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Endovenous Laser Therapy Versus Radiofrequency Ablation of the Long Saphenous Vein; Analysis of the Early Postoperative Complications

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Abstract

Background: Ligation and stripping was the most frequently used therapeutic option in the treatment of varicose veins. However, with the technological advances, there has been a lot of evolving minimally invasive techniques using endovenous methods with a lot of ongoing research into their efficacy in treating the disease and the possible complications. The most commonly used endovenous ablation techniques are endovenous laser and radiofrequency.

Aim of Study: To compare between early postoperative complications in Endovenous laser therapy versus radiofrequency ablation of the great saphenous vein.

Patients and Methods: This is a prospective cohort study which includes patients presented to Egyptian Railway Medical Center vascular clinic between Jan. 2019 to Jan. 2021 with primary lower limb(s) varicose veins, and undergoing endovenous thermal ablation of the great saphenous vein. Patients were randomly divided into 2 groups; endovenous laser ablation and radiofrequency ablation. Comparison between the 2 groups was done regarding successful ablation rate, post-operative complications and improvement of symptoms.

Results: 43 patients were included in our study, 18 patients underwent radiofrequency ablation and 25 patients underwent endovenous laser ablation. On comparing both techniques with regards to successful ablation, minor postoperative complication and improvement of symptoms, EVLA was found to be superior to RFA. Patient's demographics, medical comorbidities of both groups were not significantly different.

Conclusion: Endovenous thermal ablation is becoming more popular in management of varicose veins. Both EVLA and RFA have comparable results, with less incidence of thrombophlebitis in EVLA.

Key Words: *Varicose veins – Endovascular laser ablation – Radiofrequency ablation.*

Introduction

VARICOSE veins are a common problem and cause disfigurement, disability, and impairment in the quality of life. The advent of endovenous ablation techniques has expanded the surgical options for patients requiring treatment [1].

Definitive treatment of varicose veins aims at abolishing sources of venous reflux. Removing long refluxing segments and varicose reservoirs can be achieved by conventional surgery or by endovenous ablation techniques [2].

Varicose veins surgery has been practiced in various forms for more than 2000 years. Stripping of the saphenous vein was described 100 years ago both by Keller and by Babcock who used to remove saphenous trunks in order to reduce the rate of recurrence achieved by ligation of the saphenous vein alone [3].

Endovenous laser ablation is one of the most accepted treatment options for insufficient great and small saphenous veins [4].

These endovenous techniques are cost-effective, especially when performed in an outpatient or 'office-based' setting [5].

The management of varicose veins has changed dramatically over recent years, but the ideal treatment remains elusive. Traditionally, varicose veins have been treated with surgical ligation and stripping under general anaesthetic; however, over the past decade, minimally invasive techniques and local anaesthesia have become increasingly popular and indeed preferred [6].

Moreover, office based procedures are gaining more popularity in the presence of growing patients' reluctance in hospitalization during the Covid-19 pandemic.

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The severity of symptoms of varicose veins can range from occasional discomfort and itching to severe skin ulceration, absence from work, pain and decline in the quality of life. About 10% of patients with varicose veins develop skin changes, such as pigmentation or eczema, and about 3% may develop venous ulcers [7].

The clinical signs and symptoms of venous disease may be classified using the Clinical status, Etiology, Anatomy, and Pathophysiology (CEAP) classification. The degree of severity of pain and other clinical signs or symptoms can be measured using the Venous Clinical Severity Score (VCSS); the change of VCSS before and after the intervention can be used to measure the efficacy of the intervention [8].

The CEAP classification is an accepted standard for classifying chronic venous disorders. The chronic venous disorders are classified from C0 to C6 based on the severity of venous symptoms [9].

Lower limb varicose veins management has changed rapidly in the recent years, with replacement of the conventional surgery by newer endovenous methods [6].

The treatments for varicose veins developed in the last 15-20 years have mainly concentrated on ablation of the saphenous trunk as a way of addressing the problem of varicose veins. This includes radiofrequency ablation, endovenous laser ablation, ultrasound guided foam sclerotherapy, mechanochemical endovenous ablation and vein glue [10].

In 2013, the National Institute for Health and Care Excellence (NICE) recommended Endovenous thermal ablation (EVTA) as the preferred treatment option for symptomatic varicose veins [11].

