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# Importance of Subfascial Collaterals in Deep-Vein Malformations

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**BACKGROUND.** The removal of varicose veins in patients with absent or hypoplastic deep veins is contraindicated.

**OBJECTIVE.** To determine a reliable examination for detection of the function of subfascial collaterals.

**METHODS.** Five crural ulcer limbs with deep-vein aplasia and hypoplasia were operated on. In all cases, a segmental or total deep-vein aplasia (four cases) or hypoplasia (one case) was found in the affected limb by venography. Patients were selected

for surgery using a new modification of the Perthes test. Radical varicectomy was performed in every case using stripper and open varicectomy.

**RESULTS.** There was no circulatory complication during or after the operation. Crural ulcers healed.

**CONCLUSION.** The agenesis or hypoplasia of a shorter or longer segment of deep veins is not a contraindication to radical varicectomy in every patient.

I. BIHARI, MD, PhD, G. TASNÁDI, MD, PhD, AND P. BIHARI, MD HAVE INDICATED NO SIGNIFICANT INTEREST WITH COMMERCIAL SUPPORTERS.

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FOR A century and even in the last decades, it has been emphasized by several authors that removal of varicose veins in patients with absent or hypoplastic deep veins is contraindicated.<sup>1-4</sup> This issue is based on some sad experiences, for example, amputation because of gangrene after varicectomy in a complete deep-vein agenesis,<sup>5,6</sup> severe intraoperative, and postoperative venous congestion appeared after ligation of a compensatory saphenous vein.<sup>7</sup> According to Lindner's personal experiences, surgical excision of varicose veins in these cases is "deleterious and apt to enhance venous stasis."<sup>8</sup> This is the reason that patients with absent deep veins are not mentioned as subjects of varicectomy;<sup>9</sup> every surgical study deals exclusively with patent deep-vein cases.<sup>6,10</sup>

In spite of that, according to Comerota,<sup>11</sup> obstruction should be viewed in a linear sense (as a spectrum) rather than "all or none." Important questions that are not yet answered include the following: At which point does obstruction impact venous return? At which point can obstruction be detected? What method/technique will be accepted as definitive? In our previous study, radical varicectomy was performed in 61 postthrombotic deep-vein occlusion cases. There was no intraoperative or postoperative circulatory disturbance in any case.<sup>12</sup> Similar good results were

reported by Raju et al.<sup>13</sup> He recommends the re-examination of the traditional admonition against removal of secondary varices.

For the therapy of deep-vein malformation cases, two reasonable operative techniques were described by Belov: (1) in hypoplasia of the axial vein "careful resection, sometimes in several stages" or (2) in aplasia cases "skeletonization" that means resection of side branches with saving the main superficial venous stem.<sup>14-17</sup> The aim of skeletonization is the resection of arteriovenous (AV) shunts or their venous limb, leaving the compensatory vein intact. In this manner, the vicious "AV short circuit" is interrupted, and a substantial normalization of the hemodynamic condition is achieved.

In deep-vein aplasia cases, some authors mention no other operative method but venous bypass.<sup>4,18</sup> It seems to be reasonable but not used as a routine operation.

In our opinion, surgery of the large superficial veins is extremely important partly in relieving congestion and removing AV shunts so as to stop destruction of the skin and subcutaneous tissue. This operation can be performed in spite of the absence of the deep veins if the subfascial collateral pathways are functioning well.<sup>19</sup>

## Methods

During a 7-year period of time in the Semmelweis University, Cardio-Vascular Surgical Clinic, and Heim Pál Hospital, Pediatric Surgical Department, Budapest,

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Hungary, five limbs with deep-vein aplasia and hypoplasia were operated on. In all cases, a segmental or total deep-vein aplasia (four cases) or hypoplasia (one case) was found in the affected limb by venography.

Three patients were male, and two were female (mean age of 17, range of 10 to 23 years). All five patients had large varicose or lateral embryonic veins. CEAP classification scores were C-5 in one and C-6 in four.

Pain and heaviness were the most common complaint, which was present in every patient, followed by crural ulcer in four, bleeding in three, phlebitis in two, and lipodermatosclerosis in two.

All patients underwent contrast phlebography and venous duplex scan. Both examinations documented aplastic or hypoplastic iliac and femoral veins in one lower limb, femoral in two, and popliteal in three. In one case, the anatomically known deep-venous system was totally absent (Figure 1).

