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ORIGINAL ARTICLE

Lumbar sympathectomy can improve symptoms associated with ischaemia, vasculitis, diabetic neuropathy and hyperhidrosis affecting the lower extremities—a single-centre experience

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Abstract

Background Lumbar sympthectomy (LS) was traditionally performed for intermittent claudication but is now eclipsed by revascularisation for that indication. However, it retains a role in the management of critical limb ischaemia and other conditions causing lower limb pain with or without ischaemia. We report the role of LS in modern surgical practice when revascularisation and pain management options have been exhausted.

Methods A medical chart review was performed on all patients who underwent LS in our unit from 2005 to 2016 (inclusive). Symptomatology, surgical indications and patient outcomes were reported.

Results Twenty-seven cases were performed in total (21 unilateral, 3 bilateral). Underlying diagnoses were as follows: PAD [59.3% ($n = 16$)], hyperhidrosis [18.5% ($n = 5$)] and equal numbers of complex regional pain syndrome, diabetic neuropathy and vasculitis [7.4% ($n = 2$) each]. Overall, 85.2% ($n = 23$) had improvement or resolution of symptoms at 1 month and 70.3% ($n = 19$) had persistent improvement of symptoms at 1 year. Non-PAD patients had superior outcomes with 90.9% ($n = 10$) reporting improved symptomatology at 1 month and nearly three quarters [72.8% ($n = 8$)] maintaining this improvement at 1 year. Only four patients required subsequent major amputation, all in the severe PAD group.

Conclusion Lumbar sympathectomy can improve symptoms associated with ischaemia, vasculitis, diabetic neuropathy and hyperhidrosis. Non-PAD patients have the greatest benefit.

Keywords Hyperhidrosis · Ischaemia · Lumbar · Neuropathy · Sympathectomy · Vasculitis

Introduction

Lumbar sympathectomy (LS) spans two centuries of surgical practice [1–3]. Originally developed as a treatment for peripheral vascular disease (PAD), it has since been eclipsed by the advent of more definitive surgical options such as arterial bypass and endovascular treatment [4, 5, 2]. LS results in reflex dilation of vasculature from loss of sympathetic tone, in particular of superficial arterioles, facilitating improved blood flow and skin perfusion [6–9]. LS can be beneficial for patients with other conditions including hyperhidrosis, diabetic neuropathy and vasospastic disorders [10, 11]. Patients suffering intractable pain from a variety of aetiologies also benefit from LS [12, 13].

Traditionally, an open operation, technique has evolved over time and with increasing technological innovation. Surgical LS can be done by open or retroperitonoscopic techniques, and percutaneous chemical sympathectomy can be performed using anatomical or radiologically guided techniques [13, 8]. Choice of approach is influenced by a number of factors, not limited to indication, patient preference and local expertise. In our department, we perform LS using an open, retroperiotoneal approach with clipping and excision of the lumbar sympathetic chain under direct vision at the level of L3. Little data exists in the literature about the outcomes from this procedure in a modern context, since most of the relevant literature is several decades old [12]. The aim of our study was to report the role of LS in modern surgical practice by describing our single-centre experience of LS surgery, including surgical indication and patient outcomes.

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Methods

A retrospective audit was undertaken of all LS performed from January 2005 to December 2016 (inclusive). All cases were identified from the official theatre logbooks, which accurately record all cases performed in the operating theatre in our hospital. All cases were performed by a single senior vascular sub-specialised surgeon. Follow-up outpatient assessment was also performed by a senior surgeon. All patients were followed up for at least 1 year.

A detailed medical chart review was systematically performed on each patient. Patient demographics including age, gender, co-morbidities, primary diagnosis (categorised as PAD, hyperhidrosis, complex regional pain syndrome (CRPS), diabetic neuropathy or vasculitis) and primary indication for surgery (categorised as pain, tissue integrity, hyperhidrosis or severe vasospasm) were identified and analysed. Many patients undergoing this procedure did so as a last resort in an attempt to avoid major amputation for critical limb ischaemia and intractable rest pain. Therefore, outcomes included the following: resolution of symptoms and requirement for and time to further intervention or major amputation.

Lumbar sympathectomy procedure

All procedures are performed under general anaesthesia. Patients are positioned supine with a table break at the level of the umbilicus. A wedge is placed under the flank on the side of the incision. A slightly oblique abdominal incision is made following lines of cleavage, positioned at the level of the umbilicus and starting at the lateral border of the rectus sheath. It inclines upwards for a length of approximately 6–8 cm depending on body habitus. Muscle splitting (external and internal oblique and transversus abdominis) technique is then performed and the peritoneum identified and preserved. The peritoneum and intraperitoneal contents are retracted medially with the ureter. The sympathetic chain is identified overlying the lumbar spine, adjacent and lateral to the aorta on the left and beneath the inferior vena cava on the right. Great care must be taken to avoid injury to lumbar veins on the right. It is initially felt as a very strong wire-like structure which aids subsequent visualisation. The chain is dissected out and any side branches identified. A small segment (approximately 1–2 cm) is resected usually at the level of L3 to disrupt the chain and this specimen is sent to histopathology for assessment. Haemostasis is achieved, local anaesthesia is instilled to the area and closure is performed in layers.

