

Varicose Vein Treatment by Suction-assisted Shaving Phlebectomy without the Use of Transillumination/Irrigation: A Simple, Quick and Effective Method

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Background: Traditional management of saphenous vein incompetency is using high ligation and stripping with multiple stab incision phlebectomies for the varicose tributaries. A number of minimally invasive options have been described, each with their own advantages and disadvantages. We describe a new technique using suction-assisted shaving phlebectomy without transillumination and irrigation in the management of varicose veins.

Methods: All patients that underwent combined conventional high ligation and stripping for saphenous vein insufficiency and suction-assisted shaving phlebectomy for varicose tributaries between 2011 and 2016 was included. They were evaluated with respect to surgical time, number of incisions, complications, and outcomes.

Results: A total of 232 patients with mean age of 49 years old were included. The mean operation time for combined saphenous stripping and suction-assisted shaving phlebectomy was 29.5 minutes and for suction-assisted shaving phlebectomy was 7.4 minutes. The number of incisions excluding the groin incision was 3 incisions in 38 limbs, 2 incisions in 186 limbs, and 1 incision in 33 limbs. Postoperative complications included 2 (0.8%) skin perforation, 1 cellulitis (0.4%), 2 hematoma (0.8%), 3 saphenous neuropathy (1.2%), 4 skin pigmentation (1.6%), 4 skin depression or irregularities (1.6%), and 3 hypertrophic scarring (1.2%).

Conclusions: Suction-assisted shaving phlebectomy has the advantage of decreased operating time, fewer surgical incisions, and decreased scar formation. There is no need to purchase expensive medical equipment. It is a simple and effective procedure with comparable complication rates. This technique aims to replace traditional ambulatory phlebectomy and transilluminated powered phlebectomy. (*Plast Reconstr Surg Glob Open* 2019;7:e2307; doi: 10.1097/GOX.0000000000002307; Published online 25 July 2019.)

INTRODUCTION

The traditional treatment for saphenous vein incompetency is using high ligation and stripping with multiple stab incision phlebectomies for the varicose tributaries. A number of minimally invasive options for the management of varicose veins have now been described. Endovenous laser therapy and intravenous radiofrequency ablation

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Received for publication April 13, 2019; accepted April 26, 2019.

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DOI: 10.1097/GOX.0000000000002307

were introduced for the treatment of greater and lesser saphenous vein incompetency. Transilluminated powered phlebectomy (TIPP) was introduced for the surgical management of the varicose tributaries.¹ Each of these treatment modalities has its own indications, contraindications, advantages, and disadvantages. Among these, TIPP has the advantage of significantly decreased surgical time and incisions, especially for patients with extensive varicosities. However, the medical equipment and supplies required for TIPP are expensive, increasing the overall medical expenditure. In this article, we describe a new technique using suction-assisted shaving phlebectomy without the aid of transillumination and irrigation in the management of varicose veins.

PATIENTS AND METHODS

A retrospective review of all patients using suction-assisted shaving phlebectomy in the treatment of varicose

Disclosure: *The authors have no financial interest to declare in relation to the content of this article*

veins without the use of transillumination and irrigation from May 2011 to April 2016, at a university-affiliated medical center was performed. All patients underwent a combined operative approach of conventional high ligation and stripping for saphenous vein insufficiency and suction-assisted shaving phlebectomy for varicose tributaries. Those that only underwent saphenous vein stripping, or were treated only with suction-assisted shaving phlebectomy, and those that were treated using combined endovenous laser ablation with suction-assisted shaving phlebectomy were excluded from the study. All patients received preoperative venous duplex ultrasound examination to assess venous reflux and to exclude deep vein thrombosis. Varicosities were graded using Clinical, Etiologic, Anatomic, Pathophysiologic classification.² The patients were evaluated with respect to surgical time, number of incisions, complications, and patient outcomes.

A suction-assisted cartilage shaver (E9000 System, ConMed Linvatec Corporation, Largo, Fla.; Fig. 1A) was used for resection of the varicose tributary veins. The cartilage shaver blade consists of 2 concentric metal cannulas with diameters of 3 and 4 mm (Fig. 1B). The outer cannula has an upward opening to allow the rotating serrated

inner cannula to serve as a continuous curette for the resection of varicose veins. The shaver was held with the opening of the cannula facing upward. We set the rotation rate of the inner cannula at 300–500 rotations per minute in oscillation mode. A suction tube was connected to the handpiece for prompt removal of resected tissue.

