

Laparoscopic Treatment of Obstrutive Uropathy Due to Retrocaval Ureter: Literature Review and Case Report

Tratamento Laparoscópico da Uropatia Obstrutiva por Ureter Retrocaval: Revisão e Relato de Caso

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ABSTRACT

Introduction: The retrocaval ureter, also known as circuncaval ureter, was first reported by Hochestetter in 1893. This rare anomaly is caused by an error in the embryonic development of the inferior vena cava. Congenital abnormalities that result in obstruction of the ureter are uncommon; however, the ureter retrocaval is the most common malformation arising from a venous abnormality. **Propose:** The aim of this article is to report our experience in laparoscopic treatment of obstructive uropathy due to retrocaval ureter, and perform a review of the literature. **Methods:** A PubMed search was performed for studies published between 1990-2013, on the surgical treatment of obstructive uropathy due to the presence of retrocaval ureter. A 42 years old male patient with symptoms of back and right flank pain associated with repeated urinary infection was diagnosed with retrocaval ureter. CT imaging revealed the middle segment of the right ureter in a retrocaval position, explaining the obstruction. The laparoscopic transperitoneal technique was used by our service. **Results:** Operative time was 210 minutes. There were no intraoperative complications or significant bleeding; estimated blood loss was 230 ml. Postoperative control was carried out using laboratory tests and CT imaging, which revealed a significant decrease in the hydronephrosis. **Conclusion:** Transperitoneal laparoscopic approach is an excellent option for treatment of obstructive uropathy by retrocaval ureter with the advantages of minimally invasive procedures.

Key words: Ureter. Retrocaval ureter. Laparoscopy. Hand assisted laparoscopy and Surgical procedures.

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INTRODUCTION

The retrocaval ureter, also known as circuncaval ureter, was first described by Hochestetter.[1] This rare anomaly – caused by an error in embryonic development of the inferior vena cava (IVC) – has an estimated incidence of 1 in 1000 live births. It occurs when the fetal posterior cardinal vein does not regress, and the inferior vena cava develops anterior to the ureter, displacing it medially.[2] Congenital abnormalities that result in obstruction of the ureter are uncommon; however, the retrocaval ureter is the most common malformation arising from a venous abnormality.[3]

This kind of anomaly is usually observed on the right side; it occurs 2.8 times more frequently in males. Although a congenital malformation, symptoms typically first present in the third or fourth decade of life.[4] Retrocaval ureter is associated with upper urinary tract obstruction, ureterhydronephrosis and related symptoms.[5]

There are two types of retrocaval ureter: type I which is the most prevalent and has an S-shape or hook appearance; and type II, which has a sickle shape.[6]

Surgical intervention in symptomatic cases is recommended and has traditionally been treated by laparotomy. With advances in laparoscopic and robotic

surgery, minimally invasive approaches are become preferred due to lower morbidity, shorter hospitalizations, and excellent cosmetic results.[7]

PROPOSE

The aim of this article is to systematically review the literature and report our experience with the laparoscopic treatment of obstructive uropathy due to the presence of a retrocaval ureter.

METHODS

A search of the PubMed database was conducted for studies published between 1990 and 2013 about the surgical treatment of obstructive uropathy due to the presence of a retrocaval ureter. The descriptors used included: ureter, ureter diseases, the term “retrocaval ureter”, laparoscopy, hand assisted laparoscopy, surgery and video-assisted surgery. Details of the search: (((“ureter”[MeSH Terms] OR “ureter”[All Fields]) OR (“ureter”[MeSH Terms] OR “ureter”[All Fields]) AND (“disease”[MeSH Terms] OR “disease”[All Fields] OR “diseases”[All Fields]) OR “retrocaval ureter”[All Fields]) AND (“laparoscopy”[MeSH Terms] OR “laparoscopy”[All Fields] OR “hand assisted laparoscopy”[All Fields] OR “surgery”[Subheading] OR “surgery”[All Fields] OR “surgical procedures, operative”[MeSH Terms] OR (“surgical”[All Fields] AND “procedures”[All Fields] AND “operative”[All Fields]) OR “operative surgical procedures”[All Fields] OR “surgery”[All Fields] OR “general surgery”[MeSH Terms] OR (“general”[All Fields] AND “surgery”[All Fields]) OR “general

surgery”[All Fields] OR “video-assisted surgery”[All Fields]) AND “Venae Cavae”[Mesh]) AND (“1990/01/01”[PDAT] : “2013/12/31”[PDAT]).

