Copper dressings substitute debridement and skin grafting in full thickness skin necrosis (Eschar) in diabetic patients

Eyal Melamed[1], Jihad Dabbah[1], Alexei Rovitsky[1], Ilana Kan[1], Tohar Roth[2], Gadi Borkow[2]
[1]Foot and Ankle Service, Rambam Health Care Campus, Haifa, Israel. [2]MedCu Technologies Ltd.

Introduction

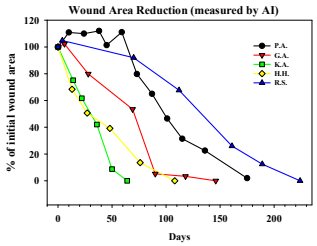
Dry eschar is a solid denaturalized proteins that coalesced after skin and subcutaneous tissue necrosis. It can be regarded as a "biological dressing" since it confers protection from bacterial invasion. Nevertheless, the eschar shrinks and the interface between intact skin and the eschar becomes a portal of entry for bacteria. The dry eschar often becomes wet and infected, resulting in cellulitis or other form of spreading infection. Treatment typically includes debridement, means to promote granulation tissue formation and skin grafting. Copper dressings (COD) convey antimicrobial protection and promotes angiogenesis, debridement, granulation tissue formation and epithelization. The goal of the current work is to describe the effect of COD on a cohort of patients with skin and subcutaneous necrosis who present with eschar.

Methods

We present five cases of diabetic patients in whom eschar wounds were treated with copper dressings from the beginning to full closure.

Results

All patients had type II diabetes mellitus (DM). The locations of the wounds were on the dorsum of the foot/anterior ankle (3 pts.) and transtibial amputation stump (2 pts.). The causes of the eschar were tight bandages (2 pts.), infection (2 pts.) and chemical burn (1 pt.). Original wound area was 15.0 ± 3.1 cm². Time to closure was 22.8 ± 3.6 weeks with average 29.6 dressing changes. There were no infectious episodes throughout the treatment period and no antibiotics was prescribed.



Discussion

In all patients the healing process comprised of eschar shrinkage with debridement (liquification) of the underlying necrotic tissue and granulation tissue formation, all happening simultaneously. Epithelization of the granulation tissue ensued and was followed by skin maturation resulting in mature, normal or near normal appearing skin. This pathway is in line with the "continuum of care" concept (from skin rupture to skin closure) known to happen with copper dressings.

Case No.1 (P.A): 60 years old diabetic patient developed full thickness skin and subcutaneous tissue necrosis in front of the ankle secondary to infection from IV catheter in the ankle. CT (upper left corner) demonstrated the depth on the infection down to the extensor tendons.

The infection was eradicated with antibiotic treatment and debridement surgery was contemplated for the eschar, to be followed by skin grafting. Home treatment with COD was without antibiotic treatment for the whole period. The eschar peeled away gradually, and the necrotic tissue underneath was auto-debrided by the growing granulation tissue. Epithelization happened almost from the beginning, with skin growth underneath the eschar first, and then over the granulation tissue.

At 5 months the wound was closed. COD was continued on the dry healed skin to promote maturation and a smaller eschar. It is noteworthy that the extensor tendons were never exposed as granulation crawled over them, thus their full function was preserved. Melamed, E., Rovitsky, A., Roth, T., Borkow, G. (2022) Archives of Clinical and Medical Case Reports 6: 501-510.

Case No.2 (G.A): 64 y.o. man with type 2 DM suffered chemical burn to the dorsal aspect of the foot 3 weeks prior to arriving to our clinic. The dry eschar measured 85x25 mm without signs of infection. Ultrasound revealed damage to the skin and subcutis fat, not involving the extensor foot tendons. COD were applied. Skin crawled into the wound, the eschar pealed away at first on the lateral side, where the damage was more superficial. In the medial aspect wound closure was preceded by granulation tissue. At 4.5 months the wound was closed. No infection occurred throughout the healing period.

Case No.3 (R.S): 62 y.o. man with type 2 DM and PVD (ABI = 0.72 & 076, TP & DP) developed pressure injury on the dorsomedial aspect of the foot, apparently as a result of tight bandage after lateral ray resection. The wound turned into dry black eschar measuring 55x37mm, without infection or discharge. Adhesive copper bandage were applied and replaced every 5-7 days. After 4 months the eschar detached and trimmed away, revealing mixed white necrotic and granulation tissue. The necrosis was replaced by red granulation tissue, which in term was exchanged by invading epithelium. At 8 months the wound was closed. One year follow up revealed firm closed wound with some scarring in the center or the original eschar. Although healing was slow, due to the poor blood supply, the copper dressing was very convenient and inexpensive, and conferred full antibacterial protection without infectious episodes or need for an antibiotic.

