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## INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/18717  
DOI URL: <http://dx.doi.org/10.21474/IJAR01/18717>



### RESEARCH ARTICLE

#### A STUDY OF PREVALENCE, CLINICAL PRESENTATION AND MANAGEMENT OF LOWER LIMB ULCERS AT A TERTIARY HOSPITAL

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#### Manuscript Info

##### Manuscript History

Received: 15 March 2024  
Final Accepted: 18 April 2024  
Published: May 2024

##### Key words:-

Lower Limb Ulcer, Chronic Ulcer, Ulcer Management

#### Abstract

**Background:** Lower limb ulcers are debilitating and painful, greatly reducing patient's quality of life. These ulcers are often difficult to treat. The most common aetiologies for lower limb ulcers are venous, arterial, mixed venous and arterial, diabetic and pressure ulcers. However, atypical wounds comprise approximately 20% of chronic wounds and should be kept in mind during differential diagnosis. The successful ulcer management depends upon the accurate diagnosis and treatment of the underlying cause, and it often needs a multidisciplinary approach.

**Methods:** This prospective cross-sectional study conducted in Department of General Surgery at Basaveshwara Teaching and General Hospital, Attached to Mahadevappa Rampure Medical College, Kalaburagi. The study was conducted during the period from June 2022 to December 2023 which included 97 patients presenting with lower limb ulcers and admitted in surgical wards of our hospital.

**Results:** Most of the patients were engaged in agriculture (24%) followed by business (23%) and service (14%). 47.5% of the patients had habit of smoking, alcohol consumption and tobacco chewing. Most of the ulcers were diabetic (36.1%) followed by venous (22.6%) ( $Z=2.17$ ;  $p=0$ ). Only 4.1% and 3.1% were malignant and trophic ulcers. Peripheral neuropathy (26.8%) was the most common cause of ulcer followed by venous hypertension (24.7%). In most of the cases, debridement with dressing (32.9%) and Debridement+dressing+skin grafting (19.6%) was done. At the end of study period, 90 ulcers were healed, 4 were disease free, 2 had recurrence and 1 patient died.

**Conclusion:** A comprehensive assessment of patients' general status, personal habits, skin, vascular status, limb, ulcer characteristics are required to determine the etiology and to formulate effective treatment plan. Thus, the study of various cases of lower limb ulcers arouses lot of interest and is mind boggling as far as the treatment of these cases

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are concerned. With the availability of arsenal of investigation, wide range of antibiotics and with ever improving dressing material, there is certainly a great improvement in treatment of lower limb ulcers. Education and training are vital for all those involved in caring of patients with ulcer.

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### **Introduction:-**

Leg ulcers are debilitating and painful, greatly reducing patient's quality of life. These ulcers are often difficult to treat and the successful treatment of leg ulcers depends upon the accurate diagnosis and treatment of the underlying cause. A leg ulcer is an open sore that develops when the skin is broken and air & bacteria get into the underlying tissue. This is usually caused by an injury, often a minor one that breaks the skin. In most people such an injury will heal up without difficulty within a week or two. However, when there is an underlying problem, the skin does not heal and the area of breakdown can increase in size.

Chronic leg ulcers are defined as those that show no tendency to heal after 3 months of appropriate treatment or are still not fully healed at 12 months<sup>1</sup>. As a result of ageing population and increased risk factors for atherosclerotic occlusion such as smoking, obesity, and diabetes, the incidence of Ulceration is rising. Ulcers of skin can result in complete loss of the epidermis and often portions of the dermis and even subcutaneous fat<sup>2</sup>.

Chronic ulcer of the lower limb is a relatively common condition amongst adults and symptoms usually include increasing pain, friable granulation tissue, foul odour and wound breakdown instead of healing. These results in social distress and considerable healthcare and personal costs<sup>3,4</sup>. Since numerous factors lead to lower limb ulceration, it is essential that healthcare professionals adopt an interdisciplinary approach to the systematic assessment of the individual in order to ascertain the pathogenesis, a definitive diagnosis and optimal treatment required. A correct diagnosis is essential to avoid inappropriate treatment that may delay wound healing, cause deterioration of the wound or harm the patient.

Venous ulcers are located below knee, usually on inner part of the ankle, relatively painless, associated with varicose veins, swollen ankles, aching, thickening and pigmentation of surroundings<sup>5</sup>. Arterial leg ulcers are caused by insufficient blood supply to the lower limbs resulting in ischemia and tissue necrosis<sup>6</sup>. Arterial leg ulcer can occur anywhere below knee, but are most commonly seen on the foot and they are more likely to be painful<sup>5</sup>. Ulcers due to diabetes are usually found on foot and usually have a sloughy or necrotic appearance. An ulcer in the patient with diabetes may have neuropathic, arterial or venous component.

Leg ulcers have wide spectrum of etiology, pathology, severity and morbidity. The common causes are venous valve insufficiency, lower extremity arterial disease and diabetes. For a proper treatment of patients with leg ulcers, it is important to be aware of the large differential diagnosis of leg ulceration.

A multidisciplinary approach is needed to treat this condition as it is reported to have impact on virtually every aspect of daily life: pain, disturbed sleep, mobility, restricted work capacity and personal finances are often adversely affected<sup>7,8,9,10,11</sup>. During the past three decades considerable knowledge has been gained regarding the pathophysiology and management of chronic leg ulcers. But still the treatment of these ulcers forms a challenging task.

