Clinical Spectrum and Various Surgical Options in Management of Lower Limb Ulcers

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Abstract

Lower limb ulcer is a condition commonly seen to cause pain and social distress. It affects approximately 4% of the people above 65 years [1]. These wounds can be either acute or chronic depending on their duration since onset. Acute wounds heal within a predicted time frame. Wounds that do not heal in a timely and predicted period of three months are classified as chronic wounds. Diabetes, venous diseases, neuropathy, arterial diseases, and trauma are the common causes of ulcer formation [1]. Due to multiple causative factors of lower limb ulcers, it requires a multidisciplinary approach to assess the etiopathogenesis of the disease, and establish the diagnosis. The management of lower limb ulcers must include the history, clinical examination of the ulcer and the entire lower limb, relevant investigations, and treatment should be planned after identifying the cause of the ulcer. The treatment of ulcer includes debridement (local care), medical and surgical management based on the type of ulcer.

Keywords: Ulcer; Venous Diseases; Arterial Disease; Neuropathy; Diabetic Ulcers; Debridement; Surgical Management

Background

Lower limb ulcer is a condition commonly seen to cause pain and social distress. It affects approximately 4% of the people above 65 years [1]. Ulcers of the lower limb immensely hamper the patient’s quality of life and are severely debilitating for the patient.

These wounds can be either acute or chronic depending on their duration since onset. Acute wounds heal within a predicted time frame. Wounds that do not heal in a timely and predicted period of three months are classified as chronic wounds. Such wounds are quite challenging for the health care professionals with respect to its treatment [2]. The most witnessed chronic wounds are lower limb ulcers [3].

Ulcer is defined as a break in the continuity of the epithelium which includes skin or mucous membrane [4]. Lower limb ulcer is a commonly witnessed condition in hospitals all over the world leading to high morbidity and having a major effect on patient's mental status. Late presentation, poor compliance with the treatment of the ulcer can also result in limb amputation and is associated with high chances of recurrence leading to malignancy [5]. Since the healing of the ulcer requires daily dressings which requires a prolonged hospital stay, it tends to be exhausting not only for the patient but also their families. It also has a great impact on the patient’s mental health due to the inability to independently perform his daily activities leading to loss of productivity.

Due to multiple causative factors of lower limb ulcers, it requires a multidisciplinary approach to assess the etiopathogenesis of the disease, and establish the diagnosis and treatment is specific to each patient based on the underlying pathophysiology [6].

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The management of lower limb ulcers must include the history, clinical examination of the ulcer and the entire lower limb, relevant investigations, and treatment should be planned after identifying the cause of the ulcer. The treatment of ulcer includes debridement (local care), medical and surgical management based on the type of ulcer. Educating the patient as well as the families of the patient with chronic ulceration is of great importance.

Objectives of the Study

The objective of this study is to observe the clinical spectrum of various types and effectiveness of different management modalities of lower limb ulcers. This study also aims at preventing the formation of lower limb ulcers by providing prophylactic measures in individuals who are at high risk of developing this condition.

Pathophysiology

Lower limb ulcers are commonly caused due to venous or arterial insufficiency, diabetes, neuropathy. The most common type of leg ulcers, which account for approximately 70% of cases are ulcers caused by venous insufficiency [7,8]. Diabetic ulcers are also a leading cause of lower limb ulcers. Only around 5% to 10% of leg ulcers are caused due to arterial insufficiency [9,10].

Venous ulcers

Venous ulcers are mainly caused by stasis of blood within the dilated and tortuous superficial vein, this leads to cell death due to tissue anoxia. Before the development of venous ulcer, the skin overlying the venous stasis turns eczematous and this condition is known as lipodermatosclerosis [11]. Increased activity of proteases particularly of fibrinolytic factors of plasminogen activation system, matrix metalloproteinases [12] and there is a growing recognition that an excessive proteolytic activity by proteases, especially that of matrix metalloproteinases [12] play an important role in the formation of venous ulcers. The perforating veins which connect the superficial veins to the deep venous systems have incompetent valves, due to which the pressure within the veins remains high during exercise, whereas in any normal individual there is a decrease in venous pressure. This increased venous pressure leads of increased permeability of large molecules [13,14]. There have been multiple theories to explain the pathogenesis of venous ulcers, which includes fibrin cuff, venous stagnation, trapping of white cells and trapping of growth factors. In venous stagnation theory, there is venous blood stasis which leads to ischemic changes locally and ulcer formation. Three mechanisms involved in the skin breakdown are injury to blood vessels causing ischaemia, inflammation, and infiltration. Ulceration often results from the inability of the skin to repair itself.

