

## Systematic Review

# The Role of Lumbar Sympathectomy in the Management of Buerger's Disease: A Systematic Review

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## Abstract

### Introduction

Lumbar sympathectomy has been explored to manage Buerger's disease (BD) with varying success rates, but the results are often controversial. Despite the substantial morbidity associated with BD, there is a scarcity of comprehensive reviews on the topic. The current study is a systematic review of the efficacy of lumbar sympathectomy in the management of BD.

### Methods

A meticulous systematic exploration was conducted across reputable databases and search platforms. The search strategy employed the following keywords: (lumbar sympathetic OR sympathectomy OR lumbar sympathetic block) AND (Buerger's disease OR Buerger OR thromboangiitis obliterans OR lower limb disease). Out of 42 identified studies, 16 were excluded during the initial screening phase. Following initial and full-text screenings, 10 studies remained eligible. The assessment of studies regarding the inclusion criteria was conducted independently by two authors, with a third author intervening to arbitrate any discrepancies.

### Results

The demographic characteristics revealed that all participants were male, with a mean age of 38.9 years. Smoking prevalence among the cases was notably high (99%). Chemical sympathectomy was the predominant intervention, employed in 87.8% of cases, while surgical sympathectomy was utilized in only 12.2% of cases. Among the cases, 8.7% achieved complete resolution from the disease, while 91.3% reported partial relief.

### Conclusion

Lumbar sympathectomy can be a viable treatment option for BD with fair outcomes. Nevertheless, smoking cessation remains the primary factor impeding disease progression and aggressiveness.

## 1. Introduction

Buerger's disease (BD), or thromboangiitis obliterans, is a challenging vascular disorder identified by peripheral ischemia of an inflammatory nature, primarily affecting the small and medium-sized arteries of the extremities [1-3]. The disease's hallmark features include a nonatherosclerotic inflammatory pathology, occlusive thrombosis, and segmental vessel involvement [1]. Although BD occurs worldwide, its incidence exhibits regional variations, with a higher prevalence in regions like India, the Far East, and the Middle East [4]. This condition is predominantly found in young male smokers. The etiology of BD remains elusive but is closely linked to tobacco exposure [1,2]. Genetic predisposition, infectious agents, hyper eosinophilia, HLA-A9 and HLA-B5 antigens, and potential autoimmune, allergic, or idiosyncratic responses to smoking have also been suggested as risk factors [4]. Clinically, BD manifests as peripheral ischemia, resulting in severe pain and discomfort, most commonly in the arch of the foot or the calf of the leg. Symptoms may also include chest pain and distinct skin abnormalities such as asymmetric coldness, skin atrophy, and abnormal nail growth [4]. The disease progression can lead to gangrene and amputation, significantly impairing patients' quality of life [2,5]. Challenges in managing BD lie in its limited therapeutic options and the minimal possibility of endovascular interventions or vascular reconstruction [2,6,7]. The mainstay of treatment is complete abstinence from tobacco, as it remains the most effective way to halt disease progression [2,8]. Interventions like lumbar sympathectomy (LS), have been explored with varying success rates, but the results are often controversial [2,8]. Despite the substantial morbidity associated with BD, there is a scarcity of comprehensive reviews on the topic [1,5].

The current study is a systematic review of the efficacy of LS in the management of BD.

## 2. Methods

### 2.1. Study design

This study constituted a comprehensive review focusing on the treatment of BD through LS.

### 2.2. Data sources and search strategy

A meticulous systematic exploration was conducted across reputable databases and search platforms, including Web of Science, PubMed/MEDLINE, EMBASE, Science Direct, CINAHL, the Cochrane Library, and Google Scholar. The search strategy employed the following keywords: (lumbar

sympathetic OR sympathectomy OR lumbar sympathetic block) AND (Buerger's disease OR Buerger OR thromboangiitis obliterans OR lower limb disease).

### 2.3. Eligibility criteria

Inclusion criteria encompassed studies primarily addressing the treatment of BD in the lower limbs through LS. Excluded from consideration were studies with only abstracts available, pre-prints, review studies, and studies lacking comprehensive or pertinent data. The credibility of all references was assessed based on Kscien's List [9]. Out of 42 identified studies, 16 were excluded during the initial screening phase (duplicate = 9, non-English = 7). Following meticulous initial and full-text screenings, 10 studies remained eligible (Figure 1) [2-4,6-8,10-13].

