


COMPARATION OF EFFECTIVENESS OF SILVER SULFADIAZINE AND GENTAMICIN ON ABRASION WOUND HEALING

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ABSTRACT

Introduction: Abrasion is injury to skin due to trauma that affects the surface of the epidermis or superficial epithelium, especially from friction to the depth of the dermal papillae. The basic principle of abrasion treatment is to maintain moist condition in wound surface. This study aims to compare the effectiveness of silver sulfadiazine (SSD) and gentamicin cream in the process of healing abrasions.

Methods: The study used a post-test only control group design. A total of 30 samples of abrasion patients who came for treatment at the ED were sampled, and divided into 3 groups, namely wound care by providing SSD, gentamicin and tulle.

Results: The wound dimensions are assessed from the length and width measured at the 1st day, the 5th day, and the 10th day. At the 10th day assessment, SSD was found to be more effective in healing abrasions compared to other groups.

Conclusions: The use of SSD in abrasion wound treatment is believed to have advantages in proliferation phase where SSD is a sulfonamide class antibiotic that produces synergic effects along with silver which constantly absorbs exudates and bacteria, combines chloride tissue and several other proteins in the process of wound healing.

Highlights:

1. Silver sulfadiazine (SSD) in abrasion wound treatment giving the advantages in proliferation phase.
2. SSD was found to be more effective in healing abrasions than gentamicin cream.

INTRODUCTION

Wound is discontinuity of tissue caused by sharp or blunt trauma, temperature changes, chemical substances, explosions, electric shock, or animal bites, causing loss of all part of organ function, sympathetic stress response, bleeding and blood clots, bacterial contamination and cell death.¹

Abrasion is injury of skin from trauma

that affects the surface of the epidermis or superficial epithelium, due to a friction to the depth of the dermal papillae.^{2,3}

Wound healing is a complex condition involving cellular and biochemical systems in restoring general skin function. Each individual has different and unique characteristics in wound healing, with the same basic wound healing process. The process goes through exudative, resortive,

proliferative and maturation processes. The maturation phase may last for months.

Wound healing is a complex process, which gives the clinical picture of inflammation around the wound, there is a neoepithelialization of the wound edge. The process of repairing skin tissue in wound healing requires topical antibiotics as one that plays a role in wound healing.⁴

The wound healing process will occur through 3 stages that are dynamic, interrelated and continuous in the initial stages, a hemostasis process that will release and activate cytokines which includes Epidermal Growth Factor (EGF), Insulin-like Growth Factor (IGF), Platelet-derived Growth Factor (PDGF) and Transforming Growth Factor beta (TGF- β) which plays roles in neutrophil chemotaxis, macrophages, mast cells, endothelial cells and fibroblasts. In this phase, there is vasodilation and accumulation of Polymorphonuclear leukocytes (PMN). Platelet aggregates will emit inflammatory mediators Transforming Growth Factor beta 1 (TGF β 1) released by macrophages. The presence of TGF β 1 will activate fibroblast to collagen synthesis.^{5,6}

Closed and semi-closed wound closure applied in the first 48 hours after injury, can maintain tissue moisture and optimize epithelialization.

In the second phase, the proliferative phase of the fibrin clot produced in phase I is release, sign of inflammation begin to decrease. The tissue formed from a new capillary coil, which supports collagen and the basic substance, is called granulation tissue.

Maintain the wound in moist condition with the presence of exudates but do not become too moist. Some topical antiseptics and antimicrobial materials can speed up the wound healing process. Among them are dimethyl sulfoxide (Rimso-50), silver sulfadiazine (Silvadene), benzoyl peroxide (Benzac,

Brevoxyl, Desquam, Triaz, ZoDerm), oxyquinoline (Trimo-san Vaginal Jelly), and gentamicin (Garamycin). Experts and consensus in Canada and the wound management advisory board concluded that wound care was closed using silver, topical and systemic antibiotics gave excellent results in the wound healing process.^{3,7,8,9,10}

Welsh conclude that SSD was far more effective than betadine in reducing the process of acute wound healing. The silver component as a dressing has been used in wound healing and silver product apparently has positive effect on wound healing and able to make wound free of germs or microbes, moisture is one of the main factors in wound healing.

The silver component helps the antibiotics contained in the SSD to optimize its effect, believed to be able to help the wound healing process, especially in the 2 initial phases of wound healing. SSD provide benefits in reducing metalloproteinase matrix levels and increasing the frequency of apoptosis. Wright et al concluded that silver nanocrystalline is able to reduce metalloproteinase matrix and increase cellular response to apoptosis.^{3,5,11}

METHODS

The design of this study was experimental with a post-test only control group design. There are 30 samples was randomly divided into 3 sample groups. The sampling technique used in this study was accidental sampling in patients who met the inclusion criteria.

