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Clinical Efficacy of Meek Grafting Combined with Moist Exposed Burn Ointment in Extensive Burn

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【 Abstract 】 Objective To analyze clinical efficacy of Meek grafting combined with Moist Exposed Burn Ointment (MEBO) in treatment of extensive burn. **Method** 82 extensive burn patients were admitted to the Hospital of Traditional Chinese Medicine of Nanyang from January 2014 to May 2017 and randomly divided into study group (n=41) treated with Meek grafting combined with MEBO and control group (n=41) with stamp grafting. **Result** For study group and control group, time of 1% skin grafting procedure were 1.03 ± 0.02 min vs. 2.15 ± 0.33 min, time of entire operation 3.99 ± 1.33 h vs. 6.13 ± 1.89 h, graft survival rate $81.23\pm 2.03\%$ vs. $71.69\pm 3.44\%$, graft integration time 11.03 ± 1.44 d vs. 17.95 ± 2.52 d, length of hospital stay 35.89 ± 3.69 d vs. 59.89 ± 3.77 d, cost of treatment 4661.49 ± 73.01 USD vs. 8546.82 ± 79.34 USD, satisfaction rate 95.12% vs. 80.49% , complication incidence 7.32% vs. 21.96% (All $p<0.05$). **Conclusion** Meek grafting combined with MEBO in treating extensive burn injuries could promote surgical efficacy, reduce incidence of complications, shorten healing time, and improve patient's satisfaction.

【 Keywords 】 Meek skin grafting; MEBO; Extensive burn; Clinical efficacy; Patient Satisfaction

Extensive burn could threaten patient's life, affecting patients psychologically and physically. Treatment of extensive burns is not only to heal wounds and save patient's life but also to focus on healing efficacy and improve patients' quality of life. Studies showed that autologous skin grafting used in extensive burn could improve patients' immunity and reduce mortality rate.^{1,2} However, larger size requirement of donor skin, longer operation time, and etc, could be recognized as disadvantages of autologous skin grafting.³ In order to increase treatment efficacy,

comparison of Meek grating combined with Moist Exposed Burn Ointment (MEBO) and stamp skin grafting was studied.

1. General Data

1.1 Baseline Data

82 extensive burn patients admitted to the Hospital of Traditional Chinese Medicine of Nanyang from January 2014 to May 2017 were enrolled and randomly divided into study group (n=41) and control group (n=41). In study group, male (n=23), female (n=18), 10-55 (35.26 ± 4.11) years old. Flame burn

(n=13), cement burn (n=10), and scald (n=18). In control group, male (n=24), female (n=17), 10-55 (35.77±4.41) years old. Flame burn (n=15), cement burn (n=10), and scald (n=16). The difference in baseline data of 2 groups was not statistically significant.

1.2 Inclusion criteria

55%-80% Total Body Surface Area (TBSA) burn, II-III degree burn, signed informed consent form.

1.3 Exclusion criteria

Vital organ dysfunction, severe organ disease, mental illness, poor compliance.⁴

2. Methods

2.1 Treatment methods

Study group: according to the size of skin grafting area, take proper size of 0.25 mm thickness skin from patient's head, limbs, or other healthy areas using Meek electric dermatome. Cut the skin into a side length of about 3.0 mm square-shaped micro-skin by using Meek skin graft mesher, and smear special glue on surface of the micro-skin. Glue the micro-skin on polyamide gauze and stretch properly. Place the stretched micro-skin on wound surface, and smear MEBO evenly then cover with sterile dressing and bandage with slight pressure. Control group: according to the size of skin grafting area, cut side length of 0.5 cm square-shaped skin from patient's head, limbs, or other healthy areas by using an electric dermatome. Place the skin grafts on wound at 0.8-1.1 cm intervals. Cover with sterile dry gauze and bandage with slight pressure. Dressing was changed daily or every

second day until wounds completely healed for both groups.

2.2 Evaluation criteria

Skin grafting size rate (skin grafting size/wound size ×100%), donor site size, grafts survival rate, grafts integration time, duration of 1% grafting procedure, length of entire operation, length of hospital stay, treatment cost, satisfaction rate (number of very satisfied patients + satisfied patients) / number of total patients × 100%.

2.3 Statistical methods

Satisfaction was evaluated by questionnaire with a total score of 100 points. More than 80 as very satisfied, 60-80 as satisfied, and lower than 60 dissatisfied. SPSS 20.0 was used for statistical analysis. Measurement data was represented as mean ± standard deviation ($\bar{x} \pm s$), tested by *t*-test. Count data was represented as n (%), tested by Chi-square.

