

## CHRONIC VENOUS ULCERS

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The prevalence of lower extremity ulceration secondary to chronic venous disease (CVD) in European and Western populations is estimated to be 0.5% to 1%.<sup>1,2</sup> Approximately 12% to 14% of patients with CVD in recent series<sup>3,4</sup> have venous ulcers (clinical classes C<sub>5</sub> and C<sub>6</sub>). Despite the high prevalence and the significant morbidity of this problem, it has always been relatively neglected. Even currently, many patients are offered conservative management only. Duplex ultrasound examination of the lower extremity veins was introduced in recent years and significantly improved our understanding of the etiology of CVD. Moreover, this non-invasive test has allowed precise identification of the malfunctioning vein segments and has contributed to a more rational therapeutic approach that targets the affected venous segment.

The main mechanisms responsible for venous ulcers are reflux, venous outflow obstruction, or a combination of the two. Reflux is the most common cause of CVD and is seen in the vast majority of limbs with ulcers. Combined reflux and obstruction is more often seen in limbs belonging to classes C<sub>4</sub> to C<sub>6</sub>.<sup>3</sup> A recent prospective study demonstrated that a combination of reflux and obstruction had worst prognosis for developing limb ulceration compared to reflux or obstruction alone (odds ratio 3.5, 95% CI 1.4-8.6).<sup>5</sup>

In contrast to what was previously thought, a documented episode of DVT is only seen in 33%-50%<sup>6-10</sup> of patients with ulceration and this prevalence is higher than in any other CVD class.<sup>11</sup> This prevalence is probably underestimated because many thrombi remain undetected and may resolve without leaving any evidence of luminal damage other than reflux due to destruction of the valves.

The efficiency of calf muscle pump and amount of reflux are also associated with the development of ulceration. Nicolaides, et al, in a study of 220 unselected patients with CVD demonstrated that the prevalence of ulceration increased with higher ambulatory venous pressures.<sup>12</sup> The calf muscle function in terms of strength (peak torque/body weight) and endurance (total work) of patients with recently healed venous ulcers were significantly reduced compared to age- and sex-matched healthy subjects (p=0.049, 95%CI 0.3-18.4% and p=0.05, 95%CI 6.01-97.6 Nm respectively).<sup>13</sup> It has also been shown that patients with ulceration had worst ejection fraction compared to patients with varicose veins only.<sup>14</sup> However, in another study where the patients were matched for age and duration of disease, the amount of reflux was the most significant factor for the severity of CVD.<sup>15</sup>

Several studies have shown that the site and extent of reflux are important determinants for the severity of CVD and the development of ulceration. The greater saphenous vein is most often involved from the superficial veins. In fact, reflux involving both the above and below knee segments of this vein is the most common pattern of reflux in patients with ulceration.<sup>7,9,16</sup> Reflux in the lesser saphenous vein alone rarely causes ulcers unless it is combined with reflux in the greater saphenous and/or the deep veins.<sup>16,17</sup> The more deep veins involved the higher the prevalence of ulceration. However, among all deep veins, reflux in the popliteal vein has been

shown to be very significant for ulcer development and it is also a predictor for poor healing.<sup>17-20</sup>

Most recent studies have shown that reflux in the superficial system is seen in 79%-93% of limbs with ulceration.<sup>3,7-10</sup> Reflux confined to the superficial veins alone is responsible for 17% to 54% of venous ulcers<sup>3,6-9</sup> whereas deep venous reflux alone accounts for 2.1% to 15%.<sup>4,6,9,15</sup> The prevalence of deep venous reflux in patients with venous ulcers ranges between 50% and 70% in various reports.<sup>3,7-9,11</sup> Most patients with ulcers (52%-70%) have incompetence in more than one system<sup>7-9,21</sup> and reflux in all three venous systems is seen in 16%-50%.<sup>3,7-9,15,21</sup>

When venous ulceration is due to superficial and perforator incompetence, surgical treatment may heal up to 90% of the ulcers with very good medium to long term results.<sup>22,23</sup> About 30-50% of patients with ulcers belong to this category.<sup>6-9</sup> Superficial vein ligation and/or stripping has worst results, with very high recurrence rates at 5 years, when there is reflux in the deep venous system.<sup>23</sup> In these patients additional procedures that are designed to improve the underlying abnormality may be required, and several studies have shown encouraging results.<sup>24-27</sup>

