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ROLE OF POLY HEXA METHYLENE BIGUANIDE (PHMB) IN WOUND BED PREPARATION: REPORT OF A SUCCESSFULLY MANAGED CASE

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ABSTRACT

Wound bed preparation is an art. It is a complex process that involves an understanding of the physiology of wound healing, the factors, which disrupt wound healing and methods to overcome them. Necrotizing fasciitis is one of the most challenging wounds to prepare due to rampant infection, debilitated condition of the patient and comorbid conditions. Various modalities have been tried and described for accelerating the wound bed preparation of such chronic wounds. Wound irrigation and dressing is an integral part of wound bed preparation. Poly Hexa Methylene Biguanide (PHMB) and betaine solution is a novel compound that has been introduced for that purpose. PHMB is a heterodisperse mixture of polymers and is a compound belonging to a family of antimicrobial peptides. We tried the solution for a patient with a Fournier's gangrene (necrotizing fasciitis of the scrotum and groin) and share our experience with the same.

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INTRODUCTION

Wound bed preparation is an ever-changing paradigm that has evolved rapidly in the past few years. It is defined as the global management of the wound to accelerate endogenous healing or to facilitate the effectiveness of other therapeutic measures.

Wound bed preparation has been classically managed by the TIME concept[1] which is an acronym standing for

T : Tissue Management

I : Inflammation and infection control

M : Moisture Balance

E : Epithelial advancement (Edge)

The recent concept is the "Removal of Barriers" to wound healing which includes necrotic tissue, biofilms, corrupt matrix, infection, edema, etc.

The selection of wound dressing and irrigation solution depends on these factors.

A recent introduction to the armamentarium of a wound surgeon is a solution containing polyhexanide biguanide (PHMB) and betaine (Prontosan™, B. Braun). PHMB is a heterodispersed mixture of polymers and is a compound belonging to a family of antimicrobial peptides.

The AMPs are positively charged molecules that bind to the cell membrane of the bacteria and lyse the cell by destroying the membrane integrity[2].

The betaine component aids in increasing the penetration of the PHMB by acting as a surfactant.

No resistance to PHMB has been documented and it has been shown to be superior to agents such as chlorhexidine, povidone-iodine, triclosan, silver and sulfadiazine [3].

PHMB impregnated gauze dressings have been shown to reduce the ingress of pseudomonas bacteria[4].

The study is our experience with the wound irrigation and dressing in a patient with necrotizingfasciitis of the scrotum and perineum (Fournier's Gangrene).

Case Report

A 65-year-old married gentleman, resident of Tamil Nadu, India,a known diabetic with uncontrolled diabetes, presented in the surgical emergency of JIPMER on 26th of September 2017 with complaints of gradually progressive scrotal swelling for 3 days associated with redness, severe pain, and high-grade fever with chills. He had been operated for hydrocele in a local government hospital 7 days go

and developed wound infection following surgery.

He had gone to the primary surgeon who had operated on him and he had opened the sutures and given a lavage. On examination, he was anxious, irritable, dehydrated, with a temperature of 101.6 F and tachycardia. There was significant scrotal wall edema, erythema and blackish necrotic patches over the right hemi-scrotum (Figure 1).

Figure 1 : Wound at initial presentation

The right testis was enlarged and covered with slough. The perineal region was oedematous. The clinical findings were supplemented with urgent ultrasonography of the perineal region and a diagnosis of Fournier's gangrene was made and was planned for immediate debridement and exploration. Arterial blood gas (ABG) analysis showed a picture of compensated metabolic acidosis. Fournier's gangrene severity index (FGSI) score was 9 at presentation[5].

He was admitted on an emergency basis and resuscitated. The insulin dose was titrated to control the blood sugar level. Intravenous antibiotics were started, and immediate debridement was done.

Regular dressings were changed on the SOS basis (whenever wound soakage was noted). All dressings were done in strict aseptic conditions with PHMB & Betaine irrigation solution (Prontosan™, B Braun) (Figure 2,3).

