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Brazilian Journal of Videoendoscopic Surgery

Editorial

How to be more Efficient with Bibliographic Citations and References

MARCO AURELIO PINHO DE OLIVEIRA

Adjunct Professor and Chief of the Department of Gynecology, Faculty of Medical Sciences, State University of Rio de Janeiro (UERJ). Master's in Surgery from the Federal University of Rio de Janeiro (UFRJ); Ph.D. in Epidemiology from the Institute of Social Medicine, UERJ. Member of the AAGL Board of Trustees - Minimally Invasive Gynecology Worldwide.

For an article to be published, one of the requirements is that the citations and the corresponding references be properly formatted. It is not uncommon for editors to hear complaints from authors about the burden posed by all the requirements imposed by scientific journals.

At the Brazilian Journal of Videoendoscopic Surgery we favor the Vancouver style of referencing. In this style citations in the text are identified with superscript Arabic numerals and the references at the end of the article are numbered consecutively in the same order as they appear in the text. When there are up to six authors, all of them should be named in the references. If there are more than six authors, name the first six followed by "et al.". The names should be separated by commas; periods are not used to separate the authors' initials. Note that the year of publication comes after the name of the journal and not at the end. For example: "Parkin DM, Clayton D, Black RJ, Masuyer E, Friedl HP, Ivanov E, et al. Childood leukaemia in Europe after Chernobyl: 5 years follow-up. Br J Cancer 1996; 73:1006-12."

The problem is that in addition to these norms, there are many other rules to be followed, not always known by the authors. Moreover, during the drafting of the article, the author inserts citations and the corresponding references. It's not unusual as an article is being finalized for the author to shuffle the order of paragraphs, thus changing the sequence of some of the citations, which can generate a lot of work.

To overcome these challenges/difficulties, software programs were created that automate the numbering and formatting of citations and references. All the user has to do is choose the desired style and program does the rest. Most of these programs integrate with Microsoft Word®, further facilitating the work. The best known commercial software programs are EndNote® and Reference Manager®.

There is, however, an excellent free program: the Mendeley Desktop®. This "freeware" also offers an interesting feature; it organizes the PDF files of your bibliographic references. Just drag this type of file into a folder and the program extracts the information to be used later in the references. It too integrates with MS Word®, and there is a free application for the iPhone® and iPad®. The program is easy to use. Windows, Mac OS, and Linux versions can be downloaded at: http://www.mendeley.com/download-mendeley-desktop. It's worth checking out!

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Brazilian Journal of Videoendoscopic Surgery

Editorial

Como ser mais Eficiente nas Citações e Referências Bibliográficas

MARCO AURÉLIO PINHO DE OLIVEIRA

Professor Adjunto e Chefe da Disciplina de Ginecologia da FCM/UERJ; Mestre em Cirurgia pela UFRJ; Doutor em Epidemiologia pelo Instituto de Medicina Social da Universidade do Estado do Rio de Janeiro. Membro do Board da AAGL - Minimally Invasive Gynecology Worldwide.

Para que um artigo seja publicado, uma das exigências é que as citações com as respectivas referências bibliográficas estejam bem formatadas. Não é incomum o editor ouvir queixas dos autores sobre a dificuldade em cumprir todas as exigências requeridas pelas revistas científicas.

No Brazilian Journal of Videoendoscopic Surgery damos preferência para as referências no estilo Vancouver. Neste estilo as citações no artigo são feitas com algarismos arábicos em sobrescrito e as referências ao final do artigo são numeradas consecutivamente, na mesma ordem que foi citada no texto. Quando existem até seis autores, todos eles devem ser citados nas referências. Caso existam mais de seis autores, citar todos os seis primeiros seguidos de "et al.". Os nomes são separados por vírgulas e não se coloca pontos separando as iniciais dos autores. Notar que o ano de publicação vem após o nome da revista e não no final, p.ex: "Parkin DM, Clayton D, Black RJ, Masuyer E, Friedl HP, Ivanov E, et al. Childood leukaemia in Europe after Chernobyl: 5 years follow-up. Br J Cancer 1996; 73: 1006-12".

O problema é que além das observações anteriores, existem várias outras regras a serem obedecidas, nem sempre conhecidas pelos autores. Além disso, durante a elaboração do texto do artigo, o autor vai inserindo as citações e a respectiva referência. Pode acontecer que, com o artigo praticamente finalizado, o autor decida alterar a ordem dos parágrafos e com isso haja troca da sequência de algumas citações, o que acaba dando muito trabalho.

Para superar estas dificuldades foram criados programas de computador que permitem uma automatização das numerações e formatações das referências. Basta o usuário escolher qual o estilo a ser usado e o programa formata de acordo com a solicitação. A maioria desses programas possui também uma integração com o Microsoft Word ®, facilitando ainda mais o trabalho. Os programas pagos mais conhecidos são o Endnote ® e o Reference Manager ®. Porém, existe um excelente programa gratuito que é o Mendeley Desktop ®. Ele apresenta uma função interessante que é a organização de arquivos PDF. Basta arrastar este tipo de arquivo para uma pasta específica que o programa procura extrair as informações para serem usadas posteriormente nas referências. Ele possui também integração com o Microsoft Word ® e também existe aplicativo gratuito para iphone e ipad. É um programa de fácil manuseio e pode ser baixado no sítio: *http://www.mendeley.com/download-mendeley-desktop*. Existe versão para Windows, Mac OS e Linux. Vale a pena conferir!

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Brazilian Journal of Videoendoscopic Surgery

Original Article

Peroral Endoscopic Myotomy: New Technique - Study in Pigs

Miotomia Endoscópica Per Oral: Nova Técnica - Estudo em Suínos

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Study carried out at the Center for Immersion Training in Surgery and Endoscopy, Goiânia, Goiás, Brasil. [1] Coordinator, Immersion Courses in Surgery and Endoscopy,Goiânia, Goiás; Doctorate in Surgery from the University of São Paulo; Member, Brazilian College of Surgeons and Brazilian College of Digestive Surgery; Specialist in Digestive Endoscopy from the Brazilian Society of Digestive Endoscopy; Member, Brazilian Society of Videosurgery, Member, Brazilian Society of Bariatric Surgery and Metabolism; Member, International Federation of Surgery of Obesity; Surgeon and Endoscopist, Digestive Surgery and Obesity Clinic, Goiânia, Goiás; [2] Collaborating Professor, Immersion Courses in Surgery and Endoscopy, Goiânia, Goiás; Specialist in Gastroenterology by the Brazilian Federation of Gastroenterology; Gastro-enterologist and Endoscopist, Digestive Surgery and Obesity Clinic, Goiânia, Goiás; [3] Collaborating Professor, Immersion Courses in Surgery and Endoscopy, Goiânia, Goiás; Resident, Radiology Service, Santa Casa of Ribeirão Preto, São Paulo; [4] Monitor, Immersion Courses in Surgery and Endoscopy, Goiânia, Goiás; Internist and Endoscopist, Digestive Surgery and Obesity Clinic, Goiânia, Goiás; [5] Medical Student, School of Medicine, Catholic University of the State of Goiás; Intern, Immersion Courses in Surgery and Endoscopy, Goiânia, Goiás; Intern, Digestive Surgery and Obesity Clinic, Goiânia, Goiás; [6] Collaborating Professor, Immersion Courses in Surgery and Endoscopy, Goiânia, Goiás; Member, Brazilian College of Digestive Surgery; Specialist in Digestive Endoscopy from the Brazilian Society of Digestive Endoscopy; Digestive System Surgeon and Endoscopist of the Gastro-Center Clinic, Goiânia, Goiás; [7] Collaborating Professor, Immersion Courses in Surgery and Endoscopy, Goiânia, Goiás; Member, Brazilian Society of Videosurgery; Digestive System Surgeon and Proctologist of the Santa Luzia Hospital of the Federal District; Chief, Department of Surgery, Ceilândia Regional Hospital, Federal District, DF.

ABSTRACT

OBJECTIVES: To propose a new technique for endoscopic dissection between the submucosa and the lower esophageal sphincter to enable myotomy. **MATERIALS AND METHODS:** Ten pigs underwent dissection of the internal muscle and submucosal layers of the esophagus and cardia, through a 15 cm tunnel in the space created by endoscopically injecting saline with a needle and inflating of a balloon-catheter. After insertion of the endoscope, dissection movements were to used to advance, culminating with myotomy of 3 cm in the cardia and 5 cm in the esophagus. Eight animals of the ELECTRIC GROUP underwent myotomy with electrocautery at 10 watts and for the two pigs of the ARGON GROUP myotomy was performed with an argon scalpel argon at 8 watts. Feasibility of dissection and myotomy, visualization of the sphincter, operative time and complications were analyzed. **RESULTS:** In all the animals it was possible to do the following: dissection, visualization of the sphincter, and myotomy. Blood loss was negligible. Operative time: ELECTRIC GROUP, 8 to 12 minutes with two perforations, and ARGON GROUP, 12 to 14 minutes without perforations. **DISCUSSION:** Peroral endoscopic access offers advantages over videolaparoscopic surgery of achalasia. Studies have shown good results and effectiveness in animals and humans, however the procedure is considered difficult and time consuming and there is no consensus regarding indications of clinical applicability. With this technique fast and safe dissection, visualization, and myotomy of the sphincter are feasible, however, with complications in 25% of the ELECTRIC GROUP. **CONCLUSION:** Despite the good results with regard to access, visualization, sphincter and short cirurgical time, more trials are needed to study the effectiveness of myotomy with pre- and post-operative manometry and to generate complication rates and outcomes data.

Key words: Achalasia. Megaesophagus. Cardiomyotomy. Myotomy. Peroral Endoscopic Myotomy. Therapeutic Endoscopy, Endoscopic Treatment.

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Accepted after revision: november, 13, 2011.

INTRODUCTION

Achalasia of the lower esophageal sphincter is a disease that is prevalent in the countries of South America, especially Brazil, where the principal cause is Chagas Disease. Destruction of Meissner's and Auerbach's plexuses by *Trypanosoma cruzi* results in disturbances of esophageal contractility and of lower esophageal sphincter (LES) relaxation. In Europe and the United States – where Chagas Disease is only seen in immigrants from endemic areas – the disease has no known cause, and thus is called idiopathic achalasia.[1,2]

Rezende's classification divides patients into four groups – Groups I, II, III and IV – based on the degree of dilatation and elongation of the esophagus, disorders of peristalsis, lower esophageal sphincter hypertonia, and retention of contrast.[3]

Except for Group I, the preferred treatment is surgery, provided patients meet cardio-pulmonary criteria. For Group I patients, treatment is basically endoscopic, ranging from the infiltration of the LES using botulinum toxin to dilation with baloon-catheters. In various European and U.S. services surgical treatment for Groups II and III involves sectioning of the lower esophageal sphincter with or without fundoplication. In Brazil, preventive fundoplication to prevent gastroesophageal reflux disease (GERD) resulting from relaxation of the lower esophageal sphincter after surgical section of it muscle fibers has been widely described and studied, mainly by the Esophageal Surgery Service of the University Hospital of the University of São Paulo (USP). One of these techniques which has yielded satisfactory results is called the Heller's Cardiomyotomy with Pinotti's fundoplication, which encircles 270 degrees of the circumference.[4,5,6,7,8,9,10]

In some European and American centers the surgery for idiopathic achalasia consists of cardiomyotomy without fundoplication, and the authors claim that there is no need to take additional measures to prevent reflux, because other natural anti-reflux factors such as the angle of Hiss, the tortuosity the abdominal esophagus, and the diaphragmatic hiatus are not adversely affected.[11,12] Worldwide, over the last 20 years these procedures have been performed by laparoscopy, with better results than open surgery, especially as regards the incidence of incisional hernias and aesthetic aspects, as well as the rapid recovery of patients with shorter hospital stay and an earlier return to normal activities.[13,14,15,16]

Recently, several procedures have been described for treatment of achalasia using a peroral endoscopic approach to perform myotomy of the lower esophageal sphincter. These endoscopic techniques seek to section the lower esophageal sphincter through the esophageal lumen, either by including the mucosa or by the formation of a tunnel by dissection of the esophageal submucosa. The results of these studies, whether in animals or in humans, with or without fundoplication, are the most varied possible. However, the technical difficulty and operative time are still considered excessive when compared with the preferred approach performed by most authors, which is laparoscopic.[17,18,19,20,21,22,23,24,25]

The authors describe a peroral endoscopic approach to the lower esophageal sphincter, carried out in swine, which, in an extremely short time, creates a space between the circular muscle and submucosal layers of the esophagus through which it is possible to access and perform cardiomyotomy.

MATERIALS AND METHODS

At the training center of the Immersion Courses in Surgery and Endoscopy of Goiás, the procedure was performed in ten animals – five females and five males – weighing around 18 to 20 kg, which had fasted (both food and water) for 24 hours. These animals were divided into two groups referred to-as the ELECTRIC GROUP and the ARGON GROUP:

ELECTRIC GROUP: eight animals – four females and four males – underwent myotomy using electrocautery, at a power of 10 watts, and monopolar current.

ARGON GROUP: two animals, one female and one male, underwent myotomy using an argon scalpel, at a power of 8 watts.

The two groups were evaluated according to: technical feasibility of submucosal dissection of the entire length of the lower esophagus and cardia, visual identification of the musculature, feasibility of selectively sectioning muscle fibers, operative time, and complications such as bleeding and perforation.

All animals were euthanized immediately after the withdrawal of the endoscope from the animal's mouth.

Surgical Technique

1. The male or female pig is placed in the left lateral decubitus position with extremities anchored

to the operating table by bandages, with venous access in the right ear. The pig is sedated with acepromazine, intubated, ventilated with pure oxygen using Takaoka equipment, and anesthetized by veterinarians using thionembutal. The endoscopist is to the left of the animal, the videoendoscopy apparatus is also to the left and close to the head (Figure 1).

2. The snout is anchored using a modified 20 ml disposable syringe in the recesses of the pig's mouth, with transfixing sutures of 2-0 cotton thread mounted on a cutting needle, in order to protect the passage of the gastroscope through the mouth and pharynx until reaching the animal's esophagus (Figure 1).

3. After introduction of the insertion tube of the 8.9 mm diameter Fujinon Series 2500/530 gastroscope through the mouth, pharynx, cricopharyngeal muscle, and upper esophageal sphincter into the esophagus, a complete endoscopy of the esophagus, stomach and duodenum of the pig is performed (Figure 1).

4. The distance from the cardia to the upper dental arch of the pig is measured. A point 12 cm proximal to the esophagogastric transition is identified, where one plans to start the procedure.

4. Medida da distância de cárdia até a arcada dentária superior do suino e identificação de um ponto cuja distância foi de 12 cm proximal à transição esôfago-gástrica, onde se planejou iniciar o procedimento.

5. Once this point is identified, the submucosal layer of the esophagus is punctured with an endoscopic sclerosing needle and 10 ml of 0.9% saline solution is injected, creating a liquid-filled blister between the circular muscle and submucosal layers of the esophagus, in the anterior curve of the organ (Figure 2).

6. The blister is perforated with an endoscopic needle knife, crossing the mucosal and submucosal layers that form the wall proximal to the blister, until it reaches its liquid content (Figure 3).

7. A three channel balloon-catheter – normally used to extract gallstones from the biliary tract – is introducted into the orifice of the blister, which is inflated with 1 ml of 0.9% saline solution (Figure 4A and B).

8. The inflated balloon is advanced along the longitudinal axis (back and forth) and from left to right as the gastroscope is gentlyadvanced.

9. Interspersed with movements of the balloon, saline is injected through the irrigation canal

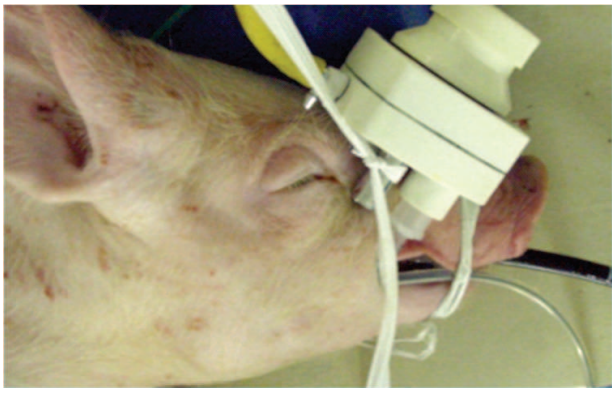

Figure 1 – *Experimental animal anesthetized, intubated, mechanically ventilated with the placement of the insertion tube of the endoscope.*

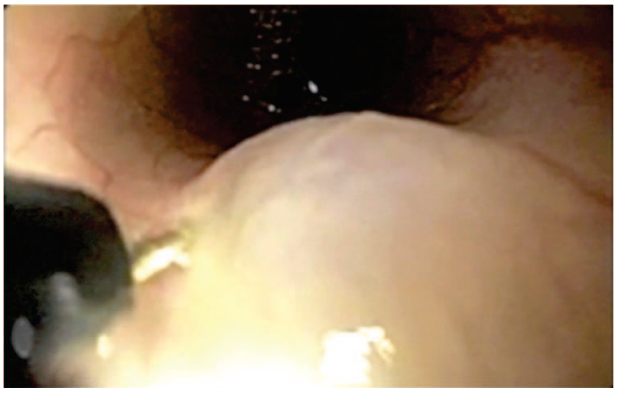

Figure 2 – *Endoscopic sclerosing needle and the saline blister between the circular muscle and the submucosa of the esôfago.*

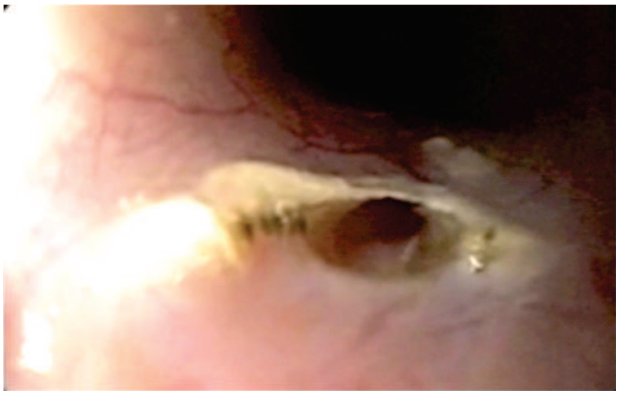

Figure 3 – *Orifice in the saline blister in the proximal wall.*

of the balloon-catheter promoting the hydro-dissection, expanding the separation between the circular muscle and submucosal layers of the esophagus.

10. Withdrawal of the balloon-catheter after creating a space between the layers, a space which is large enough to permit penetration of the tip of gastroscope (Figure 5).

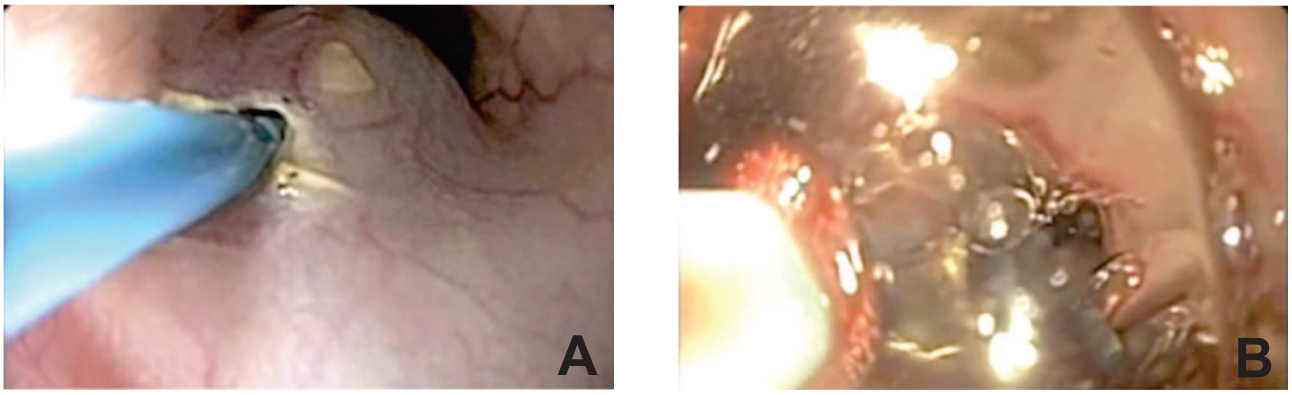

Figure 4 - A) *View from the lumen of the esophagus: balloon inflated between the circular muscle and submucosal layers of the esophagus.* ***B)*** *View from the space created: inflated balloon between the circular muscle and submucosal layers of the esophagus.*

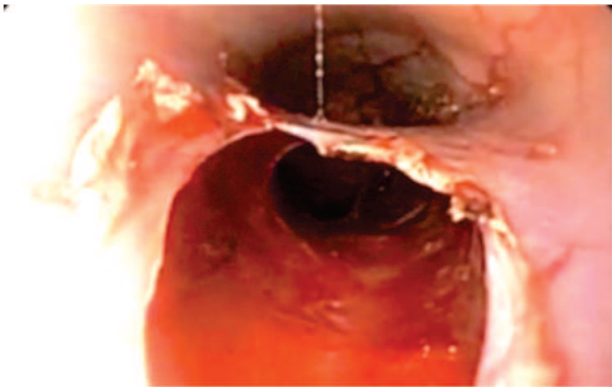

Figure 5 – *Above, one observes the lumen of the esophagus. Below, one observes the proximal entrance of the space (tunnel) between the circular muscle and submucosal layers in the middle third of the esophagus.*

11. The insertion tube of the gastroscope is introducted into the space through the orifice in the wall of the blister. This orifice is intentionally widened by the withdrawal of the inflated balloon-catheter. From this point the dissection proceeds with delicate back and forth and left-right movements, interspersed with 5 ml injections of saline solution through the working channel. This hydro-dissection facilitates the progression of the tip of the gastroscope to the region of the cardia, and permits the identification of the circular esophageal musculature and oblique musculature of the cardia corresponding to the lower esophageal sphincter. The process creates a tunnel extending longitunally for 12 cm in the esophagus and 3 cm in the region of the cardia (Figure 6A and B).

12. Once the tunnel is dissected in the submucosa of the final 12 cm of the esophagus and the first 3 cm of the stomach, a needle knife is introduced – as was done with the eight animals in the ELECTRIC GROUP – through the working channel of gastroscope, to carry out the selective sectioning of the oblique layer of the cardia and circular layer of the esophagus that constitute the lower esophageal sphincter. For the two animals of the ARGON GROUP, an argon gas and electric current transmitting catheter were introduced through the working channel of the gastroscope to perform the sectioning of the same layers.

13. The eight animals of the ELECTRIC GROUP underwent sectioning with a needle knife of the musculature corresponding to the lower esophageal sphincter, extending 3 cm in the cardia and 5 cm in the esophagus, using eletrocautery at a power setting of 10 watts, in a distal to proximal direction, with slow and gradual traction, from the set formed by the insertion tube and the needle knife. The two animals in the ARGON GROUP underwent sectioning of the fibers of the lower esophageal sphincter, also extending 3 cm in the cardia and 5 cm in the esophagus, with a gas and current transmitting catheter, in the same direction, and also with traction from the complexformed by the insertion tube and argon transmitting catheter with power setting of 8 watts (Figure 7A and B).

15. The euthanasia of the animal after the procedure is carried out by veterinarians by intravenous injection of 20 ml of 15% KCl.

