

The use of silver nitrate in wound management



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The use of silver nitrate for chronic wounds such as leg ulcers, as well as burns and acute wounds has already been described in literature. However there is currently conflicting evidence in the literature to support the use of silver nitrate. We present our experience on two cases with extensive co-morbidities associated, where the use of silver nitrate application reduce dramatically the size of large wounds, which eventually healed, avoiding the patients to undergone surgery. Furthermore to reduce pain and distress associated with the application we used local anaesthetic prior to applying the silver nitrate.

KEY WORDS: Difficult wound, Lower limb wounds, Management of complex wound, Silver nitrate

Introduction

Wounds are often the only external evidence to a patient of a surgical procedure, and much effort is made to close these effectively and produce a good cosmetic result whilst preventing wound dehiscence and infection. Nonetheless complications related to wounds are prevalent, with wound infection being one of the most common, resulting in significant morbidity and mortality ¹. With respect to the burden on the health service, patients with surgical site infections stay in hospital on average about twice as long as uninfected patients, and the cost of total care is more than doubled-inpatient costs of surgical site infections alone were estimated to be about £65m in England in 1995 ². There are a variety of antimicrobial dressings available, however it is necessary to improve the diagnosis of infection in order to use these dressings correctly ³.

Silver-based compounds

Several measures have been introduced over the years to combat wound infection, such as strict hand hygiene rules, shaving, skin disinfection and prophylactic antimicrobial therapy. Furthermore various antiseptic dressings have emerged in an attempt to overcome problematic wounds, more so in the chronic setting. Silver-based compounds are becoming increasingly popular, though they have been in use since the 1960s when silver sulfadiazine cream (SSD) was used in the management of burns. [4] The silver ions bind to bacterial DNA, reducing their ability to replicate ⁵. The antimicrobial activity of silver is well known and there are various studies documenting its effect on a wide variety of organisms, including anaerobic and aerobic bacteria, fungi and viruses ^{6,7}. An additional advantage is the ability of silver to act against several multi-resistant micro-organisms ⁸. Silver can be applied to open dermal sounds in the form of inorganic silver salts such as silver nitrate, metallic silver, or as organic compounds such as SSD ⁹. There are a range of dressings and agents available, including creams, salts, alginates, foams, hydrocolloids, hydrofibres and meshes.

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Silver products can be used on a variety of wounds, most commonly chronic wounds such as leg ulcers, as well as burns and acute wounds.

Current Evidence

There is currently conflicting evidence in the literature to support the use of silver. There have been extensive reviews on the subject which do not conclusively support the use of silver dressings, and whilst there is evidence to suggest their benefit, many of the published studies are limited by small sample sizes and lack of reliability and validity outcome measures, with a limited number of randomised control trials (RCTs) and conflicting variables that cast a haze on any outcomes¹⁰.

Two Cochrane reviews on the subject by Vermeulen et al¹¹ and Storm-Versloot et al¹² conclude no significant benefits have yet been demonstrated in the literature. The former found 3 relevant RCTs, none of which showed silver-containing foam dressings significantly increased complete ulcer healing as compared to standard foam dressings up to four weeks follow up. Furthermore data on pain, patient satisfaction, length of hospital stay and costs showed little differences. However silver was seen to result in a greater reduction in size of ulcer and significantly less leakage in patients with leg ulcers and chronic wounds.

Storm-Versloot et al identified thirteen RCTs which compared topical silver to non-silver dressings, with one trial showing less infection in the silver group, whilst three trials showed more infection with SSD. With evidence from a further thirteen RCTs which found no significant benefit, they concluded there is insufficient evidence to establish whether silver-containing dressings or topical agents promote wound healing or prevent wound infection¹².

Despite the reliably informed evidence presented by the Cochrane studies, there are a number of small studies which support the use of silver, demonstrating that it can help to enhance wound bed infection and inflammation control, tissue management, moisture balance and epithelial (edge) advancement¹⁰.