3. Result

3.1 Operation data

For study group and control group of skin grafting size rate was 67.44 ± 2.33% vs. 68.11 ± 2.15% ($p>0.05$), donor site size 213.56 ± 31.22 cm² vs. 677.58 ± 35.01 cm², 1% grafting time 1.03 ± 0.02 min vs. 2.15 ± 0.33 min, time of entire operation 3.99 ± 1.33 h vs. 6.13 ± 1.89 h ($p<0.01$). (Table 1)

3.2 Treatment data

For study group and control group of graft survival rate was 81.23 ± 2.03% vs. 71.69 ± 3.44%, grafts integration time 11.03 ± 1.44d vs. 17.95 ± 2.52d, length of hospital stay

35.89 ± 3.69d vs. 59.89 ± 3.77d, treatment cost 4661.49 ± 73.01 USD vs. 8546.82 ± 79.34 USD ($p<0.01$). (Table 2)

Table 1 Comparison of operation ($\bar{x}\pm s$)

Group	Percentage of grafting size (%)	Donor size (cm ²)	1% grafting time (min)	Time of entire operation (h)
Study group	67.44 ± 2.33	213.56 ± 31.22	1.03 ± 0.02	3.99 ± 1.33
Control group	68.11 ± 2.15	677.58 ± 35.01	2.15 ± 0.33	6.13 ± 1.89

Table 2 Comparison of treatment efficacy

Group	Grafts survival rate (%)	Grafts integration time (d)	Length of hospital stay (d)	Treatment cost (USD)
Study group	81.23 ± 2.03	11.03 ± 1.44	35.89 ± 3.69	4661.49 ± 73.01
Control group	71.69 ± 3.44	17.95 ± 2.52	59.89 ± 3.77	8546.82 ± 79.34

Table 3 Comparison of satisfaction (n, %)

Group	Very satisfied	Satisfied	Dissatisfied	Satisfaction rate
Study group	19 (46.34%)	20 (48.78%)	2 (4.88%)	95.12%
Control group	15 (36.58%)	18 (43.90%)	8 (19.51%)	80.49%

Table 4 Comparison of complication (n,%)

Group	Hypertrophic scar	Thinned epithelial layer	Joint dysfunction	Complication incidence
Study group	2 (4.88%)	1 (2.44%)	0 (0.00%)	7.32%
Control group	5 (12.20%)	3 (7.32%)	2 (4.88%)	24.39%

3.3 Patient satisfaction

Patient satisfaction rate of study group and control group was 95.12% vs.80.49% ($p<0.05$). (Table 3)

3.4 Complication incidence

In study group, 2 patients developed hypertrophic scar, 1 developed thinned epithelial layer, with a total complication incidence of 7.32%. In control group, 5 patients developed hypertrophic scar, 3 developed thinned epithelial layer, and 2 developed joint dysfunction, with a total

complication incidence of 24.39% ($p<0.05$). (Table 4)

4. Discussion

The result of our study showed that study group had better performance than control group in regards to donor site size, entire operation time, length of hospital stay, cost of treatment, satisfaction rate and complication incidence. Meek grafting is more effective than stamp grafting is because Meek grafting is a semi-mechanical procedure, which promotes efficacy, shortens operation time,

and requires smaller size of donor site skin. Meanwhile, skin layer of Meek grafting is thinner, therefore grafts survival rate increases. Also, polyamide dressing material has more extensibility, better moisturizing effect, and breathability, which promotes drainage of exudate from wounds.⁵ Besides, MEBO contains active ingredients that can activate normal skin cells into stem cells that further

proliferate and differentiate in various skin cells in different layers therefore repairing the wound.⁶

To sum up, Meek grafting combined with MEBO in treatment of extensive burns could promote clinical efficacy, reduce complication incidence, shorten healing time, and improve patients satisfaction.

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Clinical Research on Moist Exposed Burn Therapy Combined with Autologous Cylinder-shaped Micro-skin Grafting in Elderly Burn Patients

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【Abstract】 Objective To evaluate the clinical efficacy of Moist Exposed Burn Therapy (MEBT) combined with Autologous Cylinder-shaped Micro-skin Grafting (ACMG) in treating elderly burn patients. **Methods** 80 elderly burn patients admitted to the Affiliated Hospital of Yan'an University from January 2016 to January 2018 was treated by MEBT combined with ACMG. **Results** Healing time of superficial second-degree burn was 7-14 days, deep second-degree burn was 5-22 days and third-degree burn was 30-35 days, and most patients developed no scars. **Conclusion** MEBT combined with ACMG could effectively promote wound healing, inhibit scar formation in elderly burn patients.

【Key words】 Elderly burn patient; Moist Exposed Burn Therapy; Moist Exposed Burn Ointment; Autologous Cylinder-shaped Micro-skins Grafting; Clinical efficacy

Researches show that elderly burn patients in hospitalization have accounted for more than 20% of total burn hospitalized patients as the aging population increases¹. The mortality of elderly burn patients has been remaining high in recent years due to their poor health status and multiple primary diseases despite the advancement of burn treatments². Because of the significant efficacy of Moist Exposed Burn Therapy (MEBT) in controlling infection, promoting wound healing and reducing scar formation³⁻⁵, MEBT combined with Autologous Cylinder-shaped Micro-skin Grafting (ACMG) was used in treating elderly

burn patients in this study in order to further improve clinical efficacy.

1 Clinical data

1.1 General data

80 elderly burn patients were admitted to the Affiliated Hospital of Yan'an University from January 2016 to January 2018. In this study, male (n=48), female (n=32); age 55-85y (67.0±1.0); scald (n=35), flame burn (n=28), chemical burn (n=2); superficial second-degree burn (n=45), deep second-degree burn (n=28), and mixed-depth burn (n=7); 2%-9% TBSA; coronary atherosclerotic heart disease (n=13),

diabetes mellitus (n=22), hypertension (n=29), chronic obstructive pulmonary disease (n=7), other diseases (n=7). This study was approved by the Medical Ethics Committees of Affiliated Hospital of Yan'an University, and all patients have signed the informed consent form.

