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DUPLEX SCAN-GUIDED OCCLUSION OF LEG PERFORATORS USING HISTOACRYL IN PATIENTS WITH CHRONIC VENOUS INSUFFICIENCY (C.V.I.)

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ABSTRACT

Chronic venous insufficiency (C.V.I.) with its sequelae ranging from edema, heaviness up to chronic leg ulcer remain a therapeutic dilemma. Incompetent valves of perforator veins remains the main cause of this problem. Many methods of treatment have been adopted for control of these perforators namely; surgical ligation, subfascial endoscopic perforator surgery (S.E.P.S) and injection sclerotherapy.

THE AIM OF THIS STUDY is to evaluate the efficacy of duplex scan-guided occlusion of leg perforators (with injection of Histoacryl) in patients with chronic venous insufficiency (C.V.I.)

PATIENTS AND METHODS : This study was carried out in the outpatient surgical clinic and Radiology Dept. of Mansoura University Hospital during the period from December 1996 to April 1998. Twenty patients with different grades of chronic venous insufficiency were treated with duplex-guided occlusion of perforators using Histoacryl.

RESULTS: In eleven patients, the ulcers healed and symptoms of pain and heaviness as well as muscle cramps resolved. In four patients, improvement in the size of the ulcers and symptoms has been achieved. Three patients did not show ulceration during the follow up period but a limited improvement of symptoms. Two.

patients were ranked as unchanged following injection of perforators.

CONCLUSIONS: Histoacryl has the property of rapid polymerization when it comes in contact with tissue fluids, heat generation during polymerization induces endothelial damage and vascular scarring, and when used in considerable thickness it shows extraordinary delayed absorption and hence permanent occlusion of perforators is the end result.

This method of perforators occlusion appears to be easy, safe, cost-effective, can be done in outpatient clinic and can be repeated as often as necessary.

INTRODUCTION

Chronic venous insufficiency (C.V.I.) with its sequelae ranging from edema, heaviness up to chronic leg ulcer remain a therapeutic dilemma. Incompetent valves of the superficial, deep and perforator veins remains the main cause of this problem.

Patients with venous ulceration may require multiple hospitalizations, prolonged outpatient care and multiple surgical procedures and in spite of that may be left with persistent dis-

bility and high rate of recurrence.

The Clinical, Etiologic, Anatomical and Pathophysiological (C.E.A.P classification) proposed by American vascular societies and abroaded by American venous forum in 1996 is shown in table (1).

The non-invasive technique of Duplex Scanning overcomes many of the problems associated with venography. It has been used for the diagnosis of acute deep vein thrombosis (Killewich, 1989), and more recently, in that of venous incompetence of the lower limb (Szendro, 1986, Killwish et al 1989).

Perforator vein surgery started by Homans in 1916 by adopting subfascial ligation of perforators which was popularized by Linton in 1953. In the same time Cockett introduced the extrafascial (prefascial) ligation of perforator in 1953. Posterior approach (Rob procedure) was introduced by Blumenburg et al 1978. Recently, Subfascial Endoscopic Perforator Surgery (SEPS) had been introduced by Hauer et al 1988 and Rhodes et al 1998. Good Results have been achieved by employing injectin sclerotherapy with stripping of long Sapher-

nous vein (Sladen et al 1983).

The Aim of this Study is to evaluate the efficacy of Duplex scan-guided occlusion of leg perforators in patients with C.V.I via injection of human glue (histoacryl or n-butyle-2-cyano acrylate).