Figure 1: Venous ulcer.
Arterial (ischaemic) ulcers

Arterial ulcers are caused by occlusion or blockage of due to any reason leading to decreased blood flow to that tissue causes ischemia and ulceration. Peripheral vascular disease (PVD) due to atherosclerosis or thromboangiitis obliterans could lead to ischaemic changes in the leg which ultimately resulting in ulceration [15]. The pathophysiology of arterial ulcers involves 3 mechanisms which are (a) extramural strangulation, (b) mural thickening, (c) intramural restriction of blood flow [15]. Scar tissue and fibrotic bands on the external surface of arterioles is called extramural strangulation which leads to ischemic ulcerations. Mural thickening is due to accumulation of intimal plaques leading to atherosclerosis, causing impaired blood flow until there is complete occlusion due to any superimposed infection or embolism which results in the formation of ulcer. Intramural restriction of blood flow due to platelet adhesiveness or change in viscosity of blood can lead ulceration of lower limb.

Diabetic ulcers

A variety of factors lead to the formation of diabetic foot ulcer, the most of them being trauma in a diabetic patient. Diabetes leads to peripheral neuropathy which leads to damage of the motor, sensory and autonomic nerves. The nerve damage in diabetes is due to metabolic abnormalities, which is worsened by addition of the disease of the vasa nervorum [16,17]. The damage interferes with the peripheral sensation, innervation of the foot muscles, and fine vasomotor control of the circulation of the foot. Due to loss of sensory functions, the patient is unaware of the trauma caused to the foot and the formation of ulcer. Due to the loss of motor function of the muscles of the foot, which is required for normal movement and distribution of pressure while walking, there is callus formation due to thickening of skin at the site of abnormal load. After callus formation, there is ischemic necrosis of the tissue underneath resulting in an ulcer.
Trophic ulcers (Pressure sore)

Trophic ulcers are perforating ulcers of the foot due to prolonged pressure. It occurs due to neurological deficit, inadequate nutrition, and impaired blood supply. Common sites in the leg and foot are heel and head of the metatarsals. Trophic ulcer is also called neuropathic ulcer because of the neurological deficit associated with it. Neurological causes, e.g. Diabetic neuropathy, peripheral neuritis, leprosy, tabes dorsalis, spinal injury, paraplegia.

![Figure 4: Trophic ulcer.](image)

Tropical ulcer

It is a skin lesion observed in tropical regions like South America, Africa and India. It is commonly associated with conditions such as anaemia, poor socioeconomic conditions, anaemia, vitamin deficiency and nutrient deficiency. *Fusobacterium fusiformis* and *Borrelia vincenti* are the commonly involved organisms.

Clinical examination of the ulcer

- Location: Arterial ulcer is usually seen over the tip of the toes, dorsum of the foot. Ulcer due to varicose of the long saphenous vein is found over the medial side of leg. Ulcer due to short saphenous vein is usually located over the lateral side of leg. Trophic/Neuropathic ulcers is seen over the pressure points.

- Floor is the exposed surface of the ulcer. Healing ulcer has a red granulation tissue. Necrotic tissue, slough indicates a spreading ulcer. Slow healing ulcer shows a pale and smooth granulation tissue. Gummatous ulcer shows a wash leather slough.

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- Discharge from the ulcer could be serous, purulent, bloody, containing bony spicules, greenish
- Edge is the area between the margin and floor of the ulcer. Sloping edges are seen in all healing ulcers, punched out edges in gummatous and trophic ulcers, undermined edges in tuberculosis, raised or beaded edges in basal cell carcinoma, everted edges in squamous cell carcinoma or ulcerated adenocarcinoma.
- Margin formed by the junction between normal epithelium and the ulcer.
- Base of the ulcer (on which the ulcer rests) - Slight induration is seen in all chronic ulcers. Marked induration is seen in malignancy.
- Surrounding skin: Glossy, red, tender and edematous skin signifies acute inflammatory origin. Thick and pigmented signifies varicose ulcer. Loss of hair, brittle skin, shiny, thin and dark skin signifies arterial ulcer.

![Diagrammatic representation of various parts of an ulcer](image)

**Figure 5:** Diagrammatic representation of various parts of an ulcer. Source: Jaypee Digital of an ulcer.

Clinical examination of regional lymph nodes must be done. Examination of foot and joint must be done for deformities. Sensory and vascular assessment is also of importance in establishing a diagnosis.

