

A Case Series on Recent Advances in Management of Diabetic Lower Limb Infections

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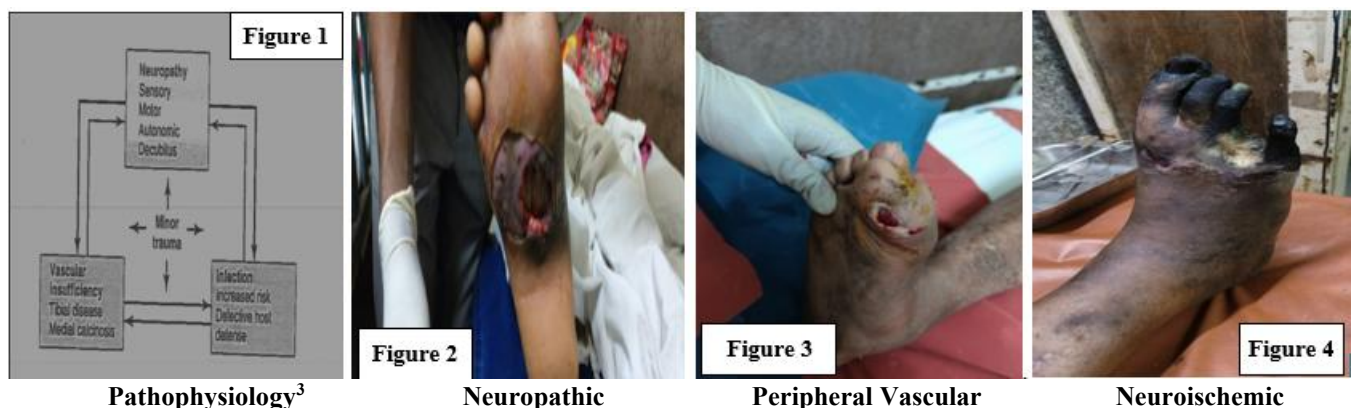
Abstract: Background: Diabetes mellitus is a complex disease that often causes multiple systemic complications, is regarded as a major world-wide international public health problem. Nearly 85 % of patients presenting with diabetic foot ulcers are at risk of non-traumatic lower limb amputations. If an amputation is performed annual mortality is 10%-20%. So, Limb Salvage is the primary aim of the study & hence the decrease % of morbidity and mortality due to Diabetic Lower Limb Infections. Materials & Methods: 1) Sample Size: 42 cases 2) Study Duration: 1 year (March 2023- February 2024) 3) Study Design: Prospective Observational Study 4) Study Setting: Ramakrishna Mission Seva Pratishthan, Vivekananda Institute of Medical Sciences. 5) Inclusion Criteria: a) Wagner's grade 3, 4 & 5 b) Age group 18-80 years c) Wound involving Lower Limb d) T2 Diabetes Mellitus 6) Exclusion Criteria: a) T1 Diabetes Mellitus b) Wagner's grade 1, 2 c) Vascular abnormality like DVT, Atherosclerotic Plaque in lower limb. Methodology: Total 42 cases were taken. Among them 12 cases (28.57%) were conservative & 30 cases (71.44%) were managed surgically. Among the surgical cases Toe Amputation 2 cases (6.67%), Mid-Foot Amputation 1 case (3.33%), Rotational Flap closure 10 cases (33.33%), Advancement Flap closure 8 cases (26.67%), Transposition Flap Closure 4 cases (13.33%), Bipedicular Flap Closure 3 cases (6.67%), Split-Thickness Skin Grafting Closure 2 cases (6.67%) were performed. Result: The mean Age (Years) (mean±SD) of patients was 53.78±11.90. Among the surgical cases Seroma formation 5 cases (16.67%), Flap necrosis 2 cases (6.67%), Wound dehiscence 4 cases (13.33%), Donor site infection 1 case (3.33%) and average recovery time observed 1-1.5 months. Among the cases conservatively managed there were Excessive exudate present 4 cases (33.33%), Deeper tissue wound extension 2 cases (16.67%) & both were ulceration, no osteomyelitis noted and this 2 cases need surgical intervention. The average time of recovery in conservatively managed cases was 2-3 months. Conclusion: No single approach would correct the complex pathogenesis of diabetic foot. Reasonable selection and combination of recent techniques should be considered. Above all, patients and their family must be educated about the nature and complication of the disease. So, my presentation highlights the rising of awareness and recent approaches towards this alarming condition to salvage the limb from amputation and its level.

