

Comparison of Excision and Graft of Early-Onset and Late-Onset Burns: A Systematic Review

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ABSTRACT

Autologous skin grafts are generally considered the gold standard for covering large skin defects in burn patients. Full-thickness skin grafts produce the best aesthetic and functional results in burn reconstruction. Many techniques and adjustments have been developed over time, and even the optimal timing for intervention remains a debatable topic. This article will discuss the comparison of excision and graft actions for early-onset and late-onset burns. This research used the PRISMA 2020 standard, ensuring that all requirements were met. The studies included in this article were published between 2015 and 2025 and were sourced from the Google Scholar database and other web resources. The search yielded nine studies relevant to the research objectives from the last ten years. Relevant articles generally suggest that early intervention can provide longer-lasting benefits and lower treatment costs, albeit inconsistently in terms of complications during treatment—for example, the need for transfusions and shock events. Early skin graft and excision management can reduce both treatment duration and cost. Research outcomes based on patient satisfaction showed that interventions performed at early onset resulted in higher satisfaction.

KEYWORDS Epithelialization, Burns, Graft, Wound healing



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INTRODUCTION

The skin is not only the largest organ of the human body but also the first line of defense against harmful influences such as mechanical forces, microorganisms, or radiation. The skin regulates body temperature and fluid balance and acts as a sensory organ capable of detecting pressure, temperature, and pain. The integrity of human skin plays an important role in maintaining the physiological homeostasis of the body. Significant skin loss due to burns can cause impairment of this integrity (Sorg et al., 2017). Burns are damage or loss of the skin layer or tissue beneath it caused by direct and indirect exposure to heat sources, frost bite (cold temperatures), chemicals, electricity, or radiation (Pruitt et al., 2012).

According to the World Health Organization (2023), approximately 11 million people worldwide require medical treatment for burn injuries annually, with burns being the fourth most common cause of trauma-related deaths globally. Recent data from the Indonesian Ministry of Health (2022) shows that burn injuries account for 3.2% of all emergency department visits, with 67% occurring in males and the highest incidence in young adults aged 20–29 years. Severe burns can cause relatively high morbidity and disability compared to injuries from other causes and require special management from the beginning (shock phase) to the advanced phase (Jeschke et al., 2020; Branski et al., 2018). Serious burns occur most

often in men (67%). The highest incidence of serious burns occurs in young adults (20–29 years), followed by children under 9 years old. Individuals over 50 years of age had the lowest number of serious burns (2.3%). The main causes of severe burns were flame burns (37%) and liquid burns (24%). After the age of 2, flames are the most common cause of serious burns, accounting for nearly one-third of all serious burns (Pruitt et al., 2012; Mason et al., 2017).

People of all ages are prone to minor burns. The highest incidence occurs during the first few years of life and in people aged 20–29 years. The mechanism of minor burns varies greatly with the age of the victim (Pruitt et al., 2012; Branski et al., 2018; Mason et al., 2017). Wound healing problems persist, and immediate complications such as wound dehiscence continue to occur even as physiological knowledge of the wound healing process increases, accompanied by advances in surgical techniques (Hahler, 2006). Wound healing can occur primarily or secondarily. Secondary healing occurs whenever there is a loss of an area of cells and tissues in the projection part, inflammatory processes, abscesses formation, and the like. Both processes cascade through three stages, including the exudative phase, the proliferation phase, and the reparation phase (Heller et al., 2006).

Autologous skin grafts are generally considered the gold standard for covering large skin defects. While the use of a split-thickness skin graft is the best option for the treatment of extensive burns, a mesh skin graft is used for minor burns and in areas of aesthetic importance (Jeschke et al., 2018). Full-thickness skin grafts produce the best aesthetic and functional results in burn reconstruction (Jackson & Roman, 2019). The origins of skin grafts can be traced back more than 3,500 years. Many techniques and adjustments have been developed over time, and even the right timing for intervention is still a debatable topic (Jeschke et al., 2020; Kohlhauser et al., 2021; Gojowy et al., 2019).

Previous studies have shown mixed results regarding the optimal timing of burn wound management. While Study A emphasizes the benefits of autologous grafts for immediate wound coverage, Study B demonstrates that mesh grafts provide better outcomes compared to full-thickness grafts in certain cases. Study C highlights that early excision may accelerate healing but carries risks of significant bleeding and hemodynamic instability, while Study D suggests that delayed excision reduces immediate complications but may prolong hospitalization and increase infection risk. These inconsistent results across studies indicate a significant research gap regarding the optimal timing of excision and grafting procedures.

The clinical dilemma centers on whether early excision (typically within 24–72 hours) accelerates healing but carries high risks of massive blood loss and hemodynamic compromise, or whether late excision (after 7 days) reduces immediate surgical complications but prolongs hospitalization and increases infection rates. This article will discuss the comparison of excision and graft of early-onset and late-onset burns.

