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## Pancreatectomy The era of Minimally invasive surgery

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We are delighted to announce the release of the second issue of the E-World Journal of Minimally Invasive Surgery. We are particularly honored to have Dr. Schwaitzberg, Chief of Surgery at the Cambridge Health Alliance, contribute to this issue with his introduction entitled "Innovation and surgery: a fantastic voyage". This editorial gives us a unique insight into the incredible evolution of minimally invasive surgery as seen by one of its main actors.

Alsace is a region of many talents, and this second issue focuses on one of the brands that have made not only local, but also French pride for over a hundred years. Bugatti, one of the most prestigious high-performance automobile manufacturers in the world, was founded in Molsheim, and has been in the limelight over the past few years for putting the fastest and most powerful car ever made in the world - the Bugatti Veyron - on the market.

Since the publication of the first issue of the E-World Journal of Minimally Invasive Surgery, we have positioned ourselves in the world's top 10 medical e-book ranking. We take much pride in this and I wish to thank you all for your trust and enthusiasm.

We would be most grateful for your feedback concerning the ergonomics we have chosen for our journal. Any remarks are more than welcomed, as we are constantly trying to put knowledge and technology hand in hand for an enhanced learning experience.



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



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**Steven D Schwaitzberg, MD** Cambridge, Massachusetts, USA

I vividly remember the summer of 1980 sitting in the library of the Texas Medical Center thumbing through the latest issue of the Journal of Pediatric Surgery when I stumbled upon an article entitled, *Correction of congenital diaphragmatic hernia in utero I.* I was intrigued and despite not being a pediatric surgeon, I followed the next 8 chapters of this story of the correction of congenital malformation in the developing fetus that unfolded over 18 years.

This expedition was led by Michael Harrison. He and his team captured the imagination of hundreds if not thousands of physicians who marveled at the mere idea of correcting a devastating congenital defect before birth.

When I reviewed the story of the Magnamosis highlighted in this issue, I was not completely surprised to find that this tantalizing innovation was also the development of the same Michael Harrison, who again has laid out the stepwise development of a potential advance, this time in anastomosis technology.

Unquestionably Dr. Harrison is a lightening rod for innovation. Where does

that leave the rest of us? I would argue that every surgeon and endoscopists could be as inventive. Whether you do it with a scalpel or a scope, you too display genius to solve problems for which there are no books, no randomized trials, and often no time to debate the proper course of action.

The operating room and the endoscopy suite are micro-incubators of ingenuity. Opportunities abound in the operating room every day, but the transforming innovations represent more than just a good idea. Each one is a journey onto itself and embodies the principle that innovation is 1% inspiration and 99% perspiration.

In other words, chance favors the prepared mind.

In this issue of the electronic World Journal of Minimally Invasive Surgery, there are several examples of this *fantastic voyage* we continue to proceed along to reduce pain and suffering and improve the outcomes for our patients undergoing surgical and endoscopic interventions.

Each step whether large or small represents a surgeon or endoscopist who



saw an opportunity, conceptualized the way forward and was willing to workup the solutions in the laboratory and finally, the operating room.

The robotics procedures in this issue also represent such an exploration. It has been a long and winding road between a prototype in the laboratory and a robotic laparoscopic pancreaticoduodenectomy. The voyage has taken more than a dozen years to this point and there are certainly more ports to explore.

There have certainly been potholes, wrong turns, unexpected complications and more than one corporate casualty along the way. In many ways, the operating room is an ideal place to innovate. Small changes often represent variations in clinical care that fall below the threshold of research.

Yet at the same time, we must never lose sight of our responsibility to place patient safety as our first priority. As a result, some of the most creative minds we see on the national and international stage are also some of the most careful and thoughtful clinicians who test their innovations in the laboratory and rehearsing procedures in the preclinical setting before using them on their patients.

Historically, surgeons have worked in silos. We hesitate to leave them because they feel safe and familiar, however many of the most exciting of innovations arise when we move out of our comfort zones and cross-pollinate with disparate disciplines.

Robotics – surgery and engineering. NOTES – surgery and gastroenterology. Magnamosis – surgery and material science.

Those who have ventured out usually found that it was not nearly as scary and often far more interesting than they thought it would be. I encourage you to consider the possibilities.

As you browse through this issue, take a moment to ponder and appreciate the journey undertaken by each one of these innovators and pioneers.

Steven D Schwaitzberg, MD Cambridge, Massachusetts, USA







1.1.SET : Submucosal Endoscopic Tumor resection

### 1.2.NOTES for colorectal resection

**1.3. Robotic facelift thyroidectomy** 

1.4. Ethical issues in Thyroid MIS

# Original Articles

Browse through original articles taken from the eWorld Journal of MIS

#### **ORIGINAL ARTICLES**

### 1.1. SET : Submucosal Endoscopic Tumor resection



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

a commentary by: Lee Swanström, MD, FACS, FRCS Legacy Health System, The Oregon Clinic, Portland, Oregon, USA



Haruhiro Inoue interview by Silvana Perretta

Endoscopic submucosal tunnelling techniques are an offshoot of the NOTES experience where researchers were trying to find ways of exiting the gastrointestinal tract with flexible endoscope in a safe fashion that could subsequently be closed with existing endoscopic clips[1] **P**. These efforts subsequently led to a new field of intramural flexible endoscopy. The first human applications were the selective access and division of the circular muscles of the lower esophageal sphincter (LES) as a focused treatment for achalasia as pioneered by Hiru Inoue [2] **P**. This approach has spread rapidly worldwide as it is relatively pain-free and very effective, representing a definite advance over laparoscopic treatments [3] **P**.

The innovative intramural approach has now been extended to submucosal tumors [4] = . Using technology from ESD (standard HD upper scopes, dissecting caps and specialized cautery tools)

EWJ MIS

and tunnelling techniques developed from the Per Oral Endoscopic Myotomy (POEM) experience -practitioners make a mucosal incision remotely from the tumor, tunnel up to it and separate it from surrounding muscle layers. This is an especially valuable approach as alternatives are often difficult. Laparoscopically, lesions may be difficult to identify and one risks missing the lesion or over-resecting tissue in order to remove these usually benign lesions. Endoscopic treatments have been described but involve resecting the overlying mucosa and snaring intramural lesions with a high risk of a full-thickness injury.

The SET technique as described by Inoue [5]  $\blacksquare$  offers a safer approach by leaving the overlying mucosa intact and tunnelling to the lesion. If resection of the lesion --typically arising from the



Submucosal Endoscopic Tumor resection: Technique



Submucosal Endoscopic Tumor resection of the cardia: Results

muscle layers, results in serosal penetration, it is probably not a problem as a mucosal flap will cover it. This represents an elegant solution. And yet, there are limitations to this approach. These submucosal tumors have variable etiologies and origins (such as lipomas, leiomyomas, GIST, embryologic implants, etc.) and can be hard or impossible to determine preoperatively. This can be a difficulty as each inhabits different layers of the gastrointestinal wall and consequently represent different dissection challenges. Naturally, size is the major challenge and in the series by Inoue, it was the reason why 2 out of 9 cases could not be performed with this approach. One might argue that the 2 to 3cm lesions that are ideal for this approach do not even require a resection but should rather be watched. Finally, while it is unusual in lesions smaller than 3cm, the possibility of malignancy cannot be ignored. An enucleation approach such as SET would be difficult to perform if a

#### 1.1. SET : Submucosal Endoscopic Tumor resection



cancer was encountered, and would be oncologically contraindicated.