RESULTS

The following items were analyzed: the technical feasibility of submucosal dissection of the entire length of the lower third of the esophagus and of the cardia, visual identification of these muscle

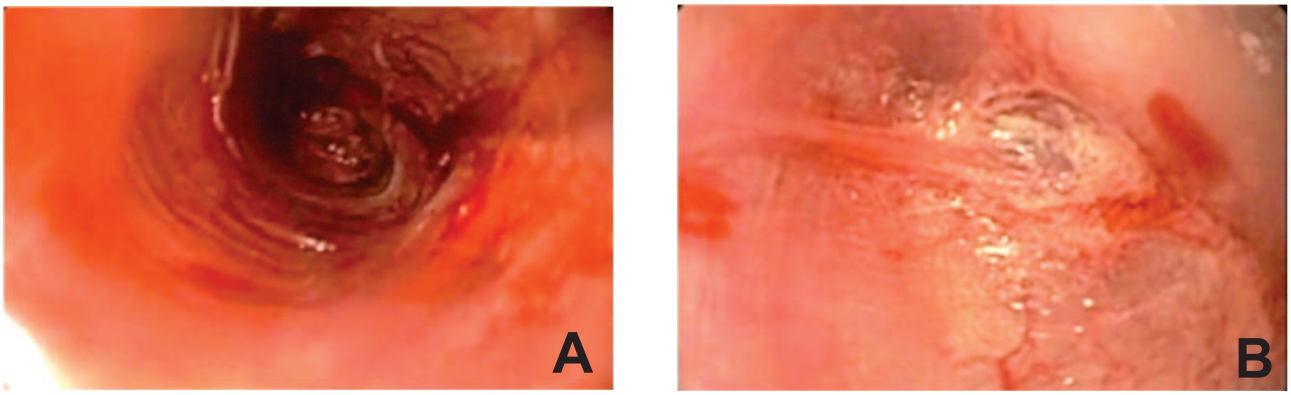

Figure 6 - A) *circular musculature of the esophagus.* ***B)*** *oblique musculature of the cardia.*

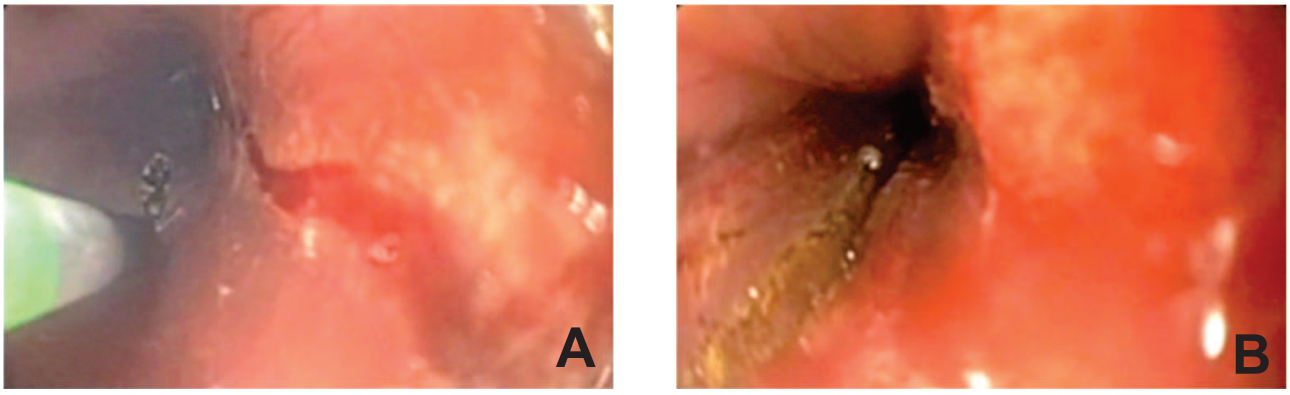

Figure 7 – A) *Beginning of the myotomy at the distal end of the lower esophageal sphincter (cardia).* ***B)*** *Myotomy completed: viewed from the proximal end (esophagus).*

fibers, feasibility of selectively sectioning only these fibers, operative time, and complications such as bleeding and perforation. The findings of this research for the two groups are presented in table 1. Results for each criterion follow:

TECHNICAL FEASIBILITY OF SUBMUCOSAL DISSECTION: the eight animals of the ELECTRIC GROUP underwent dissection between the submucosa and circular muscle layers of the esophagus, step by step as described above, in a span extending 12 cm in the esophagus and continuing 3 cm between the layers of the oblique muscle and submucosa of the stomach, without an occurrence of perforation and with negligible bleeding. The two animals in the ARGON GROUP also underwent dissection step-by-step in the same plane between the layers, as described, without complications.

VISUAL IDENTIFICATION OF THE CIRCULAR MUSCULATURE OF THE ESOPHAGUS AND THE OBLIQUE FIBERS OF THE CARDIA: in the eight animals in the ELECTRIC GROUP and

Table 1 – *Results of the evaluated items.*

Itens Evaluated	Electric Group	Argon Group
Submucosal Dissection	Feasible	Feasible
Visualization of the Musculature	Circular and Oblique	Circular and Oblique
Sectioning of Muscular Fibers	Feasible	Feasible
Operative time	8 - 12 minutes	12 - 14 minutes
Complications	2 Perfurations	None Occurred

in the two animals in the ARGON GROUP, the fibers that comprise the lower esophageal sphincter (LES) were perfectly and clearly identified visually on the monitor, through the lens of the Fujinon videoendoscope.

TECHNICAL FEASIBILITY OF SECTIONING THE FIBERS OF THE LOWER ESOPHAGEAL SPHINCTER: both in the eight animals of the ELECTRIC GROUP, and the two of the ARGON GROUP, fibers of the lower esophageal sphincter were sectioned, approximately 5 cm in the esophagus and 3 cm in the stomach.

OPERATIVE TIME: the time measured from the moment of introduction of the endoscope insertion tube to its withdrawal from the mouth of the animals ranged in eight pigs of the ELECTRIC GROUP from 8 to 12 minutes, with an average pf 10 minutes. In the ARGON GROUP, the operative time of the two animals was 14 and 12 minutes.

COMPLICATIONS: In 25% of the ELECTRIC GROUP animals perforation occurred at the time of myotomy, using electrocautery of the fibers at a power of 10 watts. There were no perforations in the ARGON GROUP.

DISCUSSION

The idiopathic achalasia of unknown etiology and the achalasia caused by Chagas disease, have no curative treatment for the underlying diseases. Patients begin to experience motility abnormalities of both the body of the esophagus and the lower esophageal sphincter caused by injury or degeneration of Meissner's submucosal plexus and of Auerbach's myenteric plexus. Diminuition of esophageal peristalsis and of LES relaxation lead to the symptoms of achalasia.[1,2]

The main symptom is dysphagia, which ultimately leads to malnutrition due to increased tone of the lower esophageal sphincter with consequent installation and worsening of the dilatation and elongation of the esophagus, features called megaesophagus. (Figure 8 [26,27])

Treatment seeks to eliminate the dysphagia, allowing the patient to eat comfortably and have intake commensurate with adequate nutrition.

Cardiomyotomy is the treatment of choice for correction of achalasia of the lower esophageal sphincter in patients belonging to Groups II and III of the Rezende classification.[3, 8,9,10,11,12]

LEHMAN et al[32] (2001), proved that the squamous mucosa of tissue removed by esophagectomy in patients with end-stage achalasia shows significant changes, which are responsible for the increased risk of cancer in patients with this disease.

In patients with Group IV megaesophagus, many authors recommend the removal of the esophagus and its replacement with another organ, usually the stomach, because of the atony and aperistalsis of the esophagus, the near total loss of LES relaxation, and the risk of malignant degeneration.[28,29,32]

Patients that undergo cardiomyotomy usually experience a significant decrease in sphincter pressure, improvement in the dysphagia, and are able to improve their food intake; many recover weight.[8,9,10,11,12]

Open surgery with the attendant complications of laparotomies, such as dehiscence,

infections, and incisional hernias, has been replaced over the last twenty years, by the videolaparoscopic approach with good results in terms of safety, comprable operative time, shorter hospital stays, rapid recuperation, more satisfying visualization of the lower esophagus a lower incidence of incisional hernias, and excellent cosmetic results.[8,9,10,11,12,13,14,28,29,30,31]

Despite the current indisputable advantages of laparoscopic over open cardiomyotomy, laparoscopy is not without risks and complications.[15,16,33]

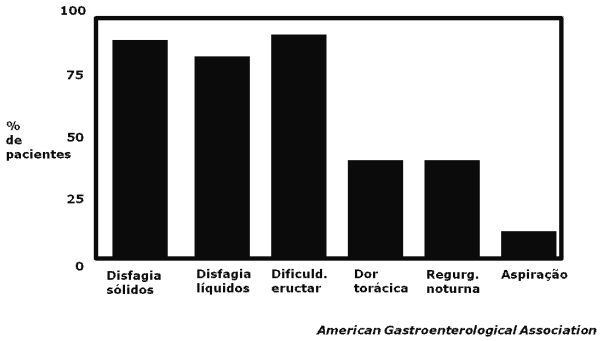

Figure 8 – *Achalasia symptoms*

Spechler SJ. Gastroenterology. 1999 Jul;117(1):229-33. [26,27]

Translation of chart axes:

Y-axis: % of patient
X-axis: Dysphagia with solids, Dysphagia with liquids, Difficulty Belching, Thoracic Pain, Noctural regurgitation, Aspiration

SOUSA et al[16, 33,34] (1993-2011), report puncture and perioperative complications such as as injury to the spleen, stomach, pneumothorax, and other organs.

In light of these risks and complications that can occur with laparoscopic surgery, several minimally invasive methods have been developed in experiments with animals and humans.[16,33,34]

Over the past seven years the idea of using natural orifices to gain access into thoracic and abdominal cavities stimulated various research initiatives around the world, all with the goal of permitting surgical procedures on thoracic and abdominal organs while minimizing the trauma to the chest or abdominal wall.

- In 2005, SWANSTRON et al[35] report the development of a new instrument for transgastric access to the abdominal cavity.
- In 2007, ZORRÓN et al[36] perform the first hybrid transvaginal cholecystectomy in the world, without complications.
- In 2009 SOUSA et al,[37,38] published a report announcing that in June 2007 they had, after training with eight pigs, performed, in four women, the first surgeries anywhere in the world carried entirely through natural orifices – in these cases through the vagina – without abdominal wall puncture, using two flexible endoscopes.
- In 2008, SUMIYAMA et al[39] publish a pilot study of access to the mediastinum and coagulation of the epicardium through endoscopic submucosal dissection of the esophagus, and creation of a mucosal flap functioning as a safety valve.
- In 2008, GEE et al[40] access the pig mediastinum through submucosal dissection of the esophagus with flexible endoscopy.

Natural orifice surgeries continue to be performed and studied, but new means of sterilization, new platforms, and new accessories need to be developed to consolidate the benefits this type of access can offer.

The peroral endoscopic approach to reach the LES is a mode of access by natural orifices, although it does not penetrate the thoracic or abdominal cavity.

This route was used by Pasricha et al (2007) to perform myotomy in four pigs. The authors conclude that peroral endoscopic myotomy (POEM) is feasible and effective, and they are already suggesting it as a new treatment for achalasia. 17

These results were corroborated by Perretta et al (2010, 2011), who after studies in animais also suggested this approach as a novel treatment for achalasia.[18, 19]

It has been shown both in animals by Pasricha et al (2007) and Perretta et al (2010, 2011), and in humans by INOUE et al (2010) and VON RENTEIN et al (2011), that sphincter pressure decreases by 65% after (POEM) endoscopic myotomy, without significantly increasing the postoperative incidence of gastroesophageal reflux disease (GERD).[17.18,19,20,22]

Although Pasricha et al (2007), INOUE et al (2010), ZHOU et al (2011) and SWANSTRON et al (2011) conclude that the procedure is feasible, safe, and effective in humans – and even suggest that it is a promising method to replace the prevailing laparoscopic treatment – the authors call for longer follow-up to establish the clinical applicability of their experiments.[17,20,23,24]

Although these preliminary results are satisfactory in terms of technical feasibility, safety, effectiveness, the decrease in sphincter pressure, and the low incidence of post-operative GERD, there is no unanimity in advocating the implementation of the technique in humans.[25]

ABU et al[25] (2011), performing POEM in humans, had a 25% death rate due to pneumothorax and mediastinal sepsis. In addition, two patients developed ischemic ulcers. The authors conclude their work stating the procedure should not be performed in humans.

The current trials of POEM have shown the procedure to be technically difficult and time consuming. In humans ZHOU et al (2011) reported operative times ranging from 23 to 180 minutes, while SWANSTRON et al (2011) reported operative times ranging from 120 to 240 minutes.[23,24]

Further research in peroral endoscopic myotomy (POEM) is therefore justified, to improve submucosal dissection – which is considered technically difficult – and in this way avoid perioperative complications such as perforation, reduce the well-documented long operative time, and establish the effectiveness of the procedure as regards sphincter pressure reduction, and the absence or low incidence of post-operative GERD.

These results, if confirmed, should be compared with the results already known about laparoscopic myotomy. If advantages over the laparoscopic approach were demonstrated, then peroral endoscopic myotomy (POEM) could be recommended as an alternative treatment for achalasia in humans.

In this research in animals, carried out by the SOUSA GROUP, the authors report excellent results, particularly in relation to the items that most often limit the development and subsequent implementation of peroral endoscopic myotomy so it can be systematic in humans: technical ability and the operative time.

The surgical technique was performed in ten animals by a videolaparoscopic surgeon and an endoscopist accustomed to laparoscopic surgery and therapeutic endoscopy, including NOTES & TNOTES (TOTALLY NOTES). This experience demonstrates the feasibility of the submucosal approach with full visualization of the fibers of the lower esophageal sphincter, the adequacy of tools common to the day-to-day work of endoscopists, but with a perforation rate (25% in the ELECTRIC GROUP) that is still high for the small number of animals used in this study.

Bleeding was negligible and establishing the 15 cm tunnel was safe, fast, and easy, allowing access between the circular muscle and submucosal layers of the esophagus and between the oblique muscle layers and submucosa in the stomach, in the cardia region.

It seems likely that lower rates of perforation will accompany more training and the use of a greater number of animals in future research, using instruments with types of energies that penetrate the muscular layer less.

CONCLUSION

Considering the variables that we propose to evaluate, in the case of experimental research for technical, surgical, and endoscopic development in animals that were not suject to the study of survival, the results of this study permits us to conclude that:

Peroral endoscopic myotomy (POEM) using the dissection technique between the internal muscle layer and the submucosa developed and proposed in this research is technically feasible, allowing clear visualization of the circular musculature of the lower third of the esophagus and the oblique muscle fibers of the cardia, making it possible to perform a cardiomyotomy with instruments routinely used by endoscopists, in much shorter time than that described for other techniques of peroral endoscopic myotomy, with negligible bleeding.

These results allow us to propose a novel technique for peroral endoscopic myotomy and stimulates us to perform the technique in a greater number of animals, in order to truly evaluate safety in relation to the true rate of esophageal perforation. Studies of survival in animals should be performed to evaluate pre- and post-operative sphincter pressures, and thus the effectiveness of myotomy in the correction of dysphagia.

RESUMO

OBJETIVOS: Propor nova técnica de dissecção endoscópica entre a submucosa e o esfíncter inferior do esôfago com realização de miotomia. **MATERIAL E MÉTODOS:** Dez suínos foram submetidos à dissecção entre as camadas muscular interna e a submucosa do esôfago e de cárdia, por um túnel de 15 cm iniciado em espaço criado endoscopicamente por injeção salina com agulha e insuflação de balão. Após penetração do endoscópio, procedeu-se movimentos de dissecção e miotomia de 3 cm em cárdia e 5 cm no esôfago. Oito animais do GRUPO ELÉTRICO submeteram à miotomia com bisturi elétrico a 10 watts. Dois do GRUPO ARGÔNIO, com bisturi argônio a 8 watts. Analisou-se: factibilidade da dissecção e miotomia, visibilidade do esfíncter, tempo cirúrgico e complicações. **RESULTADOS:** Em todos animais foram factíveis: dissecção, visão do esfíncter e miotomia. Sangramento desprezível. Tempo Cirúrgico: GRUPO ELÉTRICO, 8 a 12 minutos com duas perfurações e GRUPO ARGÔNIO, 12 a 14 minutos sem perfuração. **DISCUSSÃO:** Acesso endoscópico peroral objetiva vantagens sobre a videocirurgia da acalásia. Estudos têm demonstrado bons resultados e efetividade em animais e humanos, entretanto o procedimento é considerado difícil e demorado, não havendo unanimidade na indicação da aplicabilidade clínica. Nessa técnica foram factíveis dissecção rápida, segura, visão e miotomia do esfíncter, porém, ocorreram complicações em 25% do GRUPO ELÉTRICO. **CONCLUSÃO:** Apesar dos bons resultados quanto ao acesso, visão do esfíncter e curto tempo, sugere-se maior número de experimentos incluindo sobrevivência para conhecer a real taxa de complicações e estudar efetividade da miotomia com manometria pré e pós-operatórias.

Palavras chave: Acalásia, Megaesôfago, Cardiomiotomia, Miotomia, Miotomia Endoscópica Per oral, Endoscopia Terapêutica, Tratamento Endoscópico.

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Original Article

How Do I Treat the Ureter in Deep Infiltrating Endometriosis by Laparoscopy?

Como Eu Trato o Ureter na Endometriose Infiltrativa Profunda por Laparoscopia?

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ABSTRACT

Surgery remains the best treatment for deep infiltrating endometriosis affecting the ureter. Different surgical procedures (ureterolysis, segmental ureteral resection with end-to-end anastomosis, ureteral reimplantation, and nephrectomy) have been performed with heterogeneous outcomes. In this article we discussed the indications and the technical details of each procedure.

Key words: Endometriosis. Laparoscopy. Ureter.

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INTRODUCTION

The prevalence of pelvic endometriosis, superficial or deep, in women of reproductive age is estimated at 10%.[1,2] In women with chronic pelvic pain the prevalence can reach 82%.[3,4] In those under investigation for infertility the prevalence is 20% to 50%.[1,5,6]

Deep infiltrating endometriosis may involve the urinary tract.[7] Such envolvement is uncommon, observed in 0.03% to 5% of cases;[8-12] more specifically, ureteral endometriosis is estimated at 0.08% to 1% of patients.[12,13] Among the endometriotic lesions of the urinary system, the bladder is the organ most affected (80%-84%), followed by the ureter (15%), kidney (4%) and urethra (2%).[14] Two types of ureteral injury should be considered: intrinsic and extrinsic.

The extrinsic form is the most common and is characterized by continguous envelopment of the ureter, compressing and causing periureteral fibrosis, with impaired renal function in 30% of cases.[15] The intrinsic form arises from lymphatic or venous metastasis[16] and can present as an obstructive condition or cause cyclical hematuria when the ureteral mucosa is involved.[17]

The diagnosis of ureteral endometriosis can be difficult when specific symptoms are not present.[18] The diagnosis may be missed during the physical examination as well as during the pre-operative work-up, and may even go unnoticed during surgical inspection.[19]

Limited series of cases of ureteral endometriosis are described in the literature, making it difficult to assess the efficacy of different treatments. Medical therapy is of limited benefit in patients with endometriosis, leading to temporary regression rather than eliminating the disease. Fibrosis, found in virtually all cases of ureteral endometriosis, responds poorly to hormonal treatment and recurrence

Institutions: Sugisawa Hospital and Medical Center. Vita Batel Hospital. Red Cross Hospital.

rates are substantial. The management of the obstructive uropathy caused by endometriosis is primarily surgical, including ureterolysis, ureteral reimplantation, ureterectomy with termino-terminal anastomosis and, in extreme cases, nephrectomy.[19]

In this article we detail the techniques of the various forms of laparoscopic surgery for ureteral endometriosis.

SURGICAL TECHNIQUE

Under general anesthesia, the patient is placed in a supine position with the legs abducted so that the thighs are flexed 20º relative to the pelvis. To avoid injuries of the brachial plexus, both arms are positioned alongside the body. Positioning of the lower extremities should avoid compression of the sciatic, external popliteal, and calf nerves. The buttocks of the patient should extend slightly beyond the edge of the operating table.

The set-up for laparoscopy is traditional, with a 10 mm umbilical trocar for the 0º optic and three 5mm trocars in the suprapubic region. One trocar is positioned in the midline, 8 to 10 cm below the umbilical port and two trocars are placed in the iliac fossas, about 2 cm medial to the anterior-superior iliac spine, always lateral to the inferior epigastric vessels.

Uterine cannulation needs to be done with care. We position a large caliber curette through the cervix, anchored with a Pozzi clamp; this permits anterior flexion of the uterus, while reducing the risk of perforation of the uterine fundus.

If the ureter is dilated or if the lateral extension of the lesion is considerable, one can place a double-J catheter before beginning the dissection of the ureters. Placement of the cateter before beginning the laparoscopy facilitates the ureteral dissection, but is not mandatory. The laparoscopic placement of the double-J catheter during surgery is optional and is performed using a retrograde technique.

TREATMENT OF ENDOMETRIOSIS

The principles of surgery for deep endometriosis are simple:

- Start the dissection in healthy tissue to identify vulnerable structures (ureters, gastrointestinal tract, and branches of the nerve plexus) at a distance from the pathological tissue;
- Complete excision of the lesion;
- Avoid unnecessary movement of adjacent organs.

The surgical steps for treatment of deep endometriosis include:

- Release of pelvic adhesions;
- Treatment of any endometriomas – release of adhesions of the endometrioma and ovarian cystectomy;
- Mobilization of the sigmoid colon;
- Identification of the ureters and treatment of ureteral endometriosis (ureterolysis, segmental resection of the ureter, ureteral reimplantation or nephrectomy);
- Resection of anterior deep endometriosis lesions, with or without resection of bladder, as needed;
- Transection of the uterosacral ligament and identification of the pararectal space, identification of the posterior fornix of the vagina, dissection of endometrial nodule, separation of the nodule from the retrocervical region, resection of the posterior vaginal fornix (if there is infiltration of the vagina) and treatment of lesions of the rectal wall (shaving, disk resection, or segmental resection of the rectum).

These manuvers are individualized for each patient.

The final three surgical steps described above do not occur necessarily in that order. Typically we first address the anterior deep lesions, followed by the ureteral dissection and resection of the posterior deep lesions. When segmental resection or reimplantation of the ureters is necessary, it should be performed before the treatment of deep rectal lesions to avoid contamination of the urinary tract with fecal content.

The checklist at the end of surgery includes:

- Test of tubal patency;
- Verification of hemostasis with and without anteversion of the uterus;
- In cases with bladder resection verification of the integrity of the bladder: injection of

200 ml of normal saline with methylene blue to identify possible areas of leakage;

- In cases of colorectal resection for endometriosis verification of the integrity of the rectum: injection of 100ml air transanally after filling the pelvis with Ringer's lactate solution.

TREATMENT OF THE URETER

The diagnosis of ureteral involvement should ideally be done preoperatively, whenever possible.

The mobilization of the sigmoid colon along the upper narrowing of the pelvis allows the identification of the ureter medial to the lumbo-ovarian vessels (Figure 1). If the ureter is not identified during the mobilization of the sigmoid, or if the lesion is located on the right side, an incision is made in a healthy part of the peritoneum, and then the ureter is sought in contact with the peritoneum, knowing that if the dissection of the peritoneum is complete, a bluish hue of the peritoneum will be observed, explained by the fact that the pneumo-peritoneum is seen because of the transparency of the serosa. This bluish hue merely permits one to affirm that only the serosa remains and that the ureter is no longer adhering to the peritoneum. The ureteral repair guides the resection of the lesion.

During this phase of the ureteral dissection, the ovarian pexia is very useful because it frees up a surgical instrument. After freeing the ovaries from the broad ligament, the pexia can be performed via a transparietal route uni- or bilaterally with a straight needle (Figures 2 and 3).

