

*Original/Research Paper***Early graft in patients with burn wounds: A two-year retrospective study of 582 patients at a referral burn center in northern Iran**

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<https://doi.org/10.32598/JNRC.P.2312.1009>

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Abstract

Skin graft is the main treatment for burn wounds, which provides a favorable functional and aesthetic scar outcome. This study aimed to assess early graft in patients with burn wounds admitted to a referral burn center in northern Iran. This retrospective research was conducted on 582 patients with burn wounds with an early graft between May 2019 to 2021 at a referral burn center in northern Iran. Data gathering was conducted from May 2019 to 2021. A total of 582 patients with burn wounds with early graft were enrolled in this research. Of the patients, 91.41% were treated with one graft and 60.14% were treated with grafts less than 10% in size. The average graft/burn ratio in patients with burn wounds was 0.75 (SD=0.52). Also, 55.15% of patients with burn wounds had graft/burn ratio less than 0.75 ($P=0.03$). The mean length of stay in hospital in patients with burn wounds was 7.20 (SD=6.10). 61.34% of patients with burn wounds had stayed less than seven days in the hospital after early grafting. 4.12% of patients with burn wounds died due to early grafts ($P<0.001$). Although in the past decades, progress had been made in skin grafts for burns in Iran, however, prevention of complications and negative outcomes of burns and timely treatment of patients is still weak in Iran. Overall, the present study showed that patients with burn wounds with early grafts in Iran have had better clinical outcomes compared with low- and middle-income countries.

Keywords: Burns, Early Graft, Mortality, Burn Injury, Iran.

1 | Introduction

Burn is a health problem that happens all over the world and it has inappropriate effects on society [1-13]. Burns can be defined as damage to the skin or any organic tissue that is mainly caused by fire, electricity, radioactive, radiation, and chemical substances [14-27]. Burn injuries produce some of the most painful patient experiences [28-43] and may result in unpleasant physical and psychological outcomes among patients [44-60]. Annually, more than 300,000 people die because of burns [61]. The mortality rate

of burn patients in Iran is 10%, annually [3]. However, mortality is only a part of these problems. Lack of timely and appropriate treatment of burns leads to lifelong problems and disabilities in many survivors, which ultimately have widespread negative effects on health systems, families, and society [61-71].

Meanwhile, skin graft is the main treatment for burn wounds, which provides a favorable functional and aesthetic scar outcome [72, 73]. Skin graft is a surgical procedure to remove a burn

wound and cover the wound with autograft, allograft, or replacement with artificial skin [74]. Therefore, early graft leads to the preservation of the integrity of living tissues, prevents or controls infection, maintains shape and function, closes wounds in a timely manner, and reduces mortality [75]. In developed countries, an early graft is used as the standard treatment in patients with severe burns [72, 76, 77]. However, there are differences in the use of this procedure. For example, the optimal time for early burn removal and graft in previous studies vary from 24 hours to 6 days [75, 78-80]. This time may vary based on variables such as inadequate resources, inadequate primary resuscitation, and pre-existing malnutrition and anemia having inability to tolerate major surgery and blood loss in different countries [75]. A study in Iran (2017) showed that the most common cause of burns in burn patients with an early graft was hot liquids and their mortality rate was 4.8%. Also, they showed that age, inhalational damage, and burn grade were important predictors of mortality in burn patients with an early graft [3]. To our knowledge, there is limited epidemiological evidence in Iran that has described the epidemiological features and clinical outcomes of patients with burn wounds with early graft [3]. Therefore, the present study aimed to assess early graft in patients with burn wounds admitted to a referral burn center in northern Iran.

2 | Methods

2.1 | Study design and subjects

This retrospective research was conducted on 582 patients with burn wounds with an early graft between May 2019 to 2021 at a referral burn center in northern Iran. The present study was confirmed by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1399.285).

2.2 | Inclusion and exclusion criteria

Acute burn patients with an early graft were included in all age groups. Medical records with incomplete information, patients who were hospitalized for more than 48 hours due to burns, patients who didn't have any graft within 7 days after the burn, and patients with grade I and II superficial burns were excluded from the present study.

2.3 | Data collection

Data were collected from medical records of patients with burn wounds with an early graft using a researcher-made checklist including age, gender, the primary cause of burns, burn's grade, burn's total body surface area (TBSA), number and size of grafts, graft/burn ratio, stay length in hospital, and in-hospital mortality.

2.4 | Statistical analysis

Data were analyzed using the SPSS software package (version 22.0, SPSS Inc., Chicago, IL, USA). Mean (standard deviation [SD]) and number (percentage) were used to present quantitative and qualitative variables, respectively. Based on the Kolmogorov-Smirnov test, data didn't have normal distribution. Chi-square test was used to assess the relationship between the study variables. Statistical significance was considered $P < 0.05$.

