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RESEARCH ARTICLE
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ANTI-INFLAMMATORY IMPACT: MULTIPLE USE OF TOPICAL THERAPEUTIC AGENTS IN WOUND REPAIR

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ABSTRACT

Objective: To assess the multiple therapeutic agents and an anti-inflammatory role in wound management

Place and duration of the study: The study was done at Al-Tibri Medical College and Hospital, from Jan 2024 to March 2025.

Methodology: The experimental study was done with 24 numbers of male albino rats, the rats were randomly selected between the weights of 150-250gms. The animal were divided into three groups, control treated with normal saline, another treated with eusol and one is treated with zinc oxide for 14 days. The subcutaneous wound was created on the dorsal surface of the rats of 2x2cm^2 after anesthetized with ethanol. The sample were taken from the margins of the wound at day 3, 7 & 14. The tissue were processed and stained with Haematoxylin & Eosin for microscopy. At x400 the inflammatory cells were calculated through micrometry. The data were evaluated through SPSS, mean±SD of cells and compare after applied one way ANOVA followed by post hoc tuckey's test. The level of significance was set at P=<0.05.

Results: Total Mean of neutrophil count found to be at low in group treated with zinc oxide, P=<0.001 as compared with others. Mean lymphocyte count was increased in zinc oxide treated group on day 3and 7, P=<0.001 that stimulate the granulation process.

Conclusion: The significant rapid wound repair was found in topical applied zinc oxide group, and decreased cell count evidence the anti-inflammatory impact at day 3 & 7 as compared to others. Zinc oxide is safer, cheaper and easy available compound with potent role in wound management.

Keywords: wound, anti-inflammatory, zinc oxide, neutrophil, lymphocyte

INTRODUCTION

There are so many therapeutic agents available for the wound care.[1] Still the researcher are focused to add more ideal options in the list of wound care therapeutics. In surgical world, the wound care and its management always put under the scientific inquiry.[2]Biomedical ingredients having great biomedical functionality with minimum adverse effects. The most potential trace element like zinc, that evidence the potent healing ability as compared with others.[3] Zinc is a trace element, that composed of multiple enzymes, that are essential for healing and health care.[4] Mainly collagen formation is a key element of the zinc that had a potential to reduce the wound size and wound repair.[5] Zinc oxide (ZnO) is an inorganic compound that founds to be non-toxic according to various studies. Topical preparations of zinc oxide composed of anti-oxidants with low risk of carcinogens, and due to these properties easily use in different creams, lotions, and sunscreens.[6] Hospital acquired surgical wound infections are more critical than other risk factors. Utilization of accurate antiseptic solutions make it possible, to cure it from multiple microorganisms. One of the choice are superoxide solutions with antibacterial activity against huge array of pathogens. EUSOL is one of them, with composition of hydrochloride with lime, boric acid, sterile water and bleaching agent. EUSOL is a potent disinfectant, and covers the open wound and prevent from the surrounding hospital based infections. Wound treated with super oxide solutions shows early re-epithelization and stimulate the granulation tissue formation at the margins of the wound. The background of this study to evaluate the two different cheaper, easily available and most commonly used preparations in wound management. As the wound care still a biggest challenge for surgeons and medical experts.

METHODOLOGY

This experimental study was done at research lab and animal house of Al-Tibri Medical College and Hospital. From Jan 2024, to May 2025. Total 24 male albino rats were randomly taken from the animal house, after an ethical approval from the concerned authority. The animal were selected with weight of 150-250gms, all diseased animal were excluded from the study. The animal were divided into three different groups on the basis of the treatment plan. Group A was control applied normal saline topically, Group B was topically treated with zinc oxide 10% and Group C was treated with EUSOL solutions, applied topically once daily for 14 days. After shaving the dorsal surface of the rat, the wound was created under anesthetized condition. The wound of $2x2cm^2$ and measure with normal scale, and kept all animals separately in different cages with maintained day and night cycle. The sample was taken from each group from the wound margins, on day 3,7& 14. The tissue was processed and passing through the staining process of Haematoxylin & Eosin (H&E) stain. For microscopy the light microscope was used at 400x, the micrometry was done for cell count like neutrophil and lymphocytes. The data was analyzed through SPSS, followed by Mean±SD and applied one way ANOVA followed by post hoc tukey's test to compare the mean among the groups. The level of significance was set at $P=<0.05$.

RESULTS

The mean weight of rats in Group A was 162.45±1.21, Group B was 152.45 ±0.21, and in Group C was 184.34±1.35.

Neutrophil count: Mean cell count as shown in Figure 1.1

The Mean±SD of neutrophil/x400 on day 3 was in Group A 55.15±0.24, Group B was 30.25±1.48 and Group C was 47.32±1.56.

The Mean±SD of neutrophil/x400 on day 7 was in Group A 48.17±0.34, Group B was 21.25±1.88 and Group C was 42.032±0.56.