The debate regarding the optimal timing of excision and grafting (early vs. late) has led to variations in clinical practice across hospitals and countries, making this study important to clarify the advantages and risks of each approach. Current literature shows conflicting evidence, with some studies favoring early intervention for reduced hospitalization time, while others report higher complication rates with early procedures.

This systematic review focuses on comparing the timing of excision and grafting in burn wounds, which remains controversial in the literature due to inconsistent findings regarding patient outcomes, complications, and resource utilization.

This study aims to systematically compare the clinical outcomes of early-onset versus late-onset excision and grafting in burn patients through a comprehensive analysis of existing literature. The benefits of this research include providing evidence-based guidance for clinicians in choosing optimal timing for surgical intervention, improving patient outcomes through standardized protocols, and reducing healthcare costs through more efficient treatment approaches.

METHOD

This article is compiled based on the principles of PRISMA 2020 collection and reporting. The research conducted was to compare the excision and graft of early and late-onset burns. The main conclusion of this research is that all written information regarding the relationship between the two variables. The articles involved must be written in English.

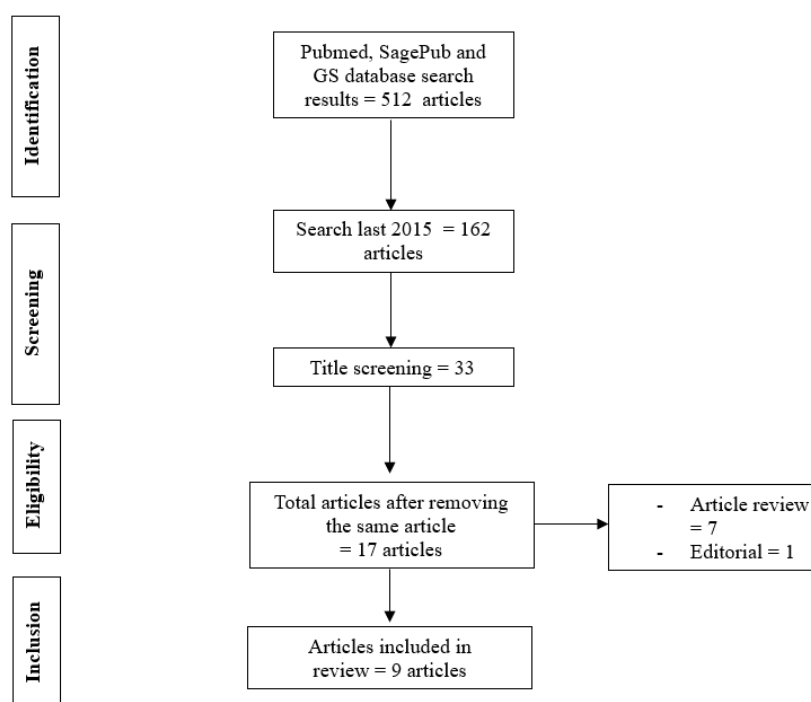


Figure 1. Article search flowchart

The research involved in this article is the one published after 2015, the research should explain the comparison of excision and graft actions of early and late onset burns, this methodical evaluation evaluates scientific papers that meet the research inclusion standards. The issue editorial letters, publications without DOIs, reviews of published books, literature reviews, and the like. The search for studies to be included in this literature review was conducted starting March 10, 2025 using Google Scholar, PubMed, and SagePub databases by entering the words: "graft"; "early"; "late" and "burn injury".

The research selection by reviewing the title and abstract, then including the relevant studies. The data extracted from the research includes authors, year of publication, location, research methods, and the results of the research. The database identifies and removes duplicate articles after EndNote logs the search results. Each writer carefully reviews abstracts and titles before covering. Every manuscript that passes the review criteria will be thoroughly analyzed.

RESULTS AND DISCUSSION

Result obtained nine studies relevant to the search objectives in the last ten years, of which each research is presented in Table 1.

