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- 01** Case Report: One Patient with Scald on Both Heels Treated with Moist Exposed Burn Therapy Combined with Platelet-Rich Plasma
- 04** Treatment of Extravasation-induced Pretibial Skin Necrosis with Moist Exposed Burn Ointment: A Case Report
- 08** Experience of Treating an Elderly Patient with Diabetic Foot Ulcer
- 11** Moist Exposed Burn Ointment Combined with Microskin Grafting in the Treatment of Chronic Ulcer on Lower Extremity: A Case Report
- 15** Efficacy of Treating Traumatic Nail Bed Defect with Moist Exposed Burn Therapy
- 20** Treatment of Severe Electrical Burn of Wrist with Moist Exposed Burn Ointment: A Case Report

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Case Report: One Patient with Scald on Both Heels Treated with Moist Exposed Burn Therapy Combined with Platelet-Rich Plasma

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【Abstract】 One patient with scalds on both heels admitted to Donghe Hospital of Ganzhou in February 2020 was treated with Moist Exposed Burn Therapy combined with Platelet-Rich Plasma. After 21 days of treatment, wound size significantly reduced and patient was discharged. Follow-up at 1 month, wound healed well, skin sensation and elasticity were normal, no significant scar formed and subcutaneous tissues grew well.

【Key words】 Moist Exposed Burn Therapy; Moist Exposed Burn Ointment; Platelet-rich plasma; Heel; Scald; Wound

Clinically, scald is mainly treated with skin graft etc. but scar formation remains a problem. With the increased understanding of moist healing environment in recent years, Moist Exposed Burn Therapy (MEBT) and Platelet-Rich Plasma (PRP) had been widely used in wound treatment in the departments of orthopedics and burns.¹⁻² However combined treatment of MEBT and PRP was rarely used. Based on their mechanisms of action and our previous experience, we combined them in treating heel scald and achieved satisfying result.

1. Case report

The patient was a 46-year-old male who was admitted in February 2020 with unhealed scald on both heels for 3 months. The patient had both his heels scalded by hot water 3 months ago and used Mercurochrome solution

at home without good effect. Then patient went to local hospital for treatment but still didn't improve. To seek further treatment, he came to our hospital. Examination on admission: T 36.5°C, P 98 bpm, R 20 bpm, BP 129/82 mmHg. Wound on left heel: size 8.5 cm×5 cm, depth 1.0 cm; wound on right heel: size 5.5 cm×2.3cm, depth 1.0 cm. Auxiliary examination: C-reactive protein 13.8 mg/L, hypersensitive C-reactive protein >10.0 mg/L. Clinical diagnosis: scald on both heels complicated with infection.

After admission, systemic treatments such as anti-infection etc. were given. After surgical debridement, apply Moist Exposed Burn Ointment (MEBO) directly on wounds, then cover wounds with 4 layers of MEBO impregnated gauze and secure with sterile dressing. Dressing was changed daily.

Meanwhile perform infrared therapy for 15 minutes, 2 times a day. At day 3, inject PRP into wound and apply it on wound surface as well, and cover wound with air-permeable film. At day 10, remove film and continue with MEBO dressing and infrared therapy. At

day 21, wound size significantly reduced and patient was discharged. Follow-up at 1 month found wound healed well: skin sensation was normal, skin elasticity was normal, no notable scar formed and subcutaneous tissues grew well. (Figure 1-4).



Figure 1. At day 3, no noticeable necrotic tissues on wound; Figure 2. At day 10, granulation tissues grew well; Figure 3. At day 16, wound size reduced; Figure 4. At day 21, wound size significantly reduced.

2. Discussion

Repair of serious heel injury caused by burns, frostbite, avulsion injury or crush injury etc. is difficult due to thin soft tissues on heel and not so good circulation. Conventional treatment such as flap transplantation could cause scar formation and impact patients' mobility. Therefore, seeking an effective treatment to repair heel wound is critical to improve these patients' life quality.

Clinical research found that MEBT could facilitate the removal of necrotic tissues on wound and the preserving of zone of stasis, which creates favorable conditions for granulation tissue growth.³ Some ingredients in MEBO could alter living environment of bacteria and inhibit their motility and toxicity, which could effectively prevent wound infection.⁴ Other constituents could provide rich nutrients for regeneration and repair of wound to accelerate wound healing.⁵ Besides,

active constituents could inhibit excessive proliferation of fibroblasts, prevent excessive synthesis and secretion of collagen mucopolysaccharide, promote growth of epithelial cells and fibroblasts at the ratio of 1:4, therefore reduce scar formation and prevent contracture.¹ In addition, various growth factors in PRP could promote proliferation of various cells during tissue regeneration and repair and therefore promote angiogenesis of capillary blood vessels and synthesis of extracellular matrix such as

collagen and fibrin.⁶ Combined use of MEBT and PRP could effectively promote regeneration and repair of heel wound. And PRP which has abundant source is easy to use and low in costs, and it could easily be accepted by patients as it causes no significant adverse reactions or immunosuppression reactions.⁷⁻¹¹

In summary, combined use of MEBT and PRP could effectively promote healing of heel scald with significant efficacy.

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Treatment of Extravasation-induced Pretibial Skin Necrosis with Moist Exposed Burn Ointment: A Case Report

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【Abstract】 A patient with pretibial skin necrosis caused by extravasation was given systemic treatment including anti-infection and nutritional support, etc., while Moist Exposed Burn Ointment was used for wound management. At day 41, the wound healed completely, with no severe scar formation.