Cost and Convenience Comparison Between Copper Oxide Dressings to Negative Pressure Wound Therapy (NPWT) - Preliminary Results of a Randomized Controlled Trial

RAMBAM Health Care Campus

Eyal A. Melamed, MD[1]; Jihad Dabbah, MD[1]; Talia Israel, BSc[1]; Michael S. Pinzur, MD[2]

[1]Department of Orthopaedics, Rambam Health Care Campus, Haifa, Israel; [2]Loyola University Health System, Maywood, IL, USA

LOYOLA UNIVERSITY HEALTH SYSTEM

Introduction

Negative Pressure Wound Therapy (NPWT) is the standard of care for treating large and deep wounds, that are often hard to heal. While cost is a major obstacle to its use it's inconvenience for the patient and the applying care giver is another limitation Copper Oxide Dressings (COD) have been recently approved as an antibacterial dressing. Scientific research and clinical experience demonstrated COD positive effect throughout the various phases of wound healing, including stimulation of autolytic debridement, granulation tissue formation and epithelization. This study compares convenience and cost between NPWT and COD in a prospective randomized control trial (RCT).

Methods

RCT with 60 diabetic patients comparing COD to NPWT. Primary end point was reduction of wound size as determined by an artificial intelligence program [Tissue Analytics, (TA)]. Secondary end points included convenience to the care giver and patient (including pain), assessed by Visual Analog Score (VAS); time of application (minutes); and cost.

Results

29 patients have finished the study so far. Of the 14 patients in the NPWT arm, 5 dropped from the study, 4 due to worsening foot condition and 1 due to his general health condition. All 15 patients in the COD arm completed the study. COD therapy was more convenient to the patient [VAS 8.44 (COD) vs. 5.33 (NPWT); p=0.002]; and to the medical personnel [8.29 vs. 6.0; p=0.007].

COD was less painful [VAS 1.15 vs. 2.19; p=0.67].Mean application time was shorter for the COD compared to the NPWT [8.5 vs. 13.25 minutes; p<0.001].

Cost: Average time of NPWT was 28 days (±17).

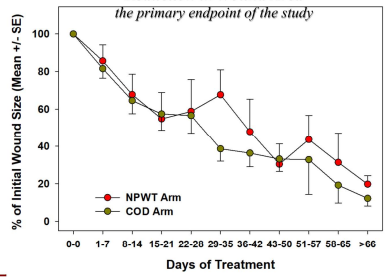
Since healing rate was similar in the two treatment arms we estimated the cost of COD in that period to be ~15% of NPWT price.

Reduction of wound size in the COD and NPWT arms, assessed by TA, was 61.5% and 41% (p=0.04) after 1 month, 80.9% and 69% (p=0.28) after 2 months, and 88% and 84% (p=0.17) after 3 months, respectively.

7 wounds (46.7%) were closed in the COD arm and 4 wounds (28.6%) were closed in the NPWT arm, with shorter time to closure of COD compared to NPWT arms [60.14 vs. 77.75 (p=0.18)].

Reduction in Wound Area

the primary endpoint of the study



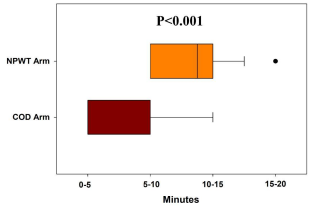
Conclusions

COD was superior to NPWT in terms of convenience, time of application and pain. It was non-inferior to NPWT in regard to wound closure (statistically significant). In addition, treatments cost was greatly reduced (~85%). We conclude that COD should be considered as first line of treatment for wounds in diabetic patients when NPWT is considered.

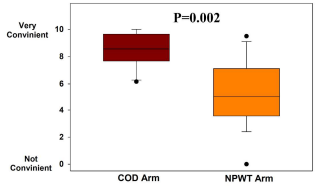
Disclosure: Dr. Eyal Melamed and Dr. Michael Pinzur are members of the advisory board of MedCu, the COD manufacturing company.