Overall, SET represents more movement on the frontiers of endoscopic surgery. Interventionalists are not only moving away from open access and major organ resection, but are also moving away from mucosal-based evaluations and treatments. It may be that the future of gastrointestinal surgery is neither outside nor inside, but rather in-between.



#### 1.1. SET : Submucosal Endoscopic Tumor resection



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#### **ORIGINAL ARTICLES**

### 1.2. NOTES for colorectal resection



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a commentary by **Nicolas Demartines, MD** Centre Hospitalier Universitaire Vaudois Lausanne, Switzerland



Colorectal surgery has traditionally been a conservative incubator of new technology. It was many years before laparoscopic colon resections gathered momentum and now the possibility has been raised that colon surgery may be an ideal application for Natural Orifice Translumenal Endoscopic Surgery (NOTES). It certainly makes sense for this in theory. The anus can tolerate large specimen retrieval and multiple instrument insertion. By nature, colon surgery is a clean contaminated surgery. At best, colorectal surgeons are familiar with flexible and laparoscopic endoscopy, and at least for the left colon, the exit site can be converted to the anastomotic line for a validated closure. Since 2006, we have investigated the possibilities of incisionless transanal colon resection: first with animal and cadaver models of sigmoid and left colectomy [1]  $\blacksquare$ , and subsequently with right colectomy experiments as presented in this video.

#### NOTES Right Colectomy with TEM



Martinec, Awad, Whiteford, Swanstrom Video Session, Am Coll Surgeons Clinical Congress 2009

NOTES Right Colectomy



Colorectal surgeons should not rest on the triumph of laparoscopic colectomy, the perfection of surgery will be when it cures the disease, restores the physiology, leaves no scars, has no pain and no longer strikes fear in the heart of the patient

Lee Swanström

While our studies and even some limited clinical success indicate the feasibility of the transrectal concept, there are significant limitations of NOTES for large organ surgery such as colonic resection. A major problem has been the lack of robust retraction and the ability to triangulate the end effectors of flexible endoscopes and tools. An innovation is the addition of at least some rigid instruments transanally; however, single access transanal rigid instruments are also limited in their ability to visualize and reach middle and upper abdominal structures [2]  $\square$ . One solution to this is to use a synchronous two-surgeon technique using a flexible transgastric endoscope partnered with a rigid transanal endoscopic surgical system. This is the approach we have illustrated in this video on a cadaver model where we were able to perform a total NOTES right colectomy on a fresh tissue cadaver model using these tools. The fundamental steps of ileocolic mobilization, mesenteric division, intracorporeal anastomosis, and transanal specimen extraction are demonstrated in this preclinical setting.

Other pioneers in the field of NOTES colonic surgery (e.g., Patricia Sylla, Joel Leroy, Antonio Lacy) have adopted other strategies to solve the "technology deficit": use of the vagina as a secondary access or using limited laparoscopic access for the upper quadrant dissection or high-vessel ligation. This solution (hybrid transenteric colectomy [HYTEC]) would seem to offer the most reasonable transition to a "**less invasive colorectal future**". Most surgeons skilled in flexible endoscopy and laparoscopic colectomy should be able to move their practice steadily down the "invasiveness ladder" although we would always advise practice in the lab on cadaver and animal models before taking any steps in this direction.





Expert panel: Transanal endoscopic resection



Do you think you can push the indications for TEM with regards to early cancer?



Pure transanal colectomy: Ready to go?



From TEM to NOTES

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# 1.3. Remote access neck surgery (Robotic facelift thyroidectomy)



**David J. Terris, M.D., F.A.C.S** Professor and Chairman, Otolaryngology Stanford University, Stanford, CA USA



David J. Terris interviewed by Silvana Perretta

A series of remote access thyroidectomy techniques, some using a surgical robot, have been introduced in the last decade. Most of these approaches require a positioning that is not the most comfortable. Unfamiliar dissection planes are used and such approaches have been associated with a number of significant complications. Consequently, acceptance has been limited. We describe technical details and patient selection criteria of a recently described robotic facelift thyroidectomy (RFT) approach that precludes such pitfalls.

Inanimate and cadaver dissection studies and clinical implementation were pursued. A 3-arm RFT technique with a 30-degree offset base location proved optimal. The patient positioned supine with arms tucked and in a slight Trendelenburg facilitated the dissection of the optical pocket. Demographic and surgical



data previously obtained include patient age, gender, body mass index (BMI), pathology, and complications.

A consecutive series of more than 50 RFT procedures was performed in a selected population of patients. All cases were completed robotically and no conversions to open surgery were necessary. All but the first case were accomplished on a drainless, outpatient basis. The only complications were one case of transient recurrent laryngeal nerve paresis that resolved spontaneously and three cases of seroma formation that similarly resolved without surgical intervention.



Robotic facelift thyroidectomy: Access



Robotic facelift thyroidectomy: Procedure

A number of remote access thyroidectomy techniques with or without the assistance of robotic technology have proliferated. We have developed and described an intuitive approach that uses familiar dissection planes and obviates the need for breast incisions and for crossing the clavicle. It is technically less challenging than other remote access methods, and therefore recently described complications such as arm paralysis and chest wall numbness can be avoided.

# 1.4. Ethical issues in Minimally Invasive Thyroid Surgery



**Peter Angelos, MD, PhD, FACS** The University of Chicago Chicago, Illinois, USA



Peter Angelos interviewed by Silvana Perretta

In minimally invasive thyroid surgery, as with any aspect of the surgical care of patients, many potential ethical issues may arise depending on the patient and on the specific clinical setting. Based on a widely accepted principle of respect for the autonomy of patients, informed consent is an important notion in all aspects of surgical care. Essentially, informed consent requires that prior to operating on a patient, the surgeon must inform the patient of the indications, risks, and benefits of surgery, and the patient must freely choose to undergo the surgery.

Despite the wide acceptance of the importance of obtaining informed consent from patients, a number of ethical issues remain surrounding the informed consent process. For one thing, exactly how much information is necessary for a patient to be truly "informed" is not clear and varies dramatically from one patient to



another. Does informed consent require the inexperienced surgeon to disclose his or her lack of experience? When discussing risks related to thyroidectomy, are the generally accepted rates of nerve injury and hypocalcemia adequate for the surgeon to disclose, or should the surgeon provide complication rates from his or her own personal series of cases? Although there is not a single answer to all of these questions, the importance of considering them in every case is evidence of the critical nature of informed consent.

A closely related issue that also centers on informed consent relates to "new" or innovative thyroidectomy procedures such as natural orifice transendoscopic surgical approaches to thyroidectomy (e.g., NOTES thyroidectomy).

The central issue for informed consent when discussing innovative procedures with patients is that in the early experience with any procedure, risks are never fully known. If one considers the risks of, for instance, permanent hoarseness from recurrent laryngeal nerve injury to be approximately 1-2% using a conventional approach, then a surgeon would need to study thousands of patients to show even a 50% increase in the nerve injury rate. Certainly, such knowledge is unknown for the many patients operated on in the earlier experience.

Additionally, if a patient has decided that a particular "minimally invasive" operation is better than conventional approaches based on information in the lay press or marketing, then the consent process is altered by the need for the surgeon to often temper the patient's enthusiasm. How to do so in a way that respects the patient's autonomy, but does not give in to hype or market pressures remains a challenge for thyroid surgeons and, in fact, all surgeons. The challenge of informed consent is therefore, how to adequately inform patients and respect their autonomy without necessarily abrogating all responsibility for clinical judgment. Making decisions that are in the patient's best interests even when such decisions may run counter to the surgeon's financial concerns, remains at the core of the ethical practice of surgery.