【Key words】 Extravasation; Skin necrosis; MEBO; Wound

Extravasation occurs when drug leaks from veins into extravascular tissue during infusion, resulting in swelling, infection, ulcers and even necrosis in local tissue. Extravasation on the palm side of wrist and back of hand or foot where there are small tendons and ligaments, could cause injuries that are difficult to treat.¹⁻² In addition, the large amount of venous valves in lower extremities decreases blood flow velocity, which could cause unintended drug accumulation and damage to the vascular endothelium.³ In this study, drug extravasation occurred after infusion of human serum albumin in lower extremity, and caused local tissue necrosis. After applying wet compress with magnesium sulfate solution, the wound didn't heal but aggravated. To promote wound healing, Moist Exposed Burn Ointment (MEBO) was used as it has shown significant efficacy in wound management and could significantly shorten wound healing time.⁴

1. Baseline data

The patient, an 86-year-old male, had cough

with sputum for 1 month before admission. His condition did not improve after treatment at home, and even aggravated. He then came to our hospital for treatment. The patient had a history of stroke and hypertension, and was bedridden for a long time. Examination on admission: advanced cognitive decline, malnutrition, Waterlow pressure ulcer risk assessment scale score: 21 (very high risk), Activities of Daily Living score: 0 (total dependence). Auxiliary examination: white blood cell count (12×10^9 /L), red blood cell count (4.24×10^{12} /L), hemoglobin (16 g/L), platelet count (215×10^9 /L), monocyte percentage (9.10%), and serum albumin (24 g/L).

After admission, an indwelling needle was placed in pretibial area of right leg, and infusion of human serum albumin was given via it. However, extravasation occurred, causing severe local redness and swelling with the size of about 10.0 cm×12.0 cm. Wet compress with 50% magnesium sulfate solution was applied, which showed limited

effect. Then, skin at the extravasation site started to break down with light yellow exudate, and sterile gauze was placed on top. Black scab gradually formed on wound, and MEBO was applied on wound at 2.0 mm thickness, and then MEBO impregnated gauze and sterile gauze were sequentially placed (dressing was changed daily). At the same time, systemic treatment was given: piperacillin sodium and tazobactam sodium injection was used to treat infection, human serum albumin and medium-chain and long-chain lipid emulsion were used for nutritional support, high-protein, high-calorie and high-vitamin diet was given, patient's position was regularly changed, and pillows and air mattress etc. were used for bone prominence offloading. Lower limbs were elevated to promote blood circulation, affected limb was massaged to prevent venous

thrombosis. Patient education was delivered. After 10 days of treatment, the scab on wound softened and separated from surrounding viable tissue, and its color changed from black to light yellow. After removal of scab, the wound surface was seen covered with odorless white necrotic tissue. After 24 days of treatment, wound reduced in size, redness and swelling significantly subsided. White necrotic tissue was liquefied, and debridement was performed to such thickness that slight bleeding was seen. After 34 days of treatment, wound size reduced significantly, large amount of granulation tissue and epithelialization were seen, and redness and swelling subsided. At day 41, wound healed completely without noticeable scar formation, as shown in Figure 1-5.



Figure 1. Before treatment; Figure 2. 10 days after treatment; Figure 3. 24 days; Figure 4. 34 days; Figure 5. Wound healed after 41 days

2. Discussion

As for elderly patients, their physiological

function degenerates, blood vessel wall thins, and vascular fragility increases while elasticity

decreases. As a result, elderly patients tend to have extravasation. In addition, elderly patients often have malnutrition and poor blood circulation. In the event of extravasation, necrosis might develop, and wound could become chronic wound without proper treatment.⁵

MEBO could form a transparent film on wound that isolate wound from external irritation, and create a physiological moist environment. MEBO contains carbohydrates, fatty acids, amino acids, vitamins, etc. which are essential nutrients for tissue regeneration and wound repair, and are conducive to wound healing.⁶ MEBO could react with necrotic tissue through a series of biochemical reactions such as hydrolysis, enzymolysis, rancidification, saponification, and esterification, liquefying and removing necrotic tissue without damage, meanwhile viable tissue is well preserved.⁷ Potential regeneration cells are activated and transformed into stem cells which proliferate

and differentiate into tissue cells of different layers, promoting wound healing in situ.⁸⁻⁹ In this study, MEBO was used for the treatment of one patient with pretibial skin necrosis caused by extravasation. After 41 days of treatment, wound healed completely, with no noticeable scar formation. Therefore, MEBO could effectively promote the healing of necrotic wounds caused by extravasation, and effectively prevent scar formation. The mechanism for inhibiting scar formation could be that the active constituents contained in MEBO could inhibit the excessive proliferation of fibroblasts, prevent the excessive synthesis of collagen mucopolysaccharides, and promote the growth of epithelial cells and fibroblasts at a ratio of 1 : 4 in early stage of wound healing.¹⁰⁻¹¹

In conclusion, MEBO in the treatment of local skin necrosis caused by extravasation could accelerate wound healing and reduce scar formation.

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Experience of Treating an Elderly Patient with Diabetic Foot Ulcer

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【Abstract】 An elderly patient with diabetic foot ulcer was admitted on October 9th 2019 to our hospital. While providing systemic treatment to him, Moist Exposed Burn Ointment (MEBO) was used for wound management. On day 22, wound size significantly reduced, and the patient was discharged with continued dressing change at outpatient. Follow-up at 18 days after discharge showed the wound basically healed without noticeable scar formation.

【Key words】 Elderly; Diabetic foot; Wound; Moist Exposed Burn Ointment

Diabetic foot ulcer is one of the main chronic complications of diabetes, and one of the main factors responsible for disabilities and deaths in diabetic patients. According to epidemiological researches, about 70% of amputation worldwide are attributed to diabetic foot ulcer, and foot ulcer or gangrene could occur in over 15% of diabetic patients.²⁻³ Both figures are now on the rise because of the increase number of diabetic patients. So how to effectively prevent and treat diabetic foot ulcer has become the focus of clinical research. In this study, Moist Exposed Burn Ointment (MEBO) was used to treat diabetic foot ulcer of an elderly patient while providing proper systemic care.