2 Methods

2.1 Systematic treatment

(1) Anti-shock: resuscitation fluids calculated by Burn Resuscitation Formula was given to patients (80-100 mL/kg each day), and colloidal solution was given after 16 hours⁶. In addition to fluid resuscitation, Continuous Venovenous Hemofiltration (CVVH) was performed for delayed resuscitation to maintain normal blood pressure and urine output at 0.5-1.0 ml·kg⁻¹·h⁻¹⁷⁻⁹.

(2) Infection control: sufficient broad-spectrum anti-biotics were used for infection (sensitive antibiotics were used after bacterial culture and drug sensitivity test), regular liver and kidney function testing were conducted¹⁰⁻¹¹.

(3) Management of inhalation injury and complications: tracheostomy was prepared for moderate and severe inhalation injuries; medication for vascular dilatation and myocardial nutrients were given to patients with coronary atherosclerotic heart diseases; control of hypertension and blood sugar; symptoms relief for chronic obstructive pulmonary diseases¹².

(4) Nutritional support: high-protein diet was provided. Parenteral nutrition was used when oral intake was not sufficient to prevent hypoproteinemia.

2.2 Wound treatment

Wound management in early stage varies in different burn degrees. Second-degree burn: fluid-filled blisters were pierced at the lower position and the fluid was drained, in the meanwhile the blister skin was kept intact on wound; superficial third-degree burn: ploughing technique was performed to relieve tension; deep third-degree burn: eschar was thinned.

Then MEBO was applied evenly on wound at a thickness of 1 mm, dressing was changed every 4-6 hours. ACMG was performed after granulation tissue grew well, and MEBO was continually used until wound completely healed¹³.

3 Results

77 patients had complete wound healing (3 patients gave up treatment). Healing time of superficial second-degree burn was 7-14 days; deep second-degree burn was 5-22 days and third-degree burn was 30-35 days. No infection and other complications occurred. 3 patients with third-degree burn developed scars which affected no functions. 74 patients had good skin elasticity with no obvious scar formation. Clinical cases are shown in Figure 1-2.



Figure 1: Treatment process with mild scar formation; Figure 2: Treatment process with no obvious scar formation.

4. Discussion

In elderly patients, regressive change and atrophy of skin might result in deeper degree burns¹⁴⁻¹⁵, the state of high inflammation and high stress caused by a large number of inflammatory cytokines released from burned body may seriously affect patients' treatment and prognosis¹⁶⁻¹⁸.

In this study, MEBT combined with ACMG was used in elderly burn patients, and results showed that the wound infection was reduced effectively and scarless healing was achieved.

Some studies demonstrated that the Potential Regenerative Cells of wound tissue could be activated and induced to stem cells by active ingredients of MEBO, then differentiating and proliferating into normal cells in situ. Carbohydrates, fatty acids, amino acids, vitamins and other nutrients contained in MEBO provide sufficient nutrients for wound

repair¹⁹. Also, MEBO is able to increase the levels of epidermal growth factor, basic fibroblast growth factor and vascular endothelial growth factor in granulation tissue, promote the proliferation and differentiation of fibroblasts and vascular endothelial cells, thereby accelerating wound healing²⁰⁻²¹. Furthermore, hyperproliferation of fibroblasts can be inhibited by MEBO, therefore preventing excessive synthesis of collagen and mucopolysaccharide, reducing scar formation²². A micro skin of ACMG includes full-thickness skin structure consisting of epidermis, dermis and subcutaneous tissue, and each layer quickly interconnects with each other, hence promoting wound repair¹³.

In conclusion, MEBT combined with ACMG could effectively promote wound healing in elderly burn patients, reduce scar formation and prevent disabilities caused by scar contracture²³⁻²⁴.

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Efficacy of Moist Exposed Burn Therapy Combined with Autologous Micro-skin Grafting in Treating Skin Flap Necrosis after Breast Cancer Surgery

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【Abstract】Objective To evaluate the efficacy of Moist Exposed Burn Therapy (MEBT) combined with Autologous Micro-skin Grafting (AMG) in treating skin flap necrosis after breast cancer surgery. **Methods** 98 patients with skin flap necrosis after breast cancer surgery admitted to The Anyang Cancer Hospital from January 2017 to January 2020 were enrolled in the study and divided into study group (n=49) and control group (n=49) according to different treatment methods. Study group was treated with MEBT combined with AMG, while control group with recombinant human-basic fibroblast growth factor (rh-bFGF) combined with AMG. Levels of vascular endothelial growth factor (VEGF) and epidermal growth factor (EGF) in wound tissue before and after treatment, clinical efficacy and wound healing time were studied and compared between these two groups. **Results** After treatment, levels of VEGF and EGF both progressively increased in two groups, and compared with control group, study group had higher levels at day 3 ($t=2.716, 2.138$) and day 7 ($t=2.187, 2.624$). After 5 weeks' treatment, study group had higher efficacy 100% vs. 91.8% ($z=-3.068$), and also had shorter wound healing time 31.34 ± 14.67 d vs. 38.89 ± 15.44 d ($t=2.481$) (all $p<0.05$). **Conclusion** MEBT combined with AMG could significantly increase the levels of VEGF and EGF in wound tissue, thus promoting the formation of granulation tissue and reducing wound healing time, which accelerated the wound repair.