The subject of the study was abrasion patients treated at Emergency Department of Zainoel Abidin General Hospital. Each subject performed a debridement procedure using normal saline to get rid of debris and dead tissue. Furthermore, the measurement of abrasion. The dimensions of the wound are measured in length and

width in centimeter. The research intervention was carried out by administering topical silver sulfadiazine cream on abrasions and then covered with neutral tulle, in the second treatment group topically administered gentamicin cream on abrasions and then covered with neutral tulle, in the third study group only neutral tulle was given and then covered with sterile gauze.

On the 5th day, the dressing was replaced according to the wound replacement procedure. After drying, the dimensions of the wound are measured and documented. Then the wound is closed again by giving back the treatment as in the previous stage. Furthermore, on the 10th day, the wound dressing was replaced again, then computerized measurements of abrasions were performed again using the Correl Draw 7 program.

Normality test using the Kolmogorov-Smirnov test and homogeneity with the Levene test. Then analyzed by using one-way analysis of variance (ANOVA). If the results show differences, then the analysis is continued by using the Duncan test.

RESULTS

The results of the Kolmogorov-Smirnov test found that the p value for the gentamicin group, SSD group and tulle group (control) was >0.05 , so it can be concluded that the data is normally distributed. Significant values for the variance uniformity test using the Levene test showed 0.414 ($P>0.05$). This matter indicates that the data obtained is homogeneous.

The results of the one-way ANOVA statistical test showed that there was a difference with the significance value of 0.00, this showed a difference ($P<0.05$) in the study group. These results indicate that administration of gentamicin, SSD and tulle has an effect on the healing

process of abrasions and then followed by Duncan's test showed that the group treated with SSD creams in healing abrasions on the treatment group using gentamicin or tulle cream which were evaluated for abrasions on the 10th day was significantly different ($P<0.05$) in healing abrasions. These results prove that SSD creams is more effective in abrasion wound treatment.

DISCUSSION

The wound closure process, will run twice as fast in moist conditions as in under scab, this principle prevents the formation of scab to optimize cell transfer and reduce the possibility of scars. This will make wound healing faster and is believed to directly accelerate the process of epithelialization. In this study, the healing process of abrasions in each group was in a moist condition and the average showed the wound healing process went well. In each group treated with $P<0.00$ proved to be significantly influential in the process of healing abrasions ($P<0.05$). this research shows that administration of gentamicin cream, SSD cream and tulle can trigger the wound healing process consistently during the healing period. However, clinically there are differences in the speed of healing of abrasions, this is believed due to the components contained in abrasion wound care material used.

In this study, SSD cream in healing abrasions provide a better role than gentamicin cream and groups that use tulle only, it is believed that the role of antibiotics Sulfadiazine proves after multiple test SSD cream obtained significantly different ($P<0.05$) in the evaluation of healing abrasions on the 10th day. Diessemond in his study strengthened the theory which concluded that Sulfadiazine is an antibiotic sulfonamid group produces a synergistic effect with siver which is in subinhibition level. Sulfadiazine works as a competitive

inhibitor of para-aminobenzoic acid (PABA) which is a substrate of dihydropteroate synthetase enzyme. This inhibition will then inhibit the formation of folic acid bacteria.¹²

Woodward in its journal analyzes the basic use of silver with SSD products which explains that silver has a positive effect on wound healing by shifting zinc from metallothionin, changes in metalloprotein levels in wound, and affecting inflammatory cytokines. Preliminary evidence shows that SSD is useful for increasing epithelialization by as much as 28% in clean wound.¹⁵

The researchers concluded that the silver component helped the role of antibiotics contained with it in SSD cream preparation to increase its effect, so that would more quickly help the wound healing process, especially in the initial two phases of wound healing and plays a role in reducing the process of acute wound healing which greatly contributes to the process of re-epithelialization with a vital role in the re-epithelialization process capable of reducing metalloproteinase matrix so that accelerate the wound healing process. In this study, SSD results are more effective in healing wounds.

Kucan et al, examined the effects of SSD in the development of bacteria, SSD are very effective in reducing bacterial numbers to 105/gr of tissue.⁴ The silver component constantly absorbs exudates and bacteria, combines chloride tissue and several other proteins in the process of wound healing.^{7,11} Wright et al in their study concluded that silver nanocrystalline is able to reduce metalloproteinase matrix and increase cellular response to apoptosis, so SSD cream provide benefits in reducing metalloproteinase matrix levels and increasing the frequency of apoptosis.¹²

Sharma R in his study looked at the

silver effect on wound healing in a prospective study of 50 patients with all types of wounds that were treated with nano silver compared to other methods such as using povidone iodine, vaselin and others, the conclusion that silver cream combines the benefits of antiseptic effects and maintain wound in moist conditions, this is believed when in contact with the exudate, silver ions are removed and moved into the wound then eradicate the bacteria and help reduce the risk of infection. The polyurethane matrix creates moist conditions, optimize the process of wound healing.¹⁴

CONCLUSION

We conclude that abrasion treatment using SSD cream is more effective than using gentamicin cream.

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CONFLICT OF INTEREST

None.

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AUTHORS CONTRIBUTION

All authors contributed to the study design, analysis data, methodology, manuscript wrote and revision.

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