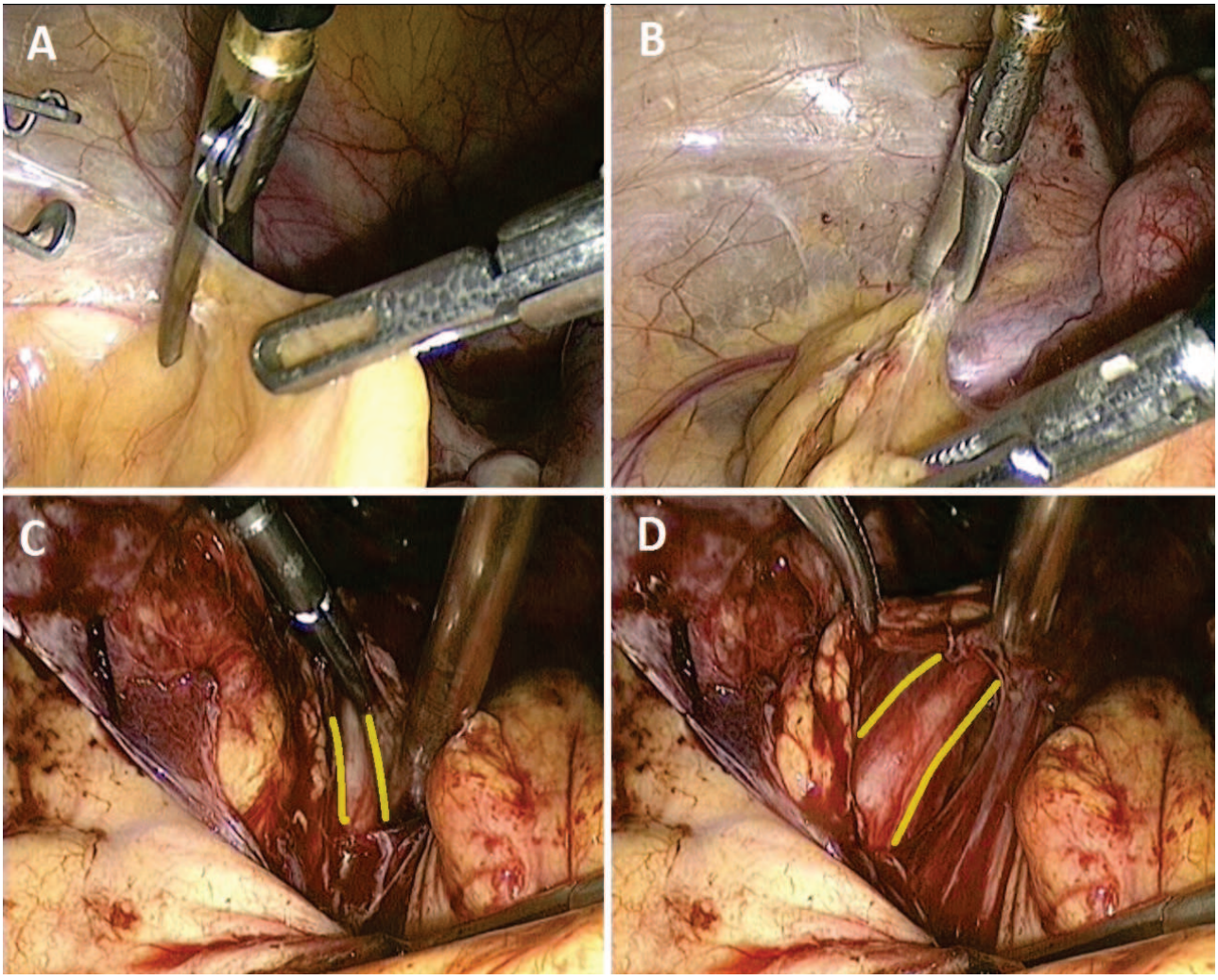

Figure 1 *- (A and B) Mobilization of the sigmoid colon. (C and D) Identification of the ureter medial to the vessels of the pelvic infundibulum.*

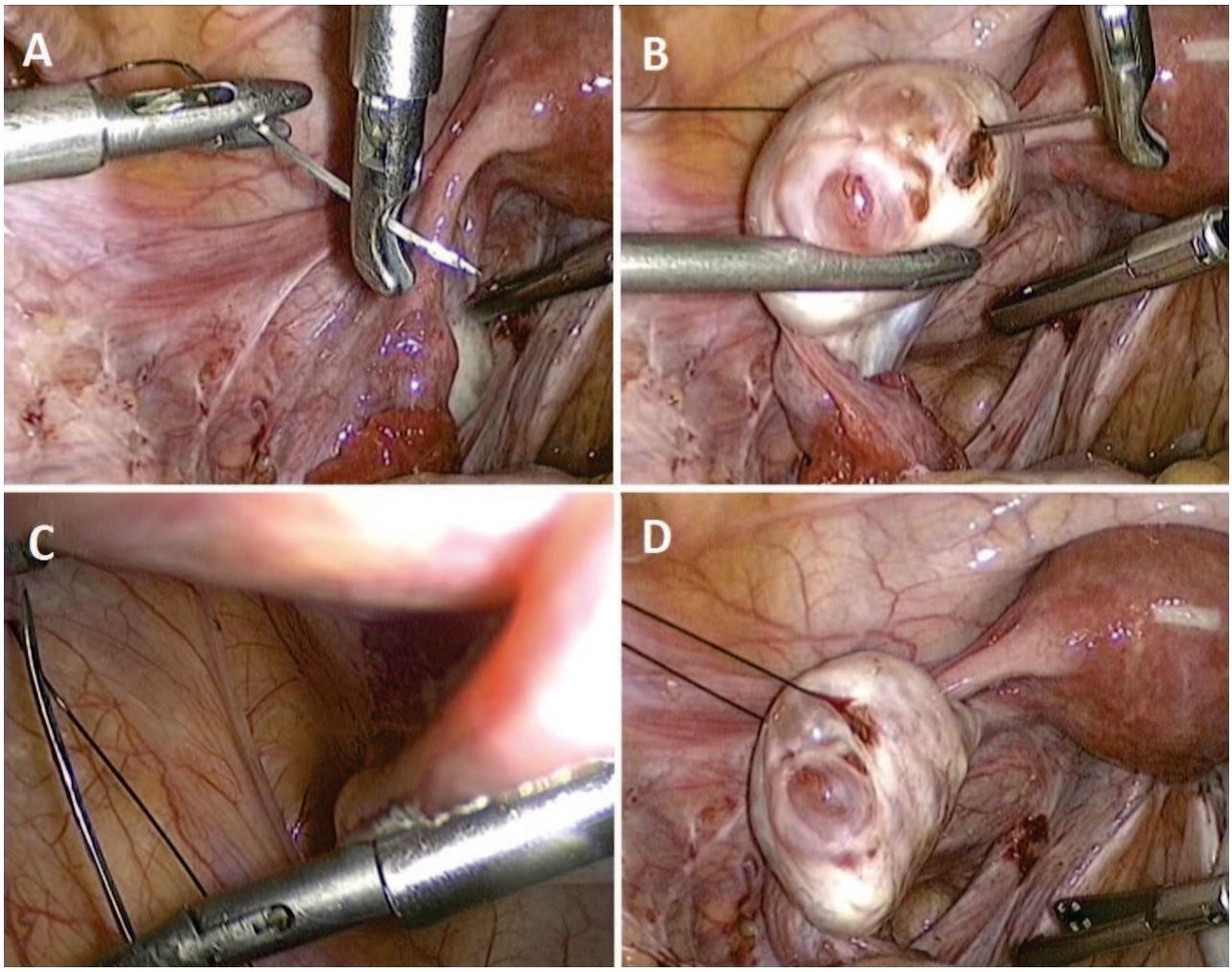

Figure 2 - *(A) Transparietal passing of the suture needle. (B) Pulling the needle through the left ovary. (C) Transparietal removal of the needle from inside the abdominal cavity. (D) Appearance of the suspended left ovary.*

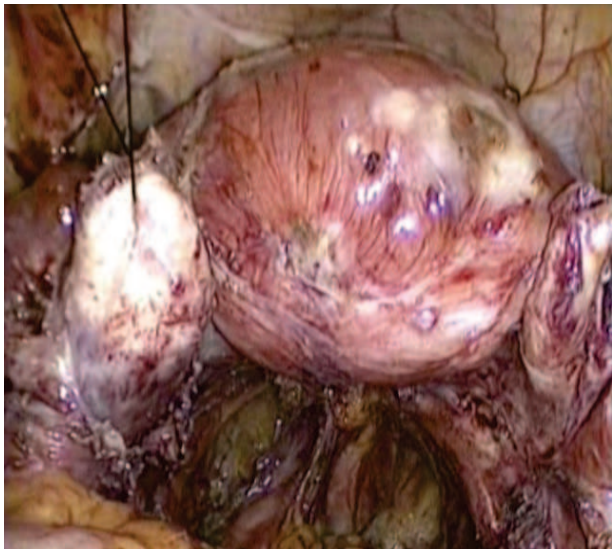

Figure 3 - *Bilateral ovarian suspension in a resection of deep endometriosis.*

The ureter should be excluded from the dissection in cases where the area to be resected does not involve the broad ligament. This is the case of lesions which only involve the uterosacral ligament or retrocervical region, in which only the dissection medial to the ureter is able to ensure a safe distance from the area of the ureter to be coagulated (Figure 4). When the lesion penetrates only the portion of broad ligament medial to the ureter, dissection of the lateral ureteral face is not required (Figure 5). When there is need for resection of the entire broad ligament because of involvement of endometriosis, the lateral, anterior and medial aspect of the ureter should be dissected (Figures 6 and 7).

In bulky posterior lesions (more than 2 cm in diameter) located in the midline, encompassing the uterosacral ligaments and retrocervical region, in order to ensure that there is no risk of injuring the ureter at

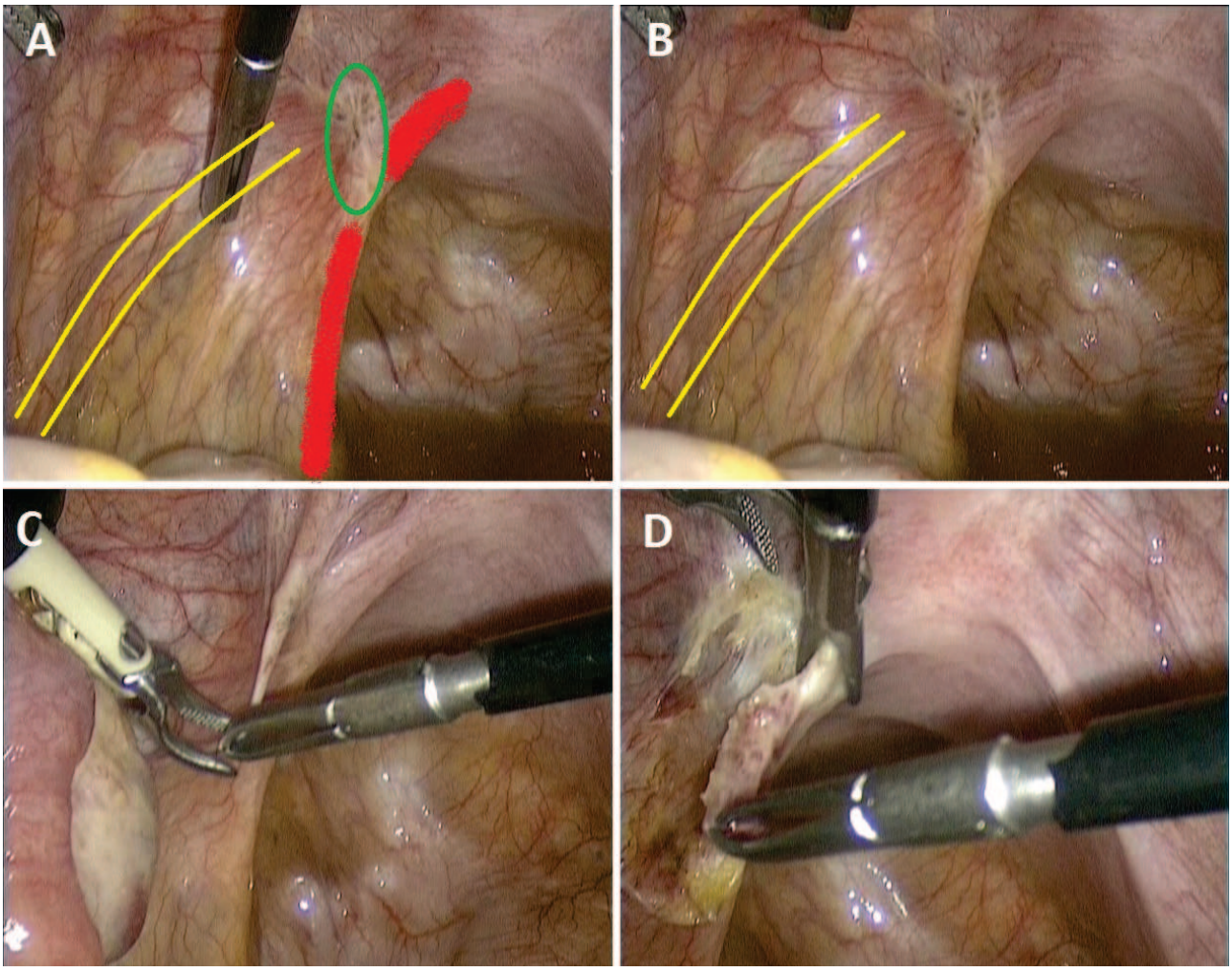

Figure 4 - *Endometriosis lesion (green circle) in the left uterosacral ligament (in red), distant from the ureteral course (in yellow). The lesion is resected without having to dissect the medial aspect of the ureter.*

the end of resection, it is important to completely release the ureter to where it crosses the uterine artery (Figure 8).

Depending on the degree of ureteral involvement of the endometriosis, it may be necessary to perform ureterolysis, segmental resection of ureter, ureteral reimplantation, or, in extreme cases, nephrectomy. When the procedure performed is limited to ureterolysis, without altering the caliber of the ureter and in the absence of upstream dilatation of the urinary tract, no further intervention is required. If, however, after ureterolysis there is a persistent ureteral stenosis, if the ureterolysis involved the resection of a portion of ureteral musculature, or led to the discovery of a cystic lesion in the ureteral wall, a part of the ureteral course should be resected.

The question of whether to conduct reimplantation systematically, or if a termino-terminal anastomosis is possible after ureteral resection, depends primarily on technical considerations, especially the length of the resected segment. If there is a dilation of the urinary tract, the indications for ureteral resection should be broadened, even when the ureterolysis seemed to have been carried out under ideal conditions.

Ureterolysis

Ureterolysis consists of the surgical excision of fibrotic endometriotic tissue enveloping the ureter to relieve an ureteral obstruction.[18] In these cases, ureteral dissection is initiated close to the bifurcation of iliac vessels in healthy tissue. The ureter should be freed from the peritoneum of the broad ligament, which is often retracted by an inflammatory reaction association of the endometriosis. The dissection proceeds toward the uterosacral ligament, freeing the

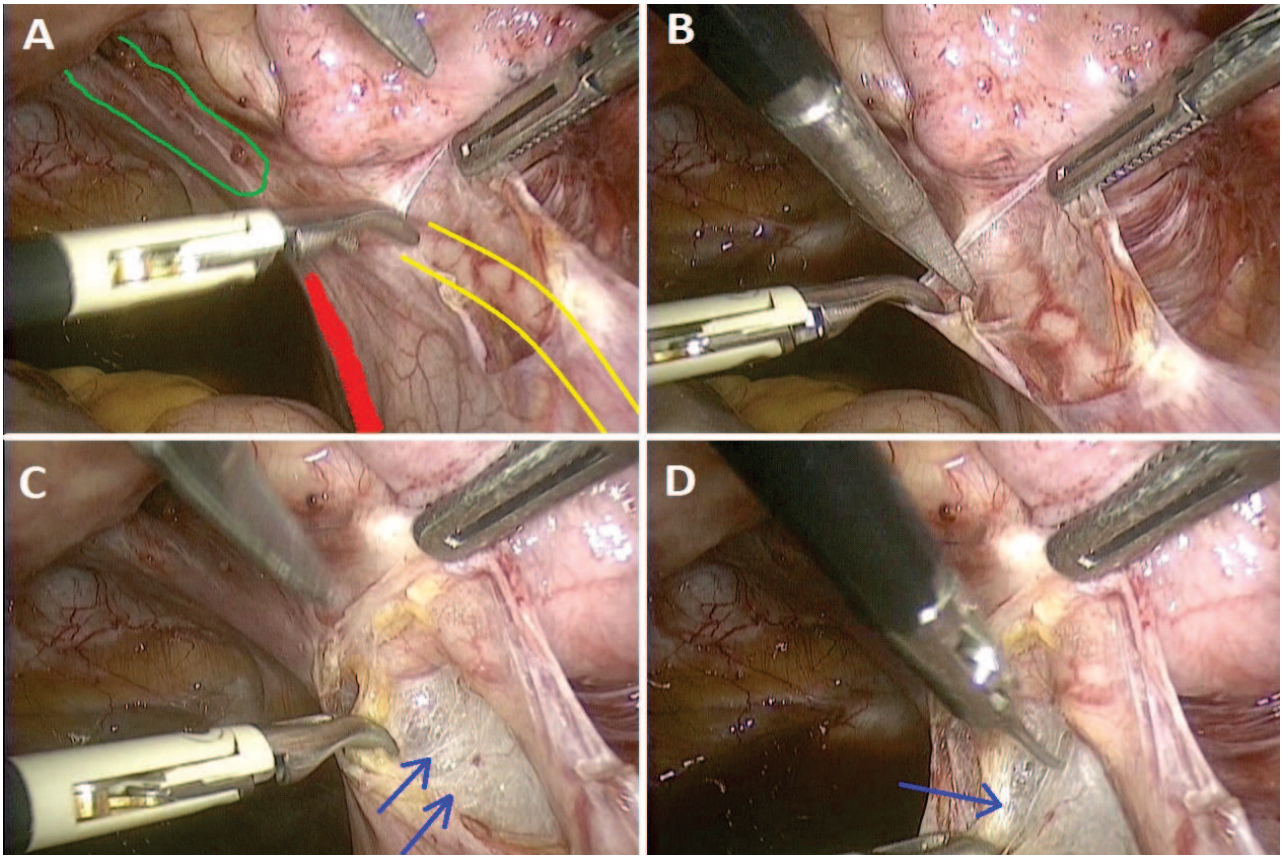

Figure 5 - *(A) The endometriotic lesion (in green) involves the broad ligament medial to the ureter (in yellow). The area in red corresponds to the right uterosacral ligament. (B) The dissection of the ureter begins in a region of healthy tissue, medial to the ureter. (C and D) The dissection proceeds toward the right uterosacral ligament. The blue arrows point to "bubbles" of CO2 gas penetrating into healthy tissue.*

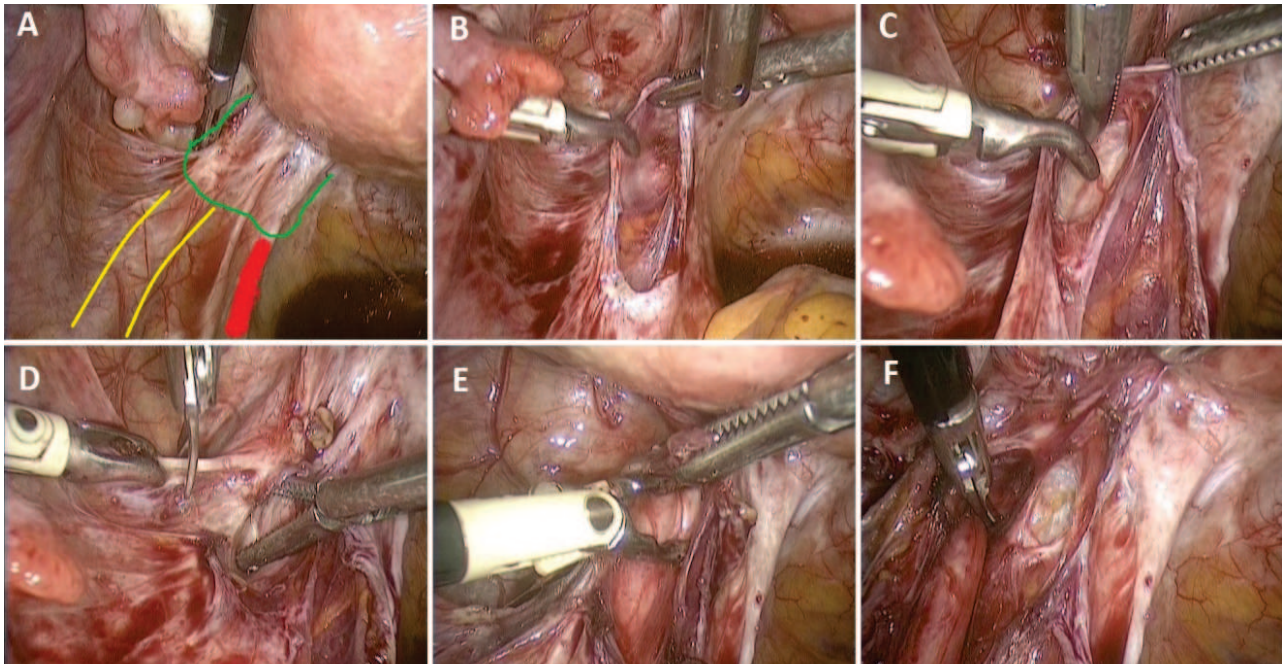

Figure 6 - *(A) Endometriosis lesions (in green) involving the uterosacral ligament (red) and the broad ligament, medial and lateral to the ureter (in yellow). (B) The dissection begins in the healthy area and proceeds toward the area of retraction. (C) Identification of the anterior wall of the ureter. (D) Ressection the broad ligament lateral to the ureter. (E) Release of the anterior wall of the ureter. (F) Dissection of the medial aspect of the ureter.*

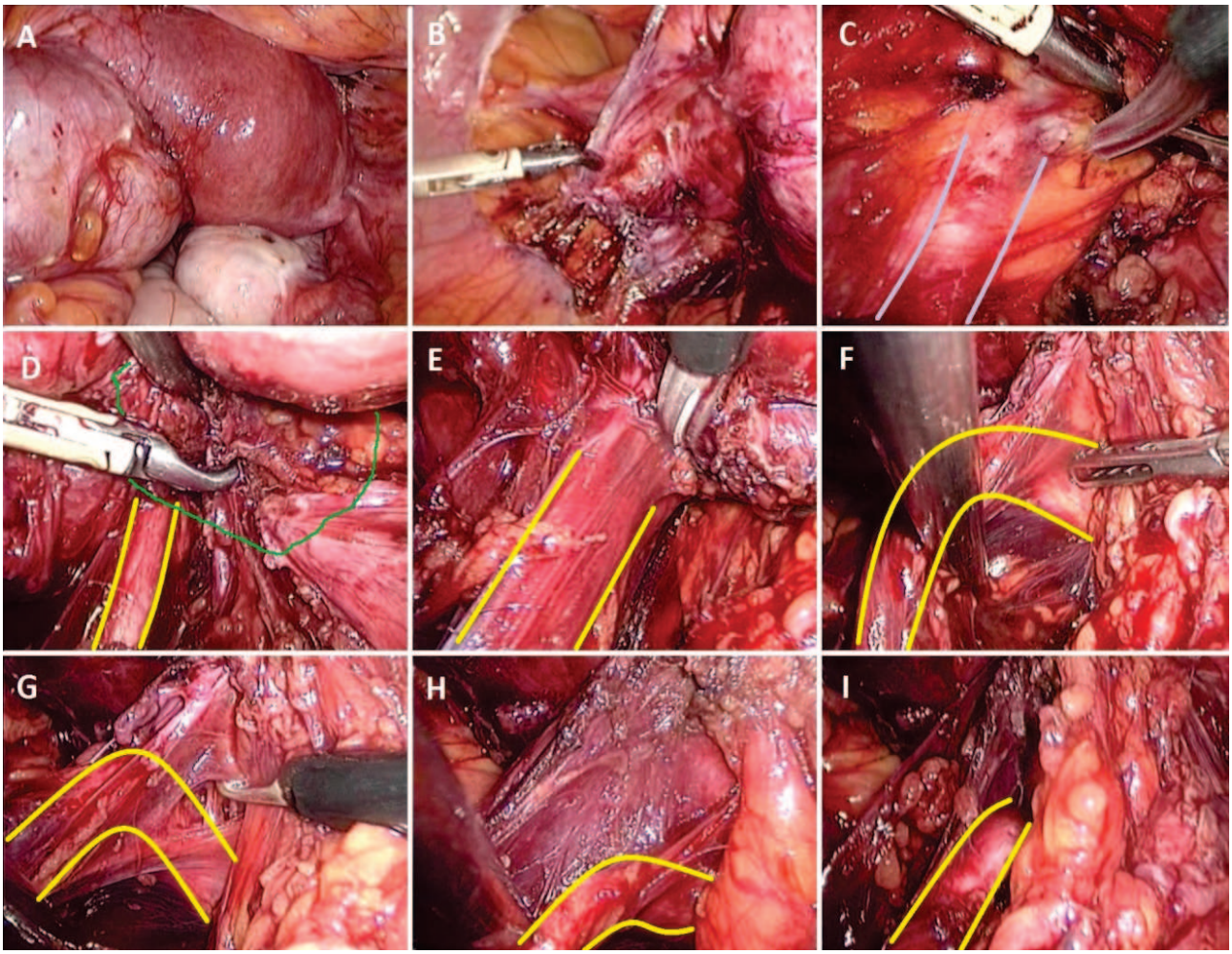

Figure 7 *- (A) Endometrioma in the left ovary adhering to the posterior wall of the uterus, left ovarian fossa, and epiploic appendages of the sigmoid colon. (B) Wide ressection of the left broad ligament. (C) Identification of the iliac vessels (the iliac artery is outlined in light blue). (D) Identification of the ureter (in yellow) adjacent to the posterior deep endometriosis to be ressected (in green). (E through I) Dissection of lateral, anterior, and medial aspects of the ureter (in yellow).*

ureter from the inflammatory reaction in this topography, and leaving it alongside the endometriotic area to be resected (Figure 9).

In those cases where it is difficult to identify the ureter or when there is concern about the integrity of the ureter after ureterolysis, a double-J catheter can inserted via cystoscopy. Placement of the double J catheter before beginning ureterolysis facilitates the identification and dissection of the ureter, but is not routinely required and should be indicated in selected cases.

