Management of patients with venous leg ulcer*

*Abordagem de pacientes com úlcera da perna de etiologia venosa**

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Abstract: Venous ulcers are common in adult population. They cause significant socioeconomic impact due to recurrence and the long interval between onset and healing. If venous ulcers are not appropriately managed, they present high rates of healing failure and recurrence. Despite their high prevalence and importance, venous ulcers are often neglected and inadequately managed. This review discusses diagnosis and therapy of lower limb venous ulcers. Clinical diagnosis is based on history and physical examination, emphasizing associated signs and symptoms, and pulse palpation of lower limbs. Doppler must be used to determine the ankle-arm index, and non-invasive exams, such as duplex scan, are requested to evaluate the superficial, deep and perforating venous systems. Accurate clinical and laboratory diagnosis of venous ulcers, as well as appropriate treatment of their complications are fundamental for successful therapy. Efforts must be directed towards healing and avoiding recurrences. Advanced knowledge on the venous ulcer physiopathogenesis has led to development of new clinical and surgical treatments.
Keywords: Leg ulcer; Varicose ulcer; Venous insufficiency

Resumo: *Úlceras venosas são comuns na população adulta, causando significante impacto social e econômico devido a sua natureza recorrente e ao longo tempo decorrido entre sua abertura e cicatrização. Quando não manejadas adequadamente, as úlceras venosas têm altas taxas de falha de cicatrização e recorrência. Apesar da elevada prevalência e da importância da úlcera venosa, ela é freqüentemente negligenciada e abordada de maneira inadequada. Esta revisão discute abordagem diagnóstica e terapêutica das úlceras venosas. O diagnóstico clínico baseia-se em história e exame físico, com ênfase nos sinais e sintomas associados e palpação dos pulsos dos membros inferiores. A ultra-sonografia Doppler deve ser utilizada para determinar o índice pressórico entre o tornozelo e o braço, e exames não invasivos, como o duplex scan, devem ser realizados para avaliar o sistema venoso superficial, profundo e perfurante. Para abordagem terapêutica são fundamentais os diagnósticos clínico e laboratorial corretos, além do diagnóstico e tratamento adequados das complicações das úlceras crônicas. Os esforços devem ser direcionados para a cicatrização da úlcera e, posteriormente, para evitar as recidivas. O grande avanço no conhecimento da fisiopatogenia das úlceras venosas tem permitido o desenvolvimento de novas modalidades de tratamento clínico e cirúrgico.*
Palavras-chave: Insuficiência venosa; Úlcera da perna; Úlcera varicosa

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INTRODUCTION

Venous ulcers are very common among the adult population and their prevalence varies depending on the many study methods, population age and definitions of venous ulcer. Some articles include in their results all chronic ulcer of lower limbs and are not restricted to venous ulcers. Most studies show a prevalence of active (not healed) venous ulcers of approximately 0.3% , that is, roughly one per 350 adults, while a history of active or healed ulcer occurs in about 1% of adult population.[1-3] Prevalence increases with age and it is greater than 4% in patients aged over 65 years.[2]

Venous ulcers cause significant social and economic impact due to their recurrent nature and long lasting course between onset and healing. When they are not properly managed, about 30% of the healed venous ulcers relapse within the first year, and that increases to 78% after two years. Thus, due to prolonged treatment, patients with venous ulcer need frequent health care delivered by physicians and other professionals, besides being absent from work countless times, and often retiring early. According to a previous study performed by the authors with venous ulcer patients, with a mean age of 57 years, 35% were retired, 16.1% off work due to the ulcer, 2.5% receiving sick leave compensation, and 4.2% unemployed.5 All these factors are a burden to the health and social insurance systems, in addition to interfering in the patients´ quality of life, due to the high costs of treatment, time off work and threat of unemployment, as well as the decreased pleasure in daily activities.

In spite of high prevalence and importance of venous ulcer, it is frequently neglected and inadequately treated. For didactic reasons, the management of patients with venous ulcer may be done from diagnostic and therapeutic stand points.

DIAGNOSTIC MANAGEMENT

From a diagnostic stand point, venous ulcer is part of the differential diagnosis of chronic lower limb ulcers, so considered when they do not heal within a period of six weeks.[1]

Other causes of chronic lower limb ulcers are arterial insufficiency, neuropathy, lymphedema, rheumatoid arthritis, trauma, chronic osteomyelitis, sickle cell anemia, vasculitis, skin tumors (basal cell carcinoma and squamous cell carcinoma), chronic infectious diseases (leishmaniasis, tuberculosis, etc).

In spite of a wide range of etiological factors, the main causes of lower limb chronic ulcers are venous and arterial diseases; in that, 60 to 70% being caused by venous problems, the so-called venous ulcer[6,7], and 10 to 25% by arterial insufficiency, that may coexist with venous disease (mixed ulcer).[8] In about 3.5% of patients, the cause is not identified.[9]

Clinical diagnosis is initially based on history and physical examination. Onset is usually slow, but may be fast in a few cases. Lower limb trauma is an important triggering factor. Patients usually tell a history of varicose veins, and some may have a past history of deep venous thrombosis (DVT). The question on whether they have had lower limb edema after surgery or pregnancy should be asked, since those may be associated to a previous non-diagnosed DVT episode. Other situations related to subclinical DVT should be questioned, such as prolonged bed rest and lower limb fracture treated with cast.[8,10]

Pain is the most frequent symptom and it varies in intensity, not being influenced by ulcer size, since small lesions may be very painful, while large ones may be almost painless. When present, pain usually worsens towards the end of the day, with orthostatic position, and improves with limb elevation.[11] Deep malleolar ulcers and small ulcers associated to white atrophy are the most painful.[8] When pain is very intense, especially with elevation of the limb, other diagnostic possibilities should be considered, including arterial disease. Ankle edema is frequently present, especially at the end of the day.[11]

The venous ulcer is usually an irregular wound, shallow in the beginning but it may become deeper, with well defined borders and often with a yellow exudate. Rarely the ulcer bed will have necrotic tissue or tendon exposure. Ulcers may be single or multiple, of variable sizes and in different sites, but are usually at the distal portion of the lower limbs (leg), most commonly in the region of the medial malleolus (Figure 1).[8] Under special circumstances, the venous ulcer may occur in the upper portion of the calf or on the feet. On such cases, other etiologies for chronic ulcers should be ruled out before the diagnosis of venous etiology. The skin surrounding the ulcer may be of purpuric color and hyperpigmented (ochre dermatitis), due to red blood cell leakage into the dermis and hemosiderin deposit in macrophages.[12]