**Management of leg and foot ulcers**

Management of lower limb ulcers aims at examination and identification of the cause of ulcer, providing the necessary ingredients for healing for wound healing, removing the factors that could prolong the healing process, prevention of any complications [18].

**Investigations**

Blood and urine investigations including complete blood count, Blood sugar estimation (FBS and PPBS) and urine sugar estimation should be done to exclude diabetes. Lipid profile, serum albumin, renal function test.

**Other investigations**

- **Biopsy:** Ulcers with everted or rolled-out edges and more than 4 weeks duration should be biopsied. Biopsy is taken from the edge of the ulcer along with part of healthy tissue around it.
• **Pus culture and sensitivity**: The ulcer should be swabbed for microbiology to start appropriate antibiotics and to plan for any surgical intervention.

• **Bone marrow aspiration**: Bone marrow aspiration is recommended in cases where leukaemia or aplastic anemia is suspected. The use of the sternal bone for this test is usual practice. Presence of abnormal blood cells and an increase in the WBC content and their precursors help in the process of diagnosis.

• **Plain radiograph**: Chest xray is important in tuberculous ulcers to detect any primary focus in the lung. Xray of the ulcer site and the neighbouring joint can help identify any underlying bony pathology.

**Figure 6a**: Osteomyelitis of the navicular bone on radiography. AP view of the left foot shows a deep ulcer (arrow) overlying the navicular bone. The medial cortex of the navicular is destroyed, representing osteomyelitis.

**6b**: Soft tissue air and deep ulcers on radiography. Source: Cambridge.org.

### Noninvasive hemodynamic assessment in peripheral arterial occlusive disease

#### Ankle Brachial Pressure Index (ABPI)

The ABPI, a reproducible noninvasive test is considered to be the most sensitive means of detecting large vessel disease. The hand-held Doppler probe (8 to 10 MHz) reproduces arterial pulse waveforms of the dorsalis pedis or posterior tibial arteries. When used with a blood pressure cuff (greater than 12 cm), the systolic pressure of the ankle can be obtained with the patient supine. At the same time, the arm (brachial) systolic pressure is determined. The ABPI is derived by dividing the systolic blood pressure of the ankle with the systolic blood pressure of the arm.

<table>
<thead>
<tr>
<th>Resting ABPI value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.9 - 1.2</td>
<td>Normal</td>
</tr>
<tr>
<td>0.8 - 0.5</td>
<td>Claudication (Some degree of arterial obstruction)</td>
</tr>
<tr>
<td>Less than 0.4</td>
<td>Critical ischemia (Rest pain or tissue necrosis)</td>
</tr>
</tbody>
</table>

Segmental pressure technique

Digital pressures are useful in patients with disease confined to the distal vessels (e.g., advanced Raynaud’s disease with fixed obstructive lesions) or, more commonly, to help predict the likelihood of healing of forefoot procedures, ulcerations, or toe amputations. A toe pressure of greater than 30 mm Hg is predictive of successful healing in about 90% of cases, whereas values less than 10 mm Hg are highly predictive of poor outcome.

Limb plethysmography

![Figure 7: Pulse Volume recordings (PVR) from a normal lower extremity (left) and a patient with rest pain (right). The tracings on the right are consistent with combined aortoiliac and femoropopliteal disease with minimal distal collateralization. Source: Pubs.rsna.org.](image)

It measures the fluctuation in limb volume during the cardiac cycle and is a useful adjunct to segmental pressure measurements. The most common technique involves segmental air plethysmograph cuffs, commonly referred to as a pulse volume recording (PVR). Accurate PVR waveforms is obtained by inflating the cuff to approximately 60 - 65 mmHg to identify volume changes. Pulse volume tracings suggest a proximal disease if the peak of the wave tracing is rounded, the upstroke of the pulse is not brisk, and there is no evidence of the dicrotic notch.

**Duplex imaging**

This technique is of major significance in vascular disease. A duplex scanner uses B-mode US to show the vasculature imaging. Another type of US, the Doppler ultrasound, is helpful to identify the imaged vessels and the Doppler shift obtained is assessed by a dedicated computer in the duplex scanner.

The colours reveal the change in direction and velocity of flow; areas of high flow signify a stenosis.

Figure 8: Duplex scan of the saphenofemoral junction showing antegrade and retrograde flow (reflux).

Figure 9: Doppler finding of thrombus in right popliteal vein. Filling defects in flow and lack of compressibility indicate presence of thrombus. Source: ahajournals.org.

