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Original Research Article

Comparison of Early Excision and Grafting Versus Conservative Management in Thermal Burn Patients: A Prospective Cohort Study

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Abstract

Aim: To compare and evaluate the outcomes associated with early excision and grafting versus conservative management in thermal burn patients, focusing on recovery parameters, complications, and patient satisfaction.

Methodology: This single-center, hospital-based prospective cohort study was conducted over 22 months at Gajra Raja Medical College and Jaya Arogya Group of Hospitals, Gwalior, India. The study enrolled 40 patients admitted to the burn ward, divided into two groups: Group A (conservative management) and Group B (early excision and grafting). Inclusion criteria included thermal burns covering less than 40% of total body surface area in hemodynamically stable patients aged ≥12 years. Key outcomes measured included hospital stay duration, wound healing time, satisfaction levels, and incidence of complications. Statistical analyses were conducted using Stata 17.0, with a significance level of $p < 0.05$.

Results: The mean duration of hospital stay was significantly shorter in the excision and grafting group (21 ± 10.8 days) compared to the conservative group (28 ± 10.7 days; $p = 0.0315$). Wound healing was also faster in the excision and grafting group, with an average healing time of 35.6 ± 5.1 days compared to 46.5 ± 6.3 days in the conservative group ($p = 0.008$). Complications such as postburn contractures and deformities were less prevalent in the excision and grafting group, and patient satisfaction rates were significantly higher (70% vs. 30%; $p = 0.033$).

Conclusion: Early excision and grafting in thermal burn patients is associated with reduced hospital stays, quicker wound healing, fewer complications, and higher satisfaction rates compared to conservative management. These findings support the adoption of early excision and grafting as a preferred treatment modality for optimizing burn care outcomes.

Keywords: Thermal burns, early excision, grafting, conservative management, wound healing, burn complications, patient satisfaction, hospital stay duration.

1. INTRODUCTION

According to the World Health Organization (2017), burns present a global public health concern, resulting in an estimated 180,000 deaths annually[1]. Most of these fatalities occur in low and middle-income nations, with about two-thirds taking place in the WHO

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

African and South-East Asia regions[2]. In India, more than 10,00,000 individuals experience moderate to severe burns each year[3]. Despite advancements in medical care, preventive measures, and awareness campaigns, the prevalence of burns continues to impose a substantial burden on individuals, families, and the healthcare system in the country[4]. The impact of burn injuries extends beyond the physical trauma, inflicting substantial socio-economic ramifications[4]. Victims often face long-term disabilities, disfigurement, and psychological distress, leading to diminished quality of life[5]. Furthermore, the financial burden arising from medical expenses, rehabilitation, and loss of income aggravates the plight of affected individuals and their families, particularly those from low-income backgrounds[5].

Managing burns encompasses a comprehensive approach that involves immediate first aid, acute medical care, wound management, and long-term rehabilitation[6,7]. The severity of burns dictates the management strategy, which often involves a multidisciplinary team of healthcare professionals, specialized facilities, and ongoing support[8]. Continued research and innovation in the field of burn management contribute to improved techniques, better wound healing, scar reduction methods, and pain management[8]. Amidst the array of available treatment modalities, the debate between early excision and grafting versus conservative management stands as a critical focal point in determining the most effective approach to address thermal burn injuries[9,10]. *Early excision and grafting involve the timely removal of necrotic tissue and prompt coverage of the wound with skin grafts, whereas conservative management entails a more passive approach focusing on wound care and natural healing processes (optimal time for early excision and grafting with in 7 days from burn)* [11,12]. While both strategies have been employed in clinical practice, the absence of a consensus on the superior approach underscores the necessity for a comprehensive and comparative analysis. The lack of conclusive evidence regarding the superiority of either treatment modality necessitates a systematic evaluation through a well-structured comparative study. Such an investigation is essential not only for clinicians and healthcare practitioners but also for policymakers, aiming to establish standardized protocols and guidelines for burn care. Studying the outcomes of early excision and grafting versus conservative management in thermal burn patients is a critical endeavor that holds profound implications for the field of burn care and patient outcomes[11,13,14]. The comparison between early excision and grafting versus conservative management in thermal burn patients is essential due to its direct impact on patient recovery, morbidity, mortality rates, and long-term outcomes. Understanding which approach yields better results is crucial for optimizing treatment protocols and enhancing patient care standards.

This study seeks to address this gap by conducting an in-depth evaluation of the outcomes associated with early excision and grafting versus conservative management in thermal burn patients. The rationale behind investigating and comparing these treatment modalities lies in the imperative to optimize patient care and treatment outcomes. Understanding the nuances, advantages, and potential drawbacks of each approach is crucial for guiding clinical decisions, establishing evidence-based practices, and ultimately enhancing the quality of care provided to thermal burn patients.