Keywords: Diabetic lower limb infection, Wagner's gradings, Limb Salvage, Amputation, Growth factors, Surgical dressing, Antibiotics.

1. Introduction

Diabetes mellitus, is a complex disease that often causes multiple systemic complication, is regarded as a major world-wide international public health problem. Diabetic lower limb infections are a debilitating complication of

Diabetes Mellitus. Also, Diabetic Foot is affecting 15% of patients with type 2 DM⁵. Nearly 85 % of patients presenting with diabetic foot ulcers are at risk of non-traumatic lower limb amputations⁶. If an amputation is performed annual mortality is 10%-20%⁷.



Clinical Grading⁴:

Grade	Lesion
0	Intact skin
1	Superficial ulcer of skin or subcutaneous tissue
2	Ulcer extend into tendon, bone, or capsule
3	Deep ulcer with osteomyelitis or abscess
4	Gangrene of toes or forefoot
5	Midfoot or hindfoot gangrene

Figure 5



Figure 6



Figure 7

Grade 1

Grade 2



Figure 8

Grade 3



Figure 9

Grade 4



Figure 10

Grade 5

Recent Advances in Diabetic Lower Limb Infection:^{1, 13, 17}**Medical Therapy¹⁴:**

- 1) Hyperbaric Oxygen Therapy⁸
- 2) Dressing Materials (Collagen dressing: Alginate foam dressing etc)
- 3) Negative Pressure Wound Therapy⁹
- 4) Use Of Growth Factors (PDGF, VEGF etc)¹⁰
- 5) Pressure Offloading Devices²⁰ (Offloading Shoes, Crutches etc)
- 6) Antibiotics Therapy As per NICE Guideline¹¹
- 7) Circulation enhancing Drugs like Pentoxifylline

Advantage

- 1) Increase fibroblast proliferation
- 2) Increased collagen production
- 3) Increased capillary angiogenesis
- 4) Increased release of growth factors

Surgical Therapy²

- 1) **Debridement**
 - a) To remove infected necrotic tissue
 - b) To control sepsis
- 2) **Skin Grafting and Local Flaps**
To cover large wound
- 3) **Selective Amputation In Gangrenous Toes/ and Foot**
Depending on severity of infection and vascularity of the limb Proper Level of Amputation should be considered.

ADVANTAGES: Decrease Risk and Level of Amputation.

2. Materials & Methods

- **Sample Size:** 42 cases
- **Study Duration:** 1 years (March 2023- February 2024)
- **Study Design:** Prospective Observational Study
- **Study Setting:** Ramakrishna Mission Seva Pratishthan, Vivekananda Institute Of Medical Sciences
- **Inclusion Criteria:**
 - a) Wagner's grade 3, 4 & 5
 - b) Age group 18-60 years
 - c) T2 Diabetes Mellitus
- **Exclusion Criteria:**
 - a) T1 Diabetes Mellitus
 - b) Wagner's grade 1, 2
 - c) Vascular abnormality like DVT, Atherosclerotic Plaque in lower limb

Investigations:

- 1) Wound swab for C/S sent
- 2) Color Doppler of Bilateral Lower Limb done both Artery and Venous.