The use of silver-coated alginate dressings have been shown to reduce the wound complication rate from 14% to 5% when compared to conventional cotton gauze with regard to acute wounds of the lower extremity following re-vascularisation surgery¹³. Other studies have brought up similar results, finding a statistically significant reduction in infection by silver-releasing dressings, with relative infection control reductions of 60%¹⁴ and 16.7%¹⁵.

There have been studies showing silver-releasing dressings reduce incidences of wound leakage and improve wound odour^{16,17}. The severity of wound exudate has also been seen to be reduced¹⁴.

There have been demonstrated benefits of the action of

nanocrystalline silver dressings against methicillin-resistant *Staphylococcus aureus* (MRSA), where a complete, or almost complete, barrier to the penetration/spread of MRSA was seen in 95% of cases¹⁸.

Our experience

CASE 1

A 75 year old woman lady initially presented with an open right bimalleolar ankle fracture in June 2010. She suffered from extensive co-morbidities, including ischaemic heart disease (with previous coronary artery stenting), asthma, cerebrovascular disease and recurrent pulmonary emboli. Medication history included warfarin and clopidogrel.

Wound debridement and ORIF was performed by the orthopaedic team. Her hospital stay was prolonged as she had an open wound which required VAC dressing and eventual debridement and split-thickness skin graft reconstruction from the right thigh. The skin graft was taken up well.

However she then developed a spontaneous expanding haematoma to the left calf, four weeks after initial hospital admission. This was managed conservatively with aspiration and tissue viability input, as well as FFP and vitamin K therapy to treat a raised prothrombin time. Of note she was continuing to receive therapeutic tinzaparin in place of her usual warfarin therapy. Despite this the wound become necrotic (Fig. 1). Therefore debridement was performed 4 weeks after the initial presentation of the haematoma. The patient was not keen on a further skin grafting, therefore we managed the wound conservatively, with silver nitrate application. In order to reduce associated pain and distress associated with the application we used local anaesthetic prior to applying the silver nitrate. Over the course of 8 weeks



Fig. 1: Necrotic wound in case 1.



Fig. 2: Case 1 after 4 weeks of silver nitrate.



Fig. 4: Case 2.



Fig. 3: Case 1 after 8 weeks of silver nitrate.



Fig. 5: Case 2 after silver nitrate.

the wound dramatically reduced in size (Figg. 2, 3). No wound infection was encountered.

CASE 2

A 70 year old woman presented with an expanding haematoma on the lateral aspect of her right calf. A week prior to the haematoma developing she presented with chest pain and was diagnosed with multiple pulmonary emboli and she was suitably commenced on warfarin therapy, with therapeutic enoxaparin until INR was therapeutic. At the time of presentation her INR was 1.4. The haematoma (22cmx8cmx0.5cm) was evacuated under general anaesthetic, leaving a deep wound which required a vac dressing to assist healing. 19 days after initial presentation a further debridement and split-thickness skin graft (from right thigh) was per-

formed under general anaesthetic. 3 weeks following the procedure two small areas were noted to be still healing on the donor site (Fig. 4). Silver nitrate was applied, again using local anaesthetic prior to application. This resulted in complete wound healing after 4 weeks (Fig. 5). No wound infection was encountered at any stage.

Conclusion

Although there is limited conclusive evidence in the literature for the use of silver nitrate in wound management, there are a number of case studies advocating its use. Our mini-case series gives further support for its use, with excellent results demonstrated over a relatively short space of time. More conclusive randomised controlled trials are required to ascertain the level of benefit of silver nitrate.

Riassunto

L'uso del nitrato d'argento per il trattamento delle ulcere croniche dell'arto inferiore delle ustioni e delle ferite recenti è già stato descritto in letteratura.

Vi sono attualmente in letteratura opinioni contrastanti proprio riguardo l'uso del nitrato d'argento.

Gli Autori presentano la loro esperienza su due casi caratterizzati dall'associazione di importanti comorbidità, nei quali l'utilizzazione dell'applicazione del nitrato d'argento ha ridotto drammaticamente le dimensioni di ampie e difficili ferite che sono giunte infine a guarigione, evitando ai pazienti di essere sottoposti a trattamento chirurgico.

