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Retroperitoneoscopic lumbar sympathectomy: prospective study upon a series of 50 consecutive patients

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Abstract
Background Lumbar sympathectomy (LS) is still indicated for peripheral arterial occlusive diseases (PAOD) with critical ischemia beyond any vascular reconstruction. The retroperitoneoscopic approach was proven feasible and effective but its results were never evaluated in larger series.
Methods Between January 2007 and January 2009, 50 patients were included in a prospective study (age range = 49–71 years; sex ratio: M/F = 9:1). Their comorbidities included arterial hypertension, $n = 12$ (24%); atrial fibrillation, $n = 4$ (8%); cerebral stroke sequels, $n = 4$ (8%); diabetes mellitus, $n = 6$ (12%); chronic coronary ischemic disease, $n = 20$ (40%); and obstructive bronchitis, $n = 4$ (8%). Fifty-one retroperitoneoscopic lumbar sympathectomies were performed (31 on the left side and 20 on the right side; 1 patient was operated on both sides).
Results Intervention was successful in 50 cases (98.04%), with one conversion in the first three cases. Results were excellent in all patients, with warming of the extremity and regression of pain. The pathology report confirmed excision of the ganglia in all cases. Complications included 3 cases (6%) of accidental peritoneal tear and pneumoperitoneum which were resolved by insertion of a Veress needle in the hypochondrium; 2 (4%) retroperitoneal hematoma, and 6 (12%) superficial wound infections. Operative time was 65–105 min in the first ten cases and <40 min for the last 41. There was no neuralgia, sexual dysfunction, or postoperative mortality. Associated interventions included necrectomy in 10 cases. The limb preservation rate was 77.09% at 1 year and 58.69% at 2 years.
Conclusion For a larger number of cases, retroperitoneal LS has been proven effective and safe in PAOD beyond reconstruction.

Keywords Lumbar sympathectomy · Peripheral occlusive arterial diseases · Retroperitoneoscopy

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Lumbar sympathectomy (LS) is still indicated for peripheral arterial occlusive diseases (PAOD) with critical ischemia beyond any vascular reconstruction [1–3]. With the advent of laparoscopy this intervention was performed by either a transperitoneal or a retroperitoneal approach [4] and was proven feasible and effective with the advantage of minimal invasiveness [5] but the results were never evaluated in larger series. The purpose of our study was to evaluate retroperitoneoscopic lumbar sympathectomy (RLS) in a prospective study that included a larger number of patients, thus allowing statistic analysis. Our focus was on the technique and its safety and efficacy.

Material and methods

Between June 2007 and January 2009 we included in our prospective study all the patients admitted to our surgical department who had PAOD and who were excluded from vascular reconstruction based on Doppler ultrasound and angiographic studies. Preoperative evaluation of patients also included a complete physical examination and laboratory tests (hemoglobin, blood urea, creatinine, glycemia, coagulation profile, blood group). The operative risk was evaluated using the criteria of American Association of Anesthesiology. Patients with trophic lesions were given intravenous broad-spectrum antibiotics. All patients received vasodilators and anticoagulants such as LMWH (low-molecular-weight heparins) in therapeutic doses. They were all given information about the purpose of the operation, results expected, and possible complications, upon which they all gave informed consent. Approvals from the Institutional Review Board and the Ethical Committee of the hospital were obtained.

The primary end points of the study were the safety of the operation, intraoperative incidents and accidents, operative time, correct identification of sympathetic ganglia, postoperative morbidity and mortality, degree of pain alleviation, and delay of amputation.

Operative technique

The patient was set in a lateral decubitus 45–60° backward tilt, on the opposite side, legs crossed, opposite arm cross-extended for IV access and the homolateral arm elevated and fixed on a steel cadre at the head of the table. The table was broken at the level of L_3–L_4 to better expose the flank. The laparoscopy unit was placed at the head of the operative table and behind the patient. The operator was situated in front of the patient, the first assistant in front of the operator and behind the patient, and the second assistant was at the right of the operator.