There may be eczema around the ulcer, with erythema, scaling, pruritus and, occasionally, exudate (Figure 2). There is no formal proof that the same pathophysiologic changes for development of venous ulcer and of chronic venous insufficiency be the cause of the eczema, known as stasis eczema.[13] Nevertheless, it is worsened by topical medication sensitization, specially antibiotics and lanolin, to which patients are particularly susceptible.[14] This type of sensitization ranges from 58 to 86% in patients with venous ulcers.[13]

Lipodermatosclerosis also occurs, with indura-

tion and fibrosis of different intensities which, when present for many years, may comprise the whole distal third of the lower limb, that assumes the shape of an inverted champagne bottle.[12] This lipodermatosclerosis is usually chronic, with exacerbation periods (acute lipodermatosclerosis), with inflammatory signs, such as poorly demarcated erythema, pain, induration and higher local temperature (Figure 3). Often, during such periods, lipodermatosclerosis may be confounded with erysipelas or cellulitis.[8] Lipodermatosclerosis usually precedes the venous ulcer. Absence of the typical changes of lipodermatosclerosis must raise the hypothesis of non-venous ulcer, although some cases of venous ulcer may not present with lipodermatosclerosis.[10,14]

White atrophy, recognized by atrophic star-like scars of ivory color, surrounded by telangiectasis and locate mainly on the distal third of the lower limb, is described in about 40% of patients with chronic venous insufficiency.[8] When there are ulcers associated, they may be extremely painful and of slow healing. White atrophy may also be found in other vascular or systemic diseases, such as livedoid vasculitis.[15]

Some patients have a plaque of intradermal dilated venules, usually at the ankle, on the submalleolar region. This is known as corona phlebectatica, and results from persistent venous hypertension, leading to dilation and elongation of capillaries and venules (Figure 4).[16]

Varicose veins may be found on the physical exam by the presence of venous dilations of different sizes. There may be varicose trunks in the territory of the venae saphena magna and parva, and the presence of leaking perfurans veins in the calf and thigh. A venous ulcer at the lateral malleolus may be associated to insufficiency of the vena saphena parva.[17] Although the presence of varicose veins reinforces the diagnosis of venous ulcer, it is not pathognomonic, and their absence is not excludent of venous etyology.[10]

All lower limb pulses should be palpated, specially the pedis arterial and posterior tibial pulses, although this may be difficult to detect due to the presence of lipodermatosclerosis or ulcer at the site. Doppler ultra sound should be used to determine the ankle/arm systolic index (AAI). The ratio is calculated using the highest value of systolic blood pressure at the ankle divided by the systolic blood pressure of the brachial artery (Figure 5). An AAI lower than 0.9 indicates arterial insufficiency, having influence on ulcer development. An AAI bellow 0.7 is highly significant and, when there is no venous abnormality, it may indicate that arterial insufficiency is the sole cause of the ulcer.[10] Patients with diabetes mellitus may have normal ratios due to stiffened arteries, thus, on them, the absence of distal pulses is also an indication of arterial disease, irrespective of the index value.[18] Even with an index below the normal value, the venous disease may be the main cause of ulcer. In some cases it is very hard to determine which factor is the most important in the ulcer pathogenesis.[10+]

Once the clinical diagnosis of venous ulcer is established, some exams should be ordered for a more precise diagnosis of the anatomic and functional changes of the venous system. The anatomic identification of the venous disease is extremely impor-

Figure 1: Chronic ulcer on the medial malleolus, typical aspects of venous ulcer

Figure 2: Erythema and scaling arround the ulcer characterizing eczema

Figure 3: Acute lipodermatosclerosis on the left, chronic lipodermatosclerosis on the right

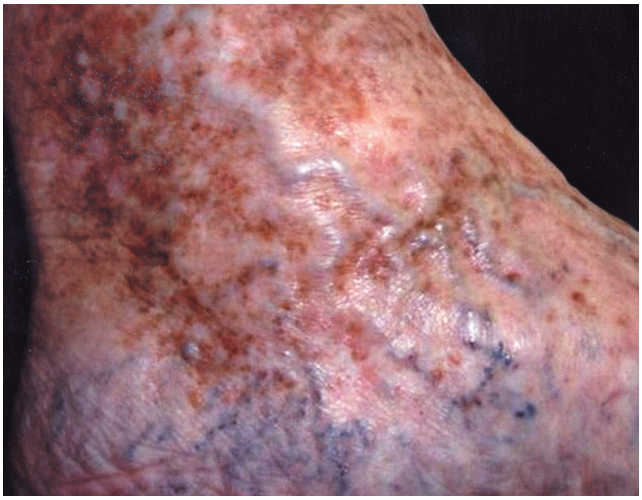


Figure 4: Corona phlebectasica – dilated dermal venules plaque on the submalleolar region

tant for planning treatment of these patients, since it may be localized in the superficial or deep venous system or in the perforating veins, or in more than one system. A functional assessment should also be carried out, identifying whether the venous disease is due to reflux, obstruction or both. Non-invasive exams should be used, such as Doppler ultrasound, plethysmography and duplex scan.[19,20] Duplex scan is the best non-invasive exam to assess the superficial and deep venous systems, as well as the perforating veins (Figure 6).[21,22]

An algorithm for the diagnostic management of patients with chronic ulcer of lower limbs is suggested for didactic and practical reasons (Chart 1).

THERAPEUTIC MANAGEMENT

PFor an adequate therapeutic management, accurate clinical and laboratorial diagnoses are essential. Besides establishing the diagnosis of venous ulcer, it is important to recognize and treat chronic ulcer complications, mainly soft tissue infections, contact dermatitis, osteomyelitis and, more rarely, neoplastic transformation.

Soft tissue infection happens when there is deep penetration and proliferation of bacteria in the tissues surrounding the ulcer, leading to erysipelas, cellulitis or bacterial lymphangitis. Its clinical manifestations are erythema, edema, pain and local heat of the tissues surrounding the ulcer, and sometimes fever. It is usually difficult to determine whether the ulcer is really infected or only colonized. The increased number of bacteria in the surface of the ulcer means colonization, not necessarily infection. Some studies have shown that a large amount of bacteria on chronic ulcers may also hinder healing,. [23,24] In such cases systemic antibiotics are not indicated, since they do not improve ulcer healing,[25] local care of the wound being more indicated. Systematic use of swabs for bacteriologic exams is not indicated since they will identify only contaminating and colonizing bacteria. When there is associated infection and bacterial identification is necessary to guide the treatment, biopsies of the base of the ulcer should be performed as well as cultures of the biopsy specimens.[8,10] Systemic antibiotics should thus be preserved for true infection.