Ureterectomy and termino-terminal anastomosis

In cases of stenosis of a limited segment of the ureteral course corresponding to the ovarian fossa, a ureteral resection with termino-terminal anastomosis can be performed.[18] After the resection of the endometriosis-affected ureter, the free edges of the ureter should be spatulated. The suture used for the anastomosis should be resorbable, preferably 3-0 or 4-0 polyglactin (Vicryl ®) or polydioxanone (PDS ®). The placement of a retaining suture on the free ends of the ureter before spatulation minimizes ureteral trauma from the manipulation with gripping instruments.[20]

In the past, ureteral anastomosis was performed with a continuous suture to ensure an impermeable anastomosis.[20] Currently, we prefer to perform an anastomosis with interrupted sutures. When about 50% of the circumference of the anastomosis is complete, the double-J catheter is

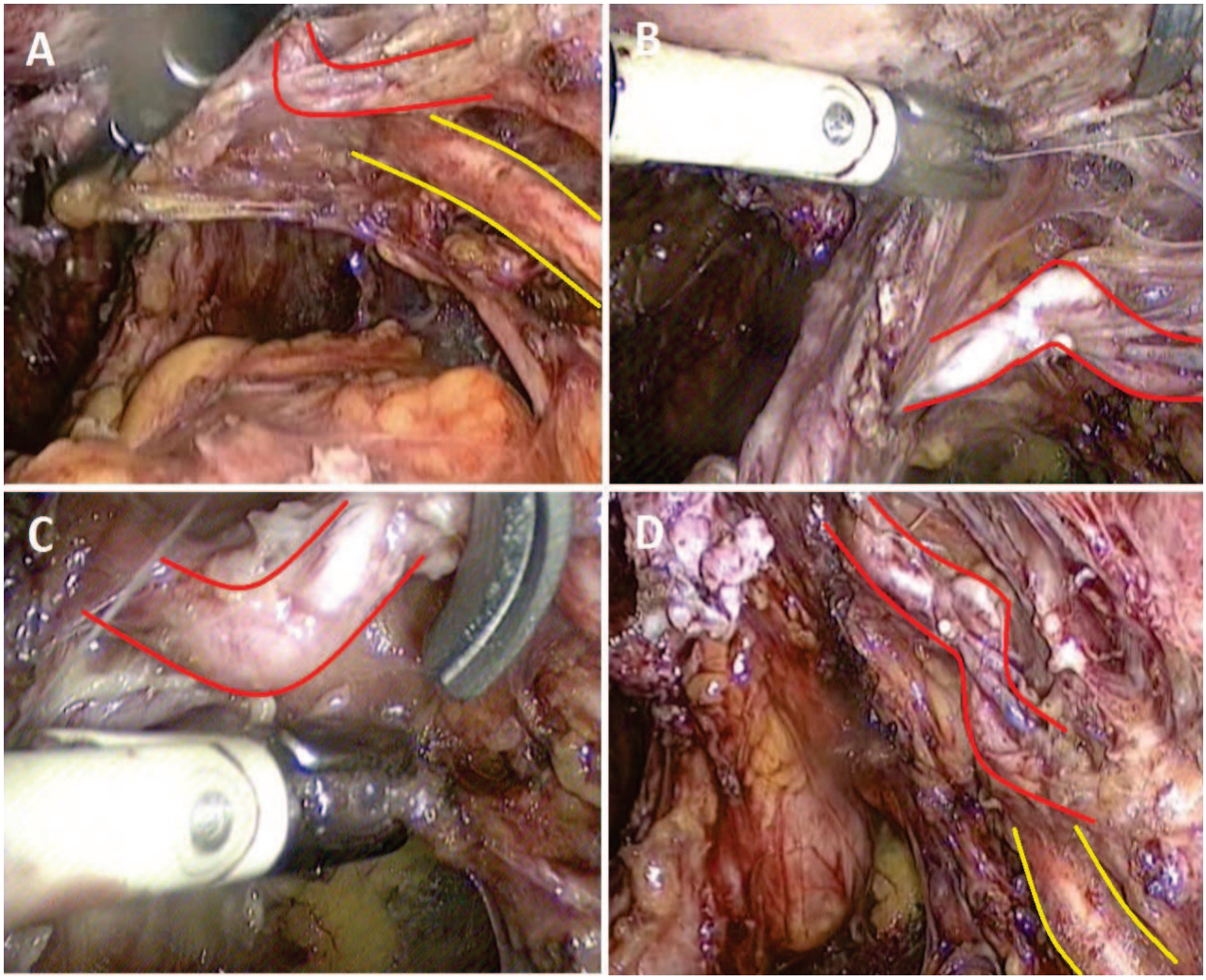

Figure 8 - *Dissection of the ureter (in yellow) up to the point where it intersects with the iliac vessels (the uterine artery is outlined in red) in the case of a large retrocervical lesion.*

passed in a retrograde manner through the 5mm trocar ipsilateral to the ureter being treated. The proximal end is positioned in the renal pelvis and distal end in the bladder. The rest of the ureteral anastomosis is completed with the double-J catheter in place.

Ureteral reimplantation

In cases of severely obstructive ureteral endometriosis in which ureterolysis is not possible, or for which a resection of a long segment of the ureter is required, ureteral reimplantation is the treatment of choice. Resection of the ureter proximal to the area of stenosis and fibrosis and its reimplantation in the bladder makes it possible for the fibrotic area that surrounds the ureter to be transposed, minimizing the risk of recurrence.[18] Short distances can be managed with ureteroneocystostomy (ureteral reimplantation) with or without a Psoas Hitch, and large defects can be corrected using a Boari flap, by ileal interposition, or autotransplant.[9]

After the ureter is dissected and isolated, it is sectioned proximal to the area of obstruction. The ureteral end that will be reimplanted is spatulated so that a uretero-vesical anastomosis of a suitable caliber can be performed. The bladder is filled with 200 to 300 ml of saline solution to facilitate its opening (Figure 10A). The peritoneum of the bladder is opened, followed by the opening of the detrusor musculature (Figures 10B and 10C). The mucosa of the bladder wall is opened with laparoscopic scissors (Figure 10E).

The double J catheter is passed into the ureter in a retrograde fashion (Figure 10D). One must be careful not to twist the ureter while inserting the

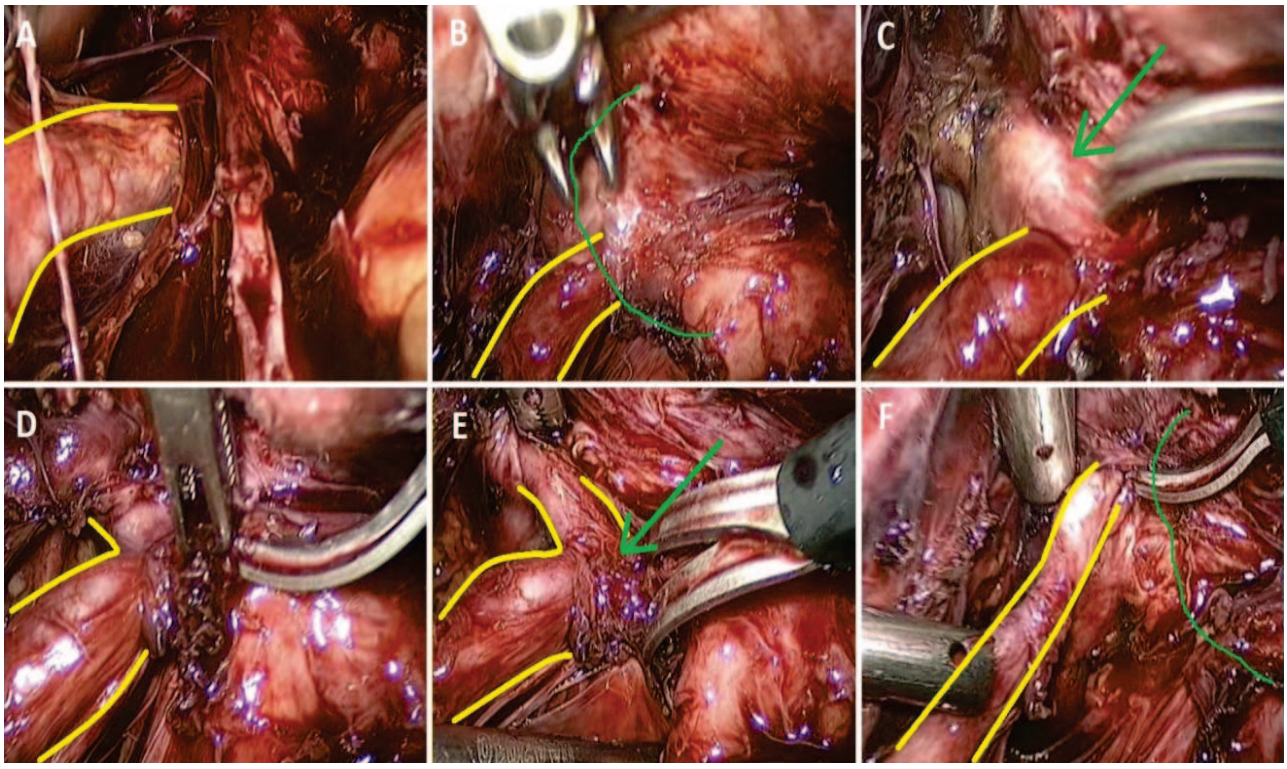

Figure 9 *- (A) Dissection of the ureter (in yellow). (B) Identification of the area of fibrosis (in green) in the course of the ureter. (C, D and E) Release of the inflammatory reaction around the ureter (in yellow), which is bent at an angle (green arrow). (F) Appearance of the ureter (in yellow) after ureterolysis, here lateral to the posterior deep endometriosis that will be resected (in green).*

catheter, as this may reduce vascularization and lead to postoperative fistulas.

The spatulated end of the ureter is anastomosed to the bladder mucosa with a continuous suture using two 3-0 or 4-0 polyglactin (Vicryl ®) or polydioxanone (PDS ®) sutures (one for the left hemi-circumference, and one for the right hemi-circumference). Start with an outside to inside suture in the ureter, and an inside to outside suture in the bladder, anchoring the posterior portion of the anastomosis (at six o'clock). This thread is then used to suture continuously in a clockwise direction until 12 o'clock. The second suture is also anchored at six o'clock. The ureter is sutured to the bladder with a continuous suture in a counterclockwise direction. Before finalizing the suture, the distal end of the double J catheter is positioned inside the bladder. The two sutures are tied together at six o'clock (Figures 10F to 10I). Then the anti-reflux mechanism is fashioned according to the Lich-Gregoir technique,[21,22] using simple sutures of 3-0 polyglactin (Vicryl ®) or polydioxanone (PDS ®) in the detrusor muscle (Figure 11A and 11B).

The bladder wall can be anchored to the ipsilateral psoas tendon to further decrease the tension of the anastomosis, using a technique called the Psoas Hitch.

In the cases of large urethral defects, the ureteral reimplantation technique with a Boari flap is used. The ureter is sectioned proximal to the area of stenosis. The bladder is filled with 200 to 300ml of normal saline. The bladder is completely mobilized from the Retzius (pre-vesical or retro-pubic) **space** with monopolar cautery. A generous flap from anterior bladder wall is created with a U-shaped incision (Figures 13A to 13D). The edges of the ureter and the bladder flap are mobilized until they abut without tension. The ureter is spatulated. Full thickness suturing with 3-0 or 4-0 polyglactin (Vicryl ®) or polydioxanone (PDS ®) is used to construct the posterior wall of the anastomosis.

Using a retrograde approach a double J catheter is inserted into the ureter (Figure 13E). The proximal end of the catheter is advanced until the renal pelvis, and the distal end into the

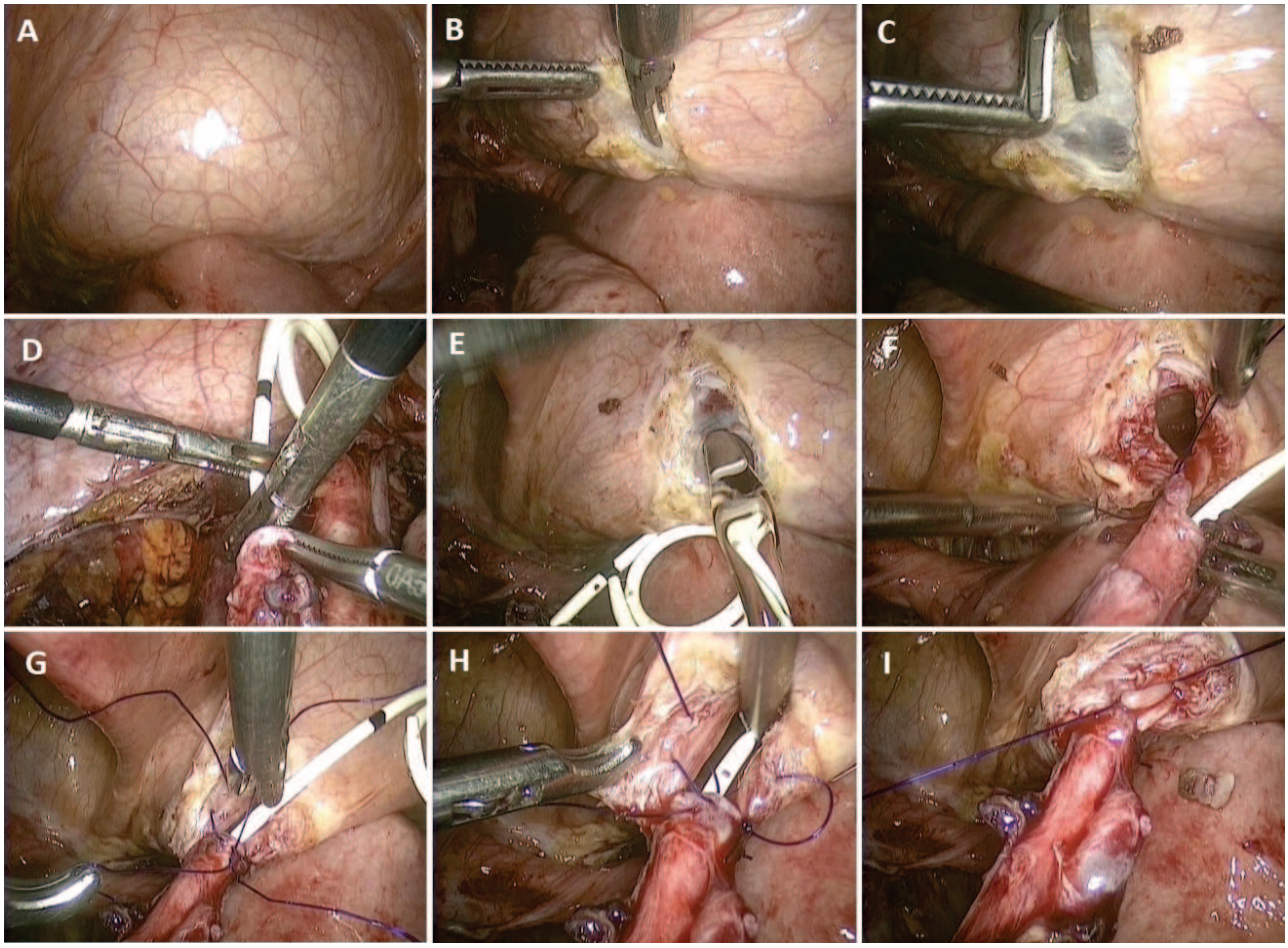

Figure 10 - *(A) The bladder filled with isotonic saline. (B and C) Opening of the bladder wall until the mucosa is identified. (D) Retrograde insertion of the double-J catheter. (E) Opening of the bladder mucosa with cold scissors. (F through I) Uretero-vesical anastomosis with two 3-0 PDS sutures.*

bladder. Full thickness sutures are positioned to complete the circumferential anastomosis (Figure 13F).

A continuous suture is used for "make a tube" in the bladder flap to the bladder (Figures 13G and 13H). Inflation of the bladder with 200 to 300 ml of isotonic saline solution establishes the impermeability of the anastomosis (Figure 13I).

After reimplantation of the ureter, the Foley catheter is left in for a period of 7 to10 days. Some authors obtain cystography before removing the Foley catheter.[23] The double-J ureteral catheter is removed 3 to 4 weeks after surgery by cystoscopy. A functional study of the kidney (excretory urography, abdominal CT with intravenous contrast, or renal scintigraphy with furosemide) is performed four weeks after the removal of double J catheter to ensure the absence of recurrent obstruction.[23]

Nephrectomy

In extreme cases of ureteral obstruction with renal exclusion, nephrectomy is indicated. The technique for nephrectomy is well described in literature.[24] Briefly, the patient is positioned in lateral decubitus contralateral to the kidney that will be operated. The colon is mobilized medially and the renal vessels are identified. The ureter is dissected and isolated. The renal vessels are controlled with LT-300 titanium clips and the kidney is completely freed from the retroperitoneum.

DISCUSSION

Ureteral involvement is a serious and silent complication that should be considered in all cases of

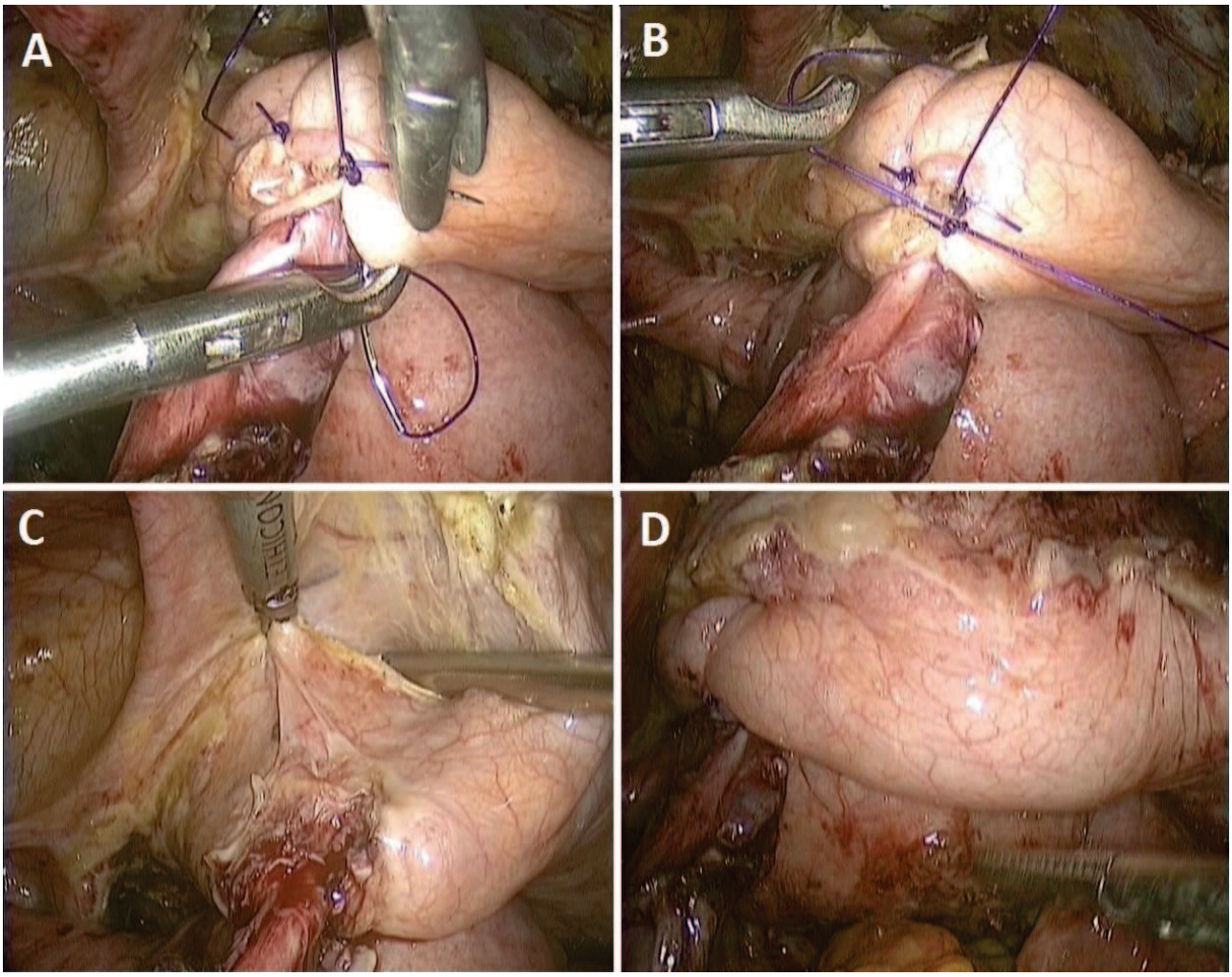

Figure 11 *- (A and B) Construction of the anti-reflux valve. (C and D) Freeing of the bladder in Retzius' space to reduce the tension on the anastomosis. To reduce the tension on the anastomosis, the bladder should be completely freed in Retzius' space (Figures 11C and 11D).*

deep infiltrative endometriosis. Isolation and laparoscopic retroperitoneal inspection of both ureters helps to diagnose cases of clinically silent ureteral involvement.

Approximately 25-50% of kidneys affected by ureteral endometriosis are lost. This high rate of renal wastage may be the result of (1) a delay in diagnosis, since the endometriotic lesion progressively narrows the ureteral lumen, with consequent worsening of the hydronephrosis, or (2) a misdiagnosis when ureteronephrectomy is performed because of a suspicion of a ureteral cancer.[9]

Ultrasonography of the urinary tract is essential in the preoperative investigation of all large volume posterior infiltrative endometriosis lesions located in the midline or posterior lateral lesions. Donnez et al[25] showed that with a nodule 3 cm or greater in diameter in the posterior fornix, the risk of ureteral involvement was 11%, justifying the systematic use of ultrasonography of the urinary tract.

In the study by SERACCHIOLI et al[26] including 30 women with laparoscopic diagnosis of endometriosis with ureteral involvement, confirmed histologically, the diagnosis was considered preoperatively in only 40% of patients. Involvement of the ureter occurred on the left side in 46.7%, on the right side in 26.7%, and bilaterally in 26.7%. Ureteral involvement was associated with endometriosis in the ipsilateral uterosacral ligament in 100% of cases, in the bladder in 50%, in the rectovaginal septum in 80%, in the ovaries in 53.3%, and in the bowel in 36.7%. A case series published by BOSEV et al[27] included 96 patients with ureteral endometriosis diagnosed surgically and confirmed histologically. Among the preoperative findings were four cases of hydroureter and two cases of

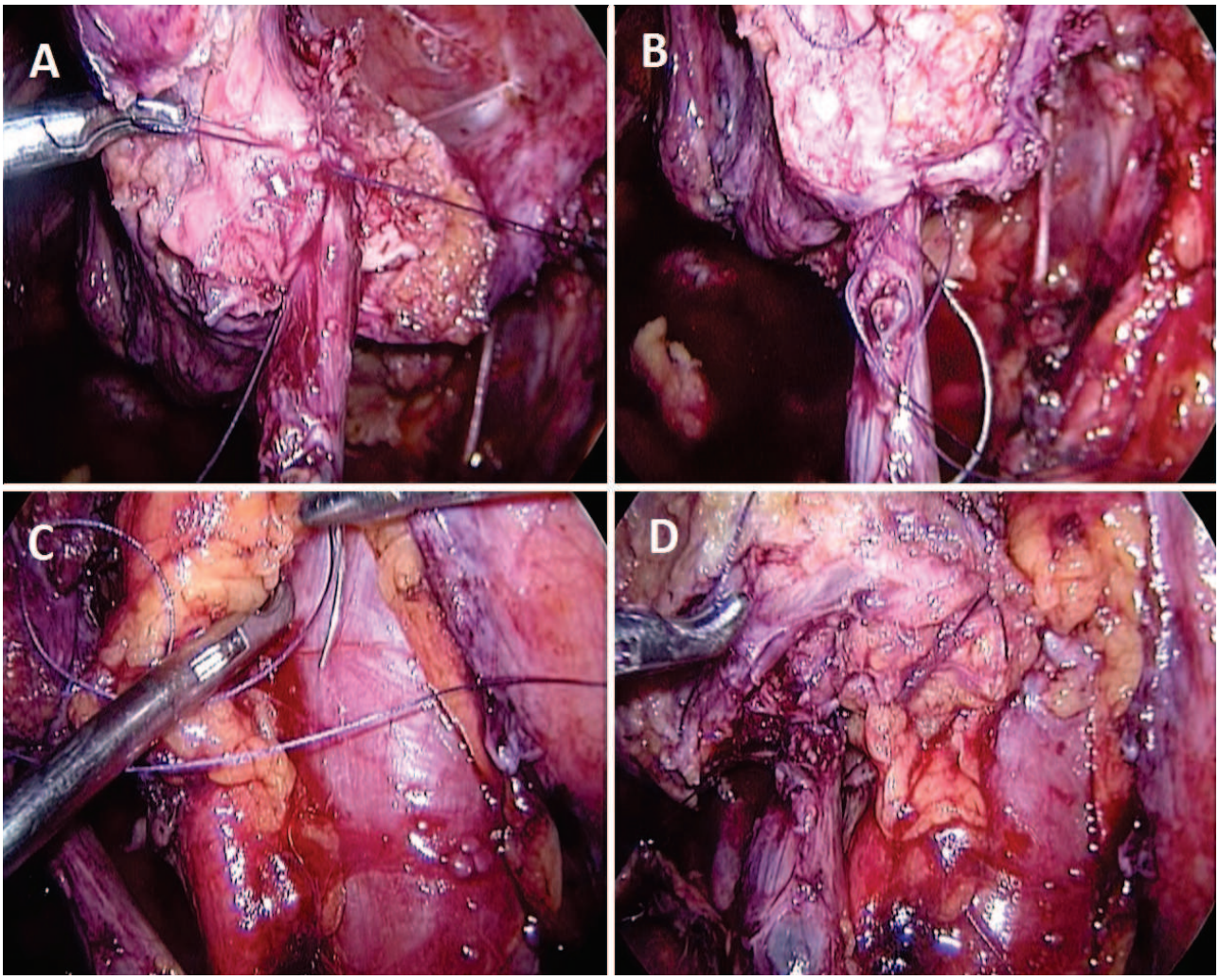

Figure 12 - *(A) Right ureteral reimplantation. (B) Construction of anti-reflux mechanism. (C) Stitching into the psoas muscle. (D) Final appearance after fixation of the bladder wall to the psoas muscle (Psoas Hitch).*

hydronephrosis. Endometriosis affected only the left ureter in 53% of the cases, only the right ureter in 36%, and both ureters in 10%.

