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A PROSPECTIVE STUDY ON EFFECTIVENESS OF VINEGAR DRESSING ON WOUNDS INFECTED WITH PSEUDOMONAS AERUGINOSA

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Abstract

Aims and objectives: This prospective study is aimed to evaluate the effect of vinegar (1% Acetic acid) in treatment of wounds infected with Pseudomonas.

Methods: A total of 60 patients attending the OPD of Vinayaka Mission's Kirupananda Variyar Medical College with any wound and a positive culture report for Pseudomonas aeruginosa was included in our study after obtaining proper consent. The following patients are randomised into two groups of 30. Group A (Test) was subjected to vinegar dressing (1% acetic acid) once daily and Group B (Control) was subjected to normal saline dressing. Both groups did not receive enteral or parenteral antibiotics throughout the period of study. Patients were followed up with wound cultures repeated on day 3, 7, and 14.

Results: The duration of treatment required to eliminate the *Pseudomonas* from the wounds in the acetic acid group was on an average 7days less than that required by the saline group. *P* value was <0·001. This was a very significant factor. Majority of the cultures tested negative after 7 days of treatment with acetic acid as compared to saline dressing ($p<0.001$) which is also statistically significant. The wounds also showed a marked reduction in wound size.

Conclusion: Vinegar (1%acetic acid) is a holy grail in the treatment of chronic wounds with P. Aeruginosa as it is highly efficacious and a cost-effective alternative.

Keywords: Pseudomonas aeruginosa, 1% Acetic acid, Vinegar dressing, Saline dressing

Introduction

In this day and age of MDR organisms, finding an alternative to antibiotics is a necessity. Majority of the wounds encountered in surgical practice are contaminated by several strains of bacteria, derived

Received: September 04, 2023 / Revised: September 30, 2023 / Accepted: October 18, 2023 / Published: November 18, 2023

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from endogenous sources such as the gastrointestinal tract, the surrounding skin, the environment or from the healthcare provider.

Pseudomonas aeruginosa (P. aeruginosa) is one of the most common pathogens isolated from chronic wounds, a very problematic microbe due to its resistance to many antimicrobial agents. P. aeruginosa being an opportunistic pathogen, is often acquired in hospital environments. Limitations associated with traditional therapies with antipseudomonal agents are many owing to multiple antibiotic resistance in nosocomial strains of P. aeruginosa.

Topical therapy for wound management has been evaluated in many in vitro and in vivo studies. The ideal topical therapy aims at reduction of bacterial contamination and removal of soluble debris without adversely affecting cellular activities vital to wound healing process. Although several studies support their value, many are not approved for use in wound infections.

Vinegar or dilute acetic acid has been used from time to time as a topical agent for the treatment of pseudomonal infections, specifically for superficial infection. It has a varied mechanism of action. Vinegar is bactericidal against many Gram-positive and Gram-negative organisms, especially P. aeruginosa. It is frequently used for wounds at concentrations varying between 0·5% and 5%.

Most studies have looked at topical therapy with vinegar for wounds as a second line treatment. There are lack of prospective studies which evaluate its efficacy in eliminating pseudomonas as primary modality. In an economically deprived population, topical therapy has a role in reducing the financial burden on the hospital and the patient. It can help eliminate multidrug resistant (MDR) P. Aeruginosa from chronic wounds without the use of expensive antibiotics.

Hence, we propose this prospective randomised controlled study which aims to evaluate the efficacy of vinegar in treatment of chronic wounds infected with P. Aeruginosa.

Patients and methods

This was a prospective study conducted over a period of 5 months from (March 2022 to July 2022) in the Department of General Surgery, Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Salem. The following study was approved by the Institutional Review Board.

A total of 60 patients attending the OPD of Vinayaka Mission's Kirupananda Variyar Medical College with any wound and a positive culture report for Pseudomonas aeruginosa was included in our study after obtaining proper consent. Detailed history, physical examination, and investigations such as would culture sensitivity and microscopy were done as part of evaluation. Adult patients above the age of 18 years, of both genders having wounds with positive cultures for Psuedomonas aeruginosa were included in the study. Patients under the age of 18 years, suspected malignancy, immunocompromised individuals, patients in sepsis and septic shock, grossly contaminated wounds

with profuse purulent discharge, major burns, gangrenous wounds were excluded.

The included patients were randomized into two groups of 30 according to block randomization with sealed envelope system. Group A (Test) was subjected to vinegar dressing (1% acetic acid) once daily and Group B (Control) was subjected to normal saline dressing. Both groups did not receive enteral or parenteral antibiotics throughout the period of study but were given analgesics (diclofenac 100mg sustained release tablets) which were taken on demand. Patients were followed up with wound cultures repeated on day 3, 7, and 14. Treatment was continued for 2 weeks or until negative wound culture report, whichever was earlier. Patients who developed signs of sepsis were started on parenteral antibiotics and excluded from the study. Patients with negative cultures and large ulcers were subject to SSG and those with small ulcers were allowed to granulate and heal by secondary intention.

Primary outcomes: To evaluate the efficacy of vinegar dressings as compared to normal saline dressings in the elimination of P. aeruginosa from wounds.

Secondary objectives: To assess the effect of vinegar dressings on other wound parameters such as wound size, discharge, granulation tissue, odor.