2.1.Clean net

2.2. Retroperitoneal adrenalectomy

# **Operative Techniques**

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

#### **OPERATIVE TECHNIQUES**

2.1 Clean Net: Combination of Laparoscopic and Endoscopic Approaches to Neoplasia with Non-Exposure Technique for early gastric cancer with severe scar: a steady step towards organ- sparing GI cancer surgery



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



**Thierry Ponchon, MD, PhD** Digestive Diseases Department, Hospital Edouard Herriot, Lyon, France



Haruhiro Inoue and Thierry Ponchon interviewed by Silvana Perretta

Adenocarcinomas in the gastrointestinal (GI) tract are mucosabased so wider mucosal resection is most important. Endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) have become the standard of care for most early gastric cancers in Japan. As endoscopists have gained experience, the ratio between EMR and ESD has been shifting to a prevalence of ESDs, which are used to manage more advanced lesions.

Haruhiro Inoue pioneered the technique and has performed over 1,000 EMR and ESD procedures. In experienced hands, the risk of complications such as bleeding or perforation is extremely low, 2% and 1.4% respectively in his series of over 600 gastric endoscopic resections.

## 2.1 Clean Net: Combination of Laparoscopic and Endoscopic Approaches to Neoplasia with Non-Exposure Technique for early gastric cancer with severe scar: a steady step towards organ- sparing GI cancer surgery



Although generally associated with a low risk of lymph node metastasis even in superficial cancer, preserving oncologic integrity remains a primary need.

Endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) are techniques of local excision of neoplasia confined to the mucosal layer. Specimens from EMR/ESD contribute to several diagnoses, and histological results impact treatment decisions. Severe fibrosis can make it difficult or impossible to lift the mucosa by means of hyaluronic acid injection, and as a result, the quality of the resected specimen for histological assessment is often poor. Using direct cutting techniques often damages tissue specimens and leads to a higher rate of perforation. A full-layer resection such as described by Abe et al in 2008 [1] **(F)**, although possible endoscopically, may expose to the risk of cancer cell dissemination.

A combined laparoscopic and endoscopic approach to neoplasia with a non-exposure technique allows full-thickness resection of the stomach wall without exposing the gastric lumen to the peritoneal cavity, preventing cancer cell dissemination, and consequently sparing gastric tissue.

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#### **OPERATIVE TECHNIQUES**

## 2.2. Retroperitoneal adrenalectomy



Martin Walz, MD Kliniken Essen-Mitte, Essen, Germany



Quan Yang Duh, MD Endocrine Surgery, University of California, San Francisco, USA



In 1992, minimally invasive adrenalectomy was described for the first time using the laparoscopic transperitoneal route. Early results of the first series described a mean operating time of about 5 hours. At that time, we used the posterior open approach for adrenalectomy, which was a rather fast procedure that allowed for early recovery. Due to the dissection of the 12th rib, many patients developed chronic pain and/or a relaxation of the abdominal wall in the long-term follow-up. Nothing seemed to be more logical than to combine the advantages of the open posterior approach with minimally invasive technology.



Martin Walz interviewed by Jacques Marescaux





Retroperitoneal adrenalectomy: Technique

In July 1994, we started our project of posterior retroperitoneoscopic adrenalectomy.

Patients were operated in the prone jack-knife position by inserting 3 ports beneath the 12th and 11th rib. In the first 35 procedures, we created the retroperitoneal space by using a balloon trocar. After learning how to dissect the space without a balloon, we never used that device again.

Major technical developments concerned the use of higher carbon dioxide pressures in the retroperitoneum than usually used in laparoscopy.

Step by step, the capnoretroperitoneum was created by pressures going up to 20mmHg or even more.

Today, a pressure of 20mmHg is the standard level, and in about 30% of procedures we increase the insufflation pressure up to 30mmHg. This is extremely useful in obese patients.

The second main technical improvement concerned the use of modern devices for the dissection of tissue.

These tools allow a precise anatomical en bloc resection of the adrenal and the surrounding fatty tissue.

As of now, we have performed more than 1300 posterior retroperitoneoscopic adrenalectomies for all types of adrenal tumors and diseases. Mean operating time is 50 minutes, mean



Retroperitoneoscopic adrenalectomy: Patient position

#### 2.2. Retroperitoneal adrenalectomy





Virtual reality reconstruction at retroperitoneoscopic adrenalectomy

blood loss is less than 50mL and mean hospital stay 2 days. Major complications were found in 1.4% of patients, the conversion rate was1.2 %.

Chronic sequelae are extremely rare. Meanwhile, variations of the standard technique including partial adrenalectomy, single access adrenalectomy, robotic adrenalectomy and synchronous bilateral adrenalectomy have been demonstrated and described.

From our point of view, the posterior retroperitoneoscopic access offers the best approach to adrenal glands in tumors up to 6cm in size.





#### 2.2. Retroperitoneal adrenalectomy



#### Expert panel: Minimally Invasive Adrenalectomy - Quan-Yang Duh interviewed by Jacques Marescaux



Malignant tumors and minimally invasive approach



Minimally invasive adrenalectomy and virtual reality



Transabdominal versus retroperitoneal approach



Robotics and adrenalectomy

3.1.Robotic pancreatectomy

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3.2. Laparoscopic spleen-preserving

SPECIAL ISSUE

3.3. Minimally invasive pancreatic resection

3.4 Total pancreatectomy

# **Operative Techniques**

Where do we stand What the future holds

#### **OPERATIVE TECHNIQUES MIS PANCREATIC RESECTION**

## 3.1 Pancreatectomy: minimally invasive or robotic approach?



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**Gianmarco Contino, MD** University of Illinois at Chicago Chicago, Illinois USA



**Francesco Maria Bianco, MD** University of Illinois at Chicago Chicago, Illinois USA



Pier Cristoforo Giulianotti interviewed by Silvana Perretta

Spleen-preservation has recently been emphasized in benign and borderline malignant pancreatic diseases requiring distal pancreatectomy. It has been associated with fewer short- and long-term complications [1] (2). At the same time, minimally invasive distal pancreatectomy has emerged as a safe alternative to the open procedure [2] (2). In this context, robotic surgery offers technical advantages over the conventional laparoscopic technique, which might affect the overall success rate of spleen preservation. In this report, we describe the surgical technique and short-term clinical outcomes of our series of robotic distal pancreatectomies, focusing on spleen preservation. The technique involves a 5-port access (3 robotic and 2 assistant ports). In brief, the major steps of the procedure include entering the lesser sac through the gastrocolic ligament and retraction of the stomach with the fourth arm. After defining the inferior and superior borders of

the pancreas, the splenic artery and the portal vein are dissected and preserved dividing all the small pancreatic branches. Transection of the pancreas is performed, when feasible, with the use of the Habib<sup>™</sup> bipolar device. Interestingly, Indocyanine Green Fluorescence can be used to analyze blood flow and stump vascularization. We performed a total of 67 robotic distal pancreatectomies from January 2001 to December 2011. Our series include 31 spleen-preserving distal robotic pancreatectomies (46.2%), corresponding to 96.8% of spleenpreserving rate according to the intention to treat. In expert hands, robotic distal pancreatectomy demonstrated to be a feasible procedure for a wide range of indications including malignant (42%), borderline (6%), and benign (53%) lesions, indicating that over 70% of patients with non-malignant disease had spleen preservation. The overall conversion rate was low (3 cases, 4.4%), occurring in 2 cases of large cystic lesion and adenocarcinoma. Notably, no conversion was necessary in the spleen-preserving



5-port access (3 robotic and 2 assistant ports)





CT-Scan

group; intraoperative and short-term outcomes favorably compare with the laparoscopic technique [2]  $\bigcirc$ . In particular, postoperative morbidity was 16.1%, and only a single case of fistula was reported (3.2%). Mean operative time was 282 minutes (range 140-510) and median length of stay was 7 days (range 3-19). Our experience warrants further investigation particularly in consideration of the increasing evidence supporting laparoscopy over open surgery for distal pancreatectomy. This allows to define the potential contribution of some of the specific benefits of robotics in spleen preservation rate and postoperative morbidity [3]  $\bigcirc$ .