Contact dermatitis is usually manifested by eczema-like lesions around the ulcer. It may appear as acute eczema, with erythema, vesicles and blisters, and exudation, or as sub-acute and chronic eczema when there is an erythematous scaling lesion or lichenification, respectively. In both situations the lesions are usually itchy and secondary to sensitiza-

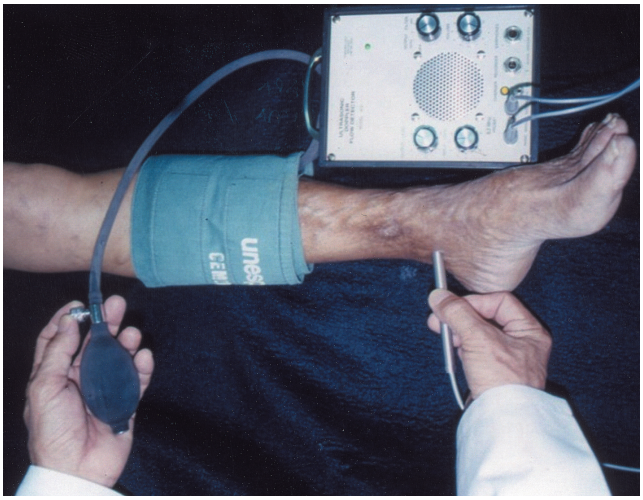


Figure 5: Technique to measure the ankle-arm index using a portable Doppler ultrasound

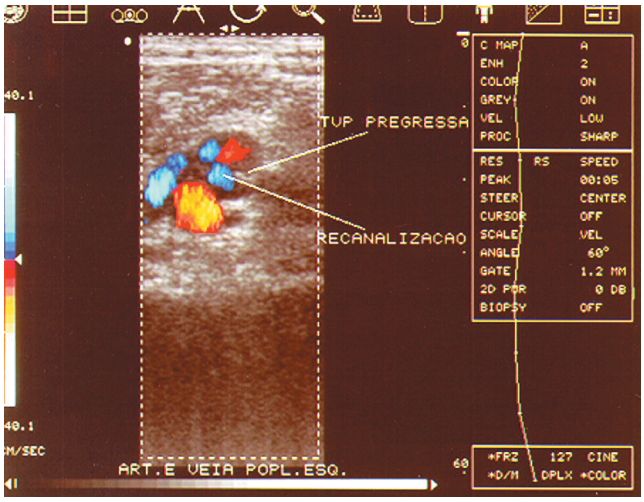


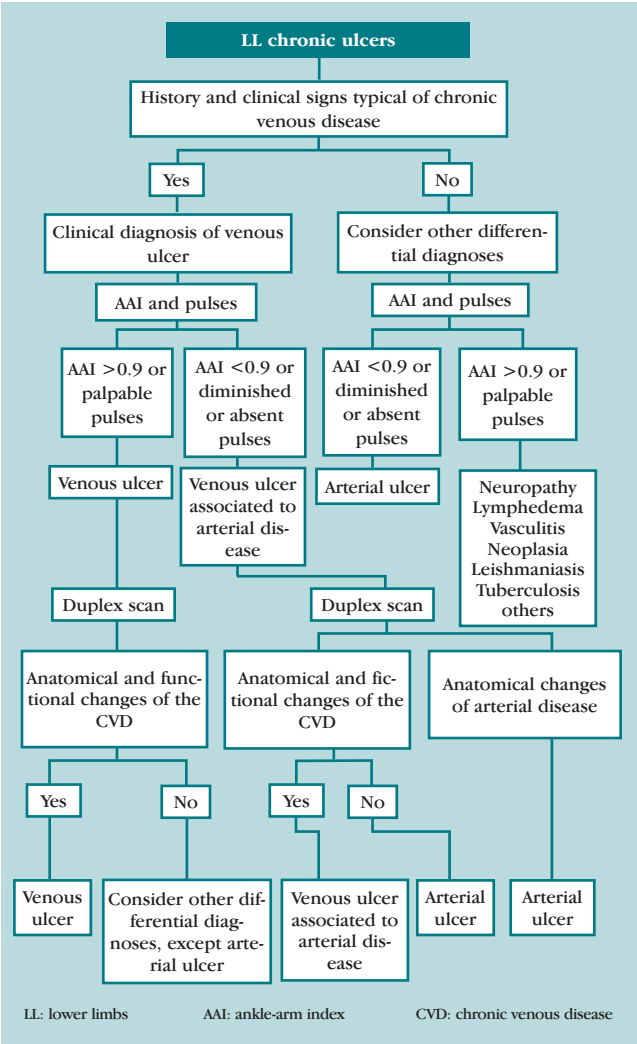
FIGURE 6: Venous Duplex scan (cross section) of a patient with past deep venous thrombosis, showing a retracted popliteous vein and flow inside recanalization channels

tion that patients develop along time, especially to topical antibiotics (neomycin, sulfa, gentamycin, among others), lanolin and antiseptics (povidine-iodine). In such cases, the triggering cause should be avoided and topical steroids as well as antihistame drugs should be used and, in more severe cases, systemic steroids for a short time, 40 to 60 mg of prednisone, for instance. Some patients may also present with dermatitis due to the irritation caused by the ulcer exudate. The exudate will macerate the skin around the ulcer and increase the local inflammatory process, favoring bacterial colonization which has additional pro inflammatory role, and is known as microbial eczema.[13]

There may be osteomyelitis in long lasting venous ulcers, but its incidence is unknown. When bone tissue is exposed and can be palpated at the base of the ulcer, osteomyelitis should be suspected. A radiograph is then indicated to check for bone destruction, increased soft tissue volume and periosteal reaction. In some cases a bone biopsy is indicated.[10]

There may be neoplastic transformation at the bed of chronic ulcers, such as squamous cell carcinomas and basal cell carcinomas (Figure 7). Chronic ulcers of atypical appearance and lesions that do not respond to adequate clinical treatment should raise the possibility of neoplastic transformation. Squamous cell carcinomas over venous ulcers, known as Marjolin ulcers, usually have raised borders, excessive exudate and necrotic tissue.[26] Basal cell carcinomas over venous ulcers present with profuse granulation tissue and thick borders in some regions of the ulcer.[27] In ulcers that have been active for a long time, the need for periodic biopsies for histological exam should be thought of, since malignant transformation

CHART 1: Algorithm of the diagnostic management for patients with lower limb chronic ulcer



is directly related to duration.[26] Different ulcer regions should be biopsied to obtain proper material for histology. Upon a diagnosis of malignant transformation, the treatment is either surgery or radiation therapy.

