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SURGICAL ENDOSCOPY and Other Interventional Techniques

Laparoscopic lumbar sympathectomy for lower-limb disease

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Abstract
Background: The standard procedure for sympathectomy is open surgery. The oblique retroperitoneal approach is popular because it provides good visibility, albeit at the expense of requiring a long skin incision. Chemical sympathectomy has been introduced as a less invasive means of achieving sympatholysis; however, this method is also associated with a significant incidence of incomplete block and transient denervation. Laparoscopic surgery is a new approach that simplifies various surgical procedures. The aim of our report was to evaluate the benefits of endoscopic retroperitoneal surgery for lumbar sympathectomies.
Methods: Between March 1997 and April 2000, seven patients underwent laparoscopic lumbar sympathectomy in our department (all men, with an average age or 45.1 years). The predominant presenting symptoms were unilateral pain at rest and lower-extremity coldness. Symphaectomy was performed using a retroperitoneal approach on six patients and an anterior transperitoneal approach on one patient. After laparoscopic lumbar sympathectomy, skin thermometry was carried out on all patients.
Results: The postoperative skin temperature of the affected leg rose to 36.6 ± 0.5°C, as compared to 33.8 ± 0.8°C preoperatively. After laparoscopic lumbar sympathectomy, none of the patients complained of neuralgia. All patients achieved sustained symptomatic relief, and no major postoperative complications were noted.
Conclusions: Lumbar sympathectomy can be performed laparoscopically. Currently, our standard technique is the retroperitoneal approach. More clinical experience and long-term follow-up will ultimately determine if this will become the procedure of choice. However, we believe that a learning period is necessary for this technique to be fully mastered.

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Key words: Laparoscopy — Lumbar sympathectomy — Buerger's disease — Raynaud's disease — Lower extremities — Spine

Open lumbar sympathectomy, with all the inherent drawbacks of open surgery's, still the standard treatment for patients who present with nonreconstructable arterial occlusive disease, symptomatic vasospasm, causalgia, or reflex sympathetic dystrophy not responsive to medical therapy [2]. An oblique retroperitoneal approach is popular because it provides good visibility, albeit at the expense of requiring a long skin incision. Percutaneous lumbar sympathectomy using injections of phenol or alcohol has become increasingly popular. Radiofrequency ablation has also been used with some success. However, incomplete sympathectomy and a return of sympathetic tone are significant limitations of these methods [3]. Laparoscopicsurgery is a new procedure that has been used to simplify different surgical procedures. As better instrumentation is developed, more complicated surgical procedures are being performed. However, there have been few reports describing laparoscopic lumbar sympathectomy [7]. Here we report our own experience with laparoscopic lumbar sympathectomy.

Patients and methods

Our study population consisted of seven adult patients who underwent laparoscopic lumbar sympathectomy. Patients were enrolled in the study between March 1997 and April 2000. All patients were male. The patients' ages at the time of operation ranged from 26 to 67 years, with an average age of 45.1 ± 15.8 years (mean ± standard deviation [SD]). The preoperative diagnosis was thromboangitis obliterance (Buerger's disease) in three patients, Raynaud's disease in three patients, and reflex sympathetic dystrophy in one patient. The affected lower extremity was on the right in four patients and the left in three patients. The predominant presenting symptoms were unilateral pain at rest and lower extremity burn. Clinical details and patient histories

Table 1. Patient information

Patient no.	Age (yr)	Sex	Disease	Affected leg	Symptom
1	40	male	Buerger's disease	left	pain at rest
2	26	male	Buerger's disease	right	pain at rest
3	46	male	Reflex sympathetic dystrophy	left	pain at rest, burn
4	60	male	Raynaud's disease	right	pain at rest
5	67	male	Buerger's disease	left	pain at rest
6	51	male	Raynaud's disease	right	pain at rest
7	26	male	Raynaud's disease	right	pain at rest

