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The Impact of Breastfeeding on the Prognosis in Burns with 20% and Greater in Children Under 2 Years Old

The Role of Breastfeeding in Burns Under 2 Years of Age

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ABSTRACT

Objective: Burn injuries are a significant cause of worldwide mortality and morbidity. Most of the cases have severe burns (>15% Total Body Surface Area (TBSA)), and 48% of cases require surgery (debridement and/or grafting). Burns induce a hypermetabolic state in the patient, leading to rapid malnutrition development. Studies have demonstrated the regenerative potential of breast milk on the proliferative signaling pathways of skin fibroblasts.
Materials and Methods: A hundred and twenty-five patients under age two with acutely burned lesions of 20% TBSA or greater who were admitted to the pediatric burn clinic were enrolled between 2013-2023. Data of patients were collected retrospectively. Patients were divided into two groups based on breastfeeding: those who breastfed during the treatment (65/125) and those who did not (60/125).
Results: There wasn't any statistically significant difference between groups in terms of operation need, infectious status, blood product and albumin transfusion, and length of hospital stay. The overall mortality rate was 4.8% (6/125). There was no statistically significant difference in mortality rates in both groups.
Conclusion: Although statistical evidence may not directly show that oral breast milk intake has a significant impact on the wound healing process and mortality in major burn patients, it has been observed to assist in maintaining the nutritional status and preserving total body mass in these patients.

2 Yaş Altında %20 ve Üzeri Yanık Olgularında Anne Sütü ile Beslenmenin Prognoza Etkisi

Kovid-19 sırasında Kas-iskelet Sağlığı

2 Yaş Altı Ciddi Yanıklarda Anne Sütünün Prognozdaki Yeri

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ÖZET

Amaç: Yanık yaralanmaları dünya çapında önemli bir mortalite ve morbidite nedenidir. Vakaların büyük çoğunluğunu yüzey alanı geniş ve derin yanıklar oluşturmaktadır (>%15 Toplam Vücut Yüzey Alanı (TVYA)) ve vakaların %48'i ameliyat gerektirir (debridman ve/veya greftleme). Yanık travması hastalarda hipermetabolik bir durum oluşturarak hızla malnütrisyon gelişimine neden olur. Yapılan çalışmalar, anne sütünün cilt fibroblastlarının proliferatif sinyal yolları üzerindeki rejeneratif potansiyelini göstermiştir.
Gereç ve Yöntemler: 2013-2023 yılları arasında pediatrik yanık kliniğine başvuran, TVYA'nı %20 ve üzerinde akut yanık travması olan, iki yaş altı 125 hasta çalışmaya alındı. Hastaların verileri retrospektif olarak incelendi. Hastalar anne sütü ile beslenme durumuna göre tedavi sırasında anne sütüyle beslenenler (65/125) ve beslenmeyenler (60/125) olmak üzere iki gruba ayrıldı.
Bulgular: Gruplar arasında operasyon ihtiyacı, enfeksiyon durumu, kan ürünü ve albumin transfüzyonu ihtiyacı ve hastanede kalış süresi açısından istatistiksel olarak anlamlı fark görülmedi. Mortalite oranı %4,8 (6/125) idi. Her iki grupta da mortalite oranlarında istatistiksel olarak anlamlı bir fark görülmedi.
Sonuç: TVYA'sı %20 ve üzerinde akut yanık travması olan iki yaş altı hastalarda anne sütüyle beslenmenin yara iyileşme süreci ve mortalite üzerinde istatistiksel olarak anlamlı bir etkiye sahip olduğunu doğrudan göstermese de, bu hastalarda nutrisyonun desteklenmesine ve toplam vücut kütlesinin korunmasına yardımcı olduğu gözlemlenmiştir.

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Introduction

Burn injuries are a significant cause of worldwide mortality and morbidity. 62% of pediatric burn cases are in the infant period, scald burns are the most common, accounting for 80%, followed by flame burns at 14% (1,2). Research has shown that pediatric burns are more common in low and middle-income societies. Most of the cases have severe burns (>15% Total Body Surface Area (TBSA)), and 48% of cases require surgery (debridement and/or grafting) (3). Managing pediatric burns is challenging even in the most advanced centers. Burn wounds cause both physiological and psychological pain. Burns induce a hypermetabolic state in the patient, leading to rapid malnutrition development. It is crucial for burn patients to receive adequate nutrition with calorie and content calculations as early as possible (4). Studies have demonstrated the regenerative potential of breast milk on the proliferative signaling pathways of skin fibroblasts. Directly exposure to breast milk has shown an upregulation of Bcl-2 in dermal fibroblast cell lines. L-arginine, a semi-essential amino acid in intra and intercellular pathways, plays a fundamental role in upregulating Erk1/2, pErk1/2, JNK, and pJNK kinases, and inducing and sustaining the proliferative period in skin repair through the anti-apoptotic pathway Bcl-2/Bax ratio increase (5). Based on this information, we aimed to investigate the impact of oral intake of breast milk on the clinical course of patients under age two with severe burns (>20% TBSA) in this study.