In this study the prevalence, etiopathogenesis, clinical features and management of different ulcers of the leg and foot have been analysed and discussed.

### **Causes of Leg Ulcers**

<p><b>1. Vascular diseases</b></p> <p>a. Venous</p> <p>b. Arterial</p> <ul style="list-style-type: none"> <li>➤ Atherosclerosis</li> <li>➤ Thromboangiitis obliterans</li> <li>➤ Arteriovenous malformation</li> <li>➤ Cholesterol embolism</li> </ul> <p>c. Vasculitis</p> <ul style="list-style-type: none"> <li>➤ Small vessel           <ul style="list-style-type: none"> <li>• Hypersensitivity vasculitis</li> <li>• Rheumatoid arthritis</li> <li>• Lupus erythematosus</li> <li>• Scleroderma</li> <li>• Sjogren's syndrome</li> <li>• Behcet's disease</li> <li>• AtrophicBlanche</li> </ul> </li> <li>➤ Medium and large vessel           <ul style="list-style-type: none"> <li>• Polyarteritis nodosa</li> <li>• Nodular vasculitis</li> <li>• Wegener's granulomatosis</li> </ul> </li> </ul> <p>d. Lymphatics - Lymphedema</p> <p><b>2. Neuropathic</b></p> <ul style="list-style-type: none"> <li>➤ Diabetes</li> <li>➤ Tabes dorsalis</li> <li>➤ Syringomyelia</li> </ul> <p><b>3. Metabolic</b></p> <ul style="list-style-type: none"> <li>➤ Diabetes</li> <li>➤ Gout</li> <li>➤ Prolidase deficiency</li> <li>➤ Gaucher's disease</li> </ul> <p><b>4. Hematologic diseases</b></p> <p>a. red blood cell disorders</p> <ul style="list-style-type: none"> <li>➤ Sickle cell anaemia</li> <li>➤ Hereditary spherocytosis</li> <li>➤ Thalassemia</li> <li>➤ Polycythaemia rubra vera</li> </ul> <p>b. White blood cell disorders</p> <ul style="list-style-type: none"> <li>➤ Leukaemia</li> </ul> <p>c. Dysproteinaemias</p> <ul style="list-style-type: none"> <li>➤ Cryoglobulinemia</li> <li>➤ Cold agglutinin disease</li> <li>➤ Macroglobulinemia</li> </ul>	<p><b>5. Trauma</b></p> <ul style="list-style-type: none"> <li>➤ PressurePressure</li> <li>➤ Cold injury (frostbite, pernio)</li> <li>➤ Radiation dermatitis</li> <li>➤ Burns (thermal, chemical)</li> <li>➤ Factitia</li> </ul> <p><b>6. Neoplastic</b></p> <p>a. Epitheliomas</p> <ul style="list-style-type: none"> <li>➤ Squamous cell carcinoma</li> <li>➤ Basal cell carcinoma</li> </ul> <p>b. Sarcoma (e.g., Kaposi's sarcoma)</p> <p>c. Lymphoproliferative</p> <ul style="list-style-type: none"> <li>➤ Lymphoma</li> <li>➤ Cutaneous T cell lymphoma</li> </ul> <p>d. Metastatic tumours</p> <p><b>7. Infection</b></p> <p>a. Bacterial - Furuncle</p> <ul style="list-style-type: none"> <li>➤ Ecthyma</li> <li>➤ Ecthyma gangrenosum</li> <li>➤ Septic emboli</li> <li>➤ Gram-negative infections</li> <li>➤ Anaerobic infections</li> <li>➤ Mycobacterial (typical and atypical)</li> <li>➤ Spirochetal</li> </ul> <p>b. Fungal</p> <ul style="list-style-type: none"> <li>➤ Majocchi's granuloma</li> <li>➤ Deep fungal infections</li> </ul> <p>c. Protozoal - Leishmania</p> <p>d. Infestations and bites</p> <p><b>8. Panniculitis</b></p> <ul style="list-style-type: none"> <li>➤ Weber-Christian disease</li> <li>➤ Pancreatic fat necrosis</li> <li>➤ Necrobiosis lipoidica</li> </ul> <p><b>9. Pyoderma gangrenosum</b></p>
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### **Venous ulcer pathogenesis**

- The association between ulceration at the ankle and venous disorders of the lower limb has been known for more than 2000 years<sup>12,13</sup>.
- The term varicose ulcer is misleading as venous ulcers are usually associated with deep venous insufficiency.
- This connection between deep vein damage and ulceration was noted by Gay<sup>14</sup> and later by Homans<sup>15</sup>, who also noticed that venous ulcers often had few visible varicose veins.
- The concept of venous stasis suggested that stagnant blood lying within tortuous and dilated veins close to the skin might cause tissue anoxia and cell death.
- In patients with venous disease, there is incompetence of the valves within the perforating veins connecting the superficial to the deep venous systems in the leg.
- In normal subjects, venous pressure decreases during exercise.
- In patients with venous incompetence, pressure remains high during exertion<sup>16</sup>.
- High venous pressure is associated with capillary proliferation and increased permeability of large molecules into the skin<sup>16,17</sup>.
- In 1982, Browse and Burnand<sup>13</sup> proposed that the high ambulatory venous pressure within the calf muscle pump is transmitted to the capillary circulation in the skin and subcutaneous tissues of the calf.
- They hypothesized that the distended local capillary bed widened the endothelial pores, allowing fibrinogen molecules to escape into the extracellular fluid, where they form fibrin complexes around the capillaries<sup>18</sup>.
- It was postulated that this layer of fibrin forms a pericapillary barrier to the diffusion of oxygen and other nutrients that are essential for the normal vitality of the skin.
- Burnand et al. demonstrated a pericapillary fibrin layer in patients with venous disease, a finding which has been subsequently confirmed by others<sup>19</sup>.
- Pericapillary fibrin has been shown to impede oxygen diffusion in patients with venous disease<sup>20</sup>.
- In patients with ulcers of other origins, pericapillary fibrin deposition is not found.
- In addition, patients with venous disease have been found to have faulty fibrinolysis with prolonged euglobulin lysis time and an elevated plasma fibrinogen level<sup>21</sup>, but it is uncertain whether these findings are primary or secondary to the fibrin deposition.
- A more recent hypothesis proposes that in venous ulceration, trapped leukocytes occlude capillaries, thereby resulting in cutaneous ischemia<sup>22</sup>.