The significance of incompetent perforating veins remains controversial. Some investigators reported that incompetent perforators do not contribute to venous hypertension,<sup>28-30</sup> whereas others suggest that they are important.<sup>9,10,31-33</sup> Some recent reports have shown that subfascial ligation of these veins, combined with ligation and/or stripping of the superficial incompetent veins, is associated with high rates of ulcer healing and improved disease free intervals.<sup>32,33</sup>

A detailed study of the ulcerated lower extremity that will identify the etiology and outline the anatomic distribution of CVD is necessary prior to planning a surgical intervention in order to achieve the best outcome.

### References

1. Cornwall JV, Lewis JD. Leg ulcer revisited, *Br J Surg*. 1983;70:681.
2. Callam MJ, Ruckley CV, Harper DR, Dale JJ. Chronic ulceration of the leg: Extent of the problem and provision of care. *Br Med J*. 1985; 290:1855-1856.
3. Kistner RL, Eklof B, Masuda EM. Diagnosis of chronic venous disease of the lower extremities: The "CEAP" classification, *Mayo Clin Proc*. 1996;71:338-345.
4. Labropoulos N. CEAP in clinical practice, *Vasc Surg*. 1997;31:224-225.
5. Johnson BF, Manzo RA, Bergelin RO, Strandness DE Jr. Relationship between changes in the deep venous system and the development of the post-thrombotic syndrome after an acute episode of lower limb deep vein thrombosis: a one- to six-year follow-up, *J Vasc Surg*. 1995;21: 307-312.
6. Shami SK, Sarin S, Cheate TR, Scurr JH, Coleridge Smith PD. Venous ulcers and the superficial venous system, *J Vasc Surg*. 1993; 17:487-490.
7. Labropoulos N, Leon M, Geroulakos G, Volteas N, Chan P, Nicolaides AN. Venous hemodynamic abnormalities in patients with leg ulceration, *Am J Surg*. 1995;169:572-574.
8. Labropoulos N, Giannoukas AD, Nicolaides AN, Ramaswami G, Leon M, Burke P. New insights into the pathophysiologic condition of venous ulceration with color-flow duplex imaging: Implications for treatment? *J Vasc Surg*. 1995;22:45-50.
9. Hanrahan LM, Araki CT, Rodriguez AA, Kechejian GJ, LaMorte WW, Menzoian JO. Distribution of valvular incompetence in patients with venous stasis ulceration, *J Vasc Surg*. 1991;3:805-812.
10. Labropoulos N, Delis K, Nicolaides AN, Leon M, Ramaswami G, Volteas N. The role of the distribution and anatomic extent of reflux in the development of signs and symptoms in chronic venous insufficiency, *J Vasc Surg*. 1996; 23:504-510.
11. Labropoulos N. Clinical correlation to various patterns of reflux, *Vasc Surg*. 1997;31:242-248.
12. Nicolaides AN, Hussein MK, Szendro G, Christopoulos D, Vasdekis S, Clarke H. The relation of venous ulceration with ambulatory venous pressure measurements, *J Vasc Surg*. 1993; 17:414-419.
13. Yang D, Vandongen YK, Stacey MC. Changes in calf muscle function in chronic venous disease, *Cardiovasc Surg*. 1999;7:451-456.
14. Christopoulos D, Nicolaides AN, Cook A, Irvine A, Galloway JM, Wilkinson A. Pathogenesis of venous ulceration in relation to the calf muscle pump function, *Surgery*. 1989;106:829-835.
15. Labropoulos N, Giannoukas AD, Nicolaides AN, Veller M, Leon M, Volteas N. The role of venous reflux and calf muscle pump function in nonthrombotic chronic venous insufficiency. Correlation with severity of signs and symptoms, *Arch Surg*. 1996;131:403-406.
16. Labropoulos N, Leon M, Nicolaides AN, Giannoukas AD, Volteas N, Chan P. Superficial venous insufficiency: Correlation of anatomic extent of reflux with clinical symptoms and signs, *J Vasc Surg*. 1994;20:953-958.
17. Payne SP, London NJ, Newland CJ, Bell PR, Barrie WW. Investigation and significance of short saphenous vein incompetence, *Ann R Coll Surg Engl*. 1993;75:354-357.

