Section: Radiodiagnosis

Original Research Article

EFFECT OF FEMORAL NERVE BLOCK ON PERIOPERATIVE PAIN AND COMFORT IN ENDOVENOUS LASER ABLATION OF THE GREAT SAPHENOUS VEIN

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ABSTRACT

Background: Endovenous laser ablation (EVLA) has become the preferred minimally invasive technique for treating great saphenous vein (GSV) insufficiency. Although tumescent anaesthesia is routinely used to provide perivenous analgesia, patients often experience significant discomfort during laser ablation and the multiple needle punctures required along the course of the vein. Peripheral nerve blocks, particularly femoral nerve blockade (FNB), have been investigated as adjuncts to improve intraoperative analgesia and overall patient comfort. However, the use of general anaesthesia or sedation with nerve blocks may delay recovery, prolong immobilization, and increase the risk of deep vein thrombosis. This study aimed to evaluate the safety and efficacy of an ultrasound-guided femoral nerve block, administered without sedation, in reducing pain during tumescent anaesthesia infiltration and laser ablation of the GSV. The objective was to assess whether a single femoral nerve block could enhance patient comfort and reduce pain perception during and after EVLA in patients with symptomatic venous insufficiency.

Materials and Methods: In this randomized comparative study, patients with great saphenous vein insufficiency underwent endovenous laser ablation (EVLA) at an outpatient clinic. All patients received tumescent anaesthesia; however, one group additionally received an ultrasound-guided femoral nerve block (FNB) prior to the procedure. Pain and discomfort were assessed using the Visual Analog Scale (VAS) from the initiation of tumescent anaesthesia to the completion of laser ablation. The Numeric Rating Scale (NRS) was also used to evaluate pain before and during tumescent infiltration & EVLA. Procedural duration and the treated length of the great saphenous vein were recorded. All patients were evaluated postoperatively for pain, comfort, and recovery at a 1-month follow-up. Data were analysed using standard statistical methods.

Results: Patients who received an ultrasound-guided femoral nerve block reported significantly greater intraoperative and postoperative comfort compared to those who received only tumescent anaesthesia alone. Pain scores,

as measured by both the Visual Analog Scale (VAS) and Numeric Rating Scale (NRS), were consistently lower in the femoral nerve block group. No major complications or motor deficits were observed during follow-up evaluations.
Conclusion: Ultrasound-guided femoral nerve block is an effective and safe adjunct to tumescent anaesthesia for endovenous laser ablation of the great saphenous vein. It significantly improves patient comfort during and after the procedure without the need for sedation or general anaesthesia.
Keywords: Femoral nerve block, endovascular laser ablation, tumescent anaesthesia, varicose veins.

INTRODUCTION

Chronic venous insufficiency (CVI) of the lower limbs is a common vascular disorder affecting approximately 25–40% of adults worldwide. It frequently results from great saphenous vein (GSV) reflux due to valvular incompetence and is associated with symptoms such as leg heaviness, oedema, skin changes, and, in advanced cases, venous ulcers. Risk factors include advancing age, female gender, pregnancy, obesity, family history, and occupations involving prolonged standing.

Minimally invasive techniques, particularly endovenous laser ablation (EVLA), have largely replaced traditional surgical ligation and stripping due to their superior outcomes in terms of efficacy, recovery, and cosmetic results. EVLA is typically performed under tumescent anaesthesia, which provides perivenous analgesia and thermal protection to surrounding tissues. However, the procedure can be uncomfortable, especially due to multiple needle punctures required for tumescent infiltration along the GSV, often necessitating additional analgesia or sedation.

While sedation and general or spinal anaesthesia can offer complete analgesia, their use is associated with potential complications, delayed mobilization, prolonged recovery, and increased resource utilization. Moreover, post-procedural immobilization raises the risk of deep vein thrombosis (DVT).

Ultrasound-guided femoral nerve block (FNB) has emerged as a promising regional anaesthetic technique, particularly for surgeries involving the anterior thigh and knee. FNB selectively anesthetizes the medial thigh—the sensory territory of the GSV—making it well-suited to enhance comfort during EVLA without the drawbacks of systemic anaesthesia. It is a quick, low-risk, and technically straightforward procedure when performed under ultrasound guidance.

Objective:

This study aimed to evaluate the safety and efficacy of an ultrasound-guided femoral nerve block, administered without sedation, in reducing intraoperative and postoperative pain during endovenous laser ablation of the GSV. We hypothesized that FNB, when added to tumescent anaesthesia, would significantly enhance patient comfort and reduce pain.

MATERIALS AND METHODS

Study Design and Ethical Approval

This was a prospective, comparative study conducted at an outpatient vascular centre following approval by the Institutional Review Board and Ethics Committee. All patients provided written informed consent. Two separate consent forms were used based on group allocation: one for patients receiving tumescent anaesthesia (TA) alone, and another for those receiving femoral nerve block (FNB) in addition to TA.