【Key words】 Moist Exposed Burn Therapy; Autologous Micro-skin Grafting; Breast cancer; Skin flap necrosis; Recombinant human-basic fibroblast growth factor; Vascular endothelial growth factor; Epidermal growth factor

Breast cancer ranks top one among malignant tumors in female with the increasing incidence rate and the trend of affecting younger women in recent years¹. Modified radical mastectomy is the most effective surgery to treat breast cancer until now. However, the skin flap necrosis is prone to occur after surgery because

resecting large area from primary lesion might cause excessive skin tension after suture, hence seriously affecting the outcome of surgery and leading to poor prognosis in patient². Epidemiological studies showed that the incidence rate of skin flap necrosis after breast cancer surgery is as high as 16.6%-60.0%².

Moist Exposed Burn Therapy (MEBT) has significant clinical efficacy in the treatment of burn, pressure ulcer, diabetic foot ulcer and other wounds⁴⁻⁶. Autologous Micro-skin Grafting (AMG) is also widely applied in various wound management due to its easy skin harvest and high survival rate⁷⁻⁸. In this study, the efficacy of MEBT combined with AMG was studied.

1 Clinical data

1.1 General data

98 patients with skin flap necrosis after breast cancer surgery admitted to The Anyang Cancer Hospital from January 2017 to January 2020 were enrolled in the study and divided into study group (n=49) and control group (n=49). In study group, age 56.75 ± 13.47 y; lesion diameter 9.71 ± 1.34 cm; invasive ductal carcinoma (n=27), invasive lobular carcinoma (n=6) and medullary carcinoma (n=16); TNM stage I (n=7), stage II (n=38), stage III (n=4). In control group, age 55.81 ± 14.75 y; lesion diameter 9.65 ± 1.42 cm; invasive ductal carcinoma (n=25), invasive lobular carcinoma (n=7) and medullary carcinoma (n=17); TNM stage I (n=5), stage II (n=40), stage III (n=4). The differences of age and lesion diameter were tested by *t* test ($t=0.330, 0.215; p=0.743, 0.830$), differences of pathological type and TNM staging were tested by Chi-square test ($\chi^2=0.184, 0.385; p=0.912, 0.825$). This study was approved by the Medical Ethics Committees of The Anyang Cancer Hospital, all patients signed the informed consent form.

1.2 Inclusion and exclusion criteria

Inclusion criteria: diagnosed with breast cancer,

skin flap necrosis occurred after initial surgery. Exclusion criteria: (1) combined with severe liver, kidney and other relevant diseases (2) combined with malignant tumors at other sites; (3) allergic constitution or allergic to the drugs used in this study; (4) poor adherence.

2 Methods

2.1 Treatment method

Study group: smeared Moist Exposed Burn Ointment (MEBO) evenly on necrotic skin flap, covered with MEBO impregnated gauze and sterile dressing in sequence, and dressing was changed 1-2 times a day; implanted micro-skin grafts into well-grown wound granulation tissue with 3.0-5.0 mm intervals and depth of 2.0-3.0 mm. The preparation for micro-skin grafts: took proper skin grafts from donor site (ratio of donor size and wound size was 1:20-1:30), then placed it into sterile saline; cut it into rectangular shape with the side length of 1.0-2.0 mm by ophthalmic scissors. Performed MEBT on donor site, covered with MEBO impregnated gauze and sterile dressing on the wound, packed with pressure bandages for 48 hours, and MEBO dressing was changed continually until wound completely healed.

Control group: sprayed recombinant human-basic fibroblast growth factor (rh-bFGF) evenly on wound, covered with rh-bFGF impregnated gauze and sterile dressing in sequence, and dressing was changed 1-2 times a day; implanted micro-skin grafts into well-grown wound granulation tissue as in study group, covered with rh-bFGF impregnated gauze and sterile dressing, packed with pressure bandages for 48 hours, and rh-bFGF

dressing was changed continually until wound completely healed.

2.2 Evaluation criteria

(1) Levels of vascular endothelial growth factor (VEGF) and epidermal growth factor (EGF) before treatment and at day 3, day 7 after treatment.

(2) Clinical efficacy after 5 weeks' treatment. Overall efficacy=healed cases + significantly effective cases + effective cases/ total cases × 100%. Healed: wound completely heals; significantly effective: more than 75% size of wound heals; effective: 25%-75% size of wound heals; ineffective: less than 25% size of wound heals.

(3) Wound healing time.

2.3 Statistical analysis

SPSS 23.0 was used for statistical analysis. Count data was represented as frequency or n (%), tested by Chi-square test or rank sum test; measurement data which follows the normal distribution was represented as mean ± standard deviation ($\bar{x}\pm s$), tested by *t* test.