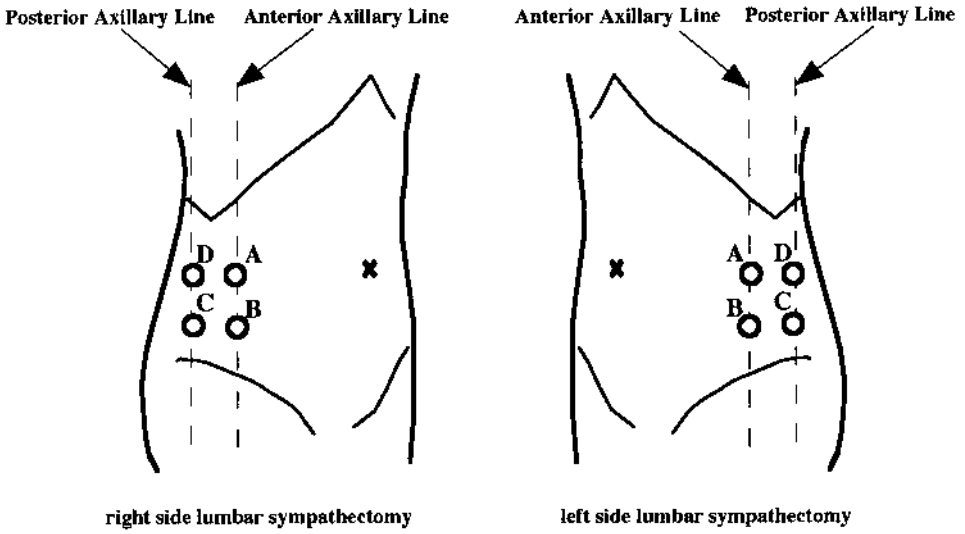

Fig. 1. Schematic drawing showing the sites of the trocars: **A** level of the umbilicus on the anterior axillary line, **B** 4 cm below the level of the umbilicus on the anterior axillary line, **C** 4 cm below the level of the umbilicus on the posterior axillary line, **D** level of the umbilicus on the posterior axillary line.

are summarized in Table 1. Skin thermometry was carried out on all patients.

Surgical techniques

Retroperitoneal lumbar sympathectomy.

The patient was placed in a lateral position. The table was then flexed to spread a space between the 11th rib and the ileum.

An 2–3-cm transverse incision was made at the level of the umbilicus on the anterior axillary line. The external and internal oblique abdominal muscles and transverse abdominalis were divided bluntly. This division was deepened in a muscle-splitting manner until a finger could be gently pushed over the peritoneum into the retroperitoneal space. The space was developed by digital dissection, alternating with the use of an endopeanut dissector. The retroperitoneal space was then insufflated with carbon dioxide (CO_2) to a pressure of 8 cmH_2O. This pneumodissection completed the development of the retroperitoneal space.

A laparoscope was introduced to inspect the retroperitoneal space, and two secondary ports were inserted 4 cm below the level of the umbilicus on the posterior and anterior axillary line. A fourth port was used to place a nontraumatic retractor at the level of the umbilicus on the posterior axillary line. Figure 1 shows the site of trocars.

The anatomic landmarks for the adequate exposure of the right side include the inferior vena cava as it runs medially over the right side of the vertebral bodies; 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. The sympathetic chain at the level of L2–L3 could be clearly seen inside the psoas muscle insertion by pushing the iliac vessels on the left side. To confirm that this was indeed the L2–L3 sympathetic ganglion, the upper end of the sympathetic chain was clipped and examined with an intraoperative abdominal radiograph. Transection of the L2 and L3 sympathetic ganglion was done using an ultrasonically activated scalpel (Harmonic Scalpel; Ethicon Endosurgery, Cincinnati, OH, USA). The rami communicantes were also transected. A closed suction drain was fitted at the end of the procedure.

Anterior transperitoneal right lumbar sympathectomy.

In our fourth case, we used an anterior transperitoneal approach because a cholecystectomy had to be performed at the same time. For the right retroperitoneal lumbar sympathectomy and cholecystectomy, the patient was placed with the right side supported. After the standard laparoscopic cholecystectomy, the table was then flexed to spread a space between the 11th rib and the ileum. The lateral peritoneal attachments of the right colon were incised from the hepatic flexure down to the pelvic brim. The colon was then reflected medially through the force of gravity. The L2 lumbar ganglion, lying below the renal pedicle, was identified and lifted away from the vertebra. Methods of confirming and transecting the L2–L3 sympathetic ganglion were the same as in the retroperitoneal approach. A closed suction drain was fitted at the end of the procedure.