Two endovenous modalities include radiofrequency ablation (RFA) and endovenous laser therapy (EVLT). Both treatments involve inserting a heat-generating laser fiber or catheter into the incompetent saphenous vein, positioned just below the Saphenofemoral junction (SFJ) or Saphenopopliteal junction (SPJ). Heat is generated through laser endovenous laser therapy (EVLT) or radiofrequency (RFA) energy, and as the fiber or catheter is slowly removed down the length of the vein, endothelial and venous wall damage occurs, causing contraction of the vein wall and ultimately destruction of the vessel [12].

Deep vein thrombosis (DVT) after varicose vein surgery is a well-recognized complication. With the growing popularity of endovenous thermoablative techniques, there have been numerous reports of endovenous heat induced thrombosis (EHIT). EHIT is a thrombus extending from the superficial venous system into the deep venous system at, or proximal to, a site of recent thermoablation, most commonly thrombus extending from the great saphenous vein (GSV) into the common femoral vein [13].

The overall common and most devastating complications including burns, nerve injury, arteriovenous fistula (AVF),endothermal heat-induced thrombosis and deep venous thrombosis [14].

Patients and Methods

This is a comparative study which was conducted on patients presented to Egyptian railway medical center vascular clinic between Jan. 2019 to Jan. 2021 with primary varicose veins who underwent endogenous thermal ablation of the great saphenous vein.

43 patients were included in our study, 18 patients underwent radiofrequency ablation (RFA group) and 25 patients underwent endovenous laser ablation (EVLA group). Bilateral EVLA was done in one case.

The two groups were compared with regards to demographics and baseline clinical, radiological, and laboratory findings. Comparison was done between the postoperative complications among the 2 groups based on follow-up visits performed at 2 weeks, 3 months and 6 months post–intervention.

All participating patients' procedures were totally sponsored by the Egyptian Railway Hospital as part of their insurance coverage. The study was approved by Ain Shams University Ethical Committee, and all participating patients signed an informed consent.

Inclusion criteria: Patients aged (18-50) and fit for anesthesia. Varicose veins affecting the GSV system with documented saphenofemoral junction incompetence through a standing duplex scan showing reflux for more than 2 seconds. Patients with primary varicose veins.

Exclusion criteria:

Patients with secondary varicose veins due to: History of deep vein thrombosis. Concomitant malignancy. Pregnancy or lactation. Patients in C6 stage with active ulcers and those with post thrombotic etiology. Highly tortuous LSV or GSV diam-

eter more than 20mm [Maximum diameter of GSV Ablation in Closure Fast Radiofrequency Catheter = 17±4mm 15 (medtronic), and maximum diameter of GSV Ablation in Laser Ablation Catheter = 20 mm according to the manufacturers' IFU - bioletic radial fiber] **[16]**. Patients with a pacemaker, internal defibrillator or other active implanted devices (contra-indications to the use of EVL). Concomitant peripheral arterial insufficiency. Patients refusing to give consent to participate in the study.

All patients included in the study were diagnosed based on full history and clinical examination. Presenting symptoms and signs are classified according to CEAP classification, Venous Clinical Severity Score. Investigations included laboratory tests, and venous duplex ultrasound.

EVTA procedures were performed under general or regionals anesthetic, duplex guided access to the incompetent vein was achieved through Seldinger's technique, followed by the insertion of a 6 French sheath. A catheter or fiber is inserted in the vein and its tip is positioned about 1-2cm below the saphenofemoral or saphenopopliteal junction. Under ultrasound guidance, local tumescent anesthesia was administered around the vein, along the entire course that acquires treatment. When the device is switched on (and the fiber/ catheter is pulled back), energy is emitted intraluminal, causing thermal damage of the vein wall **[17,18]**.

All patients were followed up after 2 weeks, after 3 months, and 6 months from the date of procedure through clinical examination and duplex assessment. Statistical analysis was performed using SPSS (IBM SPSS) version 23.

Results

43 patients were included in our study, those patients were randomly divided into 2 groups, 18 patients were candidates for radiofrequency ablation (RFA group) and 25 patients were candidates for endovenous laser ablation (EVLA group). Bilateral EVLA was done in one case. The left sided varicose veins was the common presentation and only 2 patient presented with right side varicose veins.