After a correct diagnosis of venous ulcer and appropriate control of complications, the goal should be healing, and after that, avoiding recurrence. The major advance in understanding the pathophysiology of venous ulcers has led to the development of new modalities of clinical and surgical treatments.

METHODS FOR ULCER HEALING

The most important methods for ulcer healing are compression treatment, local treatment of the ulcer, systemic drugs and surgical treatment of the venous disease.

1. Compression treatment

Venous ulcers are caused by venous hypertension; thus some steps should be taken to decrease

Figure 7: Lower limb chronic ulcer lasting longer than 40 years with atypical presentation (deep ulcer, bone destruction, abundant exudate), not responding to clinical treatment. On histology, a basal cell carcinoma was found

hypertension and its consequences in the macro and microcirculations. Compression treatment is mandatory for that,[28,29] since it acts on the macrocirculation, increasing deep venous return, decreasing pathologic reflux during deambulation and increasing stroke volume during the activation of the calf muscles.[11] Limb compression increases tissue pressure, favoring edema absorption[11] and improving lymphatic drainage.[30] Moreover, this acts on the microcirculation decreasing fluid and macromolecule leakage from the capillaries and venules into the interstitium, and it may also stimulate fibrinolytic activity.[31] The external pressure that should be exerted at the ankle by compression is roughly 35 to 40 mmHg, decreasing gradually under the knee.[8,32] For compression benefits the patient should deambulate.[11]

The compression methods available are compression dressings, elastic stockings and pneumatic compression. All these are not indicated if the patient has severe peripheral arterial disease, non-palpable distal pulses or AAI lower than 0.5.[10,32] Nevertheless, in cases of venous ulcers associated to mild to moderated arterial disease, the careful use of compression may be considered, exerting low pressure at rest (inelastic compression).[11]

Compression bandages are often used in the initial phase of treatment and may be elastic or inelastic (Figure 8). The Unna boot is the most used inelastic dressing, a bandage impregnated with a zinc oxide paste, creating a semi solid cast for efficient external compression. The modified Unna boot, less rigid, is also called short stretch compression bandage; some examples are Viscopaste® (Smith & Nephew) and Flexdress® (ConvaTec).[8] These inelastic dressings generate high compression at muscular contraction (during deambulation) and low pressure at rest. Both the traditional and modified Unna boot should be worn for seven days, but in the beginning of treatment, due to the presence of large amounts of exudate and edema, they may be replaced more often.[30] Favorable features of that form of compression are: comfort, protection against trauma, and minimal interference in regular activities. Unfavorable features are change in pressure along time, need for well trained nurses and physicians, inadequacy for extremely exudative wounds.[33]

Elastic bandages stretch more and cause high pressure under muscular contraction as well as at rest. Some examples of these bandages are Tensopress (Smith & Nephew) and Surepress® (ConvaTec). The latter has superficial rectangles that shape into squares when stretched to a proper tension.[10] The advantages of this type of compression are low cost and reuse, whereas the disadvantages include incorrect application by the patient, pressure variation along the day, and elasticity loss with washings.[33]

Treatment by multilayer elastic compression is the modern and effective form for the treatment of venous ulcer. With this type of compression the pressure is sustained between 40 and 45 mmHg at the ankle and 17 mmHg below the knee. One example of this type of compression is DynaflexR (Johnson&Johnson), the first layer is a woolen fabric applied as spiral, which absorbs exudate and redistributes pressure around the ankle: the second layer is a compression elastic bandage, and the top layer is an adhesive bandage that adequately sustains all layers. This compression system may remain in

Figure 8: Two types of compression dressings. On the left, elastic bandage with rectangles in the surface, which shape into squares when properly strechted. On the right, a modified Unna boot.e bota de Unna modificada

place for seven days.[32] Advantages of its use are comfort, seven-day stay, sustained pressure, trauma protection, use in exudative wounds. The most important disadvantage is high cost, besides the need for well trained nurses and physicians.[33]

It is important to point out that inelastic and elastic compression bandages may be harmful or useless if not properly used, and their effectiveness may be influenced by the application technique used by physicians, nurses or patients themselves.

The second compression method, elastic stockings, is usually difficult to use in the active phase, since it is not easy for patients with ulcer to put them on as appropriate. They are more indicated for the post healing period, to avoid recurrence. There are, though, special elastic stockings for patients with venous ulcer, featuring a zipper to facilitate their use; and ankle pressure is either 30-40 mmHg or 40-50 mmHg (Ulcercare®, made by Jobst).[11]

Intermittent pneumatic compression is useful when the patient does not respond to conventional compression,[12,31] although it is a very expensive method and demands some hours of immobility every day.[32]

According to a systematic review on compression therapy used for venous ulcers, compression increases healing rates. The multilayer system is more effective than the traditional ones. High compression is more effective than low compression, but the differences in effectiveness of the many types of high compression are not yet clear.[34]

2. Local treatment of the ulcer

For ulcer cleaning, initially only saline solution or drinking water should be used, since many antiseptic chemicals (chlorhexidine, povidine-iodine, acetic acid, sodium hypochlorite, among others) are cytotoxic and may slow down healing.[32]

Later on, the ulcer bed should be assessed for the presence of non-viable tissues, amount of exudate and presence of infection (discussed with complications). Non-viable tissue should be debrided, since they favor infection and hinder production of a good granulation tissue and adequate reepithelization.[35]

There are basically three forms of debridement: autolytic, chemical and mechanical. Autolytic may be achieved with occlusive dressings, through the action of exudate enzymes that remain in contact with the ulcer. Some examples are hydrogels (Nu-gel®, Duoderm gel®, IntraSite gel®) and hydrocolloids (Nuderm®, Duoderm®, Comfeel®).[8] Chemical debridement is done by applying different enzymes, including collagenase and papain. Randomized, controlled studies did not show any evidence of its efficacy.[36] Mechanical debridement may be performed using surgical instruments or by applying dressings that vary from moist to dry. The major disadvantage of this technique is not being selective, since it removes viable tissue along with devitalized tissue.[37]

The amount of ulcer exudate should also be controlled, a moist bed being desired. Too much exudate should not be accepted, since it favors infection and is uncomfortable for patients. On the other hand, ulcer bed dehydration should be avoided, since it favors tissue devitalization. There are occlusive dressings that will give an optimal healing medium and may be indicated according to the ulcer characteristics. Alginate dressings are indicated for excessively exudative ulcers (for instance, Kaltostat®, Sobsan®), coal and silver dressings (for example, Actsorb plus®), coal and alginate dressings (for example, Carboflex®), dressings with hydropolymers (such as Aquacel®, Allevyn®, Tielle®). Hydrocolloid dressings (Nu-derm®, Duoderm®, Comfeel®) and hydrogels (Nu-gel®, Duoderm gel®, IntraSite gel®) are indicated for ulcers with a mild to moderate amount of exudate.[38,39] Compression treatment may and should be used with those bandages whenever possible.[11]

When the venous ulcer does not respond to clinical treatment, skin autograft is an alternative, especially for those with a long lasting history. Although in many cases that will lead to healing, this treatment alone[40] is controversial in the literature, since ulcers will frequently relapse.