For those with bilateral symptoms, a decision to proceed to contralateral surgery was based on a clear improvement of symptoms and measurable clinical benefit following the initial operation on the contralateral side during outpatient follow-up. All data was recorded using Microsoft® excel and outcomes reported as absolute patient number and percentage expression.

Results

In total, 27 LS were performed on 24 patients during this time period (21 unilateral and 3 bilateral). Patient demographics are outlined in Table 1. A further individualised summary of each patient is outlined in Table 4. Three quarters of patients were male and one quarter female. Mean age at the time of operation was 55 years. Underlying diagnosis included PAD [59.3% ($n = 16$)], hyperhidrosis [18.5% ($n = 5$)] and equal number of complex regional pain syndrome, diabetic neuropathy and vasculitis [7.4% ($n = 2$) each]. Indications for surgery were sometimes multifactorial with pain as the most common indication [59.2% ($n = 16$)].

Tables 2 and 3 outline patient outcomes post-operatively. Overall, 85.2% ($n = 23$) had improvement or resolution of symptoms at 1 month with only four patients not achieving significant symptom improvement. A total of 70.3% ($n = 19$) had persistent improvement of symptoms at 1 year with over half [15 (55.6%)] reporting complete resolution of symptoms at 1 year.

When outcomes are divided between those who were treated for PAD and non-PAD (Table 3), it is clear that significantly more patients treated for non-PAD indications have better outcomes with 90.9% ($n = 10$) of this cohort reporting improved symptomatology at 1 month, and nearly three quarters [72.8%($n = 8$)] maintaining this improvement at 1 year. A total

Table 1 Patient demographics, underlying diagnosis and primary indication for surgery

	N (%)
Total patients	24
Unilateral	21 (87.5)
Bilateral	3 (12.5)
Gender	
Male	18 (75)
Female	6 (25)
Age (years)	
Mean	55
SD	21
Diagnosis[a]	
PAD	16 (59.3)
Hyperhidrosis	5 (18.5)
CRPS	2 (7.4)
Diabetic neuropathy	2 (7.4)
Vasculitis	2 (7.4)
Indication for surgery[a]	
Pain	16 (59.2)
Tissue integrity	4 (14.9)
Hyperhidrosis	5 (18.5)
Severe vasospasm	2 (7.4)

PAD peripheral arterial disease, *CRPS* complex regional pain syndrome

[a] Denominator of 27 as total number of procedures performed

Table 2 Patient outcomes post-lumbar sympathectomy (percentages report proportion of patients that achieved symptom resolution at time points outlined)

	Yes [*n* (%)]	Partially [*n* (%)]	No [*n* (%)]
1 month	12 (44.4%)	11 (40.7%)	4 (14.8%)
1 year	15 (55.6%)	4 (14.8%)	8 (29.6%)

Yes = complete resolution of presenting complaint; *Partial* = improvement with some residual issues; *No* = persistent symptoms

of 63.6% ($n = 7$) of this cohort had complete resolution of symptoms at 1 year. Overall, only four patients (14.8%) proceeded to major amputation with mean time to amputation of 3 months. Regarding operative complications, one patient developed intra-operative bleeding from a lumbar vein which was successfully ligated. Blood transfusion was not required and length of hospital stay was not affected.

Discussion

We report improvement of symptoms in almost three out of four patients who undergo LS for non-PAD and two out of three patients who undergo LS for PAD indications at 1-year follow-up. This is similar to international literature which reports that approximately three quarters of patients experience short-term benefit following LS for intractable pain due to PAD, and approximately half have sustained benefit long term [12]. These patients were selected for LS as they had exhausted all revascularisation and pain management options (Table 4). Pain was the main symptom triggering referral for consideration of surgery. Several patients in our PAD cohort were advised that amputation was indicated but they were not psychologically ready for that. It is well established that patient engagement and preparation prior to major amputation significantly improve post-operative success with mobilisation, prosthesis use and overall reduction in morbidity [14–16]. In our cohort, just four patients went on to major amputation following LS. This suggests that LS can potentially stave off major amputation but can also allow time for patients to adapt and prepare. The mean interval between LS and major amputation in our cohort was 3 months, which is consistent with rates published elsewhere [17].