Patient Selection

Sixty adult patients with symptomatic unilateral varicose veins and confirmed great saphenous vein (GSV) reflux on duplex ultrasonography (DU) were included. A comprehensive DU evaluation of both deep and superficial venous systems was performed by certified vascular ultrasound technologists. Exclusion criteria included pregnancy, known allergy to lidocaine, bleeding disorders, history of groin surgery, active infection at the puncture site, or neurological deficits in the lower limbs.

Patients were educated about the EVLA procedure, its outpatient nature, postoperative expectations, and the possibility of discomfort related to tumescent injections and thermal ablation. They were also informed in detail about the potential benefits of FNB in reducing procedural pain. Based on this discussion and personal preference, patients were divided into two groups:

- Group I (n = 22): Received TA alone
- Group II (n = 38): Received ultrasound-guided FNB followed by TA

Preoperative Preparation and Positioning

All procedures were performed by the same surgeon in a sterile outpatient minor operating suite. Standard antiseptic preparation was carried out from groin to foot, and sterile drapes were applied. Patients were positioned supine with the leg slightly abducted and externally rotated. Monitoring included continuous pulse oximetry and vital signs throughout the procedure. The Visual Analog Scale (VAS) was introduced to all patients at the start of the procedure for real-time pain scoring.

Procedure Details

Group I: Tumescent Anaesthesia (TA) Alone

The patient was placed in the reverse Trendelenburg position. A 26G intradermal injection of 1% lidocaine was given to anesthetize the puncture site. Under ultrasound guidance, the incompetent GSV was

cannulated with an 18G needle, and a 0.035-inch angled-tip guidewire was advanced to the saphenofemoral junction (SFJ). A 6 Fr. Radial vascular access sheath was inserted over the guidewire, which was removed after the venous ablation done.

Tumescent anaesthesia solution consisting of lidocaine 400 mg/L (0.04%), epinephrine 1 mg/L (1:1,000,000), and sodium bicarbonate 10 mEq/L in normal saline was infiltrated along the length of the vein using a power pump under ultrasound guidance. Following TA administration, a laser fibre was introduced into the Radial vascular access sheath and laser fibre tip positionedthree centimetres distal to the SFJ. Ablation was performed using a 1470 -nm (A.R.C. Laser GmbH, Nuremberg, Germany) or 810-nm (Angiodynamics, Queensbury, NY, USA) laser, delivering 50–120 J/cm energy based on vein diameter.

Group II: Femoral Nerve Block (FNB) + Tumescent Anaesthesia

Patients were positioned identically to Group I. The femoral nerve block was administered using a high-frequency linear ultrasound probe. The probe was placed transversely over the inguinal crease to identify the femoral artery and vein, with the femoral nerve visualized lateral to the artery as a hyperechoic oval structure.

A 26G needle was used to anesthetize the skin, followed by insertion of a 26G needle at a 45° angle lateral to the femoral artery. After confirming negative aspiration, 2 ml of cold saline then subsequently 3 mL of 2% lidocaine were injected incrementally at perineural area of Femoral nerve . The spread of the local anaesthetic around the nerve was visualized in real time. Patients were instructed to report any tingling sensations along the medial thigh, confirming sensory block onset.

After 5–10 minutes, the same EVLA procedure as described in Group I was carried out. Tumescent anaesthesia and laser fibre insertion were performed identically, using the same energy parameters and catheter positioning.

Postoperative Care and Assessment

After the procedure, all patients had their legs wrapped with compression bandages. They were encouraged to ambulate under nurse supervision within 15–20 minutes. No patient in Group II reported muscle weakness or prolonged sensory changes following the FNB.

Pain scores were recorded using the Visual Analog Scale (VAS, 0–10 scale) during:

- Tumescent anaesthesia infiltration
- Laser ablation
- Any adjunctive local phlebectomy (if performed)

The effectiveness of anaesthesia was further confirmed via pin-prick testing and the Numeric Rating Scale (NRS). In Group II, motor function of the femoral nerve was assessed at the end of the procedure and again one hour later using the Modified Bromage Scale.

Follow-Up and Statistical Analysis: All patients were followed up at 1 month to assess for residual symptoms, recurrence, adverse events, or complications such as deep vein thrombosis or nerve injury. Data were recorded and analysed using SPSS software version XX. Continuous variables were reported as mean ± standard deviation and compared using the Student's t-test. Categorical variables were compared using Chi-square or Fisher's exact test. A p-value < 0.05 was considered statistically significant.