In recent years, the use of autogenic and allogenic cultures of keratinocytea have drawn attention.[41] In autogenic culture, the cells are obtained by skin biopsy, cultivated and applied to the ulcer. Such technique poses time restrictions because it takes several weeks for culture besides being technically difficult. The skin equivalent obtained by bioengineering (Apligraf®) is a representative of allogenic culture of keratinocytes and it uses neonatal keratinocytes. It has been used in venous ulcers, but although it does give good results, it demands specialized technology, thus having high cost.[42]

3. Systemic drugs

Pentoxifylline,[43] aspirin,[44] diosmin,[45] among other drugs, are mentioned in the literature due to their apparent capacity to stimulate healing.

Pentoxifylline is known for stimulating fibrinolysis, facilitating capillary perfusion due to reduction in blood viscosity following red blood cell and leukocyte deformity, plus platelet adhesion and decreased fibrinogen levels[10]. A systematic review showed that pentoxifylline (800 mg, three times a day) was an effective adjunct to compression therapy for the treatment of venous ulcers.[46]

As to aspirin, there is no systematic review, since double-blind, randomized studies are scarce;

one placebo controlled study suggested that a 300mg/day dose might accelerate venous ulcer healing, but the number of patients was small (20).[47] Further studies to define its action and use in venous ulcers are necessary.

Medications known as phlebotonics comprise a heterogeneous group of drugs used to treat chronic venous insufficiency. There are doubts on their effectiveness and safety. Many of them are natural flavanoids, extracted from plants; others are synthetic, like diosmine. The mechanism of action is not well established yet, but they seem to act in macrocirculation, improving venous tonus, as well as in microcirculation, decreasing capillary hyperpermeability.[48] A systematic review concluded that there is no evidence of their efficacy in cases of chronic venous insufficiency, and more controlled, randomized clinical trials are necessary.[49]

Thus, systemic treatment for patients with venous ulcer seems to be adjunct treatment.

4. Surgical treatment of venous abnormality

The surgical treatment of venous abnormality with the objective of ulcer healing aims to eliminate or decrease the transference of high venous pressure to the ulcerated areas. In patients with venous ulcer with a significant insufficiency of the superficial venous system alone or combined to perforating insufficiency, a significant improvement may occur after varicose veins surgery, besides a better prognosis along time.[11,50] In recent years the endoscopic subfascial obliteration of incompetent perforating veins at the medial calf region has also been developed. The results vary and failure or recurrence rates range from 2.5% to 22%.[51-53]

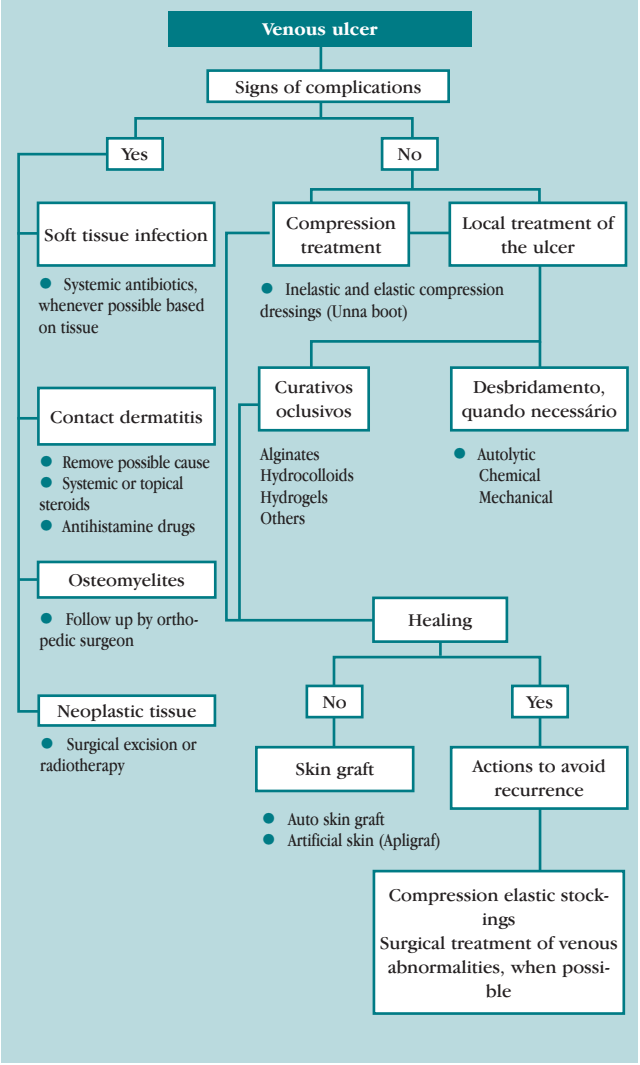
5. Additional actions

Counseling concerning appropriate rest is important for ulcer healing, since it decreases the effects of venous hypertension. Rest should be with the limb raised above the level of the heart, lasting 30 minutes, three or four times a day. During the night, limb elevation is attained elevating the feet of the bed 15 to 20 cm. Such elevation should not be done in cases associated to arterial disease.[54]

Short walks, three or four times a day, should be encouraged. Besides, patients should be oriented to maintain their weight in a range considered normal, and avoid smoking. Manual lymphatic drainage and physiotherapy to improve ankle mobility are necessary in some patients.[11]

Other therapeutic modalities, such as electrical stimulation,[55] negative pressure therapy,[56] hyperbaric oxygen therapy,[57] ultrasound[58], and low-intensity laser therapy,[59] have been used as adjunct treatment for venous ulcers, but, according to the respective systematic reviews, more studies have to be carried out to prove their effectiveness.

CHART 2: Algorithm of the therapeutic management for patients with leg ulcer of venous etiology



METHODS TO AVOID RECURRENCE

After achieving ulcer healing, the great challenge is to avoid recurrence. The two most important actions for that are the use of compression elastic stockings and adequate surgical intervention to correct venous abnormality.