A small incision was made 2 cm in front of the superior anterior iliac spine and the preperitoneal space was entered. Blunt finger dissection was then used to enlarge this space by detaching the peritoneum from both the posterior aspect of the transversus abdominis and the anterior side of the psoas muscle, until its medial side and the lumbar vertebral column could be felt. At this time the lumbar sympathetic chain of ganglia could already be palpated. A 10-mm trocar was inserted and the preperitoneal space was inflated to a pressure of 10–11 mmHg. The pressure helps the cleavage of this avascular plane. A 10-mm, 30° laparoscope was introduced into the retroperitoneal space and held by the second assistant. A second 10-mm trocar was inserted under visual control into a point situated on the posterior axillary line, at the level of the umbilicus. This port allows the introduction of a grasper with a swab that is used as a blunt dissector to further dissect the peritoneum from the lateral and anterior abdominal wall toward the umbilicus until the midclavicular line is reached. This maneuver was done gently to avoid any tearing in the peritoneum, especially in the midline where it is more adherent.

Caudally, the dissection stopped at the level of the sacral promontory, at which point the iliac artery and veins were identified. Cranially, the peritoneum was stripped off the psoas muscle until the inferior pole of the kidney was reached. The peritoneum was gently pushed medially until the medial edge of the muscle and the lateral aspect of the vertebral column were exposed. A second working trocar of 5 mm was inserted into a point on the midclavicular line at the level of the umbilicus, taking care to avoid passage through the peritoneal cavity. With the aid of two dissectors introduced through the second and third ports, the lumbar sympathetic chain was identified in the groove between the psoas muscle and aorta on the left, and vena cava on the right (Fig. 1). The communicant rami were also visible and helped distinguish from other structures, especially the lymph nodes. The L_3 and L_4 sympathetic ganglia were located easily using as a landmark the L_3 vertebral body crossed by the horizontal plane through the umbilicus, or the body of L_5 at the level of the horizontal plane through the upper anterosuperior iliac spines. If the retroperitoneal space was rich in fat, exposure difficult to maintain, or bleeding was encountered, a third trocar of 5 mm was inserted on the midaxillary line under the costal ridge. It was used for the passage of a cannula for aspiration lavage. The two sympathetic ganglia were freed from their branches and removed. Lumbar veins did not need to

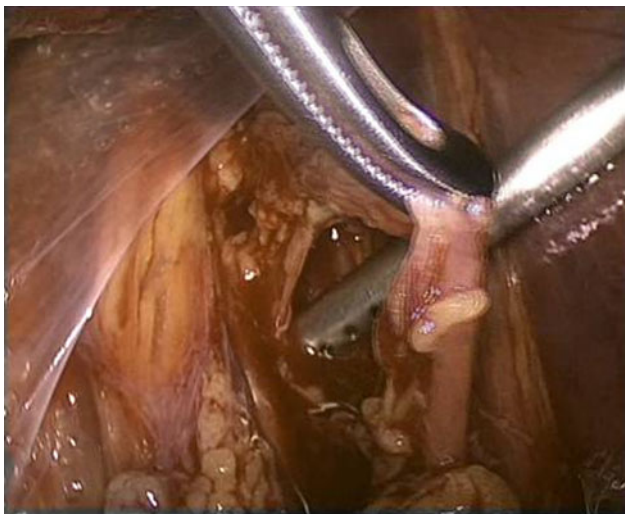

Fig. 1 Intraoperative view of a left-side retroperitoneoscopic sympathectomy showing identification and isolation of the sympathetic chain

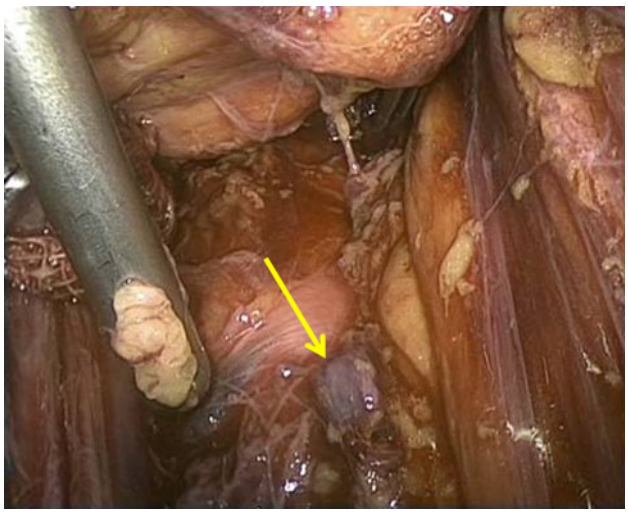

Fig. 2 Intraoperative view of a right-side retroperitoneoscopic sympathectomy after removal of sympathetic ganglia, showing a lumbar vein (*arrow*)

be dissected or ligated; they remained in a posterior plane of dissection (Fig. 2).