Operative Procedure

The patient was first placed in the standing position to allow the veins to become engorged and tortuous. This is very important as some mildly enlarged veins may become invisible with the patient in the supine position. A discussion was held with the patient as to which veins will be treated. Instead of general outlining of the vein cluster, mark directly over the varicose veins as precisely as possible. This is to avoid trauma to the healthy skin.

Initial ligation and stripping of the greater saphenous vein till the knee level was performed under either general or spinal anesthesia. Thereafter, the shaver was inserted into the medial knee wound to allow for removal of varicosities over the medial and posterior upper leg. If required, a further 1–2 small 0.5 cm incisions in the distal leg can be made to allow for the removal of varicosi-

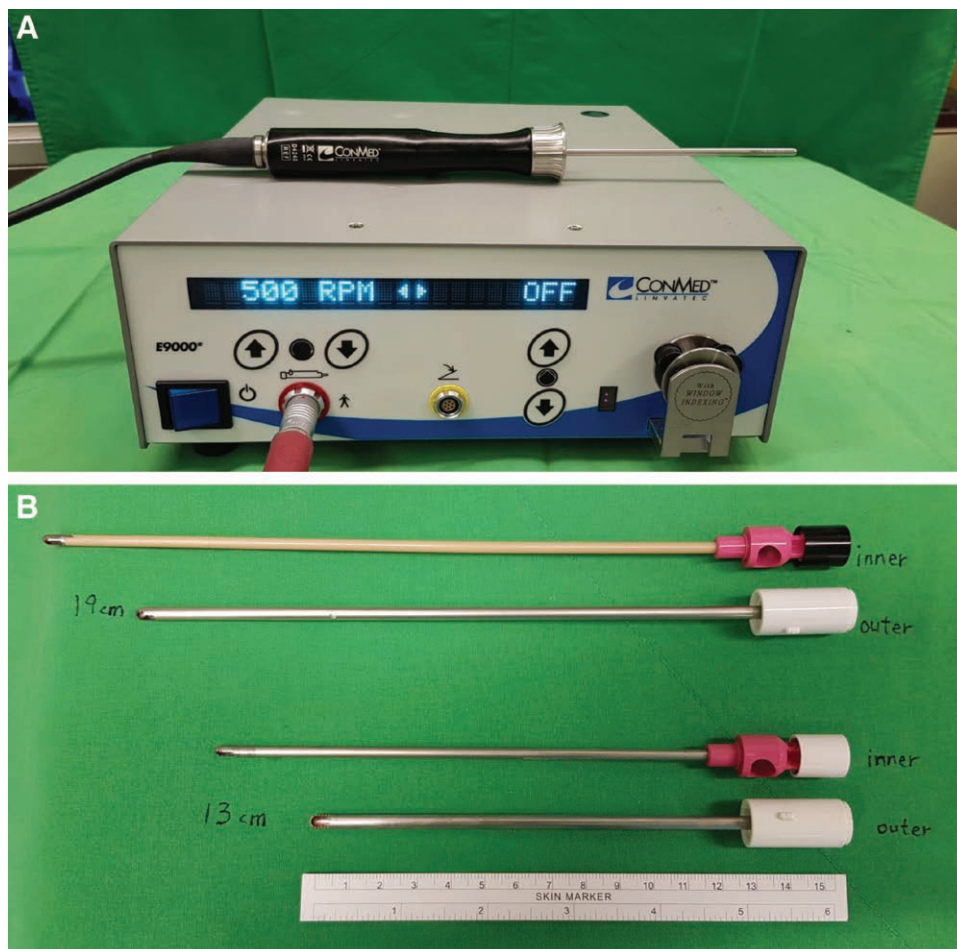


Fig. 1. A, A suction-assisted cartilage shaver system was used for resection of the varicose tributary veins. B, The cartilage shaver blade consists of 2 concentric metal cannulas with diameters of 3 and 4 mm. Two types of length of the cannula were used accordingly.