Patients should be encouraged to wear adequate elastic stockings for the rest of their lives, to avoid ulcer recurrence. There are four classes of compression stockings, according to the pressure at ankle level. The pressure should be a gradient, higher at ankle level, lower just below the knee, and even lower in the thigh. Patients with healed ulcers need pressures that vary from 30 to 40 mmHg (class II elastic stockings) or 40

to 50 mmHg (class III).[30] The stockings should be worn from early morning to bedtime. Time and laundry wear-off elasticity, so the stockings should be replaced every six months.[33]

To improve long-term prognosis it is crucial, whenever possible, to eliminate or decrease venous hypertension in the affected limb.50 This can only be achieved in well assessed cases, where a precise diagnosis is made, concerning anatomical and functional changes in the superficial and deep venous systems, as well as the perforating veins. Surgical treatment aims at correcting reflux in the superficial venous system through the removal or ligation of incompetent perforating and saphenous veins.[50] The technique of endovascular surgery with endoscopic subfascial ligation for the treatment of incompetent perforating veins is promising, since it is less invasive than the traditional surgery.[60]

The treatment of deep venous insufficiency is more complex and includes valve replacement and transplantation, and bypass. Cases with previous DVT are more difficult to be corrected. Recommendation and results of this technique are controvertial.[61,62]

An algorithm is also presented for the therapeutic management of patients with venous ulcer (Chart 2).

COMMENTS

Patients with venous ulcer need a multidisciplinary team for their treatment – vascular surgeons, dermatologists, nurses, physiotherapists, dietitians, among others, that should care for patients together and in an integrated way, aiming to improve management and the cost/effectiveness ratio. ❑

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REFERENCES

1. Bergqvist D, Lindholm C, Nelzen O. Chronic leg ulcers: the impact of venous disease. J Vasc Surg. 1999;29:752-5.
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 (Clin Res Ed). 1985;290:1855-6.
3. Maffei FH, Magaldi C, Pinho SZ, Lastoria S, Pinho W, Yoshida WB, et al. Varicose veins and chronic venous insufficiency in Brazil: prevalence among 1755 inhabitants of a country town. Int J Epidemiol. 1986;15:210-7.
4. Mayer W, Jochmann W, Partsch H. Ulcus cruris: Abheilung unter konservativer Therapie. Eine prospektive Studie. Wien Med Wochenschr. 1994;144:250-2.
5. Abbade LP, Lastoria S, de Almeida Rollo H, Stolf HO. A sociodemographic, clinical study of patients with venous ulcer. Int J Dermatol. 2005;44:989-92.
6. Baker SR, Stacey MC, Jopp-McKay AG, Hoskin SE, Thompson PJ. Epidemiology of chronic venous ulcers. Br J Surg. 1991;78:864-7.
7. Scriven JM, Hartshorne T, Bell PR, Naylor AR, London NJ. Single-visit venous ulcer assessment clinic: the first year. Br J Surg. 1997;84:334-6.
8. Valencia IC, Falabella A, Kirsner RS, Eaglstein WH. Chronic venous insufficiency and venous leg ulceration. J Am Acad Dermatol. 2001;44:401-21; quiz 422-4.
9. Mani R, Falanga V, Shearman C, Sandeman D. Clinical aspects of lower limb ulceration. Chronic Wound Healing. London: WB Saunders; 1999. p. 4-25.
10. Browse NL, Burnand KG, Irvine AT, Wilson NM. Úlcera venosa: diagnóstico. In: Browse NL, Burnand KG, IrvineAT, Wilson NM, editors. Doenças venosas. Rio de Janeiro: Di-livros; 2001. p. 485-520.
11. Zimmet SE. Venous leg ulcers: modern evaluation and management. Dermatol Surg. 1999;25:236-41.
12. Phillips TJ, Dover JS. Leg ulcers. J Am Acad Dermatol. 1991;25:965-87.
13. Fritsch PO, Reider N. Other eczematous eruptions. In: Bolognia JL, Jorizzo JL, Rapini RP, editors. Dermatology. New York: Mosby; 2003. p. 215-26.
14. Falanga V. Venous ulceration. J Dermatol Surg Oncol. 1993;19:764-71.
15. Maessen-Visch MB, Koedam MI, Hamulyak K, Neumann HA. Atrophie blanche. Int J Dermatol. 1999;38:161-72.
16. Burnand KG, Whimster I, Clemenson G, Thomas ML, Browse NL. The relationship between the number of capillaries in the skin of the venous ulcer-bearing area of the lower leg and the fall in foot vein pressure dur ing exercise. Br J Surg. 1981;68:297-300.
17. Bass A, Chayen D, Weinmann EE, Ziss M. Lateral venous ulcer and short saphenous vein insufficiency. J Vasc Surg. 1997;25:654-7.
18. Cornwall JV, Dore CJ, Lewis JD. Leg ulcers: epidemiolo gy and aetiology. Br J Surg. 1986;73:693-6.
19. Kohler TR, Strandness DE Jr. Noninvasive testing for theevaluation of chronic venous disease. World J Surg.