Surgical treatment of ureteral endometriosis should be directed at relieving urinary tract obstruction and preventing recurrence of the disease, with as little morbidity as possible. Using the combined skills of a team of urologic and gynecologic surgeons, the goal of the surgery is the complete excision of the endometriosis, including its fibrotic reactive component, with the long-term relief of ureteral obstruction and preservation of renal function. If the kidney is not functioning, the prospect of recovering renal function after conservative surgery is poor; in these cases, nephrectomy is the best option.[19]

Ureteral endometriosis can be treated effectively and safely by laparoscopy, as has been demonstrated in several case series.[26-29] Ureterolysis was performed in 69% of patients with ureteral endometriosis. Obviously, the degree of difficulty of the procedure depends on the size, location, and degree of infiltration of endometriotic tissue in the ureteral wall. Ureterolysis is contraindicated in patients with complete ureteral obstruction, while it is the procedure of choice for minimal nonobstructive extrinsic endometriosis.[18]

There is no consensus regarding the benefit of ureterolysis in patients with mild to severe ureteral obstruction.[18] In a series of 96 cases of ureteral endometriosis reported by BOSEV et al,[27] all patients initially underwent ureterolysis, followed by evaluation of ureteral function. In cases with a non-dilated ureter with subjective signs of impairment (significant change in the appearance of the ureter, poor peristaltic activity, or a desvascularized serosa), or of a dilated ureter for

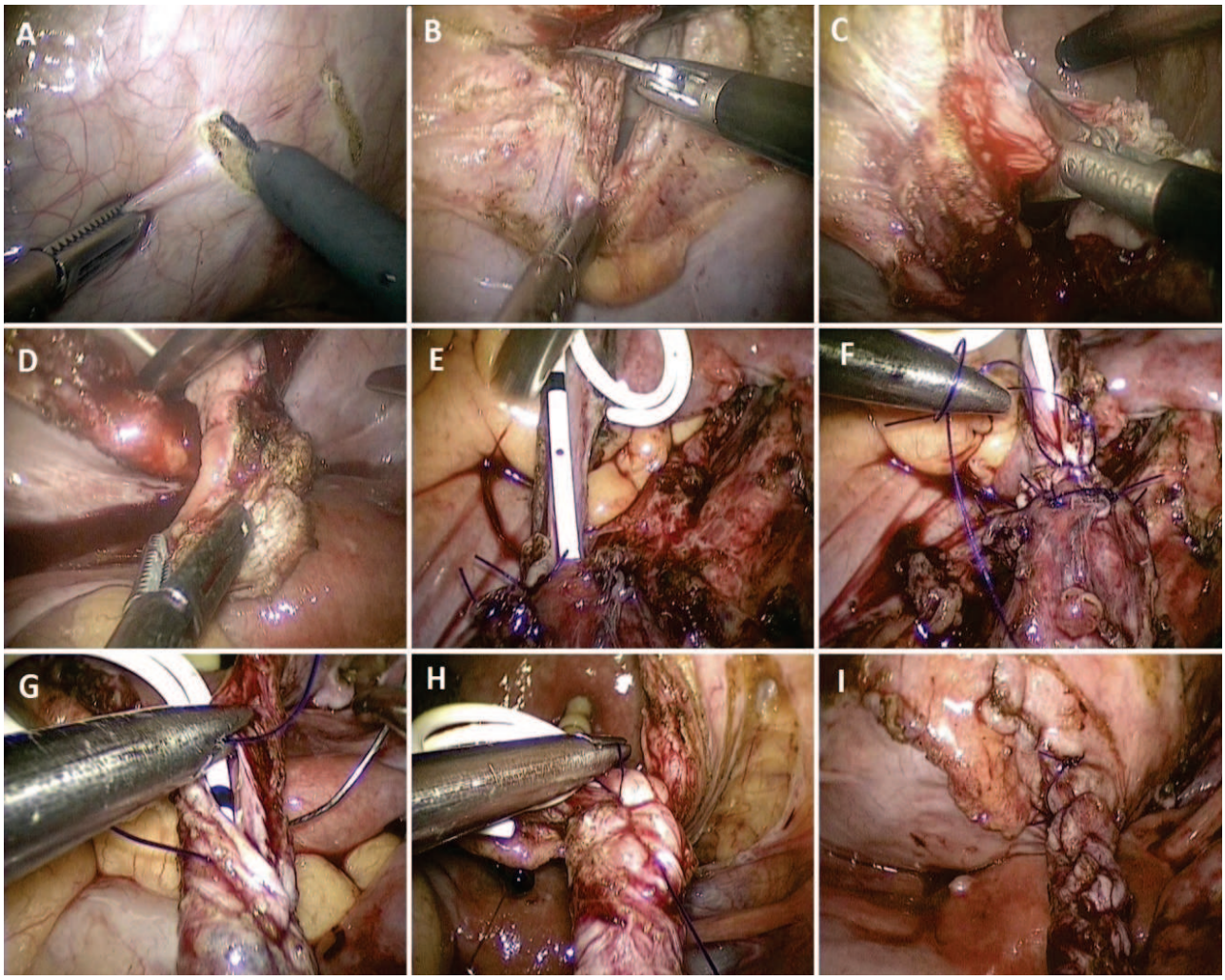

Figure 13 - *(A through D) Preparation of the U-shaped bladder flap. (E) After fixation of the posterior wall of the anastomosis between the bladder flap and the ureter, the double J catheter is inserted in a retrograde fashion. (F and G) Non-continuous 4-0 PDS sutures are used for the anastomosis between the bladder flap and the ureter. (H) The bladder flap is wrapped around the double-J catheter with a continuous 4-0 PDS suture. (I) The bladder is closed with continuous 4-0 PDS sutures and the integrity of the anastomosis is tested.*

which decompression was not possible, placement of a double J catheter was considered. The dilated ureter that could not be decompressed, suggesting true involvement of the ureter was resected and reimplanted. In two cases there was a need for a segmental ureteral resection and uretero-vesical reimplantation with a Psoas Hitch, and in six cases placement of a double J catheter was required. Two patients required rehospitalization, including one case of a septic pelvic thrombosis, and one case of partial stenosis of the right ureter, which was treated with ureteral dilatation and placement of a double J catheter.

FRENNA et al[12] reported no recurrence in 54 patients with ureteral endometriosis who underwent ureterolysis. In this series, obstructive uropathy was present in three cases. In a series reported by SERACCHIOLI et al,[26] thirty patients with retroperitoneal fibrosis involving the ureter were described, of which 10 had hydronephrosis. Thirty-two (73%) underwent ureterolysis; no recurrence or complication was reported.

Some series, on the other hand, have reported complications of ureterolysis for the treatment of ureteral endometriosis. Antonelli et al[29] described 19 patients with ureteral endometriosis; eight of them had evidence of a dilated or non-functioning urinary tract with preoperative intravenous pyelography (IVP) or computed tomography (CT). After preoperative urinary drainage by nephrostomy or ureteral stent, six patients showed a good recovery of renal function,

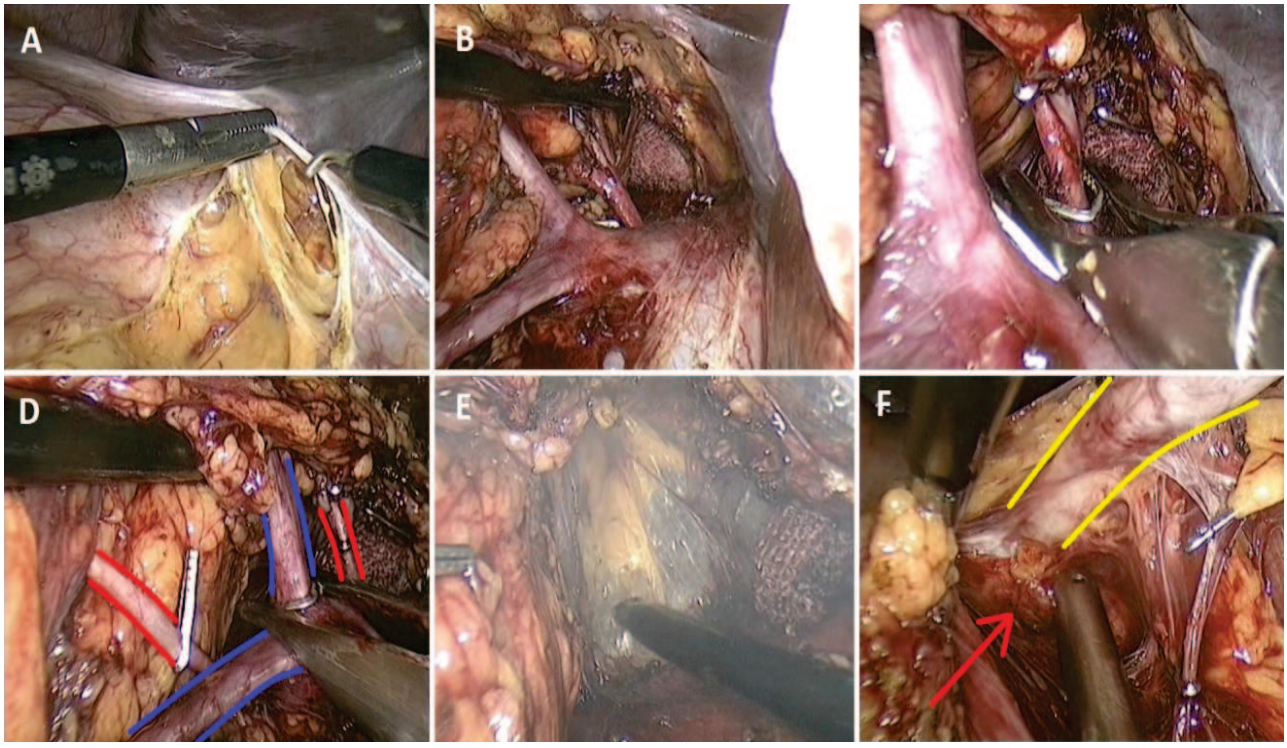

Figure 14 - *(A) Mobilization of the colonic flexure. (B) Dissection of the renal veins. (C)Ligation of the right renal artery with a LT-300 clip. (D)Ligation of the renal vein with a LT-300 clip. Note the presence of two renal arterties (in red) and the gonadal vein draining into right renal vein (in blue). (E) Release of the posterior wall rim near the psoas muscle. (F) Dissection of the right ureter (in yellow) at the point of the obstruction (red arrow).*

while two patients showed irreversible renal atrophy and underwent nephrectomy. Of the remaining 17 patients, six underwent ureterolysis, with two recurrences (33%).

Mereu et al[30] reported 52 patients with ureteral endometriosis and moderate or severe uretero-hydronephrosis, defined as ureteral dilatation e" 1cm. Among the 35 patients who underwent ureterolysis, 7 (20%) required neo-cystostomy two months after the procedure. The postoperative complications requiring reoperation included one ureteral fistula, one hemoperitoneum, and two intestinal anastomotic fistulas.

GHEZZI et al[31] reported 33 patients with moderate to severe hydronephrosis documented by preoperative IVP. One patient underwent vesico-psoas hitch and one a partial ureteral resection. Among the 31 patients who underwent ureterolysis, there were 4 cases (12.9%) of recurrent ureteral stenosis four to nine months after surgery. Another patient had extensive recurrence of the endometriosis, not involving the ureter, and underwent a hysterectomy 18 months after the initial surgery.

PEREZ et al[15] reported a series of seven patients with ureteral endometriosis, of whom two underwent ureterolysis. One patient underwent immediate reoperation with a termino-terminal anastomosis, requiring percutaneous nephrostomy two months later for obstructive uropathy. She underwent neocystostomy seven months after the first surgery. The other patient had an ureterovaginal fistula which was treated with percutaneous nephrostomy.

When ureterolysis is chosen, it is important that the periureteral vascular supply be preserved during the procedure.[27] The vascular supply of the distal ureter usually comes laterally from the iliac artery, while the supply for the proximal and middle ureter comes medially from the aorta. Also, a thin vascular network extends along the ureter. Therefore, ureterolysis should preserve the peritoneal tissue and the adventitia of the ureter.[32]

The partial resection of the ureteral wall was reported in seven patients by Nezhat et al[28] and in one patient by GHEZZI et al.[31] The evaluation of the indications and results of this procedure were

hampered by the small number of cases reported in the literature.[18]

The segmental ureteral resection with termino-terminal anastomosis is another option for the surgical treatment of ureteral endometriosis. Mereu et al[30] reported 17 patients who underwent this procedure, with two (11.7%) requiring neocystostomy two months after the procedure. ANTONELLI et al[29] reported one recurrence in two patients treated. SERACCHIOLI et al[26], NEZHAT et al[28] and DONNEZ et al [5] had no complications and no recurrences in 5, 4 and 1 treated patients, respectively. Because the affected ureteral segment is resected, it is considered a more radical procedure than ureterolysis. However, as in ureterolysis, the distal ureter is preserved. This is the segment of the ureter that crosses the parametrium, which makes the chance that fibrotic tissue will recurr high.[18]

In cases of severe obstructive ureteral endometriosis, when uretero-lysis is not possible and resection of a long segment of the ureter is necessary, neo-cystostomy is the treatment of choice. Resection of the ureter above the stenotic area and reimplantation into the bladder allows the fibrotic area that surrounds the urethra to be transposed, which minimizes the risk of recurrence. As the affected ureteral segment is usually the lower third, a tension-free anastomosis is possible, using the psoas hitch technique as necessary.[18] An anti-reflux surgery is important to prevent ascending infections.[33,34]

Among the 39 patients reported in the series by PÉREZ-UTRILLA et al,[15] one (2.6%) had recurrence. This patient presented with bilateral obstructive uropathy two months after a bilateral posterior neocystostomy, and was treated with ureteral stents and percutaneous nephrostomy. Over the ensuing 16 months she presented intestinal involvement of the endometriosis, requiring colorectal anastomosis. At 22 months of follow-up, she required a right renal auto-transplant in the right iliac fossa.

CARMIGNANI et al[35] reported 13 patients with ureteral endometriosis treated with ureteroneocystostomy with psoas hitch. The indications for the procedure were severe hydronephrosis, radiologic evidence of ureteral stenosis measuring more than 4cm, or the impossibility of performing ureterolysis becaue of macroscopic infiltration of endometriosis or atonia secondary to a fibro-sclerotic segment. No recurrence was observed during six months of post-operative follow-up.

According to Seideman et al,[36] in the presence of ureteral stenosis caused by benign disease which is localized at or below the pelvic brim, ureteroneocystostomy is the treatment of choice. Obtaining a well- vascularized anastomosis, without tension and that is impermeable is critical to the success of this procedure. If there is uncertainty about the viability or vascular supply of the distal ureter, it should be ressected until viable tissue is obtained. If reimplantation cannot be achieved without tension, reimplantation with a Boari flap is preferred.

In the case series reported, in general, the recurrence rates of ureterolysis, termino-terminal anastomosis, and neocystostomy were 7.9%, 10.7% and 2.6% respectively. However, due to the heterogeneity of the populations studied in the different series, one should consider that the value of such comparisons is limited.[18]

Kidneys with a glomerular filtration rate (GFR) of less than 10ml/min have sustained irreversible damage.[37] In these cases, the affected system should be totally removed by ureteronephrectomy. However, in asymptomatic patients, non-surgical management can also be considered. There is no data that informs the indications for and results of nephrectomy versus nonsurgical management in patients with irreversible loss of function renal.[18]

FINAL CONSIDERATIONS

Ureteral endometriosis should be considered in all women with large lesions of deep infiltrating endometriosis. Surgical treatment is almost always necessary in order to preserve organ function. There is still no absolute consensus regarding the best technique to use, but in our personal experience ureterolysis should be attempted in all patients, followed by intraoperative evaluation of the ureter. In the case of signs of ureteral stenosis after ureterolysis, segmental resection with ureteral reimplantation should be considered even during the same surgical procedure. Prospective randomized trials with a larger numbers of patients are needed to define the true indications for each type of surgical procedure.

RESUMO

A cirurgia permanence o melhor tratamento para a endometriose profunda infiltrativa com comprometimento ureteral. Várias técnicas cirúrgicas têm sido aplicadas (ureterólise, ressecção segmentar ureteral com anastomose término-terminal, reimplante ureteral e nefrectomia) com resultados variados. Neste artigo abordamos as indicações de cada procedimento bem como os detalhes técnicos das mesmas.

Palavras chave: Endometriose. Laparoscopia. Ureter.

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Original Article

The Use of Porcine Intestinal Submucosa to Strengthen Stapling in Laparoscopic Rectosigmoidectomies

O Uso de Submucosa Intestinal Porcina no Reforço de Grampeamento em Retosigmoidectomias Videolaparoscópicas

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ABSTRACT

INTRODUCTION: Anastomotic complications (bleeding, dehiscence with abscess/peritonitis, or fistulas) are highly morbid intestinal surgeries and several alternative techniques are being developed and presented to the medical community. Among these alternatives are strengthening membranes that can applied to the cartridges of staplers. **MATERIALS AND METHODS:** In 2008, we performed 42 laparoscopic rectosigmoidectomies for infiltrative endometriosis involving the rectosigmoid using a double stapling technique. In this observational study, patients were grouped according to the type of cartidges/trays used in the linear staplers: Group A (without the use of membranes, n = 28) and Group B (with the use of Surgisis®, a porcine intestinal submucosa membrane, n = 14). **RESULTS AND DISCUSSION:** One complication related to the anastomosis (rectovaginal fistula) was observed in the group which did not use Surgisis® (2.8%, 1/28). The use of these stapling reinforcements appears to be safe and appears to decrease the incidence of complications of mechanical stapling, both the immediate mechanical reinforcement of the sutures and the facilitation of cicatrization, as observed in animal studies and in clinical trials in bariatric surgery. Randomized controlled trials are needed for definitive evidence of such benefits.

Key words: Rectosigmoidectomy. Laparoscopy. Surgical complications. Anastomotic reinforcement. Porcine intestinal submucosa membrane. Surgisis®.

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INTRODUCTION

The evolution of laparoscopy in gastrointestinal surgery has only been possible with the development of mechanical endostaplers to suture the intestine. The use of these instruments permit speed in sectioning and anastomoses of the gastrointestinal tract. Their use is not immune to complications such as bleeding and the feared suture dehiscence, fistulae and intracavitary abscesses. Good surgical technique aims to prevent these complications. In addition, various technologies have been developed in order to reduce the incidence of complications.

Some of these technologies can be employed at the time of stapling, such as patches used in the stapler cartridge and anastomosis sealants. [1,2,3] Among the membranes developed, one that stands out is the porcine **small intestine submucosa**, abbreviated **SIS**, and marketed as **Surgisis**® by Cook Medical Inc, (Bloomington, IN, USA),[4] which is applied in the stapler cartridge, in order to reduce the incidence of complications related to stapling. This membrane works initially by strengthening the tissue to be stapled, minimizing tearing of the tissue. Once applied, the SIS interacts with the tissue allowing healing through this animal substrate, remodeling it, and promoting a strong and well vascularized scar tissue, which is more

resistant to infection. In this article we report our experience using Surgisis® in rectal sectioning with endostaplers during retosigmodectomy using the double stapling technique in surgeries for the treatment of deep endometriosis.

MATERIALS AND METHODS

In the period from February to December 2008, we performed 42 laparoscopic rectosigmoidectomies for the treatment of infiltrative endometriosis (American Fertility Society classification of endometriosis stage IV) involving the rectosigmoid. The procedures were performed in private institutions in Rio de Janeiro by the same multidisciplinary team, which consisted of colorectal surgeons, general surgeons, gynecologists, and urologists.

All patients underwent bowel preparation with a residue-free liquid diet for 30 hours followed by a minimum of 8 hours of fasting prior to surgery. The evening before surgery patients ingested 60 g of sodium sulfate. Finally four tubes of osmotic laxative composed of sorbitol and sodium lauryl sulphate (Minilax®) were administered rectally.

In all 42 cases a written request for use of the Surgisis® was submitted to the patient's insurer payer. Authorizations were received for only 14 patients. This created two groups of patients and the conditions for a natural, albeit non-randomized experiment: 28 patients (labeled Group A) in which Surgisis® was not used and 14 patients (Group B) in which Surgisis® was used.

The laparoscopic technique used employs four ports: 10 mm transumbilical, 12 mm in the right iliac fossa (RIF), 5 mm in the left iliac fossa and flank. As per routine, a pneumoperitoneum with a maximum pressure of 12 mmHg is established by open technique and the patient is placed in a modified lithotomy position with moderate Trendelenburg.

The restoration of the pelvic anatomy is initiated by the gynecology and urology teams through the freeing of both ureters and the opening of the rectovaginal septum, after treatment of whatever adnexal alterations are encountered.

After identification and displacement of the left ureter and gonadal vessels, the intestinal phase of the procedure is then performed through a medial approach to the mesosigmoid, with the identification and sectioning of the inferior mesenteric artery.

The freeing of the sigmoid colon and the upper and middle thirds of the rectum is done posteriorly by the mesorectum with the preservation of the retroperitoneal autonomic innervation, including – whenever possible – the identification of the superior hypogastric nerves.

Once you are past the distal end of endometriotic lesion, all the fatty tissue surrounding the mesorectum is removed. At this point the distal cut is done with the endo-stapler loaded with 60mm gold or green cartridges through the 12 mm port in the right iliac fossa.

It is in this surgical step that the Surgisis® membrane, when available, is applied. The cartridges needed for complete sectioning of the rectum are then fired (in most cases only one or two cartridges are needed). After lateral release from the left parieto-colic gutter – release of the splenic flexure is not routinely done because of the short segment to be resected – the specimen is externalized by the expansion of the right iliac fossa incision, or preferably through the vagina in those cases where an excision of a vaginal fragment has been made by the gynecologist as part of the treatment of endometriosis nodules.

With resection of the specimen completed, the ogive of the 33 or 34 mm circular stapler is placed in the proximal stump which is reintroduced into the abdominal cavity. The colorectal anastomosis is made with the circular stapler and the "tire mechanic" test is routinely done at the end. Pelvic drainage with a silicon drain and closed with soft suction (Blake drain) is done in cases of extraperitoneal anastomoses or in cases with more extensive raw surface areas.

Among our perioperative clinical care recommendations, we emphasize 1) not administering pharmacological DVT prophylaxis (conventionally Enoxaparin) until 12 hours after the use of the stapler, and instead encourage non-drug preventive measures, mainly effective analgesia so that the patient ambulates as soon as possible; 2) early replacement of electrolytes (Na, K, Mg and Ca), as prophylaxis against ileus secondary to dehydration and eletrolytes disturbances and the use of hydration with Hydroxyethyl Starch 6% (Voluven®) a plasma volume expander during surgery (rather than just crystalloids) in order to avoid edema of the bowel, which could hamper the intestinal anastomosis.

A trial of an oral liquid diet (100 mL every two hours) is initiated on the first or second postoperative

day and advanced slowly. Discharge typically occurs around the fifth day with soft oral diet and only after bowel movements have resumed. During outpatient visits the first and second postoperative weeks, physicians look for signs and symptoms of intracavitary abscesses and rectovaginal fistulas.

RESULTS

In the cases reviewed in this period there was one case (2.8%) of rectovaginal fistula in Group A (which did not use Surgisis®), which was diagnosed in the ambulatory clinic on postoperative day (POD) 14. The patient reported flatulence and feces escaping from the vagina since POD 12. She was readmitted to the hospital and treated conservatively with elemental enteral nutrition administered via naso-enteral catheter and antibiotics (metronidazole and ciprofloxacin). The patient progressed satisfactorily, with a cessation of the vaginal discharge on the 10th day of therapy and was discharged from the hospital four days later.

In group B (with application of the Surgisis® membrane) no complications related to the intestinal anastomosis was observed.

There were no bleeding complications in either group.

Using the chi-square test the difference in complications between the groups was not statistically significant.

DISCUSSION

Anastomotic complications contribute to the significant increase in morbidity from intestinal surgery and all technical efforts possible should be done by the surgical team in order to avoid such morbidity. The use of membranes or patches in the stapler cartridges is aimed at protecting the mechanical suture, both immediately by increasing the mechanical resistance of the tissue to the metal staples, and later by strengthening the scar tissue. Pinheiro and cols. demonstrated a significant (more than double) increase in the strength of the mechanical sutures with the application of Surgisis® in comparison with the mechanical sutures without this reinforcement in animal models.[5] There are few studies in humans using Surgisis® in the mechanical suturing. The stand outs are studies of its use in lung resections,[6] where bronchial fistulas constitute serious complications, and in bariatric surgery,[7] where the anastomotic complications are potentially fatal.