3 | Results

3.1 | Individual characteristics and clinical features of participants

A total of 582 patients with burn wounds with early graft were enrolled in this research. The mean age of participants was 41.20 (SD=20.40) years. Of the patients with burn wounds with early graft, 67.53% were male, 58.76% had flame burns, 65.46% had grade III burn, and 69.07% had TBSA less than 20% (Table 1).

3.2 | Graft characteristics of patients with burn wounds with early graft

Of the patients with burn wounds with early graft, 91.41% were treated with one graft, and 60.14% were treated with grafts less than 10% in size. The average graft/burn ratio in patients with burn wounds was 0.75 (SD=0.52). Also, 55.15% of patients with burn wounds had Graft/burn ratio less than 0.75 ($P=0.03$) (Table 2).

3.3 | Clinical outcomes of early graft in patients with burn wounds

As presented in Table 2, the mean length of stay in hospital in patients with burn wounds was 7.20 (SD=6.10). Also, 61.34% of patients with burn wounds had stayed less than seven days in the hospital after early grafting. Finally, 4.12% of patients with burn wounds died due to early grafts ($P < 0.001$).

4 | Discussion

The findings of the present research showed that the most common primary cause of burn in participants was flame (58.76%). Also, 91.41% of patients were treated using one graft and 60.14% of patients were treated by grafts less than 10% in size. The mean length of stay in hospital in patients with burn wounds was 7.20 (SD=6.10). Also, 61.34% of patients with burn wounds had stayed less than seven days in the hospital after early grafting. Finally, 4.12% of patients with burn wounds died due to early grafts.

Table 1. Individual characteristics and clinical features of patients with burn wounds with early graft (n=582).

	Participants (n=582)	P-value
<u>Individual characteristics</u>		
Age (y)	41.20 (SD=20.40)	
< 20	85 (14.61)	
20-49	303 (52.06)	0.392
50-69	139 (23.88)	
>70	55 (9.45)	
Gender		
Male	393 (67.53)	0.521
Female	189 (32.47)	
<u>Clinical features</u>		
Primary cause of burns		
Flame	342 (58.76)	
Scald	178 (30.59)	0.043
Chemical	19 (3.26)	
Contact	25 (4.30)	
Electrical	18 (3.09)	
Burns grade		
II & III	93 (15.98)	0.879
III	381 (65.46)	
IV	108 (18.56)	
TBSA of the burn (%)		
1-20	402 (69.07)	
21-40	139 (23.88)	0.003
41-60	33 (5.67)	
61-80	8 (1.38)	
81-100	0 (0)	

SD: Standard Deviation.

Data are presented as number (percentage) and mean (standard deviation).

P-value was obtained with Chi-square test.

Table 2. Graft characteristics and clinical outcomes of patients with burn wounds with early graft (n=582).

	Participants (n=582)	P-value
Number of grafts		
1	532 (91.41)	
2	37 (6.36)	
3	7 (1.20)	0.483
4	3 (0.52)	
5	2 (0.34)	
6	1 (0.17)	
Size of grafts (%)		
1-10	350 (60.14)	
11-20	145 (24.91)	0.197
21-30	64 (11.00)	
>30	23 (3.95)	
Graft/burn ratio		
<0.75	0.75 (SD=0.52)	
≥0.75	321 (55.15)	0.03
	261 (44.85)	
<u>Clinical outcomes</u>		
Length of stay in hospital (day)		
<7	7.20 (SD=6.10)	
≥7	357 (61.34)	<0.001
	225 (38.66)	
Mortality in-hospital		
Yes	24 (4.12)	<0.001
No	558 (95.88)	

SD: Standard Deviation.

Data are presented as number (percentage) and mean (standard deviation).

P-value was obtained with Chi-square test.

As presented in the present study, the most common cause of burns was flame. This finding was supported by a study in Egypt [81]. In contrast, the results of a study in Iran [3] showed that the

most common cause of burns is hot liquids. This discrepancy may be due to differences in age, sex, occupation, and climatic conditions [82, 83]. For example, the most common cause of

burns in Nepali children was flame due to children's curiosity at home and kitchen [82].