### **Clinical features**

#### **History:**

- Not all patients with venous insufficiency will give a history of deep vein thrombosis; indeed, the majority of patients have silent thromboses.
- The patient may complain of aching and swelling in the legs that are exacerbated by dependency and relieved by elevation of the limb.

#### **Examination**

- Edema of the lower limbs is common in venous insufficiency. It becomes persistent unless treated with compression.
- Brown or brown-red pigmentation and purpura occur because of extravasation of red blood cells into the dermis, collections of hemosiderin within macrophages, and melanin deposition.
- Eczematous changes are common, with erythema, scaling, pruritus, and sometimes weeping.
- Lipodermatosclerosis is the term used to describe induration and fibrosis of the dermis and subcutaneous tissue that develops in venous insufficiency. Eventually the entire lower third of the leg may become sclerotic and woody, resulting in an "inverted champagne bottle" appearance<sup>23</sup>.
- Lipodermatosclerosis often precedes venous ulceration. Venous ulcers usually develop over the malleoli, particularly on the medial aspect of the leg, and characteristically have an irregular "shaggy" border.
- Once ulceration is well established, repeated episodes of infection and cellulitis can contribute to damage of the lymphatic system, resulting in chronic lymphedema.
- Ultimately, patients may have fibrous or bony ankylosis at the ankle because of immobility.



**Fig no. 1:- Venous Ulcer.**

### **Arterial ulcer pathogenesis**

- Atherosclerosis is a degenerative disease characterized by the accumulation of cells, matrix fibers, lipids, and tissue debris in the vessel intima, which result in narrowing of the lumen and obstruction of blood flow.
- The arteries of the lower limbs are frequently affected by atherosclerotic plaque and are subject to variation in hydrostatic pressure and flow rate, depending on the level of physical activity.
- A sedentary lifestyle is associated with low arterial flow rate in lower limbs and increased plaque formation<sup>24</sup>.
- Ulceration often arises after minor trauma to an atherosclerotic limb.

### **History**

- Patients with peripheral arterial disease are characteristically older than 45 years.
- Symptomatically they have intermittent claudication, characterized by pain in the calves or buttocks that occurs on exertion but is relieved by rest.
- With more severe occlusive disease, the patient may experience pain at rest.
- The pain from ulceration is usually severe and difficult to control, often worsening when the legs are elevated and improving on dependency.
- Patients sometimes sleep in a chair at night to relieve the pain.
- Cigarette smoking and diabetes mellitus are the risk factors most closely associated with atherosclerosis of the lower limbs.

### **Examination**

- Ischemic ulcers appear typically "punched out" with a sharply demarcated border and frequently occur over sites of pressure or trauma, such as bony prominences, or at distal points, such as the toes.
- They usually appear dry with a grey or black base that may be covered with necrotic debris.
- Granulation tissue is often scant or absent.
- Associated findings include loss of hair and shiny, atrophic-looking skin.
- Peripheral pulses may be diminished or absent, and a palpable or audible bruit over the femoral artery is usually associated with proximal atherosclerotic lesions in the iliac or common femoral arteries.
- Capillary refilling time is measured by manual compression of the tip of the great toe for a few seconds until it blanches and then release of the toe. The time taken for the toe to return to its normal color is 3 to 4 seconds in normal subjects but is prolonged in the patient with arterial disease. The legs should be elevated slightly when performing the test to exclude capillary venous congestion.
- If peripheral pulses cannot be palpated, Doppler ultrasonography is helpful.

- The change in color of the limbs with alteration in position is another simple index of ischemia.
- After elevation of the limb at a 45-degree angle for 1 minute, the ischemic limb will become pale. On subsequent dependency there is delay in filling of the veins beyond the normal. When the color does return, the limb becomes pink or bright red.
- In general, the greater the arterial insufficiency, the longer the venous filling time and the greater the intensity and extent of rubor.



**Fig.2:** - Arterial Ulcer.

### **Neuropathic ulcer pathogenesis**

- Neuropathic ulcers usually arise from frequent trauma to tissue, which results in inflammation and eventual ulceration.
- In a foot or limb with normal sensation, this degree of trauma would not be tolerated because of pain<sup>25</sup>.
- Neuropathic ulcers have been reproduced experimentally in animal models and appear to result not from a single injury, but from repetitive trauma<sup>26</sup>.

