

Efficacy of Topical Application of 1% Acetic Acid in Eradicating Pseudomonal Infections in Burn Wounds

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ABSTRACT

Objective: Determine the efficacy of topically applied 1% acetic acid in burn wounds in eradication of *Pseudomonas aeruginosa* infection.

Study Design: Retrospective observational study.

Place: Department of Burns, Civil Hospital, Karachi

Duration of Study: Study was undertaken from January 2006 to December, 2009.

Patients and Methods: The study included all adult burn patients, aged between 21 to 40 years, of either gender who had culture reports showing *Pseudomonas aeruginosa*. Patients belonged to urban and rural areas, had TBSA (Total body surface area) burnt between 15-35%. All these patients received application of 1% acetic acid for 10-14 days.

Results: *Pseudomonas aeruginosa* infection was cleared from 65 (90%) out of 72 cases and wound was free of *Pseudomonas aeruginosa* infection in 10-14 days.

Conclusions: 1% acetic acid is very effective in treating the *Pseudomonas Aeruginosa* infection in burn patients. In this study on burn patients between 15-35% TBSA, 1% acetic acid was very effective in eradicating *Pseudomonas Aeruginosa* infection in 90% of the patients.

Key words: *Pseudomonas Aeruginosa*, Acetic Acid, Burns.

INTRODUCTION

It has been observed that Acetic acid has been utilized in medicine for years for the eradication of infection of wounds.¹ In previous studies it was reported that infection prevention in burns patients is an important task, because after burn injury infection is the major cause of mortality.²⁻³ Loss of skin barrier and vascular supply, favourable environment for bacterial growth and metabolic disturbances may lead to immune suppression and in turn make them prone to infection.⁴⁻⁷ So burn wound is the frequent site of sepsis in such patients.⁸ The burnt area, as a result of exposure to very high temperature is supposed to be free of microbial contamination in the initial few hours and after about 48 hours, the gram-positive bacteria in the depth of sweat glands and hair follicles heavily colonize the wounds.⁹⁻¹¹

The topical and systemic antimicrobial use, early excision and grafting dramatically changed the survival frequency in burn patients. However increased resistance to antimicrobial agents insisted for the search of alternative methods to prevent and combat deadly infections in burn patients.¹² A number of preparations have been previously tested and include various silver preparations, topical photodynamic therapy, chitosan preparation, new iodine delivery formulations, phage therapy, honey and essential oils.¹³ Research continues to provide new modes of therapy to address the growing multidrug resistance.¹⁴

The purpose of this study was to evaluate the effectiveness of 1% acetic acid as a local antiseptic agent in terms of eradication of *Pseudomonas aeruginosa* infections in burns patients.

PATIENTS AND METHODS

This retrospective study was undertaken at department of Burns, Dow University of Health Sciences, Civil Hospital; Karachi included the patients managed between January 2006 to December 2009. The study included all adult patients of either gender who had burns and their culture reports showed *Pseudomonas aeruginosa*.

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All the other, burn cases having *Pseudomonas aeruginosa* associated with other micro-organisms on culture report and also those patients with known Diabetes, liver disease and history of heavy smoking were excluded from the study. Laboratory tests such as CBC, Blood Sugar, Albumin level, culture and sensitivity were done.

1% acetic acid was obtained commercially or prepared in Burns Centre. We made it by mixing 10cc of pure acetic acid in 1 liter of normal saline from which 10cc was discarded to make 1 liter of 1% acetic acid. Before application of 1% acetic acid on culture proven *Pseudomonas aeruginosa* infected burns, we stopped all systemic and local antibiotics. Mild infections were washed with normal saline and in heavy infections debridement under general anesthesia was done and wound surface was covered by gauze soaked in 1% acetic acid. Daily dressings with acetic acid were done. The wounds were observed and prognosis was evaluated on clinical observations like decrease in soakage of dressing and quantity of pus on wound surface. We stopped dressing on 10-14 days on the basis of these observations. The clinical improvement in the wound condition was assessed and wound swabs were sent 3 days after the stoppage of local application of acetic acid.

RESULTS

Out of 72 patients, 39(54.2%) were males and 33(45.8%) females. The minimum age of our study population was 21 years and maximum age was 40 years. The mean age was 27.47 ± 6.76 years. fifty (69.4%) patients belonged to urban area. The mean TBSA (Total Body Surface Area) burnt was $20.56 \pm 5.6\%$. Table 1 shows the TBSA burnt among included patients.