Patients were selected for surgery with a new modification of the Perthes test. Instead of a rubber strip tourniquet, a tensiometer cuff was placed on the limb just below or just above the knee. The cuff was inflated to 110 mm Hg, and the patients were asked to walk quickly for 5 minutes. This test proved to be reliable in a former study in the detection of development of subfascial collaterals in postthrombotic deep-vein occlusion cases.<sup>12</sup>

In positive cases, when deep veins were absent and superficial veins were compressed by the cuff, the limb became livid and the patient complained of heavy pain within 1 or 2 minutes. In negative cases, when collateral channels in the subfascial space were sufficient in number and diameter to drain the venous blood from the leg, the patient informed us that his leg felt better.

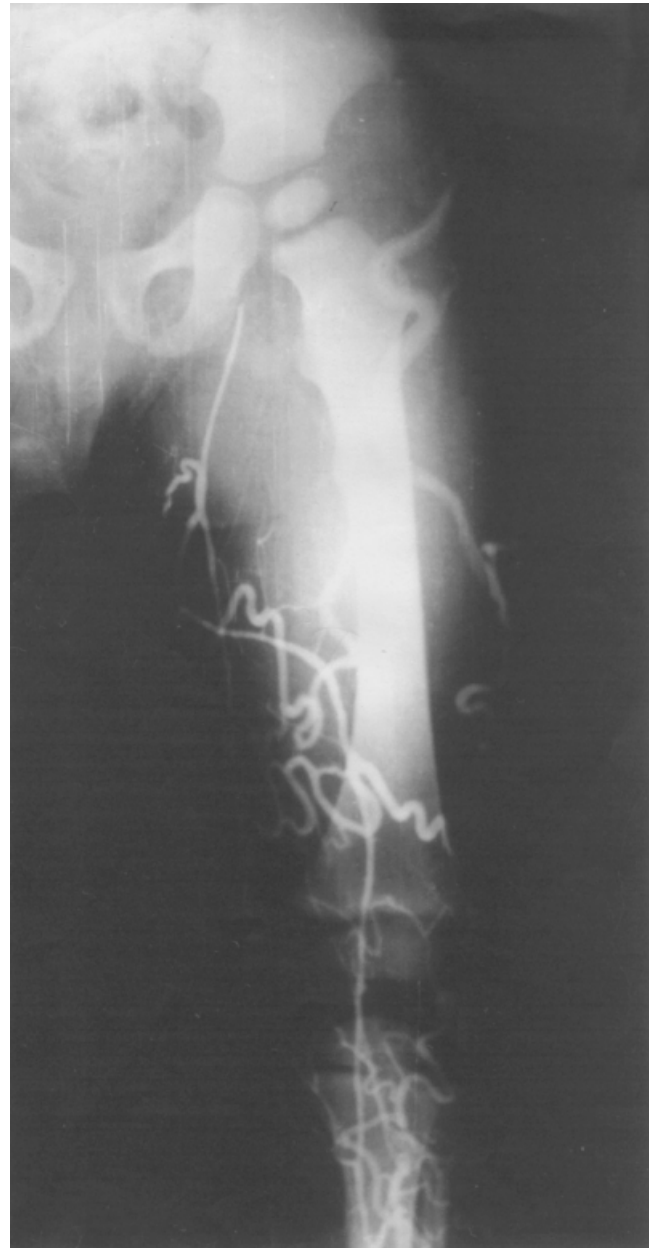
Radical varicectomy was performed only in tonometer cuff test-negative cases using stripper and open varicectomy with care to avoid the damage of dermatosclerotic or ulcerated skin of the ankle.

## Results

There was no circulatory complication during or after the operation. Limbs had complete relief of pain, with the other patients noting lesser symptoms. Crural ulcers healed. An elastic bandage or stocking was recommended for life in every case. Recurrent varicosity could be observed in some cases within 2 years, without ulcer recurrence.

## Discussion

Traditionally, the veins of the lower limbs are classified according to the anatomical relationship to the fascia



**Figure 1.** X-ray of deep vein aplasia of the lower limb in infancy. This patient was 19 years old at the time of radical varicectomy.

of the leg so that they can be subdivided into two sets: superficial and deep. Now a further venous channel system's importance is stressed. The subfascial collateral set of veins consists of vessels in and between the muscles of the limb. They dilate after an occlusion or in the absence of the deep veins. With time, these collaterals can alone maintain the venous drainage of the limb. Some of them are named, but most of them are not. Neither phlebography<sup>20</sup> nor venous duplex scan can give useful information about the function of the subfascial collaterals.