ties over the distal leg and foot. No tumescent solution was used for hydrodissection, avoiding the creation of unnecessary potential space, which will increase the risk for blood accumulation and, therefore, hematoma formation. Place the shaver directly beneath the vein and use the contralateral hand to stretch the skin taut. This will prevent the skin from being drawn into the shaver blade, causing inadvertent perforations in the skin. The varicosities drawn into the rotating blade are gently removed without the need to apply excessive pressure. No transillumination was required as the veins were previously marked out. You can see where the shaver tip is as you resect. Do not place the shaver too deep as the subcutaneous tissue could be resected causing depressions and irregularities in the skin. Perform compression from the distal to the proximal leg, to evacuate the blood and blood clot before wound closure. Penrose drains were placed in each wound and the incisions were closed with 5-0 nylon. Apply compression dressing using elastic bandage from the toe up till the thigh. It is very important to avoid direct compression over the wound where the penrose drains are to facilitate the drainage of blood (**See Video, [online]**), which demonstrates how we use the suction-assisted cartilage shaver system for the resection of the varicose tributary veins).

Patients were asked to return to the outpatients' clinic on the second or third postoperative day for removal of drains and for dressing changes. The compressive, elastic bandage was applied in the first week with subsequent transition to graduated compression stockings for another 5 weeks. The patients were followed up at 1 week, 2 weeks, 4 weeks, 2 months, 6 months, and 1 year.

RESULTS

A total of 232 patients (257 limbs) that underwent combined greater saphenous vein stripping and suction-assisted shaving phlebectomy from May 2011 to April 2016 were included in the study. Most of the limbs (89.9%) were in the C2–C4 categories and only 10.1% were in the C5 and C6 categories. The patients' mean age was 49 years old (range 32–76). There were 154 female and 78 male patients. Patient demographic data are shown in Table 1. The mean operation time for combined saphenous stripping and suction-assisted shaving phlebectomy was 29.5 minutes (range 25–45 minutes) and mean operation time for suction-assisted shaving phlebectomy was 7.4 minutes (range 4–11 minutes). The number of incisions excluding the groin incision used for high ligation and stripping was 3 incisions in 38 limbs (14.8%), 2 incisions in 186 limbs (72.4%), and 1 incision in 33 limbs (12.8%). The mean number of incisions was 2.0. Ecchymosis or discoloration beneath the skin along and surrounding the course of the treated veins were commonly seen immediately post-surgery, but these usually abate in 2–4 weeks. String-like indurations over the treated veins causing slight or moderate pain can be seen and these resolve in 3–6 weeks. Postoperative complications included 2 skin perforation (0.8%), 1 cellulitis (0.4%), 2 hematoma (0.8%), 3 saphenous neuropathy (1.2%) at 6 weeks, 4 skin pigmentation

(1.6%), 4 skin depression or irregularities (1.6%) and 3 hypertrophic scarring (1.2%). There were no postoperative skin necrosis, deep vein thrombosis, or mortality. All the complications were minor complaints and required no further surgical treatment. Two (0.8%) limbs developed residual or recurrent varicosities, 1 was treated with sclerotherapy and the other with further shaving phlebectomy under tumescent anesthesia during follow-up. The operative variables and postoperative complications are shown in Table 1. The follow-up time ranged from 12 months to 66 months with a mean of 26 months. Ninety-one percent of the patients were satisfied with the surgical outcome (Fig. 2) and would undergo the procedure again or recommend it to others.

DISCUSSION

The conventional treatment for varicose veins with saphenofemoral junction incompetence and greater saphenous vein reflux is using high ligation and stripping of the greater saphenous vein and removal of the varicose tributaries over the calf area with ambulatory phlebectomy. Ambulatory phlebectomy, which includes various techniques such as hook phlebectomy, multiple stab incision phlebectomy, miniphlebectomy, and microphlebectomy, has a low complication rate and high patient satisfaction with good cosmetic results. However, these traditional vein removal techniques can be tedious to perform and are very time-consuming. This is more so when extensive varicosities

Table 1. Demographic Characteristics, Perioperative Data, and Postoperative Complications