Results

The operative details are summarized in Table 2. The procedures were performed with the patients under general anesthesia. A total of seven patients underwent single-sided laparoscopic lumbar sympathectomy. A retroperitoneal approach was used for six patients and an anterior transperitoneal approach for one patient. Three patients who underwent the retroperitoneal procedure had a right-side lumbar sympathectomy, and three had a left-side lumbar sympathectomy. The mean

Table 2. Outcome of laparoscopic lumbar sympathectomy

Patient no.	Site of sympathectomy	Duration of operation (min)	Approach	Additional operation	Procedural complications	Postoperative symptoms
1	left L2–L3	237	R	—	none	free
2	right L2–L3	136	R	—	none	free
3	left L2–L3	318	R	—	none	free
4	right L2–L3	220	A	cholecystectomy	none	transient numbness of right leg
5	left L2–L3	243	R	—	none	free
6	right L2–L3	140	R	—	none	free
7	right L2–L3	130	R	—	none	free

operating time for the retroperitoneal approach was 200 min (range, 130–243); the operating time for the transperitoneal approach was 220 min, excluding the cholecystectomy. Intraoperative blood loss was low in all patients.

After laparoscopic lumbar sympathectomy, pathologic examination of all of the specimens demonstrated that the sympathetic chain had been removed. The postoperative skin temperatures on the affected side rose significantly to 36.6 ± 0.5° C (range, 35.9–37.2), compared with 33.8 ± 0.8°C (range, 32.9–35.1) preoperatively ($p < 0.0001$). After laparoscopic lumbar sympathectomy, three of the patients who had undergone retroperitoneal treatment were given analgesics for transient lumbago on the 1st postoperative night. The patients resumed oral intake on the following morning, and all patients could be discharged from hospital on the 3rd postoperative day. After sympathectomy, none of the patients complained of neuralgia or reported sexual dysfunction. All patients reported relief of their pain.

Discussion

The first lumbar sympathectomy for arterial occlusive disease of the lower extremity was performed in 1924 by Julio Diez of Buenos Aires [4]. Lumbar sympathectomy has been performed for nonreconstructable arterial occlusive diseases such as infrapopliteal arterial disease with critical ischemia, symptomatic vasospasm, causalgia, or reflex sympathetic dystrophy not responsive to medical therapy. Several studies have demonstrated its benefit for limb salvage [8], and it has proved valuable in the management of patients with pain at rest, with early success rates of 50–70% [10]. It has also yielded satisfactory results in patients with causalgia [9] and reflex sympathetic dystrophy [11].

Open lumbar sympathectomy has been established as the standard treatment for these diseases, because it provides good visibility, although at the expense of requiring a long skin incision. Recently, laparoscopic surgery has offered as a new means of simplifying various surgical procedures. An effective minimally invasive retroperitoneal route has recently been described by Gaur [5]. Hourlay et al. were the first to report endoscopic lumbar sympathectomy [6]. However, so far there have been few reports of laparoscopic lumbar sympathectomy [1, 12, 13].

We performed two kinds of laparoscopic lumbar sympathectomy. It was difficult to expose the lumbar sympathetic ganglion using an anterior transperitoneal approach because retraction of the large vessels, such as the inferior vena cava on the right side and the aorta on the left side, had to be performed with extreme caution using atraumatic retractors. These were handled by an experienced assistant. A retroperitoneal approach permitted clear visualization. However, it required a wide dissection of the retroperitoneal space using a balloon or pneumodissection with carbon dioxide, and wide dissection of the retroperitoneal space may induce postoperative back pain. Nevertheless, the retroperitoneal approach is considered preferable, since there are fewer long-term complications resulting from intraabdominal adhesions.

Complete anatomic denervation is important to achieve adequate sympathectomy of a given segment of an extremity. Removal of a lesser portion of the sympathetic chain may, however, prove to be inadequate. The origin of the sympathetic fibers as related to the lumbar ganglia may be helpful in determining the extent of the sympathectomy. Thus, the first lumbar ganglion supplies the sympathetic innervation of the thigh and parts of the leg. The ablation of the second and third lumbar ganglia denervates the posterior aspect of the thigh, the leg, and the foot, so a complete lumbar sympathectomy has to be performed. Great care was taken to preserve the first lumbar ganglion so that sexual function would be preserved. An ultrasonically activated scalpel was used for transection of the sympathetic ganglion to prevent degeneration of the end of the sympathetic nerve.

The use of laparoscopic techniques to perform standard sympathectomy brings together the advantages of minimally invasive surgery and the reliability of an established open procedure. As an additional advantage, the cosmetic result is significantly better than that obtained with the open method, which is particularly important in young patients. Patients undergo rehabilitation much more rapidly because of reduced wound pain, and they leave the hospital sooner.

We conclude that lumbar sympathectomy can be performed laparoscopically. Our standard technique is now the retroperitoneal approach. More clinical experience and long-term follow-up will ultimately determine if this will become the procedure of choice. However, we believe that a learning period is necessary to fully master this technique.

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