RESULTS

Patient Demographics and Baseline Characteristics

A total of 60 patients were enrolled in the study: 22 in Group I (TA only) and 38 in Group II (FNB + TA). Both groups were comparable in age, gender distribution, body mass index (BMI), and GSV reflux length. No statistically significant differences were observed in baseline characteristics [Table 1].

Intraoperative Pain Assessment: Patients in Group II (FNB + TA) reported significantly lower pain scores during both tumescent anaesthesia infiltration and laser ablation compared to Group I. The mean Visual Analog Scale (VAS) score during TA was 5.9 ± 1.2 in Group I and 2.4 ± 1.1 in Group II ($p < 0.001$). During EVLA, the mean VAS was 4.8 ± 1.3 in Group I and 1.8 ± 1.0 in Group II ($p < 0.001$) (Table 2, Figure 1).

Motor Function and Block Efficacy

Motor function in Group II was evaluated using the Modified Bromage Scale. No patients experienced significant motor blockade (score > 1), and all were ambulatory within 30 minutes post-procedure. The sensory block was confirmed in all patients in Group II via pin-prick testing 10 minutes after FNB administration. No patient in Group-II demonstrated significant motor weakness (Bromage score ≤ 1) one hour post-procedure. All patients in both groups were ambulatory within 20 minutes after the procedure. Postoperative VAS scores at 1 and 3 hours also remained significantly lower in the FNB group- II.

Complications - There were no instances of nerve injury, hematoma, or lidocaine toxicity in either group. No deep vein thrombosis (DVT) or infection was noted during the 1-month follow-up.

Procedure Duration and Recovery: There were no statistically significant differences in the mean length of the GSV treated or the duration of the EVLA procedure between the two groups. All patients were discharged the same day, with no delayed recovery or complications reported.

Complications and Follow-Up: No major complications, including deep vein thrombosis (DVT), hematoma, infection, or nerve injury, were observed in either group. At 1-month follow-up, all patients reported satisfactory symptom resolution, and no recurrence or adverse events were noted.

Analgesic Requirement - Postoperative acetaminophen use within the first 24 hours was significantly higher in Group A ($p < 0.05$).

All patients were followed up at 1 month to assess for residual symptoms, recurrence, adverse events, or complications such as deep vein thrombosis or nerve injury. Data were recorded and analysed using SPSS software version XX. Continuous variables were reported as mean ± standard deviation and compared using the Student's t-test. Categorical variables were compared using Chi-square or Fisher's exact test. A p-value < 0.05 was considered statistically significant option without requiring sedation or compromising post-procedural mobility.

Table 1: Baseline Characteristics of the Patients

	Parameter	Group I(TA only, n=22)	Group II(FNB+TA, n=38)	p-value
1	Age (years)	46.2 ± 8.3	45.7 ± 7.9	0.74
2	Gender (M/F)	14/8	25/13	0.89
3	BMI (kg/m²)	26.1 ± 3.4	25.8 ± 3.1	0.68
4	GSV reflux length (cm)	38.5 ± 6.2	37.9 ± 5.8	0.56

Table 2: Pain Scores and Procedural Metrics

	Parameter	Group I(TA only, n=22)	Group - II (FNB+TA, n=38)	p-value
1.	VAS during tumescent anaesthesia	5.9 ± 1.2	2.4 ± 1.1	<0.001
2	VAS during laser ablation	4.8 ± 1.3	1.8 ± 1.0	<0.001
3	Duration of procedure (minutes)	38.4 ± 7.5	36.9 ± 6.8	0.42
4	Length of GSV treated (cm)	36.1 ± 6.7	35.5 ± 5.9	0.57
5	Time to ambulation (minutes)	21.4 ± 3.6	20.1 ± 3.3	0.12

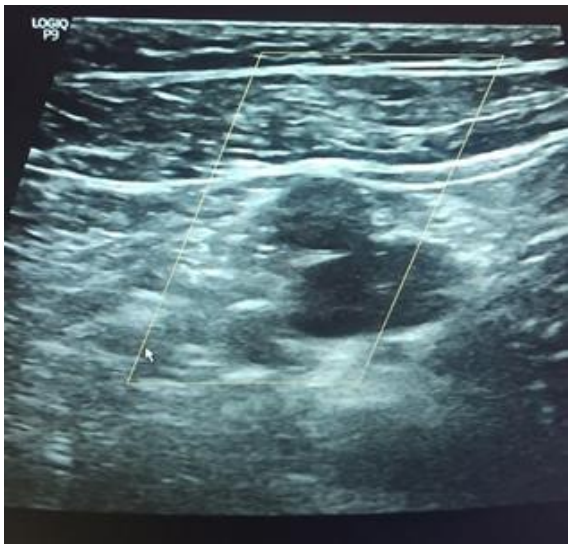

Figure 1: Femoral Nerve, Femoral Vein & Superficial Femoral Artery.