CASE REPORT

A 42 year old male with symptoms of back and right flank pain associated with repeated urinary tract infections had been diagnosed with right ureterolithiasis one year before our first evaluation. He denied hematuria or other symptoms. The patient had no comorbid conditions; he had undergone inguinal herniorrhaphy when he was 18. In 2009, he was referred to the Urology Department of the Hospital Federal da Lagoa.

Blood count, urinalysis (abnormal elements and sediment), sodium, potassium, urea, and creatinine were normal.

Abdominal ultrasound revealed grade III / IV right hydronephrosis. Excretory urography showed late excretion in the right kidney and right ureterohydronephrosis. The remainder of the ureter was not visualized. This study also revealed duplication of the left ureter. Pelvic CT imaging findings included high obstruction of the ureter, right ureterolithiasis and left pyelocaliceal and ureteral duplication. The CT also showed that the medial segment of the right ureter was in a retrocaval position, providing an etiology for the obstructive symptoms (Figure 1).

SURGICAL TECHNIQUE

The patient underwent routine preoperative evaluation and was hospitalized the day before the surgery. He received intravenous hydration, an

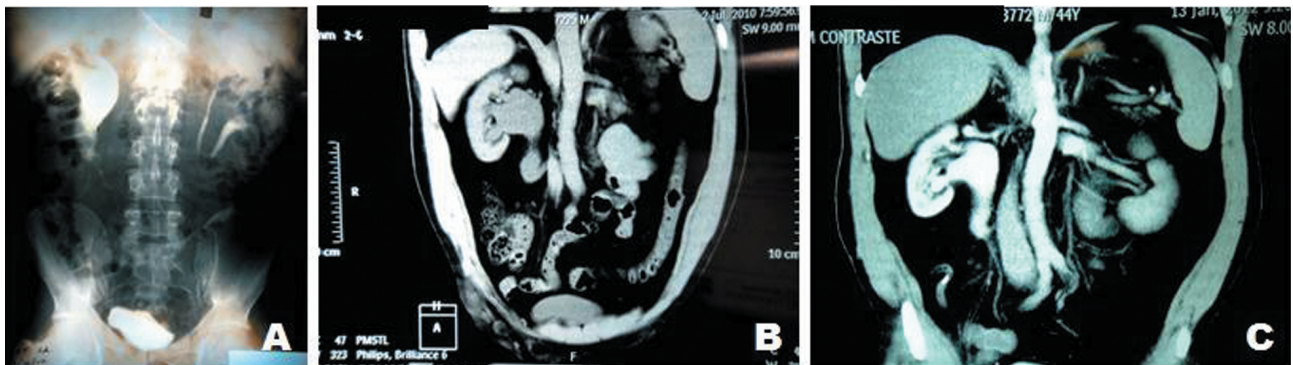


Figure 1 - A – Excretory urography: right ureterohydronephrosis and left ureteral duplication. B – CT-scan without contrast. C – CT with contrast: middle segment of the right ureter in a retrocaval position.

unrestricted diet, and fasted for eight hours before the procedure. Antibiotic prophylaxis – 1 gram of cephalothin intravenously – was administered at induction of general anesthesia with endotracheal intubation.

The laparoscopic transperitoneal technique is used by our service (Figure 2). After positioning the patient in the left lateral position, antisepsis and placement of sterile drapes, the surgical procedure was initiated. First, a 1.5 cm right pararectal incision was made at the level of the umbilicus, followed by opening of the aponeurosis, muscle dissection, opening of the peritoneum and introduction of first 10 mm trocar under direct vision by Hasson's technique.

Pneumoperitoneum is established with insufflation of carbon dioxide (CO₂) at a pressure ranging from 12 to 15 mmHg. Once the abdomen is distended, three trocars are inserted, guided under endoscopic view. A 10 mm trocar was placed 1 cm below the costal margin and a 5 mm trocar near the iliac crest. A third trocar, placed below the xiphoid process, enabled the liver to be lateralized.

