

Laparoscopically Assisted Retroperitoneal Spinal Surgery

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ABSTRACT

Background: Laparoscopically assisted spinal surgery has been reported in several series to be safe and effective. We completed a retrospective chart review of patients who underwent laparoscopically assisted retroperitoneal spinal surgery.

Methods: Between April 1996 and June 2004, 124 patients underwent laparoscopically assisted anterior spinal fusion with a retroperitoneal and gasless approach with a variety of orthopedic devices. Sixty patients were male, 64 were female, and the mean age was 40. Access to the retroperitoneal space is obtained using a balloon dissector and midline trocars, similar to that for TEP hernia repairs. An additional trocar is placed laterally to complete the dissection along the anterior spine. The procedure is then converted to a gasless technique using wound protectors in the midline and laterally. The laparoscope, a balloon retractor, and a lifting device are placed through the lateral incision. The orthopedic instrumentation is placed through the midline incision.

Results: Mean operative time and estimated blood loss were 165 minutes and 205 mL, respectively. The conversion rate was 8.9% (6/11 occurred in the first 20 cases). Mean length of stay was 3.0 days. The complication rate was 5.6%, and included iliac vein injury (3), postoperative ileus (2), and need for posterior fusion during the same hospital stay (2).

Conclusion: Laparoscopically assisted retroperitoneal spinal surgery is safe and reproducible. This technique allows for the benefits of a minimally invasive approach, but also for multi-level exposure, complete discectomy, endplate removal, and placement of conventional orthopedic devices.

Key Words: Laparoscopy, Anterior lumbar fusion, Bal-

loon dissection, Gasless endoscopy.

INTRODUCTION

Lower back pain and degenerative disc disease are common problems that lead to long-term disability and significant health-care costs. Anterior interbody fusion techniques have been performed for several decades. The laparoscopic approach to anterior spinal surgery was originally published as a case report in 1991 followed by a series of 21 patients in 1994, using pneumoperitoneum and a transperitoneal approach.^{1,2} Laparoscopically assisted retroperitoneal spinal surgery has now been reported in several series to be safe and effective.^{3,4,5} This balloon-assisted endoscopic retroperitoneal gasless (BERG) technique has been developed to allow for multi-level spinal exposure and control of associated vasculature, complete discectomy, and endplate removal, and placement of conventional orthopedic devices. These procedures have evolved to allow for an extraperitoneal and gasless approach with the coordination of the laparoscopic surgeon and spine surgeon. We update our initial experience from 1997 using a balloon-assisted and gasless technique for retroperitoneal anterior lumbar fusion.³

METHODS

We completed a retrospective chart review of patients who underwent laparoscopically assisted retroperitoneal spinal surgery during an 8-year period. Institutional review board approval was obtained before chart review.

Surgical Technique

The patient is placed on a standard fluoroscopy ready table in the supine position with the arms secured across the chest. Access to the retroperitoneal space is obtained using a transverse 1-cm incision just below the umbilicus, similar to TEP hernia repairs. The anterior rectus sheath is incised on the left, and the rectus muscle is retracted laterally. A balloon dissector is inserted deep to the rectus muscle to develop the preperitoneal space under direct vision by using a 10-mm 0° laparoscope. A blunt balloon-

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tipped port then replaces the balloon dissector, and the space is insufflated with CO₂ gas. The 10-mm 45° laparoscope is then used for the remainder of the procedure. Two 5-mm ports are then placed in the midline by using a single 3-cm incision at the skin level. Blunt dissection is performed laterally to retract the peritoneum and identify the left common iliac vessels and psoas muscle. A 10-mm trocar is then placed laterally just off the anterior iliac spine. The laparoscope is inserted through this lateral port and dissection is performed anterior to the spine to expose the appropriate disc spaces. The procedure is then converted to a gasless technique. The previous midline incision is opened into the preperitoneal space, and the lateral incision is enlarged to 3 cm. Wound protectors are placed in the midline and laterally. The laparoscope, a long-handled balloon retractor (Extrahand - Autosuture/Tyco Healthcare Group LP, Norwalk, CT), and a lifting device (Laparolift - Origin Medasystems Inc., Merlo Park, CA and Laparofan - Autosuture/Tyco Healthcare Group LP, Norwalk, CT) are placed through the lateral incision. A Kittner dissector or suction/irrigator through the lateral incision and a long, angled retractor through the midline incision are used to retract the vascular structures as needed. The aortic bifurcation and common iliac vessels are identified and retracted to expose the appropriate disc space. Smaller vascular branches are controlled using bipolar cautery. Standard discectomy, endplate removal, and placement of desired orthopedic devices are then accomplished through the midline incision. The incisions allow for placement of cages and end plates for fixation. Vertebral body screws are placed through the anterior incision, which provides appropriate access to all levels. Disc replacement has not been attempted with the laparoscopic approach. Standard radiography is used to verify the appropriate disc space, as well as demonstrate appropriate fusion. All 3 incisions are closed at the fascial and skin levels.

