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Laparoscopic lumbar sympathectomy

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Abstract
Background: Lumbar sympathectomy retains a role in the treatment of patients with causalgia, Symptomatic vasospasm, and nonreconstructable arterial occlusive disease. Open surgical sympathectomy, with its attendant morbidities, remains the standard. Chemical sympathectomy has been introduced as a less invasive means of achieving sympatholysis. However, this has been associated with incomplete and transient denervation.
Methods: We present a series of five lumbar sympathectomies performed laparoscopically.
Results: All patients sustained symptomatic relief and no postoperative complications were noted. Postoperative skin thermometry and resistance measurements confirmed adequacy of sympatholysis.
Conclusion: We conclude that lumbar sympathectomy can be performed laparoscopically. Our preferred technique is now the extraperitoneal approach. Such an approach combines the durability and reliability of standard open sympathectomy with the minimal invasiveness of laparoscopic surgery.

Key words: Laparoscopic — Lumbar — Sympathectomy

Lumbar sympathectomy was first popularized for symptomatic vasospasms by Adson and Brown in the United States and Diez in South America in the 1920s. Subsequently, it enjoyed a period of popularity during which time it was applied to arterial occlusive disease as well. With the development of arterial reconstructive techniques in the 1960s, its use has diminished. However, it still remains a role in the treatment of patients with unreconstructable arterial occlusive disease, symptomatic vasospasm unresponsive to medications, and causalgia [1, 4].

Percutaneous lumbar sympathectomy by radiologically guided injections of phenol or alcohol has been increasingly popular in Europe. Radiofrequency ablation has also been used with some success. However, incomplete sympathectomy and return of sympathetic tone remain the significant limitations with these modalities [4].

Laparoscopically performed lumbar sympathectomy promises all the advantages of a minimally invasive approach without the inconsistent therapeutic results of percutaneous ablation techniques [10]. However, there has as of yet been no description of a laparoscopic approach to this particular operation. Here we describe our technique of laparoscopic lumbar sympathectomy and present five patients who have undergone this operation.

Methods and materials

Five patients underwent laparoscopic lumbar sympathectomy. Four of the patients were diabetic males aged 29–54 years with known unreconstructable peripheral arterial disease. The predominant presenting symptoms were unilateral pain and lower extremity coldness. The fifth patient was a 27-year-old man with severe right foot rest pain and dry gangrene of the big toe. He also experienced intermittent vasospastic-like symptoms including right leg coldness. He had a 20-year history of smoking two packs of cigarettes per day and 7-year heroin addiction.

Physical examination of the fifth patient revealed a blood pressure of 122/80 mmHg, absent pulses below the right knee, and marked hyperhidrosis below the right ankle. His right great toe had dry gangrene. The admission hemoglobin, white blood count, coagulation profile, and serum chemistry were all within normal limits. A right femoral angiogram revealed occlusion of the popliteral artery with reconstitution of the distal anterior tibial artery. A femoral-to-anterior-tibial-artery reverse saphenous-vein bypass graft was performed without relief of the foot pain or the hyperhidrosis.

This initial experience with laparoscopic sympathectomy was through an anterior transperitoneal approach. In this approach, the patient was placed in a lateral position, with the table broken between the ribs and the iliac crest. The surgeon stood in front of the patient, with a first assistant on the opposite side. A Veress needle (Ethicon Endosurgery, Cincinnati, Ohio) was inserted at the edge of the rectus sheath in line with the umbilicus. The abdomen was then insufflated with carbon dioxide and a 10-mm port was inserted at the site of the Veress needle and used for the laparoscope. Under direct vision, two secondary ports, one 5 mm and one 10 mm, were then inserted in the midclavicular line. If required, a fourth port (5 mm) was placed halfway between the umbilicus and the symphysis pubis. This port was used for a fan retractor to displace the kidney and colon medially. The lateral peritoneal attachments of the right or left colon were then incised from the hepatic or splenic flexure down to the pelvic brim. The colon was then reflected medially by virtue of gravity. The kidney, including the perirenal fat and adrenal gland, was then dissected from the retroperitoneum and then medially rotated to expose the anterolateral sur-