Robotic spleen-preserving distal pancreatectomy

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#### **OPERATIVE TECHNIQUES MIS PANCREATIC RESECTION**

## 3.2. Laparoscopic spleen-preserving pancreatectomy



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



Over the past decade, minimal access surgery techniques have rapidly evolved to include a variety of complex surgical procedures. Pancreatic surgery is considered one of the most complex surgeries amongst abdominal procedures. The most logical and feasible initial application of minimally invasive surgical approaches has been for distal pancreatectomy, for which there is limited dissection and reconstruction is not required. A recent metaanalysis of comparative cohort studies has highlighted advantages of reduced blood loss, complication rate, and shorter hospitalization with laparoscopic over open approach. Reported conversion rate varied between 0 and 30%.



CT-Scan





Spleen preserving: Technique

Here we show a laparoscopic distal pancreatectomy for a 2.5cm insulinoma with preservation of the spleen by the technique of Kimura, which encompasses dissection of the splenic vessels form the resected pancreas [1]  $\blacksquare$ .

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#### **OPERATIVE TECHNIQUES MIS PANCREATIC RESECTION**

## 3.3. Minimally invasive pancreatic resection



Since the nineties, the availability of new devices and the growing experience of many teams around the world have made more complex laparoscopic procedures possible, such as pancreatic resection. The aim of this work is to describe current procedures involving distal pancreatectomy and pancreaticoduodenectomy (PD), based on the literature and on our own experience.



#### **Juan Santiago Azagra-Soria, MD** Unité des Maladies de l'Appareil Digestif et Endocrine Centre Hospitalier of Luxembourg, Luxembourg

#### O Facy, M Goergen, V De Blasi, L Arru, V Poulain

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Laparoscopic distal pancreatectomy with en bloc splenectomy for "borderline neoplasm"



#### **Distal pancreatectomy**

Distal pancreatectomy is the usual procedure for left pancreatic tumors. The laparoscopic approach improves short-term outcomes with satisfactory resection quality [1,2] 💭. Consequently, this approach is recommended for both malignant and benign tumors in suitable patients [3,4] 💭. Questions remain in the field of laparoscopic distal pancreatectomy: how to decrease the rate of pancreatic fistula as well as the place of spleen preservation.

Pancreatic fistula is the main cause of morbi-mortality and occurs in about 30% of procedures, even in experienced teams [2,5-8] EXAMPLE . The main risk factor is soft pancreatic tissue. Many techniques for closure of the remnant pancreas are described (suture, stapling with wide or thin staples, elective suture of Wirsung's duct), but none have clearly become the gold standard [2,6,7,9] 💭. The use of gl ue or hemostatic products, such as Tachosil®, proved to be of no interest, whereas the radiofrequency dissector must be evaluated [8,10] = . Interposition of the mesocolon or plasty using the greater omentum may be used to cover the splenic vessels and decrease the risk of hemorrhage associated with pancreatic fistula. Several studies have shown that spleen preservation with or without splenic vessel preservation (respectively known as Kimura technique and Warshaw technique) is feasible and safe by laparoscopy [1,2,11-14] 💭. The advantage of spleen preservation is to avoid the risk of an overwhelming infection (which persists even after preoperative vaccination) [15] =. Splenectomy may also affect the long-term prognosis in pancreatic cancer and may increase the rate of postoperative diabetes, independently of the



Whipple intervention for pancreatic cancer by full laparoscopic approach

volume of the gland resected [16,17] **P**. Additionally, spleen preservation does not seem to increase the risk of pancreatic fistula [5] **P**. On the other hand, spleen preservation is a more time-consuming and more complex procedure than distal pancreatectomy with splenectomy [18] **P**. Even in experienced teams, in 20% of procedures conducted with the intention to preserve vessels, the vessels are in fact ligated [2,13] **P**. Splenic complications have been described even in cases of vessel preservation (pain due to splenic infarction, abscess or necrosis requiring re-intervention) [18,19] **P**. This is to be correlated with a

#### 3.3. Minimally invasive pancreatic resection



high rate of splenic vein thrombosis after splenic vessel-preserving pancreatectomy [13] =. For some authors, splenic artery and vein may be ligated and spleen vascularisation is ensured by blood supply from the short gastric vessels. This is associated with an increased risk of splenic complications and of segmental portal hypertension [14,18] 💭. Despite the fact that no bleeding due to rupture of the gastric vein after ligation of splenic vessels has been described, the risk of bleeding certainly exists and is not only a "paraphysiological phenomenon" [14] =. Preservation of the splenic vessels is not an option in cases of exocrine pancreatic cancer or cystic tumour with a risk of degeneration (mucinous cystadenoma or intraductal papillary mucinous tumour) because it threatens oncological radicality and extension of lymphadenectomy [18,20] 💭 . As a result, there are very few cases suitable for spleen vessel-preserving distal pancreatectomy, including endocrine tumours, a very small proportion of chronic pancreatitis and serous cystadenoma, for which surgical indications are very limited. This mainly explains why series of laparoscopic spleen-preserving distal pancreatectomies include a small number of patients, with unusual surgical indications such as trauma or intrapancreatic spleen.

In conclusion, laparoscopic distal pancreatectomy with en bloc splenectomy remains the gold standard procedure for left pancreatic tumours. Spleen preservation can be discussed in selected cases, with a preference for vessel preservation. In our opinion, the interest of spleen preservation is not clear enough to substantiate conversion to laparotomy and to accept the risk of splenic infarction and segmental portal hypertension associated with the Warshaw technique. Although there is no clear decrease in the rate of fistula with laparoscopy, the benefits in terms of



Laparoscopic resection of the retroportal pancreatic lamina

decreased surgical aggression, wound size as well as improved breathing are of interest for tolerance to this frequent complication as well as for its management.

#### Pancreaticoduodenectomy (PD)

Although clear recommendations exist for laparoscopic distal pancreatectomy, laparoscopic PD is still undergoing evaluation and remains a particularly complex procedure. It is being developed by a few pioneer teams in highly selected patients. Staging laparoscopy is of interest to avoid unnecessary laparotomy in



suspected metastatic disease, but only 450 Whipple's procedures have been reported around the world [21-24] =. Some cases of vascular resection have also been reported, as well as associations with other procedures, such as total colectomy [25,26] 💭. The reasons for the difficulties encountered in developing the laparoscopic approach in this indication are the complexity of the resection, which requires vascular control, the number of anastomoses and the length of operative time (more than 6 hours) [27] 🥮. No recommendations have been established because the feasibility is not perfectly demonstrated, as all reported series are mainly descriptive and carry many biases: the procedures are performed by highly talented expert surgeons, patient selection is not clearly stated, and the conversion rate is certainly minimized. Nevertheless, the technical aspects of laparoscopic PD seem to be clear with a standardized procedure. The criteria for satisfactory carcinologic resection seem to be respected, with a satisfactory free-margin resection rate along with a number of removed lymph nodes [23,27] 💭. The reported conversion rate is high, mainly due to haemorrhagic complications [23] 🥮 . Mortality is below 5% and morbidity is about 30%, which is congruent with the complication rate reported with open procedures [28]  $\blacksquare$ . It is certainly too early to draw conclusions about any benefit in short-term outcomes for the laparoscopic approach in this indication, but the reduction in perioperative stress associated with laparoscopic resection may translate into cancer benefit in some patients [29] 🥮.

