [7] .




Endoscopic sphincterotomy

In consideration of the patient's age and associated co-morbidities, we decided to pursue an endoscopic sphincterotomy as the first line of treatment. ERCP was performed with a standard lateral view scope, and a giant peri-ampullary diverticulum was visualized at the level of the second duodenum. The edge of the diverticular pouch was carefully explored to find the papilla on the rim of the diverticulum. The correct angle of entry could not be attained despite placement of the scope within the diverticular neck. Several attempts to pass a sphincterotome were ultimately unsuccessful.

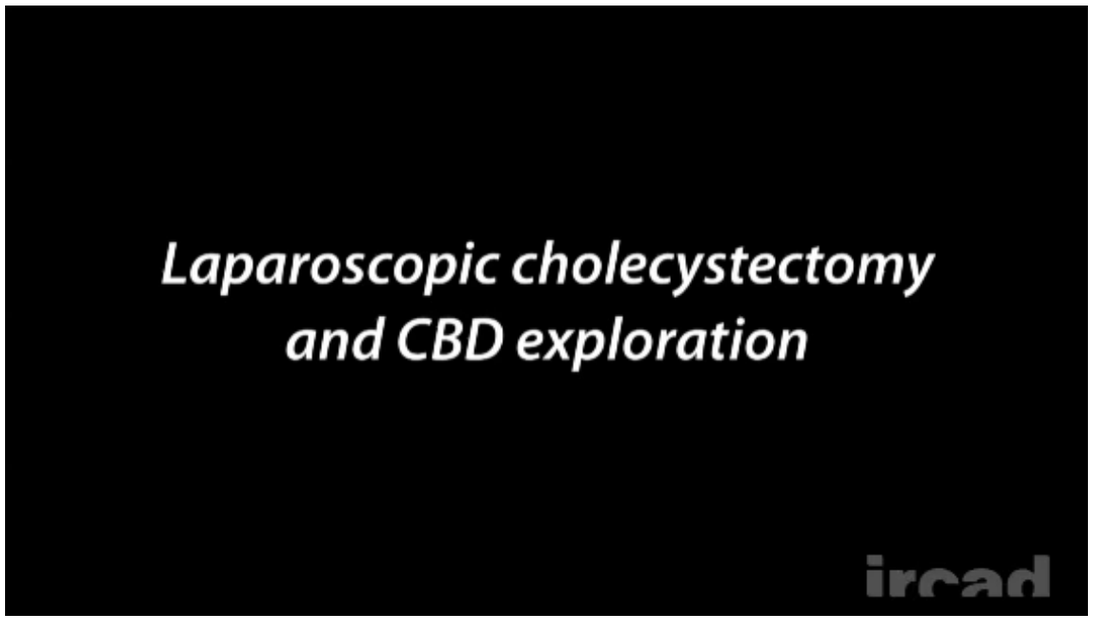
**Managing ERCP failure**

After failed ERCP, the decision was made to perform laparoscopic cholecystectomy with intraoperative cholangiography and common bile duct exploration.

In case of failure of ERCP due to duodenal diverticulum to avoid surgery or in patients unfit for surgery, a percutaneous transhepatic biliary drainage followed by endoscopic rendezvous is a possibility. It is associated with a complication rate of 15% and a mortality rate of 0-5.6% [11].

At laparoscopy, significant inflammation was encountered in exposing the triangle of Calot. Once the cystic duct and artery were clearly identified, a clip was placed on the cystic duct close to the gallbladder neck. With the gallbladder occluded, the cystic duct was opened with significant bile return, an indirect sign of distal biliary obstruction. Transcystic cholangiography demonstrated the presence of complete occlusion at the level of the papilla without flow into the duodenum, raising the suspicion of ongoing stone blockage. Intra-operative cholangiography is possible in 93% of patients.

Given the CBD dilatation-related clinical need to decompress the biliary tree in the setting of cholangitis, a laparoscopic common bile duct exploration was performed. Choledochoscopy with a 5mm Karl Storz endoscope revealed no proximal abnormality and during distal exploration, the scope passed into the duodenum. Despite not visualizing stones, the surgeon felt that the CBD had been cleared. A completion cholangiogram at this time could have confirmed clearance of the CBD, but was not performed. The CBD was drained by closing the choledochotomy over a T-tube with interrupted 3/0 PDS sutures. Cholecystectomy was completed without complication.