The mean age of the included patients was 48.26 (±6.385). There were 5 females, 2 of them underwent radiofrequency ablation and 3 of them underwent endovenous laser ablation. With regards to comorbidities, there were no statistically significant difference between the 2 groups with the exception of a higher number of diabetics in the RFA group with a p-value of 0.013 (Table 2). Demographics showed statistically significant higher number of male patients in the EVLT group (p-value 0.008). None of the included patients was cardiac or had history of previous VTE. On comparing symptoms and signs between the 2 groups, no statistically significant difference was found with regards to perioperative pain, pigmentation, edema, extent of varicosities and induration (Tables 3,4). All the included patient was classified according to CEAP classification and it was found that the majority of cases were classified as C3 preoperatively with 15 patients and 24 patients in RFA and EVLA group respectively. 2 patients were preoperatively classified as C4 and only one patient was C5, all of whom were confined to the RFA group (Table 5).

In the radio frequency ablation group the mean number of RFA cycles was 17.67 (±5.508) and the maximal vein diameter was 4.6mm (±1.17), while in EVLA group the mean total energy expenditure was 4246.8 Joules (±1010.42) with maximal vein diameter of 4.9mm (±1.32) (Table 6).

Table (1): Descriptive statistics of baseline demographics.

Variable	Frequency	Percent
Modality of ablation:		
Radiofrequency	18	41.9
Endovenous laser	25	58.1
Gender:		
Female	5	11.6
Male	38	88.4
Smoking:		
No	24	55.8
Yes	19	44.2
Obesity:		
No	18	41.9
Yes	25	58.1
Diabetes:		
No	34	79.1
Yes	19	20.9
Hypertension:		
No	42	97.7
Yes	1	2.3
Hypercholesterolemia:		
No	32	74.4
Yes	11	25.6
ISHD:		
No	43	100
Congestive cardiac failure:		
No	43	100
History of previous VTE:		
No	43	100
Side:		
Right	2	4.7
Left	40	93.0
Bilateral	1	2.3

Table (2): Association between demographics in both groups.

Variable	Radio-frequency	Endovenous laser	*p*-value
Gender:			
Female	2 (11.1%)	3 (12%)	0.008*
Male	16 (88.9%)	22 (88%)	
Smoking:			
No	7 (38.9%)	17 (68%)	0.058**
Yes	11 (61.1%)	8 (32%)	
Obesity:			
No	7 (38.9%)	11(44%)	0.738**
Yes	11 (61.1%)	14 (56%)	
Diabetes:			
No	11 (61.1%)	23 (92%)	0.013*
Yes	7 (38.9%)	2 (8%)	
Hypertension:			
No	17 (94.4%)	25 (100%)	0.183*
Yes	1 (5.6%)	0	
Hypercholesterolemia:			
No	12 (66.7%)	20 (80%)	0.325*
Yes	6 (33.3%)	5 (20%)	
Side:			
Right	2 (11.1%)	0	0.099*
Left	16 (88.9%)	24 (96%)	
Bilateral	0	1 (4%)	
Previous varicose veins surgery:			
No	15 (83.3%)	21 (84%)	0.95*
Yes	3 (16.7%)	4 (16%)	

**p*-value calculated using Fischer's exact test.

Table (3): Preoperative symptoms.

Site of incompetence	SFJ	43	100%
Previous varicose veins surgery	No	36	83.7%
	Yes	7	16.3%
Active venous ulcers	No	43	100%
Associated peripheral vascular disease	No	43	100%
Pain	None	2	4.7%
	Occasional	34	79.1%
	Daily	7	16.3%
Varicose veins	None	1	2.3%
	Few	4	9.3%
	Multiple	31	72.1%
	Extensive	7	16.3%
Venous edema	None	2	4.7%
	Evening only	33	76.7%
	Afternoon	5	11.6%
	Morning	3	7%
Pigmentation	Absent	38	88.4%
	Limited, old	5	11.6%
Inflammation	None	43	100%
Induration	Absent	40	93%
	Focal <5cm	3	7%
Compression therapy	Most days	43	100%
Anesethia	General	1	2.3%
	Spinal	42	97.7%
Complementary procedures	Phlebectomies	43	100%
Postoperative anticoagulation	Yes	43	100%

Table (4): Association between preoperative symptoms in both groups.