### **History**

- Neuropathy should be excluded in any patient who comes for treatment of a leg or foot ulcer.
- This is most common in the diabetic patient.
- The patient with a neuropathic ulcer may have pain, paraesthesia, or anaesthesia of the legs and feet, although occasionally the ulcer is completely asymptomatic.
- The character of the pain is often described as burning, tingling, numbing, or needlelike.
- At times it is almost constant and frequently is most severe at night.
- In contrast, ischemic pain that is often localized to the foot is worse on reclining and relieved by dependency.
- Neuropathic pain may be relieved by exertion, whereas ischemic pain is exacerbated by exercise.

### **Examination**

- The first sensation to be lost is light touch in the great toe, then in the foot.
- Vibration sense is subsequently lost, followed by loss of the ankle jerk, and finally joint position sense<sup>27,28</sup>.
- Patients are usually unaware of trauma, which commonly leads to ulceration of the heel, the plantar metatarsal area, or the great toe<sup>29</sup>.
- The neuropathic ulcer is often surrounded by thick callus.
- Prolonged purulent drainage of these ulcers may be associated with underlying osteomyelitis<sup>30</sup>.

- Some patients have hyperesthesia of their feet, which may be so great that the patient cannot stand even the lightest touch.
- Conversely, the ulcer may be completely anaesthetic to pinprick and deep tendon reflexes, and vibration sense to low frequencies (128 cycles/sec) may be impaired<sup>27,28</sup>.



**Fig.3: - Neuropathic Ulcer.**

#### **The diabetic patient**

- Diabetic patients are predisposed to peripheral vascular disease, neuropathy, infection, and impaired healing<sup>31</sup>.
- 45 to 70 % of all lower limb amputations are performed on diabetic patients<sup>32,33,34,35</sup> and 41 to 70% of these patients do not survive more than 5 years after the surgical procedure<sup>36,37,38,39</sup>.
- Early detection of neuropathy or angiopathy in the patient with diabetes may prevent acceleration of complications or even reverse the process<sup>40</sup>.

#### **Diabetic Foot Ulcer Pathogenesis**

- Diabetic Foot ulcers commonly arise in the diabetic patient with neuropathy, usually at sites of repeated trauma, such as over the toes, heel, and metatarsal heads on the plantar surface of the foot.
- Motor neuropathy can alter the patient's gait, thereby resulting in pressure over unusual sites.
- Autonomic neuropathy, with the loss of perspiration, can cause fissuring of skin, which acts as a nidus for ulceration.
- Arterial ulcers occur more frequently in diabetic patients and at an earlier age than in the nondiabetic population.
- Vascular involvement tends to be multisegmental, above and below the knee, in contrast to the nondiabetic patient in whom involvement generally occurs above the knee only.
- In diabetic patients there is involvement of the femoropopliteal segment, as in nondiabetic patients, but also a high propensity towards atherosclerotic occlusion of the tibial and peroneal arteries<sup>29</sup>.
- Thus, it is not unusual to see a diabetic patient with an ischemic foot but with a strong popliteal pulse.
- In these patients' distal arterial reconstruction can produce excellent results<sup>41</sup>.
- The systolic blood pressure at the ankle studied with a Doppler flowmeter can be sometimes misleadingly high in the diabetic patient, because of medial calcification of the arteries.
- In these patients, measurement of pulse amplitude with an oscillometer or plethysmograph is helpful<sup>29</sup>.
- The diabetic patient should be given every opportunity for limb salvage.
- When modern techniques of arterial reconstruction are used, long-term prognosis in diabetic patients is nearly identical to that in nondiabetic patients<sup>42</sup>.
- In the diabetic patient with ulceration of the limb, and decreased ankle/brachial systolic pressure index (ABI) measurements or limb pulsation, arteriography should be performed.

- Prospective studies of small arterial or capillary branches of diabetic patients have shown no evidence of intimal hyperplasia<sup>43,44,45,46</sup> although there does appear to be thickening of the basement membrane of muscle capillaries.
- Recent studies have also shown widened endothelial spaces in diabetic postcapillary venules and capillaries, possibly accounting for the increased vascular permeability of diabetic vessels<sup>47</sup>.
- The exact mechanism by which diabetes mellitus causes angiopathy and neuropathy is unknown<sup>27,40</sup>, although factors such as impaired autoregulation, a reduced hyperaemic response to injury, and impaired neurogenic vasodilation may reduce the healing potential of the skin after minor injury<sup>48</sup>.



Fig.4:- Diabetic Ulcer.

### Objectives of the study:-

1. To study the causal factors and clinical features of various types of lower limb ulcers.
2. To compare and analyse the distribution of age, sex, systemic diseases, and location of ulcers among the study group.
3. To study the usefulness of applied investigations.
4. To effectively manage the condition
5. To prevent as far as possible leg ulceration in high-risk individuals prone to the condition.

### Materials and Methods:-

This is a prospective cross-sectional study conducted in Department of General Surgery at Basaveshwara teaching and General Hospital, attached to Mahadevappa Rampure Medical College, Kalaburagi.

The study was conducted during the period from June 2022 to December 2023 which included a total of 97 patients presenting with ulcers of the lower limb and admitted in surgical wards of our hospital during the study period.

97 patients of chronic leg ulcers were selected randomly with the help of computer-generated random numbers from the patients, who took admission in surgical wards of BTGH, Kalaburagi.