1. Case report

The patient, a 86-year-old male, who was admitted to our hospital on October 9th 2019, complained of unhealed injuries on right toes for over 3 month. Patient accidentally injured

his right toes 3 months ago and treated at home. Instead of showing improvement, wound size gradually increased, so the patient came to our hospital for further treatment. Examination on admission: slightly overweight, walk with assistance, active position, cooperative in examination. T 36.1 °C , P 95 bpm, R 18 bpm, BP 172/83 mmHg. Pitting edema in both lower extremities, low skin temperature of feet, impaired superficial sensation, weak pulse of dorsal artery of foot. Dry necrosis on distal ends of the big toe, the second toe and the third toe, various degrees of ulcers on the second and fourth toe with purulent and bloody exudate, and a 2cm long blood blister on the outer side of the fifth toe (Figure 1). Medical history:16 years of hypertension, coronary atherosclerotic heart disease, over 30 years of diabetes with blood sugar not well controlled. Auxiliary examination: random blood sugar 23.6 mmol/L. Ultrasound Color

Doppler of both lower extremities showed atherosclerotic plaques in right femoral artery and popliteal artery, and occlusion of both pretibial arteries and dorsal arteries of foot. Bacteria culture of wounds showed *Klebsiella pneumoniae* infection. Clinical diagnosis: Wagner grade 3 diabetic foot ulcer with infection, type 2 diabetes, diabetic peripheral vascular disease and neuropathy, stage 3 hypertension, coronary atherosclerotic heart disease, gallstone with cholecystitis, fatty liver.

After admission, vital signs of the patient were closely monitored, and advised patient to take low-salt and low-fat diet, control water temperature for foot bath, trim fingernails and toenails carefully, wear loose and comfortable shoes and keep feet warm. Psychological

counseling was also provided. Treatment for primary diseases, broad-spectrum anti-infective treatment (later change to sensitive antibiotics based on wound bacteria result), and systemic treatment including microcirculation improvement and nerve nurturing etc. were given. For wound management, debridement was performed followed by application of MEBO at a thickness of 1.0-2.0 mm and MEBO impregnated gauze, and secure with sterile dressing. Dressing was changed once daily (Figure 2-4). On day 22, wound size significantly reduced (Figure 5), patient was discharged and dressing change was continued in outpatient. Follow-up at day 18 after discharge showed the wounds basically healed without noticeable scar formation. (Figure 6)



Figure 1. Wound on admission; Figure 2-4. Wound healing process during treatment; Figure 5. On day 22, wound size significantly reduced; Figure 6. Follow-up at day 18 showed wound basically healed

2. Discussion

Treating diabetic foot ulcer, especially that of an elderly patient, is difficult in clinical practice. In our study, the patient was 86 years old with multiple primary diseases, poor

physiological function and poor compliance. After admission, systemic treatment and psychological counseling were given, and MEBO was used for wound management.

Psychological counseling could effectively guide patient to face disease with positive and healthy attitude and improve his compliance.⁴ At the same time, actively treating primary disease, strictly guiding patient to take low-salt and low-fat diet and administering medicine for microcirculation improvement and nerve nurturing could create favorable conditions for wound repair.⁵⁻⁶ Active constituents in MEBO could react with necrotic tissues through a series of biochemical reactions to liquefy necrotic tissues without damage and create a

physiologically moist environment for wound, which facilitates wound regeneration and repair.⁷ Potential regenerative cells in wound could be activated into stem cells with the rich nutrients provided by MEBO, then proliferate and differentiate into various cells in skin, which promotes wound healing.⁸⁻¹⁰

In summary, application of MEBO on wound while giving systemic treatment could significantly promote diabetic foot ulcer healing in elderly patients.

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Moist Exposed Burn Ointment Combined with Microskin Grafting in the Treatment of Chronic Ulcer on Lower Extremity: A Case Report

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【Abstract】 A patient with chronic ulcer on left lower extremity caused by varicose veins was admitted to the Department of General Surgery, Fuling District Hospital of Traditional Chinese Medicine, Chongqing in September 2019. The ulcer was treated with Moist Exposed Burn Ointment (MEBO), and the ulcer size reduced significantly after 15 days. Followed by debridement and microskin grafting, and continuous application of MEBO, 61 days after treatment, ulcer basically healed and patient was discharged.

【Keywords】 Microskin graft; MEBO; Varicose vein; Chronic ulcer; Infection

Chronic ulcer on lower extremity is a common disease in clinical practice. Common reasons for such ulcer include local hypoxia and ischemia caused by vascular disease (vascular disease could lead to poor venous return of lower extremities). Bacterial colonization and antibiotic resistance are important reasons for chronic ulcer.³ In severe cases, sepsis could occur, which could be fatal.⁴ Therefore, active control of infection is important in the treatment of chronic ulcer.² As Moist Exposed Burn Ointment (MEBO) could inhibit the reproduction and growth of pathogenic bacteria, and promote skin tissue regeneration and ulcer healing as shown in some studies, it was used in combination with microskin grafting in the treatment of this patient with chronic ulcer on lower extremity.

