

Research article

A comparison between *Aloe vera* and silver sulfadiazine on second-degree burns in local male rabbits: A Histological study

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Abstract

The present study carried out on fifteen local male rabbits six months in age, the animals divided for three groups five animals for each, after general anesthesia of all animals, the thoracic region was exposed for three seconds to 2 cm² wide electrical heating rod to reach second-degree burn. The first group exposed to Vaseline only as a sham control group, second group exposed to silver sulfadiazine cream 0.2% and third group exposed to the Aloe vera (85%), all groups treated continuously once time for fifteen days, and specimens collected from affected area during 5,10 and 15 days after treatment for histopathological evaluations. The results of the study revealed semi like frequent healing process in all groups after five days, whereas at the ten days after treatment the second and third groups showed noticeable healing processes than control group, while at fifteen days from treatment the animals treated with Aloe vera showed approximately complete healing process characterized by presence of thick keratinized layer with profuse collagen in the dermis as well as new formation of hair follicle with noticeable hyperplasia of epidermal layers when compared with second and first groups.

Keywords: Aloe vera, Burns, Silver sulfadiazine, Male rabbits.

Introductions

Burn is severe injury that may result in loss of tissue fluids and is associated with infection, destruction, pain and even death (1). Burn healing is a complex process including dynamic series of events involving clotting, inflammation, granulation tissue formation, epithelialization, collagen synthesis and tissue remodeling (2). Healing of burns injury is still difficult to achieve although the evolution of antiseptic, medications and advanced operation procedures (3). Death and disability are a significant incidences associated with Burn injuries. The aim of treatment of burns is to prevent infections and achieve the best functional and aesthetic results in a shorter time with lower costs as well as avoidance of excessive scaring as soon as scar has formed, it is known to be difficult to treat because of its tendency to cause hypertrophy and

contracture (4). Burns are often followed by sepsis, so that the topical antimicrobials are always given prophylactic ally to prevent infection complication and most common topical treatment for burns injury is silver sulfadiazine 1% cream (5). It has broad antimicrobial activity; it is bactericidal for many gram-negative and gram-positive bacteria as well as being effective against yeast (5, 6). Several studies state that this cream should not be used for long time on extensive wounds due to it delayed wound healing as well as adverse reactions and side effects have been mentioned such as risk of resistance, and leucopenia (7). *Aloe vera* belongs to Asphodelaceae (Liliaceous) family, with botanical name is *Aloe barbadensis miller* it grows mainly in the dry regions, and contains many potentially active constituents such as; vitamins, enzymes,

minerals, sugars, lignin, saponins, salicylic acids and amino acids. (4). *Aloe vera* has been used in traditional medicine of many cultures and said to be beneficial in the treatment of disorders as arthritis, acne, dermatitis, gout etc. and peptic ulcers as well as burns (8). It reduces the risks of infection and accelerate wound healing by stimulation fibroblast proliferation, angiogenesis, deposition of collagen and production of growth factors in various animal models (9, 10, 11) The oral aloe vera might be valuable for reducing glucose or cholesterol levels, its topical form may be effective for genital herpes and psoriasis, but it is not effective for injuries induced by radiation (12). The study aimed to compare histopathologically the healing process between silver sulfadiazine and Aloe vera cream on second-degree burns in rabbits as experimental model.

Materials and Methods

Ethical approval

The Animal Ethical Committee of Veterinary Medicine College, University of Al-Qadisiyah, Iraq, has approved the present study under permission No: 405

Results

No mortality was noticed in the rabbits during whole period of the study. The results of the study in the five days had semi like changes for all groups of study whereas first group registered after application of Vaseline there was high infiltration of inflammatory cells with profuse collagen as well as hyperplasia and proliferation of epidermis as noticed in Figure (1). On the other hand the second group treated with silver sulfadiazine at same period discovered there was high infiltration of inflammatory cells with profuse collagen Figure (2), relatedly, the third group in the five days of study the Aloe Vera revealed there was sever hemorrhage, high infiltration of inflammatory cells with profuse collagen Figure (3). After ten day of exposure all animals to the different treatments there was a contrast in the results expressed in the first group showed a

Fifteen local male rabbits, weighing 1500±250 gm, age 6 months were used in this study, supplied with food and water adlibitum, animals were put in appropriate cages. Anesthesia was introduced for all animals using a mixture of ketamine (40 mg/kg B.W) and xylazine 2% (5 mg/kg B.W) by intramuscular injection, The dorsal hair of the rabbits of the thoracic region of all animals were shaved and cleaned with povidine iodine, the skin was exposed for 3 seconds to electrical heating rod with 2 cm²., the epidermis and whole thickness of the dermis were involved. The first group exposed to Vaseline only as sham control group, Second group exposed to silver sulfadiazine cream 0.2% and third group exposed the Aloe vera 85%, the treatments in all groups continued daily for fifteen days, and specimens collected form affected area at 5,10 and 15 days after treatment for histopathological evaluation. Prior to examination, the histologists were not informed about the experimental conditions of the samples, four slides containing three sections at least from each animal were analyzed.