As presented in this study, of the patients with burn wounds with early graft, 65.46% had a grade III burn, 69.07% had TBSA less than 20%, 91.41% were treated with one graft, and 60.14% were treated with grafts less than 10% in size. Consistent with the present study, studies from South Africa [84] and China [85] showed that the majority of patients had TBSA less than 20%. However, the true proportion of minor to moderate burns in patients with burn wounds can be higher, as many minor burns are diagnosed and treated in outpatient wards. Obviously, this group has the lowest mortality rate compared with severe burns' groups. However, improving life standards in patients with burn wounds after discharge is still an important challenge [86, 87]. Therefore, it is necessary to pay more attention to physiological and aesthetic aspects of patients with burn wounds, especially severe burns.

In the present study, the mean length of stay in hospital in patients with burn wounds was 7.20 (SD=6.10). Also, 61.34% of patients with burn wounds had stayed less than seven days in the hospital after early grafting. The length of stay in hospital in patients with burn wounds depends on several factors including age, higher TBSA, comorbidities, and respiratory injuries in patients [87-89]. Also, the results of a retrospective cohort study in Canadian patients with burn wounds [88] showed that factors such as number of days connected with mechanical ventilation and in-hospital complications like bacteremia, pneumonia, sepsis, graft loss, and respiratory failure have been significantly associated with longer expected hospital stays in patients with burn wounds.

In the present study, 4.12% of patients with burn wounds died due to early grafts. However, mortality rates in low- and middle-income countries after early grafts have been unclear. In poor populations in Africa, early grafting increases the risk of death in patients with burn wounds [75]. In contrast, the results of a study in India showed that early graft has reduced mortality rate [90]. However, mortality-related factors such as comorbidities, severity and TBSA of burns, and previous malnutrition in patients with burn wounds cannot be ignored [91]. Therefore, the present study showed that the mortality situation after early grafting in patients with burn wounds in Iran is more favorable compared with low- and middle-income countries (4.12% vs. 14.5%) [91].

4.1 | Limitations

To avoid bias selection, all medical records were evaluated over a specified period of time, and finally, subjects were selected based on predetermined inclusion and exclusion criteria. In addition, the researchers extracted the information completely and ac-

curately and removed the missing data. This study was performed in a referral burn center in the north of Iran. However, some patients visit other treatment centers. Many patients may be transferred to other centers due to different treatment needs. Therefore, complete information was not available to all patients, which reduces the generalizability of the present study.

5 | Conclusions

Although in the past decades, progress had been made in skin grafts for burns in Iran, however, prevention of complications and negative outcomes of burns and timely treatment of patients is still weak in Iran. This research described the epidemiological features of patients with burn wounds with early grafts in the north of Iran. Overall, the present study showed that patients with burn wounds with early grafts in Iran have had better clinical outcomes compared with low- and middle-income countries.

Acknowledgements

Not applicable.

Authors' contributions

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work: MM, MT, ADM, EHR, NZ, RJ, MJG, PGV, SK; Drafting the work or revising it critically for important intellectual content: MM, MT, ADM, EHR, NZ, RJ, MJG, PGV, SK; Final approval of the version to be published: MM, MT, ADM, EHR, NZ, RJ, MJG, PGV, SK; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: MM, MT, ADM, EHR, NZ, RJ, MJG, PGV, SK.

Funding

Self-funded.

Ethics approval and consent to participate

The research was approved by the ethics committee of Guilan University of Medical Sciences, Iran (IR.GUMS.REC.1399.285).

Competing interests

We do not have potential conflicts of interest with respect to the research, authorship, and publication of this article.

Availability of data and materials

The datasets used during the current study are available from the corresponding author on request.

Using artificial intelligent chatbots

None.