PATIENTS AND METHODS

Patients: This study was carried out in the outpatient surgical clinic and Radiology Dept. of Mansoura University Hospital during the period from December 1996 to April 1998. Twenty patients with different grades of chronic venous insufficiency were treated with duplex-guided occlusion of perforators. These patients were 13 males (age range 19-48 years, mean age 38 years) and 7 females (age range 26-43 years, mean age 36 years). Chronic venous insufficiency in these patients ranged from trunkal varicosities, edema, liodermatosclerosis with active or healed ulcers. Moreover, patients with incompetent perforators inaccessible to endoscopic subfascial ligation for being on the back of the leg, lateral aspect of the leg or retro-malleolar and those with ulcers following surgical exposure were also given a trial of injection. Patients with recent

deep vein thrombosis or on anticoagulant therapy were excluded from the study. Patients with injected ulcers received local wound care to treat the infection before injection. Leg ulcers were present at the time of injection in 15 patients. The mean duration of the ulcers was 6.5 years. All patients received medical care for at least one week before surgery. This care included bed rest, frequent leg elevation or decrease of daily ambulation, local care of the ulcer, and enforcement of elastic compression of the leg in the form of graduated firm compression elastic stockings. The clinical data of the patients are detailed in (Table 2). Preinjection evaluation of the patients included Photoplethysmography (PPG) to confirm deep venous or perforator incompetence. Duplex scanning of the venous system of the assigned limb was used to confirm and map incompetence of perforators and to rule out obstruction of deep veins.

Duplex Scan (Fig.1A&B) : Examinations were performed using a 7 MHZ B-mode real-time linear scanner including a 5 MHZ pulsed and color-coded doppler. With the patients preferably in the standing or semierect position, diameter of the veins, flow

velocity and flow rate can be measured. Reflux in individual veins can be quantified using valve close time or venous reflux index. Retrograde flow can be elicited by a Valsalva's maneuver or decompression of a distal limb segment by tourniquet.

Photoplethysmography (PPG) : Examination with (PPG) Imex, (USA). Consists of attaching a probe preferably to normal appearing skin above the inner malleolus. The patient sits on a chair with bare feet on a towel to avoid direct contact with the cold floor. Ten dorsiflexions are performed and the changes of local blood volume in the skin caused by ankle movement are registered on a recorder.

Sclerosant (Fig.2A&B) : We used monomeric n-butyl-2-cyanoacrylate (Histoacryl, B Braun, Melsungen AG). In this compound, the n-butyl group is responsible for the stability of polymer, the cyano group for binding to protein and acrylate group for polymerization, this material has the property of rapid polymerization when it comes in contact with tissue fluids, heat generation during polymerization induces endothelial damage and vascular scarring, and when used in con-

siderable thickness it shows extraordinary delayed absorption lasting as long as 18 months.

Technique : The plan was to inject the leg perforators, namely, the Cockett and Boyd's group but not the thigh perforators. A special attention was given to the retero and inframalleolar as well as the peroneal perforator, because the former challenges the ability of the surgeon through the bleeding resulting from the overlying engorged dermal and subdermal plexuses of venules, and the peroneal perforator is usually small and branched to the extent that it represents a common cause of recurrence of the symptoms following surgical attack.

The echomographic examinations can be made in longitudinal or transversal section. The veins has to be compressed completely by the probe to differentiate it from an artery. For arteries, compressing the vessel enhances pulsations. The size and depth of the vein are measured. So we can choose a needle of appropriate length. These measurements must be made with the patient in the supine position. Fill the syringe with the sclerosant. the probe is held in one hand and the syringe filled with

sclerosant in the other.

After visualization of the aponeurosis, superficial, deep and perforating veins, augmentation of reflux by dorsiflexion of the toes was carried out.

The size of perforator is measured with augmentation to define the amount of sclerosant to be injected which ranges from 0.5-1.5 ml for each site. In the transversal section, we place the cross-section area of the vein in the center of the screen and the needle in the middle of the probe. In the longitudinal section, the vein appears clearly on the screen. The needle is placed in the middle of the other side of the probe. Insertion of the needle should be obliquely at its exit of the aponeurosis towards the skin or deeper to the aponeurosis in case of branching perforator. Then the extremity of the needle is strictly in the lumen of the vein, it appears distinctly on the screen as a white point. No blood is aspirated in the needle because Histoacryl will immediately polymerizes if blood come in contact with it. Injection is made rapidly while the needle is withdrawn out of vein to ensure intra-perivascular injection. Reflux is then verified. Successful injection is indicated by the

appearance of white echoes corresponding to the sclerosant at the site of perforating vein which stops reflux when dorsiflexion of the toes is performed. Compression can be placed on the leg depending on the level of injection. Ambulation is immediately permitted and the patients are instructed to use elastic bandages for a period of 10 days and to use firm compression (30-40mg) graduated elastic stockings afterwards. Patients with active open ulcers also are instructed in the proper care there of.