Method of measurement of outcome of interest- The outcome of interest was morbidity and mortality of leg ulcer patients, the information of which was collected from case history sheet, relevant investigations and treatment. Limb salvage, amputation, poor control of diabetes mellitus, walking inability, poor pain management, recurrence of ulceration was considered as patient outcome. For calculation of risk factors likely to be associated with leg ulceration and calculation of patient outcome, patient's age, occupation (outdoor and indoor activities), smoking and drinking habits, presence of controlled or uncontrolled diabetes mellitus, ulcer location and characteristics, clinical examinations, arterial and venous circulation studies, biopsy of ulcer and medical and surgical treatments were taken into consideration.

After diagnosis of primary cause of the leg ulcers, management of ulcers by proper antibiotic coverage for gram positive, gram negative and anaerobic organisms, proper glycaemic control, elevation of leg, compression bandaging, total cessation of smoking and causative drugs, nutritional support, vasoactive agents to restore blood flow, nerve stimulation, proper wound care with debridement slough excision and dressing.



For large ulcers, as soon as the wound bed was ready, skin grafting had been considered.

Specific treatment for venous insufficiencies, arterial disease with lumbar sympathectomy/transluminal angioplasty, malignant ulcers was investigated and workup done. They were treated accordingly by wide local excision/superficial radiotherapy/treatment of metastasis/multimodality treatment.

Amputation was considered as a last resort for non-healing/spreading/gangrenous/malignant ulcers.

Rehabilitation with adjunctive foot wear was provided appropriately in selected cases. Education regarding foot care was provided to prevent future recurrence. Patients were reviewed on 7th day and 21st day after discharge and was found ulcer free.

#### Inclusion criteria

- Patients age more than 18yrs
- Patients presenting with ulcer of the leg were included in the study.

#### Exclusion criteria

- Patients not-willing to give consent for the study.

#### Results:-

The mean (mean±SD) age of the patients was 51.94±12.25 years with range 18-80 years and the median age was 53.0 years. Test of proportion showed that the proportion of the patients with age between 40-69 years (84.0%) was significantly higher (Z=9.61; p<0.0001). Only 5.1% and 5.2% of the patients were with age<30 years and ≥70 years respectively. Thus, leg ulcers were more prevalent in the age group 40-69 years.

Test of proportion showed that proportion of males 84.5% was significantly higher than that of females 15.5% (Z=9.89; p<0.0001). Thus, the leg ulcers were more prevalent among males.

Corrected chi-square test showed that there was no significant association between age and gender of the patients (p=0.21). Thus, the leg ulcers were evenly distributed over ages among both in males and females.

The mean (mean±SD) age of the male patients was 51.75±12.01 years with range 18-80 years and the median age was 53.0 years. The mean (mean±SD) age of the female patients was 52.96±13.75 years with range 18-80 years and the median age was 51.5 years (Table 1).

**Table 1:-** Age and Gender distribution.

AGE IN YEARS	MALE	FEMALE	TOTAL (%)
18-20	1	0	1(1)
20-30	3	1	4(4.1)
30-39	5	1	6(6.2)
40-49	21	5	25(25.8)
50-59	26	3	29(29.9)
60-69	22	4	27(27.8)
>70	4	1	5(5.2)
TOTAL (%)	82(84.5)	15(15.5)	97(100)
Mean±SD	51.75±12.01	52.96±13.75	

(chi square=8.39; p=0.21 (not significant)). Most of the patients were engaged in agriculture (23.8%) followed by business (22.8%) and service (14.5%) (Figure 1).

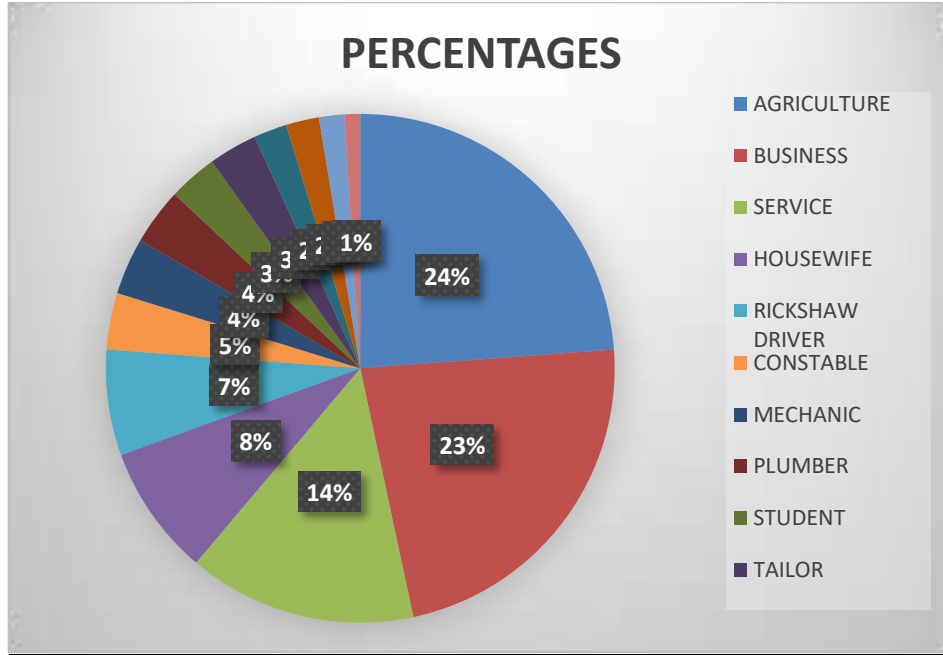


Fig 1:- Occupation distribution.