### 2.4. Study selection and data items

Initial screening of titles and abstracts was conducted by several authors to identify relevant studies. Subsequently, a thorough full-text evaluation was carried out to ascertain conformity with inclusion criteria. The assessment of studies regarding the inclusion criteria was conducted independently by two authors, with a third author intervening to arbitrate any discrepancies. Data extracted from the studies encompassed the first author's name, year of publication, number of cases, demographics, smoking status, lower limb side, type of sympathectomy, and outcomes.

### 2.5. Data analysis and synthesis

Data organization was executed using Microsoft Excel (2019), and The Statistical Package for the Social Sciences software (version 25) was employed for qualitative data analysis (descriptive statistics). The data were shown as mean values and frequencies.

## 3. Results

A total of 10 studies were included and reviewed in this review (Table 1). The demographic characteristics revealed that all participants were male, with a mean age of 38.9 years. Smoking prevalence among the cases was notably high (99%), while only two cases (1%) were non-smokers. Regarding the laterality of the disease, 58.4% of cases exhibited unilateral manifestations, while in 31.5% of cases, the laterality was not conclusively determined. In terms of sympathectomy techniques, chemical sympathectomy was the predominant intervention, employed in 87.8% of cases. However, surgical sympathectomy was utilized in only 12.2% of cases. The outcomes revealed that the

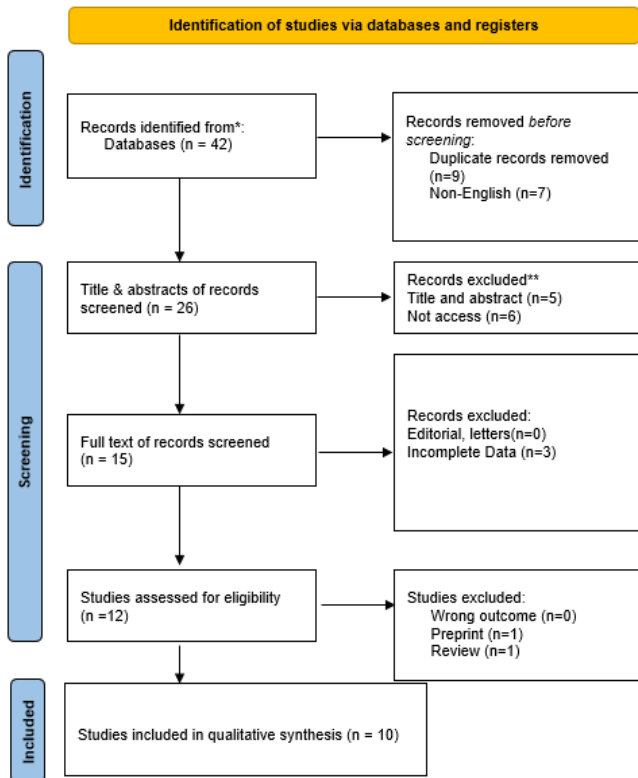


Figure 1. Study selection PRISMA flow chart.

procedures yielded variable results in terms of disease management. Among the cases, 8.7% achieved complete resolution from the disease, while 91.3% reported partial relief. (Table 2).

Table 1. The characteristics and raw data of the reviewed studies.

Author	Year	No. patient	Age (mean)	Smoking status		Lower limb side		Type of sympathectomy		Outcome	
				Yes	No	Unilateral	Bilateral	Surgical	Chemical	Totally asymptomatic	Partially asymptomatic
Messinger et al <sup>13</sup>	1949	17	34.2	17	0	8	9	17	0	10	7
O'Connor et al <sup>4</sup>	1996	1	57	1	0	1	0	1	0	0	1
Talwar et al <sup>11</sup>	2001	6	40	6	0	N/A	N/A	6	0	6	0
Watarida et al <sup>12</sup>	2001	3	44	3	0	3	0	3	0	3	0
Chander et al <sup>10</sup>	2004	8	35.5	8	0	8	0	8	0	6	2
Singh et al <sup>7</sup>	2014	15	37.8	15	0	N/A	N/A	0	15	0	15
Bhattacharya et al <sup>6</sup>	2015	32	38.94	30	2	N/A	N/A	0	32	0	32
Kothari et al <sup>2</sup>	2017	167	32	167	0	147	20	0	167	0	167
Jain et al <sup>3</sup>	2018	1	30	1	0	N/A	N/A	0	1	0	1

