

Clinical Practice Article

Acetic Acid Treatment of Superficial Pseudomonas Aeruginosa Infection in Orthopedic Patients; A Valid Option

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Abstract

Background: Pseudomonas aeruginosa is an opportunistic organism resistant against many antibiotics and disinfectants. A 05% acetic acid can be used for the eradication of pseudomonas aeruginosa infection. To determine the efficacy of topical application of 05% acetic acid in orthopedic patients in eradication of superficial Pseudomonas aeruginosa infection.

Methods: This Descriptive case series study was conducted at Department of Orthopedic Surgery, Mayo hospital, Lahore from October 2014 to June 2016 for a period of 21 months. We included adult orthopedic trauma patients, aged 13 to 45 years, of either sex who had culture reports / greenish yellow discoloration of wound and discharge showing Pseudomonas aeruginosa infection. All of them received application of 05% acetic acid for 2 to 10 days.

Results: Superficial Pseudomonas aeruginosa infection was cured in 5 (83.33%) out of 6 cases and wounds were free of Pseudomonas aeruginosa in 2 to 10 days.

Conclusion: Acetic acid 05% is potent in treating superficial Pseudomonas aeruginosa infection in Orthopedic patients.

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Introduction

Post-operative wound infections are leading cause of hospital acquired infection in orthopedic. It is associated with long hospital stay and may result in limb loss.¹ A breach in skin barrier and loss vascularity makes a favorable environment for bacterial growth and metabolic disturbances that leads to immunosuppression and in turn make the patient susceptible to infection.²⁻⁵ Pseudomonas aeruginosa is a second leading cause of infection amongst gram-

negative pathogens as reported by United state nosocomial surveillance system.⁶

Acetic acid has been used in medicine for many years for the eradication of wound infection. In studies till now, it was reported that prevention of infection in patients is very important, because infection after injury is the major cause of morbidity and mortality.^{7,8} The topical & systemic use of antimicrobial agents, early debridement and grafting dramatically changes the frequency of survival in such patients.

Increased resistance to antibiotics asked for the search of alternative methods to prevent and treat deadly infections in trauma patients.⁹ *Pseudomonas aeruginosa* one of the opportunistic pathogens with intrinsically advanced antibiotic resistance mechanisms. Its ubiquitous nature and multi drug resistance makes it one of the most common causes for nosocomial infection, especially in immuno-compromised individuals.¹⁰

It is difficult to treat the superficial infection caused by *P. aeruginosa*, in spite of the broad spectrum antimicrobial agents available to date, either due to its resistance or the adverse effects of the drug or its cost. *P. aeruginosa* can secrete different pigments, namely pyocyanin (blue-green), pyoverdine (yellow-green) and pyorubin (red-brown).¹¹

These pigments give the characteristic green color to the wound and the pus. Many literatures have advocated the use of acetic acid for treatment of superficial *pseudomonas* infection.¹²⁻¹³

No locally published study is available on use of 5% topical acetic acid in managing *Pseudomonas* infection in wounds in orthopedic trauma patients. The purpose of this study was to evaluate the effectiveness of 05% acetic acid as a local antiseptic agent in terms of eradication of *Pseudomonas aeruginosa* superficial infections in orthopedic patients.

Methods

This study was conducted in department of Orthopedic Surgery, King Edward Medical University / Mayo hospital, Lahore. Six hospitalized patients in whom wounds were infected by *Pseudomonas aeruginosa* were included in this study. All six-patient had superficial infection (muscle deep).

Pseudomonas infection was considered by the presence of greenish yellow discoloration of the dressing and the discharge along with positive culture report. Acetic acid was used for wound wash (diluted in normal saline in the ration 1:3) and acetic acid-soaked gauze was placed on the wound daily until the wound was clear of the discoloration and the culture was negative.

Acetic acid was discontinued after that and the wound

was managed accordingly, and the patients were followed till the wound healed. No antibiotics were given to the patients during this treatment course. In this study 05% acetic acid is used as antimicrobial agent for the management of superficial *pseudomonas* wound infections. Data was analyzed in terms of frequency of eradication of infection.