After incision in Toldt's line, the Gerota fascia was incised longitudinally; retroperitoneal and perirenal fat were dissected to reveal the face of the right kidney. The dilated renal pelvis, ureter and upper vena cava were identified and fully isolated. The retrocaval and interaortocaval segments of the ureter were completely

released and spatulated laterally above the ureteropelvic junction, and then transposed to the front of the IVC. Anastomosis was performed with sutures on each side of the pelvis using 4-0 polyglactin.

After completing the suturing of the rear wall, a JJ stent was passed through a puncture in the flank with a 14G venous catheter, positioned to reach the bladder and subsequently anastomosis of the anterior wall has ended. Hemostasis was checked carefully, and a suction drain was placed in the abdominal cavity. The CO₂ was evacuated and the ports closed (Figure 3).

RESULTS

The surgery was concluded laparoscopically, without conversion to open technique. Operative time was 210 minutes. There were no intraoperative complications or significant bleeding; estimated blood loss was 230 ml. The abdominal drain was removed 72 hours after surgery. There was no sign of a urinary fistula throughout the postoperative period. The Foley catheter was removed 48 hours after surgery. The hospital stay was 96 hours. Recovery was uneventful, and pain was easily controlled during the postoperative period, and there were no others symptoms. The JJ stent was removed after 4 weeks. Postoperative control was carried out using laboratory tests and CT

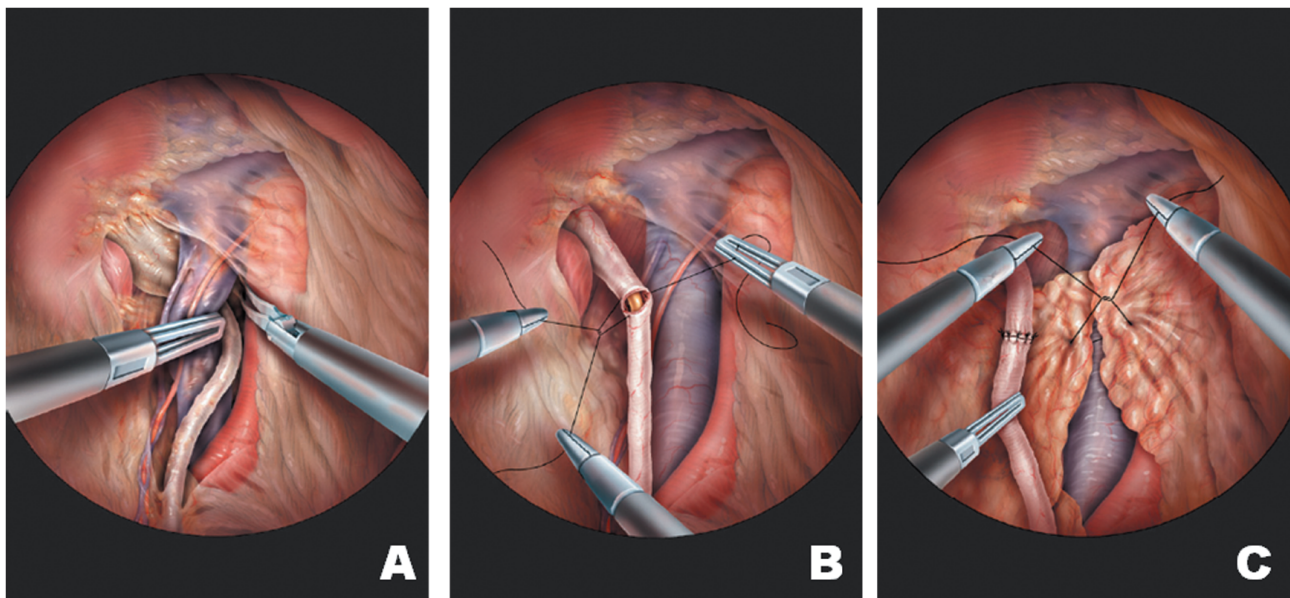


Figure 2 - Use of these images has been authorized by Mr. Stephan Spitzer. A - The ureter is identified. The renal pelvis and ureteropelvic junction (UPJ) are dissected laterally to the inferior vena cava (IVC). B - The UPJ is sectioned obliquely in the lateral border of the vena cava. The retrocaval segment of the ureter is transposed anterior to the IVC and the neoureteropyelostomy is sutured with 4-0 polygalactin. C - Adipose tissue is interposed between the neanastomosis and IVC.