Different clinical methods and more sophisticated devices are used to measure the venous function of the lower limb. Rosfors and Noren in their study stated that no reliable functional distinction could be made between limbs with patent and still-occluded deep veins.<sup>21</sup>

In deep-vein aplasia, not only the superficial veins will dilate, but collaterals will start functioning in the subfascial space. Our experience is similar to others and indicates that phlebography can be misleading in this regard. Raju<sup>20</sup> has found in postthrombotic limbs that the hemodynamic result rather than the anatomic site and extension of obstruction determines the outcome; therefore, anatomy cannot be the sole basis for therapeutic decisions. Ambulatory venous pressure measurements and photoplethysmography are useful in venous reflux disease but are not helpful in venous obstruction. The arm/foot pressure differential and reactive hyperemia techniques appear to be less subjective and more quantitative than venous Doppler examination in venous obstruction.<sup>22</sup>

Baskerville et al.<sup>23</sup> in their foot volumetric studies of patients with Klippel-Trenaunay syndrome have also shown that most patients have adequate calf pump function in that the veins empty during calf exercise with only occasional evidence of outflow obstruction. The principal and frequent defect is superficial and/or deep-vein reflux and not occlusion. Their 38 patients underwent 88 operations. The most commonly performed operation was stripping of the lateral venous trunk and other superficial varicosities. This procedure produced relief of local symptoms.

In the past, a rubber bandage test (Perthes test) was used to establish whether the subfascial collaterals were working well. Because the stretching capacity of the rubber bandage was not standardized, it is advised to use a tensiometer cuff to control the compression of the superficial veins. The cuff pressure test was calculated to be optimal at 110 mm Hg, as the subfascial veins can develop a pressure greater than 200 to 300 mm Hg<sup>24,25</sup> during walking, but in the muscular compartments, the pressure is even higher.<sup>26</sup> This cuff pressure was high enough to compress the superficial varices but was not higher than a walking patient's arterial blood pressure in the lower limb.

It is necessary to emphasize that the removal of varicose veins is beneficial in every case if it is possible. Paes and Vollmar<sup>10</sup> reported 14 treated cases (with patent deep veins). Nine of them had crural ulcers, all of which had healed completely after surgery. Even after an average observation time of 8 years for all of the operated patients, a subjective as well as objective improvement could be recorded. In other cases, only temporary relief from their symptoms can be experienced. Our results and other authors' results strongly

support the opinion that the incidence of the skin changes and ulceration are associated with chronic venous hypertension.<sup>23</sup>

In summary, this an important sentence from an experienced phlebologist, Robert Linton: "While working in this field (in phlebology for 40 years), it has become obvious to me that the great veins of the lower part of the body and the extremities are not absolutely necessary as conduits for the return of blood to the heart, because there are innumerable smaller caliber collaterals that actually suffice and gradually increase in caliber."<sup>27</sup>

In conclusion, if the varicosity is minimal and there is no complication the patient will do well with conservative therapy. This is the majority of patients.<sup>28</sup> Varicectomy is recommended in selected, complicated cases. The agenesis of a shorter or longer segment of deep veins is not a contraindication to operation in every patient.

## References

1. Vollmar J, Voss E. Vena marginalis lateralis presistens: die vergessene vene der angiologen. *Vasa* 1979;8:192-202.
2. Eifert S, Villavicencio L, Kao T-C, et al. Prevalence of deep venous anomalies on congenital vascular malformations of venous predominance. *J Vasc Surg* 2000;31:462-71.
3. Gorenstein A, Shifrin E, Gordon RL, et al. Congenital aplasia of the deep veins of lower extremities in children: the role of ascending functional phlebography. *Surgery* 1986;99:414-9.
4. Schobinger RA, Nachbur B, Senn A. The syndrome of Klippel-Trenaunay, a polyvalent angiodysplasia. *J Cardiovasc Surg* 1987;28:531-4.
5. Dimakakos PB, Portinos A. Regarding "surgical treatment of venous malformations in Klippel-Trenaunay syndrome" [editorial]. *J Vasc Surg* 2001;34:573.
6. Noel AA, Gloviczki P, Cherry KJ, et al. Surgical treatment of venous malformations in Klippel-Trenaunay syndrome. *J Vasc Surg* 2000;32:840-7.
7. Myers TT, Janes JM. Comprehensive surgical management of cavernous hemangioma of the lower extremity with special reference to stripping. *Surgery* 1955;37:184-97.
8. Lindenaier SM. The Klippel-Trenaunay syndrome. *Ann Surg* 1965;162:303-14.
9. Servelle M. Klippel and Trénaunay's syndrome: 768 operated cases. *Ann Surg* 1985;201:365-73.
10. Paes E, Vollmar J. Diagnosis and surgical aspects of congenital venous angiodysplasia in the extremities. *Phlebology* 1995;10:160-4.
11. Comerota AJ. Myths, mystique, and misconceptions of venous disease. *J Vasc Surg* 2001;34:765-73.
12. Bihari I. Can varicectomy be performed if deep veins are occluded? *J Dermatol Surg Oncol* 1990;16:806-7.
13. Raju S, Easterwood L, Fountain T, et al. Saphenectomy in the presence of chronic venous obstruction. *Surgery* 1998;123:637-44.
14. Belov S, Loose DA, Weber J. *Vascular Malformations*. Reinbek: Einhorn Presse-Verlag, 1989.
15. Belov S, Loose DA. Surgical treatment of congenital vascular defects. *Int Angiol* 1990;9:175-82.
16. Loose DA, Belov S, Mattasi R, et al. Long follow up results in active causal treatment of vascular malformations: a review of 1378 cases (Multicenter study). Proceedings of the 14th Congress of the European Chapter of the International Union of Angiology. Monduzzi Editore, Bologna, 2001:431-450.