47.5% of the patients had habit of smoking, chewing tobacco and drinking of alcohol. Out of 46 patients having any kind of personal habit, 13.4% had smoking followed by chewing tobacco (10.3%) (Table 2)

Table 2:- Distribution of personal habit.

PERSONAL HABBIT	NUMBER	%
Smoking	13	13.4
Chewing tobacco	10	10.3
Smoking + alcohol	7	7.2
Smoking + chewing tobacco + alcohol	6	6.2
Alcohol	5	5.2
Chewing tobacco + alcohol	5	5.2
No habit	51	52.5
Total	97	100

Ulcers in the left leg (49.2%) was higher than that of right leg (47.2%) but it was not significant ( $Z=0.28$ ;  $p=0.77$ ). Only 3.6% of the patients were having ulcers in both legs.

Most of the ulcers were diabetic (36.1%) followed by venous (22.6%) ( $Z=2.17$ ;  $p=0$ ). Only 4.1% and 3.1% were malignant and trophic ulcers (Table 3).

Table 3:- Distribution of diagnosis of ulcers.

Diagnosis of ulcer	Number	%
Diabetic	35	36.1
Venous	22	22.6
Traumatic	16	16.5
Arterial	12	12.4
Malignant	4	4.1
Trophic	3	3.1
Others	5	5.2
Total	97	100

Peripheral neuropathy (26.8%) was the most common pathology of ulcer followed by venous hypertension (24.7%) (Table 4)

**Table 4:-** Distribution of pathology of ulcers.

<b>PATHOLOGY OF ULCER</b>	<b>NUMBER</b>	<b>%</b>
Peripheral neuropathy	26	26.8
Venous hypertension	24	24.7
Atherosclerosis	15	15.5
Peripheral neuropathy + atherosclerosis	11	11.3
Trauma	9	9.3
TAO	5	5.2
SCC	3	3.1
Pressure sore	2	2.1
Tubercular ulcer	1	1.0
Vasculitis	1	1.0
Total	97	100

In 79.4% of the ulcer's microorganisms were found which was significantly higher than that of no growth (20.6%) ( $Z=8.25$ ;  $p<0.0001$ ). Out of the microorganisms Staphylococcus (28.9%) was most common followed by Pseudomonas (15.5%) and Klebsiella (11.4%). Only in 1% of the ulcers, Morganella and AFB were present (Table 5).

**Table 5:-** Distribution of microorganisms.

<b>Microorganisms</b>	<b>Number</b>	<b>%</b>
Staphylococcus	28	28.9
Pseudomonas	15	15.5
Klebsiella	11	11.4
MRSA	8	8.2
Streptococcus	7	7.2
Proteus	6	6.2
Morganella	1	1.0
Acid fast bacilli	1	1.0
No growth	20	20.6
Total	97	100

Muscle (35.2%) was the most common base of the ulcers followed bone (26.4%) and subcutaneous tissue (24.9%). Bone with tendon and only bone base was found in 6.7% of the cases. ( $Z=1.58$ ;  $p=0.11$ ).

Most of the floors of the ulcers were unhealthy granulation tissue and slough (37.1%) followed by pale granulation tissue and slough (21.7%). Only in 1% of the cases it was raised abnormal granulation tissue extending beyond the margin. ( $Z=2.17$ ;  $p=0.03$ ) (Table 6)

**Table 6:-** Type of floor of ulcers.

<b>Floor of ulcer</b>	<b>Number</b>	<b>%</b>
Unhealthy granulation tissue and slough	36	37.1
Pale granulation tissue and slough	21	21.7
Minimal slough	17	17.6
Necrotic tissue	7	7.2
Unhealthy granulation tissue	6	6.2
Fresh granulation tissue	4	4.1
Foul smelling slough	4	4.1
Raised granulation tissue at the wound edges	1	1.0
Raised abnormal granulation tissue extending beyond the margin	1	1.0
Total	97	100

55.4% of the ulcers had shallow edge followed by sloping (20.7%) ( $Z=5.05$ ;  $p<0.001$ ). Only 1% was undermined. Most of the margin of the ulcers were irregular (38.3%) which was significantly higher ( $Z=2.46$ ;  $p=0.0139$ ) followed by thin bluish irregular (22.3%). Only 3.1% of the margin of ulcers was regular.

22.3% of the surrounding area was lipodermatosclerosis and hyper-pigmentation with itching. 31.1% of the discharge was slough with purulent discharge followed by serous (26.4%). In most of the cases debridement with dressing (32.9%) was done (Table 7).