References

1. Mehrabi A, Falakdami A, Mollaei A, Takasi P, Ghorbani Vajargah P, Jafari H, et al. A systematic review of self-esteem and related factors among burns patients. *Ann Med Surg (Lond)*. 2022;84:104811.
2. Mobayen M, Pour-Abbas SE, Naghipour M, Akhouni M, Ashoobi MT. Evaluating the Knowledge and Attitudes of the Members of the Medical Community Mobilization on First Aid for Burn Injuries in Guilan, Iran. *J Mazandaran Univ Med Sci*. 2020;30(186):148-155.
3. Mobayen M, Farzan R, Dadashi A, Rimaz S, Aghebati R. Effect of early grafting on improvement of lethal area index (la50) in burn patients: a 7-year investigation in a burn referral centre in the North of Iran. *Ann Burns Fire Disasters*. 2017;30(3):189-192.
4. Vaghardoost R, Ghavami Y, Sobouti B, Mobayen MR. Mortality and morbidity of fireworks-related burns on the annual last wednesday of the year festival (charshanbeh soori) in iran: an 11-year study. *Trauma Mon*. 2013;18(2):81-85.
5. Feizkhanh A, Mobayen M, Habibiroudkenar P, Toolaroud PB, Pourmohammadi Bejarpasi Z, Mirmasoudi SS, et al. The importance of considering biomechanical properties in skin graft: Are we missing something? *Burns*. 2022;48(7):1768-1769.
6. Hosseini SJ, Firooz M, Norouzkhani N, Mehrabian F, Emami Zeydi A, Jafaraghaee F, et al. Age group as a predictor of the effect of virtual reality on pain management in burn retain->patientsretain->. *Burns*. 2023;49(3):730-732.
7. Miri S, Hosseini SJ, Takasi P, Mollaei A, Firooz M, Falakdami A, et al. Effects of breathing exercise techniques on the pain and anxiety of burn patients: A systematic review and meta-analysis. *Int Wound J*. 2023;20(6):2360-2375.
8. Farzan R, Moeinian M, Abdollahi A, Jahangard-Rafsanjani Z, Ali-pour A, Ebrahimi M, et al. Effects of amniotic membrane extract and deferoxamine on angiogenesis in wound healing: an in vivo model. *J Wound Care*. 2018;27(Sup6):S26-S32.
9. Haddadi S, Parvizi A, Niknama R, Nemati S, Farzan R, Kazemnejad E. Baseline Characteristics and Outcomes of Patients with Head and Neck Burn Injuries; a Cross-Sectional Study of 2181 Cases. *Arch Acad Emerg Med*. 2020;9(1):e8.
10. Kazemzadeh J, Vaghardoost R, Dahmardehei M, Rabiepoor S, Farzan R, Asghar Kheiri A, et al. Retrospective Epidemiological Study of Burn Injuries in 1717 Pediatric Patients: 10 Years Analysis of Hospital Data in Iran. *Iran J Public Health*. 2018;47(4):584-590.
11. Tolouie M, Farzan R. A Six-Year Study on Epidemiology of Electrical Burns in Northern Iran: Is It Time to Pay Attention? *World J Plast Surg*. 2019;8(3):365-371.
12. Vaghardoost R, Kazemzadeh J, Dahmardehei M, Rabiepoor S, Farzan R, Kheiri AA, et al. Epidemiology of Acid-Burns in a Major Referral Hospital in Tehran, Iran. *World J Plast Surg*. 2017;6(2):170-175.
13. Parvizi A, Haddadi S, Ghorbani Vajargah P, Mollaei A, Firooz M, Hosseini SJ, et al. A systematic review of life satisfaction and related factors among burns patients. *Int Wound J*. 2023;20(7):2830-2842.
14. Bagheri Toolaroud P, Attarchi M, Afshari Haghdoust R, Feizkhanh A, Esmailzadeh M, Rimaz S, et al. Epidemiology of work-related burn injuries: A ten-year retrospective study of 429 patients at a referral burn centre in the north of Iran. *Int Wound J*. 2023;20(9):3599-3605.
15. Farzan R, Parvizi A, Haddadi S, Sadeh Tabarian M, Jamshidbeigi A, Samidoust P, et al. Effects of non-pharmacological interventions on pain intensity of children with burns: A systematic review and meta-analysis. *Int Wound J*. 2023;20(7):2898-2913.
16. Farzan R, Parvizi A, Takasi P, Mollaei A, Karkhah S, Firooz M, et al. Caregivers' knowledge with burned children and related factors towards burn first aid: A systematic review. *Int Wound J*. 2023;20(7):2887-2897.
17. Toolaroud PB, Nabovati E, Mobayen M, Akbari H, Feizkhanh A, Farrahi R, et al. Design and usability evaluation of a mobile-based-self-management application for caregivers of children with severe burns. *Int Wound J*. 2023;20(7):2571-2581.
18. Eftekhari H, Sadeghi M, Mobayen M, Esmailzadeh M, Feizkhanh A, Lahiji MS, et al. Epidemiology of chemical burns: An 11-year retrospective study of 126 patients at a referral burn centre in the north of Iran. *Int Wound J*. 2023;20(7):2788-2794.
19. Rangraz Jeddi F, Nabovati E, Mobayen M, Akbari H, Feizkhanh A, Motalebi Kashani M, et al. A Smartphone Application for Caregivers of Children With Severe Burns: A Survey to Identify Minimum Data Set and Requirements. *J Burn Care Res*. 2023;44(5):1200-1207.
20. Farzan R, Ghorbani Vajargah P, Mollaei A, Karkhah S, Samidoust P, Takasi P, et al. A systematic review of social support and related factors among burns patients. *Int Wound J*. 2023;20(8):3349-3361.
21. Farzan R, Hosseini SJ, Firooz M, Tabarian MS, Jamshidbeigi A, Samidoust P, et al. Perceived stigmatisation and reliability of questionnaire in the survivors with burns wound: A systematic review and meta-analysis. *Int Wound J*. 2023;20(8):3391-3403.
22. Alizadeh Otaghvar H, Parvizi A, Ghorbani Vajargah P, Mollaei A, Karkhah S, Takasi P, et al. A systematic review of medical science students' knowledge and related factors towards burns first aids. *Int Wound J*. 2023;20(8):3380-3390.
23. Yarali M, Parvizi A, Ghorbani Vajargah P, Tamimi P, Mollaei A, Karkhah S, et al. A systematic review of health care workers'