1. Clinical data

The patient, a 68-year-old male, was admitted for skin ulcer on left lower extremity that had not healed for more than 3 months. 3 months ago, patient developed ulcer on left lower extremity associated with mild pain and pruritus after eating seafood. After topical application of gentamicin and vitamin B12, etc., and IV therapy, patient's condition didn't improve, and ulcer size gradually increased. One day before admission, he underwent color Doppler ultrasonography in a local hospital, which showed varicose vein of left lower extremity, and then he came to our hospital for treatment. 20 years ago, patient underwent skin grafting for skin ulcer of left lower extremity caused by trauma. Examination: the superficial veins of left lower extremity were tortuous and dilated, skin was pigmented

without hair growth. An 18.0 cm × 4.0 cm ulcer was in the middle and lower part of calf, with a large amount of light yellow exudate. Base of ulcer was dark red and most of the tissue was fibrotic. Granulation tissue was not fresh, and there wasn't noticeable epithelial cell migration at ulcer edge. Ulcer was tender and slightly high in temperature. The ankle joint was free to move, and the left dorsum of foot was slightly swollen. Auxiliary examination: bacterial culture test results of ulcer exudate showed multidrug-resistant *Acinetobacter baumannii* positive; color Doppler ultrasonography found left lower varicose great saphenous vein and small saphenous vein, plaques in left lower extremity, and multiple thrombus in deep veins. Clinical diagnosis: chronic ulcer on left lower extremity; varicose veins of left lower extremity.

After admission, systemic treatment was given: aescin sodium was administered intravenously for promoting blood circulation and reducing swelling, cefmetazole sodium for infection prevention, and enoxaparin sodium for thrombosis prevention. For ulcer management: after debridement, MEBO was applied on ulcer followed by MEBO impregnated gauze, then secure with sterile gauze, dressing was changed 2 times a day. 5 days after treatment, exudate reduced significantly, scattered granulation tissues growth and a few epithelial cell migration at ulcer edge were seen. 9 days after treatment, bacterial culture test result of

exudate showed proteus mirabilis positive. 15 days after treatment, ulcer size decreased significantly, and microskin grafting was performed after debridement. Microskin grafting procedure: after combined spinal-epidural anesthesia, a piece of 4.0 cm×3.0 cm skin was harvested from anterior thigh, and was cut into smaller fragments (0.2 cm×0.2 cm), and then soaked into normal saline; then skin fragments were injected into the granulation tissue with a 2 mL syringe, at a depth of about 0.2 cm and an interval of 0.5~1.0 cm; at last, the remaining skin fragments were placed on ulcer evenly. Application of MEBO on original ulcer was continued after surgery, and donor site was treated with MEBO as well. 30 days after treatment, most of the skin fragments survived, contributing to the formation of epithelial islands, few necrotic tissue on ulcer, and donor site almost healed. 36 days after treatment, patient complained of slight pruritus, with a few blisters at ulcer edge. Therefore, application of MEBO was stopped, and Recombinant Human Basic Fibroblast Growth Factor was used for ulcer treatment. 56 days after treatment, ulcer decreased in size, but growth of epithelial tissue slowed down significantly, so application of MEBO was resumed. 61 days after treatment, donor site healed completely, and ulcer almost healed. Patient was discharged and applied MEBO by himself at home since then. Treatment process is shown in Figures 1-10.



Figure 1-2. On admission; Figure 3-4. After debridement; Figure 5-6. Most microskin fragments survived on the 34th day of treatment; Figure 7-8. Skin fragments grew and merged into epithelial islands on the 42nd day of treatment. Figure 9-10. Ulcer almost healed on the 61st day of treatment.

2. Discussion

Patients with varicose veins of lower extremities have poor blood circulation. Once skin ulcer occurs, it tends to be complicated with multidrug-resistant bacteria infection, resulting in chronic ulcer.⁵ Promoting local blood circulation, controlling ulcer infection, and providing a good environment for the growth of granulation tissue are critical to ulcer healing.⁶

The patient in this study had on his left lower extremity varicose veins, atherosclerotic plaque, and multiple deep vein thrombosis, which caused poor blood circulation and venous return, resulting in chronic ulcers. After admission, the ulcer was treated with

MEBO combined with microskin grafting. 61 days after treatment, ulcer almost healed. Compared with other treatment methods, microskin grafting requires less skin taken from donor site, and increases survival rate of skin fragments. In addition, it is easy to conduct, at a low cost.⁷ Combined with MEBO that has rich nutrients, microskin grafting could promote tissue growth for rapid closure of ulcer.⁸⁻⁹ In addition, MEBO could activate the Potential Regenerative Cells in tissue into stem cells that further differentiate and proliferate in situ into various skin cells.¹⁰ Active constituents contained in MEBO could effectively control ulcer infection by reducing bacterial virulence.¹¹⁻¹² On the 9th day of treatment, the main species of microorganism

had changed from multidrug-resistant *Acinetobacter baumannii* to susceptible *Proteus mirabilis*. The mechanism could be that MEBO causes non-specific mutation of bacteria by changing the local environment, and the use of MEBO could prevent the overuse of antibiotics which causes the

generation of drug-resistant bacteria.¹³

In conclusion, MEBO combined with microskin grafting in the treatment of chronic ulcer caused by varicose veins of lower extremity could effectively control ulcer infection and accelerate healing.

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Efficacy of Treating Traumatic Nail Bed Defect with Moist Exposed Burn Therapy

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【Abstract】 Objective To study the efficacy of treating traumatic nail bed defect with Moist Exposed Burn Therapy (MEBT). **Methods** 80 patients with traumatic nail bed defects admitted to People's Hospital of Huangdao District between November 2016 and November 2019 were enrolled and randomized into study group (n=40) receiving MEBT for 46 injured fingers and control group (n=40) receiving autologous nail bed graft (n=40) for 43 injured fingers. Visual Analog Scale (VAS) score, function and appearance of injured fingers between 2 groups were compared. **Results** At 4, 8, 24, 48 and 72 hours, VAS scores in study group were significantly lower than control group ($t=24.660, 46.590, 33.560, 52.600, 29.900, p < 0.001$); at 3, 6 and 9 months, function scores of injured fingers in study group were significantly higher than control group ($t=16.910, 15.540, 14.110, p < 0.001$); at 9 months, efficacy in study group was 100%, significantly higher than 74.42% in control group ($z=-8.391, p < 0.001$). **Conclusion** Application of MEBT in treating traumatic nail bed defects could effectively relieve wound pain, and promote function and appearance recovery of injured fingers.