complete sloughing of keratinized layer with destruction and thinning of epidermis besides there was a destruction of hair follicle with few collagen in the dermis .as well as a marked ulcer in the epidermis which extend to dermis and absence of hair follicles with few collagen network Figure (4). The second group, which treated with silver sulfadiazine as clarified in Figure (5), appeared a sloughing of keratinized layer of epidermis additionally there was formation of very small new blood vessels with fibrosis in dermis and marked complete absence of hair follicles. While the third group seemingly recorded an improved healing process when it denoted in Figure (6) there was a thickening of keratinized layer with marked downward hyperplasia of epidermis also profuse collagen with infiltration of inflammatory cells in the dermis with

observed formation of very small new blood vessels and proliferation of fibroblast. After fifteen days, beginning of study, the sham group as in Figure (7) demonstrated there was an incomplete healing with presence of sever hemorrhage also there was a mild proliferation of the basal cells of epidermis and downward hyperplasia of the epidermis layer in the neighboring sides as well as mild proliferation of collagen in the dermis had shown. With better healing process as appeared in the second group included application of silver sulfadiazine elucidated in Figure (8) there was a profuse granulation tissue which characterized by formation of new blood vessels and profuse fibrosis and hyperplasia of epidermal layers. The third group reached the best healing process as explicated in Figure (9), application Aloe Vera for continuous fifteen days discovered there was a thick keratinized layer and

hyperplasia of epidermis layer was noticed apart from profuse collagen in the dermis in addition to that a new formation of hair follicles.

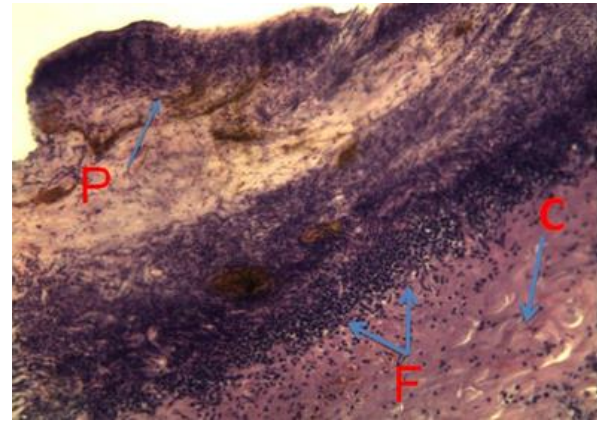


Figure (1): sham group five days there is high infiltration of inflammatory cells (F) with profuse collagen (C) hyperplasia and proliferation of epidermis (P) (10X.H and E Stain)

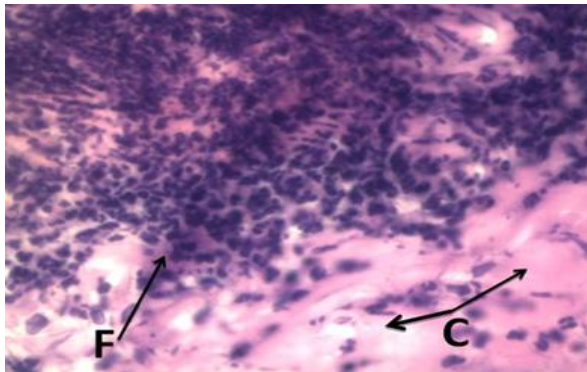


Figure (2): silver sulfadiazine group five days there is high infiltration of inflammatory cells (F) with collagen (C) (40X H&E stain)

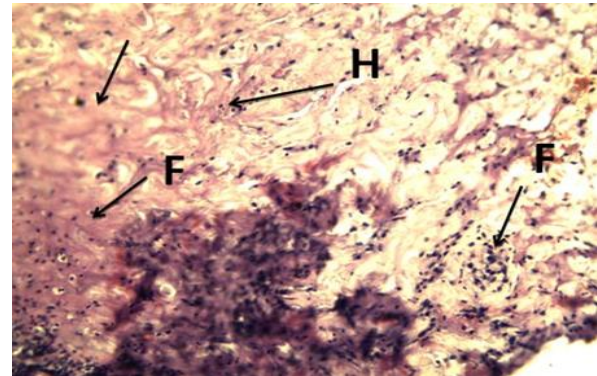


Figure (3): Aloe vera grope five days there is sever hemorrhage (H) high infiltration of inflammatory cells (F) with profuse collagen (C) (40% X H and E stain)