Materials and Methods

The study was approved by the ethical committee of the hospital. Informed consent was obtained from each patient's parent. A hundred and twenty-five patients under age two with acutely burned lesions of 20% TBSA or greater who were admitted to pediatric burn clinic were enrolled between 2013-2023. Data of patients were collected retrospectively.

All patients were resuscitated according to either Parkland or Galveston Formula with lactated Ringer's solution and burn lesions covered with optimal wound dressings. Admission criteria were based on American Burn Association guidelines. All patients consulted with a nutritionist and personalized calorie intake was calculated specifically for each patient. Patients were fed accompanied by their mother and ICU nurse, provided they did not fall below the calorie intake calculated specifically for them. Both enteral and intravenous nutrition were provided starting from the first day of hospitalization, except for preoperative 6-hour fasting periods. Although patients were especially encouraged for total enteral nutrition, enteral nutrition was provided by giving breast milk and necessary formula supplements through a nasogastric tube in cases that could not tolerate oral nutrition. Demographics, burn characteristics, breast milk intake, operations, blood and albumin transfusion requirements, hospital duration, and mortality data were obtained and analyzed.

Statistical analysis

The data were analyzed using the IBM SPSS Statistics Standard Concurrent User V 26 (IBM Corp., Armonk, New York, USA) statistical package program. Descriptive statistics were provided as the number of units (n), percentage (%), and mean ± standard deviation values. The normal data distribution for numerical variables was assessed using the Shapiro-Wilk normality test. In the comparison of the two groups, if the data showed a normal distribution, the independent samples t-test was used; if the data did not have a normal distribution, the Mann-Whitney U Test was employed. Relationships between categorical variables were assessed using Pearson chi-square and Fisher's exact test. A p-value <0.05 was considered statistically significant.

Results

The study included a total of 125 patients. 43.2% of the patients were female, and 56.8% of them were male. Median burn size was 26.3% TBSA and scald burn was the most common cause (96.8%). Detailed demographic and descriptive data are shown in Table 1.

Patients were divided into two groups based on breastfeeding: those who were still breastfeeding during the treatment period (65/125) and those who did not (60/125). Demographic data were similar between groups. TBSA (%) was higher in the breastfed group.

There wasn't any statistically significant difference between groups in terms of operation need, infectious status, blood product and albumin transfusion, and length of hospital stay (Table 2).

The overall mortality rate was 4.8% (6/125). There was no statistically significant difference in mortality rates in both groups (Table 3).

Discussion

Many studies focus on the role of breast milk on children both health and development (6). The main concerns about wound healing are reducing inflammation and improving regeneration. According to the study that shows skin wrinkles were treated with implanted autologous fibroblasts, cutaneous treatment with milk can induce wound healing (7).

Since there has been no other study investigating the effects of breastfeeding in pediatric burn patients, we think that this study will contribute to the literature. Although it is known that breast milk is beneficial in many ways, in our study, no statistical difference was observed between the groups in terms of wound epithelialization time, infectious status, and hospital stay due to breast milk feeding in burn patients.

In a study that reviews research conducted between 1995 and 2021, it has been observed that studies related to the therapeutic use of breast milk are generally concentrated in various areas. These studies

have often investigated the use of breast milk in the treatment and prevention of diseases in infants, improvement of the mother's own health issues, treatment of other individuals (such as skin infections), experimental animal studies, and in vivo/in vitro studies (8).

Adequate nutritional support for burn patients is mandatory. The burn itself triggers a hypermetabolic process in the patient, and lesions lead to fluid loss (4). Weight loss in these patients causes impaired wound epithelization, immune deficiency, infections, and mortality (9). Early enteral feeding is important for the maintenance of body mass (4).

Studies on milk show that breast milk-derived exosomes improve endothelial cell function and promote wound healing (10). Exosomes promote wound healing via microRNA (11).

Breastfeeding increases the Expression of TLR4, TNF-α, CCL2, and CCL3 may improve wound healing (12).

Various bioactive molecules in breast milk protect infants against infection, reduce inflammation, and contribute to immune maturation, and organ development. Lactoperoxidase, lactoferrin, immunoglobulin A, and lysozyme have bactericidal effects. Fibronectin, Interleukin-6, EGF, and TNF-α enhance the phagocytosis of microorganisms and cell migration in damaged tissues, and TGF-β, IGF-1, lipids, and vitamins in human milk have a role in wound healing (13).

Lacto-N-neotetraose (LNnT) is an oligosaccharide found in human milk. It has been reported that it induces type 2 immune response (Th2 immunity) which promotes re-epithelialization, angiogenesis, and wound contraction by recruiting cells producing associated cytokines (14).