Variable	Radio-frequency	Endovenous laser	*p*-value
CEAP Classification pre-intervention:			
C3EpAsPr	15 (83.3%)	24 (96%)	0.262*
C4EpAsPr	2 (11.1)	1 (4%)	
C5EpAsPr	1 (5.6%)	0	
Pain:			
None	1 (5.6%)	1 (4%)	0.205*
Occasional	12 (66.7%)	22 (88%)	
Daily	5 (27.8%)	2 (8%)	
Varicose veins:			
None	1 (5.6%)	0	0.38*
Few	1 (5.6%)	3 (12%)	
Multiple	12 (66.7%)	19 (76%)	
Extensive	4 (22.2%)	3 (12%)	
Venous oedema:			
None	1 (5.6%)	1 (4%)	0.182*
Evening only	11 (61.1%)	22 (88%)	
Afternoon	4 (22.2%)	1 (4%)	
Morning	2 (11.1%)	1 (4%)	
Pigmentation:			
Absent	15 (83.3%)	23 (92%)	0.385**
Limited/old	3 (16.7%)	2 (8%)	
Induration:			
Absent	26 (88.9%)	2 (11.1%)	0.56**
Focal <5cm	24 (96%)	1 (4%)	

* *p*-value calculated using likelihood ratio.
***p*-value calculated using Fisher's exact test.

Table (5): CEAP Classification.

CEAP Classification pre-intervention:		
C3EpAsPr	39	90.7%
C4EpAsPr	3	7%
C5EpAsPr	1	2.3%
CEAP Classification post-intervention:		
C 1EpAsPr	41	95.3%
C3EpAsPr	2	4.7%

Table (6): Technical operative data.

	Variable	Mean	SD
Radiofrequency group	Radiofrequency cycles	17.67	5.508
	Maximal vein diameter	4.6 cm	1.17
Endovenous laser group	Endovenous laser total energy expenditure	4246.8 Joules	1010.42 1.32
	Maximal vein diameter	4.9 cm	

Outcome and follow-up:

Initial clinical assessment of the patients according to VCSS score revealed that 40 patients (93%) had a VCSS score of 3 and only 3 patients (7%) had a VCSS score of 4. At the first month post-operatively, 24 patients (55.8%) had a VCSS score of zero and 19 patients (44.2%) had a VCSS score of one. 41 patients (95.3%) had a VCSS score of zero and only 2 patients (4.7%) had a VCSS score of one both at 3 months and 6 months respectively (Table 7).

On comparing duplex findings between the 2 groups, all EVLA patients showed successful ablation of the LSV along its whole course at the 1 st, 3rd and 6th months follow-up duplex, while in the RFA group, 2 patients showed recanalization of the LSV and one patient showed incomplete ablation of the LSV at 1 month. At 3 months and 6 months, 3 patients in the RFA group showed some degree of patency in the LSV with only one of them complaining of recurrence of symptoms, and in comparison to the EVLA group, this finding was statistically insignificant (Table 8).

Complications:

None of the included patients developed DVT throughout all the follow-up period. 13 out of all the included patients developed hematoma formation with 7 at the RFA group and 6 at the EVLA group; and this wasn't statistically significant (*p*-value 0.29).

Thrombophlebitis was found in 11 patients of all the study population, 9 of them were at the RFA group (50%) and 2 patients in the EVLA group (8%), which was found to be statistically significant with a *p*-value of 0.004 (Table 9).

Table (7): VCSS score follow-up.

Variable	Number	Percent
Initial VCSS:		
3	40	93
4	3	7
VCSS score 1 month postoperative:		
0	24	55
1	19	44.2
VCSS score 3 months postoperative:		
0	41	95.3
2	2	4.7
VCSS score 6 months postoperative:		
0	41	95.3
2	2	4.7

Table (8): Association between duplex findings in both groups.

Variable	Radio-frequency	Endovenous laser	*p*-value
Duplex findings at 1 month postoperative:			
- Recanalization of the LSV	2 (11%)	0	0.063 *
- Successful ablation of the LSV	15 (83.3%)	25 (100%)	
- Incomplete ablation of the proximal LSV in thigh	1 (5.6%)	0	
Duplex findings at 3 months postoperative:			
- Recanalization of the LSV	2 (11.1%)	0	0.169**
- Successful ablation of the LSV	16 (88.9%)	25 (100%)	
Duplex findings at 6 months postoperative:			
- Recanalization of the LSV	2 (11.1%)	0	0.169**
- Successful ablation of the LSV	16 (88.9%)	25 (100%)	

*p-value calculated using likelihood ratio.
**p-value calculated using Fisher's exact test.
***p-value calculated using Pearson's Chi-Square test.

Table (9): Comparison of outcome.