Data was entered and analyzed using SPSS version 21.0. Quantitative variables were presented as median age and inter-quartile range with standard error of mean. Qualitative variables like age and superficial and deep wound infection are presented as frequency and percentages.

Results

Out of 06 patients, 05 (83.33%) were males and 01 (16.67%) female. The median age was 22.5-year, with minimum age was 13-year and maximum age was 45-year and inter-quartile range was 19.25-year and standard error of mean was 4.731. The mean age was 26.33±11.59 years (Table 01).

Out of the total six patient, even though few patients

Table 1: Shows Particulars of the Patients and the Number of Dressings Done

Sr. no.	Age	Sex	Nature of wound	Acetic acid concentration	Number of dressing for elimination of infection
1	45	F	Wound on Right popliteal fossa (#Schatzker type VI)	5%	5
2	23	M	Wound on Right shoulder and arm (#right Humerus)	5%	2
3	35	M	Wound on right tibia with # of tibia and fibula	5%	6
4	13	M	Wound on right leg and foot (open # right tibia/fibula)	5%	7
5	22	M	Wound on left leg (open #Left tibia/fibula)	5%	10
6	20	M	Wound on right leg and foot (open #right tibia/fibula)	5%	Not eliminated
Median age (year)				22.5	
inert-quartile range (year)				19.25	
Standard error of mean (Year)				4.731	

complained of stinging on application of acetic acid, there was no other adverse effect with its use to necessitate the interruption of the treatment.

Five of the patient showed elimination of discharge and discoloration of the wound after less than 10 dressings and the granulation tissue was visible. They also became culture negative for pseudomonas. They were referred to plastic surgery for further management and coverage of the wound. While in 01 patients, who had deep infection, the discharge continued and showed no progressive signs of wound healing after 10 dressings. Other treatment modalities were used to manage the wound.

Discussion

Infected wound management is a grave problem in many countries of the world^{14,15}. According to an estimate, 75% of the mortalities following wounds are infection related¹⁶. Thus, it is not sufficient just to know the microorganisms that pose a problem for patients with open wounds¹⁷.

To have a detailed knowledge of the organisms that are predominantly found in that particular hospital during the particular period along with their sensitivity pattern to antimicrobial agents is vital as many septic patients with superficial infections need to be treated empirically with broad spectrum antibiotics before the results of microbiology cultures and sensitivity are available¹⁸. This would be critical to reduce the overall infection related morbidity and mortality¹⁹⁻²⁰.

Ryssel H, et al in his study has compared the in vitro antimicrobial effect of acetic acid with those of commonly used local antiseptic agents like Povidone-Iodine 11% (Betaisodona), Polyhexanide 0.04% (Lavasept), Mafenide 5%, Chlorhexidine gluconate 1.5% and Cetrimide 15% (Hibicet)²¹.

Previous studies suggest that Acetic acid has bactericidal effect, but these data are very heterogeneous; therefore, a standardized in vitro study was conducted and the results showed excellent bactericidal effect of acetic acid, particularly with problematic *P. aeruginosa* as it lowers the pH of the wound, in which pseudomonas cannot survive.

The antimicrobial spectrum of acetic acid is wide,

even when at a lower concentration of 1%. In comparison to currently used antiseptic agents, it showed similar or even better bactericidal properties.

Pseudomonas aeruginosa and *Staphylococcus aureus* are the organisms most commonly isolated from the burn wounds internationally but according to our observations in Department of Orthopaedic Surgery, Mayo hospital, Lahore it is also isolated from the superficial wounds of trauma patients suffering from open fractures.

Pseudomonas aeruginosa, the Gram-negative organisms, have a higher association with mortality and also has higher prevalence of resistance to topical and systemic antimicrobial agents¹⁴.

This study has limitation of small sample size, and randomizations has not been done. We didn't consider the low-cost aspect of treatment. Further clinical studies with large sample size and randomization are necessary to support our results.

Conclusion

In this study 05% acetic acid is potent and cost effective in treating the superficial *Pseudomonas Aeruginosa* infection in orthopedic trauma patients.

Ethical Approval: Given

Conflict of Interest: The authors declare no conflict of interest

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