RESULTS

Table (2) : show clinical data and results of injection of perforators in 20 Patients with CVI. The number of incompetent perforators identified by duplex before injection averaged 4.1 (range 2 to 8). During the procedure all perforators shown ,to be incompetent were injected in the same session. Duplex assessment and injection time averaged 57.5 minnutes (range 46 to 75 minutes).

Table (3): shows the procedure and ancillary procedures; In twelve patients, injection of perforators alone was performed. In three patients, injection of perforators was followed by limited stripping of supragenicular part

of the long saphenous vein. In two patients injection was performed for residual perforators after endoscopic subfascial ligation of those on the medial aspect of the leg. In three patients injection of perforators was followed by injection of superficial varicosities using hypertonic saline solution (23.4 %).

One patient had a localized infection at the site of injection of high medial perforator. One patient had superficial thrombophlebitis in residual varicose veins in the medial aspect of the knee.

Table (4) : shows clinical improvement after one year follow up: In eleven patients, the ulcers healed and symptoms of pain and heaviness as well as muscle cramps resolved. In four patients, improvement in the size of the ulcers and symptoms has been achieved. Three patients did not show ulceration during the follow up period but a limited improvement of symptoms. Two patients were ranked as unchanged following injection of perforators.

Table (5) : shows Duplex and

PPG before and after one year follow up: PPG analysis of the limbs using the venous reflux test revealed venous refilling time of more than 28 seconds in the normal limbs and average 11.2 seconds (range 8 to 16) in limbs with CVI before injection. Following injection, there was a statistically significant prolongation in the venous refilling time to an average of 21 seconds ($P < 0.05$). Follow up duplex scan showed complete absence of reflux in 19 patients and recurrence in one despite the persistence of polymerized sclerosant. None of the patients showed deep vein thrombosis during the follow up period.

Fig (1A&B) : Show Duplex Scan and Duplex probe + Mapping of leg perforator

Fig (2A&B) : Sclerosant (Histoacryl Ampule). And Duplex probe in Left hand and Histoacryl in syring in Right hand.

Fig (3 A&B) : leg ulcer before injection and healed ulcer after one year follow up

Fig (4A&B) : Evident reflux through incompetent perforator and loss of reflux after successful injection.

Table (1) : classification of chronic lower extremity venous disease (C.E.A.P Classification by American venous forum, 1996).

C	<p>Clinical signs (Class₀₋₆) , supplemented by (A) for asymptomatic And (s) for symptomatic presentation)</p> <p>Class 0 : No visible or palpable sings of venous disease</p> <p>Class 1 : Telangiectases, reticular veins malleolar flare</p> <p>Class 2: Varicose venis</p> <p>Class 3: Edema without skin changes</p> <p>Class 4: skin changes ascribed to venous disease (e.g. pigmentation, venous eczema, lipodermatosclerosis)</p> <p>Class 5: skin changes as defined above with healed ulceration</p> <p>Class 6: skin changes as defined above with active ulceration.</p> <p style="text-align: center;">(porter and Moneta, 1995)</p>
E	Etiologic classification (Congenital, Primary, Secondary)
A	Anatomic distribution (Superficial, Deep, or Perforator, alone or in combination)
P	Pathophysiologic Dysfunction (Reflux or Obstruction, alone or in combination)

Table (2) : Clinical data and results of injection of perforators in 20 Patients with CVI.