In these 14 cases, the application of Surgisis® worked without difficulties or complications, other than creating one more step in the preparation of the mechanical suture, since the membrane does not come ready in the cartridge of the stapler and needs to be applied and fixed to it each shot. The use of biological glue would be an alternative, but in addition to its higher cost, it extends the operative time, because it implies another surgical step, after the anastomosis.[7] The absence of complications was a desired outcome, but a causal relationship between the use of Surgisis® and this outcome cannot be asserted given the small number of patients and the lack of randomization. These preliminary results should encourage the use of these mechanisms of protecting the anastomosis in randomized clinical trials to prove their relative effectiveness.

RESUMO

INTRODUÇÃO: Complicações anastomóticas (sangramentos, deiscências com abscesso/peritonite ou fístulas) são altamente mórbidas em cirurgias intestinais e diversas alternativas técnicas são dia-a-dia desenvolvidas e apresentadas a comunidade médica. Entre essas alternativas figuram as membranas de reforço a serem aplicadas nas cargas dos grampeadores. **MATERIAL E MÉTODOS:** No ano de 2008, realizamos 42 retosigmoidectomias por videolaparoscopia pelo diagnóstico de endometriose infiltrativa com acometimento de retosigmóide pela técnica de duplo grampeamento. Neste estudo observacional, as pacientes foram agrupadas quanto aos tipos de cargas utilizadas pelos grampeadores lineares: Grupo A (sem o uso de membranas; n=28) e Grupo B (com o uso de membrana de submucosa intestinal porcina Surgisis®; n=14). **RESULTADOS E DISCUSSÃO:** Uma complicação relacionada à anastomose foi observada (fístula reto-vaginal) no grupo onde não foi utilizado o Surgisis® (2,8%, 1/28). O uso destes reforços de grampeamento parece ser seguro e parece diminuir a incidência de complicações da sutura mecânica, tanto pelo reforço mecânico imediato da sutura quanto pela facilitação da cicatrização - observada em estudos animais e ensaios clínicos em cirurgias bariátricas. Estudos clínicos randomizados são necessários para a definitiva comprovação destas vantagens.

Palavras chave: Retosigmoidectomia. Laparoscopia. Complicações cirúrgicas. Reforço da anastomose. Membrana de submucosa intestinal porcina. Surgisis®.

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Original Article

Schauta's Operation: A Review of the Literature and Single-Center Case Series

Cirurgia de Schauta - Revisão da Literatura e Casuística do Serviço do HMIPV

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ABSTRACT

Great strides have been made in the field of vaginal surgery over the past decade. Radical vaginal surgery is gaining wide acceptance in the treatment of cervical cancer at many centers worldwide, due to its many advantages to patients (including faster recovery and fewer postoperative complications) and the health sector (including lower cost as compared to traditional abdominal surgery). Radical vaginal operations thus belong in the armamentarium of any gynecologic oncologist in current practice. The objective of this study was to demonstrate the efficacy of radical vaginal hysterectomy (Schauta's operation) versus Wertheim-Meigs hysterectomy for the treatment of cervical cancer through a review of the literature. We also present a case series of patients in whom the Schauta procedure was performed by the gynecologic oncology team at Hospital Materno Infantil Presidente Vargas, Porto Alegre, Brazil. We conclude that the Schauta-Amreich procedure (radical vaginal hysterectomy) is a valid option for treatment of early-stage cervical cancer, providing lower morbidity than the Wertheim-Meigs operation (radical abdominal hysterectomy) with non inferior survival rates.

Key words: Vaginal Hysterectomy. Cervical cancer. Laparoscopy.

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INTRODUCTION

The renaissance of vaginal surgery has been followed by an expansion of its indications beyond classical ones such as uterine prolapse and fibroids to encompass gynecologic oncology as well.

Radical vaginal hysterectomy is currently a valid option for treatment of cervical cancer, as it is associated with fewer postoperative complications, shorter lengths of hospital stay and, consequently, lower cost, particularly the public health care settings.[1]

The advent of laparoscopy has made it possible to perform pelvic lymphadenectomy, which was previously performed using the Mitra technique (extraperitoneal pelvic lymphadenectomy). Both approaches provide an excellent method for disease staging, with the number of nodes sampled comparable to that of open dissection.[2]

Schauta's operation (radical vaginal hysterectomy) thus constitutes a good option for the treatment of cervical cancer, as it provides cost reductions, decreased operative time, earlier discharge, and a lower complication rate compared with the Wertheim/Meigs procedure (radical abdominal hysterectomy).[1]

LITERATURE REVIEW

Historical aspects

The use of radical vaginal hysterectomy in the treatment of neoplastic disease of the uterus was first proposed by Karl August Schuchardt in the late 18th century. On April 21, 1893, Schuchardt performed the first such procedure in a patient with cervical cancer, using the incisional approach to the vagina, perineum, and levator ani muscles that has borne his name since 1908, which allows opening of the apex of the vaginal fornix for complete resection of the parametria. Prior to his death from a surgical infection, Schuchardt had obtained - and demonstrated - highly

positive outcomes using the procedure, with unprecedented cure rates. Around the same time, Friedrich Schauta, a young Viennese gynecologist, took Schuchardt's ideas to the next level, perfecting the latter's approach even further and showing that survival rates after radical vaginal hysterectomy were dramatically superior to those obtained with simple vaginal hysterectomy. Twenty-five years would pass before the procedure found its next enthusiast in Walter Stoeckel, whose pupil — Isidor Amreich — provided a detailed description of the relevant surgical anatomy and developed the operation into a systematic anatomical procedure.

Despite early criticism due to the inability of lymphadenectomy with this approach, the Schauta-Amreich procedure was remarkably effective in the treatment of cervical cancer, and outcomes were noninferior to those obtained after abdominal surgery with pelvic lymphadenectomy.

In 1958, Mitra introduced a new technique to gynecologic practice: extraperitoneal pelvic lymphadenectomy. Indications for this procedure, which was devised as an adjunct to vaginal hysterectomy, were limited. The relatively challenging nature of vaginal surgery, which requires above-average dexterity and experience due to the constraints of the surgical field, curtailed wider use of the Mitra procedure, and cases of cervical cancer posing a high surgical risk or not providing adequate conditions for the vaginal approach were long treated with radiation alone.

In recent years, growing interest in improved prognostic assessment has favored surgical treatment at the expense of radiation therapy. The role of surgery, which was originally regarded as exclusively therapeutic, has shifted substantially; greater emphasis is now placed on its diagnostic aspects, in an attempt to integrate clinical staging with more precise anatomical assessment. If, on the one hand, this has opened the door to more individualized therapy with integrated treatment approaches, it has also led to issues concerning surgical treatment in patients whose constitution or comorbid conditions (including obesity, heart disease, and lung disease) places them at high operative and anesthetic risk. In this respect, the more favorable risk-benefit ratio of vaginal surgery (which includes shorter operative times, reduced surgical trauma, and the possibility of regional anesthesia) plays a crucial role in the management of these patients.

In 1993, Massi et al.,[1] of the University of Florence, Italy, published a landmark study that compared survival rates obtained after Schauta-Amreich and Wertheim/Meigs hysterectomy and found them to be similar. Recent advances in endoscopic surgery, with the development of laparoscopic lymphadenectomy, have led to renewed interest in the applicability of radical vaginal hysterectomy to gynecologic oncology.

The first Schauta operation carried out in Brazil was performed in 1932 in Rio de Janeiro, by José Alves Maurity Santos.

Indications

- Indications for Schauta's operation overlap with those of Wertheim/Meigs hysterectomy:
- Stage IA2, IB1, and IIA cervical tumors < 4.0 cm in size;
- Patients at high surgical risk, including those with obesity, diabetes mellitus, and chronic hypertension, among other conditions (a particular indication for the procedure);
- Young patients who request improved cosmesis.

Operative technique

The same preoperative care regimen employed in vaginal hysterectomy for the treatment of benign uterine conditions apply to the Schauta-Amreich radical vaginal hysterectomy.

The patient is placed in the lithotomy position with the legs suspended in high stirrups. Bladder catheterization may be transurethral or suprapubic; both are fine methods of ensuring that the bladder remains empty intraoperatively, although transurethral catheterization is currently preferred.

The catheter is kept in place after surgery to prevent bladder distension due to atony, which is a common consequence of this type of procedure.

- *Schuchardt incision and preparation of the left pararectal space*

The procedure begins with a mediolateral perineal incision on the patient's left side, through skin and vaginal mucosa and extending as high and deep as the perineal muscles and levator ani; this is known as the Schuchardt incision, and is preceded by infiltration of a vasoconstrictive solution compounded

by mixing a single vial of epinephrine in 200 to 300 mL of normal saline (Figure 1).

Major case series published in recent years no longer use the Schuchardt incision, as it is considered inordinately invasive and unnecessary when the performing surgeon is past the learning stage.

The left pararectal space is dissected and Breisky retractors are used to displace the rectum medially until the inferior border of the left cardinal ligament presents itself.

- *Cervical incision and preparation of the vaginal vault*

One of the advantages of radical vaginal hysterectomy is that it enables more precise demarcation of the amount of vaginal mucosa to be removed, guiding circular incision of the cervix according to tumor size, location, and extension. The anterior vaginal mucosa is pulled downward and incised perpendicularly all the way through with a scalpel. This incision must be performed above the anterior sulcus of the vagina, permitting dissection of enough vaginal tissue to invaginate the tumor.

The posterior vaginal mucosa is then pulled upward; a circular incision is performed with a scalpel and the tissue is dissected with scissors as in the anterior mucosa.

After the vaginal cuff has been created, the cervix is invaginated, enclosing the tumor, to prevent seeding of tumor cells and facilitate manipulation of the uterus (Figure 2).

The supravaginal septum is divided with scissors, the vesicouterine excavation is opened up, and the bladder is retracted cranially.

The same procedure is performed posteriorly, with displacement of the rectum, although the rectouterine pouch is not opened.

- *Opening of the paravesical space, dissection of the ureter and resection of the anterior parametrium*

The uterus is retracted downward and rightward by the first assistant while the border of the anterior mucosal incision is grasped by two Kocher clamps at the 1 and 3 o' clock positions. The left paravesical space is entered with scissors; the incision thus made is expanded bluntly with the operator's finger and a Breisky retractor is introduced. Traction on the retractors introduced into the vesicouterine excavation and left paravesical space distends the bladder pillar, which contains the ureter. The left ureter

Figure 1 *- Schuchardt incision and preparation of the left pararectal space.*

Figure 2 *- Cervical incision and preparation of the vaginal vault.*

can be palpated between two fingers, allowing the surgeon to determine exactly where the anterior parametrium is to be incised.

Three structures must be identified at this point: the ureter, the vascular bundle, and the dome of the bladder. The surgeon should know the exact location of the ureter, because the radical nature of the procedure is dependent upon how much of the anterior parametrium (vesicouterine ligament) is resected. The ureter can then be further dissected cranially to the level of the tunnel, where it crosses the cardinal ligament.

The uterine artery is located near a bend or elbow in the ureter, and should then be protected and displaced cranially with Breisky retractors.

The ureter and pedicle of the uterine artery are then retracted cranially, exposing the upper border of the cardinal ligament. The same procedure is repeated on the right side after development of the right pararectal space. Ureteral dissection allows safe resection of the cardinal ligaments (lateral parametria) (Figures 3 and 4).

▪ *Opening of the rectouterine pouch and resection of the posterior parametrium*

The uterus is retracted upward by an assistant and the posterior peritoneum is opened with scissors.

The next step is resection of the posterior parametrium, which requires broad dissection of the rectovaginal space, exposing the full extent of the uterosacral ligaments. A Breisky retractor is introduced into the peritoneal cavity to provide upward traction on the uterus, while another retractor is placed into the left pararectal space. Simultaneously, a forceps-held gauze swab is used to depress the lateral portion of the rectum, distending the left uterosacral ligament. The base of the ligament is clamped with a slightly curved Z-clamp, cut, and ligated.

The plane of resection of the posterior parametrium will depend on how radical the surgeon feels the procedure should be, according to preoperative clinical assessment. The same procedure is repeated contralaterally (Figure 5).

▪ *Opening of the anterior peritoneum and removal of the uterus and adnexae*

The peritoneum is opened and a Breisky retractor is introduced into the anterior portion of the rectouterine pouch. The index finger of the operator's left hand is advanced under the peritoneal leaf until it reaches the left round ligament, which is clamped, cut, and sutured; this brings the uterus further downward and broadens exposure of the suspensory ligament of the left ovary. The ovaries and Fallopian tubes are removed or preserved depending on patient age. The same procedure is repeated on the right, again resecting or preserving the adnexa as appropriate (Figure 6).

▪ *Resection of the cardinal ligament*

Adequate resection of the lateral parametrium away from the uterus and near the pelvic wall requires complete exposure of the surgical field with Breisky retractors and lateral traction on the uterus. One retractor is placed in the pararectal fossa while a wider one retracts

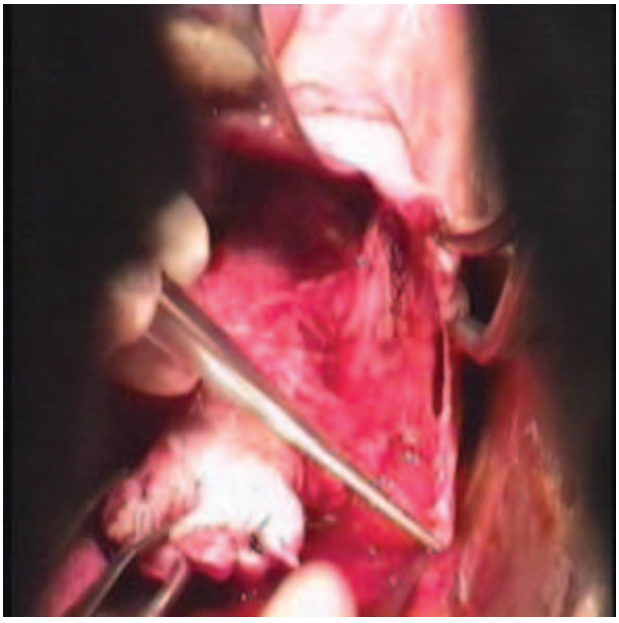

Figure 3 - *Opening of the paravesical space.*

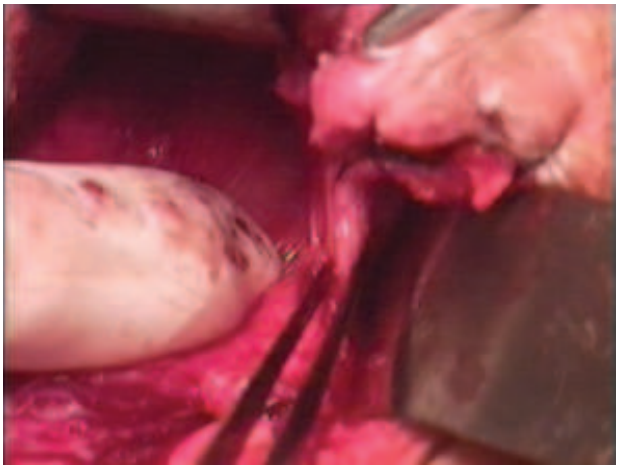

Figure 4 - *Dissection of the ureter and resection of the anterior parametrium.*

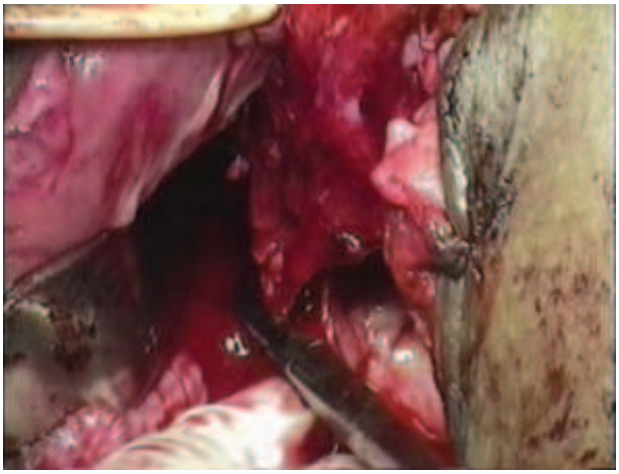

Figure 5 - *Opening of the rectouterine pouch and resection of the posterior parametrium.*

the bladder and ureter upward. The cardinal ligament and adjacent paravaginal tissues are clamped laterally with a strongly curved Z-clamp. The precise location of clamping in relation to the pelvic wall will depend on the desired radicality of the procedure.

Clamping, section, and suture of the right cardinal ligament follow the same sequence; the uterus will then usually develop through the introitus, attached solely to the suspensory (infundibulopelvic) ligament and the vessels it carries (Figure 7).

- *Closure of the vaginal dome and Schuchardt incision*

The vaginal dome is closed with slow-absorption sutures. Finally, the Schuchardt incision is closed in a layered fashion (levator ani muscles, subcutaneous tissue, vaginal mucosa and skin).

Classes of radical vaginal hysterectomy

The term "radical" hysterectomy is used to refer to any procedure in which the uterus is removed with its surrounding connective tissue, the anterior, posterior, and lateral parametria are resected, the uterine artery is ligated at its source, and the distal ureter is mobilized.

Broad excision of the parametria and extensive dissection of the distal ureter may lead to significant changes in bladder function. Current gynecologic oncology practice thus seeks to provide individualized treatment, tailored to each patient, to reduce the postoperative complication rate and preserve urinary function.

With this in mind, Piver et al.[3] proposed five classes of radical abdominal hysterectomy according to the amount of vaginal tissue and parametrium resected. Following their example, Massi et al.[1] later suggested three classes of radical vaginal hysterectomy, also according to the amount of vaginal tissue and parametrium removed, namely:

- *Vaginal hysterectomy (Class I)*

The parametria are dissected near the uterus. No ureteral dissection is performed.

Indications: recurrent cervical carcinoma in situ, unclear margins after conization/ LEEP, select cases of microinvasive carcinoma (stage IA1).

- *Schauta-Stoeckel operation (Class II)*

The initial stages are similar to those of the classical Schauta-Amreich operation (class III);

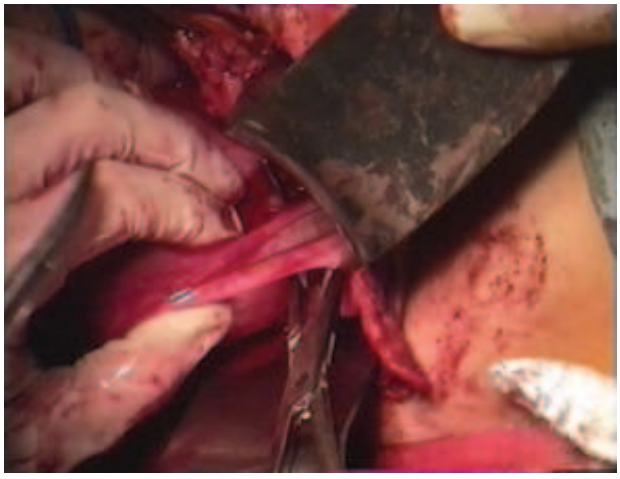

Figure 6 - *Opening of the anterior peritoneum and removal of the uterus and adnexae.*

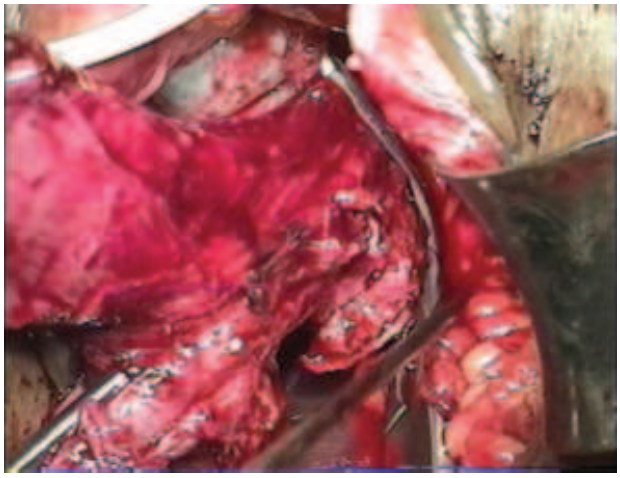

Figure 7 - *Resection of the cardinal ligament.*

however, the ureter is dissected not completely, but only far enough to enable ligation of the uterine artery a few centimeters from the uterus and rexection of the proximal portion of the anterior parametrium. The distal half of the posterior parametrium is left intact, whereas resection of the lateral parametrium is identical to that performed in class III surgery (near the pelvic wall).

Indications: invasive stage IA2 and IB cervical tumors < 2 cm in size.

- *Schauta-Amreich surgery (Class III)*

Detailed description provided above.

Indications: alternative to the Wertheim/ Meigs radical abdominal hysterectomy. Schauta's operation is chiefly indicated in obese or high-risk patients with stage IB or IIA cervical cancer. However, augmentation of this procedure with extraperitoneal or laparoscopic pelvic lymphadenectomy allows safe

expansion of these indications to include all operable cases of cervical cancer.[1,2,4,5]

Available options for lymphadenectomy (Mitra vs. laparoscopic)

Pelvic lymphadenectomy may be performed by various approaches: intraperitoneal abdominal (Wertheim/Meigs), extraperitoneal abdominal (Mitra), or laparoscopically. In 1993, Massi[1] proposed a modified version of the extraperitoneal lymphadenectomy procedure described by Mitra in 1959. This procedure seeks to accomplish complete dissection of all lymphatic tissues surrounding the common, external, and internal iliac vessels and the obturator fossa.

Adequate exposure of these areas is obtained via two oblique, 6- to 7-cm-long incisions made medially to the anterior superior iliac spines and above the inguinal ligament. After layered dissection, the surgeon locates the upper and lower boundaries of the external iliac vessels, the source of the internal iliac vessels, and the ureter (attached to the peritoneum). All lymph nodes in this region and at the level of the obturator fossa are resected.

In laparoscopic lymphadenectomy, the retroperitoneal approach is also required for resection of lymph nodes located near the aforementioned structures, but the layered opening essential to the Mitra procedure is by definition unnecessary. The advantages of laparoscopy include the possibility of inventorying the abdominal cavity, the absence of scars on the lower abdomen, the lower rate of surgical site complications, and lymph node sampling perfectly comparable to that accomplished with the Mitra procedure.

Furthermore, two of the main advantages of endoscopic techniques are their lower cost and current popularity, which improve the acceptability of extending their indications to staging and treatment of cervical cancer.

COMPLICATIONS

The mortality rate of radical vaginal hysterectomy ranges from 0.27% to 2.5%.[1,6] Morbidity is related to the underlying indication for the procedure, and includes urinary and bowel complications (injury, fistulas, and infection). The main urinary tract complication is dyskinesia (atony) of the bladder; all patients experience this adverse effect to some extent after radical vaginal surgery. The incidence of major bladder dyskinesia may exceed 50%. Early signs include a hypertonic reaction with decreased bladder capacity, increased residuals, and loss of sensation of bladder fullness. Self-catheterization is essential, and must continue until symptoms resolve completely, which may take several months. Some patients will never regain preoperative bladder function. Ureteral dilation occurs in 87% of patients in the first postoperative week. In most cases, the dilation has resolved and ultrasonographic assessment of the urinary tract is within normal limits on the sixth postoperative week. Peristalsis along the distal ureter returns to normal within 1 month of the procedure.

The incidence of vesicovaginal, ureterovaginal, and rectovaginal fistula is 2.0%, 3.0%, and 0.7% respectively. Other complications include surgical site infection of the Schuchardt incision, dehiscence of the vaginal vault, and, on rare occasions, bowel evisceration.

Results

In patients with IB stage disease, 5-year survival after radical vaginal hysterectomy is comparable to that obtained after the Wertheim/Meigs procedure.[1,6,7] In a review of 1089 patients undergoing vaginal hysterectomy and 809 undergoing the abdominal version of the procedure, 5-year survival was 74.2% and 79.0% respectively. A more recent study by Massi[8] reported higher 5-year survival rates after the Schauta-Amreich operation (81% vs. 75% in stage IB disease, $p < 0.05$; 68% vs. 64% in stage IIA disease, $p > 0.05$). The results reported by these and other authors suggest that the radical vaginal hysterectomy approach described by Schauta and Amreich can play a role in the treatment of patients with operable cervical cancer.

Schauta vs. Wertheim in the published literature

Schwartz et al.[9] published the outcomes of radical vaginal hysterectomies performed via the Schauta-Amreich approach between 1959 and 1970: 234 surgeries; 5-year survival rate — overall, 84%; for tumors > 2.0 x 2.0 cm in size and 1.0 cm depth, 76%; for tumors smaller than the above dimensions, 91%; low morbidity and no perioperative mortality.

The authors conclude that the possibility of pelvic lymph node metastasis depends on the size of the primary tumor.

Massi et al.[1] compared the Schauta-Amreich vaginal hysterectomy and the Meigs

abdominal hysterectomy in the treatment of cervical cancer.