- knowledge and related factors towards burn first aid. *Int Wound J.* 2023;20(8):3338-3348.
24. Farzan R, Hossein-Nezhadi M, Toloei M, Rimaz S, Ezani F, Jafaryparvar Z. Investigation of Anxiety and Depression Predictors in Burn Patients Hospitalized at Velayat Hospital, a Newly Established Burn Center. *J Burn Care Res.* 2023;44(3):723-730.
 25. Mobayen M, Torabi H, Bagheri Toolaroud P, Tolouei M, Dehnadi Moghadam A, Saadatmand M, et al. Acute burns during the COVID-19 pandemic: A one-year retrospective study of 611 patients at a referral burn centre in northern Iran. *Int Wound J.* 2023;20(8):3204-3211.
 26. Rahbar Taramsari M, Mobayen M, Feizkhah A, Letafatkar N, Esmailzadeh M, Hoseinzadeh S, et al. The Effect of Drug Abuse on Clinical Outcomes of Adult Burn Patients Admitted to a Burn Center in the North of Iran. *Bull Emerg Trauma.* 2023;11(2):90-95.
 27. Zavarmousavi M, Eslamdoust-Siahestalkhi F, Feizkhah A, Mohammadreza M, Fazeli Masouleh SA, Badrikoochi M, et al. Gamification-based Virtual Reality and Post-burn Rehabilitation: How Promising Is That? *Bull Emerg Trauma.* 2023;11(2):106-107.
 28. Miri S, Mobayen M, Aboutaleb E, Ezzati K, Feizkhah A, Karkhah S. Exercise as a rehabilitation intervention for severe burn survivors: Benefits & barriers. *Burns.* 2022;48(5):1269-1270.
 29. Akhoondian M, Zabihi MR, Yavari S, Karampoor M, Fouladpour A, Samadnia A, et al. Radiation burns and fertility: a negative correlation. *Burns.* 2022;48(8):2017-2019.
 30. Ghazanfari MJ, Mazloun SMH, Rahimzadeh N, Arasteh M, Ghorbani Vajargah P, Mollaei A, et al. Burns and pregnancy during the COVID-19 pandemic. *Burns.* 2022;48(8):2015-2017.
 31. Feizkhah A, Mobayen M, Ghazanfari MJ, Bagheri Toolaroud P, Ghorbani Vajargah P, Mollaei A, et al. Machine learning for burned wound management. *Burns.* 2022;48(5):1261-1262.
 32. Mobayen M, Feizkhah A, Ghazanfari MJ, Ezzati K, Mehrabian F, Bagheri Toolaroud P, et al. Sexual satisfaction among women with severe burns. *Burns.* 2022;48(6):1518-1519.
 33. Mobayen M, Ghazanfari MJ, Feizkhah A, Ezzati K, Mehrabian F, Aboutaleb E, et al. Parental adjustment after pediatric burn injury. *Burns.* 2022;48(6):1520-1521.
 34. Bazzi A, Ghazanfari MJ, Norouzi M, Mobayen M, Jafaraghaee F, Emami Zeydi A, et al. Adherence to Referral Criteria for Burn Patients; a Systematic Review. *Arch Acad Emerg Med.* 2022;10(1):e43.
 35. Miri S, Mobayen M, Mazloun SMH, Rahimzadeh N, Mehrabi A, Abd Sonboli R, et al. The role of a structured rehabilitative exercise program as a safe and effective strategy for restoring the physiological function of burn survivors. *Burns.* 2022;48(6):1521-1523.
 36. Mobayen M, Ghazanfari MJ, Feizkhah A, Emami Zeydi A, Karkhah S. Machine learning for burns clinical care: Opportunities & challenges. *Burns.* 2022;48(3):734-735.