In 65(90.3%) of patients *Pseudomonas Aeruginosa* infection was cleared with 1% acetic acid, while in 7(9.7%) patients, it could not be cleared by 1% acetic acid daily dressing for 10-14 days and these patients were then treated with other treatment modalities like Polymyxin B ointment, 1% Silver Sulphadiazine. But, as compared to 1% Acetic acid, these are very expensive.

Table 2 shows the outcome of treatment with 1% acetic acid dressing among the patients. On further analysis, final outcome of clearance of *Pseudomonas aeruginosa* infection with respect to gender, we found that out of 39 males, infection was cleared in 36 but in 3 it could not be cleared whereas out of 33 females, 29 were cleared from infection.

Table 1: Percentage of Burned Wound (N=72)

Gender	Burned wound percentage					Total
	15%	20%	25%	30%	35%	
Male	14	18	1	5	1	39(54.2%)
Female	10	11	9	0	3	33(45.8%)
Total	24(33.3%)	29(40.3%)	10(13.9%)	5(6.9%)	4(5.6%)	72(100%)

Table 2: Efficacy of the Acidic acid 1% in burn management (n=72)

Burn percentage	Outcome		Total
	Infection cleared	Infection not cleared	
15%	23 (95.83%)	1(4.17%)	24(33.3%)
20%	27(93.89%)	2(6.11%)	29(40.3%)
25%	9(90%)	1(10.0%)	10(13.9%)
30%	4(80%)	1(20%)	5(6.9%)
35%	2(50%)	2(50%)	4(5.6%)
Total	65(90.3%)	7(9.3%)	72(100%)

DISCUSSION

Burn infection management is a major problem in many parts of the world.¹⁵⁻¹⁶ It has been estimated that 75% of the deaths following burns are related to infection.¹⁷ Thus, it is just not sufficient to be aware of the micro organisms that pose a problem for burn patients.¹⁸ To have an in-depth knowledge of the organisms that are predominant in that particular treatment facility during the particular period along with their sensitivity pattern is vital as many septic burn patients need to be treated empirically with antibiotics before the results of microbiology cultures are available.¹⁹ This would be crucial to reduce the overall infection-related morbidity and mortality.²⁰⁻²¹

Ryssel H, et al in his study compared the in vitro antimicrobial effect of acetic acid with those of common local antiseptics such as povidone-iodine 11% (Betaisodona), polyhexanide 0.04% (Lavasept), mafenide 5% and chlorhexidine gluconate 1.5% cetrimide 15% (Hibicet).¹ Former studies suggest the bactericidal effect of acetic acid, but these data are very heterogeneous; therefore, a standardized in vitro study was conducted. The tests showed excellent bactericidal effect of acetic acid, particularly with problematic *P. aeruginosa*. The microbiological spectrum of acetic acid is wide, even when tested at a low concentration of 1%. In comparison to our currently used antiseptic solutions, it showed similar in some bacteria, even better - bactericidal properties.

Pseudomonas aeruginosa and *Staphylococcus aureus* are the organisms most commonly isolated from the burn wounds mentioned not only in international studies but also in our observations in Burns Centre, Civil Hospital, Karachi. Among these two organisms *Pseudomonas aeruginosa*, the Gram negative organisms, have a higher mortality association and also has higher prevalence of resistance to topical and systemic antibiotics.¹⁵

In our Centre, some times even after giving conventional local antibiotic treatment (1% Silver sulfadiazine, Polymyxin B etc) we did not get clinically appreciable results and also on culture reports but as far as commonly used local antibiotic Silver Sulphadiazine is concerned, still we don't have any methods for 1% Silver sulphadiazine sensitivity with organisms isolated in order to get an idea of its sensitivity specially with *Pseudomonas aeruginosa* or any other organism because of presence of silver component in it due to which sensitivity can not be done. So we follow the studies of many workers who use acetic acid for the eradication of *Pseudomonas aeruginosa* from the burn wounds, according to these workers acetic acid, is cheap and effective.¹²⁻¹⁴

Care must be taken as topical antimicrobial agents and many disinfectant applications cause damage to normal tissues like H₂O₂ these are very toxic in full strength leading to destruction of area where they are applied so only minimal effective concentration of acetic acid should be used. Workers on previous studies used it in 0.5-1% concentration. Even at this strength the formation of fibroblasts which are supposed to play a fundamental role in formation of granulation tissues and wound healing was affected.²²

To our information no local published study is available on 1% topical acetic acid in managing Pseudomonal infection in burn wounds but further clinical studies are necessary to confirm our results.

CONCLUSION

1% acetic acid is very effective in treating the *Pseudomonas Aeruginosa* infection in burn patients. In burn patients with 15-35% TBSA burns, 1% acetic acid was effective in more than 90% of patients in eradicating the *Pseudomonas Aeruginosa*.

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