\* N/A, not applicable

#### 4. Discussion

The disease typically targets young male smokers and is characterized by ischemia occurring in either the hands or feet due to damage in the small arteries and veins of the extremities. Rest pain generally manifests in the forefoot, often with an intensity that contradicts the apparent limitation of ischemic lesions. Diagnosis relies on a comprehensive evaluation, including patient history, clinical examination, angiography, and histological assessment. This pathology can be differentiated from other forms of vasculitis through the absence of specific

antibodies and abnormal levels of inflammatory markers. Despite the unknown etiology, the diagnosis of BD primarily relies on detecting distal arterial lesions in smokers after excluding other potential causes [3,14]. Individuals suffering from ischemic limb ulcers not only experience incapacitating pain but are also frequently subjected to social isolation and even request amputation [7].

The only established approach to prevent the progression of BD and avoid amputation is the complete cessation of tobacco usage. Nevertheless, even with such measures, the possibility of new episodes of ischemia and tissue loss cannot be discounted [15]. There have been reports suggesting a potential association between passive smoking and the presence of BD, although the evidence remains limited [15]. According to a study conducted in Japan involving 850 cases, it was found that patients who persisted in smoking faced a 2.73 times greater risk of amputation [16]. This pathology primarily affects men, and instances involving women are regarded as exceedingly rare, with an incidence rate of less than 2% [17]. In line with prior findings, the mean age of the individuals in the reviewed studies was 38.9 years, and all were male. Almost all the cases (99%) were smokers, and the disease presented unilaterally in more than half of them (58.4%).

**Table 2.** The findings summary of the reviewed studies.

Characteristics	N. patients (%)
Age (mean of means) ± SD	38.9 ± 4.45
Sex	
Male	286 (100%)
Female	0 (0.0%)
Smoking status	
Yes	284 (99%)
No	2 (1%)
Lower limb site	
Unilateral	167 (58.4%)
Bilateral	29 (10.1%)
Unknown	90 (31.5%)
Type of sympathectomy	
Chemical	251 (87.8%)
Surgical	35 (12.2%)
Outcome	
Totally asymptomatic	25 (8.7%)
Partially asymptomatic	261 (91.3%)

\* SD, Standard deviation

A range of pharmaceutical interventions has been employed in the treatment of BD, encompassing vasodilators, platelet inhibitors, anticoagulants, prostaglandins, steroids, and nonsteroidal anti-inflammatory drugs. Calcium channel blockers, particularly nifedipine, have long exhibited efficacy in providing relief from symptoms and ameliorating trophic changes in the lower limbs. Pentoxifylline and Cilostazol have also shown favorable responses in patients with this condition,

although they can contraindicate in cases of angina, myocardial infarction, and percutaneous coronary intervention with anti-platelet therapy [15]. Hence, their clinical utilization remains relatively limited, with scant data available in this context.

Despite acetylsalicylic acid (aspirin) being a common prescription for BD patients, controlled studies have yet to confirm its therapeutic benefit or that of other orally administered anti-clotting agents. In certain cases, involving gangrene or pre-gangrenous lesions of the toes or feet, intra-arterial thrombolytic therapy utilizing streptokinase has been explored and has shown some success in averting amputation. In addition, iloprost, a prostacyclin, has been administered orally and intravenously, yielding a reduction in rest pain and facilitating ulcer healing in more than 60% of cases within four weeks of therapy [15].

While LS has been one of the longstanding treatments for patients with critical limb ischemia due to BD, it is noteworthy

that only a single study, conducted by Cocine et al, has generated high-quality evidence concerning its efficacy [1]. LS functions as a vasodilator by reducing sympathetic tone, thereby enhancing tissue oxygenation. This mechanism underpins its utilization in promoting ulcer healing. Furthermore, it alleviates pain by interrupting the coupling between the sympathetic and nociceptive systems and by directly affecting nociceptive fibers. Although surgical sympathectomy is still performed, chemical LS has largely supplanted it, mainly due to its minimally invasive nature [6,7]. Consequently, in the majority of the reviewed studies, chemical LS was utilized in 87.8%, while the surgical approach was employed in only 12.2%.