17. Loose DA, Wang ZG. The surgical treatment of predominantly venous defects. *Int Angiol* 1990;9:189-95.
18. Dougherty MJ, Calligaro KD, DeLaurentis DA. Congenitally absent inferior vena cava presenting in adulthood with venous stasis and ulceration: a surgically treated case. *J Vasc Surg* 1966;23:141-6.
19. Bihari I, Tasnádi G, Bohár L, et al. Varicectomy in deep vein aplasia. *Phlebol Suppl* 1995;1:829-31.
20. Raju S. New approaches to the diagnosis and treatment of venous obstruction. *J Vasc Surg* 1986;4:42-54.
21. Rosfors S, Norén A. Venous haemodynamics and morphology in relation to recanalisation and thrombus resolution in patients with proximal deep venous thrombosis. *Phlebology* 1999;14:33-8.
22. Raju S, Fredeticks R. Venous obstruction. an analysis of one hundred thirty-seven cases with haemodynamic, venographic and clinical correlations. *J Vasc Surg* 1991;14:305-13.
23. Baskerville PA, Ackroyd JS, Thomas ML, Browse NL. The Klippel-Trénaunay syndrome: clinical, radiological and haemodynamic features and management. *Br J Surg* 1985;72:232-6.
24. Browse NL, Burnand KG, Irvine AT, Wilson NM. *Diseases of the Veins*, 2nd ed. London, Sydney, Auckland: Arnold, 1999.
25. Sumner DS. Hemodynamics and pathophysiology of venous disease. In: Rutherford RB, ed. *Vascular Surgery*. Philadelphia, London, Toronto, Mexico City, Rio de Janeiro, Sydney, Tokyo: W.B. Saunders, 1984:148-67.
26. Alimi YS, Barthelemy P, Juhan C. Venous pump of the calf: a study of venous and muscular pressures. *J Vasc Surg* 1994;20:728-35.
27. Linton RR. John Homan's impact on diseases of the veins of the lower extremity, with special reference to deep thrombophlebitis and the post-thrombotic syndrome with ulceration. *Surgery* 1977;81:1-11.
28. Gloviczki P, Hollier LH, Teland RL, et al. Surgical implications of Klippel-Trénaunay syndrome. *Ann Surg* 1983;197:353-62.

## Commentary

A traditional dictum of phlebology has been never to treat superficial varicosities accompanied by obstruction or aplasia of the deep venous system of the leg. The reasoning was that the superficial varicosities occurred to bypass the obstructed or absent deep venous system allowing venous blood exit from the leg. It was taught that treating by surgery or sclerotherapy would invariably worsen the condition, with the end result being a swollen leg. Logic dictated that blood would have no way to exit once the superficial bypass mechanism was eliminated. This article is significant for introducing a major new concept that superficial varicosities may not be the only bypass mechanism for a poorly developed or possibly obstructed deep venous system. It is possible to treat superficial varicosities when one is certain that subfascial venous channels have dilated and are functional to compensate for the lack of traditional deep venous outflow. The authors have performed meticulous venography (phlebography) and duplex ultrasound scanning to document the existence of the subfascial collaterals not corresponding to known deep venous anatomy. They have

added a simple physiologic test to determine whether these collaterals are functionally useful. This test involves cuff occlusion of the superficial varicosities by external pressure. The patient then walks for several minutes. If the leg feels better, then the subfascial collaterals are functional, and the superficial varicosities may be eliminated. If the leg feels worse, then subfascial collaterals have no functional or physiologic value, and the superficial varicosities should not be touched. As a result of these findings, we can now perform a better job of evaluating patients with nondeveloped or obstructed or injured deep-venous systems and potentially help those with painful and ulcerated superficial venous disease who have functioning subfascial collaterals, a new category of bypass system situated "in and between the muscles of the lower limb." The taboo has finally been demystified as a result of careful study, observation, and logical thought. The authors are to be congratulated for their excellent contribution to phlebology.

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