



Effectiveness of 1% acetic acid in chronic wounds infected with *Pseudomonas aeruginosa*

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Abstract

Objective: To determine the effectiveness of topically applied 1% acetic acid upon *Pseudomonas aeruginosa* infected chronic wounds and to estimate the duration required for elimination of *Pseudomonas aeruginosa*.

Design: Cross sectional study

Setting: tertiary care hospital

Participants: A Cross sectional study was undertaken in 32 patients presenting with chronic wounds infected with *Pseudomonas aeruginosa* attending Out-patient and getting admitted to In-patient Department of General Surgery in K.V.G. Medical College, Sullia. During the period 1st October 2021 to 30th November 2021.

Results: Out of 32 patients 24 were male and 8 were females. All the wounds showed successful elimination of the bacteria with mean duration of elimination was 9.23+/-3.12 days.

Conclusions: 1% acetic acid is cheap, easily available and with very less adverse effects can be used in patients with chronic wounds infected with *P. Aeruginosa* as an alternative to systemic antibiotics. This overcomes the problem of antibacterial resistance for systemic antibiotics, avoids adverse effects of systemically used antibiotics and best alternative which can be used in poor patients who come to rural tertiary care centers, as it is cheap.

Keywords: 1 % acetic acid, *Pseudomonas aeruginosa*

Introduction

The first wound treatments were described five millennia ago. Since then, various principles of wound care have been passed on from generation to generation

Chronic wounds in general are estimated to affect 1-2% of the world's population. They pose a major challenge that is cumbersome in terms of wound healing and also add to the cost in terms of quality of life to the patient and is a financial burden for the hospitals –1.

Three main factors have been found to be the causative factors for the development of a chronic wound: firstly, bacterial colonisation or commonly called bio burden; secondly, reperfusion injury; and thirdly, cellular and systemic factors [2, 3].

Most of the wounds if not all of them are contaminated with pathogenic microorganisms, but this itself does not affect the healing of wounds [4-6]. When the contamination increases to a point of critical colonisation or infection, then the infection or the bio burden in the wound becomes a major contributing factor that impedes wound healing [5].

Chronic wounds do not progress to the proliferative phase of wound healing and undergo a detention in the inflammatory phase of healing because of which there is a continuous influx of neutrophils into the wound area, with the release of free radicals, catalytic enzymes and inflammatory mediators that cause damage to the invading pathogens as well as to the host tissue [7]. Poor blood supply results in hypoxic conditions in tissues, which can lead to cell death and tissue necrosis

This provides good growing conditions for pathogenic microorganisms leading to the establishment and colonisation of bacteria in the host tissue [7].

The main cause for an acute wound to get converted into a

chronic wound is infection and its prevention and control forms the basis for healing of wounds [8].

The concept of using topical antiseptics on open wounds is to prevent and treat infections. They also help to shorten the time taken to heal the wounds.

The use of topical agents on wounds to prevent infection is a minimal ability to develop resistance to the microorganisms. *Pseudomonas aeruginosa* is a gram-negative opportunistic pathogen with innate resistance to many antibiotics. In places that are economically backward, these problems get compounded by the inability of patients to afford newer expensive drugs.

Patient with chronic wounds infected with *Pseudomonas aeruginosa* is a common presentation at surgical OPD. Also *Pseudomonas aeruginosa* infection is one of the common hospital acquired infection seen in patients with chronic wounds like diabetic foot, ulcers in peripheral vascular disease, etc.,

As patients visiting KVG MCH, a rural tertiary care centre are usually economically backward, 1% acetic acid topical treatment will be helpful, as acetic acid is cheap, easily available with less adverse effects.

Materials and Methods

Setting

This is a cross sectional study done on 32 patients between October 1st 2021 to November 30th 2021.

This study was conducted at the department of General Surgery, KVG MCH, Sullia after receiving clearance from the Institutional ethics committee. Patients fulfilling the inclusion and exclusion criteria were approached, explained about the study and were requested for enrolment. They were provided with a patient information sheet either in

Kannada or English (depending upon their choice). Only those patients who volunteered for participation after fully satisfying themselves about the nature of the study and who gave written consent for this study were included.