Laparoscopic cholecystectomy with intraoperative cholangiography and common bile duct exploration

**Follow-up**

The postoperative course was uneventful, the liver function tests normalized and the patient was discharged with the T-tube. At cholangiography, 4 weeks postoperatively prior to the removal of the T-tube, residual choledocholithiasis with mild intra- and extra-hepatic biliary dilatation was discovered.

**Management of retained CBD stones**

Since the first ERCP failed due to the technical challenge of an intradiverticular papilla, a radiological endoscopic rendezvous technique was attempted.

With the patient under general anesthesia and in supine position, a cholangiography was carried out through the T-tube. A 4.5-meter 0.0025 French VisiGlide guidewire (Olympus) was inserted in the T-tube and gently advanced. Aided by its super-elastic alloy and hydrophilic coatings, the guidewire was passed into the duodenum.

The guidewire was secured to the drain proximally. Its distal end was grasped with a standard biopsy forceps and fed into the endoscope.


Endoscopic rendezvous technique

The guidewire was then exteriorized through the scope. A standard triple-lumen sphincterotome was advanced over the guidewire and sphincterotomy was performed. A sphincteroplasty was added to facilitate remove the residual stones by means of a 15ml balloon catheter inflated to 8mmHg for one minute.

Multiple stones between 2 and 6mm were then removed by running the balloon catheter along the common bile duct. Completion retrograde cholangiography showed no residual lithiasis. The T-tube was left in place and clamped. Three days later, as liver function tests normalized, a final T-tube cholangiography was performed before removal of the T-tube.

**Conclusions**

Modern surgical, radiological, and endoscopic tools have provided the surgeon with multiple options and algorithms in the treatment of choledocholithiasis. It is important for surgeons to understand the many techniques that can be employed in the treatment goals of biliary drainage, stone clearance and gallbladder resection.

## References


1. Strömberg C, Nilsson M, Leijonmarck CE. Stone clearance and risk factors for failure in laparoscopic transcystic exploration of the common bile duct. Surg Endosc. 2008 May;22(5):1194-9. ☞ PubMed

2. Ludwig K, Lorenz D, Koeckerling F. Surgical strategies in the laparoscopic therapy of cholecystolithiasis and common duct stones. ANZ J Surg, 2002 Aug;72(8):547-52. ☞ PubMed

3. Tokumura H, et al. Laparoscopic management of common bile duct stones: transcystic approach and choledochotomy. J Hepatobiliary Pancreat Surg , 2002;9(2):206-12.. ☞ PubMed

4. Fitzgibbons RJ Jr, Gardner GC. Laparoscopic surgery and the common bile duct. World J Surg. 2001 Oct;25(10):1317-24. ☞ PubMed

5. Tranter SE, Thompson MH. Comparison of endoscopic sphincterotomy and laparoscopic exploration of the common bile duct Br J Surg 2002;89:1495-504. ☞ PubMed

6. Martin DJ, Vernon DR, Toouli J. Surgical versus endoscopic treatment of bile duct stones Cochrane Database Sys Rev 2006 Apr 19;(2):CD003327. ☞ PubMed

7. Enochsson L, Lindberg B, Swahn F, Arnelo U. Intraoperative ERCP to remove common bile duct stones during routine laparoscopic cholecystectomy does not prolong hospitalization: a 2-year experience. Surg Endosc. 2004 Mar;18(3):367-71. ☞ PubMed

8. Siegel JH. The needle knife: a valuable tool in diagnostic and therapeutic ERCP. Gastrointest Endosc 1989 Nov-Dec;35(6): 499-503. ☞ PubMed

9. Lobo DN, Balfour TW, Iftikhar SY. Periampullary diverticula: consequences of failed ERCP. Ann R Coll Surg Engl. 1998 Sep;80(5): 326-31. ☞ PubMed

10. Lai R, Freeman ML. Endoscopic ultrasound-guided bile duct access for rendezvous ERCP drainage in the setting of intradiverticular papilla. Endoscopy. 2005 May;37(5):487-9. ☞ PubMed

11. Burmester E, Niehaus J, Leineweber T, Huetteroth T. EUS-cholangio-drainage of the bile duct: report of 4 cases. Gastrointest Endosc. 2003 Feb;57(2):246-51. ☞ PubMed