Table 1. Literature included in this article

Writer	Country	Method	Sample	Conclusion
(Hayashi et al., 2023)	Japan	Retrospective cohort	626 patients underwent early surgery (<7 days) and 1736 patients underwent delayed surgery	The mortality rate in hospitals did not differ significantly between the early (15.9%) and delayed (17.2%) groups; $p = 0.70$). Excision or graft within 2 days of hospital admission was not associated with an increase in mortality compared to delay.
(Glaser et al., 2021)	Germany	Retrospective cohort	1,494 patients had burns, of which 670 (44%) underwent early treatment (<3 days).	Patients with early excision had a much shorter mean length of stay (18 days vs 21 days, $p < 0.01$). The average number of operations was comparable for both groups. The mortality rate appears to be higher in the early group.
(Badr et al., 2019)	Egypt	Prospective cohort	15 people underwent excision + early graft within 7 days of burn onset and 15 people >7 grafts after onset.	Early excision and graft outcomes were better than delayed grafting in terms of intake, infection and post-burn contraction (mean 91.33 ± 7.67 in the early group and 83.67 ± 10.08 in the delayed group with $p = 0.026$).
(Ayaz et al., 2019)	Iran	Double randomized-simulated parallel clinical trials	25 people underwent excision + early graft within 7 days of burn onset and 25 people >7 grafts after onset.	There was no significant difference between the two groups, except for better patient satisfaction in the early group. The early group was associated with shorter treatment times and lower treatment costs. The graft acceptance rate was similar in both groups.
(Goswami et al., 2019)	India	Retrospective cohort	24 people underwent excision + early graft within 7 days of burn onset and 34 people >7 grafts after onset.	There were no significant differences in the number of surgeries, PRC transfusions, and FFP used between the early and delayed excision groups. The length of hospitalization and the cost of treatment were significantly lower in the early excision group.
(Gawaziuk et al., 2018)	India	Retrospective cohort	42 people underwent excision + early graft within 7 days of burn onset and 42 people >7 grafts after onset.	Skin graft results were much better in the early excision group than in the delayed group. The duration of early cluster treatment is shorter. Functional and aesthetic results are achieved better with less need for secondary surgical procedures. There are no major complications.
(Puri et al., 2016)	India	Prospective cohort	10 people underwent excision + early graft within 5 days of burn onset and 10 people >3 grafts after onset.	The average percentage of areas recoated with grafts in the early group was $9.4 \pm 2.3\%$ and $8.1 \pm 1.6\%$ in the late group. The average length of hospital stay in patients in the early group was 15.1 ± 4.1 days, while in the delayed group it was 36.2 ± 6.3 days ($P = 0.001$).
(Singer et al., 2016)	Israel	Randomized clinical studies	12 early surgery actions (2 days) and 12 delayed actions (>14 days)	Early burn management makes the skin look better than it has been delayed.

Writer	Country	Method	Sample	Conclusion
(Gallaher et al., 2015)	Malawi	Prospective cohort	91 patients (33%) underwent early excision and graft (≤ 5 days) and 184 patients (67%) underwent delayed excision and graft (> 5 days)	The mortality rate was significantly higher in the early group (25.3% vs. 9.2%, $p = 0.001$). The probability of predicting adjusted mortality was 0.256 (CI = 0.159–0.385) and 0.107 (CI = 0.062–0.177) if operated ≤ 5 and > 5 days ($p = 0.011$).

Discussion

Burn management is always evolving, where there is debate about the appropriate timing of skin excision and graft (Gojowy et al., 2019). Previous research has shown that considerations regarding the timing of excision or skin graft to improve the patient's medium-term prognosis do not differ significantly between the two groups. Research over the past 10 years has shown conflicting results. The benefits of early excision or skin grafts on fluid retention and infection prevention may have been offset by complications associated with early surgery. Early-onset skin excision or grafts in patients with severe burns can cause massive intraoperative hemorrhage and require blood transfusions. This indicates the risk of systemic damage and complications due to overwork (Gallaher et al., 2015).

Deeper burns (e.g., in the deep and full dermal cavities) are characterized by two characteristics, namely the absence of residual epidermal potential in the wound and poor dermal structure (Jackson & Roman, 2019). This can hinder epithelialization. This is the reason why edge epithelialization occurs only about 5 mm from the edge of the inner wound, and why epidermal sheets and suspensions (keratinocytes) (both cultured and uncultured) have no benefit in the primary treatment of deep dermal burns and full-thickness burns (Dargan et al., 2021). This results in long healing times, contractures, and hypertrophic scarring and functional disability, unacceptable dyesthesia, as well as symptoms of pain and itching. Scar tissue damage and recurrent infections are common. Patients with this condition generally require a graft quickly (Greenwood, 2020; Hundeshagen et al., 2020).

Other studies have shown that excision and early-onset grafts are standard procedures for deep cutaneous burns, but they have found no significant difference between the impact of actions performed quickly and delayed on hand function (Dargan et al., 2021). The primary goal of burn treatment is the restoration of function of the parts of the body involved. They showed that hand function was not associated with the type of surgery (Ayaz et al., 2019). Early excision or skin grafts were not associated with shorter duration of catecholamine use or mechanical ventilation. Patients with early excision and grafts are also associated with shorter treatment durations, thus saving on treatment costs (Botman et al., 2019). Early excision of necrotic tissue of burns can cause inflammation, but skin grafts can protect against infection. These conflicting effects may be the reason for the lack of significant differences in prognosis between the two groups (Gawaziuk et al., 2018; Rennekampff & Tenenhaus, 2022).

CONCLUSION

The skin, the largest organ of the human body, serves as the primary defense against harmful factors such as mechanical forces, microorganisms, and radiation, but significant skin loss from burns can severely compromise this protective barrier. Burns result from damage to

the skin and underlying tissues caused by heat, cold (frost bite), chemicals, electricity, or radiation. Autologous skin grafts remain the gold standard for treating large skin defects, with early excision and grafting shown to reduce hospitalization time and healthcare costs. Moreover, studies indicate that early intervention leads to higher patient satisfaction. Future research should focus on optimizing the timing and techniques of excision and grafting to further improve clinical outcomes and patient quality of life.

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