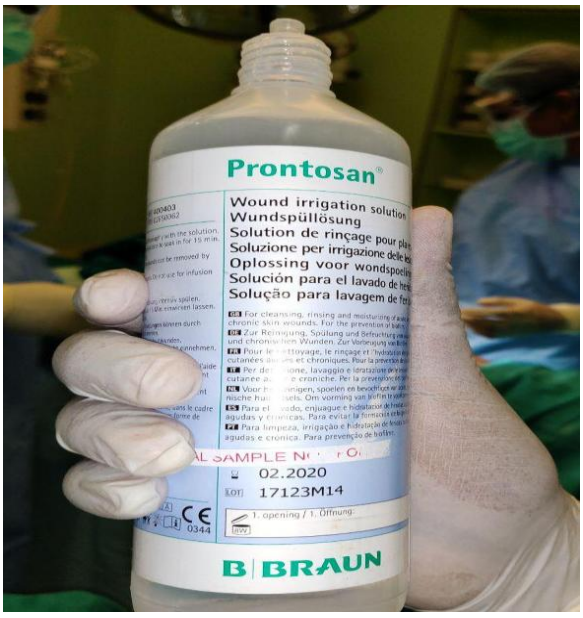

Figure 2 : PHMB & Betaine wound irrigating solution (Prontosan)

Figure 3 :Wound/lesion after first irrigation and dressing with PHMB & Betaine solution

After 2 dressing changes, the wound started improving. Healthy granulation tissue was noted at the base and edema reduced by day 4. Wound size was documented using planimetry software. Tissue culture was sent on every dressing change and antibiotics were continued till systemic septic features were seen.

A high protein diet was given with supplemental parental nutrition (Peripheral) in the initial 2 weeks to improve general condition of the patient.

There was a drastic improvement in the wound noted with PHMB use and within three weeks, the wound was well granulated.

Tissue cultures collected throughout the hospital stay indicated the improvement in the wound bed environment with PHMB solution.

The Wound culture was *Staphylococcusaureus* at initial presentation, and subsequently changed to *Streptococcusagalactiae* by the second dressing change, *Escherichiacoli* by third dressing to sterile subsequently.

Discussion

Fournier's gangrene is named after Jean Alfred Fournier, French dermatologist, who described fulminant gangrene of the scrotum occurring in young men and progressing rapidly in 1883 [6]. The understanding of the disease has since evolved to the present day.

The documented mortality rate with Fournier's gangrene is 20 to 75% and especially higher in elderly diabetics [7,8].

The use of irrigating solutions in infected wounds has been a constant source of debate.

Most surgeons vouch for the traditional copious amount of saline. The classical explanation for wound irrigation solutions use is that it reduces bacterial loads by dilution and mechanical

effects rather than direct bactericidal action [10].

PHMB has been shown to cause direct lysis of bacteria when used as an irrigating solution. The required contact period for PHMB has been shown to be 10 to 15 mins to have optimal bactericidal action [11].

This can be maintained by various methods - Constant instillation (used in our patient) (Figure 4 & 5), using PHMB soaked gauze dressings, and using negative pressure wound therapy with instillation (NPWTI) with PHMB.

The betadine component reduces the surface tension and aids in binding to the bacteria.

Figure 4 :Continous irrigation of Prontosan ™ using JETFORCE ™ Cannula

Daeschlein et al[12] the reported that it reduces pain and malodour of purulent wounds. Mueller and Krebsbach[13] have reported that it reduced slough and promoted connective tissue regeneration.

In our patient, 6 dressing changes with PHMB changed the wound from an actively discharging wound with pus and slough to a healthy wound fit for cover.

The wound culture changed from positive for bacteria to sterile with subsequent dressings with PHMB solution and the exudate was reduced by a huge margin.

These findings lead u to believe that the preliminary experience with the solution is extremely satisfactory.

More studies with an objective assessment of wound epithelization and biofilm status need to be conducted to validate the same.