【Key words】 Moist Exposed Burn Therapy; Moist Exposed Burn Ointment; Autologous Nail Bed Graft; Nail Bed Defect; Traumatic Injury; Nail

Traumatic nail bed defect, common in clinical practice, is a severe nail bed injury, often complicated with phalanges or surrounding soft tissue injury. Although the development of microsurgery makes repair and construction of nail bed defect possible¹, surgery could cause inevitable injury, and wounds are prone to scar formation after surgery, which impacts finger function. So seeking a treatment which could restore finger appearance and function besides surgery has become a focus in clinical study.² The author had been applying Moist Exposed Burn Therapy (MEBT) in treating traumatic nail bed defect since November 2016, and nails of all the treated patients regrew, and finger length, appearance and function were restored. Compared with

conventional autologous nail bed graft, this treatment has significant efficacy.

1. Clinical data

1.1 General data

80 patients with traumatic nail bed defects admitted to People's Hospital of Huangdao District between November 2016 and November 2019 were enrolled and randomized into study group (n=40) and control group (n=40). In study group, male (n=27), female (n=13), 3-78 years old (mean 32.6 ± 13.4); sites of injuries: thumb (n=15), index finger (n=8), middle finger (n=11), ring finger (n=12) and little finger (n=12); causes of injury: machine crush (n=13), electric saw injury (n=12), heavy objects smash (n=14),

sharp objects cut (n=7); degrees of injuries: second-degree defect (n=26), third-degree defect (n=17). In control group. Male (n=26), female (n=14), 7-68 years old (mean 33.7 ± 12.9); sites of injuries: thumb (n=13), index finger (n=9), middle finger (n=10), ring finger (n=11) and little finger (n=11); causes of injury: machine crush (n=12), electric saw injury (n=11), heavy objects smash (n=13), sharp objects cut (n=7); degrees of injuries: second-degree defect (n=26), third-degree defect (n=17). Comparison of above data between 2 groups was tested by *chi-square test* ($\chi^2=0.056, 0.192, 0.019, 0.029, p=0.813, 0.979, 0.987, 0.865, p > 0.05$). Age was tested by *t test*, $t=0.374, p=0.709, p > 0.05$. This study was approved by the ethics committee of the People's Hospital of Huangdao District and all patients had signed informed consent forms.

1.2 Inclusion and exclusion criteria

Inclusion criteria: diagnosed as traumatic nail bed injury, required nail reconstruction (evaluation standard for nail bed defects³: first-degree defect: diameter of defect $< 0.5\text{cm}$; second-degree defect: diameter of defect between $0.5\text{ cm}-1.0\text{cm}$; third-degree defect: complete injury of nail bed; fourth-degree defect: complete injury of nail bed combined with nail matrix injury); signed informed consent forms; complete medical record. Exclusion criteria: abnormal function of injured fingers caused by hemiplegia or nerve injury of upper limb, abnormal function of injured fingers caused by other reasons, unable to communicate normally due to mental diseases.

2. Methods

2.1 Treatment methods

Study group: tetanus antitoxin IM injection was given. For patient without fracture or underwent fracture surgery, apply Moist

Exposed Burn Ointment (MEBO) evenly on wound at a thickness of about 1.0 mm to cover $1/2$ area below the uninjured knuckle and cover with sterile dressing. After 24 hours, remove the dressing, apply MEBO again and expose the wound. MEBO was applied every 2-3 hours.

Control group: tetanus antitoxin IM injection was given. After fracture surgery, take medium-thickness nail bed skin (donor site size was 1.0 mm larger than that of defects) from the first toe and transplanted to the defect area. Sew up with atraumatic interrupted suture and secure with vaseline gauze.

2.2. Clinical outcome and evaluation standard

Pain level, recovery of function and appearance of injured fingers between 2 groups were compared. Visual Analog Scale (VAS) was used to evaluate pain levels at 4, 8, 24, 48 and 72 hours. Finger function after nail bed reconstruction was evaluated with the Chinese Medical Association designated evaluation standard for the Functions of Severed Fingers after Graft⁵ in which functions were evaluated from movement, sensation, appearance and working ability, scores between 13-16 was excellent, 9-12 was good, 5-8 was fair and ≤ 4 was poor).

2.3 Statistical analysis

SPSS 22.0 was used for statistical analysis. Count data was represented as n (%), tested by *chi-square test* or *rank sum test*; measurement data was represented as mean \pm standard deviation ($\bar{x} \pm s$), tested by *t test*. $p < 0.05$ was considered statistically significant.

3. Results

3.1 VAS scores

VAS scores in study group at 4, 8, 24, 48 and 72 hours were significantly lower than control

group ($p < 0.05$). See Table 1.

3.2 Scores for function of injured fingers

Scores for function of injured fingers in study group were significantly higher than control group at 3, 6 and 9 months ($p < 0.05$). See Table 2.

3.3 Regrowth of defect nail beds and nails

At 9 months, regrowth of defect nail beds and nails in study group was 100%, significantly higher than 74.42% in control group ($z=-8.391$, $p < 0.001$).

Table 1 VAS scores (point, $\bar{x} \pm s$)

Group	Cases	4 h	8h	24h	48h	72h
Study group	40	3.01±0.75	2.81±0.45	2.51±0.15	1.58±0.21	1.25±0.38
Control group	40	6.88±0.65	7.01±0.35	7.09±0.85	5.71±0.45	4.81±0.65
<i>t</i>		24.660	46.590	33.560	52.600	29.900
<i>p</i>		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Note: MEBT was used in study group while autologous nail bed graft was performed in control group.