Patient No.	Age (years)	Gender	Leg	Duration of ulcer (years)	No. of Perforators occluded
1.	25	Male	Right	6	2
2.	32	Male	Right	5	3
3.	46	Male	Right	8	6
4.	29	Female	Left	6	3
5.	35	Female	Left	-	4
6.	19	Male	Right	-	2
7.	47	Male	Right	9	8
8.	38	Female	Left	4	6
9.	42	Male	Left	8	3
10.	40	Male	Left	12	4
11.	35	Male	Left	-	2
12.	35	Male	Right	7	5
13.	26	Female	Left	3	2
14.	37	Male	Right	-	4
15.	40	Female	Right	9	5
16.	42	Female	Right	-	3
17.	34	Male	Right	7	4
18.	22	Male	Left	4	7
19.	43	Female	Left	7	3
20.	19	Male	Right	3	5
Total 20	19-47 mean 38	13 Male 7 Female	11 Right 9 Left	3-12 mean 6.5	2-8 mean 4.1

Table (3) : Duplex scan-guided occlusion of perforator plus ancillary procedures:

NO	Procedures
12	Duplex scan-guided occlusion of perforator <i>only</i>
3	Procedure + Stripping of Supra genicular portion of long Saphenous vein
3	Procedure + injection of superfascial varicosities
2	Procedure + subfascial endoscopic perforator surgery (SEPS)
Total	20 patients

Table (4) : Clinical improvement after one year follow up .

NO	Improvement
11	Healing of the ulcer + good improvement of Symptoms
4	Moderate improvement of both the size of the ulcer and Symptoms
3	No ulcer but there is limited improvement of Symptoms
2	No improvement

Table (5) : Duplex and PPG before and after one year follow up

Duplex		(PPG)		
Occlusion Just after injection	Occlusion After follow up	V.R.T. In seconds		
		Normal	In C.V.I Before injection	After injection
20 patients	19 patients	>28	8-16. Mean (11.2)	18-25. Mean (21)

PPG : Photoplethysmography

V.R.T : Venous Refilling Time

C.V.I: Chronic Venous insufficiency .

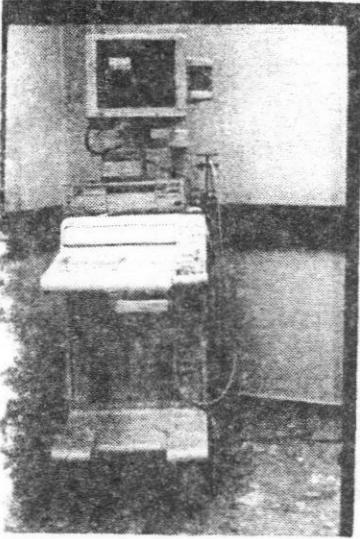


Fig (1) : (1-A) : Duplex Scan



Fig (1-B) : Duplex Probe + Mapping of Leg Perforators.

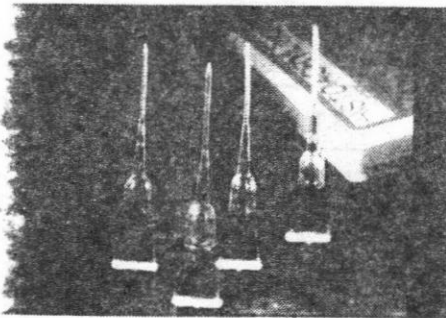


Fig (2) : (2-A) : Sclerosant (Histoacryl ampule) .



Fig (2-B) : Duplex in left hand and Histoacryl in syringe in right hand.

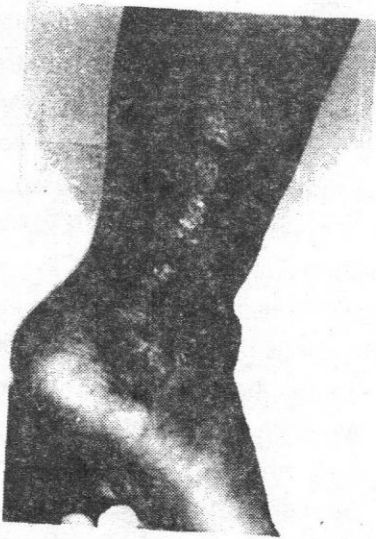


Fig (1) : (3-A) : Leg ulcer before injection.



Fig (3-B) : Healed ulcer after one year follow up .