 37. Mobayen M, Feizkhah A, Ghazanfari MJ, Bagheri Toolaroud P, Mobayen M, Osuji J, et al. Intraoperative three-dimensional bi-printing: A transformative technology for burn wound reconstruction. *Burns.* 2022;48(4):1023-1024.
 38. Akhoondian M, Zabihi MR, Yavari S, Karampoor M, Fouladpour A, Fallahpour M, et al. Identification of TGF- β 1 expression pathway in the improvement of burn wound healing. *Burns.* 2022;48(8):2007-2010.
 39. Akhoondian M, Zabihi MR, Yavari S, Karampoor M, Fouladpour A, Samadnia A, et al. Burns may be a risk factor for endometriosis. *Burns.* 2023;49(2):476-480.
 40. Asadi K, Aris A, Fouladpour A, Ghazanfari MJ, Karkhah S, Salari A. Is the assessment of sympathetic skin response valuable for bone damage management of severe electrical burns? *Burns.* 2022;48(8):2013-2014.
 41. Salari A, Fouladpour A, Aris A, Ghazanfari MJ, Karkhah S, Asadi K. Osteoporosis in electrical burn injuries. *Burns.* 2022;48(7):1769-1770.
 42. Takasi P, Falakdami A, Ghorbani Vajargah P, Mollaei A, Mehrabi H, Ghazanfari MJ, et al. Dissatisfaction or slight satisfaction with life in burn patients: A rising cause for concern of the world's burn community. *Burns.* 2022;48(8):2000-2002.
 43. Zabihi MR, Akhoondian M, Tajik MH, Mastalizadeh A, Mobayen M, Karkhah S. Burns as a risk factor for glioblastoma. *Burns.* 2023;49(1):236-241.
 44. Mobayen M, Feizkhah A, Mirmasoudi SS, Bejarpasi ZP, Bejarbane EJ, Habibiroudkenar P, et al. Nature efficient approach; Application of biomimetic nanocomposites in burn injuries. *Burns.* 2022;48(6):1525-1526.
 45. Jeddi FR, Mobayen M, Feizkhah A, Farrahi R, Heydari S, Toolaroud PB. Cost Analysis of the Treatment of Severe Burn Injuries in a Tertiary Burn Center in Northern Iran. *Iran Red Crescent Med J.* 2022;24(5):e1522.
 46. Mobayen M, Sadeghi M. Prevalence and Related Factors of Electrical Burns in Patients Referred to Iranian Medical Centers: A Systematic Review and Meta-Analysis. *World J Plast Surg.* 2022;11(1):3-11.
 47. Mobayen M, Zarei R, Masoumi S, Shahrousvand M, Mazloun SMH, Ghaed Z, et al. Epidemiology of Childhood Burn: A 5-Year Retrospective Study in the Referral Burn Center of Northern Iran Northern Iran. *Caspian J Health Res.* 2021;6(3):101-108.
 48. Haghdoost Z, Mobayen M, Omidi S. Predicting hope to be alive using spiritual experiences in burn patients. *Ann Romanian Soc Cell Biol.* 2021;25(4):18957-18962.
 49. Mobayen M, Rimaz S, Malekshahi A. Evaluation of clinical and laboratory causes of burns in pre-school children. *J Curr Biomed Rep.* 2021;2(1):27-31.
 50. Ghaed Chukamei Z, Mobayen M, Bagheri Toolaroud P, Ghalandari M, Delavari S. The length of stay and cost of burn patients and the affecting factors. *Int J Burns Trauma.* 2021;11(5):397-405.