The issue of surgical morbidity, especially in those for whom this procedure does not provide a significant benefit, has been questioned [17]. Given that many patients with PAD usually have significant co-morbidities, which increase surgical and anaesthetic risk overall, evaluation on a case by case basis is important. It is worth noting that for many, quality of life is already very poor and this procedure represents a "last chance" to gain improved quality of life without undergoing major amputation [18]. Almost 70% of our cohort was asymptomatic at 1 year, and it is important to counsel all patients well pre-operatively regarding expected outcomes.

Due to the invasive nature of open surgery, other approaches have been trialled. Chemical ablation as performed by a variety of specialists remains popular, with transcutaneous techniques involving phenol, absolute alcohol and local anaesthetic all described [19–21]. More recently, innovative techniques involving radiofrequency ablation have also been trialled; however, the effectiveness of this modality remains poor by comparison to open surgery [19, 22]. Injection with local anaesthetic is popular and effective in the short term, but most lose effect within 8 weeks [22]. The success of minimally invasive techniques may be skewed by the fact that accurate localisation of the sympathetic chain may not be feasible due to its variable position. This is not a problem with open surgery as the chain is clearly visualised. Long-term follow-up from injection-based therapies is lacking in the literature, with most reporting results in the short to medium term, usually only a few months and little data beyond that. The Cochrane Library has recommended the establishment of a database to assist with such research in the future [19].

There are a number of limitations to this study. This is a retrospective review, and methods of data recording were not designed specifically for this study purpose. Also, patient symptom improvement was subjectively reported as yes/no/partially improved. However, LS is an infrequently performed procedure with minimal current data published on this topic; thus, we feel quantitative report of our institutional experience greatly adds to the literature. Certainly going forward, prospective collection of data using validated pain questionnaires will be performed and increase the strength of knowledge on this topic.

In conclusion, LS remains as a safe useful procedure for PAD patients with severe pain who have exhausted all revascularisation and pain management options. Further superior results are observed in patients with non-PAD including

Table 3 Patient outcomes reported as two groups: (1) patients treated for peripheral arterial disease (PAD) and (2) patients treated for non-PAD

	PAD			Non-PAD		
	Yes [*N* (%)]	Partially [*N* (%)]	No [*N* (%)]	Yes [*N* (%)]	Partially [*N* (%)]	No [*N* (%)]
1 month	6 (37.5%)	7 (43.8%)	3 (18.8%)	6 (54.5%)	4 (36.3%)	1 (9.1%)
1 year	8 (50%)	3 (18.8%)	5 (31.3%)	7 (63.6%)	1 (9.1%)	3 (27.2%)

Yes = complete resolution of presenting complaint; *Partial* = improvement with some residual issues; *No* = persistent symptoms

vasculitis, CRPS, hyperhidrosis further supporting a specific role of LS in modern surgical practice.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Appendix

Table 4 Individualised summary of each patient

Patient	Age	Side	Diagnosis	Surgical indication	Outcome at 1 month	Outcome at 1 year	Further outcome
1	34	B/L	PAD	Pain	Resolution	Resolution	–
2	40	R	Hyperhidrosis	Sweating	Resolution	Resolution	–
3	38	R	APS, vasculitis	Pain and tissue loss	Partial improvement	Resolution	–
4	31	R	Hyperhidrosis	Sweating	Resolution	Resolution	–
5	72	R	Vasospasm/vasculitis	Pain	Partial improvement	Partial improvement	–
6	32	B/L	Hyperhidrosis	Sweating	Resolution	Resolution	–
7	20	B/L	Diabetic neuropathy	Pain	Partial improvement	No improvement	–
8	78	L	PAD	Pain	Partial improvement	No improvement	BKA (expected)
9	80	R	PAD	Pain	No improvement	No improvement	BKA (expected)
10	66		PAD	Pain and tissue loss	Partial improvement	Resolution	–
11	52	R	PAD	Pain and tissue loss	Resolution	Resolution	–
12	67	L	PAD	Pain	Resolution	Partial improvement	–
13	72	L	PAD	Pain	Resolution	Resolution	–
14	61	R	PAD	Pain	Partial improvement	No improvement	AKA (expected)
15	58	R	PAD	Pain and tissue loss	Partial improvement	No improvement	AKA (expected)
16	50	R	Buergers	Pain	Partial improvement	Resolution	–
17	81	L	PAD	Pain	Partial improvement	Partial improvement	–
18	79	L	PAD	Pain	Partial improvement	Partial improvement	–
19	84	R	PAD	Pain	No improvement	No improvement	–
20	67	L	PAD	Pain and tissue loss	No improvement	Resolution	–
21	72	L	PAD	Pain	Resolution	Resolution	–
22	56	L	PAD	Pain	Resolution	Resolution	BKA (expected)
23	75	R	PAD	Pain	Resolution	Resolution	–
24	31	L	Hyperhidrosis	Sweating	No improvement	No improvement	–

B/L = bilateral

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