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A PROSPECTIVE STUDY ON SALVAGE SURGERY IN DIABETIC FOOT SYNDROME WITH AIM OF MAXIMUM PRESERVATION OF LIMB.

General Surgery

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ABSTRACT

A prospective study was conducted on 100 patients who were admitted in department of General Surgery with diabetic foot ulcers, at Alluri Sitarama Raju Academy of Medical Sciences, Eluru from February 2019 to February 2020. **AIMS:** One of the most important strategies for diabetic foot is to prevent complications that may require major limb amputation. **MATERIALS AND METHODS:** The purpose of this article is to provide information on determining the optimal amputation level, preserving as much limb length as possible without requiring additional re amputation by analyzing several predictive factor 100 patients requiring limb salvage surgery for diabetic foot gangrene. **CONCLUSION:** This study shows that: This study evaluated the factors predictive of the success of limb salvage surgery and identified indicators for preserving the limbs of patients with diabetic foot complications, allowing the establishment of an appropriate amputation level of the diabetic foot and minimizing subsequent operations.

KEYWORDS

DFU (diabetic foot ulcer), PVD (peripheral vascular disease), NPWT (negative pressure wound therapy)

INTRODUCTION:

Diabetic foot ulcer is most devastating complication of diabetes mellitus affecting 15 % of patients. Early effective management of diabetic foot ulcer reduces severity of complications such as avoidable amputations and mortality. Surgery to heal chronic ulcer and prevent recurrence should be considered as an component of management .Hyperbaric o2 therapy , electrical stimulation, negative pressure wound therapy ,bio-engineered skin and growth factors are adjuncts and recent advances for rapid healing .

Overall , lower limb amputation in patients with diabetes mellitus is 15 times higher than normal population.50% of lower limb amputaions is due to diabetic foot complications .

Diabetic amputation is responsible for substantial emotional, physical distress and financial loss that lower quality of life.

Some of the signs of diabetes include frequent urination, fatigue, excessive hunger and thirst, blurry vision, slow healing wounds etc. The other complications of diabetes include nephropathy, retinopathy, neuropathy, heart disease and limb amputations. In this prospective study we are going to discuss about diabetic foot ulcer.

AIMS & OBJECTIVES:

- To prevent complications that may necessitate a major limb amputation.
- To minimize the level of amputation and maximal retention of limb
- To attain successful limb salvage: Defined as a stump fit for functional ambulation, which is determined by the level of amputation. It is mostly affected by preservation of the talus and calcaneus because it minimizes limb length discrepancy and preserves the heel padMATERIALS AND METHODS: 100 patients admitted in department of general surgery at Alluri Sitarama Raju Academy of Medical Sciences, Eluru from February 2019 to February 2020.

According to the final level of amputation, the patients were divided into two groups:

1. Patients with primary success of the limb salvage.
2. Patients that failed to heal after the primary limb salvage surgery.

The factors predictive of success, including comorbidity, laboratory findings, and radiologic findings which were evaluated by a retrospective chart review.

The primary outcome measures included.
1. Age.
2. Sex.
3. Smoking status.
4. Presence of comorbidities (hypertension, ischemic heart syndrome, stroke, chronic renal failure, chronic osteomyelitis),
5. Preoperative laboratory investigations, including the hemoglobin level (Hb), white blood cell (WBC) count, glycosylated hemoglobin (HbA1c), creatinine, and C-reactive protein (CRP) levels were collected.

A preoperative ARTERIAL DOPPLER STUDY was performed in all patients to evaluate the number of abnormal vessels and the state (patent, partial occlusion, total occlusion) of each vessel of the lower extremity, white cell count, glycosylated hemoglobin (HbA1c), creatinine, and C-reactive protein.

Results & Statistics:

Figure: 1

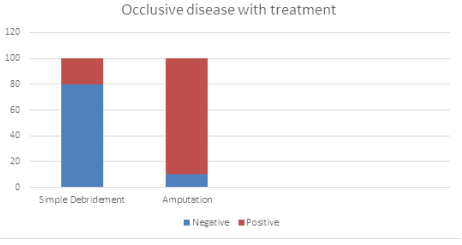
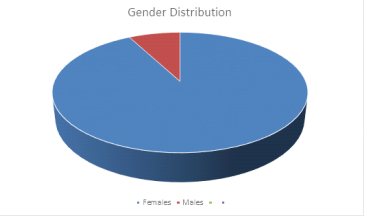


Figure: 2



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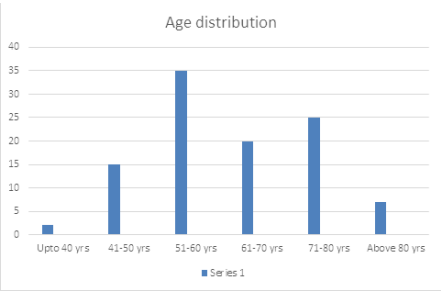


DISCUSSION:
Diabetes is more in developing countries compared to developed countries, moreover India is considered as the home for more number of diabetic individuals. The increase in diabetes mellitus leads to many infections, especially foot ulcer infections.