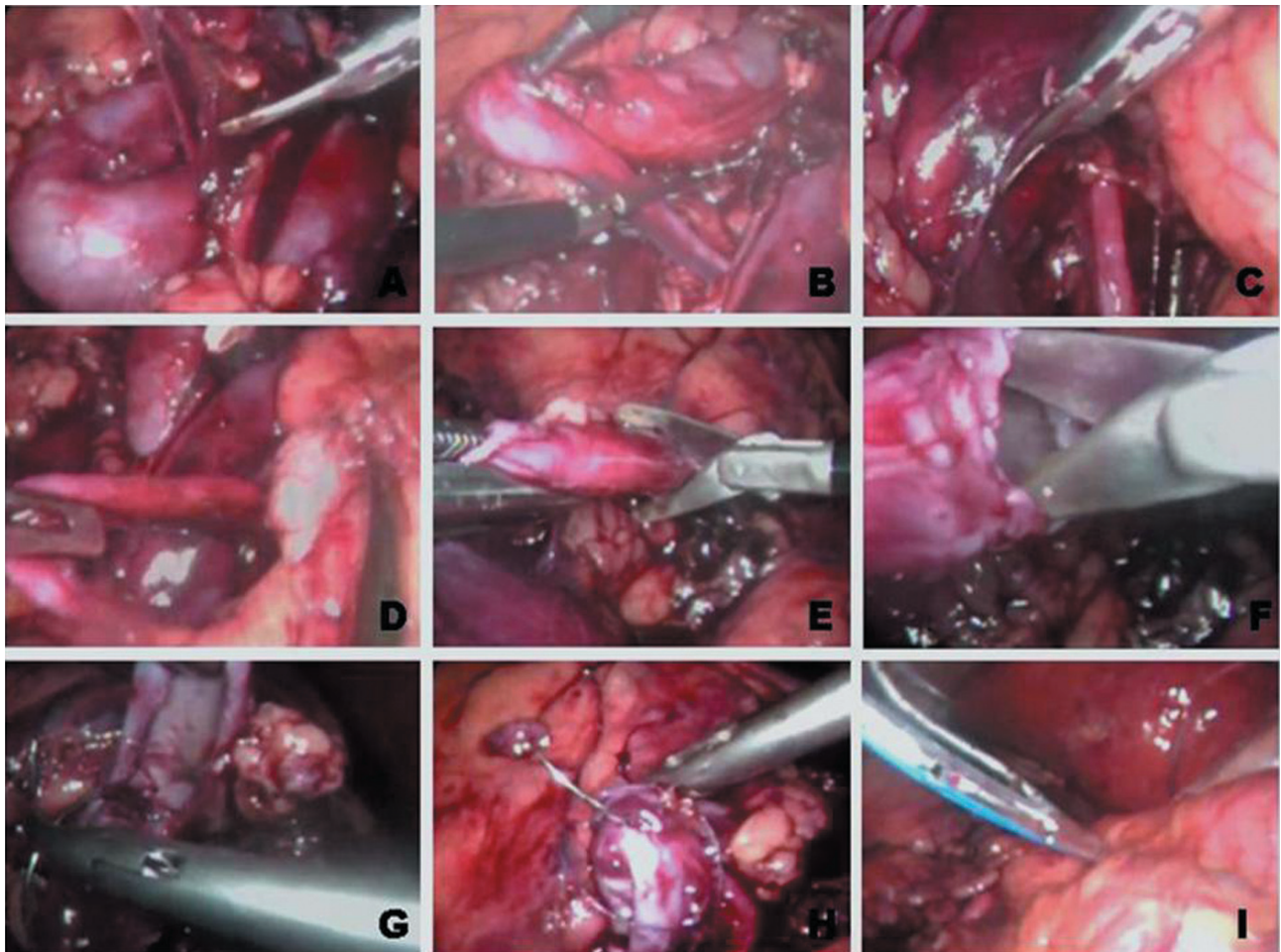


Figure 3 - A and B - The dilated proximal ureter was mobilized. C and D - The ureter was identified in the region interaortocaval and dissected caudally. E and F - The distal ureter was tooled. G and H - A tension-free anastomosis was performed with 4-0 polyglactin suture. I - Adipose tissue is interposed between the neoanastomose and VCI.

imaging, which showed a significant decrease in the hydronephrosis. Six months after surgery, the patient had no complaints of pain or other symptoms (Table 1).