The Mean±SD of neutrophil/x400 on day 14 was in Group A 42.58±1.98, Group B was 19.32±1.48 and Group C was 40.32±1.56.

Lymphocyte count: Mean cell count as shown in Figure 1.2

The Mean±SD of lymphocyte/x400 on day 3 was in Group A 39.15±0.74, Group B was 60.57±1.88 and Group C was 44.92±0.56.

The Mean±SD of lymphocyte/x400 on day 7 was in Group A 41.52±0.51, Group B was 42.21±1.36 and Group C was 50.12±0.81.

The Mean±SD of lymphocyte/x400 on day 14 was in Group A 37.02±1.57, Group B was 29.52±1.63 and Group C was 37.08±0.17.

Comparisoof Neutrophil count Among different Groups on days of sampling:

On Day 3 compare the mean cell count among GP B vs GP A, the P=<0.001, GP B vs GP C P=<0.001 shows significant decreased neutrophil count in zinc oxide treated group as compare with others. This shows the potent anti-inflammatory effect of zinc oxide in wound management.

On Day 7 compare the mean cell count among GP B vs GP A, the P=<0.001, GP B vs GP C P=<0.001 shows significant decreased neutrophil count in zinc oxide treated group as compare with others. This shows the similar anti-inflammatory effect of zinc oxide in wound management

On Day 14 compare the mean cell count among GP B vs GP A, the P=<0.001, GP B vs GP C P=<0.001 shows significant decreased neutrophil count in zinc oxide treated group as compare with others. This shows the infected wound in GP A & C.

Comparison of Lymphocyte count Among different Groups on days of sampling:

On Day 3 compare the mean cell count among GP B vs GP A, the P=<0.001, GP B vs GP C P=<0.001 shows significant increased number of lymphocyte count in zinc oxide treated group as compare with others. This shows the potent anti-inflammatory effect of zinc oxide in wound management due to availability of immune cells at large scale near the margins of wound, that shows defensive mechanism of cells.

On Day 7 compare the mean cell count among GP B vs GP A, the P=<0.001, GP B vs GP C P=<0.001 shows significant number of lymphocytes according to the phase of healing in zinc oxide treated group as compare with others. This shows the similar anti-inflammatory effect of zinc oxide in wound management

On Day 14 compare the mean cell count among GP B vs GP A, the P=<0.001, GP B vs GP C P=<0.001 shows normal range of cell count in term of healing process in zinc oxide treated group as compare with others. This shows the infected wound in GP A & C.