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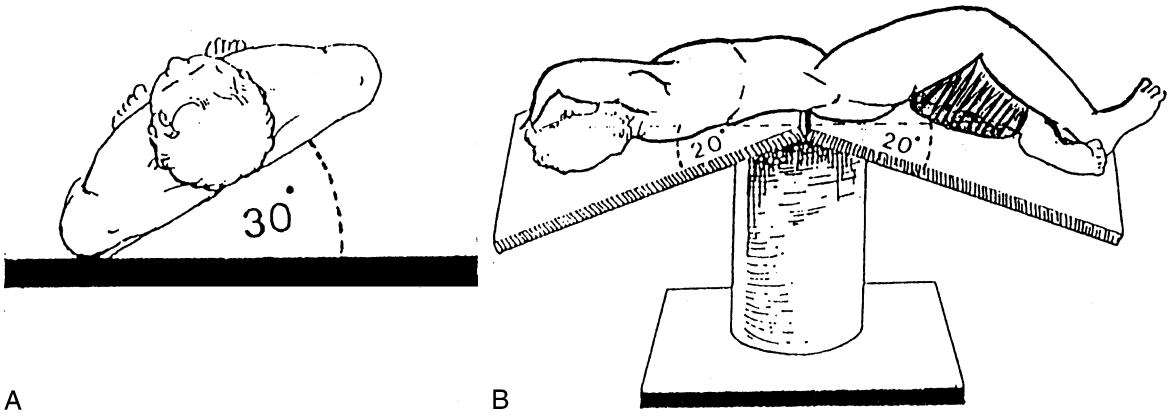

Fig. 1. Patient positioning: **A:** Supine position with the right side supported 30° upward. **B** The thighs are flexed 20° and the table is flexed 20°.

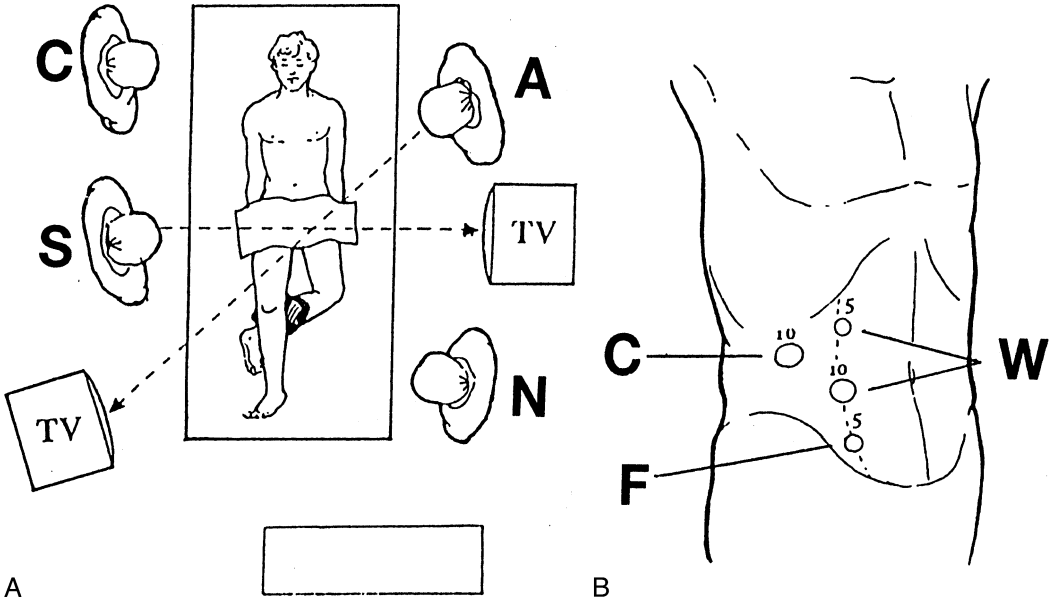

Fig. 2. The operative setup: **A** shows position of primary surgeon (*S*), camera operator (*C*), assistant (*A*), and scrub nurse (*N*). **B** Port placements for camera (*C*), fan retractor (*F*), and working instruments (*W*).

face of the vertebral column. The second lumbar ganlion, lying below the renal pedicle, was then identified and lifted away from the vertebra. The upper end of the sympathetic chain was clipped and transected, and the rami communicantes were dissected free and secured with clips. The dissection then proceeded inferiorly until the iliac arteries were encountered. The chain was then clipped, transected, and removed. A closed suction drain was placed at the end of the procedure.