AIM: To compare and evaluate the outcomes associated with early excision and grafting versus conservative management in thermal burn patients, aiming to determine the most effective treatment modality for optimizing patient recovery and healthcare resource utilization.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

2. MATERIAL AND METHODS:

- **Study Type:** A single centre, hospital, inpatient based, prospective, cohort, observational study.
- **Study Settings:** Department of Surgery, Gajra Raja Medical College, Gwalior, Madhya Pradesh, and affiliated Jaya Arogya Group of Hospitals, Gwalior
- **Ethical Clearance:** This study has received ethical approval from the institutional review board of the GRMC, Gwalior.
- **Study Duration:** 22 months; September'22 to June' 24 divided into following phases-
- **Study Outcomes**
  1. Length of Hospital Stay
  2. Wound Healing Time
  3. Patient Satisfaction
  4. Development of complications.
- **Sample Size**[15]**:**
  - ✓ **n = (Zα/2 + Zβ)^2 * p0 * (1 - p0) / (p - p0)^2**
  - ✓ where:
  - ✓ n = total sample size (to be divided equally between groups)
  - ✓ Zα/2 = standard normal deviate for a one-sided (α) or two-sided (α/2) significance level (usually set at 0.05 for a two-sided test)
  - ✓ Zβ = standard normal deviate for the desired statistical power (usually set at 0.8 or 0.9)
  - ✓ p0 = expected proportion of positive outcomes in the control group
  - ✓ p = expected proportion of positive outcomes in the intervention group (**this is where you specify the anticipated effect size**)
  - ✓ (1 - p0) = proportion of negative outcomes in the control group
  - ✓ (1 - p) = proportion of negative outcomes in the intervention group
  - ✓ N=40; 20 in each group.
- **Study Participant:** Patients admitted to the burn ward Department of General Surgery, G.R. Medical College, Gwalior treatment and fulfilling the below mentioned selection criteria.

Inclusion Criteria-

i. Aged >= 12 years.
ii. Patients of both genders.
iii. TBSA < 40%
iv. Patient who was haemodynamically stable at the time of admission.
v. Patients or guardian who gave written informed consent to participate in study.

Exclusion Criteria

i. Associated poly trauma
ii. Pregnant Women
iii. High voltage electric burn
iv. With multiple comorbid conditions – like DM type II, HTN, TB etc.
v. Severe inhalation injury
vi. Pre-existing chronic pain conditions like – Neurpathic pain, Tendinitis, arthritis etc. that might interfere with the comparative procedure.
vii. Patient or guardian who refused to consent for the study.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

- **Participant's definition:** A haemodynamically stable patient admitted with thermal burns with TBSA < 40%, consented to participate in the present study and fulfilled the above-mentioned inclusion and exclusion criteria.
- **Definition of Exposure Groups:**
  - **Group A (Conservative Management):**
  - **Group B (Early excision & Grafting):**
- **Participants Recruitment:** An initial screening was conducted based on the defined eligibility criteria to select potential participants from the identified pool.
- **Choosing the Exposure:** Participants were presented with the choice between two exposures i.e., Conservative Management of Thermal Burns versus Early Excision & Grafting (within one week) in the management of thermal burns. All participants and their care givers were provided with detailed information about the study, its purpose, procedures, potential risks, benefits. Following this information session, participants were asked for their preference from the two options. Their responses were recorded, and the same was noted on their case sheets.
- **Obtaining Informed Consent:** A bilingual (Hindi & English) consent form was drafted for the purpose of obtaining informed consent. The information was conveyed in a language and manner understandable to the participant. Details regarding the comparison of two treatment techniques for thermal burn were explained, emphasizing the research objectives. Potential risks (e.g., complications, pain) and benefits (e.g., potential for improved outcomes) associated with both treatments were discussed. Participants were assured that their participation was voluntary, and they had the right to refuse or withdraw at any time without facing any consequences.
- **Data Collection Procedure.**
  i. Re-verification of the informed consent before the initiation of any study-related procedures.
  ii. Preoperative Assessments: Comprehensive data regarding patients' demographics, medical history, and burns were collected before beginning the treatment.
  iii. Detailed recording of procedure including the type of intervention performed, duration of surgery, intraoperative complications, and any specific procedural notes. Documentation of anaesthesia used, duration, and any complications related to anaesthesia during the surgical procedure.
  iv. Collection of data related to the immediate recovery phase, including initial pain scores, post-anaesthesia recovery details, and early complications observed during the hospital stay.
  v. Scheduled follow-up visits at predetermined intervals (e.g., 1 month, 3 months, 6 months) to assess postoperative outcomes and monitor participant progress.
  vi. Monitoring and recording any postoperative complications, such as infections, contracture, keloid formation.
  vii. Regular assessment of postoperative pain using standardized pain assessment tools (e.g., Visual Analog Scale, Numerical Rating Scale) during follow-up visits.
  viii. Recording and storing participant data securely in electronic systems to ensure accuracy and confidentiality.
  ix. Implementing measures to ensure the accuracy, completeness, and consistency of collected data, including regular checks and validation procedures.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