All patients coming to OPD at KVG MCH with chronic wounds infected with *Pseudomonas aeruginosa* enrolled in the study for 2 months. None of the patients received any systemic antibiotics during the study period and received twice daily dressings with 1% acetic acid.

Conduct of Study

Patients were recruited for the purpose of the study. In the cases who had given consent for the study, history was collected and thorough physical examination done at the time of admission. Data collection included age, sex, and clinical presentation.

For this study, patients coming to KVG MCH OPD, department of General Surgery with wound infections, not responding to traditional therapy for more than 10 days, also patients who were admitted previously for chronic wounds and post-operative patients who acquired the pseudomonas infection in the hospital were selected.

A specimen of pus was collected before application of 1% acetic acid and after completion of treatment and processed for culture study. Isolation of *Pseudomonas aeruginosa* was confirmed by using standard techniques⁴. And only those patients infected with *Pseudomonas aeruginosa* and confirmed by culture was included in the study.

For use in patients, 1% acetic acid was applied in the form of wound irrigation and wound wash, or gauze soaked in 1% acetic acid was placed on wound daily until the culture of swabs sent to see no growth. No antibiotics were given to any of the patients during the course of management.

Statistical analysis was done. Data was entered into MS excel sheet and mean was calculated

Inclusion Criteria

All patients with chronic wounds infected with *Pseudomonas aeruginosa*

Exclusion Criteria

Wounds due to massive burns, suspected malignancy, immuno-compromised individuals and individuals with sepsis

Results

1. In our study, out of 32 patients 24 were males and 8 were females.
2. Our study consisted of patients aged between 26 to 72 years old. Age distribution of the patients is depicted in the following table

Table 1

Age	Male	Female	Total
20 to 40 years	2		2
40 to 60 years	10	5	15
60 to 80 years	12	3	15
Total	24	8	32

3. Associated factors in patients with chronic ulcers with *Pseudomonas aeruginosa* infection are shown in following table.

Table 2

Associated factors	frequency
Diabetes Mellitus	8
Peripheral Vascular Disease	6
Varicosity of Lower LIMB Venous System	1
Trauma	11
Post-operative hospital acquired wound infection	4
gluteal abscess	1
burns	1

4. The pus culture sensitivity from the chronic wounds yielded *Pseudomonas aeruginosa*. and they were resistant to two or more broad spectrum antibiotics.
5. These wounds are washed with 1% acetic acid. All patients showed successful elimination of P.Aeruginosa from their wounds with 8 to 14 times application of 1% acetic acid in the form of wound wash, wound irrigation, and a gauze soaked in 1% acetic acid. The mean duration required to eliminate the bacteria was 9.23+/-3.12 days.
6. Later these wounds healed completely by secondary intention, some wounds required split skin grafting and in some cases secondary suturing was done. In one case after elimination of the bacteria vacuum assisted therapy was done.

Discussion

1. *Pseudomonas aeruginosa* is one of the most common hospital acquired gram negative bacterial infection.
2. One third of the burns infection yield *Pseudomonas aeruginosa* in culture swabs which carry high mortality in burns patients.
3. When the contamination of the bacteria increases to a point of critical colonization, the bio burden in the wound impedes wound healing. Also this bacteria forms biofilms which provides protection from antimicrobial agents by forming physical barrier.
4. In our study 1% acetic acid used upon chronic wounds, postoperative wounds, burns, gluteal abscess which are infected with *Pseudomonas aeruginosa* had eliminated the bacteria successfully with mean application of 9 days.

Conclusions

1% acetic acid is cheap, easily available, and with very less adverse effects can be used in patients as a best alternative to systemic antibiotics. This overcomes the problem of antibacterial resistance of the bacteria to the systemically used antibacterial agents, avoids adverse effects of systemically used antibacterial agents and best alternative which can be used in poor patients who comes to rural tertiary care centers, as it is very cheap

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