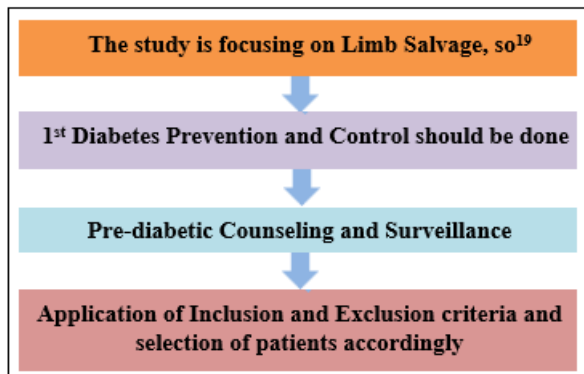
3. Methodology¹⁸

Total 42 cases were taken, among them 12 cases (28.57%) were managed conservatively with proper glycemic control, life style modification, different pharmacotherapy, application of different growth factors and Negative Pressure Wound Therapy (VAC). Colloid & hydrocolloid

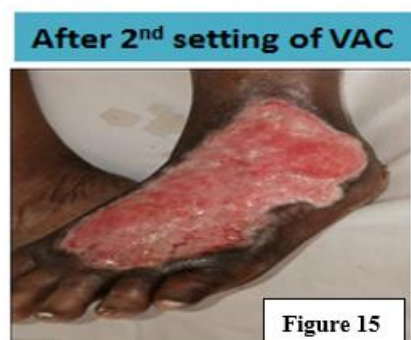
dressing with normal saline done 24-48 hourly and wound was followed up gradually. 30 cases (71.14%) were managed surgically¹³. Among the surgical cases Toe Amputation 2 cases (6.67%), Mid-Foot Amputation 1 case (3.33%), Rotational Flap closure 10 cases (33.33%), Advancement Flap closure 8 cases (26.67%), Transposition Flap Closure 4 cases (13.33%), Bipedicular Flap Closure 3 cases (6.67%), Split-Thickness Skin Grafting Closure 2 cases (6.67%) were performed. 1st dressing done at 48 hrs and then regularly at an interval of 24-48hrs and wound condition was followed up.

Here we have performed:

- 1) Antibiotic Coverage
- 2) Earliest possible intervention done in form of **Medical Management** that causes proper wound care, reduce inflammation and increase growth factors in the tissue, pressure off-loadings
- 3) Surgical intervention should be assessed by **Color Doppler** study of lower limb vessels at regular interval
- 4) **Surgical Management** where we aims to salvage the limb through proper Debridement and Wound Cover with Flap, Graft or Proper Level of Amputation.
- 5) Follow up should be done with proper wound care.



Case 1



Case 2

Diabetic Heel Wound



Coverage With Local Rotational Flap Followed By Skin Grafting



Case 3

Trauma Induced Diabetic Lower Limb Cellulitis With Escher Formation



Escherectomy With Debridement



Case 4

Diabetic Foot Dry Gangrene with Little Toe Auto-amputation



Excision of Gangrenous part followed by Skin Grafting



Case 5

Diabetic Gangrenous Infected Foot



Partial Amputation Of Diabetic Forefoot Following Transposition Flap Coverage



Case 6

Diabetic Foot Ulcer with Exposed Bone



Figure 27

Debridement with Rotational Flap With Skin Grafting



Figure 28

Case 7

Osteomyelitis with Sequestration



Figure 29

Excision of Sequestration



Figure 30

Gastrocnemius Muscle Flap Raised



Figure 31

Bipedicular Flap



Figure 32

Flap Raised

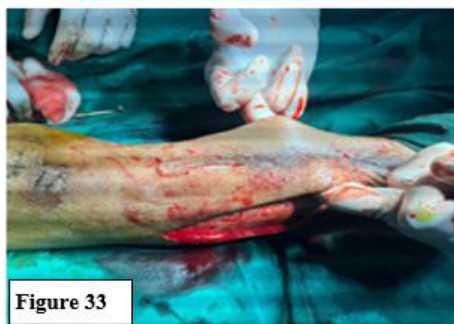


Figure 33

Flap Closure



Figure 34

Discharge: Patients were discharged when the wound became healthy and with good general condition.

