

Citric Acid Treatment of Chronic Wounds in Animals

¹B.S. Nagoba, ²B.J. Wadher and ³S.P. Selkar

¹Department of Microbiology, MIMSR Medical College, Latur

²Medical Microbiology Research Laboratory, P.G. Department of Microbiology,
RTM Nagpur University, Nagpur

³Department of Physiotherapy, MIMSR Medical College, Latur, India

Abstract: Chronic wound infections in animals not responding to conventional treatment modality are the important cause of morbidity. Infection is responsible for delayed wound healing. In the present study, an attempt was made to develop simple and effective treatment modality by using citric acid as a sole antimicrobial agent to control chronic wound infections in animals. Thirty eight cases of chronic wounds not responding to conventional treatment modalities were divided into two groups. Each group included 19 cases. In group 1, 3% citric acid solution and in group 2, 5% citric acid solution was used for local application to find out its efficacy in the treatment of chronic wound infections in animals. Citric acid was found effective in the control of all 38 cases in 7 to 20 applications. In group 1, the wounds healed in 10-20 applications. In group 2, the wounds healed in 7-15 applications. Citric acid treatment was found most effective and economical approach for the successful treatment of chronic infected wounds in animals not responding to conventional antibiotic treatment and local wound care. These results suggest that when healing of chronic wounds in animals is a matter of great concern, the value of topical agents like citric acid should not be forgotten.

Key words: Chronic wound infections, citric acid treatment, ox gall, topical agent, traumatic wounds in animals, wound care

INTRODUCTION

Even with the best possible local care and prevention, an animal can develop infection in an open sore or wound. If not controlled within time, the microbes in the wound can enter the bloodstream and cause a systemic infection. To prevent an infection from getting worse, animals with a wound or open sore needs special attention by a veterinarian.

Without appropriate antibacterial drugs to control and treat infections, it would be practically impossible to practice rational health care to animals. Veterinarians rely on effective, inexpensive and convenient antibacterial drugs to treat infections. Penicillins, cephalosporins, fluoroquinolones, tetracyclines, etc. are the common antibacterial agents used in the treatment of various infections in animals. Drug resistant bacteria are primarily a problem and help to spread infections among animals. Sometimes, the multiple drug resistant bacteria can become a therapeutic challenge.

A variety of chemical agents are available, which are nontoxic, inexpensive and highly effective against various organisms. It has been reported that in some cases of local applications, chemical agents have advantages over antibiotics, especially in controlling hospital strains

(Krasilnikov *et al.*, 1991). These agents can be used locally in the treatment of wound infections and the use of antibiotics can be avoided to some extent. The topical use of various acids, notably acetic acid (Philips *et al.*, 1968; Sloss *et al.*, 1993; Nagoba *et al.*, 1997), boric acid (Adarchenko *et al.*, 1989; Husain *et al.*, 1989; Kujath and Hugelschaffer, 1987) and ascorbic acid (Mujumdar, 1993) has been reported to eliminate *P. aeruginosa* from burns infections and skin and soft tissue infections. Use of citric acid has also been reported in the treatment of a variety of wounds infected with various bacteria in human beings (Nagoba *et al.*, 1998, 2008, 2010). In the present study, an attempt was made to use citric acid for the treatment of chronic wounds in animals.

MATERIALS AND METHODS

The present study was carried out in the Department of Microbiology, MIMSR Medical College, Latur during the period January 1999 to December 2009. This study was carried out on 38 animals having chronic wounds not responding to conventional antibiotic treatment and local wound care. The details of animals and type of wounds are given in the Table 1. On trial and error basis, the animals under study were grouped into two groups:

Table 1: Details of animals and type of wounds

S.No.	Animal	Type of wound	No. of cases		
			Group 1	Group 2	Total
1	Ox	Yolk gall	04	04	08
2	Ox	Traumatic wound	05	05	10
3	Buffalo	Traumatic wound	05	05	10
4	Cow	Traumatic wound	05	05	10
Total			19	19	38

Group 1 - included 19 cases in which 3% citric acid solution was used for local application and Group 2 - included 19 cases in which 5% citric acid solution was used for local application. Citric acid was used in a liquid form (3% citric acid prepared by adding 3 g of citric acid to 100 mL of sterile distilled water and 5% citric acid prepared by adding 5 g of citric acid to 100 mL of sterile distilled water). For use in animals, citric acid solution (3 or 5%) was used to irrigate and wash the wound, a sterile gauze soaked in citric acid was applied to wound and finally wound was dressed. In this way, citric acid was applied once daily or on alternate days based on the severity of wound infection (daily once in severely infected wounds and on alternate days in less severe wounds). This treatment modality was used until the wound healed completely. No antibiotics were given during this treatment modality.

RESULTS AND DISCUSSION

All 38 cases responded well and healed in 7 to 20 applications of citric acid. In a group 1, the wounds healed in 10-20 applications. In a group 2, the wounds healed in 7-15 applications. After application of citric acid, pus and slough was minimized and rapid laying of granulation and epithelization was observed in wounds, which were not responding to earlier conventional antibiotic treatment and local wound care. No any adverse effects were noticed in any of the animals.