The current trend is towards full laparoscopic procedures, avoiding video assistance, which increases operative length and probably decreases the interest of minimally invasive surgery. In our

experience, laparoscopy is clearly of interest for staging and for palliative procedures. In our institution, 32 Laparoscopic PD were performed, 20 Laparoscopic-Assisted PD and 12 Total Laparoscopic PD. In this group, TLPD were performed with the intent of full laparoscopic procedures, with 3 conversions to LAPD anastomoses. The reason for conversion was an excessively long operative time. The mean operative time was 380 min and the mean blood loss was 250 mL. There was no mortality and there were three complications (one grade A pancreatic fistula (Clavien II), one grade B and one haemorrhage (Clavien III). According to the pathology report, the margins were free. Fatigue due to stress and to operative time was resolved by separating resection and reconstruction and by having a different surgical team for each. According to the teams that performed robot-assisted PD (DaVinci® system), the robot certainly simplified some of the difficulties of this procedure, as it allows for a more precise dissection, with a likely gain in precision and time spent on anastomoses [30,31] 戸.

Laparoscopic distal pancreatectomy is currently the recommended procedure for left pancreatic tumours, with improvements in shortterm outcomes and satisfactory resection quality. The aim is now to decrease the rate of pancreatic fistula and to determine the place of spleen preservation.

Laparoscopic pancreaticoduodenectomy has to be evaluated to ascertain its feasibility and to clarify which patients will benefit from minimally invasive procedures. Robotic assistance is probably of interest to make major complex surgeries available to a wider range of patients.

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## 3.4. Total pancreatectomy



Despite the initial description of laparoscopic pancreatoduodenectomy (PD), almost 20 years ago, acceptance has been limited owing to the technical demands of this procedure. Several authors have described hybrid, laparoscopic-open approaches to avoid the complexity of a purely laparoscopic procedure. In a recent review of published of laparoscopic PD, Gumbs et al. identified 285 attempted procedures [1] (Conversion rate was 9%, 87% were performed completely laparoscopically, and 14 (6%) used robotic assistance. Total pancreatoduodenectomy (TPD) combines the operative steps of distal pancreatectomy and PD, but facilitates reconstruction and



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MRI

#### 3.4. Total pancreatectomy



lowers the risk of common complications by eluding the need for a pancreatic anastomosis. Only a few cases of laparoscopic-assisted total pancreatectomy have been attempted to-date [2-4] , and Giulianotti recently reported 4 full laparoscopic robotic procedures [5] . The role of robotics in digestive surgery is still controversial and no clear advantages were demonstrated in comparative studies. However, in complex pancreatic surgery, such as PD or TPD, robotics may provide a substantial assistance during the execution of difficult anastomoses thanks to the stability of images and instruments as well as wristed articulations of the robotic graspers.

#### **Clinical Case**

We present the case of a laparoscopic pancreatectomy with preservation of the spleen and the pylorus for Intraductal Papillary Mucinous Neoplasm (IPMN).

The patient was a 69-year-old woman who was initially admitted for epigastric abdominal pain to an outside hospital. Initial diagnostic tests revealed elevated amylase, lipase and transaminase levels. An abdominal computed tomography (CT) scan showed multiple cystic neoplasms distributed along the entire length of the pancreas. Magnetic Retrograde CholangioPancreatography (MRCP) demonstrated the presence of multiple intraparenchymal cysts, extending from the pancreatic uncinate process to the tail, probably developed on secondary ducts. The size of the largest cyst was 24mm (FIGURE 1).



#### Total Pancreatectomy

There was no enlargement of lesions on two MRCPs performed at 6-month intervals. There was no dilation of Wirsung's duct, nor was there dilation of the biliary tract. Echo-endoscopy confirmed the mucinous nature of the wider cyst. Tumor markers were normal. Diagnosis of Intraductal Papillary Mucinous Neoplasm (IPMN) was established. In this context, a discussion was started with the patient who preferred the option of a total pancreatectomy rather than a partial pancreatectomy with a risk of iterative surgery.



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4.1.Sleeve gastrectomy: Endoscopic management of stenosis and leaks

4.2.Sleeve gastrectomy: a simple operation with complex results

4.3.Laparoscopic revision of Nissen fundoplication for dysphagia

.4.Laparoscopy for internal hernia after RYBP



Clinical Cases

Clinical cases, continuing medical education

#### **CLINICAL CASES**

### 4.1. Sleeve gastrectomy: Endoscopic management of stenosis and leaks



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#### **Managment of Stenosis**

Sleeve gastrectomy has gained popularity as primary treatment in patients with morbid obesity and is considered a less complex procedure with favorable postoperative outcomes. Its complications, specifically stenosis and leaks, are now better understood in such a way that its clinical outcomes are more prone to becoming chronic and treatment to be more complex when compared with gastric bypass and gastric band procedures [1-4]

Stenosis after sleeve gastrectomy is generally identified by symptoms of reflux, dysphagia, pain and excessive weight loss [1] Contrast X-ray can identify narrowing, dilations and axis deviation. Endoscopy, which should be used to define it, really is a challenge. Generally, the endoscope passes throughout the sleeve and stenosis is not diagnosed because it runs against the endoscopic dogma of the "once my scope has passed through,



Video 1 : Endoscopy





Rigiflex achalasia balloon



there is no stenosis". Indeed, what happens is that the stenotic sleeve presents itself with various degrees of rotation that go unnoticed to the endoscopist (various degrees of axis deviation) All kinds of stenoses, either functional such as axis deviation or mechanical ones where the scope does not pass through, have an important role in the pathogenesis of complications leading to various degrees of stasis and keeping a high-pressure intragastric environment. In digestive surgery, most of anastomotic stenoses are treated endoscopically by means of TTS (Through The Scope), CRE (Continuous Radial Expansion) hydrostatic balloons [2]

However, when it comes to sleeve gastrectomy, this approach tends to fail since a greater amount of pressure is needed to obtain a functional gastric lumen. Our group has started to use pneumatic dilation to treat such stenoses with good results. The procedure is performed with an OTS (Over The Scope) achalasia balloon (Rigiflex® balloon, 30 to 35mm) over a stainless steel or super-stiff guide-wire in consecutive dilation sessions with pressure coming on a stepwise way from 15 up to 25 psi.

Once the balloon has been inflated under radiological guidance, correction of the gastric tube axis can be easily observed. To be efficient, treatment must be aggressive; however, until now, we have had no cases of staple line disruption. If there is no improvement after 3 to 4 dilation sessions, a surgical option such as conversion to gastric bypass should be considered.



#### **Managment of Leaks**

Leaks in gastric bypass and sleeve gastrectomy are amongst the worst and possibly the most dramatic complications in bariatric surgery [4-8] E. From a healing perspective, it seems that the two procedures have different outcomes in terms of leakage. Reportedly, leaks occur in up to 9% of sleeve gastrectomy cases, and even more often in revision cases.

A majority of leaks appears close to the gastroesophageal junction. These leaks are known to be difficult to treat by conventional means. If gastric bypass has a well-established and known endoscopic approach, sleeve gastrectomy leaks point to another direction in terms of healing outcomes, especially when the leak originates from the angle of His and when the sleeve has been calibrated using thinner bougies (32 to 36 French).