Inoltre, per ridurre il dolore ed il disagio conseguente a queste applicazioni è stato usato un anestetico locale prima di applicare il nitrato d'argento.

References

1. Wilson AP, Gibbons C, Reeves BC, Hodgson B, Liu M, Plummer D, Krukowski ZH, Bruce J, Wilson J, Pearson A: *Surgical wound infection as a performance indicator: Agreement of common definitions of wound infection in 4773 patients*. BMJ, 2004; 329(7648):720.
2. Plowman R, Graves N, Griffin M, Roberts JA, Swan AV, Cookson B, et al.: *The socio-economic burden of hospital acquired infection*. London: Public Health Laboratory Service, 1999.
3. EWMA (European Wound Management Association): *Position Document: Identifying criteria for wound infection*. London: MEP Ltd, 2005.
4. Hartford CE: *The requests of Monierie and Moyer: An appraisal of topical therapy of burns*. 1981 American burn association presidential address. Joun Trauma, 1981; 21(10):827-34.
5. Ballard K, McGregor F: *Product Focus. Avance: silver hydropolymer dressing for critically colonised wound*. Br Journ Nurs, 2002; 11(3): 208-11.
6. Thurman RB, Gerba CP: *The molecular mechanisms of copper and silver ion disinfection of bacteria and viruses*. CRC Crit Rev Environ Contr, 1989; 18(4):295-315.
7. Ovington LG: *Nanocrystalline silver: Where the old and familiar meets a new frontier*. Wounds: A compendium of clinical practice and research, 2001; 13(2): 4-10.
8. Hermans MH: *Silver -containing dressing and the need for evidence*. Am J Nurs, 2006; 106(12):60-68.
9. White RJ, Cooper RA: *Silver sulfadiazine: A review of the evidence*. Wounds-UK, 2005; 1(2):51-62.
10. Shu-Fen Lo, Hayter M, Chee-Jen C, Wen-Yu H, Ling-Ling L: *A systematic review of silver releasing dressing in the management of infected chronic wounds*. Journal of Clinical Nursing, 2008; 17(15):1973-985.
11. Vermeulen H, van Hattem JM, Storm-Versloot MN, Ubbink DT: *Topical silver for treating infected wounds*. Cochrane Database of Systematic Reviews, 2007 n.1.
12. Storm-Verloot MN, Vos CG, Ubbink DT, Vermeulen H: *Topical silver for preventing wound infections*. Cochrane Database of Systematic Reviews, 2010, n-3.
13. Childress, et al: *Impact of an absorbent silver-eluting dressing system on lower extremity revascularization*. Wound Complications, 2007; 21(5):598-602.
14. Vanscheidt W, Lazareth I, Routkovsky-Norval C: *Safety evaluation of a new ionic silver dressing in the management of chronic ulcer*. Wounds, 2003; 15:371-78.
15. Schuman H, Apelqvist J, Schmidtchen A, Hansson C: *Open, non-comparative multicentric investigation exploring the tolerance of an absorbent dressing containing silver used in chronic wounds*. Proceedings of the 17th Conference of the European Wound Management Association, abst. 120.
16. Jorgensen B, Price P, Andersen KE, Bech-Thomsen N, Scanlon E, Kisner R, Rheinen H, Roed-Petersen J, Romanelli M, Jemec G, Leaper DJ, Neumann MH, Veraart J, Coerper S, Agerslev RH, Bendz SH, Larsen JR, Sibbad RG: *The silver -releasing foam dressing, Contreet Form, promotes faster healing of critically colonised venous leg ulcers: A randomised controlled trial*. Wound Journal, 2005; 2:64-73.
17. Karlsmark T, Agerslev R, Bendz S, Larsen J, Roed-Petersen J, Andersen K: *Clinical performance of a new silver dressing, Contreet Foam, for chronic exuding venous leg*. Journal of Wound Care, 2002; 12:351-54.
18. Stroha, et al.: *Nanocrystalline silver dressings as an efficient anti-MRSA barrier: A new solution to an increasing problem*. Journal of Hospital Infection, 2005; 60(3):226-30.