Infection is a common reason for poor wound healing. Complete healing of wound can not occur in the presence of infection. The use of various acids to control wound infections caused by *Pseudomonas aeruginosa* has been reported by earlier workers. Notably, use of acetic acid as a topical agent for the treatment of superficial wounds infected by *Pseudomonas aeruginosa* has been reported from time to time by many workers (Philips *et al.*, 1968; Sloss *et al.*, 1993; Nagoba *et al.*, 1997). Topical use of acetic acid at concentrations between 0.5 to 5% eliminated *Pseudomonas aeruginosa* from burns and soft tissue wounds within two weeks of treatment (Sloss *et al.*, 1993). In addition to acetic acid, some workers suggested use of ascorbic acid (Mujumdar, 1993) and boric acid (Adarchenko *et al.*, 1989; Husain *et al.*, 1989; Kujath and Hugelschaffer, 1987) for the control of wound or burns infections caused by

Pseudomonas aeruginosa. Citric acid has also been found effective in the treatment of a variety of wounds infected with various bacteria in human beings (Nagoba *et al.*, 1998; Nagoba *et al.*, 2008; Nagoba *et al.*, 2010).

Considering the use of various acids in the effective treatment of a variety of wounds from time to time by different workers, in the present study an attempt was made to use citric acid, a natural product obtained from citrus fruits and a well known preservative commonly used in various edible preparations, in the treatment of animal wounds not responding to conventional treatment. Considering that citric acid is the best among the different acids used in the treatment of wound infections, it was used as a sole topical agent for the treatment of various animal wounds with success rate of 100%. Citric acid was not only found to control infection but also enhanced the wound healing process, as evident from minimization of pus discharge and slough, and laying of granulation tissue and epithelization.

CONCLUSION

Use of citric acid resulted in complete healing of wounds in all 38 animals with success rate of 100%. These results indicate that citric acid treatment is a simple, reliable, nontoxic, economical and highly effective in the treatment of chronic wound infections in animals in which conventional treatment has been shown to yield little lasting success. These results suggest that when healing of chronic wounds in animals is a matter of great concern, the value of topical agents like citric acid should not be forgotten.

This being observational study, we feel that further detailed studies involving control group for comparative evaluation are necessary to achieve more concrete conclusions.

ACKNOWLEDGMENT

Authors wish to thank Prof. Dr. V.D. Karad, Executive President & Director, MAEER's MIT, Pune, Mr. R.K. Karad, Coordinator, Dr N.S. Arvikar, Ex Principal and Dr. Sarita Mantri, Principal, MIMSR Medical College, Latur, for their support and encouragement. We extend our heartfelt thanks to Dr. Ismail Makandar, a veterinary doctor for his kind

cooperation and to Mr. Devendra Mule, a farmer from a village Borgaon, Tq. Tuljapur, Dist. Osmanabad for his special interest in this study in searching animals with infected wounds and their recruitment in the present study by convincing the owners. Our thanks are also due to Mr. S.S. Gutte, Miss Nameeta Surwase, Mr. S.P. Mane, Mr. D.L. Ghante, Mr. M.A. Bhogade, Mr. Datta Shinde, Mr. Mahadeo Kaule and Mr. S.P. Kadam for technical assistance.

REFERENCES

- Adarchenko, A.A., A.P. Krasilnikov and O.P. Sobeshchuk, 1989. Antiseptic sensitivity of clinical strains of *Pseudomonas aeruginosa*. *Antibiotiki I Khimioterapiia*, 34: 902-907.
- Husain, M.T., Q.N. Karim and S. Tajuri, 1989. Analysis of infection in a burn ward. *Burns*, 15: 299-302.
- Krasilnikov, A.P., A.A. Adarchenko, P.I. Bulai and O.P. Sobeshchuk, 1991. A comparative analysis of the antibacterial activity of antiseptics and antibiotics on samples of *Pseudomonas aeruginosa*. *Zhurnal Mikrobiologii, Epidemiologii I Immunobiologii*, 8: 30-33.
- Kujath, P. and C. Hugelschaffer, 1987. *Pseudomonas aeruginosa*: Pathogenicity, prevention and therapeutic approaches. *Zentralbl Chir*, 112: 558-563.
- Mujumdar, R.K., 1993. Treatment of resistant pseudomonas infection in burn patients in tropical climate using acetic medium, oxidizing agent and metronidazole. *Indian J. Surg.*, 55: 501-507.
- Nagoba, B.S., S.R. Deshmukh, B.J. Wadher and S.B. Patil, 1997. Acetic acid treatment of pseudomonal postoperative wound infection. *J. Hosp. Infect.*, 36: 243-244.
- Nagoba, B.S., B.J. Wadher, S.R. Deshmukh, L. Mahabaleshwar, R.C. Gandhi, P.B. Kulkarni, V.A. Mane and J.S. Deshmukh, 1998. Treatment of superficial pseudomonal infections with citric acid - an effective and economical approach. *J. Hosp. Infect.*, 40: 155-157.
- Nagoba, B.S., B.J. Wadher, A.K. Rao, G.D. Kore, A.V. Gomashe and A.B. Ingle, 2008. Simple and effective approach for the treatment of chronic wound infections caused by multiple antibiotic resistant *Escherichia coli*. *J. Hosp. Infect.*, 69: 177-180.
- Nagoba, B.S., R.C. Gandhi, B.J. Wadher, A.K. Rao, A.R. Hartalkar and S.P. Selkar, 2010. A simple and effective approach for the treatment of diabetic foot ulcers with different Wagner grades. *Int. Wound J.*, 7: 153-158.
- Philips, I., A.Z. Lobo, R. Fernandes and N.S. Gundara, 1968. Acetic acid in the treatment of superficial wounds infected by *Pseudomonas aeruginosa*. *Lancet*, 1: 11-14.
- Sloss, J.M., N. Cumberland and S.M. Milner, 1993. Acetic acid used for the elimination of *Pseudomonas aeruginosa* from burn and soft tissue wounds. *J. Army Med. Corps*, 139: 49-51.