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Klinik Çalışma

A biological dressing versus 'conventional' treatment in patients with massive burns: a clinical trial

Büyük çaplı yanıkları bulunan hastalarda konvansiyonel tedaviye karşı biyolojik pansuman: Klinik çalışma

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BACKGROUND

For many years, burns were treated by daily saline-soaked dressings until the burns healed primarily. Today, wounds are closed via grafting techniques, or by using synthetic and biological dressings. Due to less experience and interest in the use of biological dressing in developing countries, the aim of this study was to compare the outcome of biological dressings versus 'conventional' treatment in patients with massive burns.

METHODS

One hundred eighteen patients with total body surface area (TBSA) burns of 30% to 75%, by flame or scalds, were investigated from October 2002 to June 2006. The patients were divided into two groups. Those in the first group received conventional treatment (n=53) and those in the second group (n=65) received treatment with a biological dressing (Xenoderm).

RESULTS

Mortality rates in the conventional group and biological group were 19 (35%) and 7 (10.8%), respectively (p=0.001). The mean hospital stay was 31.3 days vs 18.2 days and the number of dressings was 22.1 vs 9.9, respectively (p=0.0005).

CONCLUSION

The results of this study indicate that a biological dressing (Xenoderm) gave a better outcome and lower mortality. However, a randomized clinical trial that compares the number of operations and decreasing need for split thickness skin grafts is warranted.

Key Words: Biological dressing; burns/surgery; massive burns; pig skin; Xenoderm.

AMAÇ

Yıllardan beri yanıklar, iyileşme elde edilinceye kadar serum fizyolojikle ıslatılmış pansumanlarla günlük olarak tedavi edilmiştir. Günümüzde, yaralar greft teknikleri yoluyla veya sentetik ve biyolojik pansumanlar kullanılarak kapatılmaktadır. Bu yazıda, gelişmekte olan ülkelerde biyolojik pansuman kullanımı ile ilgili daha az deneyim ve ilgi bulunması nedeniyle, büyük çaplı yanıkları bulunan hastalarda konvansiyonel tedaviye karşı biyolojik sargıların tedavi sonucu karşılaştırıldı.

GEREÇ VE YÖNTEM

Ekim 2002 ile Haziran 2006 tarihleri arasında, alev veya haşlanma yoluyla %30 ile %75 arasındaki oranlarda total vücut yüzeyi alanı (TVYA) yanığı oluşan 118 hasta incelemeye alındı. Hastalar iki gruba ayrıldı; konvansiyonel tedavide olan birinci grup (n=53), biyolojik pansuman (Xenoderm) ile tedavi edilen ikinci grup (n=65).

BULGULAR

Konvansiyonel grup ile biyolojik pansuman grubundaki mortalite oranları sırasıyla 19 (%35) ve 7 (%10,8) olarak bulundu (p=0,001). Ortalama hastanede kalma süresi 31,3 güne karşı 18,2 gün ve pansuman sayısı 22,1'e karşı 9,9 oldu (p=0,0005).

SONUÇ

Bu çalışma sonucunda, biyolojik pansuman (Xenoderm) daha iyi bir sonuç ve daha düşük bir mortalite oranı vermiştir. Bununla birlikte, ameliyat sayısı ile ince kalınlıkta deri grefti gereksiniminin azalmasını karşılaştıran randomize bir klinik çalışma yapılması gerekmektedir.

Anahtar Sözcükler: Biyolojik pansuman; yanıklar/cerrahi; büyük çaplı yanık; domuz derisi; Xenoderm.

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Burns are a major cause of death and disability throughout the world and an effective treatment requires the cooperation of many different medical teams. For many years, burns were treated by daily washing, removal of loose dead tissue and topical application of saline-soaked dressings until the burns had healed primarily, or granulation tissue appeared in the base of the wound. When the granulating bed became free of debris and relatively uninfected, split thickness skin grafts (STSG) were applied, usually some 3 to 8 weeks after injury.[1,2] However, today, generally, the eschar is surgically removed and the wound closed using various grafting techniques (i.e. early excision and grafting), or using various synthetic and biological dressings (as an alternative to antimicrobial dressing for massive burns) especially in massive burns.[2]

These coverings include biological dressings [e.g. allograft (cadaver), heterograft (pig skin, xenograft and Xenoderm)] and synthetic dressings (e.g. Transcyte, Biobrane, and Integra).[1,2] Since 1960, porcine skin has gained in acceptance as a temporary dressing,[3-5] and three types are common: living, fresh and lyophilized (Xenoderm, Xenograft).[5,6] Experimental trial studies have shown that these three types produced the same results.[7-9] In Iran, usage of lyophilized Xenoderm has been legalized. Porcine skin has the desirable properties of being able to:

1. Adhere to clean wounds.[4]

2. Cover nerve endings to decrease pain.[2-4,6,7,10-12]

3. Decrease heat, protein and electrolyte loss.[2-4,5,7,10,13]

4. Heal skin faster in partial thickness burns, with less scar formation.[2,14]

5. Create an environment that facilitates migration and proliferation of epithelial cells, whilst protecting against bacterial invasion and evaporative water loss.[4] The antibacterial action seems to be primarily dependent on its tight adherence to the wound.[6,15,16]

6. Not be rejected by the usual immune mechanisms, which cause grafts to slough.[2]

7. Allow the surgeon the opportunity to reconstruct the wounds step by step with the application of these dressings.[5]

Disadvantages are theoretical risk of zoonosis and nonacceptance by ethnic/religious groups.[3]

The application of porcine skin might lead to reduction in costs for treatment of severely burned patients and might possibly help to increase the chances of survival in critical cases.[5] Biological dressings have become an integral part of modern burn care.[6] They are particularly well suited to massive partial thickness injuries (total body surface area [TBSA] >50%) for closing the wound.[2]

Even today some surgeons do not believe the effect of biologic dressing in treatment of massively burned patients. Due to a tendency of having less experience and interest in the use of biological dressing in developing countries, the aim of this study was to compare the outcome of biological dressing versus 'conventional' treatments in patients with massive burns.

MATERIALS AND METHODS

In this non-randomized prospective clinical study, 118 burn patients were investigated in Shafieeh Hospital (Zanjan, Iran) between October 2002 and June 2006. The patients enrolled in the study had burns of 30% to 75% (TBSA) due to scalds or flames. Patients with infection (wound infection, 72 hours after burn), dirt (chemical material, fecal and soil) and existence of associated disease or multiple trauma were excluded from the study. Patients had second-degree and third-degree burns. The patients were divided into two groups. Those in the first group (conventional treatment) did not accept to enter the biological dressing group due to financial problems or because they were non-insured. This group was treated by daily washing and removal of loose dead tissue (early excision), followed by topical application of saline-soaked dressing. When the granulating bed had become free of debris and was uninfected, STSG were applied, usually after 2-8 weeks. The second group (biological dressings) included patients who accepted to enter into the treatment with biologic dressing (Xenoderm). In Iran, usage of lyophilized Xenoderm has been legalized by authorities in the Ministry of Health and Education and by religious authorities. Permission to import these types of products is given to one Iranian company. Xenoderm is lyophilized pig skin, manufactured by MBP (Medical Biomaterial Products, Germany). First, Xenoderm was prepared in normal saline solution. After debridement of the burnt area with a dermatome (tangential excision) and rinsing of the wound with normal saline, Xenoderm was placed on the wound

by the surgeon (first author) and fixed using a suture, dressing or bandage. The region was immobilized by a splint if necessary (Fig. 1). Twenty-four hours after surgery, the dressing was removed. For full thickness areas, after 2 to 8 weeks, Xenoderm was removed and STSG was performed (Fig. 2). All patients received cefazolin prophylaxis. This study was approved by the Ethics Committee of Zanjan University of Medical Sciences and all patients gave informed consent before entering into the study.

Data, including demographics, mechanism of injury, type of burn, TBSA, location of burns, total hospital stay, amount of serum until start of oral feed, number of oral or injectable analgesics, and the number of dressings were recorded, together with inhalation injury, mortality, and albumin and fresh frozen plasma (FFP) intake measured by nursing staff, Burn Department physician and general surgeon.

Significant differences were evaluated using the unpaired Student's t test, the Mann-Whitney U test and the test. A p value less than 0.05 was considered significant. All analyses were performed using SPSS 11.5.

RESULTS

A total of 118 patients were divided into two groups (53 patients in conventional treatment group; 65 patients in biological dressing group, using Xenoderm).

There were no significant differences in terms of age, gender, place of residence, type of burn, thickness of burn and burn site between the two groups (Table 1). Eight patients (15.1%) in the conventional group and 13 patients (20%) in the biological dressing group, respectively, were aged less than 5 years.