DFU is the result of various factors like peripheral vascular disease, peripheral neuropathy, trauma, foot deformities, arterial insufficiency and impaired resistance to infection. It can be caused by both type 1 and type 2 diabetes.

The diabetic foot ulcer commences with a small ulcer or surgical wound and results in loss of limb. The diabetic foot occurs in the areas of higher pressure, especially on the plantar aspect of the foot. Some other common areas of infection include medial first metatarsal phalangeal joint, posterior calcaneus and lateral aspect of the fifth metatarsal phalangeal joint. Moreover the diabetic foot ulcer is classified into ischemic, neuropathic or decubitus wounds. .The foot ulcer is diagnosed by secretion of pus from infected wound and some physical factors like tenderness, edema, erythema and pain.

Risk factors are important in predicting the prognosis of ulceration, yet many patients already have intractable ulceration prior to hospital admission. As a result, these studies are less helpful for the prognosis of patients in need of surgery for complicated diabetic foot.

ETIOLOGY: Causative organisms
The DFU mostly appears to be polymicrobial in nature. Both gram-positive (Staphylococcus aureus, Enterococcus) and gram-negative (Pseudomonas aeruginosa, E. coli, Klebsiella species, Proteus species, etc.) are involved in DFU.

BIOFILMS:
Biofilms are communities of microorganisms within extracellular polymeric matrix which comprises of lipids, proteins, polysaccharides and nucleic acids, they attach to a biotic or abiotic surface in the solid-liquid interface. Moreover the organisms in the biofilm are provided with essential nutrients supply and water for their growth. The biofilm formation is the major cause of many chronic infections. Moreover they are multidrug-resistant and cause failure of the treatment. The eradication of biofilm is not possible using conventional antibiotics.

The Wound, Ischemia and foot Infection classification (WIfI):
Published in 2014 in response to the growing concern that patients with foot lesions secondary to diabetes are not easily classified by existing classification of limb ischaemia, it has three components: a description of the ulcer divided into three grades based on depth, a description of ischaemia, carefully defined based on a combination of ankle–brachial pressure index, transcutaneous oxygen tension and toe systolic pressure and a description of infection, the grading being the same as in the Infectious Diseases Society of America (IDSA) criteria. This gives a score under the heading Wound (0–3) Ischaemia (0–3) and Infection (0–3).

The Meggitt–Wagner system:
The first of the diabetes specific classification systems to be published, the Meggitt–Wagner system, is a linear system consisting only six grades (0–5, where 0 is intact skin), the first three being related to depth. I PAD is considered only in later stages as gangrene.

PATHOPHYSIOLOGY OF PERIPHERAL VASCULAR DISEASE:
Atherosclerosis (also known as arteriosclerotic vascular disease or ASVD) is a condition in which an artery wall thickens as a result of the accumulation of fatty materials such as cholesterol.

It is a syndrome affecting arterial blood vessels, a chronic inflammatory response in the walls of arteries, caused largely by the accumulation of macrophage white blood cells promoted by low-density lipoproteins (plasma proteins that carry cholesterol and triglycerides) without adequate removal of fats and cholesterol from the macrophages by functional high density lipoproteins (HDL),It is characterized by a remodeling of arteries leading to subendothelial accumulation of fatty substances called plaques.

LABORATORY INVESTIGATIONS:
The standard procedure involves measuring blood glucose level and urine for glucose and ketones. Other investigations like full blood count, blood urea, electrolytes, and creatinine levels should be monitored regularly. Glycosylated hemoglobin (HbA1C) is important to gauge the patient's overall glycemic control as HbA1c shows the mean blood sugar concentration best over previous weeks to months.

Hepatic and renal function tests are necessary for monitoring the patient's metabolic status. ESR can be done to assess the presence and response to treatment of infections like osteomyelitis. Routine wound cultures are not recommended since all wounds harbor microorganisms .However in the presence of invasive infection, cultures from the deeper tissue will help to identify the causative microorganisms.