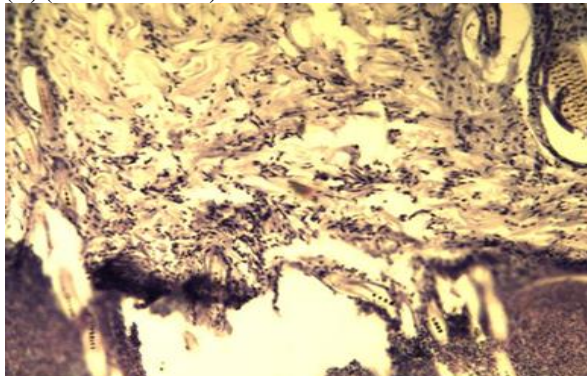


Figure (4): sham group ten days complete sloughing of keratinized layer with destruction and thinning of epidermis, destruction of hair follicles with few collagen in the dermis. Marked ulcer in the epidermis which extend to dermis absence of hair follicles and few collagen network 10X (H&E stain)

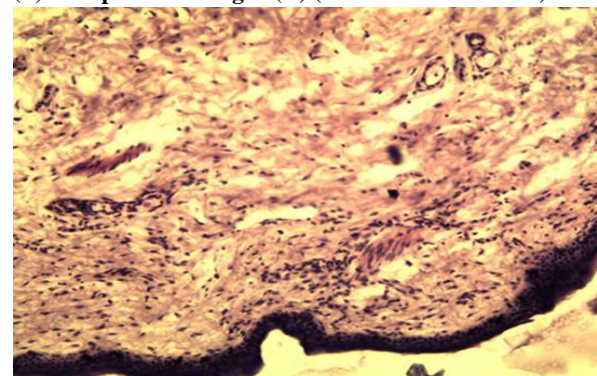


Figure. (5) silver sulfadiazine group ten days sloughing of keratinized layer of epidermis, formation of very small blood vessels with fibrosis in dermis and complete absence of hair follicles (10X) (H&E stain)

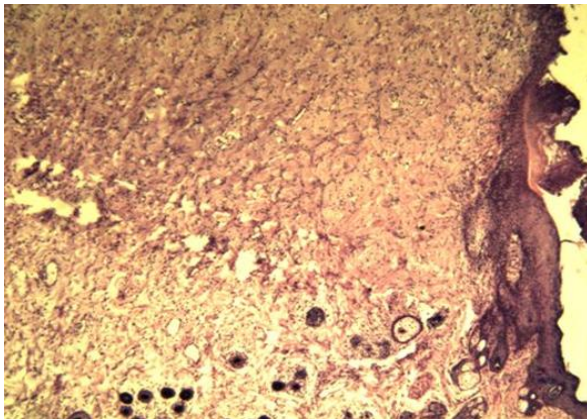


Figure (6): *Aloe vera* grope ten days thickening of keratinized layer with marked downward hyperplasia of epidermis profuse collagen with infiltration of inflammatory cells in the dermis formation of very small new blood vessels with proliferation of fibroblast (10X) (H&E stain)

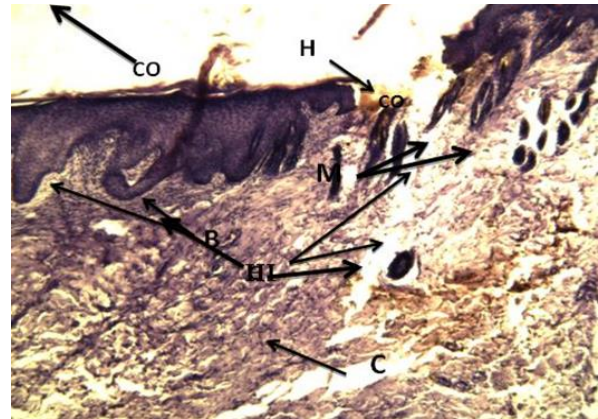


Figure (7): sham group fifteen days, incomplete healing (IH) there is presence of sever hemorrhage (H), mild proliferation of the basal cells of epidermis and downward hyperplasia of the epidermis layer in the neighboring sides (B), mild proliferation of collagen in the dermis (C) (40X H&E stain)

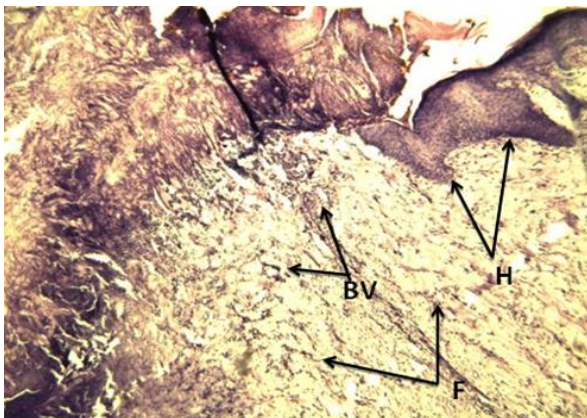


Figure (8): Silver sulfadiazine group fifteen days profuse granulation tissue which characterized by formation of new blood vessels (BV) and profuse fibroses (F) and hyperplasia of epidermal layers (H) (10X H&E stain)

