



## Case Report

# Role of lemon juice therapy in management of thermal burns

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## Abstract

Wound healing is multifactorial event with wound bed preparation (WBP) being the most important part of it. *Pseudomonas aeruginosa* is a significant cause of wound infections delaying the process of WBP. The growth of *pseudomonas* is suppressed in acidic media. Vinegar (acetic acid) has been in use to provide acidic media to suppress the growth of *pseudomonas*. Citrus group of fruits such as lemon, orange and grapes are rich source of Vitamin C (ascorbic acid) and citric acid.

**Keywords:** Lemon Juice Therapy (LJT), *Pseudomonas*, Wound Bed Preparation (WBP).

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## 1. Introduction

Wound Bed Preparation (WBP) is an important pre requisite for wound reconstruction by skin graft or flap. In the presence of infection especially resistant *pseudomonas* the process of WBP is delayed. Local antimicrobial agents are better than systemic antibiotics due to high cost and risk of resistance. *Pseudomonas aeruginosa* is a classic opportunistic pathogen with innate resistance to many antibiotics and disinfectants.<sup>1</sup> It is resistant to commonly available antiseptics and disinfectants such as quaternary ammonium compounds (e.g., cetrimide and benzalkonium chloride), chloroxylenol and hexachlorophanen.<sup>2,3</sup> Its isolation has been reported from povidone iodine, chlorhexidine, Dettol and savlon solutions used in hospitals.<sup>4-8</sup> Approximately, one third of burn wounds are infected by *P. aeruginosa*. It is an important cause of nosocomial infections and is associated with high morbidity, increased stay in hospital and increase cost of treatment because of its resistance to commonly available antibiotics. In recent years, an increased frequency of strains resistant to several antimicrobial agents has been reported.<sup>9-11</sup> In spite of continuing introduction of potent antipseudomonal agents, it is the most difficult nosocomial pathogen to be eliminated from infection site. Growing resistance to antimicrobial

agents seriously hamper the therapy of pseudomonal infections. The incidence of such multiple drug-resistant isolates remains very high in burn units. Thus, *P. aeruginosa* continues to create a threat to patient care.<sup>11</sup> *Pseudomonas* growth is suppressed in acidic media. Usually, topical vinegar is used to provide acidic media but toxic to normal cells in higher concentration. Acidic media may be provided by natural citrus fruits which are rich source of ascorbic acid and citric acid. Among various citrus group of fruits lemons are easily available in all the seasons and relatively cheaper compared to other citrus fruits. Few studies are available on effect of ascorbic & citric acid in control of resistant *pseudomonas* in wounds. This study investigated the effect of local application of lemon juice for providing acidic media in wounds to suppress growth of *pseudomonas* to enhance wound bed preparation (WBP) for reconstruction.

## 2. Materials and Methods

In this study, 40% Third-degree mixed thermal burn injury involving right chest abdomen, bilateral arms head and neck, right thigh region. (Figure 1) The study was ethical approved by the institutional review board.

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He underwent thorough clinical examination, and essential investigations such as Hemoglobin, Total Count, Differential Count, Bleeding Time, Clotting Time, Erythrocyte Sedimentation Rate, Random and/or Fasting Blood Sugar, Serum Creatinine, Blood Urea, HIV, HBsAg, and Complete Urine Examination were conducted to assess anesthesia fitness and rule out underlying systemic conditions. Additionally, wound swabs were cultured to identify the type of organism and its antibiotic sensitivity.

No systemic antibiotic was given to the patient. Wound exudate cultures were sent before each dressing until no *Pseudomonas* growth was found. Demographic profile, number of applications of LJT iodine required to control *Pseudomonas* infection and method of final reconstruction were recorded. LJT set includes lemons, knife (to cut the lemon), lemon juice extractor and a container with sprayer. Outer surface of Lemon was wiped with alcohol swab. Lemon juice was extracted by an extractor (after autoclaving) commonly available in kitchen. Extracted juice was transferred in glass container (without crack & plugged with cotton) and autoclaved (at temperature of 121 degree centigrade with pressure of 15 psi for 20 min). Sterile extracted juice was transferred in a bottle with spray device to spray the lemon juice over the wound. For every 10 sq.cm of wound, 2ml of undiluted lemon juice was sprayed directly over the wound. (Figure 2) The wound was covered with conventional moist dressing. Dressing was changed every 3 to 4 days depending upon the soakage. Before every dressing tissue culture was sent. Various parameters were recorded like number of applications of LJT required to control *Pseudomonas*, method of reconstruction for wound cover (graft or flap).