51. Khodayary R, Nikokar I, Mobayen MR, Afrasiabi F, Araghian A, Elmi A, et al. High incidence of type III secretion system associated virulence factors (exoenzymes) in *Pseudomonas aeruginosa* isolated from Iranian burn patients. *BMC Res Notes*. 2019;12(1):28.
52. Rimaz S, Moghadam AD, Mobayen M, Nasab MM, Rimaz S, Aghebaty R, et al. Changes in serum phosphorus level in patients with severe burns: A prospective study. *Burns*. 2019;45(8):1864-1870.
53. Ghavami Y, Mobayen MR, Vaghardoost R. Electrical burn injury: a five-year survey of 682 patients. *Trauma Mon*. 2014;19(4):e18748.
54. Amir Alavi S, Mobayen MR, Tolouei M, Noursalehi I, Gholipour A, Gholamalipour N, et al. Epidemiology and outcome of burn injuries in burn patients in Guilan province, Iran. *Qom Univ Med Sci J*. 2013;7(5):35-41.
55. Alavi CE, Salehi SH, Tolouei M, Paydary K, Samidoust P, Mobayen M. Epidemiology of burn injuries at a newly established burn care center in Rasht. *Trauma Mon*. 2012;17(3):341-346.
56. Norouzkhani N, Chaghian Arani R, Mehrabi H, Bagheri Toolaroud P, Ghorbani Vajargah P, Mollaei A, et al. Effect of Virtual Reality-Based Interventions on Pain During Wound Care in Burn Patients; a Systematic Review and Meta-Analysis. *Arch Acad Emerg Med*. 2022;10(1):e84.
57. Norouzkhani N, Ghazanfari MJ, Falakdami A, Takasi P, Mollaei A, Ghorbani Vajargah P, et al. Implementation of telemedicine for burns management: Challenges and opportunities. *Burns*. 2023;49(2):482-484.
58. Farzan R, Firooz M, Ghorbani Vajargah P, Mollaei A, Takasi P, Tolouei M, et al. Effects of aromatherapy with *Rosa damascena* and lavender on pain and anxiety of burn patients: A systematic review and meta-analysis. *Int Wound J*. 2023;20(6):2459-2472.
59. Miri S, Hosseini SJ, Ghorbani Vajargah P, Firooz M, Takasi P, Mollaei A, et al. Effects of massage therapy on pain and anxiety intensity in patients with burns: A systematic review and meta-analysis. *Int Wound J*. 2023;20(6):2440-2458.
60. Parvizi A, Haddadi S, Atrkar Roshan Z, Kafash P. Haemoglobin changes before and after packed red blood cells transfusion in burn patients: A retrospective cross-sectional study. *Int Wound J*. 2023;20(6):2269-2275.
61. Shokouhi M, Nasiriani K, Cheraghi Z, Ardalan A, Khankeh H, Fallahzadeh H, et al. Preventive measures for fire-related injuries and their risk factors in residential buildings: a systematic review. *J Inj Violence Res*. 2019;11(1):1-14.
62. Mobayen M, Ghazanfari MJ, Hosseini SJ, Firooz M, Ghorbani Vajargah P, Mollaei A, et al. Near-death experiences of burn survivors: An important yet challenging issue. *Burns*. 2023;49(6):1482-1483.
63. Hamza Hermis A, Tehrani PM, Hosseini SJ, Firooz M, Hosseini SR, Jamshidbeigi A, et al. Prevalence of non-accidental burns and related factors in children: A systematic review and meta-analysis. *Int Wound J*. 2023;20(9):3855-3870.
64. Doustahadi A, Beigee AM, Shahabi M, Zare-Kaseb A, Ghazanfari MJ. Burn survivors' challenges after hospital discharge: A neglected issue. *J Nurs Rep Clin Pract*. 2023;1(3):150-151.
65. Doustahadi A, Beigee AM, Shahabi M, Zare-Kaseb A, Ghazanfari MJ. Using virtual reality with morphine to reduce the pain of dressing change in burn patients. *J Nurs Rep Clin Pract*. 2023;1(3):152-153.
66. Doustahadi A, Beigee AM, Zare-Kaseb A, Ghazanfari MJ. Suicidality after burn injuries: A significant overlooked challenge in burns survivors. *J Nurs Rep Clin Pract*. 2023;1(2):104-105.
67. Heidari Gorji MA, Shorofi SA, Esfandiari M, Mohammadpour-Tahmtan RA. Psycho-social needs of family members of patients hospitalized in the burn intensive care unit: A cross-sectional study. *J Nurs Rep Clin Pract*. 2023;1(3):118-125.
68. Miri S, Rashtiani S, Zabihi MR, Akhoondian M, Farzan R. Role of exercise in nursing care for burn wound patients: A narrative review from a nursing perspective. *J Nurs Rep Clin Pract*. 2024;2(2):101-109.
69. Takasi P, Purbarar F, Tamizi A, Ghardashpoor E. Tele-rehabilitation to the improvement of the quality of burns clinical care. *J Nurs Rep Clin Pract*. 2023.
70. Takasi P, Purbarar F, Tamizi A, Ghardashpoor E. High rate of negligence induced burns in children: A rising cause for concern of the world's burn community. *J Nurs Rep Clin Pract*. 2024;2(2):118-120.
71. Zare-Kaseb A, Beigee AM, Doustahadi A, Shahabi M, Ghazanfari MJ. Social support against suicide in burn survivors: A vital but overlooked protective factor. *J Nurs Rep Clin Pract*. 2024;2(1):45-46.
72. Legemate CM, Ooms PJ, Trommel N, Middelkoop E, van Baar ME, Goei H, et al. Patient-reported scar quality of donor-sites following split-skin grafting in burn patients: Long-term results of a prospective cohort study. *Burns*. 2021;47(2):315-321.
73. Bairagi A, Griffin B, Banani T, McPhail SM, Kimble R, Tyack Z. A systematic review and meta-analysis of randomized trials evaluating the efficacy of autologous skin cell suspensions for re-epithelialization of acute partial thickness burn injuries and split-thickness skin graft donor sites. *Burns*. 2021;47(6):1225-1240.
74. Yamamoto T, Iwase H, King TW, Hara H, Cooper DKC. Skin xenotransplantation: Historical review and clinical potential. *Burns*. 2018;44(7):1738-1749.
75. Gallaher JR, Mjuweni S, Shah M, Cairns BA, Charles AG. Timing of early excision and grafting following burn in sub-Saharan Africa. *Burns*. 2015;41(6):1353-1359.
76. Shang F, Lu YH, Gao J, Hou Q. Comparison of therapeutic effects between artificial dermis combined with autologous split-thickness skin grafting and autologous intermediate-thickness skin grafting alone in severely burned patients: A prospective randomised study. *Int Wound J*. 2021;18(1):24-31.
77. Singh R, Tripathi D, Jaiswal SP, Singh P, Balar T, Viradiya C. Use of Negative Pressure Wound Therapy as a Bolster over Skin Grafts

