A Semisynthetic Bilaminar Skin Substitute Used to Treat Pediatric Full-Body Toxic Epidermal Necrolysis

“Wraparound” Technique in a 17-Month-Old Girl

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The Cutting Edge: Challenges in Medical and Surgical Therapeutics

REPORT OF A CASE

A 17-month-old immunocompromised girl was admitted to the Children’s University Hospital because of anemia and upper airway infection. Six months previously, she had undergone a matched unrelated bone marrow transplantation to treat juvenile myelomonocytic leukemia. Intravenous antibiotic therapy with ceftazidime was started for clinical and laboratory signs of infection. The following day, the child developed a rapidly spreading bullous exanthema characteristic of toxic epidermal necrolysis (TEN) (Figure 1 and Figure 2) along with respiratory insufficiency requiring artificial ventilation and intensive care. A skin biopsy specimen taken from the trunk revealed a hyperkeratotic epidermis and massive epidermal necrosis with focal regeneration of the basal cell layer (Figure 3), supporting a diagnosis of TEN and ruling out staphylococcal scalded skin syndrome. Findings from an extensive workup to rule out an associated infectious cause were negative except for 1 positive blood culture for Staphylococcus epidermidis, suggesting that the intravenous ceftazidime therapy was the most likely cause.

THERAPEUTIC CHALLENGE

Toxic epidermal necrolysis is a painful, full-thickness, exfoliative skin disorder that may involve a large body surface area and mucosae with a high risk of secondary infection. The critical issue of coping with the sequelae of sepsis due to secondary wound infection remains a challenge in the treatment of this condition. After necessary debridement for prevention of infection, an ideal dressing technique would prevent pain and fluid and electrolyte loss and would allow patient mobility without shear stress on the wound.

SOLUTION

Two days after admission, meticulous surgical debridement of the blisters was performed. The whole body surface was then completely wrapped with a semisynthetic bilaminar skin substitute (Biobrane; Dow B. Hickham Inc,
Sugarland, Tex) in an all-in-one suitlike manner using skin staples (Auto Suture; US Surgical, Norwalk, Conn) to fix the dressing and the overlapping parts of the material. This treatment has been reported to be helpful in superficial burns and scalds and in adults with TEN.

This semisynthetic material meets some standards of an ideal skin substitute: it is easy to use, provides several beneficial physiologic effects, and improves comfort. Since the membrane is stretchable, both trunk and extremities could be covered by “wrapping around” the biomaterial, fixing it with slight tension, and stapling the ends together without skin fixation. Dressing changes with dexpanthenol ointment were only necessary on the face. The wound status was easily monitored owing to the translucency of the skin substitute. General intensive care treatment was guided by the pediatric intensive care unit team, including respiratory therapy, fluid resuscitation, electrolyte balancing, and systemic infection control.

During the 10 next days, the wounds showed consistent healing without signs of new blister formation. The membrane provided excellent adherence and allowed immediate mobilization. Three days postoperatively, the child was extubated. Ten days postoperatively, the skin substitute started to fall off. Reepithelialization was observed by day 12. Five weeks after operative debridement and wound coverage, the child could return to the daily ward. Six months later, there was no sign of scarring (Figure 6).

**COMMENT**

First described by Lyell in 1956, TEN is an exfoliative skin disorder that may involve a large body surface area. The microscopic changes are comparable with those that occur in superficial dermal burns. Complications of TEN are related to the loss of the epithelial skin barrier, including fluid, protein, and electrolyte loss and an increased risk of sepsis. Despite recent advances in intensive care of such lesions, the mortality rate remains high, comparable with that of full-body burn lesions.

Surgical management includes the early debridement of necrotic areas and wound coverage. Several methods have been described to cover the skin lesions, including various ointments, allografts, xenografts, and amniotic membranes. A synthetic bilaminar membrane used as a skin substitute (Biobrane) has been shown to decrease pain and hospitalization in superficial second-degree burns. Biobrane consists of a custom-knitted nylon fabric mechanically bonded to an ultrathin silicone membrane. The entire dressing is uniformly coated with collagen peptides covalently and independently bonded to the dressing, rendering the dressing hydrophilic and tissue compatible, and it decreases the

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**Figure 3.** Biopsy specimen taken from the edge of a blister. The arrows mark the transition from intact epidermis (E) to necrosis (N) (hematoxylin-eosin, original magnification x100).

**Figure 4.** Two days after surgery, the semisynthetic bilaminar skin substitute shows excellent adherence to the wounds.

**Figure 5.** Twelve days after surgery, the semisynthetic bilaminar skin substitute has fallen off, and the wounds are completely reepithelialized.

**Figure 6.** Lower right leg 6 months after treatment without signs of scarring.
loss of fluid. The dressing is readily available, nonimmunogenic, and easy to apply, and it renders frequent and painful dressing changes unnecessary. Several authors have described the advantages of this wound coverage in cases of TEN.2,3,6,7

We describe a 17-month-old girl who underwent bone marrow transplantation and subsequently developed TEN, most likely due to intravenous cephalosporin treatment. Fluid loss was successfully managed with debridement and application of the semisynthetic membrane applied as a body suit. Usually in acute burns, such occlusive dressings are only applied within the first hours after the trauma and after surgical debridement of any skin necrosis. Owing to the potential infection, no secondary applications of this material later than 6 hours after the burn have been reported.

Nevertheless, to avoid the numerous painful dressing changes, we decided to secondarily apply the membrane to our patient after a surgical debridement 2 days after the onset of TEN. No infection occurred, and the healing was uneventful. This is consistent with our experiences in successfully treating numerous scalds in children and adults over the last 7 years with this material.8,9 The rapid healing under this body suit–type dressing without any more dressing changes confirms the positive experiences described by other authors concerning the properties of this material. The present case demonstrates that a total body wrapping with this skin substitute may ameliorate pain and the need for pain medication in cases of TEN.

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ment for our patient with recalcitrant scalp psoriasis. Large-scale trials will be necessary to further substantiate our observations and optimize dosimetry for the treatment of scalp psoriasis using this novel treatment modality.

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REFERENCES


Correction

Error in 2 Authors’ First Names. In the Cutting Edge article titled “A Semisynthetic Bilaminar Skin Substitute Used to Treat Pediatric Full-Body Toxic Epidermal Necrolysis,” published in the February 2004 issue of the ARCHIVES (2004;140:160-162), the names of the second and third authors were reported incorrectly. The authors’ correct names are Udo Kontny, MD, and Marcus Krüger, MD, respectively.