3 Results

3.1 Levels of vascular endothelial growth factor (VEGF) and epidermal growth factor (EGF)

Before treatment, there was no significant difference in levels of VEGF and EGF between two groups. After treatment, levels of VEGF and EGF both increased in two groups, and study group had higher levels at day 3, 76.37±13.38 vs. 68.98±13.56, 6.37±2.33 vs. 5.29±2.66 and day 7, 87.65±14.31 vs. 81.44±13.79, 8.46±2.47 vs. 7.14±2.51 (all $p<0.05$), as shown in Table 1.

3.2 Clinical efficacy

After 5 weeks' treatment, study group had significantly higher overall efficacy 100% vs. 91.8% (Mann-Whitney $U=777.000$, $z=-3.068$, $p=0.002$).

3.3 Wound healing time

Study group also had significantly shorter healing time 31.34±14.67 d vs. 38.89±15.44 d ($t=2.481$, $p=0.015$)

Table 1 Levels of VEGF and EGF in wound tissue (pg/mg, $\bar{x}\pm s$)

Group	VEGF			EGF		
	Before treatment	Day 3	Day 7	Before treatment	Day 3	Day 7
Study Group	63.24±15.26	76.37±13.38	87.65±14.31	3.94±1.87	6.37±2.33	8.46±2.47
Control Group	62.74±14.90	68.98±13.56	81.44±13.79	4.08±2.15	5.29±2.66	7.14±2.51
<i>t</i> value	0.164	2.716	2.187	0.344	2.138	2.624
<i>p</i> value	0.870	0.008	0.031	0.732	0.035	0.010

4 Discussion

Skin flap necrosis is the most common complication after breast cancer surgery, it might be caused by excessive electrocauterization, high tension of skin flaps, poor drainage, and excessive inflammation, which postpone wound healing, thereby affecting the functions of upper extremities and prognosis of patients. The main treatment methods for flap necrosis include debridement combined with dressing changes, skin flap transplantation, vacuum sealing drainage and MEBT etc.

Levels of VEGF and EGF both progressively increased at day 3 and day 7 after treatment, and study group had significantly higher clinical efficacy and shorter healing time than

control group, which demonstrated that MEBT was effective in this kind of wound.

A micro-skin graft consists of epidermis, dermis and subcutaneous tissue, each layer of it therefore can rapidly interconnect after implantation into well-grown wound granulation tissue. Furthermore, MEBO contains rich nutrients of carbohydrates, amino acids, fatty acids and vitamins, which provides great nutrition for growth of micro-skin grafts and wound repair⁹.

In conclusion, MEBT combined with AMG could significantly increase levels of VEGF and EGF in wound tissue, thus promoting wound repair and reducing wound healing time.

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Comparison on Clinical Efficacy of Moist Exposed Burn Therapy and Escharectomy Combined with Skin Grafting in II Degree Burn

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[Abstract] Objective To compare clinical efficacy of Moist Exposed Burn Therapy (MEBT) and escharectomy combined with skin grafting in the treatment of II degree burn. **Methods** 104 II degree burn patients were enrolled and randomly divided into study group treated with MEBT (n=52) and control group treated with escharectomy combined with skin grafting (n=52). Clinical efficacy, scar formation, duration of exudate, activities of daily living (ADL), anxiety and depression before and after treatment were compared. **Results** For study group and control group, total efficacy was 94.23% vs. 80.77%, Vancouver Scar Scale score 5.96 ± 1.47 vs. 7.58 ± 1.34 , Self-rating Anxiety Scale score 42.52 ± 2.63 vs. 50.47 ± 3.01 and Self-rating Depression Scale score 45.17 ± 2.66 vs. 48.24 ± 2.03 , duration of exudate 4.03 ± 1.36 d vs. 5.92 ± 1.72 d, and ADL score 80.96 ± 3.65 vs. 75.44 ± 3.76 (All $P < 0.05$). **Conclusion** MEBT was more effective in treating II degree burn patients compared with escharectomy combined with skin grafting and it also shortened duration of exudate, reduced scar formation, improved ADL and psychological status.

[Key words] Moist Exposed Burn Therapy; Escharectomy and skin grafting; II degree burn; Clinical efficacy

Infection is a very common complication of burn injuries, which might even cause death. Burn patients suffer from physical and psychological distress such as anxiety and depression, which have severe impact on the treatment for the disease.^{1,2}

1. Data and methods

1.1 General data

104 II degree burn patients admitted to The Second People Hospital of Huludao of China from January 2017 to March 2020 were enrolled and randomly divided into study group (n=52) treated with Moist Exposed Burn Therapy (MEBT) and control group (n=52) treated with escharectomy combined with skin grafting. In study group, male (n=34), female (n=18), 45.89 ± 6.91 years old.

In control group, male (n=35), female (n=17), 45.53 ± 7.01 years old. The differences of general data between two groups were not statistically significant.

1.2 Inclusion and exclusion criteria

1.2.1 Inclusion criteria

- ① Diagnosed with II degree burn.
- ② Signed informed consent form.

1.2.2 Exclusion criteria

- ① Mental illness
- ② Cognitive impairment
- ③ Coagulation disorder
- ④ Vital organs dysfunction
- ⑤ Contraindication of medicine and treatment used in the study
- ⑥ Pregnant and lactating women

1.3 Methods

All patients had been given systemic treatments including fluid resuscitation, antimicrobial treatment for infection and shock control.