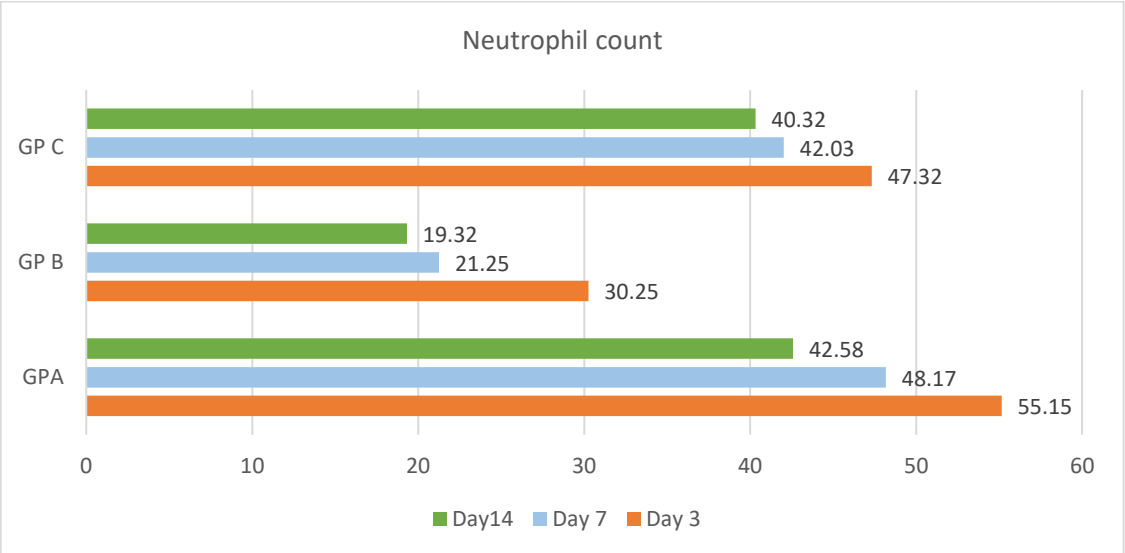

Figure: 1.1 shows Mean Neutrophil count among different therapeutic groups

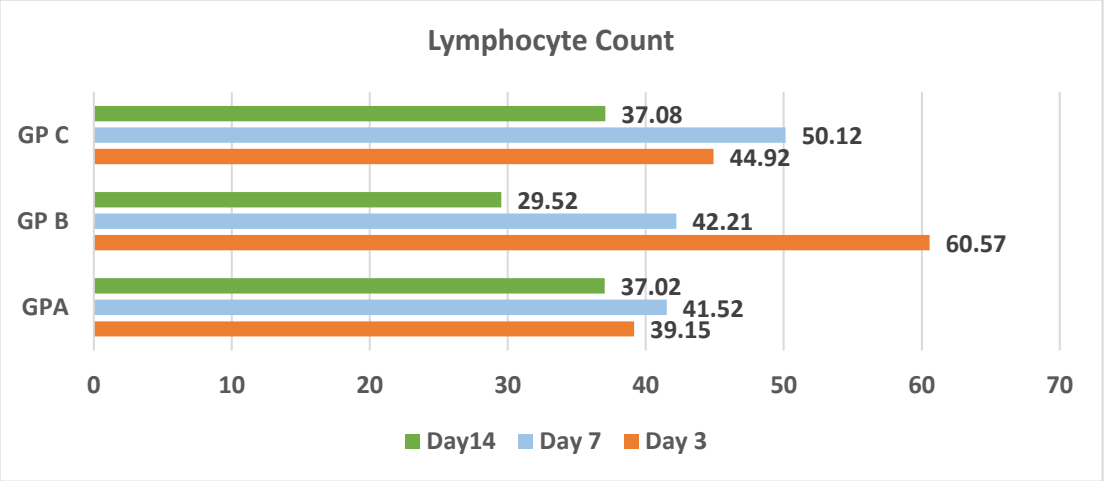

Figure: 1.2 shows Mean Lymphocyte count among different therapeutic groups

DISCUSSION

Re-epithelization is a process that depends on various factors that stimulates the healing process. Zinc oxide is one of antioxidant having a potential for healing and skin repair. One of the double blind randomized trial was done on human trial, to evaluate the anti-inflammatory effect of topically applied zinc oxide 1.1% water based. Keratinocyte proliferation was observed in a model treated with zinc, similar in this study the group B shows significant healing and anti-inflammatory effect as compare with others.[10] In accordance with other study, the assessment of tripeptide-copper complex in comparison with zinc was applied in rabbit model. The application over the open wound concluded that granulation process was faster in copper complex while the neutrophil count was found to be on lower side in zinc applied group. The results of the present study evidence the remarkable decreased in neutrophil count rather than others.[11] The research was conducted on rabbits to evaluate the efficacy of two different agents in treatment of full thickness wound. They used zinc oxide ointment and platelet rich plasma (PRP), they found the quick recovery phase and complete wound closure in PRP group as compared to zinc oxide on day 15. Recent study shows the potential evidence of zinc in healing process on day 7 & 14.[12] The calendula extract loaded in zinc oxide preparations, had great impact in wound model of animal study. The zinc based nanoparticles embedded calendula extract was used in burn wound that accelerates the anti-inflammatory, anti-oxidant properties during re-epithelization process. Likewise in the present study the zinc based cream documented the remarkable healing effects with anti-inflammatory role.[13] Total 32 Nigerian children with forty three pyomysitis abscess, were enrolled in randomized clinical trial. All subjects had a surgical wound with drainage and twenty one days antibiotic coverage. Two dressing agents were applied twice/day over the open wound, one is honey based and other eusol soaked dressings and was observed on day 1,3, 7,14 & 21. The group treated with honey soaked dressing shows clean and clear wound margins and fastest healing potential with short duration of hospitalization as compared with eusol. Similar finding was observed in this study that the eusol treated wound shows increased neutrophil and decreased lymphocyte count on day 7 & 14.[14] In accordance with the study that based on conventional treatment of wound, with fifty numbers of rabbits and treatment based on neem oil, eusol and tetrachlorodecaoxide (TCDO). They concluded the rapid epithelization, angiogenesis, and disinfected wound in (TCOD) in respect to the neem oil and eusol. The findings agreed with our conclusions, that eusol shows slow process of epithelization and inflammatory response.[15] 130 patients were included in one of the randomized trial, out of 65 treated with eusol dressing and other 65 with collagen granules dressing. The traumatic wound was found significant results in terms of healing, discharge, granulation and cost effective in collagen granules dressing in comparison with eusol. A present study results concluded the similar evidences in eusol treated group.[16]

CONCLUSION

The study results shows significant anti-inflammatory impact of topical zinc oxide with marked decreased neutrophil count, and potential increased of lymphocyte count on day 3 & 7 specifically. The significant amount of lymphocyte evidence the early mobilization of immune cells at the wound site, which stimulate the early granulation process and stimulate the keratinocyte proliferation. Both are conventional therapeutic agent and cost effective.

Conflict of Interest:

No conflict of interest

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