# 4 New Technology

Recent breakthroughs in cutting-edge minimally invasive strategies

# 4.1. The Anubiscope™: reshaping interventional endoscopy for NOTES


**Bernard Dallemagne, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

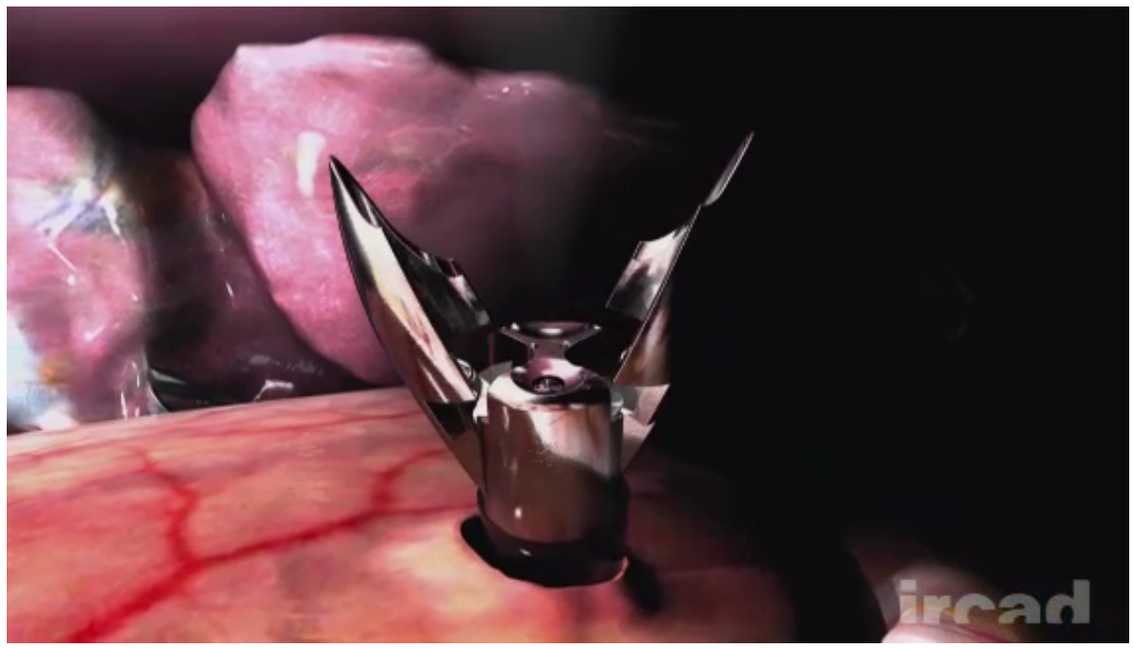
**Silvana Perretta, MD**
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France

**Jacques Marescaux, MD, FACS,**
Hon FRCS, Hon JSES
IRCAD - University of Strasbourg,
Department of Digestive & Endocrine Surgery,
France




Recent advances in interventional endoscopy in conjunction with the introduction of NOTES have highlighted the limitations of existing flexible endoscopes when performing complex tasks. In 2005, the IRCAD and Karl Storz Endoscopy began a collaborative development to create an interventional endoscopic platform to enable complex surgery both inside and outside the lumen of hollow organs. To this aim, a multi-purpose platform for endoluminal and transluminal procedures was designed under the name "Anubiscope™".

The Anubiscope™ development went through 4 generations of prototypes that explored different designs including a mother and baby scope configuration before coming to its definitive form of a flexible 110cm long, multifunctional platform. Its 4-way articulating endoscope has a 16mm articulating vertebrae section with an 18mm distal tip shaped like a trocar to facilitate introduction at the



enterotomy site. The distal head incorporates two opposing movable arms with two 4.2mm working channels. A central 3.4 channel provides suction and can be used for additional retraction. The jaws work similarly to a blunt tip trocar when in the closed position. In the open position, the jaws create triangulation of the working channels by generating opposable angles for the 2-way articulation instruments capable of deflection and rotation.

Experimental work focused on peroral transluminal and intraluminal surgery in animal models. NOTES transgastric and transvaginal cholecystectomies were completed with little or no need for transparietal assistance. Gastric endoscopic submucosal dissection was successfully and intuitively achieved by both trained endoscopists and unexperienced operators. Suturing and knot-tying, although still challenging, were possible. As a logical

next step, cadaver models were then used to confirm the results achieved in the laboratory. Once approved for clinical use, the platform was used to perform transvaginal cholecystectomy for symptomatic uncomplicated cholelithiasis.