1.3.1 Study Group

Study group was treated with MEBT. Exudate and liquefied necrotic tissues were timely removed during each dressing change.

1.3.2 Control Group

Control group was treated with escharectomy combined with skin grafting. The depth of escharectomy for deep II degree burn treatment reached down to deep fascia in order to completely remove necrotic tissue.

1.4 Evaluation criteria

Clinical efficacy, scar formation, duration of exudate, ability of daily living (ADL), level of anxiety and depression before and after treatment.

1.4.1 Clinical Efficacy

Significant effective: wound heals well, color of scar is similar to healthy skin. Effective: wound basically heals, slight color change. Ineffective: wound does not heal. Total effective rate = number of significant effective patients + number of effective patients / Total number of patients.

1.4.2 Scar formation

Scar formation was evaluated by Vancouver Scar Scale (VSS).

1.4.3 Level of anxiety and depression

Anxiety and depression were evaluated by

Self-rating Anxiety Scale (SAS) and Self-rating Depression Scale (SDS).

1.4.4 Activities of daily living

Daily activity was evaluated by ADL scale.

1.5 Statistical methods

SPSS 17.0 was used for statistical analysis. Measurement data was represented as mean \pm standard deviation ($\pm s$), tested by t test. Count data was represented as n (%), tested by Chi-square.

2.Result

2.1 Clinical efficacy

Total effective rate of study group and control group were 94.23% vs. 80.77% ($p < 0.05$). (Table 1).

2.2 Scar formation

VSS score of study group was lower than control group 5.96 ± 1.47 vs. 7.58 ± 1.34 ($P < 0.05$). (Table 2)

2.3 SAS and SDS

After treatment, compared with control group, study group had both lower SAS score 42.52 ± 2.63 vs. 50.47 ± 3.01 and SDS score 45.17 ± 2.66 vs. 48.24 ± 2.03 (all $P < 0.05$). (Table 3)

2.4 Duration of exudate

Study group had shorter duration of exudate $4.03 \pm 1.36d$ vs. $5.92 \pm 1.72d$ ($P < 0.05$).

2.5 ADL

ADL score of study group was higher than control group 80.96 ± 3.65 vs. 75.44 ± 3.76 ($P < 0.05$)

Table 1 Comparison of clinical efficacy

Group	Significant effective	Effective	Ineffective	Total effective
Study group	29(55.77)	20(38.46)	3(5.77)	49(94.23)
Control group	23(44.23)	19(36.45)	10(19.23)	42(80.77)
χ^2				4.3077
p				0.0379

Table 2 VSS

Group	Cases	VSS
Study group	52	5.96 ± 1.47
Control group	52	7.58 ± 1.34
t		5.8730
p		0.0000

Table 3 SAS and SDS score ($\bar{x} \pm s$)

Group	Cases	SAS score		SDS score	
		Before treatment	After treatment	Before treatment	After treatment
Study group	52	59.67 ± 5.81	42.52 ± 2.63	64.13 ± 4.27	45.17 ± 2.66
Control group	52	60.01 ± 5.73	50.47 ± 3.01	63.99 ± 4.56	48.24 ± 2.03
t		0.3005	14.3424	0.1616	6.6161
p		0.7644	0	0.8719	0

3. Discussion

After burn injury, various toxins are produced, which lead to change in capillaries. Thrombosis might occur due to accumulation of red blood cells. And also adhesion of leukocytes might result in accumulation of inflammatory cells in wound, which further induces severe systemic inflammatory response syndrome.³ All of above reasons could decrease survival rate of skin grafting and increase healing time.^{4,5} Moist Exposed Burn Ointment (MEBO) is the key product in

MEBT. MEBO could promote repairing of wound, reduce infection and remove necrotic tissue by liquefying it. This study showed that total effective rate of study group is significantly higher than control group. Moreover, study group also demonstrated superior results in regards to scar formation, duration of exudate, patient's ADL, anxiety and depression status.

To sum up, MEBT is an effective treatment in II degree burn management.

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Efficacy of Flap Transplantation Combined with Moist Exposed Burn Ointment in Soft Tissue Defect, Infection and Bone Exposure of Ankle

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【Abstract】 Objective To study the effect of flap transplantation combined with Moist Exposed Burn Ointment (MEBO) in soft tissue defect, infection and bone exposure of ankle. **Methods** 26 patients with soft tissue defect, infection and bone exposure of ankle admitted to the Armed Police Heilongjiang Province Corps Hospital from January 2015 to January 2018 were enrolled in the study and treated with flap transplantation combined with MEBO. **Results** After surgery, skin flaps survived and wounds healed in all patients. Follow-up after 0.5-3.5 years showed flaps were soft and elastic, and feet and ankles regained function. **Conclusion** Flap transplantation combined with MEBO could effectively promote wound healing by primary intention in soft tissue defect, infection and bone exposure of ankle.

【Keywords】 Soft tissue defect; Infection; Bone exposure; MEBO; Flap transplantation; Efficacy

Causes for soft tissue defect, infection and bone exposure of ankle include alcaenal and ankle fracture with soft tissue damage, or improper treatment after injury. Flap transplantation could quickly and effectively close wound, and Moist Exposed Burn Ointment (MEBO) could effectively promote healing of chronic refractory wounds. To improve treatment effect, flap transplantation combined with MEBO was used in treatment for such patients in our hospital.

