Haemodynamic Strategy for Treatment of Diastolic Anterograde Giacomini Varicose Veins

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Objectives. To assess the diagnosis and outcome of a haemodynamic strategy for the treatment of primary varicose veins associated with anterograde diastolic flow (ADF) in the Giacomini vein (GV).

Methods. ADF in the GV, with the escape point located at the saphenopopliteal junction, was demonstrated in 15 patients (15 limbs) by duplex ultrasound. No other escape points were seen in this group. ADF was defined as the flow present in the relaxing phase after isometric contraction of the lower limb, measured in the standing position. Duplex and clinical follow-up was performed prospectively at 1 week, at 1, 3, 6, and 12 months and once per year thereafter, between 1998 and 2001. Surgery consisted of flush division of the GV from the small saphenous vein (SSV) and division of the incompetent collateral veins from the GV.

Results. GV diameter showed an average reduction from 6 to 4 mm 33 months after surgery. Fourteen patients (93%) showed no symptoms or varicose veins. GV reconnection and recurrent ADF was demonstrated in two patients (13%).

Conclusions. ADF is a rare condition associated with primary varicose veins. ADF occurs when there is a closed venovenous shunt with recirculation in the muscular diastole. This implies that, although a part of the circuit is ascendant, the re-entry point must be located downstream to the scape point. Accurate duplex assessment is required to distinguish this atypical haemodynamic condition from an abnormal systolic circuit bypassing a deep vein obstruction. Interruption of the GV above its junction with the SSV abolished ADF with an acceptable rate of recurrences.

Keywords: Primary varicose veins; Duplex ultrasound; Giacomini vein; Varicose vein surgery; Haemodynamic venous surgery.

Introduction

The Giacomini vein (GV) is an intersaphenous anastomosis first described in 1873.1 Giacomini gave a detailed description of its anatomical variations, and since that time anatomical study of the GV has been supplemented by functional study2 with the use of duplex ultrasound. The GV typically presents three sections: a distal and a proximal section lying in the saphenous compartment,3,4 and a middle section that is usually subcutaneous. On transverse scanning of the posterior thigh, the GV is detected in a groove between the semitendinosus muscle medially, and the long head of the biceps muscle laterally.5

The GV is frequently involved in varicose vein disease, but usually with retrograde flow originating in the great saphenous vein (GSV) or pelvic veins. Less frequently, this gives rise to a particular ‘paradoxical’ varicose vein pattern with antigravitational upward diastolic flow from the saphenopopliteal junction (SPJ).6 In normal conditions, flow in the veins of the lower limbs is activated during systole of the muscle pump. Capillary inflow occurs during the relaxation phase in the deep venous system because of the decrease in venous pressure after the muscles contract. Also in the diastolic phase, blood from the superficial venous system is aspirated to the deep venous system through perforating veins. Nevertheless, diastolic flow is too low to be detected in a duplex ultrasound examination. Therefore, in both the deep and superficial venous systems, it would be considered normal to find anterograde flow in systole and an absence of flow in diastole after valve closure.

Owing to its particular anatomical and haemodynamic characteristics, the GV may be a singular case, since a varicose syndrome characterised by anterograde diastolic flow (ADF) can arise in this vein. The
The purpose of the present article is to describe this type of flow and to propose a haemodynamic strategy for treatment.

Patients and Methods

A total of 1350 patients (1350 limbs) presenting at our outpatient surgery department with primary varicose veins from January 1998 to December 2001 were examined. Fifteen (1.1%) of these patients had SPJ incompetence and ADF in the GV (Fig. 1) as demonstrated by duplex study, and were candidates for surgery. In the preoperative duplex scan there were no cases of small saphenous vein (SSV) reflux, saphenofemoral reflux or deep venous system reflux.

Nine limbs (60%) showed a 'complete' GV, that is, an intersaphenous anastomosis was present, whereas in six limbs (40%) the GV ended in a perforating vein or in the varicose vein, with the proximal section being atrophic. Incompetent GV collaterals also involved the GSV in 10 limbs (66%) (Fig. 2). The GV was not varicosed.

Clinical disease severity was graded with the standard CEAP classification recommended by The Society for Vascular Surgery and the International Society for Cardiovascular Surgery. All patients had symptoms and were CEAP Class 2 or greater. The study population consisted of 15 patients (15 limbs) (nine women and six men, mean age 44 years). The distribution of patients according to the CEAP classification was as follows: C2 (simple varicose veins), 12 patients and C3 (with oedema), three patients. The selected population was described by the algorithm C2–3, Ep, As, Pr (Fig. 3).

