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Amniotic Membrane Dressing vs Conventional Topical Antibiotic Dressing in Hospitalized Burn Patients

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Abstract

Background: Different natural and synthetic materials were used for temporary burn wound coverage; however, they are associated with disadvantages including high price which prohibit their widespread use, especially in developing countries. Among all, human amniotic membrane is the only easily available and cost free coverage. Its effects on burn wounds have been studied in this survey.

Methods: One-hundred and twenty four patients with 20-50% second and third degree burns and without any other disease were randomly assigned into two groups. The first 61 patients (control group) underwent traditional method of dressing with silver sulfadiazine and gauze which were changed twice a day. The remaining 63 patients underwent dressing with human amniotic membrane (amnion group), being changed every 3-4 days.

Results: Patients in the control group had significantly lower albumin and needed more albumin infusion (231.80±234 gr. versus 111.51±143.82 gr.), received more blood transfusion (1.75± 2.52 bags versus 0.65± 1.18 bags), had significantly more intense pain and so received more narcotics than amnion group (7.97±12.85doses versus 3.84±7.56). Wound infection was higher in the control group (65.66% versus 46.91%) and so was the incidence of sepsis (24.62% versus 6.10%). There was 8.53% mortality in the control group versus 0% in the amnion group. All of the above-mentioned differences were statistically significant.

Conclusions: Amniotic membrane dressing in deep and more extensive burns leads to better homeostatic, immunologic and local results and because of its low price, its use is strongly recommended.

Keywords: Amniotic membrane; Burn; Dressing

Introduction

The standard treatment for deep partial-thickness and full-thickness burns is early excision and grafting.[1-3] However, this is not always possible due to the paucity of autologus donor site available in patients with massive burn injuries[1] or due to the patient's general condition.[2] Besides, determining which burn will heal in 3 weeks (that will not need E&G) is challenging and not possible in the first few days.[2] In these cases, temporary skin substitutes play an important role to provide transient physiologic wound closure. Several materials have been used for this purpose; yet some are not available in large quantity (such as cadaver skin) and most are very expensive (e.g. Biobrane, INTEGRA). Among all, human amniotic membrane seems to be available, have all of the features of an ideal skin substitute[4] along with very low price (almost free) which can make it an ideal temporary skin substitute, especially in developing countries.[5- 7] The advantages of amniotic membrane in "superficial" burns (superficial 2nd degree) and "limited" burn size (less than 20%) has already been studied and proved.[8-9]

The goal of this survey was to study the effects of amniotic membrane on extensive (more than 20%) and deep burns (2nd and 3rd degree) by comparing its application with the conventional method of burn

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wound care in our center (daily washing and dressing with silver sulfadiazine and gauze).

Materials and Methods

From October 2005 to February 2007, in a prospective clinical trial, 124 patients with 2nd and 3rd degree burns, covering 20 to 50% of total body surface area (TBSA) who were admitted in our center were randomly divided into two groups, using random allocation (regardless of the depth of the burn). Our excluding criteria were age more than 60 and history of cardiac disease, renal failure, diabetes mellitus and any other severe metabolic disorder.

We received the approval of Shiraz University of Medical Sciences Ethical Committee. All of the patients (or their parents) signed an informed consent. The first group was composed of 61 patients whose wounds were irrigated twice daily with normal saline and diluted betadine and then covered with silver sulfadiazine, or in some cases mafenide acetate dressing (control group). In the second group, consisting of 63 patients, the wounds were washed with normal saline and diluted betadine and then covered with a layer of amnion, over which a layer of vaseline gauze was applied and dressing with gauze and band was done (amnion group). Every 3-4 days these patients' dressings were changed. A problem with this group was that some of them developed malodor, in which their dressings were changed sooner.

There was an 18-year-old female, a case of suicide with 40% burn, who underwent amniotic membrane dressing. On the 5th day, the patient had high grade fever due to which her dressing was changed to regular antibiotic and gauze dressing. She was expired on the 14th day of hospitalization. This was the only case whose treatment policy was changed during hospitalization and so she was excluded from the survey.