The objective of the study was to determine the effectiveness of Schauta's operation in the treatment of stage IB or IIA cervical cancer. The study was designed as a retrospective analysis of outcomes obtained with the Schauta vs. Meigs operations in 793 patients with stage IB or IIA disease, 201 of whom underwent adjuvant radiotherapy. A total of 356 patients with stage IB and 76 with stage IIA disease underwent Schauta's operation, whereat 288 and 64 patients with stage IB and IIA disease underwent Meigs' procedure respectively.

Results: 5-year survival, stage IB disease:
81% Schauta
75% Meigs
5-year survival, stage IIA disease:
68% Schauta
64% Meigs

The authors conclude that the Schauta radical vaginal hysterectomy is associated with high cure rates in stage IB or IIA cervical cancer and is a valid alternative to the Wertheim/Meigs procedure for this indication.

In 1996, Roy et al.[10] compared the safety, efficacy, and potential benefits of Schauta's operation versus the Wertheim/Meigs procedure in the treatment of early-stage cervical cancer:

- Of the 52 patients with cervical cancer, 25 underwent laparoscopic lymphadenectomy followed by Schauta's operation and 27 underwent the Meigs procedure;
- The mean number of lymph nodes was 27, and the only complication was injury to the external iliac vein, which was repaired after conversion to laparotomy;
- Patients in the Schauta and Wertheim/Meigs groups were comparable in terms of age, weight, parity, and tumor stage, histology, and size;
- Blood loss was lower in the Schauta group;
- Operative time was 270 min in the Schauta group and 280 min in the Meigs group;
- Blood transfusions were required by 4 patients in the Schauta group and 5 in the Meigs group;
- Length of postoperative stay was 7 days in both groups;
- Bladder perforation occurred in 2 patients in the Schauta group;
- Fever occurred in 4 Schauta and 9 Meigs patients;
- One preperitoneal abscess and one hematoma occurred in the Schauta group;
- One hematoma and 4 surgical site infections occurred in the Meigs group;
- Postsurgical ileus occurred in 1 Schauta and 4 Meigs patients;
- Mean length of follow-up was 27 months;
- The study concluded that the Schauta and Wertheim/Meigs operations are comparable, although the former produces no abdominal scarring and is associated with a lower incidence of fever.

Renaud et al.[11] reviewed 102 patients with early-stage cervical cancer who underwent laparoscopic pelvic lymphadenectomy followed by Schauta's operation. Mean patient age was 36 years (range, 25–68 years). Their results were as follows:

- Squamous cell carcinoma and adenocarcinoma occurred in 68% and 32% of patients respectively;
- Stage IB1 – 77%
- Stage IA1 – 1%
- Stage IA2 – 16%
- Stage IIA – 6%
- Mean operative time, 270 min;
- Mean number of lymph nodes resected, 27;
- Intraoperative complications of laparoscopy:
- Iliac vessel damage in 2 cases
- Epigastric vessel damage in 1 case
- Complications of Schauta's operation included bladder perforation and one conversion to laparotomy for control of hemorrhage;
- Postoperative complications occurred in 6% of patients, with only 1 case considered severe (abscess formation requiring incision and drainage);
- Tumors recurred in 4 patients.
- The authors conclude that the combination of laparoscopic and vaginal approaches provides a perfectly viable alternative for treatment of cervical cancer, with

remarkably low morbidity and complication rates and satisfactory lymph node sampling.

Angioli et al.[12] conclude that Schauta's operation provides significant advantages over the Wertheim/Meigs procedure, including: the possibility of performing it under regional anesthesia, particularly in patients with unfavorable clinical profiles; reduced surgical trauma due to the absence of abdominal incision; applicability in obese patients; reduced operative time; need for fewer blood transfusions; lower risk of complications; faster postoperative recovery; and shorter lengths of hospital stay.

The main disadvantage of Schauta's operation is the lack of pelvic lymph node dissection; however, this has changed with the advent of laparoscopic lymphadenectomy.

CASE SERIES

We now present a series of patients with a diagnosis of early-stage cervical cancer and indications for Schauta's operation with laparoscopic or Mitra pelvic lymphadenectomy who underwent the procedure at the Pelvic Oncology Service of Hospital Materno Infantil Presidente Vargas, Porto Alegre, Brazil.

Cases were initially limited to a tumor size < 2.0 cm, but as the learning curve progressed, application of the technique to tumors < 4.0 cm in size — a size often described in the literature as the boundary between indication of surgical therapy or radiation/ chemotherapy — became possible.

Table 1 provides a detailed description of the profile of these patients with relevant data for comparison with the current literature.

Table 1 - *Characteristics of patients who underwent Schauta's operation.*

Patient	Age	Stage	Histology	# nodes	Complications	Follow-up	LND
RO	33	IA1	SCC	3	No	13mo	Lap
EPZ	40	IB1	SCC	22	No	11mo	Mitra
MA	34	IB1	SCC	17	No	14mo	Mitra
MRC	33	IA2	SCC	12	No	41mo	Mitra
DFV	44	IB1	SCC	26	No	22mo	Mitra
JHF	31	IB1	AC	22	No	22mo	Mitra
VNR	56	IB1	SCC	21	No	18mo	Mitra
MD	42	IB1	AC	21	No	10mo	Mitra
CCG	37	IB1	SCC	30	No	3mo	Lap
DFS	66	IA2	SCC	18	No	8mo	Mitra
VR	54	IB1	SCC	21	No	41mo	Mitra
IMS	50	IB1	SCC	20	No	24mo	Mitra
FMC	44	IB1	SCC	11	Yes	25mo	Mitra
AS	39	IB1	SCC	18	Yes	24mo	Mitra
MÊS	62	IB1	AC	17	No	18mo	Lap
VM	36	IB1	SCC	14	No	16mo	Mitra
CSA	43	IB1	SCC	23	No	7mo	Mitra
ICR	41	IB1	AC	22	No	17mo	Mitra
PMN	34	IB1	AC	20	No	11mo	Lap
CLSS	58	IIA	AC	20	Yes	13mo	Mitra
MAS	62	IIA	SCC	20	Yes	20mo	Mitra
JCM	68	IIA	SCC	22	No	13mo	Mitra
MP	56	IIA	AC	23	No	11mo	Mitra
SAS	57	IB1	SCC	19	No	13mo	Mitra
AR	38	IB1	SCC	24	Yes	15mo	Mitra
JBG	55	IB1	SCC	22	No	6mo	Mitra

AC, adenocarcinoma; LND, lymph node dissection; SCC, squamous cell carcinoma.

RESULTS

- ***26 patients*** underwent the Schauta procedure
- ***Mean patient age*** was 46.6 years
- ***Histologic subtype***: Squamous cell carcinoma, 19 cases

Adenocarcinoma, 7 cases

- ***Staging***: IA1, 1 case
- IA2, 2 cases
- IB1, 18 cases
- IIA, 4 cases
- According to anatomic pathology reports, ***clear margins*** were achieved in all patients.
- The mean ***number of lymph nodes*** was 20.
- Two patients had ***lymph node involvement*** and were referred to radiation therapy.
- Mean duration of ***follow-up*** was 17 months.
- No patients had tumor ***recurrence***.
- ***Complications*** included four cases of *atonic bladder*, with a mean duration of 28 days. Management was conservative, and consisted of intermittent self-catheterization until the post-void residual was approximately 50 mL or the patient could void spontaneously.
- Four patients developed *urinary tract infections*, which became recurrent in one. Antibiotic therapy was provided in both cases.

CONCLUSION

Vaginal surgery has undergone modifications that currently enable its satisfactory use in treatment of conditions such as cervical cancer, with survival rates comparable to those of abdominal surgery.

Schauta's operation has returned to challenge the dominance of conventional hysterectomy approaches. The radical nature of the procedure is preserved and is comparable to that of the Wertheim/Meigs operation.

Future prospects for use of this treatment will require development of new guidelines and precise indications for the Schauta procedure, as well as trained and experience surgeons, in the search for better outcomes and wider adoption of this technique.

RESUMO

A cirurgia vaginal como um todo alcançou avanços importantes na última década, A cirurgia vaginal radical para tratar câncer de colo uterino vem conquistando lugar de destaque em muitos centros mundiais por se tratar de uma cirurgia minimamente invasiva com benefícios evidentes para a paciente como rápida recuperação, menos complicações pos operatórias e benefícios para as instituições de saúde como baixo custo em relação a cirurgia abdominal radical clássica. Por isso, atualmente, esta técnica operatória deve ser incluída no arsenal dos procedimentos de todo o ginecologista oncológico. O objetivo deste trabalho consiste em demonstrar a eficácia da cirurgia vaginal radical como tratamento para carcinoma de colo uterino, em comparação à técnica de Wertheim-Meigs, através de uma revisão da literatura. Apresentamos também a casuística de pacientes operadas no serviço de oncologia ginecológica do Hospital Materno Infantil PresidenteVargas de Porto Alegre. Concluimos que a técnica de cirugia de schauta-Amreich (histerectomia radical vaginal) constitui uma alternativa válida para o tratamento do câncer de colo uterino inicial com menos morbidade para a paciente em relação a clássica cirurgia de Wertheim-Meigs (histerectomia radical abdominal) e com os mesmos resultados na sobrevida destes pacientes.

Palavras chave: Histerectomia vaginal. Câncer Cervical. Laparoscopia.

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Original Article

Dismembered Laparoscopic Pyeloplasty: An Analysis of 24 cases

Pieloplastia Laparoscópica Desmembrada: Uma Análise de 24 casos

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ABSTRACT

Introduction: The first open pyeloplasty was performed by Kuster in 1891. For many decades open pyeloplasty was considered the treatment of choice for stenosis of the PUJ. Anterograde or retrograde endoscopic incisions emerged as alternative treatments with success rates ranging from 70% to 89%. In 1993 Shussler and Gune performed the first laparoscopic dismembered pyeloplasty, and since then success rates have been comparable to those of the open technique, but with less morbidity. **Objectives:** A review of patients undergoing laparoscopic pyeloplasty by the Anderson-Hynes technique at the federal Lagoa Hospital, Rio de Janeiro, Brazil. **Materials and Methods:** Between June 2008 and July 2011, twenty-four patients with PUJ stenosis underwent laparoscopic dismembered pyeloplasty at our institution. The diagnosis of PUJ stenosis was determined by history, clinical examination and imaging studies (CT, IVP or renal scintigraphy). Laparoscopic dismembered pyeloplasty was performed by the transperitoneal Anderson Hynes technique using the three trocars. Sometimes a fourth trocar in the posterior axillary line was needed to retract the colon. **Results:** A total of 24 patients underwent laparoscopic pyeloplasty in the three year timeframe. Of these, 8 (33%) were men and 16 (67%) were women. The patients' ages ranged from 13 to 67 years with an average of 35 years. Stenosis presented to the right side in 15 (60%) patients, left in 8 (32%) and bilateral in one (8%) patients (thus 25 procedures). An anomalous vessel was identified in 10 patients, and two others had kidney stones. The mean operative time was 245 minutes and the mean hospital stay was five days. Postoperatively three patients had double-J catheter migration into the ureter and two patients had urine leakage into the perirenal bed with urinoma formation, and in one of these it was necessary to perform a small lumbotomy to drain the collection. Two (8%) patients had recurrence of ureteropelvic junction obstruction. The mean follow-up was 4.5 months, ranging from 3 to 6 months. The clinical success rate – confirmed radiographically – was 92%, with only two patients showing unsatisfactory results during follow-up. **Conclusions:** Our approach for transperitoneal laparoscopic Anderson-Hynes technique showed results similar to those in literature, with low complication rates. We had technical difficulties during the antegrade placement of double-J catheter and malposition (migration of catheters into the ureter), which led us to change our approach, positioning them by cystoscopy. After this change, we had no more cases of poorly positioned double J catheters in the postoperative period.

Key words: Pyeloplasty. Laparoscopic pyeloplasty. Ureteropelvic junction obstruction.

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INTRODUCTION

The pyeloureteral junction (PUJ) is an anatomical and functional region that regulates the flow of urine from the renal pelvis into the ureter. Stenosis of the PUJ can impair renal function. Most PUJ lesions are congenital defects, but clinical manifestations may not arise before adulthood.

The first open dismembered pyeloplasty – a procedure in which the renal pelvis is completely sectioned to remove redundancy and an anastomosis then constructed – was performed by Kuster in 1891. In 1949, Anderson and Hynes modified Kuster's technique, establishing the standard for dismembered pyeloplasty. For many decades, open pyeloplasty has been considered the principal treatment for stenosis

Study carried out at the Urology Service of the Federal Hospital da Lagoa. Rio de Janeiro, RJ, Brazil.

of the PUJ in children and adults, with success rates of 90% to 100% (1).

Technological advances and the modernization of urological surgery instruments have fostered the emergence of endourologic procedures and, more recently, laparoscopic procedures for the treatment of PUJ stenosis.

Endourologic incisions – anterograde by percutaneous access or retrograde through the urinary tract – have emerged as alternative treatments, although they have success rates ranging between 70% and 89%, even in selected patients (2).

In 1993 Schussler and Gune performed the first laparoscopic pyeloplasty using the Anderson-Hynes dismembered technique. Besides being a minimally invasive procedure, success rates have been comparable to the open technique, with less morbidity and shorter hospital stays.(3,4)

OBJECTIVE

The objective of this study is the retrospective analysis of patients who underwent laparoscopic pyeloplasty with regard to patient characteristics; laterality of the obstruction; type of stenosis; presence of lithiasis or vessel anomaly; operative time; length of hospital stay; duration of drainage and of bladder and double-J catheters; intraoperative complications; conversion rate; and postoperative results.

MATERIALS AND METHODS

Between June 2008 and July 2011, twenty-four patients with primary or secondary stenosis of the ureteropelvic junction (PUJ) underwent laparoscopic pyeloplasty using the Anderson-Hynes technique at the Urology Service of the federal Hospital da Lagoa in Rio de Janeiro.

The diagnosis of stenosis of the PUJ was determined by history, physical examination and imaging studies, such as urinary tract ultrasonography (Figure 1), intravenous urography and renal scintigraphy. Computed tomography of the abdomen and pelvis with contrast was restricted to patients suspected of having an anomalous vessel.

The patients underwent routine preoperative tests and were hospitalized the day of the procedure. They received intravenous hydration, were started on a residue-free liquid diet, and were asked to fast for eight hours prior to the procedure.

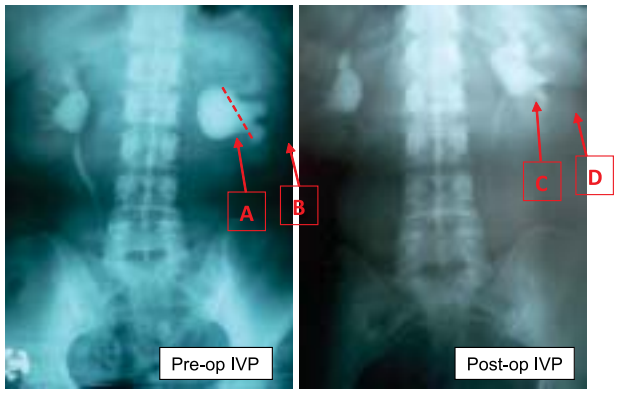

Figure 1 *- Preoperative excretory urography (Pre-op IVP) showing bulging of the renal pelvis and the contrast not progressing satisfactorily 15 minutes after injection of intravenous contrast medium (arrow A) and bulging/concavity of the renal calices (arrow B). In the postoperative excretory urography (Post-op IVP) of the same patient, there is a flattened renal pelvis (reflecting surgical removal of the excess) and contrast passing into the ureter without difficulty 15 minutes after injection of intravenous contrast medium (arrow C) and regression of bulging, returning the calices to their usual shapes (arrow D).*

All patients received prophylactic antibiotics with 1 gram of intravenous cephalothin upon induction of anesthesia. Patients received general anesthesia via endotracheal intubation.

The Anderson-Hynes laparoscopic transperitoneal dismembered pyeloplasty was the technique used by our service.

Although the double-J catheter was passed antegrade during surgery in most patients, we now consider that retrograde implantation of the catheter guided by fluoroscopy as safer and easier to position.

After posiotining the patient (Figure 2), antisepsis and placement of sterile drapes, the surgical procedure was started.

Figure 2 **–** Positioning the patient on the operative table in left lateral decubitus.

10 mm Trocar. *5 mm Trocar.*

First a skin incision is made above the umbilicus or lateral to it, para-rectal external, depending on the biotype of the patient, followed by the opening of the aponeurosis, dissection of the muscle, opening of the peritoneum, and introduction of the first 10 mm trocar, under direct vision. Next the pneumoperitoneum is established with insufflation with carbon dioxide at a pressure of 12 to 15 mmHg. Once the abdomen was distended, the cavity is explored and two more trocars are introduced by puncture and guided under endoscopic vision along the line of the para-rectus externa, a 10 mm trocar below the costal margin and a 5 mm trocar near the iliac crest. Sometimes on the right side a fourth trocar at the height of xiphoid process is needed so the liver can be retracted.

After the actual surgery a suction drain is placed in the perirenal bed until the 24 hour output is less than 50 ml. The diet was introduced the morning after surgery.

RESULTS

Between June 2008 and July 2011, twenty-four patients underwent laparoscopic transperitoneal pyeloplasty using the Anderson-Hynes technique for pyeloureteral obstruction of various etiologies.

Eight patients were men and 16 were women. The patients' ages ranged from 13 to 67 years with a mean of 35 years. The stenosis was on the right in 15 patients, on the left in eight, and bilateral in one case, thus requiring a total of 25 procedures.

In ten patients an anomalous vessel was identified anteriorly crossing the uteropelvic junction. Two patients had concomitant lithiasis; the calculi were extracted at the time of pyeloplasty.

The average time in the operating room was 245 minutes and the mean hospital stay was five days.

There was no significant bleeding during the procedures and there was no injury of adjacent organs. Surgical conversion was necessary in one patient due to the presence of an intense inflammatory process, which made it impossible to suture the renal pelvis laparoscopically.

The bladder catheter was removed 24 hours after surgery and the double J catheter was removed, on average, nine weeks later. After its removal, all patients underwent ultrasonography of the kidneys and urinary tract or excretory urography at least 90 days after the surgery.

Postoperatively three patients experienced migration of the double-J catheter, requiring ureteroscopic intervention, and two patients had leakage of urine with the formation of a perinephric urinoma (Table 1). In one case the process resolved spontaneously; the other required a small lumbar incision to drain the collection. Two patients (8%) had recurrence of the ureteropelvic junction obstruction after surgery.

Results were evaluated after 90 days of postoperative follow-up in our outpatient clinic. Results were considered positive if the patients experienced had improvement in their symptoms, imaging studies demonstrating rapid emptying of the collecting system in question, or improvement of renal function.

The mean follow-up was 4.5 months. The clinical-radiological success rate was 92% with only two patients not demonstrating improvement during follow-up.

DISCUSSION

For years open pyeloplasty was considered the standard treatment for PUJ stenosis, with success rates of 90% to 100%. The morbidity associated with open procedures stimulated the development of minimally invasive techniques that sought to shorten time needed for recuperation, while reproducing the success rates of the prior technique (1).

Endoscopic treatment – using a retrograde or anterograde incision of the PUJ stenosis – is a therapeutic alternative. The success rate can be 10% to 30% lower compared to standard treatment, especially in those cases already involving hydronephrosis, renal insufficiency, a stenosis

Table 1 – *Complications.*

Complication	Frequency	%
Migration of the duplo J catheter	3	12
Urinoma	2	8

exceeding 2 cm, or an anomalous vessel.(5-6) The main complication of these techniques is the risk of vascular injury. The rate of anomalous vessels crossing the PUJ anteriorly ou posteriorly can reach 72.2%. These anomalous vessels can be injured during the procedure resulting in bleeding (7,8). Meretyk et al reported bleeding requiring transfusion in 9% and 16% of cases of anterograde and retrograde endopyelotomy respectively, and the formation of arteriovenous fistulas in 4% of patients who underwent antegrade surgery(9).

Laparoscopic pyeloplasty has quickly become a popular therapeutic option for the correction of PUJ stenosis due to its low morbidity and mortality, allowing the surgeon to reproduce open surgery with success rates ranging from 88% to 98%.(2) In 1993 Schussler and Gune performed the first laparoscopic pyeloplasty using the Anderson-Hynes dismembered technique.

Open pyeloplasty has been considered the standard treatment for PUJ stenosis for many years, with success rates of 90% to 100%. The morbidity associated with open procedures contributed to the development of minimally invasive techniques that were designed to hasten the patient's recovery, while maintaining the success rates of the prior technique.(1)

Two approaches – retroperitoneal and transperitoneal – can be used; the approach chosen usually reflects the surgeon's experience. Some urologists, however, favor the transperitoneal technique arguing that it more closely simulates anatomically the open procedure (10).

Soulie et al. reported the results of a multi-institutional study involving 55 laparoscopic pyeloplasties using the retroperitoneal approach. The conversion rate was 5.4%, the mean operative time was 185 minutes, and the complication rate was 12.7% (11).

The transperitoneal approach has been used in most cases. Recently, Jarrett et al published the results of first 100 pyeloplasty cases performed by his group using the transperitoneal approach. The mean operative time was 4.2 hours and the average blood loss was 181 ml. The mean hospital length of stay was 3.3 days. Complications occurred in 13 patients and two patients required blood transfusions. The success rate was 96% (12).

Our laparoscopic approach is transperitoneal using the Anderson-Hynes technique; it reproduces aspects of the standard open technique, with results similar to those in the literature.

According to some authors, the incidence of anomalous vessels can reach 72.5%. In our cohort, we found anomalous vessels crossing the anterior surface of the PUJ in nine (37.5%) patients.

The greatest difficulties associated with laparoscopic pyeloplasty were the long operative time and the necessity of having mastered the skill of intracavity suturing.

CONCLUSIONS

Laparoscopic pyeloplasty is a technically difficult procedure that has a learning curve of about 50 cases.

Our laparoscopic approach is initially transperitoneal, using the Anderson-Hynes technique, with results similar to those in the literature, even with a lower curve than recommended

We experienced greater technical difficulty with antegrade progression of the double-J catheter and with malposition (migration of the bladder end of the catheter into the ureter in three cases), which led us to change our approach, instead placing it cystoscopically (retrograde). Once we made this change, there were no further instances of postoperative double J catheter malposition.

RESUMO

Introdução: A primeira pieloplastia aberta desmembrada foi realizada por Kuster em 1891. Durante muitas décadas, a pieloplastia aberta foi considerada o tratamento de escolha para estenose da JUP. Incisões endoscópicas, anterógradas ou retrógradas surgiram como tratamentos alternativos, com taxas de sucesso entre 70-89%. Em 1993 Shussler e Gune realizaram a primeira pieloplastia laparoscópica pela técnica desmembrada e desde então, esta tem demonstrado taxas de êxito semelhantes aos da técnica aberta, porém com menor morbidade. **Objetivo:** Revisão dos pacientes submetidos à pieloplastia laparoscópica pela técnica de Anderson-Hynes, no Hospital Federal da Lagoa – Rio de Janeiro. **Materiais e Métodos:** Entre junho de 2008 e julho de 2011, vinte e quatro pacientes com diagnóstico de estenose de JUP, foram submetidos a pieloplastia laparoscópica desmembrada em nossa instituição.O diagnóstico de estenose de JUP foi determinado por anamnese, exame clínico e exames de imagem (TC, UGE ou cintilografia renal). A pieloplastia laparoscópica desmembrada transperitoneal pela técnica de Anderson Hynes com colocação de

três trocartes foi a utilizada em nosso serviço. Às vezes era necessário outro trocarte na linha axilar posterior para afastamento do cólon. **Resultados:** Um total de 24 pacientes foi submetido à pieloplastia laparoscópica no período em questão. Desses, 8 (33%) eram homens e 16 (67%) mulheres. A idade dos pacientes variou de 13 a 67 anos com média de 35 anos. A estenose apresentava-se à direita em 15 (60%) pacientes, à esquerda em 8 (32%) e bilateralmente em apenas 01 (8%) paciente, totalizando 25 casos. Vaso anômalo anteriormente a JUP foi identificado em 10 pacientes e 02 outros apresentavam doença litiásica concomitante. O tempo médio de cirurgia foi de 245 minutos e o período médio de internação hospitalar foi de 05 dias. No pós-operatório, três pacientes apresentaram migração da extremidade do cateter duplo J para dentro do ureter, e dois pacientes apresentaram extravasamento de urina com formação de urinoma perirenal sendo que em um delse foi necessário a realização de uma pequena lombotomia para drenagem da coleção. Dois (8%) pacientes apresentaram recorrência da obstrução da junção ureteropélvica após a cirurgia. O tempo de seguimento médio foi de 4,5 meses, variando de 3 a 6 meses. A taxa de sucesso clínico radiológico foi de 92%, com apenas 2 pacientes não apresentando bons resultados durante o seguimento. **Conclusão:** Nossa abordagem laparoscópica transperitoneal pela técnica de Anderson-Hynes apresentou resultados semelhantes aos da literatura, com baixas taxas de complicações. Detectamos uma maior dificuldade técnica de colocação do cateter duplo J de forma anterógrada e com posicionamento inadequado (migração da extremidade vesical do cateter para dentro do ureter), o que nos levou a mudar nossa abordagem, passando a aplicar este por via cistoscópica. Após esta mudança, não tivemos mais casos de mal posicionamento do cateter duplo J no pós-operatório.