Table 2 Scores for the function of injured fingers (point, $\bar{x} \pm s$)

Group	Cases	3 months	6 months	9 months
Study group	40	12.79±1.67	13.87±1.92	14.56±1.36
Control group	40	7.73±0.89	8.69±0.87	9.79±1.65
<i>t</i>		16.910	15.540	14.110
<i>p</i>		< 0.001	< 0.001	< 0.001

Note: MEBT was used in study group while autologous nail bed graft was performed in control group.

3.4 Case report

Case 1: a 43-years old male was admitted to our emergency department 1h after his distal ends of middle and ring fingers of left hand were smashed by a rock. The patient immediately felt pain and the bleeding couldn't stop. So to seek treatment, he came to our hospital. Examination on admission: nail of middle finger fell off, contusion on nail bed and finger pulp, partial defect of non-growing part of nail matrix, obvious contusion of growing part of matrix but without defect, comminuted fracture on distal phalanx while fracture end exposed; nail of ring finger fell off, contusion on nail bed but without defect (Figure 1). After admission, emergency

fracture fixation was done and MEBT was used on wound (Figure 2). At day 10, sutures were removed, and partial injured nail bed and pulp became necrotic and fell off, so partial phalanx was exposed (Figure 3). At 1 month, nail bed and pulp skin basically healed and part of the nail regrew (Figure 4) and Kirschner wire for fixation was removed. At 4 months, nail bed of middle finger fully regrew but nail did not fully grow back while nail of ring finger was about to fully grow back (Figure 5). Follow-up at 32 months after discharge showed nail of middle finger and ring finger fully grew back with normal appearance (Figure 6).

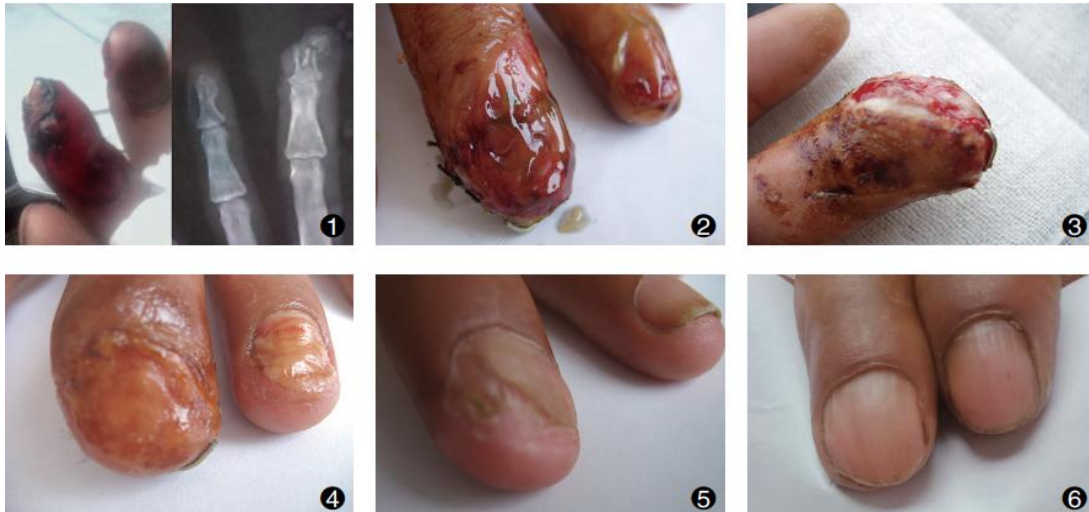


Figure 1. After admission, appearance of injured finger and X-ray examination; Figure 2. Remove dressing 2 days after fracture fixation of phalanx and apply MEBO; Figure 3. At day 10, partial injured skin on nail bed and pulp became necrotic and fell off, and partial phalanx exposed; Figure 4. At 1 month, nail bed and pulp skin basically healed and part nail regrew; Figure 5. At 4 months, nail bed of middle finger fully regrew but nail did not fully grow back while nail of ring finger was about to fully grow back; Figure 6. Follow-up at 32 months after discharge showed nail of middle finger and ring finger fully grew back with normal appearance

Case 2: a 37-year-old male was admitted to our hospital due to unhealed injury of right thumb caused by car door crush for 5 months. After the injury, patient went to local hospital for debridement, stitching and dressing change. But 5 months later, defect nail did not fully regrow and pus could be seen. To seek further treatment, he came to our hospital. Examination on admission: most of non-growing part of matrix of right thumb

were dry and necrotic, and purulent exudates could be seen (Figure 7). After admission, debridement was done followed by the application of MEBT (Figure 8-9). At 2 months, both nail bed and nail fully regrew (Figure 10). At 6 months, regrown nail was almost normal looking (Figure 11). Follow-up at 18 months after discharge showed regrown nail became normal (Figure 12).