1. Clinical data

26 patients were admitted to the Heilongjiang Provincial Corps Hospital of the Armed Police Force from January 2015 to January 2018 for soft tissue defect, infection and bone exposure

of ankle. Male (n= 19) and female (n = 7); age 18-62 (36.6±7.2) years; course of disease 3-9 (4.6±2.2) weeks; size of skin defect: 3.0 cm×3.0 cm - 6.0 cm×10.0 cm; traffic accident (n = 9), hit by heavy object (n = 6), falling from height (n = 5), electrical burn (n = 3), and machinery injury (n = 3); bone fracture complicated with local skin defects and infection (n = 10), local skin necrosis and defects after internal fixation of fractures (n = 13), infection and necrosis complicated with bone exposure from electrical burn (n = 3).

2. Treatment methods

After admission, patients were given comprehensive systemic treatment. And according to their course of disease, severity

of infection, and size of skin defect, emergency or elective debridement was performed. After thorough debridement, MEBO was applied evenly on wound at about 2.0 mm thickness. Then, wound was either exposed or covered with 2-3 layers of MEBO impregnated gauze, and dressing change was performed 3-4 times per day.

After 2 to 4 weeks of dressing change, in all patients, wound exudate reduced significantly, and granulation tissue grew well. Then flap transplantation was performed to close wound. For wounds with small skin defect size and good surrounding soft tissue, wounds were closed with local rotation flaps ($n = 26$). A healthy flap adjacent to wound was selected; selected flap was 20% larger than skin defect in size, and length: width is 1:1; no significant tension was on the pedicle. Flap rotation and advancement were performed, and then wound was covered. drainage strip was placed, and then sutured. Donor site was closed with sutures or split-thickness skin graft. For wounds with large size of skin defect and surrounding soft tissue in poor condition, wound was covered with a distal pedicled flap. Transplantation of sural artery flap was performed in 12 patients, and the flap design method is as follows: axis of the flap is aligned with the distribution of sural nerve, pivot point of the flap is 5.0-7.0 cm above lateral malleolus. Wound was covered after flap rotation; drainage strip was placed; then flap was fixed and sutured. Donor site was sutured or covered with split-thickness skin graft. After surgery, patients were given comprehensive systemic treatments including

anti-inflammation treatment, administration of antispasmodic drugs, etc.⁶

3. Results

3.1 Treatment results

Among 26 patients, 11 were treated with local rotation flaps, 12 sural artery flaps, and 3 medial supramalleolar perforator flap. After operation, flaps in 20 patients survived, wounds healed by primary intention with no complications. In the other 6 patients, necrosis occurred around the flap edge, and after treatment with MEBO, necrotic wounds healed and flaps survived. Follow-up after 0.5-3.5 years showed transplanted flaps were soft and elastic, and function of foot and ankle recovered well, with no abnormal feelings.

3.2 Typical case

A 35-year-old male patient who underwent internal fixation for calcaneal fracture was admitted with soft tissue defect, infection and bone exposure for 4 weeks. The patient fell from a height 6 weeks before admission, which caused an open fracture of calcaneus. He underwent fracture reduction and internal fixation in another hospital. The incision did not heal after operation, while infection, soft tissue necrosis and bone exposure developed. Then the patient came to our hospital for treatment. Examination on admission: skin defect (about 3.5 cm×8.0 cm in size) on the lateral side of heel, exposure of calcaneus and internal fixation plate, and purulent exudate (Figure 1). After admission, MEBO was used for wound treatment (same as procedure above). After 3 weeks, wound exudate reduced significantly, and granulation tissue

grew well (Figure 2). Sural artery flap transplantation was performed to close the wound. 3 weeks after surgery, flap survived, and wound healed by primary intention

(Figure 3). Follow-up at 6 months showed the function of foot and ankle recovered well, with no abnormal feeling.



Figure 1. On admission; Figure 2. Before flap transplantation, wound exudate reduced and granulation tissue grew well; Figure 3. 3 weeks after surgery, flap survived, and wound healed by primary intention.

4. Discussion

Ankle is not covered by muscles. Therefore, in event of injury from external force, soft tissue defects tend to occur, leading to the exposure of tendons and bones. As blood circulation in ankle is relatively poor, bone joint infection and necrosis tend to occur following soft tissue defects.⁷ In clinical practice, negative pressure wound therapy, MEBO, and flap transplantation are often used for treatment, but each of these treatment methods might not be satisfactory when used alone. For MEBO, treatment time could be long. For flap transplantation, flap survival rate could be low due to poor blood supply in wound.