Variable	Value
Demographic data	
Age, y (range)	49 (32–76)
Gender (woman), n (%)	154 (66.4)
No. of patients	232
No. of limbs treated	257
Risk factors, n (%)	
Prolonged standing position	126 (54.3)
Hereditary	113 (48.7)
Pregnancy	91 (39.2)
Obesity	68 (29.3)
Clinical CEAP classification, n (%)	
C2: varicose veins	147 (57.2)
C3: edema	46 (17.9)
C4: skin changes	38 (14.8)
C5: healed ulceration	12 (4.7)
C6: active ulceration	14 (5.4)
Duration of stripping and shaving phlebectomy, min	29.5 (25–45)
Duration of shaving phlebectomy only, min	7.4 (4–11)
No. of phlebectomy incisions (including knee incision)	2.02 (1–3)
Postoperative complications, n (%)	
Skin perforation	2 (0.8)
Cellulitis	1 (0.4)
Hematoma at 2 wk	2 (0.8)
Saphenous neuropathy at 6 wk	3 (1.2)
Skin discoloration	4 (1.6)
Skin depression or irregularities	4 (1.6)
Hypertrophic scar	3 (1.2)
Residual veins	2 (0.8)
Skin necrosis	0
Deep vein thrombosis	0
Postoperative mortality	0

CEAP indicates Clinical-Etiology-Anatomy-Pathophysiology.



Fig. 2. A, A 62-year-old male patient shown preoperatively with the varicose veins outlined. B, At 1-year postoperative follow-up.

are present. Multiple stab incisions result in multiple scars which may impair cosmesis. This is especially more noticeable in the Asian population who tend to have more visible scar problems.

Weiss and Goldman³ first reported the use of transillumination for the mapping of varicose tributaries. This ensured identification of and allowed for complete removal of the varices. The United States Food and Drug Administration approved the technique of transilluminated powered phlebectomy described by Spitz et al.¹ for clinical application in 2000. Since then the technique of TIPP using the TriVex system (LeMaitre Vascular, Burlington, Mass.) has been widely performed with remarkable results. The TIPP technique consists of 2 devices: the transilluminator/irrigator and the powered resector device. The transilluminator/irrigator is used to infuse tumescent solution for hydrodissection and to visualize directly the varicosities. The veins are suctioned into the rotating blade of the resector, which fragments and removes them. TIPP has been developed as a minimally invasive technique, intending to replace ambulatory phlebectomy. This technique offers several potential advantages: fewer incisions, shorter operative time, less incomplete vein resection with less incidence of recurrence, and better cosmesis than traditional ambulatory phlebectomy.

Some earlier studies with small case numbers comparing hood phlebectomy versus transilluminated powered phlebectomy showed TIPP was slower (although speed increased with practice) and was associated with more frequent hematoma formation (although this reduced with

practice).^{4,5} In 2006, Chetter et al.⁶ described that TIPP was associated with more extensive bruising, prolonged pain, and reduced early postoperative quality of life, but it had the advantage of less surgical incisions. Theoretically, reduction of incision using TIPP may obtain improved cosmetic results; however, Scavée et al.⁴ and Aremu et al.,⁷ reported no significant difference in cosmesis.

However, most of the recent studies showed that with increased experience, there is a decrease in operative time, the number of incisions made and a reduction in the incidence of hematoma formation. However, despite the perceived advantages of TIPP, many vein specialists remained apprehensive in adopting this technique due to the need for the acquisition of new surgical equipment and a definite learning curve required to master this surgical technique.^{5,8}

In this article, we described a new technique without the aid of transillumination and irrigation, thus obviating the need to purchase expensive equipment and avoiding the 2 steps of tumescent solution (primary and secondary) required. This decreased the operating time, and saving on medical costs. Our shaving phlebectomy method required 1 incision for the introduction of the shaver (resector) to complete the procedure, whereas TIPP will need at least 2 incisions, 1 for introduction of the resector and another for illuminator/irrigator, to treat 1 vein cluster.

In our series, the number of incisions including the medial knee wound for removal of varicose tributary veins ranged from 1 to 3, with an average of 2 incisions, which

is less than the number of incisions required with TIPP which ranged between 4 and 7.⁷⁻¹³ The mean operating time for suction-assisted shaving phlebectomy was 7.4 minutes (range 4–11 minutes), which is also much less when compared to using TIPP (range 17.1–40.5 minutes).^{6,8,13,14} Our series also showed comparably less postoperative complications. The low incidence of postoperative cellulitis (0.4%) in our series was consistent with those reported in the literature of 0%–3%.^{7-10,14} This may be attributed to the decreased incisions required. With regard to recurrence or residual veins, our result of 0.8% was comparable with the use of TIPP (0%–9.1%).^{7-9,14} This was achieved because the varicose veins were marked out with the patient in the standing position and discussing fully with the patients which veins will be treated. This reduced the incidence of incomplete resection.