Contrarily to gastric bypass fistulas which tend to heal with a conservative approach, the angle of His fistulas (the most frequent ones) in sleeve gastrectomy tend to become chronic and demand different endoscopic approaches for the early (until 30 to 40 days) and late onset respectively.

Additionally, the medical literature is limited in addressing this problem and, reference centers that receive those complications acknowledge that the traditional endoscopic approach of -"closing the hole"- does not achieve satisfactory healing rates. Leaks at the angle of His have specific characteristics that contribute to their unusual healing pattern possibly related to the combination in this specific area of high intra-gastric pressure, impaired peristaltic activity, and ischemia.



#### Video 2 :

The following additional contributing factors have also been identified: "physiologic" obstruction of the pylorus,

- · iatrogenic narrowing at the level of the incisura angularis,
- · body-antrum axis deviation "corkscrew gastric tube"
- long staple line,
- herniation of the gastroesophageal junction together with the proximal staple line in the chest, and therefore exposed to negative pressure.

#### EWJ MIS

#### A. Early treatment

Together with surgical or radiological drainage, stents represent the first line of endoscopic treatment for early leaks with reported healing rates consistently over 80% in the literature. An adequately positioned stent must encompass the incisura angularis. Consequently, only in this way, two of the most important objectives in the endoscopic treatment of the fistula may be achieved: to release the pressure and to correct the axis of the gastric tube, making sure that the lumen will remain open by lowering the pressure and maintaining the flow.

As the stents we have used until now were designed to achieve a temporary release of malignant obstructions, there is no ideal stent in a leak situation.



Sleeve axis deviation pictures: different grades of stenosis on X-ray





Stent



The stents made of silicone tend to dislodge more easily and nitinol single covered stents may be difficult to remove. In addition, the size and length of the stents have not yet been optimized, which sometimes require the use of a second stent. It is also essential to note that with stents in place, patients tend to present unpleasant symptoms such as pain, reflux, nausea, and increasing salivary secretions. The mean implant duration is around 4 weeks, and we strongly recommend that it should be checked periodically.

#### **B.** Late treatment

If the patient is referred to endoscopic treatment after 4 weeks or if stent therapy fails, our practice is to use pneumatic dilation with the technique previously described in combination with endoscopic septomy since most times, a septum dividing the leak site (at a higher level) from the gastric lumen can be found, which makes healing more difficult. In this case scenario, an endoscopic septomy is also performed by means of a needle-knife or using an IT-knife followed by balloon dilation.

This maneuver will reshape the fistula site in the same way as a Zenker's diverticulum would be treated endoscopically, thereby improving the healing process.

If the endoscopic treatment fails within 6 months, a surgical



A septum dividing the leak site



approach should be considered.

In our department, this strategy was successfully used to treat more than 30 patients with stenosis and more than 50 patients with leaks. Two patients failed within each group and were referred to surgical treatment after 4 and 8 months respectively.



Video 3 : modified double-covered nitinol stent implant



Video 4 : Endoscopic septomy is also performed by means of a needleknife or using an IT-knife followed by balloon dilation



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#### **CLINICAL CASES**

4.2. Sleeve gastrectomy: a simple operation with complex results (GERD, dysphagia, and pain issues)



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Laparoscopic Sleeve Gastrectomy (LSG) is increasingly performed as a standalone bariatric procedure. However, dysphagia, vomiting and gastroesophageal reflux are common complications, and could be secondary to esophageal motility disorders. Consequently, data on the effect of LSG on gastroesophageal junction (GEJ) physiology is scarce.

The objective is to report on 3 cases of esophageal distress detected on High Resolution Manometry (HRM) in symptomatic LSG patients.

Three post-sleeve patients with dysphagia, regurgitation and epigastric pain were studied. Esophagogastric profile and dynamics were assessed using HRM, pH impedance, endoscopy and upper gastrointestinal series (UGIs).

The median delay between surgery and symptom development was 2 months (range: 2-4). While initial esophagogastroduodenoscopy (EGD) and UGIs did not show any stricture, functional GEJ obstruction during swallowing with panesophageal pressurization and hiatal hernia (>2cm) were observed in all patients on HRM. In 2 patients, gastric pouch pressurization with retrograde gastroesophageal contractions was also detected. pH impedance showed pathological non-acid reflux with a mean of 143 reflux per 24 hours (range: 120-164). Dilatation and stenting were attempted in all patients. Revisional surgery (hiatal hernia repair) was performed in one, with no consistent symptom improvement. At a mean follow-up of 10 months, all patients still present mild to moderate esophageal dilatation with unchanged



symptoms not responding to endoscopic, surgical and medical treatment.



#### Clinical case

In this limited series, the motility pattern and esophageal dilatation raise the red flag of "esophageal distress". Endoscopy and UGIs may not assess functional complications after LSG adequately. HRM can elicit an improved understanding of esophagogastric dynamics to sharpen treatment strategy.

#### **CLINICAL CASES**

## 4.3. Laparoscopic revision of Nissen fundoplication for dysphagia



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The success rate of laparoscopic Nissen fundoplication (LNF) depends on the proper creation of a floppy and symmetric wrap together with a suitable crural repair. Most failures and complications due to technical mistakes during anti-reflux surgeries are related to an incomplete or inadequate intraoperative evaluation of the wrap and crural repair. Postoperative transient dysphagia is an unavoidable side-effect of the operation probably as a consequence of edema and esophageal dysmotility arising from surgical manipulation of the cardia [1-4] Dut resolves spontaneously in 3 months in about 90% of cases [5] .

Severe persistent dysphagia (after 3 months postoperatively) is atypical and frequently related to a technical error. An anatomical anomaly must be ruled out [6-9] **=**.

Dysphagia may be caused by a wrap that is too tight, too long, twisted, a wrap that is placed around the stomach and below the anatomic esophagogastric junction or by a distortion of the esophageal diameter and orientation at the level of the crural repair. Radiological examination can usually reveal an anatomical problem if present, while manometry can demonstrate achalasia, without clarifying whether it is primary or secondary, or outflow obstruction. When diagnostic evaluation fails to demonstrate an anatomical defect or obstruction, endoscopic dilation is indicated and is often successful in resolving the problem, and still a minority of patients requires redo surgery.

If the preoperative work-up demonstrates an iatrogenic anatomical defect such as a poorly constructed wrap, slippage or problems within the hiatus such as migration of the wrap into the thorax,



development of para-esophageal hernia, and tight hiatoplasty, early reoperation should be offered to patients with a success rate of about 75% in the recent literature [7-10] 💭.

This patient complained from pain at swallowing irradiating to her lower back and left shoulder. Careful analysis of the upper GI series revealed an abnormal angulation of the GE junction, which was confirmed at reoperation and explained by the trans-diaphragmatic position of the wrap due to poor anatomical landmark identification during her first surgery.

Dissection of the lower esophagus and posterior window creation seems to be amongst the most challenging steps for the novice. Creation of this window is guided by the correct identification of anatomical landmarks and facilitated by adequate retraction. The



Identification of landmarks

anterior surface of the esophagus, the right and left crus should guide the dissection and should be correctly prepared and exposed before creating the window.

The identification of the right and left crus and the subsequent posterior window creation while quite straightforward in the thin patient can be quite challenging at greater BMIs



Creation and calibration of the fundoplication

Another important step is the calibration of the wrap. Calibration of the valve not only implies the assessment of the wrap laxity but also the correct evaluation of the fundic fold, used to build the fundoplication.