Table 1. Patient demographics

	Conventional (n=53) [n, %]	Xenoderm (n=65) [n, %]
Male	32 (60.4%)	34 (52.3%)
Female	21 (39.6%)	31 (47.7%)
Mean age	26.54	26.52
Range	(2-80)	(1-81)
Rural	25 (47.2%)	31 (47.7%)
Urban	28 (52.8%)	34 (52.3%)
Mechanism of injury		
Scalds	9 (17%)	17 (26.2%)
Flame	44 (83%)	48 (73.8%)
Inhalation injury	13 (24.5%)	14 (22.6%)
Mean TBSA	(44.7%)	(42.8%)
Range	(31% - 70%)	(30% - 72%)
Depth of burn		
1st, 2nd degree	6 (11.3%)	9 (13.9%)
1st, 2nd, 3rd degree	47 (88.7%)	56 (86.1%)
Location of burn		
Face	34 (64%)	42 (64%)
Neck	31 (58%)	35 (54%)
Body	46 (81%)	55 (84%)
Upper limb	51 (94%)	59 (90.1%)
Lower limb	50 (94%)	56 (86%)
Genital	18 (33%)	17 (26%)
Mortality	19 (35.8%)	7 (10.8%)

TBSA: Total body surface area.

Respiratory burns were higher in the conventional group than in the biological group (Table 1). The number of dressings and albumin intake were statistically different between the two groups (Table 2).

Mortality rates in the conventional group and the biological group were 19 (35%) and 7 (10.8%), respectively, which showed a significant difference (p=0.001). Mortality rates according to different

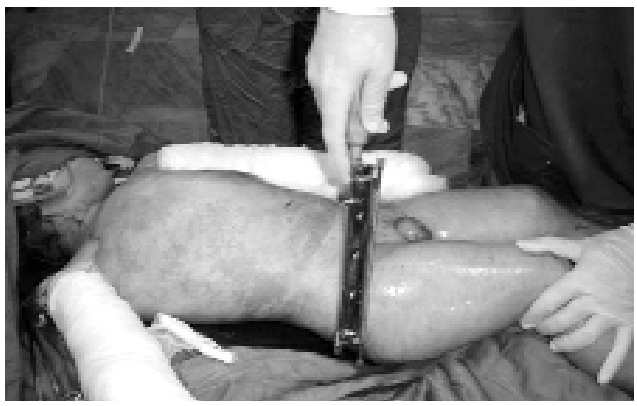

Fig. 1. Deep 2nd and 3rd degree burns in a child with 70% total body surface area burnt (tangential excision).

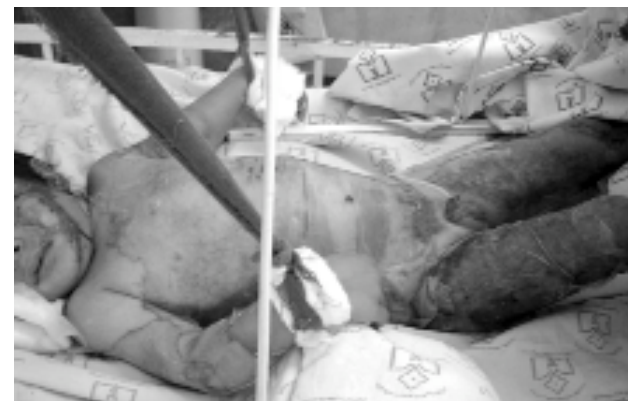

Fig. 2. Biological dressing Xenoderm: 5th postoperative day.

Table 2. Effect of treatment on various clinical parameters in surviving patients

Variable	Group	n	Mean (SD)	Median	p
Age	Conventional	53	26.5 (20.3)	21	0.57
	Xenoderm	65	26.50 (19.8)	26	
Burn skin area (%)	Conventional	53	44.7 (11.8)	43	0.31
	Xenoderm	65	42.8 (12.4)	38	
Number of dressings	Conventional	53	18.04 (13.6)	14	0.005
	Xenoderm	65	10.4 (10.9)	5	
Number of analgesics (IV)	Conventional	53	6.9 (9.9)	3	0.56
	Xenoderm	65	6.7 (8.8)	4	
Number of analgesics (oral)	Conventional	53	17.5 (17.8)	15	0.17
	Xenoderm	65	21.1 (20.6)	14	
Serum therapy before oral intake	Conventional	53	14.2 (16.6)	8	0.062
	Xenoderm	65	7.8 (5.3)	7	
First admission hospital stay (days)	Conventional	53	24.2 (18.2)	22	0.11
	Xenoderm	65	18.7 (15.2)	12	
Albumin	Conventional	53	13.1 (10.8)	13	0.0005
	Xenoderm	65	8.9 (15.2)	4	
FFP	Conventional	53	2.7 (2.5)	3	0.08
	Xenoderm	65	3.2 (7.8)	0	

SD: Standard deviation; FFP: Fresh frozen plasma; IV: Intravenous.

TBSA are shown in Table 3. If deceased patients were omitted, the mean of first admission hospital stay was 31.3 days, the number of dressings was 22.1, albumin intake was 11 vials, and mean area of burn was 41% in the conventional group, whereas the same values were 18.2 days (p=0.0005), 9.9 dressings (p=0.0005), 7.4 vials for albumin intake (p=0.02) and 41.7% mean area of burn in the biological group, respectively. No significant differences in any of the other results were determined between the two groups (with the omission of exitus patients).

