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Experience and efficacy of surgery for retaining viable subcutaneous tissue in extensive full-thickness burns

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ARTICLE INFO

Article history:
Accepted 21 June 2015

Keywords:
Burns
Skin grafting
Tangential excision
Treatment outcome
Subcutaneous tissue

ABSTRACT

Background and aim: For adult patients with extensive full-thickness burns (EFTB), a fascial excision is mostly used but it causes a very significant deformity. This study aims to summarize experience and efficacy of surgery for retaining viable subcutaneous tissue in EFTB.

Method: Clinical data were reviewed for 31 consecutive adult patients with full-thickness burn (FTB) over 70% total body surface area (TBSA) and undergoing first tangential excision and skin grafting on subcutaneous tissue wound (TESGSTW) within 7 days post burn at our burn center between 2002 and 2013.

Results: Average age, total burn area, and FTB area of 31 patients were 32.4 ± 12.8 years, 89.0 ± 6.2% and 80.4 ± 7.6% TBSA, respectively. Of these, 80.6% combined with inhalation injury and 71.0% supervened early shock. Eighteen patients who survived (58.1%) totally underwent 121 times of surgery, of which TESGSTW and autologous skin grafting were 41 and 88 times, respectively. Their average time and area of first tangential excision was 4.1 ± 0.6 days post burn and 33.8 ± 7.6% TBSA, respectively, and accumulated tangential excision area was 58.4 ± 10.8% TBSA. In 39 times of TESGSTW within 14 days post burn, cryopreserved alloskin or fresh young pigskin was applied on 84.6%, and average time and take rate of autologous skin grafting instead of grafted alloskin or xenoskin was 14.6 ± 0.7 days and 89.5 ± 1.4%, respectively. Scalp was the main donor site for autologous skin, especially microskin grafting. Systemic wound healing time roughly was 67.3 ± 1.9 days post burn, meanwhile, viable subcutaneous tissue was retained. Healed wounds were plump, and their extensibility and sensitivity were better by follow-up.

Conclusion: The surgical treatment in EFTB is practicable and effective.

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http://dx.doi.org/10.1016/j.burns.2015.06.012

1. Introduction

The burn wound is the fundamental pathogeny of burns. The eschar and subeschar (subcutaneous) tissue contain abundant bacteria, toxins, and inflammatory edema fluid [1–4]. For treating extensive full-thickness burns (EFTB), early eschar excision and skin grafting to remove necrotic and inflamed tissues and to effectively close the wound have been a key technical approach [5–12]. In life-threatening burns, the procedures that improve patient survival by reducing wound infection, hypermetabolism, and immunosuppression assume priority over those which may optimize later functional and cosmetic results. As the burn size becomes more extensive, particularly in adult patients, there is a greater tendency to use a fascial excision. This approach is faster, requires less skin grafting, and results in less bleeding; however, it can have consequences that are difficult to repair, such as severe cosmetic deformity, dysfunction, and hypoesthesia because of the excision of cutaneous nerves [6,7]. In addition, the healed wound surface is subject to recurrent ulceration, resulting in chronic ulcer and even canceration or other long-term complications. For patients with EFTB at the early stage, the condition is usually critical, and there are limitations with regard to their ability to tolerate the excision operation. Combined with inhalation injury, delayed resuscitation post burn, especially supervened early shock, the patient's condition is complicated [11–13]. In addition, because of the lack of uninjured skin for grafting, the widely distributed wounds need to be repaired by repeated skin grafting. To effectively preserve viable subcutaneous tissue to improve outcome of the appearance and function while saving patient's life, our burn center had been making efforts to improve treatment of full-thickness burn (FTB) wounds. After repeated clinical practice and animal experiments [14,15], a surgical program of tangential excision and skin grafting on subcutaneous tissue wound (TESGSTW) for EFTB, including cryopreserved alloskin or xenoskin (fresh young pigskin) grafting for temporary coverage and later on autologous skin (microskin or small stamp skin) grafting, had been formulated based on anatomic sites, post-burn time, wound grafts as well as pathophysiological changes of the patients. This study aimed to summarize retrospectively clinical experience and curative effect of TESGSTW for retaining viable subcutaneous tissue in adult patients with FTB exceeding 70% total body surface area (TBSA).

2. Patients and methods

2.1. Case selection

Inclusion criteria included: (1) Adult burn patients admitted consecutively to the Burn Center, Jinan Central Hospital Affiliated to Shandong University, between January 2002 and December 2013. (2) FTB area of more than 70% TBSA. (3) First TESGSTW performed within post-burn day (PBD) 7. Two more patients who underwent eschar excision and skin grafting on fascia wound were selected only as a historical control for long-term effects of healed wound. Permission for the medical records review was obtained from the Ethics Committee at our hospital.

2.2. Data collection

Data collected were as follows: (1) Gender, age, weight, total burn area, FTB area, inhalation injury and its severity (Table 1) [16], early shock, compound injury, important diseases before injury, and causes of death. (2) Post-burn time, site and area of tangential excision (donor site harvested) for wound with intact eschar, whether or not using tourniquet on limb of tangential excision, operation duration of limb surgery (referred to the sum of time from beginning of burn excised or skin harvested to end of bandage on every surgical limb in a surgery), 24 h preoperative and 48 h postoperative hemoglobin (Hb) level, and total blood transfusion volume at operation and through the following 48 h. (3) In cured patients, post-burn time and area of tangential excision for wound with intact eschar, category of wound graft, complications occurring within postoperative day (POD) 14 such as wound infection and graft loss; changes of alloskin and xenoskin, and blood circulation of recipient bed, times of replacing the initial grafted alloskin or xenoskin using new xenoskin, time and take rate of autologous skin grafting instead of allograft or xenograft grafted or replaced; post-burn time, site, and area of donor site harvested, and epithelialization time of exceeding 95% total wound area; and long-term follow-up assessment of healed wound.

2.3. Blood loss calculation

Blood loss of 1% area excised per operation within PBD 14 was calculated according to a formula [17,18]. Comparisons of blood loss volume among limb tangential excision without tourniquet (group A), limb tangential excision with tourniquet

Table 1 – Diagnostic key points of inhalation injury.

Severity	Lesion range	Main symptoms	Main signs	X-rays	Blood gas analysis
Mild injury	Nose, mouth, pharynx	Pharynx dry and pain	Vibrissa scorch, Nasopharynx redness	–	–
Moderate injury	Throat, trachea	Trachyphonia, Upper airway obstruction	Airway obstruction, stridor, dry rale	Tracheostenosis	±
Severe injury	Bronchia, pulmonary alveoli	Hypoxia	Dry rale and/or moist rale	Pneumonedema	Hyoxemia