Specimens were sent to pathology to confirm removal of the sympathetic ganglia. The preperitoneal space was lavaged and a Penrose drain was left in the retroperitoneal space after the operation. It was removed through the first incision or a separate incision placed below its inferior pole. The pneumoperitoneum was evacuated and the ports closed. We recorded the total time of the operation, from skin incision to the final stitches, and any intraoperative accidents or incidents. Removal and debridement of any necrotic tissue was performed in the same surgical session. The drains were removed the first or second postoperative day, liquid diet was started on the first postoperative day and solid food intake after the passage of flatus, and LMWH was continued for 3–4 days and changed to oral anticoagulants if considered necessary, for a longer period of time. Patients who had necrotic tissue removed from their lower extremities were discharged when the wounds were covered by granulation tissue to continue their care on an ambulatory basis. Postoperatively, we recorded the degree of pain alleviation and the warming of the feet. Both were based mainly on the subjective perception of the patient. The patients were reviewed periodically in the ambulatory setting, especially those with laid-open wounds.

Results

Fifty patients were included in our study. Their age ranged between 49 and 71 years and the sex ratio was M:F = 9:1. Comorbidities consisted of arterial hypertension in 12 patients (24%), atrial fibrillation in 4 (8%), antecedents of cerebral stroke in 4 (8%), diabetes mellitus in 6 (12%), chronic coronary ischemic heart disease in 20 (40%), and obstructive chronic bronchitis in 4 (8%). We performed a total of 51 lumbar sympathectomies (31 on the left side and 20 on the right side, one patient was operated on both sides). The intervention was successful in all 50 cases (98.04%). There was only one conversion, which occurred in the first three cases in an obese patient with a great amount of retroperitoneal fatty tissue which caused difficult exposure. The sympathetic chain was relatively easily identified and removed without any accidental vascular lesion of iliac vessels, aorta, cava vein, or lumbar veins. In 3 cases (6%), a pneumoperitoneum was created accidentally by injuring the peritoneum, but it was resolved successfully by insertion of a Veress needle into the hypochondrium. We registered 2 (4%) retroperitoneal hematoma and 6 cases (12%) of superficial wound infection. Operative time decreased from 65–105 min for the first 10 operations to <40 min for the last 40. No significant difference was noted between sides. No neuralgia or sexual dysfunction was noted. No postoperative mortality was registered. Necrectomy occurred in ten cases and amputation of distal phalanx of the toes in six cases. Immediate results were excellent in all patients, with warming of the feet and considerable regression of the pain. Patients with necrectomies were discharged when the wound started to granulate and the wounds were dressed for home care. The pathology report confirmed correct excision of the ganglia in all cases. At 1-year follow-up only 48 (96%) patients were available for evaluation; two had died from causes not related to the PAOD. In this period, 10 patients (22.91%) required amputation of their inferior limb for a limb preservation rate of 77.09%. At 2 years we lost another two patients to follow-up. Of the 36 patients who remained, another 8 patients required an amputation, leaving a total of 28 patients (58.33%) for whom the amputation was avoided.

Discussion

From a "vascular" operation for peripheral arterial occlusive diseases, the lumbar sympathectomy has progressively fallen out of favor with the advent of vascular reconstruction operations [1]. However, there are still patients with neglected arterial occlusive disease not amenable to reconstruction for whom this operation is still indicated for clinical improvement, leading to pain alleviation and delay of amputation [2]. In a study to evaluate the role of lumbar sympathectomy with respect to indications and outcomes in British and Irish vascular surgical practices, 75% of the vascular surgeons who returned the questionnaires considered the procedure still useful [3].