The Anubiscope™ highlighted the challenges in reproducibility of precise tasks and the overall usability of an endoscopic operating platform. These challenges are being addressed by ongoing developments focused on optimizing visualization, dexterity, ergonomics and surgeon training with robotics. Visualization can be augmented through visual servoing where feedback information extracted from a vision sensor controls the motion of the endoscope when the target is moving, as happens to visceral organs during respiration. Dexterity and ergonomics can be augmented by robotization of instruments and design of a surgical control console. In addition, by moving the surgeon to an operating console, both inherent conflicts with a second operator and limited dexterity due to conflicting instrument handles are overcome.

Finally, a robotic control platform allows for simulation and training.

With the growing capabilities of interventional endoscopy and the growing focus on minimally invasive surgery, it was somehow inevitable that the boundaries of endoscopy and surgery would become blurred. The Anubiscope™ has demonstrated its potential in bringing surgical concepts into the lumen of hollow organs by overcoming significant limitations of current flexible endoscopes.

5

# Cultural escapes

Alsace is a region of many talents.
Seep into our culture, history and traditions starting with an exquisite wine voyage

# 5.1. The sommelier Serge Dubs will introduce us to the delights of Alsace wines

Wine is so ingrained in French culture that French cuisine would not be the same without it.

Alsace is a renowned region of wine production in France. It is known for the Route des vins, meaning "wine route". It draws tourists from all over the world and has contributed to the success of Alsace wines over the past 50 years.

Alsace is a land of contrasts and enjoys a great diversity of landscapes. The region has a dry and temperate climate, a complex geology, favorable soils, and an ideal exposure for its vineyards.

Alsace has a semi-continental climate as it is sheltered from oceanic influences by the Vosges mountains. This climate offers a fantastic advantage to tourists and provides the perfect conditions for winemaking as it encourages the slow, extended ripening of the grapes, resulting in elegant, complex aromas and flavors.


The Route des Vins is famous for its exquisite natural beauty and leads visitors across rows of undulating, vine-covered hills, and through delightful quaint villages.

Our wine voyage begins in one of the villages along the Route des Vins. We shall visit the beautiful setting of the Auberge de l'Ill, one of the temples of French gastronomy, located on the banks of the Ill river. The restaurant has been bestowed with 3 Michelin stars since 1967. Four generations of chefs have built the reputation of this extraordinary restaurant where family tradition is revisited with a zest of modern touch by the current executive chef, Marc Haeberlin.

In this renowned establishment, the sommelier Serge Dubs will introduce us to the delights of Alsace wines, three of which were recently included in the 2011 "Hot Wines" ranking by Wine Spectator.

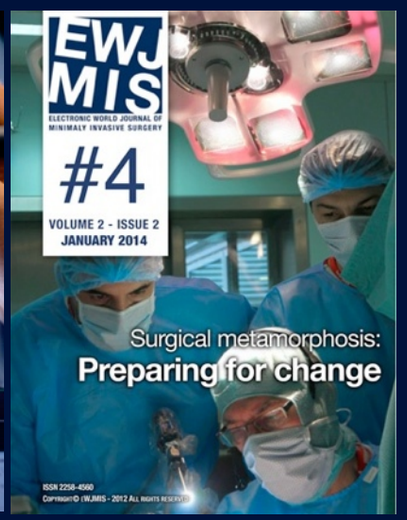
In this issue, Serge will educate our palate with a Riesling from the Trimbach winery "Cuvée Frédéric Emile". This incredibly fine wine is produced from very ripe grapes handpicked during the last weeks of the harvest. This Riesling is a dry, round and powerful wine, elegantly enveloped by mineral nuances resulting from the ancestral combination of Riesling grapes with a flourishing soil.

Alcohol can damage your health and should be consumed with moderation.

# About the eWJMIS

If you have missed one of our issues,
You can download it for free on the iBookstore










IRCAD shapes up for a revolution in the learning experience creating a vibrant multimedia iPad journal in synch with cutting-edge technologies for continuing medical education.