Arteriography

A retrograde percutaneous method is adopted, which commonly involves the femoral artery and occasionally the brachial or axillary artery. A radio-opaque solution is injected into the arterial tree. This retrograde technique is called as the Seldinger technique.

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Digital subtraction angiography

This technique employs the system to digitise the angiographic information. It allows the image formed before the injection of to be subtracted from the image formed after the contrast, providing an image with more clarity. Arterial of venous route can be used to carry out the DSA. However, an arterial route is more convenient as fine catheters can be used and it requires lesser contrast agent that used in a conventional angiography.

CT scan

This is useful for detection of radiographically occult foreign bodies; even those that are not traditionally considered radio-opaque (e.g. wood). It is superior to radiography in detection of cortical destruction, periostitis, and soft tissue or intraosseous gas. During early stages, these findings of acute osteomyelitis may be difficult to detect on radiography, but frequently can be documented on CT.

MRI

MRI is notable for its high intrinsic soft tissue contrast, i.e., it depicts the full spectrum of soft tissues without the use of intravenous contrast. It readily delineates an infection's extent, helps guide surgery, characterizes soft tissue abnormalities, and excludes osteomyelitis. It is contraindicated in patients who have pacemakers and other electronic implants, ferromagnetic cranial aneurysm clips, and intraocular metal.

Nuclear medicine studies

The three most commonly employed nuclear medicine tests are Three-Phase Technetium-99m Bone scan, gallium-67 scan and indium 111-oxine or technetium-99m-Hexamethyleneammine Oxime (Tc-HMPAO) labelled leukocyte scan. FDG (18F-2-fluoro-2-deoxy-D-glucose) has recently gained prominence as an infection imaging agent. All the three tests are considered highly sensitive to the presence of both soft tissue infection and osteomyelitis. When pre-existing bone changes (i.e., neuroarthropathy, trauma, degenerative changes) are present, labelled leukocyte scan provides the best overall sensitivity and specificity.

Figure 10: Osteomyelitis. Indium-labelled leukocyte scan showing increased indium accumulation near the ankle represents a focus of osteomyelitis in a patient with swelling and fever. Source: radiologykey.net.
Scoring system

There are several wound scoring systems, however the 2 of the best and acceptable ones are ASEPSIS and the Southampton Wound Assessment Scale. These help with wound healing to be scored based on the specific changes in the wound. It provides an objective wound assessment by the help of a numerical value.

**Figure 11:** Southampton’s scoring. Source: researchgate.net.

**Figure 12:** ASEPSIS scoring. Source: researchgate.net.
Treatment strategy

Local care of the ulcer site

It aims at providing a clean ulcer bed, devoid of any necrotic material, slough or any contamination. This process is called debridement. Currently, the commonly used wound debridement methods are: Surgical (sharp), Enzymatic, Chemical, Mechanical, Biologic (Maggot therapy).

Surgical- When a wound has abundant necrotic material, sharp technique forms the most vital part of the debridement and helps achieving a clean base. Surgical instruments are used in this process. A scalpel blade is used to excise all the dead and necrotic tissue until healthy tissue is found. This process helps decrease the load of the bacteria and other cells which are phenotypically altered that delay the healing process.

Enzymatic debridement it involves topical agents that use proteolytic enzymes to degrade necrotic tissue such as collagenase, papain-urea, papain, streptokinase- streptodornase, trypsin and fibrinolysin-DNase. These agents are typically applied on the ulcer once daily after which it is covered with an occlusive dressing.

Chemical debridement - The use of the chemical agents has been a controversial matter as there use also causes great harm to the newly developing epithelium. These agents include Eusol, hydrogen peroxide, and Acetic acid [19,20].

Mechanical debridement it helps in loosening the slough from the ulcer bed. It requires the placement of a wet dressing to the ulcer bed which is left to dry and the as the necrotic material gets adhered to the gauze piece, it is pulled off from the ulcer bed. However it affects the viable tissue as well causing immense pain to the patient, therefore its practised more commonly on wounds with excessive discharge.

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**Biological**

- **Maggots therapy:** Maggots can be introduced into the wound with slough, and dressed with a loose dressing. They help by debriding the wound, leaving behind a granulation tissue which is healthy and thus helping with the healing process.

- **Leech therapy:** Leech therapy is an effective unique technique of bloodletting. It can be used as a method to remove all the impurities from the blood in conditions such as skin disorders and non healing chronic ulcers with suppuration and inflammatory conditions [21].