- in Patients with Severe Burn Injuries at a Tertiary Care Burn Centre in India. *Burns Open*. 2021;5(3):137-140.
78. Pietsch JB, Netscher DT, Nagaraj HS, Groff DB. Early excision of major burns in children: effect on morbidity and mortality. *J Pediatr Surg*. 1985;20(6):754-757.
79. Ong YS, Samuel M, Song C. Meta-analysis of early excision of burns. *Burns*. 2006;32(2):145-150.
80. Xiao-Wu W, Herndon DN, Spies M, Sanford AP, Wolf SE. Effects of delayed wound excision and grafting in severely burned children. *Arch Surg*. 2002;137(9):1049-1054.
81. Hemeda M, Maher A, Mabrouk A. Epidemiology of burns admitted to Ain Shams University Burns Unit, Cairo, Egypt. *Burns*. 2003;29(4):353-358.
82. Tripathee S, Basnet SJ. Epidemiology of burn injuries in Nepal: a systemic review. *Burns Trauma*. 2017;5:10.
83. Toppi J, Cleland H, Gabbe B. Severe burns in Australian and New Zealand adults: Epidemiology and burn centre care. *Burns*. 2019;45(6):1456-1461.
84. Golshan A, Patel C, Hyder AA. A systematic review of the epidemiology of unintentional burn injuries in South Asia. *J Public Health (Oxf)*. 2013;35(3):384-396.
85. Cheng W, Wang S, Shen C, Zhao D, Li D, Shang Y. Epidemiology of hospitalized burn patients in China: a systematic review. *Burns Open*. 2018;2(1):8-16.
86. Martin L, Byrnes M, Bulsara MK, McGarry S, Rea S, Wood F. Quality of life and posttraumatic growth after adult burn: A prospective, longitudinal study. *Burns*. 2017;43(7):1400-1410.
87. Kishawi D, Wozniak AW, Mosier MJ. TBSA and length of stay impact quality of life following burn injury. *Burns*. 2020;46(3):616-620.
88. Dolp R, Rehou S, McCann MR, Jeschke MG. Contributors to the length-of-stay trajectory in burn-injured patients. *Burns*. 2018;44(8):2011-2017.
89. Bourgi J, Yaacoob E, Berberi M, Chedid M, Sfeir P, Yaacoub C, et al. Factors affecting length of stay among pediatric and adult patients admitted to the Lebanese Burn Centre: a retrospective study. *Ann Burns Fire Disasters*. 2019;32(3):216-221.
90. Puri V, Khare NA, Chandramouli MV, Shende N, Bharadwaj S. Comparative Analysis of Early Excision and Grafting vs Delayed Grafting in Burn Patients in a Developing Country. *J Burn Care Res*. 2016;37(5):278-282.
91. Grudziak J, Snock C, Zalinga T, Banda W, Gallaher J, Purcell L, et al. Pre-burn malnutrition increases operative mortality in burn patients who undergo early excision and grafting in a sub-Saharan African burn unit. *Burns*. 2018;44(3):692-699.

How to cite this article: Mobayen M, Tolouei M, Dehnadi Moghadam A, Homaie Rad E, Zare N, Jamshidi R, et al. Early graft in patients with burn wounds: A two-year retrospective study of 582 patients at a referral burn center in northern Iran. *J Nurs Rep Clin Pract*. 2024. <https://doi.org/10.32598/JNRCP.2312.1009>.