**Table 7:-** Type of surgical management.

Surgical management	Number	%
Debridement+dressing	32	32.9
Debridement+dressing+skin grafting	19	19.6
Debridement+dressing+disarticulation	11	11.3
Stripping GSV/SSV+ hook phlebectomy	9	9.3
Hook phlebectomy	8	8.3
Stripping GSV/SSV	5	5.2
Wide excision + skin grafting	3	3.1
Debridement+dressing+lumbar sympathectomy	2	2.1
Debridement+dressing+midtarsalamputation+angiography+balloon angioplasty	2	2.1
Debridement+skingrafting+dressing	2	2.1
Debridement+dressing+below knee amputation	1	1.0
Below knee amputation	1	1.0
Debridement+dressing+angiography+ballonangioplasty+skin grafting	1	1.0
Debridement+dressing+angiography+ballon angioplasty	1	1.0
Total	97	100

After intervention, most of the ulcers healed (92.8%) and 1 patient dead (Table 8)

**Table 8:-** Status at last contact.

Status at last contact	Number	%
Healed	90	92.8
Disease free	4	4.1
Recurred	2	2.1
Dead	1	1.0
Total	97	100

### Discussion:-

In this study, test of proportion showed that the proportion of the patients with age between 40-69 years (84.0%) was significantly higher ( $Z=9.61$ ;  $p<0.0001$ ). Only 5.1% and 5.2% of the patients were with age  $<30$  years and  $\geq 70$  years respectively. Thus, leg ulcers were more prevalent in the age group 40-69 years.

Cornwall et al, in their study found that 70% of the patients were over the age of 70 years and according to a study done by Callam et al, ulceration began before the age of 40 years in 22% of the patients<sup>49,50</sup>. This may be due to higher prevalence of venous (mean age:  $36.0\pm 9.4$  years, median: 36 years) and traumatic ulcer (mean age:  $39.3\pm 14.8$  years, median: 38 years) below 40 years and higher prevalence of diabetic (mean age:  $55.4\pm 15.5$  years, median: 63 years) and arterial ulcers (mean age:  $55.0\pm 12.8$  years, median: 55 years) in elderly age group in our study.

Test of proportion showed that proportion of males 84.5% was significantly higher than that of females 15.5% ( $Z=9.89$ ;  $p<0.0001$ ). Thus, the leg ulcers were more prevalent among males.

Chronic leg ulcers are more prevalent in female than male, as reported in various literatures<sup>49,50</sup>. In our study where male to female ratio is 5.4:1, showing male predominance. A hospital-based study in India reported male to female ratio of 5.7:1, which is similar<sup>51</sup>. This may be because of the fact that in India males are more engaged in outdoor activities compared to female who remain indoors.

Corrected Chi-square test showed that there was no significant association between age and gender of the patients ( $p=0.21$ ). Thus, the leg ulcers were evenly distributed over ages among both in males and females. The mean (mean $\pm$ SD) age of the male patients was  $51.75\pm 12.01$  years with range 19-80 years and the median age was 53.0 years. The mean (mean $\pm$ SD) age of the female patients was  $52.96\pm 13.75$  years with range 25-80 years and the median age was 51.5 years. t-test showed that there was no significant difference between mean age of males and females ( $t_{191}=0.49$ ;  $p=0.62$ )

No significant difference between sexes was found when age specific relative frequencies were compared ( $H=2.5357$ ,  $df=4$ ,  $p=0.6383$ ) in a study conducted in India<sup>52</sup>.

Most of the patients were engaged in agriculture (24%) followed by business (23%) and service (14%). As per the study conducted in China majority of leg ulcers were among the farmers and agricultural workers as in the present study<sup>53</sup>.

47.5% of the patients had habit of smoking, chewing tobacco and drinking of alcohol. Out of 46 patients having any kind of personal habit 13.4% had smoking followed by chewing tobacco (10.3%). In a study on Indian patients found that there is a positive relationship between smoking and diabetes<sup>54</sup>. Cigarette smoking has been reported to have an impact on wound healing through impairment of tissue oxygenation and local hypoxia via vasoconstriction<sup>55</sup>. Tobacco smoke has high concentration of carbon monoxide, which binds haemoglobin, forming carboxyhaemoglobin. Carboxyhaemoglobin binds to oxygen with high affinity and thereby interferes with normal oxygen delivery to hypoxic tissues<sup>56</sup>. Higher proportion of patients with smoking and drinking habit may be associated with greater population of diabetic leg ulcers in our study.

Ulcers in the left leg (49.2%) was higher than that of right leg (47.2%) but it was not significant ( $Z=0.28$ ;  $p=0.77$ ). Only 3.6% of the patients were having ulcers in both legs. In a study from Nigeria showed 17 ulcers on Left leg (51.5%), 15 ulcers on right leg (45.5%) and 1 (3%) ulcer on both leg in a population of 33 patients. But laterality of leg ulceration has no impact on the outcome of leg ulcer<sup>57</sup>.

Most of the ulcers were diabetic (36.1%) followed by venous (22.6%). ( $Z=2.17$ ;  $p=0$ ) Only 4.1% and 3.1% were malignant and trophic ulcers. Distribution of different type of ulcers in different studies varies 70% to 90% for venous ulcer, 5% to 15% for arterial ulcers and 1% to 5% for other ulcers<sup>58</sup>. All of these are based on population in western countries. But Indian study in prevalence of leg ulcer is limited to only one hospital-based study. The study suggested that leprosy (40%), diabetes (23%), venous disease (11%), and trauma (13%) were among the causes of lower extremity wounds in patients attending that hospital. 13% of wounds were not directly linked to any known cause<sup>51</sup>. Arterial ulcer is seen among 12.4% patient in our study. In region where our hospital is present, prevalence of tobacco usage is about 50-65% in the population<sup>59</sup>. Higher rate of smoking and use of tobacco products, especially use of beedi smoking in Indian male could be the cause of a greater number of male patients compared to female and higher number of arterial ulcers in our study<sup>60</sup>. Also, incidence Burger's disease among peripheral arterial disease is more in India (45-63%) than Europe (0.5- 5.6%)<sup>61</sup>. Beedi smoking is prevalent in lower socioeconomic class people who also walk bare footed, so more vulnerable to trauma to foot. Poor education and poverty prevent them to attend health care facility promptly. The above mentions causes may be the reason of more arterial ulcer in our study. Leg ulcer due to malignancy, tuberculosis, neurotrophic causes are seen rarely.