18. Shull KC, Nicolaidis AN, Fernandes e Fernandes J. Significance of popliteal reflux in relation to ambulatory venous pressure and ulceration, *Arch Surg*. 1979;114: 1304-1306.
19. Nash TP. Venous ulceration: factors influencing recurrence after standard surgical procedures, *Med J Aust*. 1991;154:48-50.
20. Brittenden J, Bradbury AW, Allan PL, Prescott RJ, Harper DR, Ruckley CV. Popliteal vein reflux reduces the healing of chronic venous ulcer, *Br J Surg*. 1998;85: 60-62.
21. Yamaki T, Nozaki M, Sasaki K. Color duplex ultrasound in the assessment of primary venous leg ulceration, *Dermatol Surg*. 1998; 24:1124-1128.
22. Darke SG, Penfold CAD. Venous ulceration and saphenous ligation, *Eur J Vasc Surg*. 1992;6:4-9.
23. Burnand KG, Thomas ML, O'Donnell TF Jr., Browse NL. Relation between postphlebotic changes in the deep veins and results of surgical treatment of venous ulcers, *Lancet*. 1976;1:936-938.
24. Masuda EM, Kistner RL. Long-term results of venous valve reconstruction: A four- to twenty-one-year follow-up, *J Vasc Surg*. 1994; 19:391-403.
25. Kistner RL, Eklof B, Masuda EM. Deep venous valve reconstruction, *Cardiovasc Surg*. 1995;3:129-140.
26. Raju S, Neglen P, Doolittle J, Meydrech EF. Axillary vein transfer in trabeculated post-thrombotic veins, *J Vasc Surg*. 1999;29:1050-1064.
27. Juhani CM, Alimi YS, Barthelemy PJ, Fabre DF, Riviere CS. Late results of iliofemoral venous thrombectomy, *J Vasc Surg*. 1997; 25:417-422.
28. Burnand KG, O'Donnell TF Jr., Thomas ML, Browse NL. The relative importance of incompetent communicating veins in the production of varicose veins and venous ulcers, *Surgery*. 1977;82:9-14.
29. Bjordal R. Flow and pressure studies in venous insufficiency, *Acta Chir Scand Suppl*. 1988;544:30-33.
30. Stacey MC, Burnand KG, Layer GT, Pattison M. Calf pump function in patients with healed venous ulcers is not improved by surgery to the communicating veins or by elastic stockings, *Br J Surg*. 1988;75:436-439.
31. Zukowski AJ, Nicolaidis AN, Szendro G. Haemodynamic significance of incompetent calf perforating veins, *Br J Surg*. 1991;78:625-629.
32. Gloviczki P, Bergan JJ, Rhodes JM, Canton LG, Harmsen S, Ilstrup DM. Mid-term results of endoscopic perforator vein interruption for chronic venous insufficiency: Lessons learned from the North American subfascial endoscopic perforator surgery registry. The North American Study Group, *J Vasc Surg*. 1999;29:489-502.
33. Pierik EG, van Urk H, Wittens CH. Efficacy of subfascial endoscopy in eradicating perforating veins of the lower leg and its relation with venous ulcer healing, *J Vasc Surg*. 1997;26:255-259.

## I. PRIMARY VENOUS DISEASE: SUPERFICIAL INCOMPETENCE

### SAVING THE SAPHENOUS VEIN

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**The extent of the problem.** Pure, superficial, primary venous incompetence<sup>15</sup> may be present (without large varicosities) for several years as a preliminary, subclinical stage. The incompetence of the SFJ and of the LSF (documented by color duplex in the San Valentino epidemiological study, 20,000 patients, 10-year follow-up) may be present in some 9% of subjects ages 45 to 65<sup>16</sup> and simple, uncomplicated varicose veins varicose in some 6% of asymptomatic subjects of an European population. However, only a part of these subjects will be referred for diagnosis and treatment. The total absence of valves in the superficial venous system is a rare occurrence (i.e. never verified in the 20,000 subjects of the San Valentino study). Therefore most subjects (70%) with simple incompetence of the SFJ could theoretically be treated with selective correction of incompetence.