DISCUSSION

The preureteral vena cava is an abnormality commonly known as a retrocaval or circuncaval ureter, terms that are anatomically descriptive but misleading with respect to embryonic development. Retrocaval ureter is a rare congenital anomaly resulting from the persistence of the posterior cardinal veins during embryonic development of the vena cava.[8]

The inferior vena cava (IVC) is formed during a number of veins changes primitive stem. Initially, venous system is in retroperitoneal vessels allocated symmetrically, central and dorsally. Posterior cardinal and

Table 1 - Laparoscopic treatment of obstructive uropathy due to retrocaval ureter.

Operating time (min)	210
Estimated Blood loss (ml)	230
Foley catheter (hours)	48
Drain (hours)	72
Length of stay (hours)	96
JJ stent (days)	30
Complications	0

supracardinal veins migrate dorsally while the veins subcardinal migrate ventrally. Normally, the left subcardinal veins and the lumbar segment of the right posterior cardinal vein atrophy. The final location of the inferior vena cava is on the right side because it develops from the right supracardinal vein. If there is no atrophy of the subcardinal vein and it becomes a major vein of

the right side, the ureter is stuck dorsally.[9] In this context, it is evident that the ureter runs circumcaval due to developmental venous vascular changes rather than errors in ureteral development. Thus the term preureteral vena cava would be more appropriate.[8]

The first description of retrocaval ureter is attributed to Hochstetter in 1893.[1] This is a very rare congenital anomaly with an incidence of 1 per 1000 births, and is 2.8 times more frequent in males. The patient operated on by our service was male, 42 at diagnosis, which is consistent with the literary data, which point to the third and fourth decades of life as the period of increased incidence.[4]

There are two forms of retrocaval ureter: type I: most prevalent and which has the shape of an “S” hook and type II or scythe. Type I is more severe and typically corresponds to 90% of cases. Type II may be asymptomatic and corresponds to 10% of the cases.[6] Our patient had a type I S-shaped retrocaval ureter.

Retrocaval ureter typically affects the right; however in cases of situs inversus and duplication of the vena cava it can be seen on the left side.[10] In our case the anomaly was located on the right side.

When a patient experiences symptoms – pain, recurrent infection, hematuria, increased slag, or lithiasis – surgical intervention is indicated.[11] In our case, the patient had pain and recurrent UTIs as the principal clinical manifestations.

Ultrasonography (USG) showed grade III hydronephrosis. Renogram showed delayed excretion and decreased function of the affected kidney. Finally, CT imaging revealed the middle third of the right ureter in a retrocaval position, establishing the cause of the obstruction. Therefore, surgical treatment was recommended.

Abdominal ultrasonography demonstrates varying degrees of hydronephrosis. The intravenous pyelogram (IVP) usually does not show the middle and distal ureter; consequently a retrograde ureteropyelography is required to confirm the diagnosis. Computed tomography (CT) can visualize the close proximity of the ureter and inferior vena cava.[12] Magnetic resonance imaging (MRI) can be an alternative to CT to avoid exposing the patient to radiation.[13] Initially, the diagnosis of retrocaval ureter was carried out by means of intravenous urography or retrograde pyelography. Currently, with the development of imaging methods, the 3D-CT scan and MRI have become favored diagnostic modalities. In our case, the diagnosis was established by means of 3D-CT.[14]

The natural history of non-surgical retrocaval ureter is not known. Hydronephrosis and ureteral dilatation

at diagnosis should encourage us to intervene promptly. Surgical treatment should be chosen before pyelocaliceal dilatation or any deterioration of renal function.[15]

Differential diagnoses includes retroperitoneal fibrosis and retroperitoneal mass displacing the ureters from its normal course. CT imaging of the abdomen and pelvis is useful to exclude these conditions.

Retrocaval ureter was traditionally operated by laparotomy. However, the reduced bleed loss and postoperative pain, shorter convalescence, and earlier return to regular activities has contributed to the rapid adoption of minimally invasive surgery.