After initial experience with the anterior transperitoneal approach to lumbar sympathectomy, the approach was modified to remain completely extraperitoneal. For a right extraperitoneal lumbar sympathectomy, the patient was placed on a bean bag with the right side supported to 30° (Fig. 1A). The table was then flexed 20°, and the thighs were flexed to 20° to relieve tension on the psoas muscle (Fig. 1B). The surgeon stood on the right of the patient with an assistant on the left (Fig. 2A). An 11-mm transverse incision was made above the anterior superor iliac spine in line with the umbilicus. This was deepened in a muscle-splitting manner until a finger could be gently pushed over the peritoneum into the retroperitoneal space. The space was then further developed by digital dissection alternating with the use of a standard open ''peanut'' dissector. A blunt-tip 10–11-mm port was then inserted through the incision and a pursestring suture was used to secure it into position. The retroperitoneal space was then insufflated with carbon dioxide to a pressure of 13 mmHg, and this pneumodissection completed the development of the retroperitoneal space. A 30° laparoscope (Karl Storz, Tuttlingten, Germany) was introduced to inspect the retroperitoneal space, and under direct vision to avoid peritoneal violation, two secondary ports were inserted at the edge of the rectus sheath in a triangulated fashion to allow the surgeon to operate with two hands. A fourth port was used to place a nontraumatic retractor (Ethicon Inc., Cincinnati, Ohio) (Fig. 2B).

The anatomic landmarks for the adequate exposure of the right side include the inferior vena cava medially as it runs over the right side of the vertebral bodies. The right renal vein forms the superior extent of the dissection, and the right psoas muscle and the inferior pole of the kidney form the lateral extent. The sympathetic chain is located between the inferior vena cava and the psoas muscle.

Dissection of the L2 sympathetic ganglion was again started below the renal pedicle (Fig. 3). The upper end of the sympathetic chain was then identified, clipped, and transected. The rami communicantes were likewise dissected, clipped, and transected (Fig. 4). One lumbar vein was encountered and was carefully ligated with two clips and divided. The sympathetic chain was divided at the level of the common iliac artery with the specimen sent for pathologic examination. Great caution was taken to preserve the first lumbar ganglion in order to preserve sexual function. No drains were used at the end of the procedure.

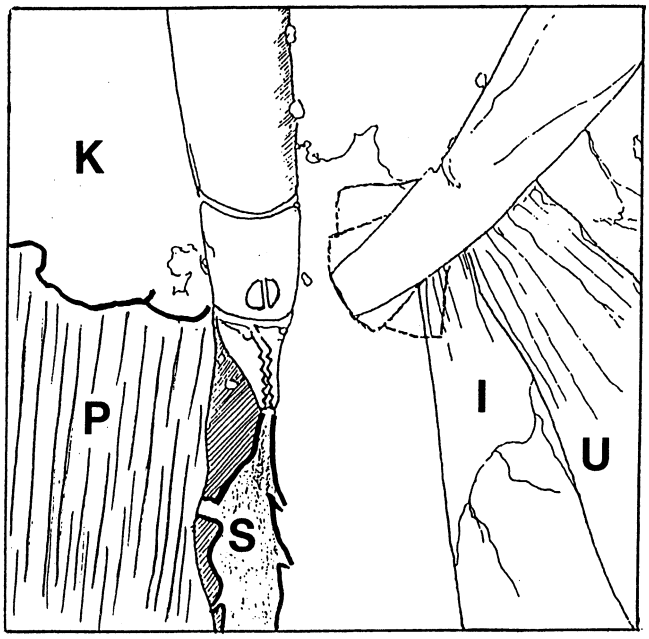

Fig. 3. Intraoperative exposure of the right sympathetic chain (*S*) completely free from its retroperitoneal attachments. Inferior vena cava (*I*) is medially retracted by an atraumatic retractor. The psoas muscle (*P*), lower pole of right kidney (*K*), and ureter (U) are seen.

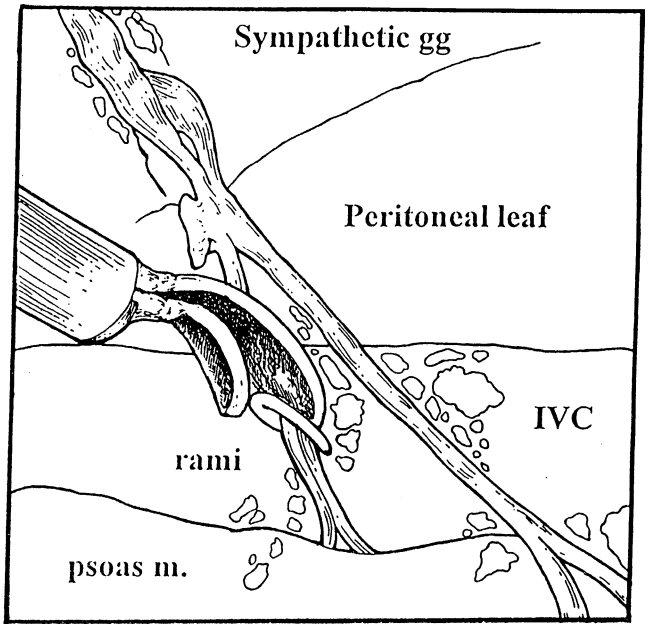

Fig. 4. Division of sympathetic chain between clips.