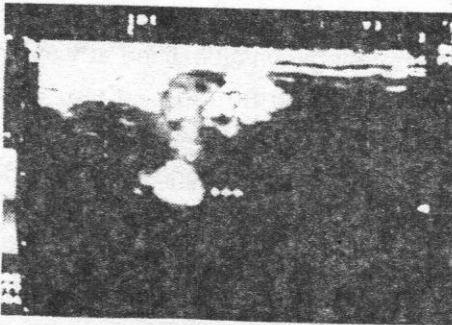


Fig (2) : (4-A) : Evident reflux through incompetent perforator

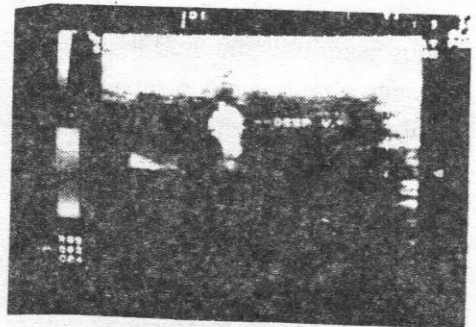


Fig (4-B) : Loss of reflux after successful injection.

DISCUSSION

Chronic venous insufficiency (CVI) afflicts 3% to 4% of population, and 10% of these patients ultimately have venous ulcerations. Incompetence of the veins plays an important role in venous hypertension and stasis changes of the skin and subcutaneous tissue of the leg. Although physical examinations suggests the location of incompetent perforating veins in many patients, using the double tourniquet tests or identifying fascial defects in the Linton line.

Imaging of incompetent perforators is required to confirm the diagnosis and map their location (Shami et al 1992). Venography cannot distinguish between perforators penetrating the fascia and horizontal veins connecting superficial varicosities, moreover, it cannot localize paratibial perforators. Duplex scan has been proved to be a unique diagnostic method that allows simultaneous morphological and functional examination of blood vessels in the context of the surrounding tissues. It can confirm the diagnosis of perforators incompetence, map their location, and define the extent of valvular incompetence or obstruction of the superficial and deep veins of the leg (Peter et al 1996).

Linton (1938) emphasized the need for control of perforating veins in treatment of chronic and recurrent venous ulceration. However, recurrence of ulcerations 5 and 10 years after surgery dimmed enthusiasm for the operation (Burnand, 1976). With a modified Linton procedure, Cikrit et al in 1988, observed complete healing in 81% of legs during a 4-year observation period" however, an 18% perioperative complication rate and a 22% ulcer recurrence rate was also reported. Numerous variations of perforators interruption had been advocated (Depalma 1979) and proved to be effective in up to 85% of patients in some studies (Mayberry et al 1991). However all of these required inpatient hospitalization and variable immobility time to heal surgical incisions and associated ulcerations. Clinically, significant perforators include the gastrocnemius point, soleal point and perforating veins identified at varying distances from the heel pad (Sherman, 1964). However, accumulating experience suggested that 90% of incompetent perforating veins occur in the lower leg in posterior arch vein distribution (Jugenheimer and Junginger 1992).

Thibault and Lewis (1992) use so-

dium tetradecyl sulphate to inject perforators under duplex guidance in patients with recurrent varicose veins and achieved a success rate of 83% and 72% in case of injection of thigh and posterior tibial incompetent perforators respectively. We injected leg perforators because they contribute to a great extent to the changes of lipodermatosclerosis and skin ulceration. Injection can be planned in sites intimately close to the ulcers without being concerned of the problem of wound healing that might occur; with the conventional surgical exposure. Perforators were injected deep to the deep fascia to avoid missing of branches unless large single perforator was clear on the screen, in such case injection can be done superficial or deep to the aponeurosis. The amount of sclerosant depended on the size of the vessel and 1.5 ml was the maximum amount used for a vein of 0.7mm wide. Withdrawal of the needle while injecting the sclerosant ensured per-intravascular sclerosis which seemed necessary for long-term obliteration of the vein. The observed reflux in a previously injected perforators could be explained by inadequate amount of sclerosant used which has to be double the width of the vein, or missed branch of the per-

forator. The absence of deep vein thrombosis during the whole follow up period in all of the patients is the result of the properties of the sclerosant which polymerizes immediately when it comes in contact of blood with no risk of migration to the deep system as well as the neat visualization of the entire venous system with proper localization of the needle tip.