Palavras Chave: Pieloplastia. Laparoscopia. Obstrução ureteral. Obstrução da junção ureteropélvica.

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Case Report

Intrahepatic Glissonian Approach for Laparoscopic Left Lateral Segmentectomy: Is it Worthwhile? Report on Six Cases

O Acesso Glissoniano Intra-Hepático para Segmentectomia Lateral Esquerda Laparoscópica: Ele Vale a Pena? Relato de Seis Casos Operados

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ABSTRACT

Background: Laparoscopic resection is considered the gold-standard approach for both benign and malignant neoplasms that arise in left hepatic lobe. Laparoscopic left lateral segmentectomy (LLLS) by means of an intrahepatic approach has emerged as an interesting alternative because it is fast and easy to perform and is associated with infrequent intraoperative bleeding. **Aim:** To report on a series of six patients who underwent LLLS by means of an intrahepatic Glissonian approach (IHGA) performed by a single surgical team at Santa Lucia Hospital, Brasilia, Federal District, Brazil. **Patients and Methods:** Six patients underwent LLLS between January 2009 and June 2011. The median age was 41 (range: 21 to 53 years). There were four women and two men. The etiologies of the lesions were: focal nodular hyperplasia (n=2), giant hemangioma (n=1) and metastasis (n=3). The mean lesion diameter was 4.6 cm (range 1.8 - 12 cm). **Results:** The mean duration of the procedure was 140 minutes (range 100-200 minutes). Mean intraoperative blood loss was 150 ml (range 50-600 ml). There was no mortality and the morbidity rate was 15%. The median hospital stay was three days (range 2-7 days). The median length of time taken to return to day-to-day activities was 12 days (range 7-30 days). **Conclusion**: LLLS by means of an intrahepatic Glissonian approach (IHGA) should be considered to be a good option for treating hepatic tumors located in the left hepatic lobe. This approach provides a safe and fast option that avoids large blood loss.

Key words: Laparoscopy. Hepatectomy. Liver neoplasms/surgery. Neoplastic metastasis.

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INTRODUCTION

The first successful laparoscopic anatomic hepatectomy was reported by Azagra et al in 1996.[1] It consisted of left lateral segmentectomy (segments II-III) by means of laparoscopy in a patient with a benign adenoma of the left hepatic lobe. After this initial procedure, laparoscopic left lateral segmentectomy (LLLS) became the mainstay for treating neoplasms located in the left hepatic lobe.[2-5,10] When performed by liver surgeons skilled in laparoscopic procedures, LLLS offers several advantages over open left lateral segmentectomy (OLLS).[2-5,10,11] Although no randomized trials have been conducted to compare LLLS with OLLS, case-controlled or cohort series have favored LLLS over OLLS in several aspects.[3,4,10] The main advantages are less postoperative pain, less use of opiate analgesia, better cosmetic results, decreased blood loss, and a shorter postoperative hospital stay.[3,4,10] With advances in laparoscopic instruments such as parenchyma transection devices, staplers and hand-assisted equipment, together with improved experience in laparoscopic liver resections, there has been increasing use of LLLS, especially in tertiary referral centers.[2-5,10] Many skilled surgeons at referral centers for laparoscopic liver resection consider LLLS to be their treatment of choice for left lobe lesions.[2,3,5] LLLS is a parenchyma-sparing procedure that can be used to treat hepatic neoplasms. Although LLLS was initially

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performed for treating benign lesions, this technique has recently also been used for treating malignant neoplasms. LLLS is an alternative of interest, compared with formal left hemihepatectomy, because when LLLS is indicated in selected cases, this leads to greater preservation of the remaining liver without comprising oncologic principles.[2-7,10,11] This is very important in the treatment of liver metastasis, because there is a high risk of hepatic recurrence after the first hepatic resection. Many patients with liver metastasis may require a second hepatectomy if recurrence occurs. Sparing or preserving hepatectomy may aid in cases in which a second resection becomes necessary, because there will be sufficient parenchymal liver for the subsequent hepatectomy, thereby avoiding postoperative liver failure.[7-14] Furthermore, since hepatocellular carcinoma (HCC) frequently arises in cases of cirrhotic liver, a more conservative procedure is also attractive since it avoids postoperative liver failure.[8-13] Classic LLLS by means of an anterior approach has generally been performed using a Pringle maneuver associated with formal hepatic transection, by means of ultrasonic devices or staplers.[2-6,10] Nevertheless, laparoscopic resection of the left liver segments using an intrahepatic Glissonian approach (IHGA), described recently in Brazil by Machado et al,[11] seems to be a very good option for accessing the left hepatic pedicle. IHGA may be safely used for performing LLLS without vascular hilar clamping. The main advantages of IHGA over the "classic procedure" are that it is faster and safer, with less bleeding. Machado et al.[11] showed that using IHGA when performing LLLS was an effective technique with good outcomes in Brazil. To our knowledge, there have not been any other reported studies using IHGA.

The aim of this study was to describe a small series of LLLS cases performed using an intrahepatic Glissonian approach. The six cases were performed by single surgical team responsible for treating liver neoplasms at a referral hospital in Brasilia, Brazil.

PATIENTS AND METHODS

Between January 2009 and June 2011, six LLLS procedures were carried out at Santa Lucia Hospital, in Brasilia, Brazil. All of the resections were performed by a single surgical team. Three of them were performed for benign hepatic lesions and the other three were for malignant lesions. The indications for laparoscopic resection of the benign liver tumors were symptomatic focal nodular hyperplasia (FNH) or hepatic hemangioma (HH). The primary site of the metastatic lesion was colorectal in one case and non-colorectal in two cases (kidney and small intestine). The surgical team considered the laparoscopic approach to be the approach of choice. For treating left lobe lesions, LLLS was chosen whenever possible (independent of tumor size or location). Abdominal ultrasonography, computed tomography and magnetic resonance imaging were obtained for all six patients. For malignant lesions, a PET-scan was also carried out. Assays for the tumor markers CEA, AFP and CA-19.9 were performed in all cases.

The surgical technique for LLLS using an intrahepatic Glissonian approach (IHGA) was based on technical principles described by Machado et al.[11] In general, the procedures were performed under pressured-controlled pneumoperitoneum using carbon dioxide, maintained at a positive pressure of 12-14 mmHg. A 30-degree optic laparoscope was used. Four or five port sites were used, depending on the case, and in accordance with the surgeon's preference and the intraoperative findings (Figure 1). After thorough inspection of the abdominal cavity, the liver was evaluated followed by identification of the lesion (Figure 2). A harmonic scalpel (Ultracision; Ethicon Endosurgery, USA) and a bipolar coagulator (Ligasure 10 mm; Covidien, USA) were used to perform the liver transection. Small vessels and biliary ducts were sealed using these devices, while major structures were sealed using metal clips. Major portal pedicles

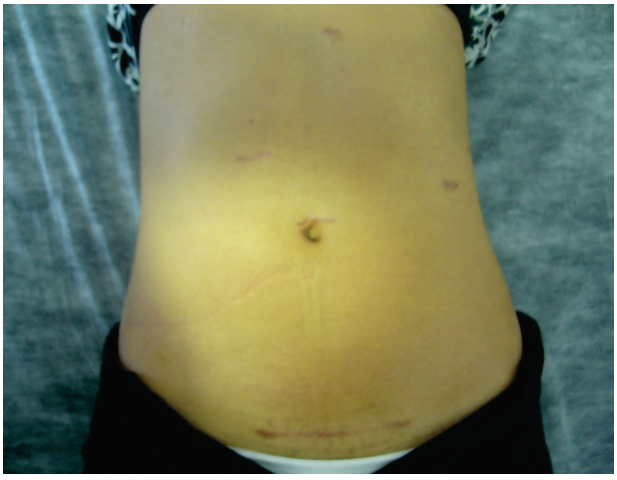

Figure 1 – *Port-site positiosn for LLLS and Pfannenstiel incision. (Late appearance: two months after the operation).*

and hepatic veins were divided using a linear stapler (Endogia – 30 or 45 mm – vascular type), as described by Machado et al.[11]

The principal techniques were standardized and identical in all of the operations. First, the pedicle of segments II and III was located by means of two small hepatotomy procedures (Figure 3), using the round ligament between segments II-III and the Arantius ligament (*ligamentum venosum*) as landmarks. The pedicle was clamped to demarcate the ischemic zone of the left lateral hepatic sector; demarcation of the ischemic zone just observed was performed quickly. After identifying the left lateral pedicle, Endogia vascular-type stapling was performed in order to section the hepatic parenchyma using a Ligasure 10 mm bipolar coagulator (five cases) or an Ultracision harmonic scalpel (one case). Finally, the left hepatic vein was sectioned using a vascular stapler, to complete the LLLS. All of the procedures, except one, were performed without the Pringle maneuver. The surgical specimen was placed into a plastic bag (Endobag) or gloves, which was then closed. The closed surgical specimen was removed by means of a Pfannenstiel incision or median mini-laparotomy. Abdominal drainage was generally not performed. Suction drains were used in only one case, the first.

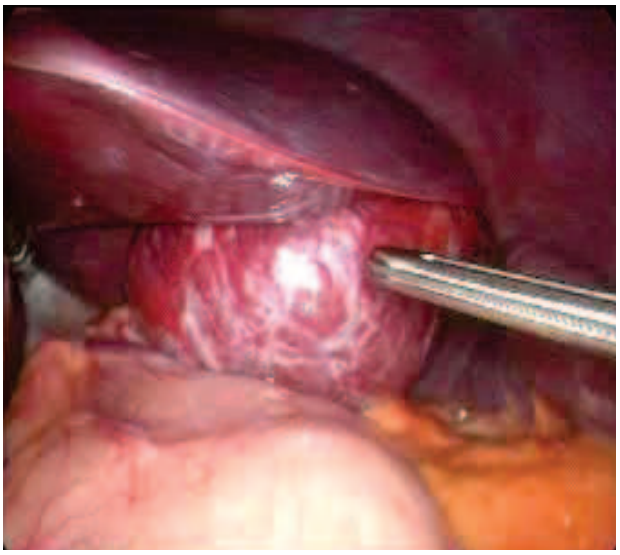

Figure 2 – *Liver evaluation - large Focal Nodular Hyperplasia (FNH) in the left hepatic lobe (segments II-III).*

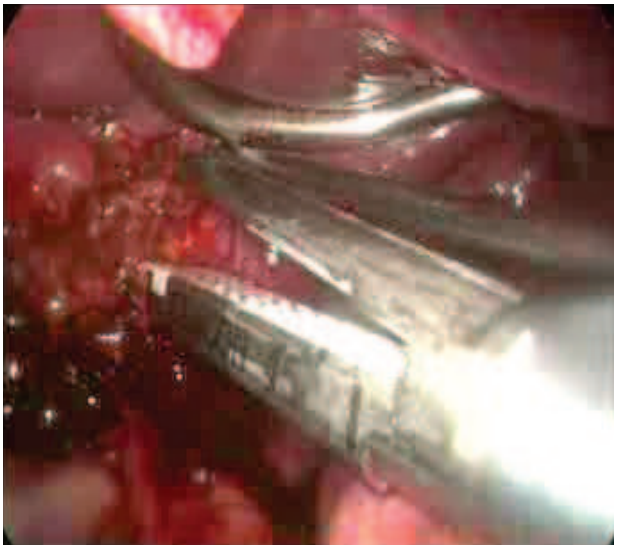

Figure 3 – *Intrahepatic Glissonian approach – Sectioning through hilar structures by means of vascular stapler (after two hepatotomy procedures).*

RESULTS

The characteristics of the six patients are shown in table 1. Preoperative imaging suggested a solid liver tumor in all six cases One patient underwent intraoperative frozen-section biopsy because the preoperative differential diagnosis included hepatocellular carcinoma; FNH was diagnosed in this case. For the patients with metastasis, the diagnosis was only confirmed through postoperative biopsy of the surgical specimen. Among the cases of benign tumors, typical features of HH and FNH were found preoperatively in two patients. All presented symptoms such as pain and discomfort. One patient had two foci of FNH. Histological examination confirmed the preoperative presumptive diagnosis in these patients.

The laparoscopic procedure was completed in five patients. There was one (15%) open conversion in this series, in the patient who had a giant (12 cm) hemangioma. The specific reason for the conversion was severe intraoperative bleeding. Five of the procedures were performed without vascular clamping (Pringle maneuver), while the open conversion case required total vascular exclusion of the liver in order to control the bleeding. In this case, a right subcostal incision was made to achieve hepatic vascular control.

Blood loss ranged from 50 to 600 ml (median 150 ml). The mean duration of the operation was 140 minutes (range 100-200 minutes). The most time-consuming operation in this series was the hepatic section using a harmonic scalpel (Ultracision, Ethicon Endosurgery, USA). The details of the hepatectomy procedures are presented in table 2.

There were no deaths in this series. There was one case of a late postoperative complication

Table 1 – *Patient Characteristics.*

Case	Gender	Age	Type of Neoplasm	Number	Diameter of largest lesion (cm)	ASA
1	female	58	FNH	1	6	1
2	female	23	FNH	2	12	1
3	male	50	CRM	3	3	2
4	female	41	NCRM (adenocarcinoma of the small bowel)	2	3	1
5	female	54	NCRM (kidney)	2	3	1
6	male	48	Hemangioma	1	12	1

FNH – Focal Nodular Hyperplasia, CRM – Colorectal metastasis, NCRM – Non-colorectal metastasis, ASA – American Society of Anesthesiologists.

(incisional hernia), which was also corrected by means of a laparoscopic procedure. Major postoperative morbidity occurred in 15%. The patient who underwent open conversion required postoperative blood transfusions (two packets of red corpuscles). There was no gas embolism. One patient (the first in this series) underwent surgical drainage of the liver bed by means of a suction drain. The drain was taken out on the second postoperative day. All six patients resumed oral intake on the first postoperative day. The median hospital stay was three days (range 2-7 days). Five patients needed low doses of common analgesics during their postoperative course (median: three days). Only one patient – the one who underwent open conversion – required narcotic analgesia. The median length of time taken to return to normal activities was 12 days (range 7-30 days). In the three patients with malignant neoplasms the histological examination showed free margins. One patient with colorectal metastasis in both lobes underwent two-stage hepatectomy: LLLS followed two months later by laparoscopic right hepatectomy. Adjuvant chemotherapy was administered to two patients. The mean length of follow-up in this series was 15 months (median 18 months; range 2-30 months). All the symptomatic patients achieved complete relief of their symptoms. In the three patients who had metastatic tumors removed there was no recurrence. These findings are shown in table 3.

DISCUSSION

Although laparoscopic hepatectomy (LH) is generally considered to be a complex laparoscopic

Table 2 - *Surgical Features.*

Feature	Number of Patients
Vascular clamping	1 (5)
Mean intraoperative blood loss in milliliters (range)	150 (50-600)
Transfusions received	1 (5)
Mean duration of operation in minutes (range)	140 (100-200)
Mean weight of the surgical specimen in grams (range)	265 (200-370)

Table 3 - Postoperative course.

	Number of patients (%)
Morbidity	1 (15%)
Mortality	0 (0%)
Median hospital stay, in days (range)	3 (2-7)
Median time taken to return to normal activities, in days (range)	12 (7-30)

procedure, LLLS is nonetheless considered by many experts to be the easiest laparoscopic anatomic hepatic resection to perform. In many published series worldwide, LLLS is one of the most-performed types of LH.[7,9] When LH started to be used in the late 1990s, the main type of laparoscopic hepatic resection was segmentectomy, or even non-anatomical resections in lesions arising in easily accessible hepatic segments such as II, III, IVB, V and VI.[7] Thus, because of anatomic accessibility, LLLS has been considered to be the ideal anatomic resection as the initial training operation for liver surgeons.[1-6] In this way, LLLS is generally the initial LH that is carried out along the learning curve.[4] LLLS offers the general advantages of LH, namely less postoperative pain, fewer peritoneal adhesions, a shorter hospital stay, and an earlier return to daily activities.[6,7,9] Additionally, in comparison with open hepatectomy, LH has less blood loss, reduced morbidity, and fewer operative complications,[1-10] The few studies that have compared LLLS and OLLS are case-control or cohort series; there have been no randomized trials to date.[3,4,10] Specifically with regard to LLLS for treating hepatic tumors, no significant difference in morbidity or mortality has been found when compared with OLLS.[2-6,10] Furthermore, the cosmetic advantages of LLLS are excellent, which is important given that most benign tumors occur in young women.[2-5] In a small cohort study Carswell et al.[4] showed that LLLS has several advantages over OLLS: LLLS was better than OLLS in comparisons of postoperative analgesia and postoperative in-hospital stay. In a small case-control study comparing LLLS and OLLS, Campos et al[3] showed that the morbidity and mortality were similar. According to these authors, LLLS is superior to OLLS because it involves both less operating time and a shorter postoperative hospital stay. Campos et al[3] also took the view that left lateral segmentectomy should be carried out laparoscopically in centers with great expertise. In a case-control study, Lesurtel et al observed that the outcomes were similar between LLLS and OLLS. Both the morbidity and the mortality rates were similar between the groups, except for blood loss, which was less in the LLLS group. The LLLS group did not present any specific complications from hepatic resection. Earlier resumption of oral intake may also be an advantage, considering that, in a general manner, hepatectomy is a major surgical procedure.[6,8,9] For these reasons, LLLS should be considered for treating lesions in segments II-III, for management both of benign and malignant liver disease.[2-7] Several authors[2-6,10,11] have taken the view that LLLS is as safe as conventional OLLS.

Laparoscopic IHGA for performing LLLS as proposed by Machado et al.,[11] is an interesting and safe alternative which spares the liver parenchyma, while adhering to the oncologic principles of the open technique. In the present series, as shown by Machado et al[11] and despite the small sample, LLLS by means of IHGA was found to be both a safe and a quick procedure, with minimal blood loss. The median operative time was shorter than in other series, perhaps because IHGA can facilitate hilar dissection of the main hepatic pedicle. In general, blood loss during LH varies, both center to center and case-by-case. Blood loss in our LLLS series was less than reported in the literature, where it ranges from 200 to 400 ml.[7] Therefore, like Machado et al,[11] we believe that IHGA leads to less blood loss than is seen in "classical" LLLS. In our opinion, a randomized trial should be conducted to resolve this question. Blood loss tends to be lower in laparoscopic hepatectomy (LH) than in open hepatectomy (OH), resulting in lower requirements for blood transfusion.[7] As in the Machado et al series,[11] there was no mortality and low morbidity. The technique used by this author to access the left pedicle by means of an intrahepatic route is, in our opinion, both simple and easy to do. As with the open approach to the left pedicle, LLLS using an intrahepatic Glissonian approach spares hepatic parenchyma and thus minimizes the intraoperative bleeding. Furthermore, with this approach a well-defined ischemic zone for segments II-III is observed, which confers greater safety.[11] Another great advantage of this technique over classical LLLS using the anterior approach is the possibility of gaining rapid and precise access to the Glissonian sheath of segments II-III, which leads to easy resection of these segments.[11]

We believe, therefore, that the Ligasure 10 mm bipolar coagulator (Covidien, USA) results in a faster procedure than when a harmonic scalpel, such as the Ultracision, is used. When compared with the

Machado et al series,[11] the procedures in the present study were faster, probably due to the technical modification of using the Ligasure 10 mm bipolar coagulator (Covidien, USA) in all but one case. One great advantage of intrahepatic Glissonian LLLS for resecting segments II-III is that it generally avoids Pringle's maneuver.[11] Pringle's maneuver has been associated with ischemia-reperfusion complications that have been linked to major postoperative morbidity.[7] In the present series only one patient with a giant hemangioma needed Pringle's maneuver, and this was because of profuse intraoperative bleeding during the surgical resection. This patient was the only case that underwent open conversion, which accounts for the 15% rate. A similar conversion rate was reported by Carswell et al.[4] In general, conversion rates from LH to open surgery have ranged from 2 to 15%.[7] These rates have been correlated with both lesion volume and lesion location. The single case requiring conversion consisted of a giant (12 cm) intrahepatic hemangioma that presented profuse intraoperative bleeding. The most frequent cause of open conversion in the literature is extensive intraoperative bleeding, which is generally very difficult to control during a laparoscopic approach.[7] As in the study by Chang et al,[5] one patient in our series developed an incisional hernia; this too was corrected laparoscopically. There were no instances of bile leakage, an experience similar to other studies.[2,3,5,7] We believe that bile leakage will be an uncommon complication in LH. According to Edwin et al,[7] this complication occurs in around 1.5% of LH cases, which is a smaller rate than in OH cases.

As with others authors,[2-5,10] we observed that there were no deaths in our series. Thus we believe that LLLS is a safe procedure. When LLLS is performed by means of IHGA, as described by Machado et al,[11] the results are excellent, with no mortality. Mortality from LH is less than 1%.[7,9] The mortality rates depend on the team's expertise, type of resection, lesion location and patients' clinical conditions.[7,9]

Uncertainty surrounds the long-term outcomes from laparoscopic liver-sparing resections to treat cancer, because the results are very preliminary. Lack of palpation sensitivity is a critical point in all laparoscopic procedures.[9-14] In some series, narrow margins have been reported more frequently. We found that there were no comprised margins in the segmentectomies performed on malignant lesions.[7] Despite the initial skepticism about the use of LLLS to treat malignant neoplasms, it is now routinely performed because this procedure is considered safe and effective.[2-7,10,11] LLLS can spare the parenchyma – which is an important consideration when treating malignant neoplasms because intrahepatic recurrence is relatively frequent.[2-7, 11] Although malignant liver tumors may recur, LLLS may be useful because it facilitates concomitant multiple resections in one-stage or two-stage hepatectomies.[11,12] In our series, as also reported by Machado et al,[12] one patient underwent two-stage hepatectomy to treat colorectal metastases in both lobes. The patient first underwent LLLS by means of an IHGA, and then, two months later, the laparoscopic right hepatectomy was performed. The postoperative course was good, and we did not observe any tumor recurrence. To date, for malignant disease, studies have suggested that there are no differences between LLLS and OLLS in relation to port-site metastasis, free margins, local-systemic recurrence or even survival rates.[2-5] However, there have been few studies, thus little formal evidence. In the present series, although there has been no tumor recurrence, the follow-up was short. Cohort series have shown that, in general, there is no difference between classical LLLS and OLLS for treating malignant disease or even HL.[2-5,8-13] These findings, however, should be considered preliminary; we should await additional studies to answer these questions more definitively. We believe that IHGA is a good option for treating left lobe tumors by laparoscopic left lobectomy. Nevertheless, new randomized trials are necessary to compare the IHGA and the classic approach to answer definitively which is superior when performing LLLS.

CONCLUSION

LLLS by means of an intrahepatic Glissonian approach is a good option for treating tumors located in the left hepatic lobe (segments II-III). This approach is both a safe and an expeditious option that avoids large blood loss.

RESUMO

Introdução: A ressecção laparoscópica de neoplasias no lobo hepático esquerdo tem sido considerada padrão-ouro para o tratamento de lesões hepáticas tanto benignas quanto malignas. Segmentectomia lateral esquerda laparoscópica (SLEL) por acesso intra-hepático tem sido uma alternativa interessante em virtude da facilidade, rapidez e pouco sangramento intra-operatório. **Objetivo –** Relatar uma série de seis casos de doentes submetidos à segmentectomia lateral esquerda laparoscópica (SLEL) por acesso intra-hepático Glissoniano realizada por uma única equipe do Hospital Santa Lucia em Brasília, Distrito Federal, Brasil. **Pacientes e Métodos** – Os doentes foram operados entre Janeiro de 2009 a Junho de 2011. A idade variou de 21 a 53 anos (med. 49). Foram quatro mulheres e dois homens. A etiologia das lesões foi: hiperplasia nodular focal (n=2), hemangioma gigante (n=1) e metástases (n=3). A média do tamanho das lesões foi 4,6 cm (variação de 1,8 a 12 cm). **Resultados -** A média de tempo cirúrgico foi de 140 minutos (variação de 100 a 200 minutos). A média de sangramento intra-operatório foi de 150 ml (variação de 50 a 600 ml). Não houve mortalidade e a morbidade foi de 15 %. A mediana de internação foi de três dias (variação de 2 a 7 dias). A mediana de retorno às atividades cotidianas foi de 12 dias (variação de 7 a 30 dias). **Conclusão** – A SLEL por acesso Glissoniano intra-hepático deve ser considerada uma boa opção tática para o tratamento dos tumores hepáticos situados no lobo esquerdo. Esse acesso representa uma opção segura e rápida que evita grande sangramento.

Palavras-Chave: Laparoscopia. Hepatectomia. Neoplasias Hepáticas/Cirurgia. Metástaseneoplásica.

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20 a 22 setembro 2012

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