

Prevention of Revision Amputation Surgery with the Use of Copper Dressings



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Introduction

Major leg Amputations have a notoriously high rate of complications and revision surgeries. Wound dehiscence, stump ischemia, skin tension, subcutaneous hematoma, pressure necrosis, and superficial or deep infections often lead to extended or repeat hospitalization and surgery. The copper dressing has a well-known antimicrobial as well as angiogenesis and granulation tissue formation effects, enabling autolytic debridement and epithelization. We describe 4 cases in which planned revision surgery was avoided with copper dressings.

Methods

Diabetic patients were treated at the Department of Orthopedics in Rambam Health Care Campus in Haifa, Israel. Three patients had a transtibial amputation and one transfemoral. The complication etiology was pressure necrosis, stump ischemia, dehiscence due to tension of the sutures, and late dehiscence and necrosis from uncertain etiology. Bilayer active copper dressing was applied to the deep parts of the wound, and an adhesive copper layer was applied on top in view of its chemical and mechanical effect (reducing tension from the wound edges). Dressings were changed once or twice weekly.



Results

None of the wounds seemed to be grossly infected. Therefore, systemic antibiotic was not prescribed, but slow-release locally applied tobramycin beads were used occasionally. The average wound size was $19.7 \pm 7.5 \text{ cm}^2$ (range 9.0-26.0 cm^2). Time to closure was 11.8 ± 4.8 weeks (range 6-14). The observed copper effects were antimicrobial protection, stimulation of autolytic debridement, granulation tissue formation, and epithelization. All stump wounds healed uneventfully.

Discussion

This selected small group of cases of management of amputation stump complications demonstrates the ability to promote healing on an outpatient basis with copper dressings in moderate-size wounds in circumstances that hitherto used to be treated with surgery. This is possible due to the combined antimicrobial, angiogenesis, debridement, granulation tissue formation and epithelization effects of the dressing. The suggested treatment is low-cost, safe and convenient treatment for the patient.

Case No.1:

Successful treatment of 64-year-old patient with NIDDM and PVD. 64 y. old man, with NIDDM and peripheral vascular disease (PVD) had a leg amputation and two revision surgeries for a higher trans-femoral amputation. Dehiscence of stump with necrotic areas and pale granulation tissue was seen (A). Although the patient was admitted for a repeated revision surgery, a trial of treatment with copper dressing was made. Bi-layer copper patch was applied on the wound and adhesive copper dressing was applied on top (with narrowing the wound width while applying the adhesive) (B). First dressing change was performed at Day 4. Deep and subcutaneous tunnels were packed with thin bilayer copper dressing, which was folded on the entire wound (C) and covered with adhesive copper dressing (the patient was allowed to shower with the adhesive dressing). Marked progress in the wound size was seen one and two weeks later (D, E). This progress was stopped due to protrusion of the ileo-femoral stent that had migrated to the wound (F). The stent was pulled out in the clinic (G). Before and after retrieval of the stent showed the severe calcifications of the arteries (H). Despite compromised blood supply, the wound healed at 2 months. Photo taken at 3 months from the onset of treatment showed solid healing of the stump (I). At one year follow-up, the patient ambulates with a prosthesis and the stump is stable.



Case No.2:

Successful treatment of 64-year-old patient with NIDDM and ESRD on hemodialysis. The patient had numerous stump complications. Pressure wound occurred on the amputation stump tip with eschar formation (A). After two weeks of copper dressing application, the eschar was largely detached and pink granulation tissue grew underneath it (B). The eschar was trimmed and a week later, pink granulation tissue was seen with initial epithelization (C). Significant reduction in wound size due to epithelization was seen at 5 and 7 weeks from onset of treatment (D-E). At 9 weeks of COD management, the wound was closed with no secretions or necrosis. The yellowish layer is hypertrophic corneal layer, that fades spontaneously (F).

Case No.3:

Complete closure of a trans-tibial amputation in an 88 y.o. woman with NIDDM. 10 weeks after surgery the wound was necrotic (~90%), but without surrounding infection (A). Dehiscence and necrosis were still present, although bedside debridement was performed (B-C). Secretions were present, probably due to lysis and liquification of the necrotic tissue and not due to infection (D-E). Increase in red granulation tissue, replacement of COD every 5-7 days (F). Wound was closed with no complications (G). PS. Note the eschar over the tibial tuberosity was treated simultaneously with copper dressing and healed completely.