Studies have shown that the active constituents contained in MEBO could activate the potential regenerative cells in the wound tissue into stem cells. The stem cells then proliferate and differentiate into various layers of tissue cells, promoting wound healing and skin regeneration in situ. Carbohydrates, fatty acids, amino acids, and

vitamins, etc. contained in MEBO provide sufficient nutrients for skin regeneration and wound healing.⁸ On the other hand, harvesting of sural artery flap is easy. Besides, there is no need for reattaching blood vessels.⁹ The color and texture of local rotation flaps and medial supramalleolar perforator flap are similar to their adjacent tissue, with good aesthetic result. Benefits of flap transplantation combined with MEBO: 1. MEBO could provide sufficient nutrition to wound, promoting the revascularization in wound tissue, which prepares for flap transplantation. 2. After granulation tissue grows well, flap transplantation is performed for wound closure, preventing long treatment time of MEBO. The combined treatment of the two methods could be more efficacious.

In conclusion, flap transplantation combined with MEBO could effectively promote wound healing by primary intention in soft tissue defect, infection and bone exposure of ankle.

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Global Regenerative Medicine & Wound Repair Workshop - Management of Diabetic Foot Ulcer was Held Online

On July 27, 2022, Global Regenerative Medicine & Wound Repair Workshop - Management of Diabetic Foot Ulcer (DFU) hosted by the International Society of Regenerative Medicine and Wound Repair (ISRMWR) was successfully held online. Approximately 300 medical professionals worldwide registered for this training, and attendees came from China, Malaysia, Indonesia, India, the Philippines, Singapore, Peru, and Ecuador.

The image is a promotional graphic for a workshop. At the top, it features the logos for 'United Nations Academic Impact' and 'Global Regenerative Medicine & Wound Repair Workshop'. The main title is 'Management of Diabetic Foot Ulcer' in large, bold, teal letters. Below the title, the word 'Agenda' is written in a teal oval. The event details are listed: '19:00-21:00, July 27, 2022' and 'Zoom video conference'. The agenda is divided into three main sections, each with a speaker's photo and name: 1. 'Diabetic Foot Ulcer Overview and Assessment' by Dr. Paulyn Ubial, Former Secretary of the Philippine Department of Health; 2. 'Diabetic Foot Ulcer Treatment' by Dr. Kishen Baboo Ramasamy, Hospital Tengku Ampuan Rahimah, Malaysia; 3. 'Regenerative Therapy for Diabetic Foot Ulcer' by Dr. Gerald Abesamis, Asian Hospital and Medical Center & ManilaMed Medical Center, The Philippines. A 'BONUS SESSION (pre-recorded)' section follows, featuring 'New Treatments in Diabetic Foot Ulcer and Chronic Wounds' by Dr. Robert S. Kirsner, University of Miami Miller School of Medicine, US.

3 experts from the Philippines and Malaysia, shared a wide variety of contents related to DFU, from the overview to the application of regenerative medical technology in DFU.

Dr. Paulyn Ubial from the Philippines, former Secretary of the Philippine Department of Health, made the first speech - *Diabetic Foot Ulcer Overview and Assessment*, in which she went in details to talk about the epidemiology, etiology and prognosis of DFU.

Subsequently, Dr. Kishen Baboo Ramasamy from the Department of Wounds and Department of Orthopedics of Tengku Ampuan Rahimah Klang Hospital in Malaysia discussed DFU treatment extensively, including systemic treatment and local treatment, as well as how regenerative medical technology could be used as an effective treatment approach.

Dr. Gerald Abesamis, surgeon from Asian Hospital and Medical Center & ManilaMed Medical Center, fueled up the last session with numerous cases that he treated using regenerative medical technology, providing convincing proofs on the advantages of regenerative medical technology in the treatment of DFU.

At last, the workshop was concluded with the recorded keynote speech of the 2021 Diabetic Lower Extremity Symposium - *New Treatments in Diabetic Foot Ulcer and Chronic Wounds* by Professor Robert Kirsner from the University of Miami Miller School of Medicine.

This workshop provided comprehensive contents regarding DFU management. Looking forward, ISRMWR will launch its last episode of the 2022 series - Management of Pressure Ulcer in November. Stay tuned.

The 21st Congress of International Society for Burn Injuries: An Academic Feast in Mexico

From August 28 to September 1, the 21st International Society for Burn Injuries (ISBI) Congress was successfully held at Expo Guadalajara, Mexico. The latest results of global academic research, clinical treatment experiences, and innovative treatment methods for burn injuries were demonstrated in this congress.



Dr. Miranda, the secretary of ISBI made the first speech at the opening ceremony. He stated that it was a very tough period for the past two years due to the pandemic, but burn specialists around the world had worked and united together to have overcome the difficulty. Then, Dr. Greenhalgh, president of ISBI pointed out that the major tasks for ISBI now are to promote global cooperation therefore enhancing wound management. Meanwhile, he thanked all the people who made constant contributions to burn injuries career.



Kevin Xu, President of MEBO International, and Antonio Yung, Chief Representative of Sacramento China Office attended this congress, and had close communication with the ISBI committee in regards of moving the cooperation between MEBO International and ISBI to a brand-new level.

The booth of MEBO International was shaped like a caterpillar breaking out and becoming a butterfly, indicating that regenerative medical technology could bring patients into their new lives. Many burns specialists visited MEBO International's booth, and asked about the latest academic development about us. Regenerative medical technology of MEBO International is recognized by more and more doctors worldwide.

MEBO International and ISBI have developed a solid partnership over these years, and this partnership is much expected to grow stronger in the future. The 2024 ISBI congress is going to be held in China, hope to see you all in China.