**Surgery.** Repair of incompetent femoral vein valves in subjects with primary valve incompetence has been developed by Kistner in 1968.<sup>1</sup> The original method involved a venotomy in the femoral vein with placement of sutures to shorten the vein cusps under direct vision. Variations of open valve repair have been reported by others.<sup>2,3,4,5</sup> More recently closed valvuloplasty has been developed by Kistner.<sup>4</sup> Variations of external valvuloplasty including the use of intraoperative angioscopy to visualise the effects of the external

valvuloplasty has been developed by Gloviczki at the Mayo Clinic.<sup>5</sup> All these techniques were aimed to treat deep venous system problems. The surgical method involves complete dissection of the femoral vein for 4 to 10 cm in order to place sutures on both sides of the vein wall at the level of the valves commissures. A progressive dilatation of the femoral vein after months has been observed in some subjects and this has led to the placement of several types of nets or vein cuffs in order to contain such dilatation and keep the valve competent.<sup>2,6</sup> The progressive dilatation of the vein – causing recurrence of incompetence - may be possibly due to the dissection of the vein wall with destruction of vasa vasorum supply and innervation. The superficial venous system, when initially incompetent, has been also treated with external valvuloplasty with initial (6-8 months)<sup>7,8</sup> and long term (> 10 years) satisfactory results. The first randomized study on superficial veins valvuloplasty (long saphenous vein) was initiated in 1986 by our group and appeared for the first time in the medical literature 1989. Therefore the idea of treating in a conservative way the LSV and the relative surgical method are relatively new. In the same period a conservative way of treating superficial venous incompetence based on information given by color duplex (which became available for venous evaluation in that period) were developed<sup>9,10</sup> and documented by long-term (5 years) randomized, controlled studies. The randomized, controlled study on the correction of superficial venous incompetence using SFJ valvuloplasty and selective LSV repair indicated a very important potential application of non-destructive superficial venous surgery.<sup>11</sup> In this period external valvuloplasty was also attempted in a limited number of patients with superficial venous incompetence, dilated but not varicose veins.<sup>12</sup> A randomized pilot study was also conducted using an external Gore-tex patch applied in tubular shape at the proximal part of the SFJ.<sup>12</sup> The control treatment was simple, proximal ligation of the SFJ. No complications were observed in all 28 cases treated. Complete correction of venous incompetence was achieved in 21 cases and partial correction in 5. Competence persisting was still present after 6 years. Also no significant reaction to the Gore-tex patch or infection were observed in the following 6 years.

In the following years a few reports have indicated that external valvuloplasty of the deep venous system too are effective in reducing and controlling both superficial and venous incompetence<sup>13,14</sup> even in protracted follow-up (>3 years).

Data on file from our group (the study is still in progress with the aim to achieve 20-year follow-up before review of data) indicate that long-lasting, effective competence of the superficial and deep venous systems may be achieved both after external valvuloplasty or by placing an external vein support (i.e. Gore-tex patch or tubular graft cut and sutured according to the vein shape) systems. However, longer studies are needed to confirm the possibilities, limits and potential clinical applications of non-destructive venous surgery.

#### References

1. Kistner RL. Surgical repair of a venous valve, *Straub Clin Proc*. 1968;24:41-3.
2. Raju S, Fredericks R. Valve reconstruction procedures for non-obstructive venous insufficiency: rationals, techniques and results in 107 procedures with two- to eight-year follow-up, *J Vasc Surg*. 1988; 7:301-10.
3. Sottiurai VS. Technique in direct venous valvuloplasty, *J Vasc Surg*. 1988;8:646-8.
4. Kistner RL. Surgical technique of external venous valve repair, *Straub Found Proc*. 1990;55:15-6.
5. Gloviczki P, Merrel SW, Bower TC. Femoral vein valve repair under direct vision without venotomy: a modified technique with use of angioscopy, *J Vasc Surg*. 1991;14: 645-8.