**Medical therapy**

Antibiotics based on culture sensitivity report of pus and control of blood sugar levels in diabetic ulcers using insulin.

**Topical insulin therapy**

It can be safely used in patients with chronic and acute ulcers. Wound healing can be accelerated by applying the topical insulin locally. The molecular structure of insulin is similar to that of Insulin-like growth factor (IGF) [22].

**Oral zinc therapy**

Zinc helps in accelerating the healing process of ulcers and has also shown to have anti-inflammatory effects on the wound [23].

Vitamin C supplements, it helps with healing time [24].

Pentoxifylline (Trental 400mg TID) is used in patients with peripheral vascular diseases with occluded arteries causing claudication.

Disease Modifying Anti-Rheumatic Drugs (DMARDS) are helpful in patients with ulcers due to rheumatic diseases. Commonly used are methotrexate, chloroquine, Oral gold (auronofin), intramuscular gold, penicillamine, sulphasalazine, leflunomide.

**Herbal therapy**

For thousands of years herbal remedies are the basis of traditional medicine systems worldwide. For preservation of health and healing, Indian and Chinese (Ayurveda and Unani) medicinal systems, along with the Amazonian ethnomedicine system, primarily depends on herbs. There is increasing number of scientific literature on the utilization of herbs for the healing of wound and herbal medicines have been stated in traditional texts [25-29]. For the treatment of small to medium sized wounds which include abrasions, excoriations, and other infections there are researches advocating the advantages of herbal extracts [30,31].

**Propolis**

It is a adhesive material collected by the bee *Apis mellifera* from trees, they use this as a insulating and building substance in the bee hive. Along with this it is also helps in keeping a minimal concentration of fungi and bacteria within the hive. Inspite of that its chemical configuration differs, propolis constituents manly include about 15% various organic polyphenolic compounds including flavonoids and phenolic acids, 10% of essential oils, and 5% pollen. Propolis is exceptionally used for wound contraction, and fast repair of wounds healing, reduction of healing time and also for ulcers due to burns. Synchronized molecular and cellular reactions ensue to repair damaged tissue, at the time of wound healing [32-34]. Propolis enhances cellular metabolism, helps in collagen formation and various enzyme systems, and enhances the healing time of venous ulcers and burn wounds [35].
Dermoplant G

Dermoplant G contained dry ethanol extract of *Hyperici herba*, oily component of *Calendulae flos* and dry water extract of *Allii bulbous*. The selected extracts possessed antimicrobial (antiseptic), anti-inflammatory and regenerative properties. The antimicrobial efficacy of this herbal therapy was demonstrated in patients with non-infected venous leg ulcers. No significant adverse reactions were documented. Many studies on antimicrobial properties of garlic (*Allium sativum*) have been shown using various tests against highly resistant pathogens. The antibacterial and anti-fungal activity was attributed to the major compounds allicin and thiosulphonate. The desirable effects of “aged garlic solution” on epithelization, dermal matrix regeneration, angiogenesis and wound closure. The effectiveness of hypericum ethanol and oil extracts [36] on wound-healing partly due to the antibacterial activity [37] and anti-inflammatory effect [38]. *H. perforatum* extracts stimulate fibroblast collagen production and activate the fibroblast cells into polygonal shapes, which play an important role in repair and closing the wounds. Constituents identified in Calendula such as saponins, micro-nutrients, flavonoids and polysaccharides may be responsible for the anti-edematous, anti-inflammatory, antiseptic, anti-oxidant and wound healing effects of the plant [39]. The activity of tincture made from flowering tops and fresh leaves was more effective after oral administration than the topical administration of tincture of Calendula flowers and leaves [40].

Arjuna bark powder

Arjuna (*Terminalia arjuna*) is a herbal plant discovered in the vicinity of river in Madhya Pradesh, Uttar Pradesh, south and central India and West Bengal [41]. Arjuna has role in initial stage of wound with slough, oedema, discharge as it helps with wound debridement activity. Arjuna has key role in patients of varicose ulcer with blood circulation as it can help with formation of new blood vessels. It is indicated in non-healing varicose ulcer which are reluctant to heal, these ulcers can be treated with Ayurveda herbal powder of Arjuna (*Terminalia arjuna*) [42].