Conclusions

We found that Duplex scan is a good and unique diagnostic and therapeutic method for diagnosis and guidance for injection of incompetent leg perforators.

Histoacryl has the property of rapid polymerization when it comes in contact with tissue fluids, heat generation during polymerization induces endothelial damage and vascular scarring, and when used in considerable thickness it shows extraordinary delayed absorption and hence permanent occlusion of perforators is the end result.

Duplex scan-guided occlusion of incompetent perforators with injection of Histoacryl seemed to overcome the potential limitations of endoscopic subfascial division of perforators in-

cluding the inability to reach the first Cockett perforator behind the malleolus, the resistance to optimal expansion of subfascial space in the distal calf due to severe lipodermatosclerosis and the inability to assess the valvular competence of the perforators and hence the mass division of all encountered perforators.

This method of perforators occlusion appears to be easy, safe, cost-effective, can be done in outpatient clinic and can be repeated as often as necessary.

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Szendro G, Nicolaides AN and

إستخدام ماسحة الدوبلكس كَمَوْجَه في حقن الأوردة النافذة بالساق (بمادة الهيستوأكريل) في مرضى القصور الوريدي المزمن

المشتركون في البحث

د. أحمد نجم * د. رمضان الليثي *

د. مسعد سليمان ** د. السيد سلام **

قسم الجراحة * ووحدة جراحة الأوعية الدموية **

كلية الطب - جامعة المنصورة

يعرف القصور المزمن للدورة الدموية الوريدية بالساق (س . ث أي) على أنه إرتفاع الضغط داخل الأوردة بسبب إنسداد وريدي أو إرتجاع بالصمامات الوريدية أو إجتماع الإثنين معاً.

مازال الإرتجاع في صمامات الأوردة النافذة بالساق يمثل معضلة علاجية لتعدد وسائل العلاج والتي منها ١- ربطها جراحياً بطرق مختلفة ٢- ربطها بإستخدام المنظار ٣- إستخدام الحقن بمواد مختلفة

الهدف من البحث : تقييم حقن الأوردة النافذة بالساق بمادة الهيستوأكريل باستخدام الموجات الصوتية (ماسحة الدوبلكس) كَمَوْجَه للحقن .

المرضى والطريقة : أجرى هذا البحث على عشرين مريضاً حضروا إلى العيادة الخارجية وقسم الأشعة بمستشفى المنصورة الجامعي في الفترة من ديسمبر ١٩٩٦ إلى أبريل ١٩٩٨ . تم تشخيصهم إكلينيكيًا وباستخدام الموجات الصوتية (دوبلكس) على أنهم يعانون من أعراض قصور مزمن بالدورة الدموية الوريدية بالساق مع إرتجاع بالأوردة النافذة. تم إستخدام مادة الهيستوأكريل في حقن الأوردة النافذة مع إستخدام الموجات الصوتية (الدوبلكس) كطريقة لتوجيه الحقن .

النتائج : في ١١ مريض تم التئام القرحة مع التحسن الجيد في الأعراض، ٤ مرضى تم تحسن

متوسط فى حجم القرحة وكذلك تحسن متوسط فى الأعراض، ٣ مرضى لم تكن هناك قرحة ولكن تم تحسن محدود فى الأعراض وفى ٢ مرضى لم يحدث أى تحسن .

الخلاصة :

وجد أن الموجات الصوتية (الدوبلكس) هى أداة تشخيصية متميزة تسمح بتحديد مكان ووظيفة الأوردة النافذة بالساق وتحديد وجود إرتجاع بالصمامات من عدمه.

تعتبر حقن الأوردة النافذة بالساق بمادة الهيستواكريل ويتوجيه من الموجات الصوتية (الدوبلكس) طريقة سهلة وآمنة وتستحق التكلفة ويمكن إجراؤها فى العيادات الخارجية ويمكن إعادة الحقن أكثر من مرة إذا تطلب الأمر ذلك .