### 3. Results

On an average the number of applications of Lemon juice therapy required was less than povidone iodine to control *Pseudomonas* infection in wounds. (Figure 3)



**Figure 1:** Showing thermal burns over the anterior and posterior part of chest and abdomen and right upper and lower limb at time of presentation (BJWAT Score 32)



**Figure 2:** Application of lemon juice over burn area



**Figure 3:** Figure showing condition of the wound after 2 weeks of lemon juice application over thermal burns (BJWAT wound score - 21)

### 4. Discussion

To the clinician it is important to reduce the number of bacteria in wounds as part of wound bed preparation (WBP) to reconstruct with skin graft or flap. *Pseudomonas* is one of the most common & resistant bacteria delaying the process of wound bed preparation (WBP). The growth of *Pseudomonas* is suppressed in an acidic media, vinegar being one of the commonly used topical agents. Few articles are available, mentioning other topical agents like citric acid and ascorbic acid. The antiseptic management has a dichotomous history anchored in tradition and science. It is an integral part of the management of acute as well as chronic wounds.<sup>12,13</sup> The ideal topical therapy is aimed at reduction of bacterial contamination and removal of soluble debris without adversely affecting cellular activities vital to wound healing process. Although several studies support the value of topical antimicrobial agents, many commonly used antiseptic agents are not approved for use in wound infections. Repeated and excessive treatment of wounds with antiseptic agents, except for short-time application to attack the causative pathogens and control the infection, may have negative outcomes or promote a micro-environment similar to those found in chronic wounds.<sup>14,15</sup> Dilute acetic acid though successfully used by many researchers for the treatment of wound infections caused by *P. aeruginosa* but has side effects. Line a weaver et al. showed that a 0.25% acetic acid solution killed

100% of exposed fibroblasts in an in vitro model impairing wound healing. Acetic acid has also been shown to slow down the wound epithelization and limit polymorphonuclear neutrophil function.<sup>16</sup> Many others also have reported that these agents are cytotoxic, retard healing and can do more harm than good when they are not used in a proper concentration. They can interfere with the normal healing process, are toxic to fibroblasts and may permit more virulent microbes to dominate.<sup>17</sup> Mujumdar in 1993, reported use of ascorbic acid in 35 cases with second degree burn injury involving 20-40% of body surface area infected with *P. aeruginosa*. He used 2% ascorbic acid to wash wound thoroughly and to create an acidic medium in a tropical climate where warm weather and alkalinity of the medium renders 0.1% silver sulfadiazine less effective. This treatment modality showed a dramatic reduction (88%) in *Pseudomonas* infection.<sup>18</sup> Various studies have mentioned that 2-3% citric acid is successful in treatment of infections caused by resistant *P. aeruginosa*. Citric acid has been found to be simple, reliable, non-toxic, effective and economical approach in the management of infections caused by resistant strains of *P. aeruginosa*.<sup>19</sup> Knowing these disadvantages of acetic acid, in our study, we used naturally available citric & ascorbic acid present in lemon juice. In our study, it was found to be effective in wound bed preparation (WBP) by controlling the resistant *Pseudomonas* infection and helping in wound reconstruction. Our study has various limitations like single center, small sample size, non-randomized, prospective study, with no controls, and dose & concentration of lemon juice not standardized.

## 5. Conclusion

In this study, we found that Lemon Juice can be used as a source of providing acidic media for suppressing the growth of *Pseudomonas* infection in wounds. It is an easily available and natural source of acidic media. But since it is a single case study, a definite conclusion cannot be made. Large randomized control trials are required to confirm the efficacy of Lemon Juice in suppressing the growth of *Pseudomonas* infection in wounds.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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