#### 54-year-old woman

1995: Laparoscopic Nissen fundoplication for documented GERD.

1995-2008: no symptoms of GERD, dysphagia, retrosternal pain, regurgitations of undigested food.

Manometric studies (6): normal esophageal peristalsis, normotonic LES with satisfactory relaxation.

24 hours pH monitoring: no acid reflux.

Barium swallow (2001) no outflow obstruction. Suspicion of a part of the fundoplication situated above the diaphragm

ircad

10 endoscopic dilatations without improvement

2009: patient reffered

Clinical case video: Laparoscopic revision of Nissen fundoplication for dysphagia

Size and shape of the fundus should be taken into consideration. In a minority of patients, the fundus is conic-shaped and therefore unsuitable for a 360-degree wrap, even after short gastric mobilization. If this is the case, the preferred option is a posterior Toupet fundoplication, which will better accommodate the anatomy of the stomach, avoiding twist and tension.

Cruroplasty should respect the anatomy of the esophageal inlet into the abdomen and gently accommodate the esophageal diameter without applying any pressure on the esophageal wall and avoiding angulation. According to the anatomy and shape of the hiatus, anterior sutures can be added to avoid kinking of the esophagogastric junction. Closure should be performed whenever possible without reinforcement.

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#### **CLINICAL CASES**

## 4.4. Laparoscopic exploration for internal hernia following Roux-en-Y gastric bypass



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Internal hernia is the most common cause of small bowel obstruction (SBO) after laparoscopic Roux-en-Y gastric bypass (LGBP) [1,2]  $\bigcirc$ . Retrospective reviews have found the incidence of SBO after LGBP to be between 1.8 and 9.7 percent [1-4]  $\bigcirc$ . The incidence of internal hernia after LGBP is between 0.2 and 8.6 percent based on multiple studies 2-4. This incidence is higher than that seen with open GBP, which is presumably due to decreased adhesion formation after laparoscopic surgery compared to open surgery [5]  $\bigcirc$ .

The creation of potential space as a result of weight loss may also be a contributing factor in the etiology of internal hernias, which often present in a delayed fashion. An internal hernia can potentially occur through either two or three defects, depending on



Retrocolic technique





whether a <u>retrocolic</u> or <u>antecolic</u> technique is used for the Roux limb [6,7]  $\blacksquare$ .

The literature shows a general trend towards lower rates of internal



Clinical case video: Laparoscopic exploration for recurrent abdominal pain following Roux-en-Y gastric bypass

hernia with antecolic compared to retrocolic, and with defect closure compared to non-closure.

If a retrocolic approach is used, a third defect in the transverse mesocolon is created. This is the most common site of internal hernia, which has prompted many surgeons to adopt an antecolic technique in order to eliminate this defect. Higa's study of 2,000 patients showed an internal hernia distribution of 67 percent mesocolic, 21 percent jejunal, and 7.5 percent Petersen (*Petersen's* 

hernia is a hernia in which the small bowel moves into a potential space between the transverse mesocolon and the mesentery of the Roux limb) [8]  $\blacksquare$ .

Internal hernia through one of the mesenteric defects can result in small bowel obstruction, ischemia, or infarction [5-8] 💭 . Due to the increasing extent of this problem and its potentially devastating consequences, surgeons should have a high clinical suspicion for internal hernia after LGBP. Symptoms of internal hernia are nonspecific, making the diagnosis challenging [7-9] 💭 . Patients with internal hernia most commonly present with abdominal pain, typically periumbilical and cramping, and may also have symptoms of small bowel obstruction, such as nausea and vomiting. The time



<sup>3</sup>D CT scan reconstruction



of presentation varies greatly and may occur within one week of the initial operation or up to three years postoperatively. However, the majority of cases occur between 6 months and 2 years postoperatively. Radiographic diagnosis of internal hernia is difficult and the characteristic findings on computed tomography (CT) scan are often missed. Sensitivity and specificity of CT is 63 % and 76 %, respectively with the preoperative diagnosis made in only 64% of patients [10-13] **=**.

Difficult radiographical diagnosis is compounded by anatomy after a Roux-en-Y gastric bypass that can be confusing and inconsistent. An effort has been made to group the main feature suggestive of an internal hernia. These include small bowel loops in the upper quadrants; evidence of small bowel mesentery crossing the transverse mesocolon; presence of the jejuno-jejunostomy superior to the transverse colon; signs of small bowel obstruction; or twisting, swirling, crowding, stretching, or engorgement of the main mesenteric trunk. One approach is to look for the effect of the hernia on herniating structures such as the mesentery and mesenteric vessels. Mesenteric swirl seems to be the most diagnostic sign with a sensitivity of 78-100% and a specificity of 80-90% [11] **—**.

These findings emphasize the need for high clinical suspicion for internal hernias. Any patient who develops cramping abdominal pain, nausea or vomiting, after LGBP should be considered to have an internal hernia until proven otherwise. If the patient has significant symptoms but radiologic studies are negative, a diagnostic laparoscopy is warranted to rule out internal hernia [11]

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### 5.1.MAGNAMOSIS™



## New Technology

Recent breakthroughs in cutting-edge minimally invasive strategies

#### **New Technology**

5.1. MAGNAMOSIS<sup>™</sup> – a novel magnetic compression anastomosis device for the future of surgery and endoscopy



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James Wall Interview Micheal Harrison

MAGNAMOSIS<sup>™</sup> is a system designed for full-thickness compression bowel anastomoses comprised of two selfassembling magnetic rings. The rings generate a compression anastomosis by applying constant force on the interposed tissue leading to transmural ischemia, necrosis scarring and full-thickness anastomosis formation. Compression anastomosis was first described by Denan in 1826 and later popularized in 1892 with the Murphy Button, which is comprised of metal rings that screw together to generate a compressive force. Several compression anastomosis systems are currently FDA approved. Human experience with magnetic anastomoses dates back to the 1980s when 5 cases were reported from Holland in which flat magnetic rings were used to form the inner mucosal to mucosal anastomosis in low anterior colon resections.







Colorectal Magnamosis





EWJ MIS

The MAGNAMOSIS<sup>™</sup> design creates a unique compression gradient between the rings which has proven superior to flat magnetic rings in the consistency of the anastomosis and the time to patency. The MAGNAMOSIS<sup>™</sup> system has been studied in a series of publications that have shown :

- ability of the system to create reliable full thickness small bowel anastomoses when compared to both suture and stapled anastomoses,
- the ability to be delivered with minimally invasive techniques
- the ability to be immediately patent by opening the tissue within the inner rings.

The evolution of surgery continues towards less invasive techniques and the boundary between endoscopy and surgery is being crossed with Natural Orifice Transluminal Endoscopic Surgery (NOTES) and advanced endoluminal techniques.

The MAGNAMOSIS<sup>™</sup> rings are ideal for endoscopic delivery with a circumferential groove that allows it to be captured and transported by a standard endoscopic snare. Animal studies have shown the feasibility of endoscopic gastric bypass and NOTES colectomy using MAGNAMOSIS<sup>™</sup>. Human trials are planned for the near future and the potential applications of MAGNAMOSIS<sup>™</sup> are exciting.

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# cultural escapesca

Alsace is a region of many talents. Seep into our culture, history and traditions



#### The Pure Fascination of a Brand

Our journey begins where power meets perfection. Bugatti is the most popular French brand today and it is now part and parcel of a national heritage that should be salvaged.