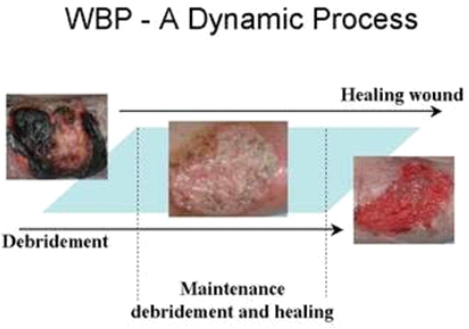
Other investigations to detect vascular insufficiency include measuring absolute toe pressure, continuous-wave Doppler Ultrasonography, duplex ultrasonography, pulse volume recordings and angiography (CT, MRI or contrast).

MANAGEMENT:
Primary management goals for diabetic foot ulcer are to obtain wound closure as much as possible. Being a muli organ systemic disease, all co morbities that affect wound healing should be dealt with multi team approach.

BLOOD SUGAR CONROL:
The best indicator of glucose control is HBA1C level. it indicates blood sugar concentraion over period of 90 days that of a average red blood cell in peripheral circulation.

DEBRIDEMENT: It is removal of necrotic and senescent tissues as well as foreign infected bodies from the wound .debridement will decrease bacterial counts and stimulates production of local growth factors.

Figure: 4



OFFLOADING:
Commonly known as pressure modulation, most important for management of neuropathic ulcers in patients with diabetes .the most effective technique is Total contact casts.

PHYSIOLOGY OF DRESSINGS:
It should confer moisture balance, protease sequestration, growth factor stimulation, antimicrobialactivity, oxygenpermeability, promote autolytic debridement, granluation tissue proliferation and re-epithelialization.

Choice of dressings depends on wound location, depth, amount of scar or slough, wound margins, infection, pain ,need for adhesiveness and

conformability of dressings.
It is classified as active, passive or interactive.

PASSIVE dressings -used as protective functions and for acute wounds since they absorb exudates and good protection.

ACTIVE and INTERACTIVE dressings modify physiology of wound by stimulating cellular activity and growth factor release. most used for chronic wounds since they adapt easily and give a moist environment.

ADVANCED DRESSINGS :

- Films
- Hydrogels
- Hydrocolloids
- Alginates
- Foams
- Silver impregnated materials

These maybe cost effective because of lowered frequency of dressing changes and not requiring extensive nursing time.

SURGERY:

WOUND CLOSURE:
Wound closure is attempted once the ulcer is clean with healthy granulation tissue. Primary closure is possible for small wounds; tissue loss can be covered with the help of skin graft, flap or commercially available skin substitutes.

Split-thickness skin grafts are preferred over full thickness grafts. In one study , topical phenytoin application before auto grafting promoted granulation tissue formation.

REVASCULARIZATION SURGERY:
Patients with peripheral ischemia who have significant functional disability should undergo surgical revascularization if medical management fails. This may decrease the amputation risk in patients with ischaemic DFUs. It is advocated early revascularization after controlling the infection in cases of ischaemic DFUs.

AMPUTATION:
Amputations are generally used as a treatment of last resort when other measures fail. However, they may be also performed earlier to allow for earlier return to work or better functional status.

ADVANCED THERAPIES:
Hyperbaric oxygen therapy (HBOT) has shown promise in the treatment of serious cases of non-healing DFU, which are resistant to other therapeutic methods. HBOT involves intermittent administration of 100% oxygen, usually in daily sessions.

During each session, patients breathed pure oxygen at 1.4-3.0 absolute atmospheres during 3 periods of 30 min (overall 90 min) intercalated by 5 min intervals in a hyperbaric chamber.

ELECTRICAL STIMULATION:
Electrical stimulation (ES) has been reported as a perfect adjunctive therapy for DFU healing in recent literature.

NEGATIVE PRESSURE WOUND THERAPY:
It is a non-invasive wound closure system that uses controlled, localized negative pressure to help heal chronic and acute wounds. This system uses latex-free and sterile polyurethane or polyvinyl alcohol foam dressing that is fitted at the bedside to the appropriate size for every wound, and then covered with an adhesive drape to create an airtight seal.

CONCLUSION:
This study shows that:
1. Though independently variables described here are analysed in several studies, there is no other study which incorporates all the variables like this study.
2. After further validation with a bigger sample size accuracy of my scoring system can be validated further for proper application in clinical practice.
3. Diabetic foot is a chronic complication of DM which is not accorded the "glamour" status of its more illustrious sisters like coronary heart disease, cerebrovascular disease, nephropathy orretinopathy.
4. Clinical examination of the feet and related systems forms the mainstay of detecting diabetic foot; investigations are only an adjunct to clinical examination. The treatment is usually conservative and a limb sparing approach is used, along with proper diabeticcontrol.
5. Management of aetiological factors like vasculopathy, neuropathy and infection is essential to get good outcomes. Amputation is usually used as a last resort in non-salvageable limbs.

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