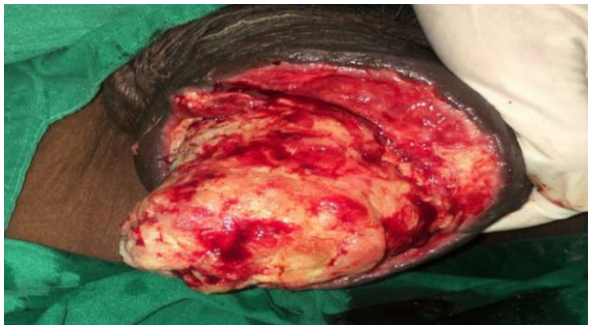

Figure 5 : Wound after 3 dressings, Irrigation and mechanical debridement

Conclusion

PHMB solution is an effective new weapon in the armamentarium of the wound surgeon in tackling difficult wounds such as Fournier gangrene in our case. Six dressing changes removed the entire slough in the wound and removed the bacterial contamination in the wound. This fact shows that PHMB solution is efficacious.

This is just a preliminary case report, more studies are needed to validate our findings.

Conflict of Interest Statement-

There is no conflict of interest.

REFERENCES:

1. Schultz GS, Barillo DJ, Mozingo DW, Chin GA. Wound bed preparation and a brief history of TIME. International wound journal. 2004 Apr;1(1):19-32.
Gangrene JA. Foudroyante de la Verge (overwhelming gangrene). Sem Med. 1883;3.

2. Sørensen OE, Cowland JB, Theilgaard-Mönch K, Liu L, Ganz T, Borregaard N. Wound healing and expression of antimicrobial peptides/polypeptides in human keratinocytes, a consequence of common growth factors. The Journal of Immunology. 2003 Jun 1;170(11):5583-9.

3. Müller G, Kramer A. Biocompatibility index of antiseptic agents by parallel assessment of antimicrobial activity and cellular cytotoxicity. Journal of Antimicrobial Chemotherapy. 2008 Mar 25;61(6):1281-7.

4. Cazzaniga A, Serralta V, Davis S, Orr R, Eaglstein W, Mertz PM. The effect of an antimicrobial gauze dressing impregnated with 0.2-percent polyhexamethylenebiguanide as a barrier to prevent Pseudomonas aeruginosa wound invasion. Wounds. 2002 Dec 1;14(5):169-76.

5. Yeniyol CO, Suelozgen T, Arslan M, Ayder AR. Fournier's gangrene: experience with 25 patients and use of Fournier's gangrene severity index score. Urology. 2004 Aug 1;64(2):218-22.

6. Meleney FL. Hemolytic streptococcus gangrene. Archives of Surgery. 1924 Sep 1;9(2):317-64.

7. Ullah S, Khan M, Jan MA. Fournier's gangrene: a dreadful disease. The Surgeon. 2009 Jun 1;7(3):138-42.

8. Sorensen MD, Krieger JN, Rivara FP, Broghammer JA, Klein MB, Mack CD, Wessells H. Fournier's Gangrene: population based epidemiology and outcomes. The Journal of urology. 2009 May 1;181(5):2120-6.

9. Dutta S, Aggarwal A, Chittoria RK, Subbarayan E, Chavan V, Reddy KS, Gupta S, Reddy CL. Role of newer technologies in wound bed preparation in Fournier's gangrene.

10. Dire DJ, Welsh AP. A comparison of wound irrigation solutions used in the

emergency department. Annals of emergency medicine. 1990 Jun 1;19(6):704-8.

11. Romanelli M, Dini V, Barbanera S, Bertone MS. Evaluation of the efficacy and tolerability of a solution containing propyl betaine and polihexanide for wound irrigation. Skin pharmacology and physiology. 2010;23(Suppl. 1):41-4.

12. Daeschlein G, Assadian O, Bruck JC, Meinl C, Kramer A, Koch S. Feasibility and clinical applicability of polihexanide for treatment of second-degree burn wounds. Skin pharmacology and physiology. 2007;20(6):292-6.

13. Mueller SW, Krebsbach LE. Impact of an antimicrobial-impregnated gauze dressing on surgical site infections including methicillin-resistant Staphylococcus aureus infections. American journal of infection control. 2008 Nov 1;36(9):651-5.