Patient No. 10. - COD Arm

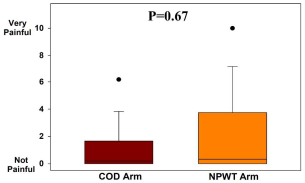
Application Time



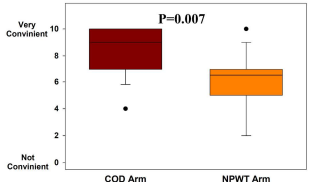
Patients Convenience



Patient Pain



Nurses/Care Givers Convenience



Cost estimation analysis for NPWT Vs. COD (Israel rates expressed in US dollars)

	Treatment (Dressing / Device)	Nurse Home Visits per Week	Total Weekly	Total 4 Weeks
COD	25*	45 (30/visit)	70	280
NPWT	480**	0 (included in the rent)	480	1920

Saving~85%

* average of 1.5 dressings changes per week **including nurse changing visits.
In Israel NPWT machine is rented with the wound nurse home service.

Mario Franolić, MD
Specialist in Emergency Medicine
Doctor of Underwater and Hyperbaric Medicine
Mentor at the Institute for Underwater and Hyperbaric Medicine, Clinical Hospital Center Rijeka, Croatia
Titled assistant at the Faculty of Medicine in Rijeka
Deputy head of the Center for Research and Development in Underwater, Hyperbaric and Marine Medicine, MF Rijeka
e-mail: dr.mariofranolic.hbot@gmail.com
tel: +385 98 742968

Compatibility of Copper based Wound Care Products with Hyperbaric Oxygen Therapy (HBOT)

The subject of consideration in this text is an innovative copper-based wound dressing. Numerous experiences around the world prove the high efficiency of these dressings for wounds with the trade name MedCu, the only ones in this group.

The promotional material states the following:

"MedCu is a groundbreaking innovation in wound care. It's the world's first provider of wound dressing products impregnated with copper oxide microparticles. Leveraging copper's potent antimicrobial properties, MedCu offers a unique solution for acute, critical, and chronic wounds. Notably, MedCu dressings have received FDA clearance, making them a reliable choice. These dressings provide protection against a broad spectrum of pathogens, allow for 7-day wear-time (reducing the need for frequent changes), and are irritant-free and biocompatible."

I have personally used these wound dressings since 2022 with excellent experiences, and it has become the leading dressing in my wound care practice, although I also use all other classes of products when necessary.

Bearing in mind that, along with wound care, my main job is hyperbaric oxygen therapy, it is clear that HBOT is very often part of my complex approach to the treatment of all types and severity of chronic wounds. Patients with MedCu dressings on their wounds also undergo treatments in the pressure chamber. So far, my team and I have not noticed any problems with applying this type of wound dressing during HBOT.

The operation of hyperbaric chambers is very strictly controlled and supervised. For safety reasons, primarily for fire protection, EVERYTHING brought into it must be certified for hyperbaric conditions, and patients wear certified cotton clothing. Everything but wound dressings! There are no reliable and unified tests, as well as no practice, of the compatibility of dressings for chronic eras with HBOT. Probably the manufacturers themselves do not find interest in such tests because it is a smaller part of their target market. Thus, almost anecdotal tests have been done for some wound dressings dealing with their flammability in hyperbaric

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COPPER DRESSINGS: MUCH MORE THAN AN ANTIMICROBIAL...

Alessandro Corsi1 , Ornella Forma2 , Sara Maria Lupi3 , Giulia Vidotto4 , anna aloise5 , Lina Ognibene6 , Umberto Cazzaro7 , Gaetano de Angelis6 , bertulli gianluca8 , Gaetano Pitoia

1OSPEDALE SAN RAFFAELE, U.O. VULNOLOGIA, MILAN, Italy

Aim: Rarely does a medication prove more effective than declared by the manufacturer. The recent appearance, in the Wound Care market, of copper dressings, represents one of these rare occasions, in which the results obtained have gone beyond expectations, allowing us to hypothesize an action on other factors influencing healing in addition to the control of microorganisms.

Method: Over 50 acute and chronic skin lesions, treated with copper dressings, used directly on the lesion or through a silicone interface, were evaluated in terms of decrease and control of the microbial load; during data collection, we noticed how other critical aspects (exudate, odor, pain, cell proliferation) were also mediated by the same medication.

Results / Discussion: All lesions showed a rapid decrease in signs of inflammation and infection, with resumption of the tissue repair process in a short time, reaching, in 75% of cases (38 patients), a rapid and complete healing.

Conclusion: Copper-containing dressings have proven to be more effective than initially conceivable in relation to their antimicrobial action, as they are able to rapidly and intensely modulate the inflammatory process, as well as stimulating tissue regeneration by intervening at various levels of the process.