ELECTRONIC WORLD JOURNAL OF MINIMALY INVASIVE SURGERY

ISSN 2258-4560
www.eworldjournalofmis.com

IRCAD (Research Institute against Digestive Cancer) was founded in 1994 within the premises of Strasbourg's University Hospital. It pools digestive cancer research laboratories, a research and development department in computer sciences and robotics, and a training centre in minimally invasive surgery (EITS - European Institute of TeleSurgery).

www.ircad.fr

WebSurg is a free virtual surgical university, accessible worldwide through the Internet. Our goal is to provide surgeons, scientific societies and the medical industry with the first online continuing medical education in laparoscopic surgery and information on the latest developments in laparoscopic surgery, including NOTES and robotics.

www.websurg.com

European Association of Transluminal Surgery

www.eats.fr

European Institute Of TeleSurgery (IRCAD France)
Located within the compounds of Strasbourg's University Hospital, the EITS (European Institute of TeleSurgery) has become internationally renowned over the past 18 years and makes full benefit of the IRCAD's 8000 square meters.

www.ircad.fr

Asia Institute Of TeleSurgery (IRCAD Taiwan)
The AITS, was inaugurated in May 2008, and is equipped with a 7300 square meter structure. It is one of the largest training centers in minimally invasive surgery and is ideally located in Asia. It provides 23 operating tables suitable for training on live tissue.

www.aits.tw

American Institute Of TeleSurgery (IRCAD América Latina)
IRCAD América Latina was inaugurated in July 2011
With a surface of more than 7.000 m², IRCAD América Latina is one of the largest training centres in minimally invasive surgery in America.

www.amits.com.br

# Terms & Conditions

The current general conditions of use and navigation (the "Conditions") apply exclusively between the IRCAD, 1 place de l'Hôpital, Hôpitaux Universitaires de STRASBOURG, 67000 STRASBOURG, an association registered in the Strasbourg District Court (Tribunal d'Instance), volume LXIV, No. 119, April 13, 1992 (the "Institute"), and the viewer of any material produced by the World Journal of Minimally Invasive Surgery (e-WJMIS) regarding the conditions of use, medias produced, and navigation on these.

The Conditions shall systematically be brought to the knowledge of each user of the e-WJMIS to allow them to use the e-WJMIS, with any other conditions being excluded.

Accordingly, by using the e-WJMIS the user agrees to be fully and unconditionally bound by the Conditions.

Any contrary condition stipulated by the user, unless it is expressly accepted, shall not be binding on the Institute regardless of when it is brought to the knowledge of the latter. Any condition not complying with the Conditions will be discarded unless the Society has recognized their applicability expressly and in writing. Any failure by the Institute to follow any one of the Conditions, at any given time, shall not be construed thereafter as a waiver of any one of the said Conditions.

The Institute reserves the right to modify the Conditions at any time, provided that these modifications are mentioned on the e-WJMIS.

**e-WJMIS content - warning**

The objective of the e-WJMIS is to allow the consultation of medical and surgical information in all surgical specialties by surgeons, doctors, nurses, the medical profession, patients and the general public.

The e-WJMIS features considerable amount of information on surgical practices through operative technique chapters, new devices, clinical cases, and case reports.

The information contained in the e-WJMIS has been provided by surgeons independent of the Institute, and validated by an editorial and scientific committee independent of the Institute. The members of the committee are listed on the e-WJMIS.

We shall use our best endeavours to ensure the accuracy and updating of any information published on the e-WJMIS, of which we reserve the right to correct the content at any time and without notice. However, we cannot guarantee the accuracy, precision or exhaustiveness of any information made available on the e-WJMIS. Accordingly, we refuse to accept responsibility or liability:

for any inaccuracy or omission in the information published on the e-WJMIS;

for any damage resulting from fraudulent intrusion by a third party with the effect of changing the information published on the e-WJMIS;

and more generally any direct or indirect damage, regardless of its cause, origins, nature or consequences, caused by any person accessing the e-WJMIS or being unable to do so, by any use of the e-WJMIS and/or by any credit attributed to information derived there from directly or indirectly.

The Institute and the e-WJMIS adhere to the ethical principles applying to medical information and healthcare services.

The information and services provided on the e-WJMIS do not constitute a medical consultation, neither directly nor indirectly. In no event may the proposed information and services be considered as replacement for a consultation, an examination or a diagnosis by a doctor, and they may not be construed as a means of promoting surgical techniques.

Users shall not use the information on the e-WJMIS in order to formulate a diagnosis or to determine a course of treatment, including the taking and/or discontinuance of medication, without first consulting a doctor.