Results

A total of five patients underwent laparoscopic lumbar sympathectomy. An anterior transperitoneal approach was used for the first four patients, and the last patient underwent an extraperitoneal procedure. The mean operating time for the transperitoneal approach was 126 min (range 75–140 min), and the operating time for the extraperitoneal approach was 145 min. Pathologic examination of all of the specimens demonstrated removal of the sympathectic chain. No parenteral analgesics were either requested or administered postoperatively. The patients resumed oral intake on the following morning, and all had resumed normal activity by the end of the 1st postoperative week. Postoperative radiographs demonstrated the positions of clips placed during the procedure (Fig. 5).

Skin thermometry and resistance measurements were done on the last patient. Preoperatively, his skin temperature on the affected right side was 35.6°C, compared to 37.2° on the left side. Ten days postoperatively, the temperatures were 37.2 and 37.0°, respectively. Skin resistance measurements were made on the medial aspect of the foot using electrodes spaced 5 cm apart. Five measurements were taken at each site. The mean resistance on the right foot preoperatively was 0.581 MΩ, compared to 15.9 on the left. Postoperatively, the values were 12.1 and 8.31, respectively.

At 1 month postoperatively, no patients complained of neuralgia, and no male patients reported sexual dysfunction. All patients reported relief of their rest pain and improvement of trophic changes in the affected extremity. The one patient with a nonhealing ulcer demonstrated the ulcer to be healing.

Discussion

Lumbar sympathectomy has been performed for a variety of indications although its role has diminished with the success of infrapopliteal arterial reconstruction and newer pharmacologic management of vasospasm and caulsalgia. Nevertheless, a significant number of patients still present with nonreconstructable arterial occlusive disease, symptomatic vasospasm, or caulsalgia not responsive to medical therapy. Open lumbar sympathectomy, with all the inherent drawbacks of open surgery, remains the standard of care for these patients.

Chemical sympathectomy by means of percutaneous radiologically guided injections of phenol or alcohol has been performed with some success. However, these techniques have been plagued with inconsistent results, particularly concerning the duration of sympathectomy block. There is also a significant incidence of incomplete block and injection-site pain. Furthermore, multiple injections can cause enough inflammation to preclude subsequent surgical sympathectomy.

The use of laparoscopic techniques to perform a standard sympathectomy brings together the advantages of minimally invasive surgery and the reliability of an established open procedure. Our initial experience was with the transperitoneal approach since newly described laparoscopic procedures on retroperitoneal structures have primarily used this approach [2, 6, 7–9]. Furthermore, early attempts at direct retroperitoneal laparoscopy by Wickham and Mille were unsuccessful [11]. Although the transperitoneal approach to this operation has been successful in our hands, a retroperitoneal approach would be preferable due to fewer long-term complications resulting from intraabdominal adhesion formation.

An effective minimally invasive retroperitoneal route has recently been described by Gaur [5]. Other authors have

Fig. 5. Postoperative X-ray demonstrating position of clips and adequate levels of transection of the ganglionic chain.

also used a dissecting balloon placed through a small incision into the retroperitoneal space [3]. We have not used this balloon in order to limit the cost of the procedure, as blunt finger dissection and insufflation created an adequate working space. As the technology evolves and the cost of a dissecting balloon becomes lower, its use can facilitate and speed the creation of the retroperitoneal space. One pitfall of the retroperitoneal approach is the potential violation of the peritoneum, which can occur particularly upon insertion of trocars. This can be avoided by excellent direct visualization during introduction of trocars.

Following exposure of the retroperioneum, the remainder of the operation proceeds as in the open surgery, and the laparoscopic dissection is essentially identical. Retraction of the large vessels such as the inferior vena cava on the right side and the aorta on the left side should be performed with extreme caution using atraumatic retractors handled by an experienced assistant.

In conclusion, we believe that laparoscopic retroperitoneal lumbar sympathectomy is a safe and technically achievable operation for the experienced laparoscopic surgeon. Excellent clinical outcome appears to be comparable to that of the open procedure with all the advantages of a minimally invasive approach. A larger clinical experience and long-term follow-up will ultimately determine if this will become the procedure of choice.

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