Because of its large incisions and muscular trauma, the open approach was criticized, opening the opportunity for chemical lumbar sympathectomy with percutaneous injection of phenol or alcohol under fluoroscopy or CT guidance. Although chemical lumbar sympathectomy is a very simple and noninvasive method, its results may be temporary because of incomplete sympathectomy and return of the sympathetic tone [6]. Chemical lumbar sympathectomy under CT guidance may seem like an accurate and safe technique [7] but it may result in very severe complications such as acute cardiogenic shock [8], pelviureteric junction disruption [9], neuralgia, and ureteral damage and paraplegia following inadvertent extradural injection [3]. The role of chemical lumbar sympathectomy is likely to remain controversial because of the lack of a valid prognostic marker, technical variability, and the fact that it is often used in elderly patients [10].

Lumbar sympathectomy via laparoscopy is more precise since it is performed under direct visualization of the sympathetic nerve chain; however, it must be simple to perform and safe for the patient. Its feasibility has been proven [4, 5], but its safety was not evaluated in larger series. In our study there was no major intraoperative incident such as damage to retroperitoneal major vascular structures, ureter, or nerves. In 50 dissections of this kind, we have seen the ureter only once, in a very slim patient. It usually lies more medially and is pushed away during dissection, together with the peritoneum, so there is no possibility of harming it unless it is looked for specifically. The technique is very effective because it completely removes the ganglia. Optical magnification and high definition allows accurate dissection, as already mentioned by other authors [4, 5].

We did not have any difficulty with orientation and working in the retroperitoneal space compared to the transperitoneal route. Actually, we consider it direct and simple. There was only one case of conversion (2%) in the first three cases and it was due to the lack of experience.

We believe that to be successful with the first few cases you must create a space that is as large as possible by using blunt finger dissection in two directions: toward the umbilicus in intimate contact with the posterior abdominal wall and toward the medial aspect of the psoas until the vertebral bodies of the lumbar column are felt. Once the optic is introduced we are easily oriented by the psoas muscle that is seen in the longitudinal axis. We believe that this initial port should remain the optic port. We found that placing the camera in the second port, as described in other techniques [4], could create a "mirror" effect because some of the instruments will work against the optic and not along its axis. Magnification allows accurate and sharp dissection, avoiding any damage to the lumbar veins, one of the most dangerous and difficult-to-manage intraoperative accidents.

Tearing in the peritoneum is possible when it is pushed away medially from the transversus abdominis. Gentle dissection maneuvers avoid tearing; however, tearing is not a fearsome complication because it may be easily resolved by inserting the Veress needle into the hypochondrium.

In our study group, postoperative complications were mild infection of the wound and retroperitoneal hematoma. Wound sepsis was due to drains that were taken out through the wound. Once we started using a separate incision for the drains this complication was no longer encountered. The one case of postoperative retroperitoneal hematoma, representing a 2% complication rate, could be considered minor if it is taken into consideration that those patients were using anticoagulants.

Postoperative results in terms of alleviation of pain, warming of the feet, healing of trophic lesions, and salvage from amputation are similar to those of other studies. In fact, we did not expect superior results by simply using laparoscopy. We only wanted to see if this technique is simple enough and safe for the patient to be able to compete with the chemical sympathectomy, which is even less invasive. Efficiency of the intervention in terms of delaying amputation by 77.09% at 1 year and 58.33% at 2 years is probably due to the precise identification and removal of the ganglia.

This is the largest series of retroperitoneoscopic lumbar sympathectomy in consecutive nonselected cases published to date. In a series of 23 procedures, Debing et al. [11] had no postoperative complications, the median hospital stay was 4 days, there were two cases of conversion to the open technique (8.67%), and failure to remove the sympathetic ganglia occurred in one case (4.34%).

Arguments for retroperitoneoscopic lumbar sympathectomy are insignificant morbidity, short operative time, accurate dissection identification and removal of ganglia. Disadvantages are, in our opinion, the cost of the equipment and the intervention compared to that for chemical LS.

Conclusion

Our study showed that in a larger number of cases lumbar sympathectomy via a retroperitoneal route is both effective and safe in peripheral arterial occlusive diseases. Therefore, the patients with critical inferior limb ischemia could be offered a safe and minimally invasive lumbar sympathectomy to delay amputation.

Disclosures Drs. Nemeş, Şurlin, Chiuţu, E. Georgescu, M. Georgescu, and I. Georgescu have no conflicts of interests and financial ties to disclose.

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