Variable	RFA	EVLA	*p*-value
Recurrence of symptoms:			
No	17 (94.4%)	25 (100%)	0.419**
Yes	1 (5.6%)	0	
Hematoma formation:			
No	11 (61.1%)	19 (76%)	0.29***
Yes	7 (38.9%)	6 (24%)	
Thrombophlebitis:			
No	9 (50%)	23 (92%)	0.004* *
Yes	9 (50%)	2 (8%)	
DVT:			
No	18 (100%)	25 (100%)	
Yes	0	0	
CEAP classification post-operative:			
C 1 EpAsPr	16 (88.9%)	25 (100%)	0.169**
C3EpAsPr	2 (11.1%)	0	

Discussion

Treatment modalities for varicose veins have been sought since the era of Hippocrates. The varicose veins management started with ligation of the saphenofemoral junction, stripping of the great saphenous veins, phlebectomy, and perforator vein surgery and progressed to the minimally invasive procedures, such as foam sclerotherapy,

radiofrequency ablation, and endovenous laser therapy. The advantages of minimal invasiveness for these procedures, showed equivalent short-term outcomes and even better long-term results which have influence our everyday practice [19].

Varicose veins affect about 25% of the adult population. The resulting complications are a major cause of morbidity [20].

The most recent Society of Vascular Surgery guidelines (SVS) clearly support using minimally invasive EVTA procedures over surgical interventions in refluxing superficial truncal veins (Class 1A). Moreover, ESVS guidelines clearly state that EVLA and RFA have the same occlusion rates, but patients with RFA have less postoperative pain and bruising.

In trials comparing EVLA and RFA, however, the Closure Fast catheter was compared with lower wavelength lasers using a bare fiber, with insufficient data published comparing both modalities but putting into perspective the newer slim, radial and double ringed fiber tips with higher wavelengths. In addition, there aren't much publications using the more recently introduced ClosureFast catheter which allegedly is more effective, faster, and induces fewer side effects compared to the older "Closure Plus" catheters [21].

Our study aims at closing the gap in literature comparing the newer generation of both EVLA fibers and RFA catheters with regards to the early postoperative complications, recurrence of symptoms and late complications such as thrombophlebitis.

We included 43 patients in our study, the mean age of the included patients was 48.26 (±6.385). There were 5 females and 38 male patients, which proved to be of statistical significance (p-value = 0.008). This finding was not with most of the published studies as according to the Medical Advisory Secretariat Systematic review at 2010 and Murad et al., Meta-analysis 2008 the majority of participants in similar studies (60%-90%) were women, and the average age was 45-60 years.

This is may be due to that the Railway Hospital offers medical services for the railway workers and employees who are mainly males with low percentage female employees, and this is found to be a confounding factor [22,23].

A systematic literature review was published in 2018 showed that patients with grade C2 disease were the most numerous in most of recent studies, with the exception of 2 studies in which most had grade C4 disease published by Ravi R, et al., 2009 and Zuniga JM, et al., 2012 [20].

This was slightly comparable to our study population as the majority of cases were classified as C3 preoperatively with 15 patients and 24 patients in RFA and EVLA groups respectively. Only 2 patients were preoperatively classified as C4 and one patient was C5 [20,24,25].

Successful occlusion in our study was assessed by duplex at 1 month, 3 months and 6 months post operatively. In EVLA group all patients (100%) showed successful ablation of the LSV in follow-up duplex after 1 month, 3 months and 6 months compared to RFA group which showed successful ablation in 15 patients only (83.3%) after 6 months postoperative.

In our study the mean radio frequency ablation RFA cycles was 17.67 (±5.508) and the maximal vein diameter was 4.6cm (±1.17) and the mean total energy expenditure used in EVLA technique was 4246.8 Joules (±1010.42) with maximal vein diameter of 4.9cm (±1.32).

The various studies comparing RFA to laser treatment were carried out with lasers using different wavelengths, which limits the scope of the results. Reported efficacy varied, with some studies indicating better results with RFA than with laser treatment after 1 year or less and some not [26].

No results are available for longer follow-up apart from indirect comparison in the meta-analysis of Brar and colleagues, which indicated a 2-year occlusion rate of 87.9% with RFA (first-generation catheter), compared to 91.5% with laser treatment [27].

However the meta-analysis of Brar and colleagues showed that DVT was more frequent with RFA than with laser treatment (1.3% v. 0.2%), none of the included patients in our study developed DVT throughout all the follow-up period in both groups.