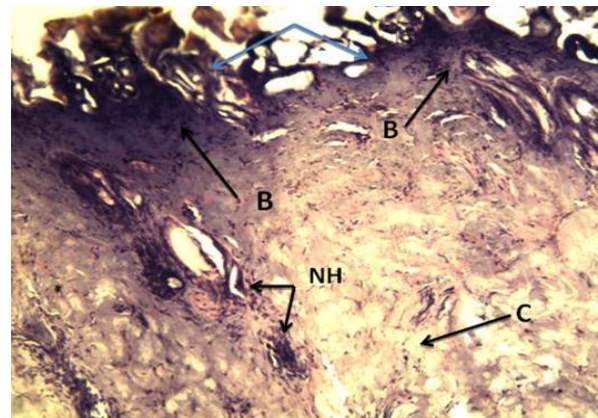


Figure (9): *Aloe vera* grope fifteen days, there is thick keratinized layer(K) hyperplasia of epidermis layer (B) profuse collagen(C) in the dermis and new formation of hair follicles (NH) (10X H&E stain)

Discussion

Topical treatment of burn is very important due to the burn considers as the most important life threatening issues and different agents have been applied for this purpose, some of them have been used for a long period. The ideal agent, which applied topically, may cure the burn in a short time with best squeal, decrease the mortality rate and morbidity by prevention of sepsis and bacterial contamination and can be accessed easily and not expensive. The researches to find out such agents are ongoing. Clinical investigations propose that *Aloe vera*

preparation quicken wound healing (13) In vivo studies pretended that *Aloe vera* booster wound healing by directly motivating the briskness of macrophages and fibroblasts, *Aloe vera* can activate fibroblast to increase both proteoglycan and collagen synthesis and so to promote repair of tissue. Some of the action precept seem to be polysaccharides consist of several monosaccharides, dominantly mannose, it has been descried that mannose 6; phosphate the main sugar included in *Aloe vera* may be fractionally accountable for the healing of wound (14).

Mannose 6-phosphate can interconnect to the receptors of growth factors on the surface of fibroblasts and thereby improve their activity (15), these results agree with what we found that Aloe vera give a perfect and better healing process when compared with others. Moreover, acemannan complex carbohydrate separated from Aloe vera has been noticed to fasten healing of wound and decrease radiation induced skin reaction (16). The mechanism of action of this carbohydrate shows to be two folds, first acemannan is a potent activating of macrophage agent and thus may stimulate the production of fibrogenic cytokines (17,18). Second growth factors may squarely bind to acemannan enhancing their residing and overstaying their stimulation of granulation tissue (16). Debarring of dermal ischemia which caused by burns can be done by the therapeutic influence of Aloe vera. In vivo analysis of burn injury shows that Aloe vera acts as inhibitor of thromboxane A₂, mediator of progressive damage of tissue (14, 19). Many other mechanisms have been suggested to explicate the activity of Aloe vera containing motivating of the complement connected to polysaccharides (20). According to what previously mentioned facts we think that Aloe vera has the key to stimulate production of growth factors as well as accelerate proliferation of cells. Silver sulfadiazine has used as the most widely used topically in burns, The resolving of this compound to give silver has an effect for prevention of termination most microorganisms as well as fungi (21). It also increase epithelialization

and inhibition of matrix metalloproteinases this action can accelerate the process of wound healing (22, 23). In deep wound, silver sulfadiazine may delay scar tissue separation and reepithelization (24, 25). As well, many complications were seen in the treatment with nitrofurazone for long period in such as hypertrophic and atrophic scar formation (26, 27). Transient leucopenia and renal toxicity has been detected when patient treated with silver sulfadiazine and this may due to toxicity of bone marrow and affection on kidneys (16, 18). In an experimental study of burned rabbits; revealed that silver sulfadiazine yielded a less effecting of this compound in terms of epithelialization, maturation of dermis and formation of scar (28) and this compatible with our study. Astoundingly a study was achieved to discover the effect of silver sulfadiazine on burn wound in rats model unveiled that this compound increase the process of healing statistically and histopathologically when compared with *Nigella sativa* (29). The recent study is accord with (24) who concluded that Aloe vera gave good results of wound healing than that of silver sulfadiazine. In conclusion the Aloe vera facilitate healing of wound in burned rabbits better than silver sulfadiazine with better healing cascades, The process of epithelialization was accelerated in the patient skin treated with Aloe vera than that in those treated with silver sulfadiazine due to its efficiency in antimicrobial and cell proliferation effects.

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