When the topical use of breast milk was investigated in cases with corneal epithelial damage; in studies conducted on mice, it was demonstrated that it facilitated wound healing and epithelialization without causing side effects (13).

In addition to the anti-inflammatory contents of breast milk, it has been observed that in breastfed infants, the regenerative healing pattern that is evident in the intrauterine period continues, unlike wounds that heal by developing scar tissue in adulthood (15).

The positive effects of breast milk on the treatment of conjunctivitis, cracked nipple tips, skin, and soft tissue infections have been demonstrated in many studies. Studies have shown that topical application of breast milk, containing growth factors, cytokines, stem cells, probiotic bacteria, and the HAMLET complex (human alpha-lactalbumin made lethal to tumor cells), serves as a treatment modality for atopic eczema, diaper dermatitis, and separation of the umbilical cord (16).

The protective effect of breast milk against skin infections has been demonstrated due to its containing IgA. In the prevention of umbilical cord infections, which are one of the most common causes of neonatal sepsis, the topical application of breast milk has been proposed as an alternative to povidone-iodine due to its easy accessibility and low cost (17).

Conclusion

Although statistical evidence may not directly show the oral intake of breast milk has a significant impact on the wound healing process and mortality in major burn patients, it has been observed to assist in maintaining the nutritional status and preserving total body mass in these patients.

Future studies should investigate the wound healing process by topically applying breast milk directly to the wound and obtaining, pasteurization, reducing the risk of disease contamination and proper preservation and dosing of breast milk.

Limitations

This study has a few limitations. First of all, due to the small number of patients included in the study, it is necessary to conduct studies with a large number of patients in order to generalize the study results to the pediatric burn population. The second limitation of the study is the subjective effect on the results because not every patient received equal amounts of breast milk.

Ethics Approval: The study was approved by the Clinical Research Ethics committee of the Health Sciences University Dr. Behcet Uz Child Diseases and Surgery Training and Research Hospital (Approval Date: 25/05/2023, Decision No: 855). Informed consent was obtained from each patient's parent.

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Table 1. Demographic and descriptive datas

	Statistics
Age*(Year)*	1.48±1.92
Gender	
F	54 (43.2)
M	71 (56.8)
Breastfeeding	
Breastfed	65 (52)
Not breastfed	60 (48)
Cause of burn	
Scald	121 (96.8)
Flame	4 (3.2)
TBSA (%)	26.36±9.49
Need for operation (debridement-grafting)	
No	78 (62.4)
Yes	47 (37.6)
Infection	
None	75 (60)
Wound infection	28 (22.4)
Blood culture positive	15 (12)
Both	7 (5.6)
Blood product transfusion	
Not recieved	35 (28)
Recieved	90 (72)
Albumin	
Not recieved	68 (54.4)
Recieved	57 (45.6)
LOHS (length of hospital stay) (days)	25.82±16.67
Mortality	
Survivor	119 (95.2)
Exitus	6 (4.8)

n: Number of patients, %: Column percentage, Numerical variables are given as mean ± standard deviation

Table 2. Statistical analysis of parameters between groups

	Breastfed	Not breastfed	Statistics	p-value
Age*(Year)*	1.66±2.62	1.29±0.47	-0.482	0.630†
Gender				
F	27(%50)	27(%50)	0.152	0.696&
M	38(%53.5)	33(%46.5)		
Cause of burn				
Scald	61(%50.4)	60(%49.6)	3.814	0.051ɳ
Flame	4(%100)	0(%0)		
TBSA (%)	28.45±11.57	24.1±5.85	-2.415	**0.016**†
Need for operation (debridement-grafting)				
No	50(%51.3)	38(%48.7)	0.043	0.836&
Yes	25(%53.2)	22(%46.8)		
Infection				
None	36(%48)	39(%52)	1.952	0.582&
Wound infection	15(%53.6)	13(%46.4)		
Blood culture positive	9(%60)	6(%40)		
Both	5(%71.4)	2(%28.6)		
Blood producttransfusion				
Not recieved	19(%54.3)	16(%45.7)	0.102	0.750&
Recieved	46(%51.1)	44(%48.9)		
Albumin				
Not recieved	31(%45.6)	37(%54.4)	2.456	0.117&
Recieved	34(%59.6)	23(%40.4)		
LOHS(days)	25.57±14.87	26.1±18.56	-0.064	0.949†

Numerical variables are given as mean ± standard deviation. ‡: Independent samples t-test, †Mann-Whitney U test, &: Chi-square analysis, ɳ: Fisher's exact test

Table 3. Mortality rates

	Breastfed	Not breastfed	Statistics	p-value
Mortality				
Survivor	60(%50.4)	59(%49.6)	2.479	0.115ɳ
Exitus	5(%83.3)	1(%16.7)		

&: Chi square test, ɳ: Fisher exact test