The first laparoscopic surgery for retrocaval ureter was performed by Baba et al in 1994.[16] Their approach is used most often due to a higher transperitoneal operative field and greater anatomical resemblance when compared with the retroperitoneal approach.[17,18] This latter technique has an advantage, since it prevents the leakage of urine into the abdominal cavity by urinary fistula. However, the surgical field is quite limited.[19,20] Recently, with the development of the DaVinci surgical robotic, surgery has become a viable – although not widely available – treatment option.[21]

The largest number of cases described in the literature is a report by an Iranian group whose 13 patients underwent surgical repair between 1983 and 2005 [14].

Data from the literature shows experiments with two types of procedures: the pyeloureterostomy and ureteroureterostomy, the former being slightly more frequent. Xu, et al in 2009 performed 7 cases of laparoscopic ureteroureterosmy mean time 128.6 minutes and no reported complications.[11]

In 2012, Chen, et al, reported having performed five pyeloureterostomies with complications. Mean surgical time was 90.2 ± 34.4 minutes.[22] Our group performed one pyeloureterostomy with a transperitoneal operative time of approximately 210 minutes and no complications. Guo-qing et al in 2012 reported blood loss of less than 60ml. Alkhudair et al, in 2012, described blood loss of less than 100ml, while Chen et al reported average losses of 50 mL.[22,23,14] The estimated blood loss in our case was 230 ml.

Chen et al reported that the catheter was removed in 5 days. Hospital stay ranged from 1.6 to 6.5 days. The control urography performed between 3 to 6 months after surgery showed no evidence now obstruction [22]. In our institution, patient remained with JJ stent for 30 days and was discharged after four days. In six months was new CT scan showed no more evidence of hydronephrosis or renal function deterioration.

CONCLUSION

Retrocaval ureter is a rare congenital anomaly often associated with uretero-hydronephrosis. When symptomatic it has traditionally been treated by laparotomy, however technical improvements, advances in laparoscopic and robotic surgical equipment, as well as the experience of the surgeons,

have led to an increase in the use of minimally invasive techniques for the correction of this anomaly. The transperitoneal laparoscopic approach is an excellent option for the treatment of obstructive uropathy due to retrocaval ureter, affording the advantages of minimally invasive procedures including less intraoperative bleeding, an earlier return to normal activities, and a more aesthetic result.

RESUMO

Introdução: O ureter retrocaval, também conhecido como ureter circuncaval, foi descrito pela primeira vez por Hochstetter em 1893 e corresponde a uma anomalia rara causada por um erro no desenvolvimento embrionário da veia cava inferior. Anomalias congênitas que resultam em obstrução do ureter são incomuns, no entanto, o ureter retrocaval é a malformação mais comum decorrente de uma alteração venosa. **Objetivo:** Apresentar a nossa experiência no tratamento laparoscópico da uropatia obstrutiva por ureter retrocaval, e realizar uma revisão sobre tema. **Materiais e Métodos:** Uma pesquisa no PubMed foi realizada entre 1990-2013, referente ao tratamento cirúrgico das uropatias devido à presença do ureter retrocaval. Nosso caso refere-se a um paciente do sexo masculino de 42 anos com sintomas de dor lombar e flanco direito, associado à infecção urinária de repetição. A tomografia computadorizada demonstrou a porção média do ureter direito em uma posição retrocaval, explicando a etiologia da obstrução. O tratamento laparoscópico transperitoneal foi a técnica cirúrgica utilizada em nossos serviços. **Resultados:** O tempo operatório foi de 210 minutos, com um sangramento de 230 ml. Não houve complicações intra-operatórias ou sangramento significativo. O seguimento pós-operatório foi realizado por meio de exames laboratoriais e tomografia computadorizada, que revelou uma diminuição significativa da hidronefrose anteriormente observada. **Conclusão:** A abordagem laparoscópica transperitoneal é uma excelente opção para o tratamento da uropatia obstrutiva por ureter retrocaval com as vantagens dos procedimentos minimamente invasivos já conhecidos.

Palavras-Chave: Ureter retrocaval, uropatia obstrutiva, laparoscopia e tratamento cirúrgico.

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Author Disclosure Statement:

No competing financial interests exist.

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