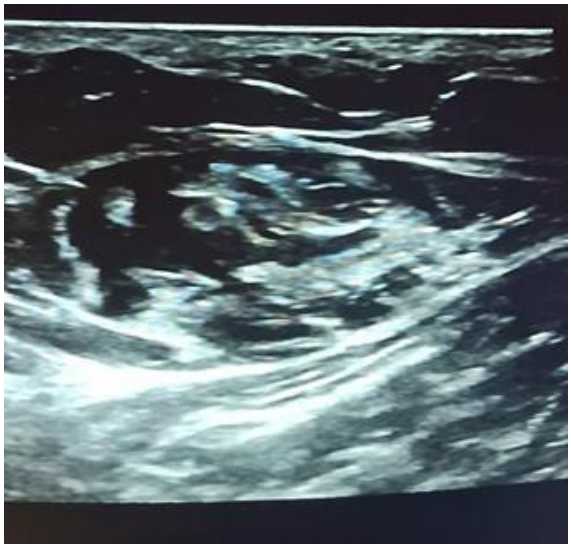

Figure 2: Femoral Nerve after nerve block injection given

DISCUSSION

This prospective, randomized study demonstrates that ultrasound-guided femoral nerve block (FNB) significantly reduces intraoperative and early postoperative pain associated with endovenous laser ablation (EVLA) of the great saphenous vein (GSV). Despite both groups receiving standard tumescent anaesthesia (TA), the addition of FNB provided a superior analgesic effect without increasing the risk of motor blockade or delaying ambulation.

Our findings align with previously published literature indicating that peripheral nerve blocks enhance patient comfort during minimally invasive venous procedures. While sedation or general anaesthesia can also reduce discomfort, these methods carry additional risks and resource burdens, including extended recovery times and potential cardiovascular compromise.

Importantly, the FNB group required significantly less intraoperative and postoperative analgesic medication, supporting its efficacy in real-world outpatient practice. The safety of the procedure was further validated by the absence of significant complications.

EVLA has become a first-line treatment for great saphenous vein (GSV) incompetence due to its minimally invasive nature, faster recovery, and lower complication rates compared to surgical ligation and stripping.[1-3] TA remains essential during EVLA for collapsing the vein and preventing thermal damage to surrounding tissues, but its administration through multiple perivenous injections is often cited as the most painful component of the procedure.[4,5]

Pain management during EVLA varies and includes TA alone, intravenous sedation, general anaesthesia, and regional techniques such as spinal or femoral nerve blocks. However, deeper anaesthesia methods are associated with delayed mobilization, increased risk of deep vein thrombosis (DVT), and higher

hospital costs.[6–9] In this context, ultrasound-guided femoral nerve block (FNB) presents as a technically simple, rapid, and safe method to improve periprocedural analgesia without compromising recovery.[10]

Our findings align with previous studies by Hakim et al,[11] Al Wahbi et al,[12] and Yilmaz et al,[13] all of whom demonstrated that FNB significantly reduces pain during EVLA, particularly during tumescent infiltration. In our study, patients receiving FNB (Group B) had significantly lower intraoperative and postoperative pain scores, improved satisfaction, and reduced TA volume requirements. This may potentially reduce the risk of local anaesthetic toxicity.

Importantly, while FNB resulted in transient motor block in some patients, all were mobilized within three hours and discharged on the same day, minimizing concerns about prolonged immobilization and DVT. No FNB-related complications (e.g., hematoma, femoral artery puncture) were observed, affirming its safety when performed under ultrasound guidance.[10]

CONCLUSION

These findings also suggest that FNB may not be necessary in all EVLA cases, as the overall pain scores during laser ablation alone (excluding phlebectomy) remain low in most patients. However, for patients undergoing extensive phlebectomy or those with a low pain threshold, the addition of FNB offers significant benefit.

The main limitation of our study is the small sample size, which may have reduced statistical power in certain comparisons. In addition, we did not record the number of stab incisions made during phlebectomy, which could have further stratified pain experiences. Despite these limitations, our randomized design strengthens the internal validity of our conclusions.

Ultrasound-guided femoral nerve block is a safe, effective, and technically feasible adjunct to tumescent anaesthesia during EVLA. It significantly reduces perioperative pain, especially during tumescent infiltration for local phlebectomy, and improves patient satisfaction without substantially increasing procedure time or costs. Although transient motor block may delay early ambulation, it does not impact same-day discharge or increase DVT risk.

Routine use of FNB in all EVLA cases may not be necessary. However, it should be strongly considered in patients requiring extensive local phlebectomy, those with heightened pain sensitivity, or when alternative analgesic strategies are contraindicated. Further multicentre trials with larger sample sizes and long-term follow-up are warranted to validate these findings and refine patient selection criteria for FNB use in varicose vein interventions.

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