The used placentas were achieved from elective cesarean sections. The amniotic membrane was delicately separated from chorion and placenta and washed thoroughly with normal saline until a whitish, smooth transparent layer remained. The resulted amniotic membrane was put in a sterile pot containing normal saline and 80 mg gentamycin and stored in refrigerator at 4°C. A blood sample was drawn from umbilical cord and checked for VDRL, HIV, HCV, and HBS. Only if all of these tests were negative, the amniotic membrane would be used. All of those samples which had been stored for more than one week in the refrigerator underwent weekly bacteriologic culture before usage to rule out any bacterial contamination. The level of hemoglobin, BUN, sodium, potassium, and albumin were checked at least twice weekly in all patients.

All of the patients were visited daily by an experienced physician for any symptoms and signs of wound infection. In patients were suspected to develop sepsis with symptom and signs of hypothermia, hypotension, abrupt hyperglycemia, decreased urine output, thrombocytopenia and diet intolerance, a thorough work up including blood culture and urine culture was done.

For the comparison of pain, a scaled spectrogram (from 0 to 10, which 0 means no pain and 10 is the most severe pain the patient has ever experienced) was used (Box- Wisker plot) according to which and the patients were asked to define the amount of their pain. The pain was checked in each patient once before the dressing change and once after it. For the patients in amnion group (with amniotic dressing change every 3-4 days), the pain was measured on a daily basis and on the day of dressing, it was checked after dressing change. Another variant which was used for comparison of pain was the amount of narcotic doses that each patient had received. This information was collected from nursing reports. Finally, for comparing the cost of each method, the charge of patients at the discharge time was considered (before skin graft).

The statistical methods which were used to analyze the data of this study were t- student and Fisher exact test.

Results

The amnion group was composed of 63 patients (35 males and 28 females) with a mean age of 23.31±14.53 years and burn 31.25±8.32% TBSA. The control group was composed of 61 patients (35 males and 26 females) with a mean age of 25.30±11.81 years and burn of 32.37±8.96% TBSA. The most common mechanism of burn in both groups was flame followed by flash.

The hemoglobin at the 3rd day and the final day did not have any significant difference in the two groups; however, the control group needed more transfusion to keep the hemoglobin within normal range (1.75±2.52 bags versus 0.65±1.18 bags) which was statistically significant (Table 1). The patients' serum albumin level at the first day was not signifi-

cantly different (3.7±1.22 vs3.75±1.15) but in the control group, the albumin was significantly lower in the middle and the final day of their hospitalization course (3.18±0.51 vs 2.85±0.59 and 3.34±0.50 vs 3.17±0.63). Moreover, they needed albumin infusion twice as much as that of the amnion group range (Table 1). The number of days which the patients had sodium or potassium imbalance was not significantly different in the two groups. The pain was significantly lower in the amnion group (Table 2). This difference was noticed in both pre and post dressing period. Meanwhile, the control group received narcotics twice as much as that in the amnion group (Table 2).

The use of amniotic membrane not only decreased the time for skin graft preparation, but also the need for skin graft. The average time for the wounds to get ready for skin graft was 15.53±3.50 days in the amnion group versus 21.09±4.66 days in the control group. The difference was statistically significant (P<0.001). The hospital stay was also shorter in the amnion group (20.70±5.00 days versus 30.47±8.59 days (P<0.001). The use of amnion decreased the surface of the burn wound and resulted in the need for skin graft to less than a half. The patients of amnion group with an average of 27.31% burn finally needed 6.95%±3.25 skin graft which means that only 25% of the burned area needed skin graft in this group. In contrast, the patients of the control group with an average burn of 32.32% needed 15.50%±5.65 skin graft which was 47% of the burned area. This was statistically significant as well (P<0.001). Five patients in the control group (8.56%) expired during the study. This included 2 males and three females. Their burn surface was between 38 and 50% TBSA. There was no mortality in amnion group. This difference was statistically significant (P=0.02). The final factor which was compared in the two groups was the cost of treatment. The average expenses in the control group was $3789.07±138.10 but in the amnion group it was $2947.60±220.004. The difference was significant (P< 0.001).