Results

The mean age of patients treated was 57years (range 22–68 years) with 57% being male and 43% female. Common aetiologies of wounds were infection and trauma as shown in Table 1, 68% diabetic.

Table 1 :

Common Ethologies	Percentage(%)
Trauma	48
Cellulitis	27
Burns	19
Venous ulcers	5
Surgical wounds	1

Various microorganisms that were isolated from wounds are shown in Table 2, which shows *Pseudomonas* being the most common isolate followed by *Klebsiella* and *Staphylococcus aureus.*

Table 2:

Organisms isolated	Percentage (%)
Pseudomonas aeruginosa	32
Klebsiella	25
Staphylococcus aureus	23
Escherichia coli	13

Organisms isolated	Percentage (%)
Proteus	7

Isolated bacteria also underwent antibiotic sensitivity tests and majority were found to be resistant to commonly tested antibiotics.

Period of treatment was 7–14 days with 1% acetic acid. Majority of the patients of Test group (88%) recorded to have no growth on culture after 7 days as compared to 26% in Control group. 100% of Test group patients recorded no growth on culture after 14 days compared to 39% of control group.

Fig 1- Case 1 before and after 1% acetic acid

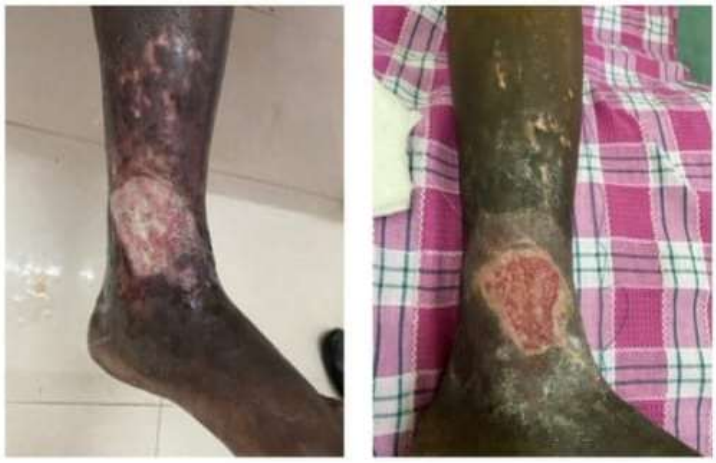

Fig 2- Case 2 before and after 1% acetic acid

Additionally, we also noticed reduction in size of the wound and faster healing, decreased discharge, and healthy granulation.

A few patients complained of mild burning sensation over the wound post dressing with 1%acetic acid. No other complaints were recorded.

Discussion

The main causative factors for a chronic wound are bacterial colonisation or bioburden, reperfusion injury, cellular and systemic factors [12][13]. As bacterial colonisation increases to a point of critical colonisation or infection, then the bioburden contributes to impeding healing [14]. Chronic wounds are arrested in inflammatory phase and do not progress to the proliferative phase of wound healing. Hypoxia due to impaired blood flow leads to cell death and necrosis, thus leading to bacterial colonisation.

Biofilms provide protection from antimicrobial agents by forming a physical barrier and play an important role in infection immunity [15,16]. Biofilm provides protection from antibiotics by preventing penetration of different agents through the biofilm [17,18]. Their ability by mutate helps develop resistance to antibiotics such as beta-lactams.[19] Biofilms of *P. aeruginosa* contribute to chronic infections in patients with cystic fibrosis or non-healing wounds. *P. aeruginosa* in chronic wounds is a very problematic microbe because of its ability to form resistant biofilms [17].

Acetic acid is used as an antimicrobial agent as it has low toxicity [1] [2]. Mechanism of action is by interaction with the cytoplasmic membrane to neutralise the electrochemical potential, lowering of internal pH and denaturation of protein [3]. Since most pathogens require a pH higher than 6, their growth is inhibited by application of acetic acid [7] [8] [9]as it reduces the action of bacterial proteases. Furthermore, it promotes healing and increases production of free radicles by increasing cell oxygenation, termed Bohr effect [9] [10]. Collectively, these mechanisms improve healing and granulation formation.

It is used for wounds at concentrations varying between 0·5% and 5%. Multiple trials have shown to disrupt the epithelialisation process, although not replicated in animal and human models [4]. Studies have shown that the tensile strength of the wound is also not affected [5]. A concentration more than 2% causes pain and burning sensation [11].

Studies have shown that MDR Bacteria to commonly used antibiotics are sensitive to acetic acid treatment. Thus, topical agent help avoided the need of antibiotics and associated adverse effects.

Conclusion

- Acetic acid dressing can be used as a cost-effective alternative to antibiotic therapy for wounds affected with P. aeruginosa by altering the alkaline milieu of chronic wounds and pivotal role in destabilising the chain of multi drug resistance.
- Concentration of 1% is highly efficacious against the bacteria with additional benefits of accelerated wound healing.
- The dressing can be done on an OPD basis and if needed, dressing protocol can be taught to the patients as domiciliary care keeps patients at ease.
- Can play a pivotal role in reducing the number of chronic non healing infected wounds requiring amputations, thus reducing morbidity, but this requires further study.

Disclosures: Nothing to disclose

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