Only a practising surgeon with State diploma or whose diploma is recognized by a State is entitled to evaluate our information and to assess, if necessary, how to practically and under his/her sole responsibility apply the surgical and medical advice published on the e-WJMIS.

The user acknowledges that the information made available thereto is neither comprehensive nor exhaustive, that it is offered in relation to specific cases that cannot be applied generally and that the said information does not cover the entire range of symptoms, medicinal products and courses of treatment pertaining to the various complaints concerned.

**Compliance with laws and regulations**

The e-WJMIS is produced in Strasbourg, France and complies with French law. In the event of any dispute, the competent courts of the city of Strasbourg (France) alone shall have jurisdiction.

When you use the e-WJMIS you are required to comply with any legal provisions and regulations in force and especially:

a) Applicable copyright and intellectual property regulations in multimedia creations, software, texts, articles, photos, registered trademarks, databases, and images of all kinds.
The name and trademark "WJMIS" have been registered under French law and are protected internationally©. If you wish to use our trade name "WJMIS", you should first obtain our prior written authorisation.
Any linking to the e-WJMIS requires our prior authorisation. The Institute, and in certain cases its partners, are the holders of the entire collection of intellectual or industrial property rights pertaining to the content of the e-WJMIS.

In particular, the illustrations are originals and the videos have been recorded specifically for use on the e-WJMIS. The rights to texts written by authors have also been ceded to the Institute. If you use any information on the e-WJMIS, you are required to obtain our prior written authorisation before any distribution thereof.
For such purpose, you are reminded that any indications pertaining to the existence of rights may not be deleted and that any total or partial reproduction without authorisation constitutes infringement.
In addition, you are prohibited from any substantial qualitative or quantitative extraction of the e-WJMIS databases, or from using the databases in an abnormal context.

b) Regulations on the automated processing of personal data
Any photographs and videos showing individuals shall only be used for the purposes of illustration.
In any video commentaries and documents published on the e-WJMIS, no information will be given that allows the identification of patients.
The Institute undertakes not to disclose any information that it may receive from you to third parties. It shall remain confidential and shall only be used by our internal services for the processing of your order, as well as to enhance and customise communication and the cultural and product offer reserved for customers of the Institute.

c) Public policy regulations, such as those pertaining to any pornographic, racist or unlawful content that may be harmful to another user or may undermine the brand image of the Institute, by means of provocative messages, texts or images
d) Regulations pertaining to the privacy of individuals
On such basis you undertake not to send, via the interactive services offered to you, any messages of an insulting, offensive, denigrating or degrading nature or messages that are unrelated to the issues raised.

e) Regulations pertaining to the rights of the press
On such basis you shall refrain from any defamation or insults against e-WJMIS users or third parties.

f) Regulations pertaining to fraud
On such basis you shall refrain from any hacking of an automated data processing system or from any partial or total alteration of the elements therein. You are hereby informed that anyone committing such acts may be prosecuted.
More specifically, in the context of the interactive services, the Institute reserves the right to delete content of any kind whatsoever, immediately and without prior notice, and especially any message, photograph or graphics that may violate applicable laws and regulations and especially those regulations mentioned hereinabove.

g) Regulations pertaining to the use of images
Regulations pertaining to the use of images of people are respected by the e-WJMIS. Any use of images of people on the e-WJMIS implies the previous consent of the e-WJMIS.

**Interactive services on the e-WJMIS**

The entire collection of provisions in the Conditions shall apply to your participation in the interactive services proposed on the e-WJMIS.

You shall accordingly comply with any applicable laws and regulations, especially those described hereinabove.

On such basis, you shall be solely liable for any information, messages or images, and in general for any content that you may send via the interactive services such as chat or forums in particular.

You hereby agree that the Institute may take the initiative, without prior notice, to partially or totally delete any content that you may send or that may be sent to you via the interactive services, should such content be likely to violate any applicable regulations or be contrary to moral standards.

You acknowledge that you shall be solely liable for any use that may be made of the content that you have sent, of any nature whatsoever, and that the Institute shall not monitor or warrant the accuracy, legality, quality or reliability of the content, of any nature whatsoever, that is distributed via the interactive services on the e-WJMIS.

You shall be solely liable for any contacts established via the interactive services on the e-WJMIS.