Whole-leg duplex US scanning was performed with a Philips P-700 scanner (Philips, Irving, CA) using a 7.5-MHz probe. Duplex US examinations were done by two experienced staff members of the vascular laboratory directly involved in the study (ME, JJ).

Patients underwent duplex examination in the standing position. Reflux was tested by means of the compression-release test and the Paranà manoeuvre. The latter stress test is used to measure changes in venous flow during isometric reflex contractions of the lower limbs in a stationary standing position when the examiner slightly pushes the patient's waist forward to induce disequilibrium. The Paranà manoeuvre has three advantages: it is easy to perform, has good reproducibility, and is haemodynamically similar to the real situation, reproducing the haemodynamic conditions controlling deep vein function when walking. The valvulomuscular pump in itself does not produce changes in the systolic flow of the superficial veins; instead the changes are brought about by compression of the Lejars plantar pump.

The Paranà manoeuvre was performed in all cases with the study limb in slight flexion. Bi-directional anterograde systolic flow and retrograde diastolic flow in the saphenopopliteal junction was demonstrated in all patients (Fig. 2). The GV presented unidirectional anterograde flow in all cases. As has been observed by other authors, no relationship was found between saphenopopliteal insufficiency and functional anterograde systolic and diastolic flow in all cases. As has been observed by other authors, no relationship was found between saphenopopliteal insufficiency and functional anterograde systolic flow in the GV, possibly because the patients were examined with the limb in slight flexion.

A preoperative skin map was obtained by duplex to determine the anatomical and functional status of the superficial and deep vein networks, and to allow flow mapping for planning the surgical strategy, as described by Franceschi.

The operations were performed under local anaesthesia and consisted of flush division of the GV from the SSV, and division of the incompetent collateral veins from the GV and from the GSV, when required (Figs. 4 and 5). Partial phlebectomy of the interrupted tributaries was done for cosmetic reasons. The level of the phlebectomy was based on the Perthes tourniquet test (Fig. 6). The tourniquet was placed at the origin of the varicose collateral and the patient was asked to walk. If the vein disappeared, phlebectomy was not done. If it did not disappear, the tourniquet was placed at a lower position and the manoeuvre was repeated until collapse of the varicose vein was observed. The level of the tourniquet marked the segment of the varicose collateral to be phlebectomized.

Patients were allowed to walk immediately after the procedure and were encouraged to return to normal daily activity. Elastic stockings exerting 20–30 mmHg

Fig. 1. Giacomini vein—upward diastolic flow in a transverse view. Venous flow direction is the same during systole and diastole of the leg muscles.
at the ankle were maintained for 7 days. No additional sclerotherapy for superficial vessels was used.

Patients were asked to return for clinical examination and duplex scanning after 1 week and at 1, 3, 6, 12, 24, 36, 48 and 60 months after the procedure. The mean follow-up time was 31 months (24–60 months).

Duplex tests were done to demonstrate patency, diameter and flow at the GV, and correct interruption of venovenous shunting. Giacomini vein diameter was measured at 10 cm above the saphenopopliteal junction during each duplex control. Clinical examination was performed by an independent physician who not involved in the treatment. Clinical findings were graded, using the CEAP classification.

Fig. 2. Retrograde diastolic flow in the sapheno–popliteal junction (SPJ) and antegrade diastolic flow in the Giacomini vein (GV) seen in longitudinal view. SSV, small saphenous vein.

Fig. 3. Anatomical variations of the Giacomini vein (GV) seen in this study.

Fig. 4. Surgical procedure. Division of the Giacomini vein (GV) flush with the small saphenous vein and division of the incompetent collaterals flush with the GV and the great saphenous vein (GSV). Diastolic flow is shown in red. An incompetent collateral between GV and GSV is always completely phlebectomised to avoid thrombophlebitis. Depending on the type of drainage established in the GSV, interruption of its collaterals will result in antegrade flow or in a retrograde flow with a normal flow rate from the competent collaterals.

Fig. 5. Surgical procedure. Division of the Giacomini vein flush with the small saphenous vein and division of the GV tributary flush with the GV. Diastolic flow is shown in red.
Outcome according to complaints and cosmetic results was assessed by the patients as ‘good’ (excellent or fair cosmesis, or absence of complaints) or ‘bad’ (cosmetic assessment poor, or complaints unchanged or worse).