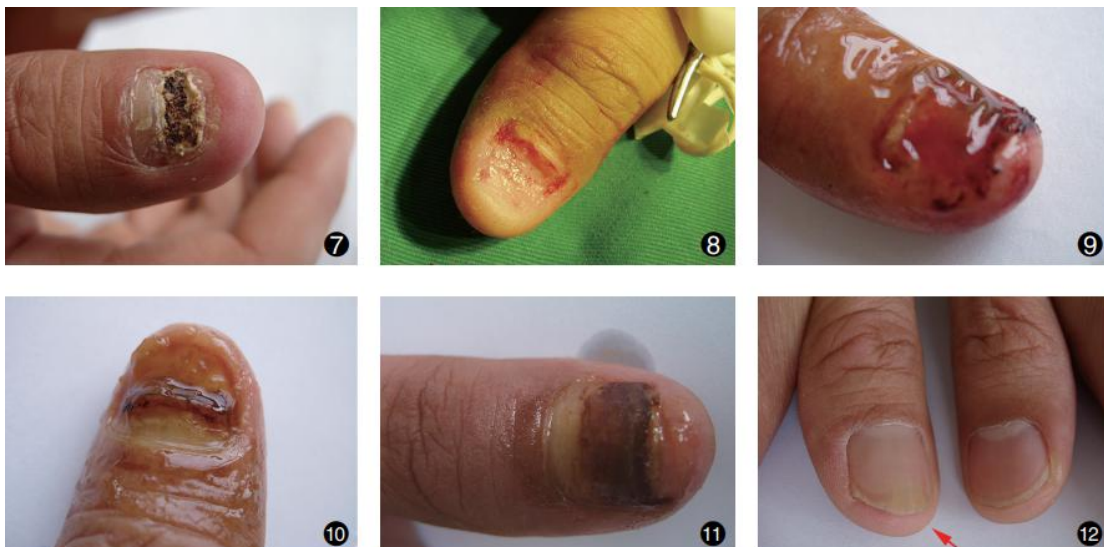


Figure 7. Finger injury on admission; Figure 8. Finger condition after debridement; Figure 9. Remove dressing 2 days after debridement and apply MEBO; Figure 10. At 2 months, nail bed and nail fully regrew; Figure 11. At 6 months, nail regrew to almost normal; Figure 12. Follow-up at 18 months after discharge showed nail returned to normal.

4. Discussion

Nail, located on the prominent part of fingers, is prone to injury. Weak regenerative ability of nail bed means that injury of it could easily cause nail deformity etc. which could impact finger function and appearance.³

As an essential part of MEBT, MEBO could create a physiologically moist environment which could salvage dying cells, promote growing of residual nail bed tissues and repair defect tissue.⁴ Clinical practice showed that MEBO could promote regeneration of injured or defect matrix, therefore remain the length and functions of injured fingers to the maximum extent.⁵ Such effects are related to the fact that MEBO could stimulate Potential

Regenerative Cells in wound tissue, activate them into stem cells which then proliferate and differentiate in-situ into tissue cells.⁶ MEBO could also relax arrector pili muscles and prevent pain caused by spasm, prevent excessive water evaporation of wound so to prevent pain caused by cell dehydration and chapped tissue. And it also promotes microcirculation, improves blood supply of wound, salvages stasis zone and prevents ischemic pain.

In summary, treating nail bed defect with MEBT could effectively relieve wound pain and promote function and appearance recovery of injured fingers.

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Treatment of Severe Electrical Burn of Wrist with Moist Exposed Burn Ointment: A Case Report

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【Abstract】 A patient with severe electrical burn on wrist was admitted to the Department of Burn and Plastic Surgery of Fuyang People's Hospital in October 2019, and the wound was treated with Moist Exposed Burn Ointment. After 60 days of treatment, wound healed well, and patient was discharged. 9-month follow-up showed no recurrence of skin ulcer, and skin sensation and motor function recovered well.

【Key words】 MEBO; Wrist; Electrical burn; Wound; Motor function

Among all types of burn, electrical burn causes a relatively high disability rate. Entry site of electrical burns, such as wrist is often seriously injured, and the treatment tends to be difficult. In severe cases, there is a risk of amputation or even death.¹ Currently, clinical treatments of electrical burn mainly include transplantation of groin flap, thoracic-umbilical flap, abdominal flap, rectus abdominis musculocutaneous flap, latissimus dorsi myocutaneous flap etc.,²⁻³ but such treatment method often require a series of surgeries, causing considerable financial and psychological burdens to patients, often with poor aesthetic and functional outcome. To find an effective method for treating electrical burns, Moist Exposed Burn Ointment (MEBO) was used in this study to treat a patient with severe electrical burn of wrist.

1. Clinical data

The patient, a 16-year-old male, was admitted for electrical burn in October 2019. One day

before admission, patient was burned by 380V shock while fixing electrical problems at home. He immediately fell into a coma after falling from 3 meters high. A few seconds later he regained consciousness, and had pelvic pain and broken skin on right wrist. After being treated by himself, the wound condition didn't improve, and he noticed wound tissue was severely necrotic. For further treatment, he came to our hospital. Examination on admission: size of wound on right wrist is about 12.0 cm×8.0 cm, and skin and subcutaneous soft tissue were severely injured; wound tissue had white waxy texture; flexor carpi radialis tendon, palmaris longus tendon and superficial flexor tendons were partially exposed and necrotic; soft tissue at distal ends of the middle finger and ring finger also had white waxy texture. Blood test results: white blood cell count (13.5×10^9 /L), percentage of neutrophils (78.8%), red blood cell count (4.3×10^9 /L), platelet count (212.0×10^9 /L), potassium (4.10 mmol/L),

blood sugar (4.94 mmol/L), urea nitrogen (4.40 mmol/L), lactate dehydrogenase (301.1 U/L), creatine kinase (3049.0 U/L), creatine kinase isoenzyme (54.7 U/L), hydroxybutyrate dehydrogenase (212.0 U/L). CT scan of pelvis showed fracture of the left ilium. Clinical diagnosis: electrical burn of right wrist, fracture of ilium. After admission, the patient was instructed to stay in bed for rest, and elevate the affected limb for facilitating the subsidence of wound swelling. Comprehensive treatments were given, to prevent shock prevention, infection, and protect heart and kidney function. Blood biochemistry test, routine blood test,

myocardial enzymes test and wound secretion test, etc. were regularly conducted, and medication was adjusted accordingly. For wound management, 1.0-2.0 mm thick MEBO was evenly applied on wound after surgical debridement, and MEBO impregnated gauze was placed on top and sterile gauze was used to secure. According to the amount of wound exudate, dressing was changed 2 to 3 times a day, kept clean and dry. After 60 days of treatment, wound healed well and patient was discharged. Follow-up at 9 months showed no skin ulcer, and skin sensation and motor function recovered well. (Figures 1-9)



Figure 1. On admission; Figure 2. After debridement, on the 4th day of treatment; Figure 3-7. During treatment, necrotic tissue fell off, wound decreased in size and granulation tissue covered exposed tendons. Figure 8. Wound healed completely on the 60th day of treatment; Figure 9. Skin sensation and motor function recovered well at 9-month follow-up.