MittiHeal

MittiHeal is a natural powder and homeopathic extract composition which is a mixture of inactive and active components that consists of *Arnica montana* L (SI 0.01% vol/wt) plus *Calendula officinalis* L (SI 0.1% vol/wt) and *Santalum album* (sandal-wood, SI 10% wt/wt) plus *Mentha arvensis* (mint, 90% wt/wt). MittiHeal contents were chosen on the basis of scientific evidence of anti-inflammatory, absorbptive, antiseptic, aromatic and synergistic properties. Particularly, the Mentha ingredient absorbs the discharge from the wound and thus preventing the wound bed and surroundings from acting as a medium for bacterial growth; the Arnica mother tincture ingredient has anti-inflammatory properties, whereas sandalwood provides an aromatic and cooling effect. This combination is known for its lymphocyte activation and anti-inflammatory properties. These ingredients work in collaboration with each other and each of the components provide their specific quality, such as protective barrier against microbial colonization, absorb wound exudate, limiting malodour and enhancing wound healing as well as autolysis [43-47]. There were no known complications or side effects. The combination of powder along with wraps or compression stockings, helped in decreasing the pain of wound and speeded the healing of chronic wounds. The powder absorbed wound exudate, helped in formation of ‘crust’ that inhibited drying, protected the ulcer from various infections and helped to retain the moisture balance in the ulcer bed, along with reduction of the malodour. Localized infection can also be suppressed by the powder.

Surgical treatment

Different options available for lower limb ulcers based on etiology.

Venous ulcers

Can be treated with saphenofemoral junction ligation and stripping of great saphenous vein, Saphenopopliteal junction ligation and stripping of short saphenous vein, Subfascial ligation of Cockett and Dodd, Subfascial Endoscopic Perforator Surgery (SEPS), Hook phlebectomy. For deep vein thrombosis, Inferior Venacaval filters, Palma operation, May-Husni operation can be performed.
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Arterial ulcers

Lumbar sympathectomy is done for cutaneous ulcer and rest pain by depriving the sympathetic nerve supply to the lower limb blood vessels, vasomotor tone is reduced so that some amount of vasospasm is reduced. It helps in healing of cutaneous ulcers and relief from rest pain.

Chemical sympathectomy

Around 5 ml of phenol in water is injected into the lumbar sympathetic chain under radiographic control. It acts by producing vasodilation in lower limbs.

Atherosclerotic disease

Bypass grafting- For reconstruction of large arteries, the synthetic grafts used at present are composed of Dacron or expanded polytetrafluoroethylene. Autogenous vein, particularly the great saphenous vein, has proved to be a durable and versatile arterial substitute. In the lower extremity, saphenous vein bypass to the tibial or below knee popliteal has had excellent results when used in situ, reversed, or nonreversed form. They are chosen as a reference for other conduits.

Endarterectomy- it use has proven to be more beneficial in stenosed large, high flow arteries. The carotid bifurcation, common femoral artery and visceral arteries are feasible for this procedure. The use of endarterectomy for longer-segment disease in the aortoiliac and femoropopliteal systems has fallen into disfavor because of the technical difficulty, higher failure rates, and clear advantages demonstrated for bypass grafting in these locations.

Percutaneous Angioplasty (PTA), Stenting, and Other Endovascular Techniques- Percutaneous techniques includes balloon dilation, stenting and atherectomy.

Ulcer reconstruction is done by either skin grafting or flap insertion. Grafts are tissues that are devoid of their blood supply during the transfer. Skin grafts can be divided as split-thickness or full-thickness, depending on the depth of dermis.

Partial or split-thickness skin graft (STSG) is removal of entire layer of epidermis and part of dermis. This is known as Thiersch grafts. Most frequently used donor site is the thigh. Humby's knife or a power dermatome is used to harvest the graft. They are used to cover all sizes of wounds, are of limited durability and will contract.

Full-thickness skin graft (FTSG) includes both the epidermis and the full dermis. This is also known as Wolfe grafts.

Whereas a flap is the transfer of donor tissue with its blood supply to the recipient. Flaps are categorised according to the tissue contained in the flap: musculocutaneous, fasciocutaneous or osteocutaneous flaps.

Conclusion

An ulcer which does not heal within 12 weeks is considered as chronic ulcer. The majority of lower leg ulcers are caused due to diabetes and arterial diseases. Due to multiple causative factors of lower limb ulcers, it requires a multidisciplinary approach to assess the etiopathogenesis of the disease and establish the diagnosis. The management of lower limb ulcers must include the history, clinical exami-
nation of the ulcer and the entire lower limb, relevant investigations, and treatment should be planned after identifying the cause of the ulcer. The treatment of ulcer includes debridement (local care), medical and surgical management based on the type of ulcer.

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