Chemical LS has demonstrated its effectiveness in aiding ulcer healing, with more than 70% of cases reporting positive outcomes, often evidenced by wound healing, a reduction in wound size, or the clear demarcation of necrotic and healthy tissue [6]. However, the success of chemical lumbar sympathectomy block in patients with critical limb ischemia depends significantly on careful case selection. A favorable response can be anticipated when there is no evidence of somatic neuropathy associated with extensive tissue damage. Conversely, the presence of deep infection or gangrene serves as a negative prognostic indicator and suggests a lower likelihood of success for the block procedure [6]. It is crucial to note that chemical LS may entail certain complications, including but not limited to epidural/spinal block, puncture of the aorta or inferior vena cava, intravascular injection, backache, hematoma formation, intervertebral disc injury, genitofemoral neuralgia, kidney and ureteric traumas, retrograde ejaculation or failure of ejaculation, lumbar plexus block, and the potential for infection [3].

A study conducted by Cocine et al. has reported the superior effectiveness of iloprost in comparison to LS concerning the healing of ischemic ulcers and the alleviation of resting pain in BD patients [1]. However, it is important to note that the available evidence supporting the previous finding is of poor quality. As a result, the routine preference for intravenous iloprost over LS lacks robust support [1].

After undergoing LS, a rapid improvement in peripheral circulation has been noted in a range from 72% to 96% of patients. Pain relief was reported by 76% to 83.5% of patients, while ulcer healing was observed in 60% to 72% of cases. Long-term relief was found to range from 30% to 88% [2]. In this review, it is evident that all patients appeared to gain advantages from the intervention. Among them, 8.7% achieved complete resolution from the disease, while 91.3% reported partial relief.

Singh et al. used 8% phenol in fluoroscopy-guided lumbar sympathectomy blocks to assess their effectiveness in enhancing visual analog scores and walking distance. They observed improved scores and increased walking distance in all patients with each successive block [7]. Similar to the prior study, Mashiah et al. conducted phenol lumbar sympathectomy blocks in individuals with arteriosclerotic peripheral vascular disease and lower limb ischemia. During a follow-up period ranging from 24 to 120 months, 219 patients (58.7%) achieved complete pain relief and the healing of gangrenous ulcers, while the treatment did not yield positive results for 154 patients (41.3%) [18]. Phenols and alcohols have long been employed in chemical neurolysis for lumbar sympathectomy blocks. However, there are

certain limitations associated with their use for permanent neurolysis. Phenol destroys both motor and sensory nerve fibers when used in concentrations exceeding 6%. Additionally, therapeutic phenol blocks are not considered permanent due to the potential for neural regeneration. Moreover, at higher concentrations, phenol can induce neuritis, similar to alcohol [6]. To overcome these drawbacks of phenol and alcohol, Bhattacharya et al. adopted a different approach by employing long-acting steroids in chemical LS procedures. Their findings indicated favorable results, however, there have been inconsistencies in the effectiveness of this method [6]. In this review, unfortunately, we were unable to arrive at a conclusive assessment on this matter, and additional research may be required to address it. The inability to attain pain alleviation or tissue healing can be attributed to various factors. These factors encompass instances of technically incomplete neurolysis or cross-innervation, which can render a complete sympathectomy unattainable. Late recurrence of symptoms may occur due to the regrowth of nerves, the heightened function of previously insignificant crossed fibers, or the natural re-establishment of vasomotor tone [2].

## 5. Conclusion

LS can be a viable treatment option for BD with fair outcomes. Nevertheless, smoking cessation remains the primary factor impeding disease progression and aggressiveness. This study, while informative, has notable limitations, including a lack of consideration for the procedure with different available agents, incomplete coverage of associated complications, insufficient data collection or variable extraction, and a lack of classification for minimally invasive techniques that can complement these procedures. Future reviews should aim to address these shortcomings for a more comprehensive understanding of treatment modalities.

## Declarations

**Conflicts of interest:** The author(s) have no conflicts of interest to disclose.

**Ethical approval:** Not applicable, as systematic reviews do not require ethical approval.

**Patient consent** (participation and publication): Not applicable.

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**Authors' contributions:** HH, LMAJ, PA, SHK and HOA participated in data collection. FHK designed the study. BAA, SHM performed the data analysis. FHK, DAI, and AKG participated in preparing the manuscript. IJH, MAA, DHA, OHGH and HHKA critically revised the manuscript. FHK, HOA confirmed the authenticity of the data. All authors approved the final version of the manuscript.

**Data availability statement:** Note applicable.

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