1986;10:903-10.
20. Welch HJ, Young CM, Semegran AB, Iafrati MD, Mackey WC, O'Donnell TF Jr. Duplex assessment of venous reflux and chronic venous insufficiency: the significance of deep venous reflux. J Vasc Surg. 1996;24:755-62.
21. Shami SK, Sarin S, Cheatle TR, Scurr JH, Smith PD. Venous ulcers and the superficial venous system. J Vasc Surg. 1993;17:487-90.
22. Weingarten MS, Branas CC, Czeredarczuk M, Schmidt JD, Wolferth CC Jr. Distribution and quantification of venous reflux in lower extremity chronic venous stasis disease with duplex scanning. J Vasc Surg. 1993;18:753-9.
23. Mertz PM, Eaglstein WH. The effect of a semiocclusive dressing on the microbial population in superficial wounds. Arch Surg. 1984;119:287-9.
24. Dagher FJ, Algoni SV, Smith A. Bacterial studies of leg ulcers. Angiology. 1987;29:641-53.
25. Alinovi A, Bassissi P, Pini M. Systemic administration of antibiotics in the management of venous ulcers. A randomized clinical trial. J Am Acad Dermatol. 1986;15:186-91.
26. Baldursson B, Sigurgeirsson B, Lindelof B. Venous leg ulcers and squamous cell carcinoma: a large-scale epidemiological study. Br J Dermatol. 1995;133:571-4.
27. Harris B, Eaglstein WH, Falanga V. Basal cell carcinoma arising in venous ulcers and mimicking granulation tissue. J Dermatol Surg Oncol. 1993;19:150-2.
28. Sandeman D, Shearman CP. Clinical aspects of lower limb ulceration. In: Mani R, Falanga V, Shearman CP, Sandeman D, editors. Chronic Wound Healing. London: W.B. Saunders; 1999. p. 4-25.
29. van Geest AJ, Veraart JC, Nelemans P, Neumann HA. The effect of medical elastic compression stockings with dif-ferent slope values on edema. Measurements under-neath three different types of stockings. Dermatol Surg. 2000;26:244-7.
30. Partsch H. Compression therapy of the legs. A review. J Dermatol Surg Oncol. 1991;17:799-805.
31. Smith PC, Sarin S, Hasty J, Scurr JH. Sequential gradient pneumatic compression enhances venous ulcer healing: a randomized trial. Surgery. 1990;108:871-5.
32. Lin P, Phillips T. Ulcers. In: Bolognia JL, Jorizzo JL, Rapini RP, editors. Dermatology. New York: Mosby; 2003. p. 1631-49.
33. Choucair M, Phillips TJ. Compression therapy. Dermatol Surg. 1998;24:141-8.
34. Cullum N, Nelson EA, Fletcher AW, Sheldon TA. Compression for venous leg ulcers. Cochrane Database Syst Rev. 2001;(2):CD000265.
35. Brem H, Kirsner RS, Falanga V. Protocol for the successful treatment of venous ulcers. Am J Surg. 2004;188:1-8.
36. Westerhof W, van Ginkel CJ, Cohen EB, Mekkes JR. Prospective randomized study comparing the debriding effect of krill enzymes and a non-enzymatic treatment in venous leg ulcers. Dermatologica. 1990; 181:293-7.
37. Marquez R. Desbridamento de feridas e hidroterapia. In: Gogia PP, editor. Feridas: tratamento e cicatrização. Rio de Janeiro: Revinter Ltda; 2003. p. 91-102.
38. Cho CH, Lo J. Dressing the part. In: Mcgillis ST, editor. Dermatologic Clinics. Philadelphia: W.B. Saunders Company; 1998. p. 25-47.
39. Cuzzell J, Krasner D. Curativos. In: Gogia PP, editor. Feridas: tratamento e cicatrização. Rio de Janeiro: Revinter Ltda; 2003. p. 103-14.
40. Kirsner RS, Mata SM, Falanga V, Kerdel FA. Split-thickness skin grafting of leg ulcers. The University of Miami Department of Dermatology's experience (1990-1993). Dermatol Surg. 1995;21:701-3.
41. Phillips TJ, Bigby M, Bercovitch L. Cultured allografts as an adjunct to the medical treatment of problematic leg ulcers. Arch Dermatol. 1991;127:799-801.
42. Jones I, Currie L, Martin R. A guide to biological skin substitutes. Br J Plast Surg. 2002;55:185-93.
43. Barbarino C. Pentoxifylline in the treatment of venous leg ulcers. Curr Med Res Opin. 1992;12:547-51.
44. Ibbotson SH, Layton AM, Davies JA, Goodfield MJ. The effect of aspirin on haemostatic activity in the treatment of chronic venous leg ulceration. Br J Dermatol. 1995;132:422-6.
45. Guilhou JJ, Dereure O, Marzin L, Ouvry P, Zuccarelli F, Debure C, et al. Efficacy of Daflon 500 mg in venous leg ulcer healing: a double-blind, randomized, controlled versus placebo trial in 107 patients. Angiology. 1997; 48:77-85.
46. Jull A, Waters J, Arroll B. Pentoxifylline for treatment of venous leg ulcers: a systematic review. Lancet. 2002;359:1550-4.
47. Layton AM, Ibbotson SH, Davies JA, Goodfield MJ. Randomised trial of oral aspirin for chronic venous leg ulcers. Lancet. 1994;344:164-5.
48. Behar A, Lagrue G, Cohen-Boulakia F, Baillet J. Capillary filtration in idiopathic cyclic edema - effects of Daflon 500 mg. Nuklearmedizin. 1988;27:105-7.
49. Martinez MJ, Bonfill X, Moreno RM, Vargas E, Capella D. Phlebotonics for venous insufficiency. Cochrane Database Syst Rev. 2005;CD003229.
50. Zamboni P, Cisno C, Marchetti F, Mazza P, Fogato L, Carandina S, et al. Minimally invasive surgical management of primary venous ulcers vs. compression treatment: a randomized clinical trial. Eur J Vasc Endovasc Surg. 2003;25:313-8.
51. Pierik EG, van Urk H, Hop WC, Wittens CH. Endoscopic versus open subfascial division of incompetent perforating veins in the treatment of venous leg ulceration: a randomized trial. J Vasc Surg. 1997;26:1049-54.
52. 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;26:255-9.
53. Sybrandy JE, van Gent WB, Pierik EG, Wittens CH. Endoscopic versus open subfascial division of incompetent perforating veins in the treatment of venous leg ulceration: long-term follow-up. J Vasc Surg. 2001; 33:1028-32.
54. Browse NL, Burnand KG, Irvine AT, Wilson NM. Úlcera venosa: história natural e tratamento. In: Browse NL, Burnand KG, Irvine AT, Wilson NM, editors. Doenças Venosas. Rio de Janeiro: Di-Livros; 2001. p. 521-51.
55. Flemming K, Cullum N. Electromagnetic therapy for the treatment of venous leg ulcers. Cochrane Database Syst Rev. 2001(1):CD002933.
56. Evans D, Land L. Topical negative pressure for treating chronic wounds. Cochrane Database Syst Rev. 2001(1): CD001898.
57. Kranke P, Bennett M, Roeckl-Wiedmann I, Debus S. Hyperbaric oxygen therapy for chronic wounds. Cochrane Database Syst Rev. 2004(2):CD004123.
58. Flemming K, Cullum N. Therapeutic ultrasound for venous leg ulcers. Cochrane Database Syst Rev. 2000 (4):CD001180.
59. Flemming K, Cullum N. Laser therapy for venous leg ulcers. Cochrane Database Syst Rev. 2000(2): CD001182.
60. Bergan JJ. Advances in venous surgery: SEPS and phlebectomy for chronic venous insufficiency. Dermatol Surg. 2002;28:26-8.
61. Puggioni A, Kistner RL, Eklof B, Lurie F. Surgical disobliteration of postthrombotic deep veins--endophlebectomy--is feasible. J Vasc Surg. 2004;39:1048-52; discussion 52.
62. Botella FG, Labios Gomez M, Portoles Reparaz O, Cabanes Vila J. Nuevos avances en el conocimiento del sindrome postrombotico. An Med Interna. 2003;20:483-92.