Competition, certainly, but also aesthetics and technique. Ettore Bugatti was in his prime as motor racing became a spectator's sport. It had shed its image of dirty exhaust gases and dusty roads and instead was taking on a more glamorous air, with a touch of heroism and romanticism. Ettore Bugatti also valued aesthetics combined with technique. The brand's models could well be compared to works of art. Take a cast aluminium Bugatti engine: its straight lines let us imagine that Ettore Bugatti did not have any compass in his illustrator's armamentarium. This man, who stood against conformism, did not allow hammers in his workshops. As a





result, the quest for beauty not only applied to drums, rims, engines, compressors in cast and straightened aluminium, but also to hoods that clearly and neatly framed the space allocated to engines. This perfectly suited the artist and esthete Ettore, who saw it as his vocation to define the new fashion. In 1898, Ettore Bugatti created his first car. The young engineer offered his talents to great brands such as De Dietrich (1902), Mathis (1904), Deutz, and Peugeot. The Baby Peugeot and Mathis's Hermes are direct heirs of such partnerships. In 1910, in then German Alsace, he created his own cars which were essentially put together for competition races. He launched the production of the type 10 in Molsheim. The design of his famous Bugatti radiators was inspired by horses and was shaped as shoehorns, and this set the first stone of the other models to come. At his plant, Ettore was never satisfied with second best. He always wanted the best available and if it did not meet his expectations, he simply made it himself. Thus, many of the tools in Molsheim were of his own design, including the feet of the wooden workbenches and the vices used by his workers. Even the entrance and oak doors to the factory were Bugatti originals. He did not consider his Atelier as just another factory; he saw it much more as a complete work of art. And none of his contemporaries set any great store by such things. Following his company's triumph in Brescia and the steady income from racing car sales, Ettore decided to purchase the Château St. Jean in Molsheim which was built in 1857. The estate grounds lies in the vicinity of the former Bugatti manufacturing plant and should represent the Bugatti brand name according to the founder's will. It was here in Saint Jean that the Italian automobile pioneer founded his legendary Bugatti car manufacturing plant. It was here that he

celebrated the racing victories of his cars and evolved from a respected businessman to a living legend.

And it was here that the story of one of the world's greatest automobile brands came to an end – or rather, a temporary halt.



Château Saint Jean - Bugatti headquarters

Credits photos Bugatti





Today, the Château is still the seat of the Bugatti Automobiles Ltd company in Molsheim, Alsace.



History

Credits photos Bugatti









**Ettore Isidoro Arco Bugatti** 

Compared to other famous automotive designers of his time. Ettore Isidoro Arco Bugatti was certainly an avant-gardist and a flamboyant character in more ways than one, resulting from being born in a family of artists. Ettore was born on September 15, 1881 as the eldest son of Carlo and Theresa Bugatti in Milan. It was his parents' desire that the young Ettore should follow in his father's artistic footsteps, while his brother Rembrandt, born in 1884. should pursue a technical career. In the end, it was to be the opposite. Rembrandt was the artist in the family and Ettore began his apprenticeship with bicycle manufacturers, Prinetti & Stucchi. Although he was never to study engineering at university, he designed machines at a furious pace. Each day he filled numerous pages of his famous notepads (over 20,000 of his sketches have survived), and not just with car designs: he also churned out ideas for fishing boats, spaghetti machines and medical instruments. He seemed to see room for improvement in almost everything and ended up owning no fewer than 500 patents!

#### **Competition first and foremost**

When people think of Bugatti today, they invariably think of the Type 35 with its over 2,000 racing victories. This vehicle was Ettore Bugatti's masterpiece, and played a huge part in establishing his reputation as one of the world's finest automotive designers. The Type 35 Grand Prix Bugatti dominated its era, and for almost a decade remained practically unbeatable. It was fast, and featured intelligent design details that were both aerodynamically effective

and esthetically pleasing. Driving the racing car was nothing short of a delight, as the vehicle was unrivaled in its responsiveness, reliability and consistency. The successes of the Bugatti Type 35 and its unique place in automotive design history have never been repeated. But what was it that made Ettore Bugatti so different from other manufacturers? And what enabled Bugatti cars to achieve so many racing victories - almost 2,000 in ten years? Firstly, even in those days, the leading sports car manufacturers aimed to develop their profile through racing success. As a result, races were held almost every weekend throughout Europe, some of them large scale, others less important. In fact, holding Grand Prix became guite the fashion – as well as the Monza Gran Premio, Italy also hosted an equivalent in Rome. In the same way as today, teams spent the summer criss-crossing Europe to battle on racetracks such as Targa Florio, and Le Mans, and at the French and Belgian Grand Prix.

And secondly, unlike its competitors, Bugatti did not just sell sports and touring cars to its customers, but also GP models. This meant that owners could race their car at the weekend, and then on Monday, after replacing the wings and lights, could drive it to the office. It may sound unbelievable, but this is how things were done in the 1920s, and a number of races at the time simply would not have taken place were it not for the amount of private racers entering with their Bugatti.



#### The most exceptional supercar of this era: the Veyron 16.4

1998: the EB16.4 Veyron became the supercar by excellence. That year, a brand fanatic, Ferdinand Piëch purchased the brand which became German once again by joining the Volkswagen group. He





introduced the EB16.4 Veyron which was put together in Molsheim's new factory: it was to become the supercar by excellence.

The Veyron 16.4, an extraordinary vehicle created by passionate engineers for discerning motoring enthusiasts, is clearly the result of the most ambitious projects in automotive history.

The final version of the Bugatti Veyron 16.4 was unveiled in autumn 2005. The Veyron is characterized by more superlatives than any other vehicle on the market today. The most powerful car with 1001 hp, the most luxurious sports car, the fastest with a top speed of 406 km/h, probably the most expensive. Its top speed far surpasses any production vehicle and makes the supercar around twice as fast as most standard models today. The bodywork, made up of a combination of aluminum and carbon components, is utterly unique among supercars, and features the two-tone coloring of Bugatti models in the 20s and 30s. The Bugatti brand has always been renowned for the way in which its innovative solutions have driven automotive design forward. The company's first high-performance sport car of this new era can only endorse this statement. A true masterpiece, the Veyron is certainly more than worthy of becoming a legend as Ettore would have wished.

#### Ettore's life in his own words

"The motor car was born when I was a child growing up. I was not exactly designated neither for this new industry nor to any other activity of this kind, as my family had been creating sculptures, paintings, engravings and chased work since the 16th century. I also started to study sculpture at the Brera Arts School in Milan.

Unfortunately, I was more concerned with amusing myself and besides, I had a brother who was already a sculptor. There are two types of artists. Those who were born artists one day they create something and are 'hooked'. My brother was one of them. The other category, to which I belong, are those who try to create art but are not as gifted, so they have to make up for it by working hard. One day they should wake up and realize that they ought to do something else. If they truly respect art, they stop and choose another path. Besides, I was not a trained engineer. Little

by little I acquired the



**Ettore Bugatti "Le Patron"** 09/15/1881 Milano - 08/21/1947 Neuilly-sur-Seine

technical knowledge, such as calculating the strength of materials. In the beginning, my greatest asset was my ability to draw. Sketches are not only a way of representing existing objects, but a

way to communicate your ideas and thoughts. Many things are easier when you can draw. And I was lucky that I could. No doubt my ancestral roots played a part. You may not necessarily be born a genius just because your father was one, but it is quite common to inherit a talent that has been cultivated in your family for several generations."

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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.

# ANTECOLIC

Situated in front of the colon



# Termes connexes du glossaire

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# Retrocolic

Behind the colon



# Termes connexes du glossaire

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