**Security**

You acknowledge that, notwithstanding the resources implemented by the Institute, the e-WJMIS may present specific technical features that make it impossible for the Institute to guarantee the absolute continuity of access to the service or response times, as well as security in the transmission of data.

In any event, you hereby acknowledge that any information and services offered on the e-WJMIS:
- may be suspended due to cases of force majeure, to events beyond the control of the Institute or to circumstances for which it is not responsible or liable,

- may contain errors of technical or human origin,

- may result in occasional losses of data.

Consequently, the Institute should not be held liable, particularly in case of:

- temporary interruptions for the updating of certain files,

- difficulties in functioning or temporary interruptions of these services outside of our control, particularly in case of interrupted electricity or telecommunication services,

- temporary interruptions of the services required for their evolution or maintenance,

**Disclaimers**

The e-WJMIS complies with any applicable legislation in France. The Institute shall not be rendered liable for any failure to comply with the legislation of the country in which the e-WJMIS is delivered and/or used. You shall be responsible for verifying with any local authorities about the possibilities of importing or using any items or services that you may consider ordering.

Any photographs and texts reproduced and illustrating the e-WJMIS are not contractually binding. Accordingly, the e-WJMIS shall not be liable in the event of errors in any of the said photographs or texts, or in case of error in the presentation of Products published on the e-WJMIS.

When the Institute does not fulfil one or several of its duties, its liability will be limited to the total sum received from the user.

The Institute shall not be liable for any failure to perform a confirmed agreement due to stock shortage, the unavailability of Products, force majeure, disturbances or partial or total strikes especially in postal services and means of transport and/or communication, as well as flooding or fire.

The Institute shall not be rendered liable for any indirect damage, any loss of business, loss of exploitation, damages, punitive damages, liquidative damages, moral prejudice, legal proceedings, any commercial nuisance, loss of brand image, loss of earnings.

Generally speaking, the Institute shall not warrant the comprehensiveness, exhaustiveness or accuracy of the content of any information and services proposed on the e-WJMIS, but the Institute shall use its best endeavours to offer users good-quality content.

The Institute shall not be liable for any undesirable effects that may result from the application of the proposed operating techniques.

Furthermore, the Institute does not in any event guarantee any particular result following the implementation of any information and services proposed on the e-WJMIS.

The Institute may not be rendered liable for any use of the e-WJMIS that is contrary to the principles of integrity and ethics.

In any event, the user acknowledges that the Institute or any one of its partners or servants may not be rendered liable on the basis of any use that the user may make of the information and services proposed on the e-WJMIS and agrees that such information and services shall be used under the user's sole and entire liability, supervision and management.

**General provisions**

The e-WJMIS is produced in Strasbourg, France and complies with French law. The language of this agreement is English. The Conditions as well as every sale and service provision performed by the Institute shall be governed by the laws of France, with respect both to procedural and substantive rules.

The Institute reserves the right to amend any provisions of the Conditions as well as the specific conditions that appear on the order forms. Your continued use of the e-WJMIS following the posting of changes to the Conditions means that you accept those changes.

The Conditions shall express the entire collection of undertakings by the parties, and no general or specific conditions in any other documents may be considered as falling within the scope of the rights and obligations existing between the Institute and users.

Should one or more of the clauses of the Conditions be declared invalid, on any grounds whatsoever, the other clauses shall remain in full force and effect.

In the event of any conflict of interpretation between any heading and the clause to which it refers, the disputed title in question shall be declared unwritten.

If you have any questions or complaints regarding this Terms of Use Statement, please email us and we will endeavor to respond to you promptly.

# POEM

Per-Oral Endoscopic Myotomy (POEM)

**Termes connexes du glossaire**

Faire glisser ici les termes connexes

**Index** Rechercher un terme

## Unsuccessful

Inability to achieve cannulation at ERCP is reported in 5-20% of cases [8]. Periampullary diverticulum is associated with failed cannulation. Failure rates are higher in patients with intradiverticular papillas than juxtapapillary diverticula [9]. Many tips and tricks have been described for difficult cannulation within the diverticulum such as everting the papilla outside the diverticulum before cannulation. EUS-guided bile duct access for rendezvous drainage in the setting of intradiverticular papilla is an interesting endoscopic approach that has been described [10].

---

**Termes connexes du glossaire**

Faire glisser ici les termes connexes

---

**Index** Rechercher un terme