RESULTS

Between April 1996 and June 2004, 124 patients underwent laparoscopically assisted anterior spinal fusion using a retroperitoneal approach and a variety of orthopedic devices. One orthopedic surgeon (S.R.) and 1 of 3 laparoscopic surgeons participated in the cases. Sixty patients were male, 64 were female, and the mean age was 40.

Ninety-one percent of cases involved a single level disc space with the majority involving L5-S1, and 11 patients underwent multi-level exposure and fixation. Twenty-two percent of patients underwent a concurrent posterior pro-

cedure. Mean operative time was 165 minutes and estimated blood loss was 205 mL for the anterior cases. Mean operative time for the last 50 cases was 114 minutes. Each additional level of fusion added approximately 30 minutes to the procedure. The conversion rate was 8.9%, but 6/11 conversions occurred in the first 20 cases. Reasons for conversion included peritoneal tears, poor visualization, and bleeding.

Mean length of stay was 3.0 days (typical length of stay for the open procedure is 4 days). The acute complication rate was 5.6% and included iliac vein injury,³ postoperative ileus,² and need for posterior fusion during the same hospital stay.² Two of the 3 iliac vein injuries required conversion to open procedures. The third vascular injury was controlled with laparoscopic clips. The 2 vascular injuries requiring conversion to open did not require transfusion. Iliac vein injury was related to retraction (AO vein retractor is most commonly used), but did not occur more commonly than with the open technique. Injuries occurred sporadically during the series and did not reflect the learning curve.

DISCUSSION

Laparoscopy has changed the approach to many procedures that require access to intraabdominal and retroperitoneal structures. Benefits of minimally invasive surgery in general include decreased postoperative pain, shorter hospital stays, decreased blood loss, and more rapid return to normal activity.

Multiple reports exist regarding the laparoscopic approach to spine surgery. Our experience was first reported in 1997 and included both the transperitoneal and retroperitoneal approaches.³ We now report our experience with 124 cases using the retroperitoneal and gasless technique with dissection similar to that of TEP hernia repairs. Initially a 1-balloon technique was used to perform the posterior and lateral dissection. The anterior dissection

Table 1.
Disc Space Fused

Disc Space	n	%
L3-L4	2	1.6
L4-L5	37	29.8
L5-S1	74	59.7
Multi-level	11	8.9
Total	124	

was performed bluntly, which led to a large number of peritoneal tears and poor visualization (6/11 conversions to open occurred in the first 20 cases). The 2-balloon technique has allowed for more controlled exposure and a lower conversion rate. In addition, once the retroperitoneal procedure was converted to a gasless technique, the orthopedic surgeon was free to use conventional orthopedic instrumentation and implants. In addition, the transperitoneal approach requires the use of pneumoperitoneum and retraction of the bowel, and exposure to the L3-L5 spaces can be more difficult. The retroperitoneal and gasless technique allows for similar exposure as that of an open technique but still allows for the benefits of the minimally invasive approach.

Exposure to the L5-S1 disc space is technically easiest with exposure below the aortic bifurcation. The middle sacral vessels are easily controlled with bipolar cautery. The left iliac vessels can then be retracted to the left of the spine for exposure to the appropriate disc space. Exposure of the L4-L5 disc space can be technically more challenging. Retraction of the left common iliac artery and vein to the right of the spine requires control of segmental vessels that often tether the major vessels to the left side of the spine. The iliolumbar vein can require ligation to facilitate exposure of the L4-L5 space. Bipolar cautery is most often used for hemostasis and avoids clips, which can be easily dislodged and lead to significant bleeding. Exposure of the L3-L4 space is similar to the exposure for L4-L5, except that the midline incision may need to be extended slightly.

Outcome data are difficult to measure, but additional study is certainly required for long-term follow-up and comparison with open techniques. Furthermore, informa-

tion regarding postoperative pain management, return to normal activities, long-term complications, and cost-effectiveness is also needed. Thalgott et al⁴ report at least 2-year clinical follow-up and fusion rates for the first 50 patients in their series, but no randomized or prospective data exist for comparing the open and laparoscopic approaches. Although the above issues are not directly addressed in this series, it is clear that laparoscopically assisted retroperitoneal spinal surgery is technically safe and reproducible, especially after the learning curve has been established. The procedure allows for the potential benefits of a minimally invasive approach, but also for multi-level exposure, conventional discectomy and endplate removal, and placement of traditional orthopedic instruments and implants.

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