Table 3. Association between death and TBSA

TBSA%	Conventional (n=53)	Xenoderm (n=65)
30%-39%		
Discharge	22	36
Death	2	2
Refer	1	0
40%-49%		
Discharge	5	8
Death	6	1
50%-59%		
Discharge	2	6
Death	5	0
60%-75%		
Discharge	2	8
Death	6	4
Refer	2	–

TBSA: Total body surface area.

The number of exitus patients was 26 (19 in conventional group and 7 in the biological group). There were 11 patients in the conventional group with a 40-49% TBSA, of whom 6 patients died. In patients with a burn area of 30-39%, the mean bed occupancy in the conventional group was 31 days versus 18.8 days in the biological group (p=0.0005). The mean number of dressings in the conventional group and biological group was 23.8 and 6.6 (p=0.0005), respectively, and mean number of oral analgesic intakes was 23 and 16.4, respectively (p=0.1). Other results showed no significant difference. The most common burned areas were the upper limb, lower limb and trunk. In burn patients over 40% of treatment results between the two groups showed no significant difference (taking into consideration the exitus patients).

Three patients in the conventional group were transferred to a tertiary referral hospital after three weeks of treatment.

DISCUSSION

The results of the present study suggest that application of Xenoderm led to a reduction in mortality, hospital stay, and dressing time and to a reduction in the use of intravenous serum when compared with conventional treatment.

The ratio of mortality in the two groups was 3:1. Thompson et al.[17] in their series studied second and third-degree burn patients involving at least 30% TBSA (early excision) and reported a decrease in mortality and also that hospital stay was not affected by early excision. Wolfe et al.[18] showed that with at least 30% TBSA (and early excision), rapid closure of full thickness wounds was associated with a lower mortality. Biological dressing is particularly well-suited for use with massive partial thickness injury.[2] Application of these dressings provides the opportunity for the surgeon to reconstruct the wounds step by step.[5] It may help to increase the chance of survival in critical cases.[5]

The hospital stay in the conventional group was longer than in the biological dressing group, which in patients with a 30-39% burn area was significant, because biological dressing course of treatment is used in second-degree burns and the remaining burned area (third-degree) is closed with STSG. However, patients with more than 40% TBSA needed to stay in hospital due to limited donor site for treatment including repeated debridement and STSG to the full thickness burn area. Becker[3] suggests that the application of pig skin affects the occupancy at the hospital, helping to cut short the duration of treatment and reducing cost.[5]

Chicarilli et al.[19] assessed patients with over 30% TBSA (using early excision and graft with allograft and/or STSG) and reported shortened hospital stay and an improved survival after aggressive excision. Still et al.[20] showed that early excision and grafting (STSG and xenograft) reduced the hospital stay without any adverse effects on clinical outcome (mean 17.7% TBSA).

The mean intravenous serum therapy was less in the biological dressing group compared with the conventional group. Biological dressings induce significant reduction in the loss of proteins, electrolytes and fluids.[3-7] It induces a water 'barrier' to minimize water loss through evaporation and to provide a moist environment for cell survival and growth.[7]

In this study, the number of dressings was very small and less in the biological dressings group when compared to the conventional group. Daily exchange of dressing is very painful. Under the protection of a skin replacement (biological dressing), remnants of skin regenerate significantly faster, with less scar formation.[5] Therefore, with decreased dressings on the burns, patients were more satisfied and more comfortable. This is very important in facilitating the mobility of patients or the burned area. This characteristic of treatment was most useful in children's burns.[21] The results showed that there was no significant difference in the number of analgesics used, but in those patients with 30-39% TBSA, the use of oral analgesics was less in the biological group. The reduction of pain has been well documented in previous studies.[3-7,22,23]

Albumin and FFP intake showed a significant difference between the two groups. Biological dressings (pig skin) reduced heat, fluid, protein and electrolyte loss.[3,4,6,7,24] However, in those patients with a 30-39% TBSA burn, albumin vial intake was very low in the biological dressing group ($p=0.04$). It should be mentioned that according to the laws of Islam, use of any part of the pig is forbidden for Moslems. However, based on benefits of this usage, Islamic authorities can remove this restriction. Therefore, in Iran, usage of lyophilized Xenoderm has been legalized by authorities in the Ministry of Health and Education and by religious authorities.

Biological dressings reduced albumin, FFP, intravenous serum therapy, number of dressings and pain; therefore, these effects led to increase in survival.

In conclusion, the results of this study indicate that biological dressings lead to a better outcome and lower mortality. However, a randomized clinical trial that compares the number of operations, hospital stay, albumin intake and decreasing need for STSG is warranted.

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