**Results**

Giacomini vein patency with anterograde systolic flow was demonstrated in all 15 limbs. The GV diameter showed an average reduction from 5.8 mm (SD: 1.01) to 3.6 mm (SD: 0.58).

Recurrent ADF was shown in two limbs (13%). Reconnection of the interrupted GV was documented after 6 to 12 months’ follow-up in these cases and anterograde diastolic flow in the GV was restored. One of these patients was re-operated after recurrent visible varicose veins were observed.

The clinical findings at the time of the last control according to the CEAP classification were: C0, 12 cases (80%); C1, 2 cases (13.3%); and C2, 1 case (6.6%). None of the patients considered that their clinical results were poor.

**Discussion**

Primary varicose veins due to SPJ junction insufficiency with anterograde diastolic flow are fairly rare, comprising 1.1% of our series. However, identification of the condition is important since surgical treatment focussing on the GSV and SSV, often resulting in removal of healthy veins, would not be effective in such cases. With the help of tests that reproduce physiological conditions, such as the Parana manoeuvre, we are able to carry out duplex studies of venous flow during systole and diastole of the leg muscles. During muscle relaxation (diastole), the pressure column is divided up as a result of closure of the venous valves. Thus, it seems paradoxical that anterograde flow should be pathological. Due to the limitations of the instrument, it is considered normal that the veins of the lower extremities do not present flow during diastole. Any flow, whether anterograde or retrograde, in the relaxation phase of the leg muscles may therefore be regarded as pathological. This being so, anterograde flow during diastole must be linked to an escape point distal to the point being examined: in this group of patients, the SPJ.

Primary varicose veins are haemodynamically...
characterised by the existence of a circuit or venovenous shunt. The shunt consists of a proximal escape point, usually located at the level of an incompetent junction, through which blood from the deep system is shunted into the superficial veins. The course of this circuit, whether partially anterograde or not, is not highly relevant. What is important is the height at which the re-entry point to the deep venous system is located. If the re-entry point is a lower leg-perforating vein located distally to the escape point, a closed circuit is formed, which is activated during muscle diastole by aspiration of superficial blood to the deep venous system. If the re-entry point is a proximal thigh-perforating vein, the shunt does not recirculate and is activated only in systole. This would occur in a shunt that bypasses a deep vein obstruction, and would also occur in postural muscular-ligamentous compression on the gastrocnemius-popliteal-femoral veins, which can result in diverted flow from the deep to superficial venous system in order to bypass the constricted deep outflow. Thus, the blood may have an ascending systolic flow from the deep venous system to the saphenous axes, using the GV as intermediary conduit.

We found no connection between anatomical variations of the GV and the presence of ADF. In nine limbs (60%) a ‘complete’ GV, that is, an intersaphenous anastomosis, was present, while in six limbs (40%) the GV ended in a perforating vein or in the varicose vein, with the proximal section being atrophic (Fig. 4). According to Giacomini’s anatomical description, it is this second group that would show backward-facing valves, directing the venous flow towards the SPJ.

One point of discussion might be the most suitable place at which to interrupt the escape point. We chose an interruption point flush with the end of the SSV in order to avoid creating a cul-de-sac. In all cases, it is important to ensure accurate echo-guided marking of the exact location of the junction of the GV with the SSV at the preoperative stage. Prior to this study, in the period between 1995 and 1997, seven cases of ADF in the GV were treated with local avulsion of the varicose branch of the GV, but there were 4/7 (57%) cases of clinical varicose vein recurrence after 12 months’ follow-up and 5/7 (71%) cases of sonographic reconnection (P = 0.0013) (Table 1). This is why we emphasise the importance of interrupting the escape point located at the SPJ.

In addition, interruption of the escape point avoids deep venous thrombosis at this level as well as possible recurrence due to an error in the identification of the complex venous anatomy at the SPJ.

With regard to possible postoperative outcomes, it should be noted that in one case (6.6%), slight retrograde flow developed in the SSV after 12 months’ follow-up, but no varices were visible. This ostial SSV insufficiency was seen in the atrophic GV group.

In conclusion, correct duplex ultrasound identification is essential in this rare, partially anterograde venovenous shunt, which produces a closed circulation system in muscular diastole. Although, more cases and longer follow-up are required to establish definite conclusions, these preliminary results suggest that GV interruption at the level of its junction with the SSV abolishes ADF with an acceptable rate of recurrences as compared to interruption of the insufficient GV collaterals alone.

### References


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