The assessment of post-operative improvement of venous symptoms was assessed by CEAP postoperatively which showed dramatic improvement in EVLA group as all patients turned to C1EpAsPr (100%) while RFA group only 88.9% turned to C 1 EpAsPr.

In all studies that provided relevant data, there was significant resolution of venous symptoms (Venous Clinical Severity Score, CEAP) and improvement in quality of life from baseline, regard-

less of the treatment used; however, Gale and colleagues reported no significant difference in improvement in quality of life between RFA and laser treatment **[28]**.

13 out of all the included patients developed hematoma formation with 7 at the RFA group and 6 at the EVLA group; and this wasn't statistically significant (*p*-value 0.29).

Thrombophlebitis was found in 11 patients of all the study population, 9 of them were at the RFA group (50%) and 2 patients in the EVLA group (8%), and this was statistically significant (*p*-value 0.004).

He et al., showed in contrast in his RCT, EVLA and RFA seem to be the same safe and effective on clinical efficacy (vein ablated length, 3 days and 10 days pain scores, 1 month and 1 year quality of life, occlusion, thrombophlebitis, haematoma and recanalization). Data on RFA seems to having potential benefits from reducing risk of overall complication than EVLA **[29]**.

The same, Insoo Park showed that Short-term outcomes showed no significant differences between 1,940-nm EVLA and RFA treatment **[30]**.

Overall, analysis of the studies indicates that RFA leads to less pain, contusion and hematoma than laser treatment. Few comparative studies have been conducted on the topic of minor complications; nevertheless, the level of evidence for these findings remains low **[20]**.

Our patient satisfaction, ease of use of RFA versus EVLA was not significantly different. As yet, there has not been any standardization in energy dosage delivered with EVL, but future studies are likely to focus on these technical issues.

Comparing the 2 techniques in this study in the term of successful ablation, minor complication and improvement of symptoms, EVLA was superior to RFA.

Further studies are still needed with longer follow-up period and larger number of patient with multicenter collaboration after standardization of dosage calculation and energy expenditure among different vein diameters.

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مضاعفات ما بعد كى الوريد الصافى العظيم باستخدام قسطرة الليزر مقارنة باستخدام قسطرة التردد الحرارى

مقدمة: كان الربط والتجريد الخيار العلاجى الأكثر استخداماً فى علاج الدوالى. ومع ذلك، مع التقدم التكنولوجى، كان هناك الكثير من التقنيات الحد الأدنى من التدخل الجراحى المتطورة باستخدام طرق الوريد مع الكثير من الأبحاث الجارية حول فعاليتها فى علاج المرض والمضاعفات المحتملة. تقنيات استئصال الوريد الأكثر شيوعاً هى الليزر داخل الوريد والترددات الراديوية.

\المرضى و\الطرق: هذه دراسة جماعية محتملة تشمل المرضى الذين تم تقديمهم إلى عيادة الأوعية الدموية بالمركز الطبى للسكك الحديدية المصرية فى الفترة ما بين يناير ٢٠١٩ إلى يناير ٢٠٢١ مع دوالى الأوردة السفلية الأولية، وخضوعهم لكى حرارى للوريد الصافى الكبير. تم تقسيم المرضى بشكل عشوائى إلى مجموعتين. الكى الوريدى بالليزر والكى بالترددات الحرارية . تم إجراء مقارنة بين المجموعتين فيما يتعلق بمعدل الاجتثاث الناجح ومضاعفات ما بعد الجراحة وتحسين الأعراض.

\النتائج: تم تضمين ٤٣ مريضاً فى دراستنا، وخضع ١٨ مريضاً لعملية الاستئصال بالترددات الراديوية وخضع ٢٥ مريضاً لعملية الاستئصال بالليزر داخل الوريد. عند مقارنة كلتا الطريقتين فيما يتعلق بالاستئصال الناجح والمضاعفات الطفيفة بعد الجراحة وتحسين الأعراض، وجد أن الليزر متفوق على التردد الحرارى. التركيبة السكانية للمريض، لم تكن الأمراض المصاحبة الطبية لكلا المجموعتين مختلفة بشكل كبير.

\ستنتاج: أصبح الكى الحرارى الوريدى أكثر شيوعاً فى إدارة الدوالى. كل من الليزر والتردد الحرارى لهما نتائج مماثلة، مع حدوث أقل من إلتهاب الوريد الخثارى فى الليزر.