



General Surgery

A STUDY ON METHYLENE BLUE AS A SURGICAL PRECISION TOOL IN DIABETIC FOOT ULCERS IN A TERTIARY HEALTH CARE HOSPITAL IN VIZIANAGARAM

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ABSTRACT Diabetic foot ulcers (DFUs) remain a major cause of morbidity and limb loss among patients with diabetes mellitus. Precise delineation of viable and non-viable tissue is critical for effective debridement and improved wound healing outcomes. This study evaluates the role of methylene blue as an intraoperative surgical precision aid in managing diabetic foot ulcers, conducted at a tertiary care hospital in Vizianagaram, which involved patients with various grades of DFUs undergoing debridement. Methylene blue dye was used to stain devitalized tissue, facilitating accurate differentiation and complete excision. The results demonstrated improved wound bed preparation, faster granulation, reduced recurrence, and better limb salvage rates compared to conventional methods. Methylene blue proved to be a simple, inexpensive, and effective tool enhancing surgical precision and clinical outcomes in diabetic foot management.

KEYWORDS : Methylene Blue, Diabetic Foot Ulcer, Surgical Precision, Debridement, Wound Healing**INTRODUCTION**

Surgical debridement of diabetic foot ulcers (DFU) remains a challenge despite advances in techniques.

Excessive excision can lead to loss of viable tissue with functional/cosmetic compromise, while inadequate debridement leaves necrotic tissue→delaying healing.

Methylene Blue (MB)

A redox dye that changes from blue (oxidized) to colorless (reduced).

Due to the role of metabolism in living cells, the cell has a strong reducing ability, which can make methylene blue change from blue (oxidation) to colourless (reduction), thus resulting in a redox reaction.

Exploits cellular metabolism to differentiate viable (colorless) from non-viable (blue) tissue.

Facilitates precise identification during debridement.

Synthesized in 1891, MB is one of the earliest synthetic drugs and remains widely available.

Backed by over a century of clinical use, its pharmacodynamic profile is well established.

Considered exceptionally safe, with broad therapeutic and diagnostic applications.

Possesses bacteriostatic effects and promotes vasodilation.

Meets technical standards for diagnostic tissue staining and performs better than many alternative dyes.

Extensively applied in wound management, including burn dressings.

Diabetic Foot Care: Challenges & Need

Management of diabetic foot problems is resource-intensive, demanding significant manpower and financial input.

The burden extends to family members, especially in low-resource settings with limited healthcare access and poor awareness.

Socioeconomic challenges are compounded in patients who are dependent on caregivers, leading to high treatment costs.

Hence, there is a pressing need for low-cost and effective treatment methods for diabetic foot ulcers in resource-limited regions.

While the surgical technique of debridement is straightforward, deciding what tissue to remove or preserve requires experience and judgment.

Methylene Blue serves as an inexpensive and reliable adjunct, guiding precise debridement and improving outcomes.

Aim of the Study

To evaluate the efficacy of Methylene Blue-guided surgical debridement compared to conventional methods in the management of Diabetic Foot Ulcers (DFUs).

MATERIALS AND METHODS:

Study Design: Quasi experimental study

Study Area: Department of General Surgery, Maharajah's Institute Of Medical Sciences, Vizianagaram

Study Duration: 12 months (June 2024 – May 2025)

Sample Size: 50 Patients.

Divided into 2 groups:

Group A – MB Dye used during surgical debridement and

Group B – surgical debridement without dye.

Inclusion Criteria

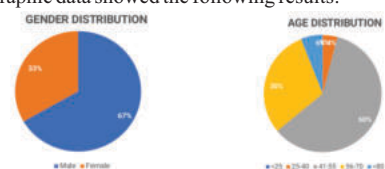
- Patients between 18 to 80 years of age with Diabetic Foot Ulcer.
- Patients who have given the consent for inclusion in the study.

Exclusion Criteria

- Patients not willing for informed consent or participation.
- Patients with peripheral vascular disease.
- Patients with grade IV and V ulcers by Wagner's classification.

RESULTS

The demographic data showed the following results:



Distribution of Ulc...

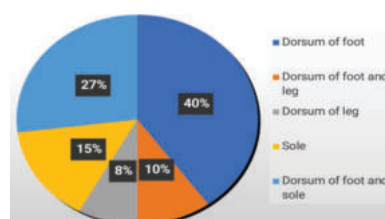


Fig: Distribution of DFU Over the Leg

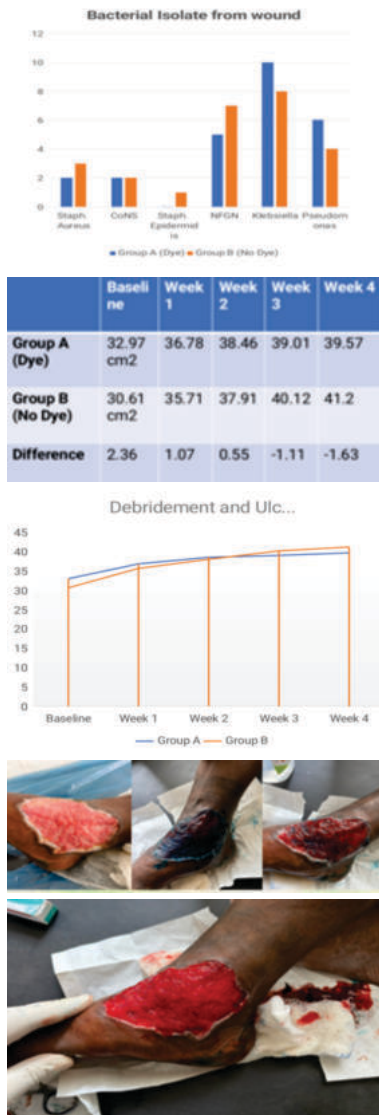


Fig: Onset of Granulation Tissue Post Debridement with Methylene Blue Dye

DISCUSSION

- 1) The demographic distribution of the study showed that majority were Males in the study population (67%) and in 41 -55years age group.
- 2) 70% were on Insulin therapy for better glycaemic control during the hospital stay.
- 3) Hypertension was the most common comorbidity present in these patients with co-existing Type 2 Diabetes Mellitus.
- 4) Distribution of DFUs were majorly seen in dorsum of the foot, dorsum and sole, sole of the foot.
- 5) With respect to the ulcer size, it was observed that as we progressed through the weeks in Group A (dye used) the difference in ulcer size relatively reduced as compared to group B. The mean size was greater in group B as compared to group A at the end of 4 weeks.
- 6) The following observations are suggestive of a more precise and better wound healing by preserving normal tissue and removing devitalized tissue, seen with MB guided surgical debridement
- 7) The onset of granulation tissue coverage was also observed to faster in case of Group A as compared to Group B (75-100% coverage seen by 4 weeks).
- 8) The results are concurrent with other studies as well:
 - Margolis et al. in her study described the predictive capacity of 61% area reduction at 4 weeks by formation of granulation tissue(1).
 - Sheehan et al, through his work also proposed a 50% wound closure at 4 weeks by granulation tissue as a good surrogate for

final healing and thus a decision point in a foot ulcer management algorithm(2)

CONCLUSION

We believe that topical use of methylene blue on open wounds is a safe and effective way of staining the surface of granulation tissue and eschar, delineating nonviable tissue from viable tissue and helps differentiate between epithelialized and non-epithelialized tissues.

Although it helps to distinguish different components of wounds and facilitates adequate debridement, it does not replace good surgical judgment.

Methylene Blue technique should be used as an useful adjunct to clinical judgment to perform precise excisional wound debridement.

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