By far, the most commonly described complication associated with TIPP is hematoma formation. Hematoma was considered as a complication when they remained present at 2 weeks following the procedure. The reported incidence of persistent hematoma at 2 weeks ranged widely from 0% to 12%.^{5,8-10,14} In the largest clinical series of TIPP procedure by Lin,⁸ the overall incidence of hematoma was 5.8% at 2 weeks. However, this incidence improved to 2.1% in their most recent 620 patients because of the modification of their surgical technique.

However, our hematoma rate (0.8%) was even less. We believe that the higher incidence of hematoma in TIPP may be due to more extensive tissue plane dissection using intraoperative tumescent solution irrigation. With regard to postoperative dressing, they routinely used 10–15 absorbent abdominal pads in every TIPP procedure, which were placed directly over the leg incision sites.⁷ We routinely placed penrose drains in each incision wound and avoided direct compression dressing over the wounds with the penrose drains, thus reducing the hematoma rate significantly.

We had 4 cases of skin depression or irregularities over the area of resected veins. This may be due to excessive subcutaneous fat being resected inadvertently. To avoid this, the resector should be placed directly beneath the vein. We had 4 cases with skin hyperpigmentation. This could be avoided by decreasing the force with which the resector was pressed against the vein and the skin. At the same time multiple passes for resection at same location should be avoided. This could cause dermal damage with resultant hyperpigmentation.^{5,14} We had 2 cases of skin perforation which occurred early in the study period. We avoided this complication by not applying too much pressure to the skin with the resector and to stretch the overlying skin taut during resection.

We further compared our technique with 2 of the largest TIPP series reported in the literature. In the report by Franz et al.¹⁴, they had 9 years experience treating 547 cases in 431 patients, they had very low complication rates: cellulitis 1.9%, persistent hematoma 0%, and residual veins 0%. The mean TIPP procedure time was 20.2 minutes (range 4.0–108.0 minutes). Distribution of total incisions was 41.5% of the cases with less than 10 incisions; 50.5% cases with 10–20 incisions; and 8.0% cases with more than 20 incisions. A further study by Peter and Lin⁸

where they treated 1,034 patients with 1,167 limbs, their complication rates were cellulitis 1%, persistent hematoma 5.8%, and residual veins 5.6%. In their 12 years experience, the mean operative time for the TIPP procedure was 18.4 ± 8.9 minutes (range 6.0–82.0 minutes), the mean number of incisions for TIPP procedure was 6.3 ± 3.6 (range 3–18). Our technique of suction-assisted shaving phlebectomy required far fewer incisions (mean 2.0 and range 1–3) and a much lower procedure time (mean 7.4 minutes and range 4–11 minutes).

In private clinics or hospitals, many plastic surgeons, dermatologists, orthopedic surgeons, and otolaryngologists already have the suction-assisted cartilage shaver, which is commonly used for the treatment of osmidrosis,^{15,16} knee osteoarthritis, and nasal diseases. It is easy and quick to learn, there is no need for extensive experience and lengthy learning curve to become familiar with this technique.

Asian skins has a tendency toward hyperpigmentation and scar formation.¹⁷ Therefore, decreasing the number of incisions is very important in our population group for leg cosmesis. We should understand that the reported statistical data regarding the number of incisions, operative time, and complication rate were related to the severity of the disease and also to the experience of the surgeon. The limitation in our study is the lack of prospective randomization or a control group.

CONCLUSIONS

The technique of suction-assisted shaving phlebectomy has the advantage of decreased operating time, fewer surgical incisions, decreased scar formation with better cosmesis. There is no need to purchase expensive equipment and supplies. It is a simple and effective procedure with comparable complication rates, if not better. This technique aims to replace the traditional very time-consuming ambulatory phlebectomy and also the more complicated and expensive technique of transilluminated powered phlebectomy.

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