2. Discussion

Electrical burns are extensive injuries to skin, subcutaneous tissue, muscles, bones, joints, and internal organs caused by electrical currents, arcs, or sparks. Currently, treatment for electrical burns is limited to a few options, and local or free skin flap surgeries are most commonly adopted.⁴⁻⁵ However, in early stage of such treatment, many problems could occur, such as progressive deepening of wound, low survival rate of skin flap, and failure to preserve stasis zone, resulting in poor aesthetic and functional outcome after wound healing.

In recent years, MEBO has been widely used in the treatment of various types of wound, with significant clinical efficacy. The active constituents contained in MEBO provide rich nutrients, and could activate potential regenerative cells into stem cells that proliferate and differentiate into various skin cells, so as to promote wound healing and

tissue regeneration.⁶⁻⁷ The use of MEBO could:

1. facilitate good air permeability on wound surface;
2. be conducive to the formation of a protective film that isolates wound from stimulation of external environment;
3. create a physiological moist environment for wound healing in situ.⁸⁻⁹

MEBO could react with necrotic tissue through a series of biochemical reactions such as hydrolysis, enzymolysis, rancidification, saponification, and esterification, liquefying and removing necrotic tissue without damage.¹⁰ In this study, MEBO was applied to treat electrical burn on right wrist, which considerably protected stasis zone, promoted wound healing, with good skin sensation and motor function recovery. The patient and his family were satisfied with the treatment result, which is consistent with preceding studies.¹¹

In conclusion, MEBO could effectively promote the healing of electrical burns on wrist, with satisfactory therapeutic effect.

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United Nations Sustainable Development Goal Action Forum Was Held

To further promote wound management in Middle East and North Africa, improve overall health of people and benefit COVID patients with skin lesions, MEBO International proposed to conduct MEBT training programme in these areas (United Nations Initiative 36733) in 2020, in order to support medical professionals during the pandemic. In July 2021, this initiative was included into United Nations Sustainable Development Goals Acceleration Actions for rapid implementation and to fully play its significance during the pandemic.

On November 17th 2021, United Nations Sustainable Development Goals organized by the International Society of Regenerative Medicine and Wound Repair was held. Doctors from the Middle East and other parts of the world were invited to share their experiences for wound management during the pandemic.



Forum speakers

The forum was hosted by Dr. Eric Wang, Secretary General of Rongxiang Xu Foundation, and the distinguished speakers were Dr. Jamil Halabi—General surgeon, diabetic foot expert, lecturer in the Faculty of Medicine University of Balamand (Lebanon), Dr. John Giurini—Associate Professor of Surgery at the Harvard Medical School and Chief of the Division of Podiatric Surgery and Medicine of Beth Israel Deaconess Medical Center, Dr. Rachna Jagia—Head of the department of Dermatology at Venkatezwar Hospital in India, and Dr. Robert Kirsner—Chairman

in Dr. Philip Frost Dermatology in the Department of Dermatology and Cutaneous Surgery at the University of Miami Miller School of Medicine.

The first topic at the forum was “The biggest challenge you encountered in clinical practice due to COVID-19 and how have you and your facility adjusted to those challenges?” Dr. Kirsner said that the biggest challenge was patients’ unwillingness to visit doctors because of fear, so doctors should provide effective treatment while trying to guarantee their safety. Dr. Halabi shared with us that shortage of medical staff and PPE, and fear among medical staff for the unknown virus were the biggest challenge at his institution.

In terms of the topic “Changes and innovations made due to COVID-19 that you would continue after the pandemic”, Dr. Giurini said that Telemedicine was the most effective evaluation method during this period so its role cannot be ignored afterwards. And Dr. Jagia also talked about the importance of telemedicine and emphasized that basic wound care education to the patients and their family was essential.

As for the topic “Has COVID-19 made us realize that our health care system is facing greater challenges?”, Dr. Giruini said many places saw resurgence of COVID-19 in winter and public’s weariness also brought negative impact. While Dr. Halabi pointed out that medical system was under tremendous pressure during global pandemic such as COVID-19 so establishing a highly effective, multidisciplinary team is critical in order to deal with public health emergency.

COVID-19 undoubtedly brought unprecedented challenges to medical system but medical workers’ persistent seeking of effective solutions produced positive results in many aspects. From their different medical systems, these speakers shared what they did and achieved during COVID-19 and their experience is valuable to global medical workers.

The First Regenerative Medicine Symposium in Ukraine



On January 25, 2022, the first Regenerative Medicine Symposium in Ukraine was delivered online, co-hosted by MEBO. Since the introduction of regenerative medical technology to Ukraine in 2021, this was the first time that it has been introduced in such a systematic way to Ukrainian medical professionals, and to most of them, this technology was novel yet effective.

Professor Kozintsa Georgy Pavlovich, Chairman of the Ukrainian Association of Burn Specialists, updated the current landscape of wound management and the indispensable part that regenerative medical technology plays in it. Professor Sadovyi, senior expert from Burn and Plastic Surgery Center of Kiev, shared his experience of using regenerative medical technology. Professor He Quanyong, Deputy Editor-in-Chief of *Chinese Journal of Burns Wounds and Surface Ulcers*, demonstrated the efficacy of regenerative medical technology on some most severe wounds.

For the first regenerative medicine symposium in 2022, it's encouraging to see Ukrainian doctors' tremendous interest in this technology and positive feedback acknowledging the informativeness of this symposium. More in-depth academic symposiums will be delivered for global medical professionals in this year.