Discussion

The use of amniotic membrane requires less blood transfusion. This is probably due to less oozing from the surface of the wound. Moreover, topical antibiotic dressing should be changed twice or at least once a day. Every dressing change causes traumatization of the fragile surface of the wound and more blood loss. Amnion prevents the oozing of protein rich plasma from the wound as well.[6-7] It accounts for the significant difference between the two groups' plasma albumin level in the middle and the end of the treatment course in spite of similar albumin level at the beginning and higher need for albumin infusion in the control group (111.45 versus 231.80 gr). Another explanation is that all biological dressings shorten the catabolic phase and induce anabolic phase more rapidly.[10]

Theoretically, patients with amniotic membrane dressing should have less electrolyte imbalance; nevertheless, this study didn't show any statistically significant difference between the two groups. We noticed less local wound infection as well as less frequent sepsis development in amnion group. Some researchers have shown that amniotic membrane dressing can prevent or at least decrease burn wound colonization.[11-12] This difference can be attributed to proved antibacterial characteristic of amnion. It has been suggested that progesterone of amniotic membrane has bacteriostatical effect on gram positive bacteria and its lysozyme donates a bacteriocidal property to it. Besides, the presence of some effective materials such as "Alantoin"

Table 1: The need for transfusion and albumin infusion.

Parameter	Amnion group (Mean±SD)	Control group (Mean±SD)	*P value*
Transfusion (bags)	0.65±1.18	1.75±2.52	0.006
Albumin Infusion (gr.)	111.5±143.8	231.8±234.1	0.001

Table 2: The pain score and need for narcotics

Parameter	Amnion group (Mean±SD)	Control group (Mean±SD)	*P value*
Pain (before dressing)	2.16±1.8	4.5±1.7	0.001
Pain (after dressing)	4.2±2.6	7.9±1.6	0.001
Narcotic (doses)	3.8±7.5	7.9±12.8	0.03

(a metabolite of purine) and some immunoglobulins have been shown on it which are effective in wound infection prevention.[13] It can also account for the lower mortality in amnion group as sepsis remains the leading cause of death in burn patients.[2]

The difference in depth between a shallow burn that heals in 3 weeks, a deep partial-thickness burn that heals after several weeks with hypertrophic scar, and a full-thickness burn that will not heal at all, may be only a few tenths of millimeter.[2] Every time that antibiotic and gauze dressing is changed, it traumatizes the fragile surface of the wound. This is repeated twice a day for several days which can eventually deepen the wound even for a few tenths of millimeter and change a shallow wound which does not need skin graft to a deeper one. Amniotic membrane dressing needs less frequent dressing change (every 3-4 days) and does not traumatize the wound because amniotic membrane completely adheres to the wound and does not need to be removed before a new amniotic membrane is applied over it. On the other hand, previous studies have shown that amnion dressing is accompanied by acceleration of reepithelialization of wounds.[14- 16] It has been suggested that the mechanism responsible for the rapid healing and developing granulation tissue is inhibition of the protease activity, thus reducing the infiltration of polymorphonuclear leukocytes.[10] In summary, less traumatization of the wound and acceleration in reepithelialization cause shorter preparation time and less need for skin graft. Moreover, wound infection can change a shallow wound to a deep one. Amnion dressing has the advantage of less wound infection and thus less conversion of a superficial wound to a deeper one.[10]

We noticed, as in the previous studies, less pain in amnion dressing group and less need for narcotic drugs in these patients. One reason is less frequent dressing change, as the patients experience more intensive pain after dressing change. Another cause is less inflammatory response to amniotic membrane. Human amniotic epithelial cells do not express HLA-A, B, C and DR or beta 2 microglobulin on their surface which could contribute to the lower inflammatory responses.[12] This causes less inflammatory mediators in the burn area and less pain sensation. It is possible that some more complex mechanisms be involved as well which are still to be investigated. Amniotic dressing is also accompanied by shorter hospital stay and lower bill.

The most important concern regarding the use of amniotic membrane is the potential of disease transmission which can be prevented by screening for viral markers (HIV, HCV, and HBS). We also screened every amnion for VDRL. Finally, all preserved amnions underwent bacterial culture to rule out any contamination. We couldn't find any reported disease transmission via amniotic membrane in literature.

The only problem with the usage of amniotic membrane is its bad smell for some patients. Although it did not impact the course of treatment in these patients, we changed these patients' dressing in shorter intervals and the smell reduced after dressing change. It seems that this smell is due to the constitutional characteristic of some amniotic membranes.

Overall, our study suggests that the use of amniotic membrane dressing for more extensive and deep burn wounds be safe and beneficial, especially in those patients who can not undergo early excision and grafting and in cases whose depth of the burned area is in doubt. But more studies are needed to comfirm widespread use of amniotic membrane in extensive burns.

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