Peripheral neuropathy (26.8%) was the most common pathology of ulcer followed by venous hypertension (24.7%). In a community-based study from Chennai, south India, Pradeepa et al measured the prevalence of DPN using VPT by biothesiometer. The prevalence in newly diagnosed patients was 19.5% and 27.8% in those with known diabetes<sup>62</sup>. However, the frequency of DPN in the subjects without diabetes was not studied. The higher proportion of peripheral neuropathy is due to higher proportion of diabetic leg ulcers in our study.

In 79.4% of the ulcer's microorganisms were found which was significantly higher than that of no growth (20.6%). Out of the microorganisms Staphylococcus (28.9%) was most common followed by Pseudomonas (15.5%) and Klebsiella (11.4%). Only in 1% of the ulcers Morganella and acid-fast Bacilli were present. Similar result was reported by Mathangi et al in their study<sup>63</sup>.

Most of the patients (67.9%) had pain which was significantly higher than of no pain (32.1%) ( $Z=5.06$ ;  $p<0.001$ ). Similar study was reported by Hassan Ghassemi et al<sup>52</sup>.

Most of the ulcers were muscle deep containing unhealthy granulation tissue and slough with serous or purulent discharge, irregular or thin bluish margins, shallow edge followed by sloping edge, associated with lipodermatosclerosis and hyperpigmentation or induration. These findings were associated with more numbers of diabetic and venous leg ulcer patients in this present study.

Arterial ulcers were more common in 40–80-year group (mean 52 years) with male preponderance (91%) because of habit of using tobacco and alcohol (58.3%) and outdoor activities, mostly patients involving in agriculture and business. All ulcers were painful involving the foot with atherosclerosis or with variable degree of peripheral arterial occlusion being the most common etiopathology. As discussed in review of literature, arterial ulcers were found to be deep punched out ulcers with majority had exposed tendon at the base (45.8%). Majority of arterial ulcers were dry or minimal discharge, containing necrotic tissue with associated hair loss, cold shiny skin, and brittle nail in the surrounding area<sup>64</sup>. Most of the arterial ulcers were benefited by angiography or angioplasty with or without some sort of amputation.

Diabetic foot ulcers were more common around 60 years age group (mean 60±9 years) with male preponderance (87.1%) because of habit of using tobacco and alcohol (75.7%) and outdoor activities, mostly involving patients engaged in agriculture and business. Majority of the ulcers were located in the foot (88.6%).

Pain was present in 67.9%. Peripheral neuropathy alone (26.8%) or peripheral neuropathy in combination with atherosclerotic occlusion (11.3%) were the frequently involved in etiopathogenesis. As discussed in review of literature, diabetic foot ulcers were found to be irregular with shallow edge with indurations and excoriation of surrounding skin and of variable depth with majority had exposed bone at the base (64.3%). Majority of diabetic ulcers were containing unhealthy granulation tissue or slough at the floor, discharging purulent material. Diabetic foot ulcers were benefited by debridement and dressing and few required amputation along with debridement and dressing.

Malignant ulcers were common in 56-75 years age group (mean 64.33±6.18) involving male slightly more than female. 100% ulcers involved right limb with foot (66.7%) being more common than leg (33.3%). Malignant ulcers were usually painless (88.9%). Malignant ulcers had variable depth, rolled out margin, everted edge, indurations of surrounding skin, fresh granulation tissue or minimal slough, serosanguinous discharge. Malignant ulcers were treated with wide surgical excision and skin grafting. 33.3% cases required amputation.

Venous ulcers were more common in 45-68 years of age (mean 51.58±4.72) with male preponderance (83.7%) and were involved mostly agriculture or service category. Gaiter area of leg involved in 83.7% with ulcer on left leg being more common (76.7%).

Venous ulcers are muscle or subcutaneous tissue deep, with usually shallow edge, usually painful (76.7%) with 100% were having thin bluish irregular margin with pale granulation tissue at floor and lipodermatosclerosis, hyperpigmentation and itching in the surrounding area. Venous ulcers were cured 100% by compression stockings, Stripping GSV/SSV and Hook Phlebotomy.

### **Conclusion:-**

In this study, we have been able to show that leg ulcers are common in elderly population and have negative impact on quality of life of affected patients. The highest number of cases was found to be ulcer of the leg associated with diabetes mellitus, ulcer due to venous valve incompetence, traumatic ulcer, ulcers due to arterial occlusion secondary to atherosclerosis and TAO and malignant ulcers. A comprehensive assessment of patients' general status, personal habits, skin, vascular status, limb, ulcer characteristics are required to determine the etiology and to formulate effective treatment plan. Thus, the study of various cases of leg ulcers arouses lot of interest and is mind boggling as far as the treatment of these cases are concerned. With the availability of arsenal of investigation, wide range of antibiotics and with ever improving dressing material, there is certainly a great improvement in treatment of chronic leg ulcers. Skin grafting when it becomes a choice for chronic ulcers with wide defects is indeed the right one.

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