Follow Up: patients were followed up at our OPD after 2 weeks, 4 weeks and 2 months.

Statistical Analysis: was performed with help of IBM-SPSS version 25.0.

4. Results & Analysis

The mean Age (Years) (mean±SD) of patients was 53.78±11.90.

Among the surgical cases Seroma formation 5 cases (16.67%), Flap necrosis 2 cases (6.67%), Wound dehiscence 4 cases (13.33%), Donor site infection 1 case (3.33%) and average recovery time observed 1-1.5 months.

Among the cases conservatively managed there were Excessive exudate present 4 cases (33.33%), deeper tissue wound extension 2 cases (16.67%) & both were ulceration, no osteomyelitis noted and this 2 cases need surgical intervention. The average time of recovery in conservatively managed cases was 2-3 months.

There was no recurrence in any patient in the 6 months follow-up period²

5. Discussion

Diabetic Foot is a major public health problem. Recent therapies are focusing on...

- 1) Decrease amputation and level of amputation.
- 2) Proper wound care
- 3) Reduction of inflammation
- 4) Enhancing concentration of growth factors
- 5) Proper offloading and adequate perfusion to deal with debilitating disease.
- 6) But it is essential to have multidisciplinary approach including a team of plastic, vascular, orthopedic surgeons along with nurses, health personals, physiotherapist and podologists.

Armstrong DG, Tan TW noticed in their study Several interventions reduce risk of ulcers compared with usual care, such as pressure-relieving footwear (13.3% vs 25.4%; relative risk, 0.49; 95% CI, 0.28-0.84), foot skin measurements with off-loading when hot spots (ie, greater than 2 °C difference between the affected foot and the unaffected foot) are found (18.7% vs 30.8%; relative risk, 0.51; 95% CI, 0.31-0.84), and treatment of preulcer signs. Surgical debridement, reducing pressure from weight bearing on the ulcer, and treating lower extremity ischemia and foot infection are first-line therapies for diabetic foot ulcers. Randomized clinical trials support treatments to accelerate wound healing and culture-directed oral antibiotics for localized osteomyelitis. Multidisciplinary care, typically consisting of podiatrists, infectious disease specialists, and vascular surgeons, in close collaboration with primary care clinicians, is associated with lower major amputation rates relative to usual care (3.2% vs 4.4%; odds ratio, 0.40; 95% CI, 0.32-0.51). Approximately 30% to 40% of diabetic foot ulcers heal at 12 weeks, and recurrence after healing is estimated to be 42% at 1 year and 65% at 5 years¹⁵

Cavanag PR noticed in their study that Tissue specimens are strongly preferred to wound swabs for wound cultures. Antimicrobial therapy should be guided by culture results,

and should aim to cure the infection, not to heal the wound. Alleviation of the mechanical load on ulcers (off-loading) should always be a part of treatment. Neuropathic ulcers typically heal in 6 weeks with total contact casting, because it effectively relieves pressure at the ulcer site and enforces patient compliance. The success of other approaches to off-loading similarly depends on the patients' adherence to the effectiveness of pressure relief. Surgery to heal ulcers and prevent recurrence can include tenotomy, tendon lengthening, reconstruction, or removal of bony prominences. However, these procedures may result in secondary ulceration and other complications. Ulcer recurrence rates are high, but appropriate education for patients, the provision of post healing footwear, and regular foot care can reduce rates of re-ulceration¹⁶.

6. Conclusion

- No single approach would correct the complex pathogenesis of diabetic foot. Reasonable selection and combination of recent techniques should be considered.
- But it is essential to have multidisciplinary approach including a team of plastic, vascular, orthopedic surgeons along with nurses, health personals, physiotherapists and podologists.
- Above all, patients and their family must be educated about the nature and complication of the disease.
- So, my presentation highlights the rising of awareness and recent approaches towards this alarming condition to salvage the limb from amputation and its level.

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