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Questions related to this article

1. Lower limb chronic ulcers are lesions that do not heal:
   a) with compression treatment
   b) with surgical treatment
   c) within six weeks
   d) in spite of clinical treatment

2. Pain in patients with venous ulcer:
   a) should call attention to other etiologies
   b) is related to the size of the ulcer
   c) if intense and worsening with limb elevation, should lead to the investigation of associated arterial disease
   d) is milder when associated to white atrophy

3. When a patient has chronic ulcer on the dorsum of the foot associated to varices in the lower limbs, one should:
   a) initiate treatment for venous ulcer with lower limb compression
   b) consider the possibility of arterial ulcer and refer the patient to a vascular surgeon
   c) not think of venous etiology since they do not occur in the dorsum of the feet
   d) check all distal pulses and, if not significantly diminished or absent, start treatment for venous ulcer

4. Choose the correct alternative concerning stasis eczema:
   a) it is aggravated by topical antibiotics
   b) its pathophysiology is identical to that of venous ulcer
   c) it is aggravated by some activated coal dress ings
   d) lanolin should be used for its treatment

5. Acute lipodermatosclerosis is diagnosed when, on the leg of the patient with venous insufficiency,
   a) there is a first episode of erythema, fibrosis and induration
   b) there are fibrosis and induration of the distal third, the shape of an inverted champagne bottle
   c) there is intense inflammatory process associ ated to fibrosis and induration
   d) there are erythema, fibrosis and induration lasting less than six weeks

6. In patients with chronic leg ulcer with clinical characteristics of venous etiology, but not associated to lower limb varices, one should:
   a) rule out venous etiology
   b) investigate deep venous thrombosis
   c) maintain the hypothesis of venous ulcer
   d) consider the hypothesis of a mixed ulcer

7. The systolic ankle-arm index (AAI) should be calculated:
   a) on every patient with chronic leg ulcer
   b) only on patients with chronic leg ulcer and diminished distal pulses
   c) only on patients with mixed ulcer
   d) only on patients wit arterial ulcer

8. What is the best complementary exam to assess anatomical and functional changes of the venous system of venous ulcer patients?
   a) Doppler ultrasound
   b) Plethysmography
   c) Phlebogram
   d) Duplex scan

9. Chronic leg ulcer is considered infected when there are:
   a) classic signs of erysipelas, cellulitis or lym phangitis on tissues surrounding the ulcer
   b) purulent exudate on the ulcer bed
   c) erythema on tissues surrounding the ulcer
   d) association of the classic signs of erysipelas, cellulitis or lymphangitis on tissues surrounding the ulcer and purulent exudate

10. Choose the incorrect alternative:
   a) the ulcer is considered colonized when there is an increased number of bacteria on its surface
   b) the ulcer becomes infected when there is deep penetration and proliferation of bacteria in the tissues surrounding the ulcer
   c) swabs should be used to identify the bacteria causing infection
   d) systemic antibiotics are indicated only for infected ulcers

11. Microbial eczema is:
   a) dermatitis caused by stasis in the tissue sur rounding the infected ulcer
   b) dermatitis caused by stasis in the tissues sur rounding the colonized ulcer
   c) dermatitis caused by stasis in the tissues sur rounding the colonized or infected ulcer
   d) irritative dermatitis in the tissues surrounding the ulcer, due to maceration from the exudate, favoring bacterial colonization

12. Choose the correct alternative on neoplastic transformation of chronic venous ulcer beds:
   a) Marjolin ulcer is the transformation into squamous cell carcinoma or basal cell carcinoma
   b) venous ulcer do not develop into basal cell carcinoma
   c) venous ulcers should be biopsied to rule out the possibility of neoplastic transformation irre spectively of their duration and clinical character istics
   d) venous ulcers with raised borders, excessive exudate production and necrotic tissue raise the possibility of transformation into squamous cell

carcinoma

13. Choose the incorrect alternative on compression treatment for patients with leg venous ulcer:
a) compression treatment acts on macrocirculation improving deep venous return
b) compression treatment improves tissue pres sure, favoring edema absorption, but does not improve lymphatic drainage
c) compression treatment acts on microcircula tion, decreasing fluid and macromolecule leakage from the capillaries and venules into the interstitium
d) compression treatment may stimulate fibrinolyt ic activity

14. Compression methods are contraindicated to patients with ulcer of mixed etiology (venous associated to arterial):
a) if the pressure ankle-arm index is lower than 0.9
b) if the pressure ankle-arm index is lower than0.5
c) if the ulcer has large amounts of exudate
d) under any circumstances, irrespective of the ankle-arm index and the amount of exudate

15. Choose the correct alternative regarding Unna boot used to treat venous ulcers:
a) the traditional Unna boot is an inelastic com pression bandage
b) the most important role of the Unna boot is protection of the ulcer bed
c) during treatment with the Unna boot patients should be oriented to not walk
d) the Unna boot generates a small pressure with deambulation and high pressure at rest

16. Elastic bandages:
a) generate high pressure on deambulation and low pressure at rest
b) should be used for exudative ulcers
c) that are multilayered represent a modern and effective way to treat venous ulcers
d) should not be used during the active phase of the venous ulcer

17- All those listed below are examples of dressings that avoid excessive amount of exudate on the ulcer bed, except:
a) silver impregnated activated carbon
b) hydropolimers
c) alginates
d) hydrogels

18. - Skin autograft for venous ulcers:
a) is well indicated when there is no response to adequate clinical treatment
b) should not be performed due to the high recurrence rates after such therapy
c) should be performed as first line method to heal recurrent ulcers
d) should not be performed in ulcers smaller than ten centimeters

19. Choose the correct alternative regarding systemic medication used for patients with venous ulcer:
a) pentoxifylline is known to stimulate fibrinol ysis, facilitate capillary perfusion, and reduce platelet adhesion and fibrinogen levels
b) there are several studies proving that aspirin helps in ulcer healing
c) phlebotonics should be used since it has been proved that they accelerate the healing process
d) synthetic and natural flavonoids are auxiliary drugs, of which mechanism of action is reduction of blood viscosity through their capacity to deform red blood cells and leukocytes

20. All following actions are important for the treatment of venous ulcer patients, except:
a) maintaining body weight within normal ranges
b) absolute rest, avoiding deambulation
c) manual lymphatic drainage of the edematous limb
d) physiotherapy to improve joint mobility

ANSWERS

Genética molecular aplicada ao câncer cutâneo não melanoma. An Bras Dermatol. 2006;81(5):405-19.

1- c	11- d
2- c	12- d
3- d	13- b
4- a	14- b
5- c	15- a
6- c	16- c
7- a	17- d
8- d	18- a
9- a	19- a
10- c	20- b

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