x. Continuous oversight and monitoring of the data collection process to by study Supervisor and members of Ethical Committee to address any discrepancies and quality control.

xi. Periodic reporting of interim findings to Institutional Review Board to ensure transparency throughout the study duration.

- **Statistical Analysis Plan:** The statistical analysis was undertaken using the Stata 17.0 version of the software. Continuous data (e.g., pain scores) were analysed using parametric tests like t-tests (for comparing two groups) to detect differences between the two groups. If the continuous data violates assumptions of normality, non-parametric tests like the Mann-Whitney U test (for two groups). Categorical or discrete data (e.g., complications, infection) were analysed using the Chi-square test to compare frequencies between the two treatment groups.
- **Funding:** There were no external funding(s) for this study. Participants were not paid money or given any freebies, incentives etc., to participate in the present study.

3. Results:

Table 1: Characteristics of Participants

Age Group	Conservative (n =20)		Excision and Grafting (n=20)	
	n	%	n	%
12-20	2	10	5	25
21-30	7	35	8	40
31-40	7	35	2	10
41-50	3	15	3	15
51-60	1	5	2	10
Mean, SD	32.6	10.2	29.7	12.7
Gender				
Female	6	30	8	40
Male	14	70	12	60

The study evaluated 40 participants, divided equally between those receiving conservative management (Group A, n=20) and those undergoing early excision and grafting (Group B, n=20). Participants' ages in Group A ranged from 12 to 60 years, with an average age of 32.6 years (SD = 10.2), while those in Group B had a mean age of 29.7 years (SD = 12.7). Gender distribution was comparable between groups, with 30% of participants in Group A and 40% in Group B being female.

Table 2: Characteristics of Burn

	Conservative (n =20)		Excision and Grafting (n=20)	
Total Burn Surface Area	**n**	**%**	**n**	**%**
1-10%	3	15	9	45
11-20%	4	20	7	35
21-30%	9	45	2	10
31-40%	4	20	2	10
Location of Burn				

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

Below Elbow	2	10	4	20
Upper Arm	5	25	1	5
Below Knee	3	15	6	30
Thigh	5	25	5	25
Chest/Abdomen/face	5	25	4	20

Regarding burn characteristics, total burn surface area (TBSA) varied significantly between groups. In Group A, 15% of patients presented with TBSA of 1–10%, 20% with 11–20%, 45% with 21–30%, and 20% with 31–40%. Conversely, in Group B, 45% of participants had a TBSA of 1–10%, 35% had 11–20%, 10% had 21–30%, and 10% had 31–40%. The location of burns also differed, with Group A reporting 10% of burns below the elbow, 25% on the upper arm, 15% below the knee, 25% on the thigh, and 25% on the chest, abdomen, or face. In Group B, 20% of burns were below the elbow, 5% on the upper arm, 30% below the knee, 25% on the thigh, and 20% on the chest, abdomen, or face.

Table 3: Duration of Hospital Stay and Healing

Duration of Hospital Stay	**Conservative (n =20)**		**Excision and Grafting (n=20)**	
	n	**%**	**n**	**%**
11-20	6	**30**	12	**60**
21-30	4	**20**	3	**15**
31-40	6	**30**	3	**15**
41-50	4	**20**	2	**10**
Mean, SD	28	**10.7**	21	**10.8**
P-value = 0.0315				
Duration of Healing				
Mean, SD	46.5	6.3	35.6	5.1
P-value = 0.008				

The analysis of hospital stay and wound healing times revealed significant differences between the two groups. The duration of hospital stay was notably shorter for the early excision and grafting group (Group B), with an average stay of 21 days (SD = 10.8) compared to 28 days (SD = 10.7) in the conservative management group (Group A), showing statistical significance ($p = 0.0315$). Wound healing times also favored early excision and grafting. Group B had a mean healing duration of 35.6 days (SD = 5.1), significantly shorter than the mean of 46.5 days (SD = 6.3) for Group A ($p = 0.008$). These findings indicate that early excision and grafting not only reduces hospital stay but also accelerates wound healing, offering a more efficient recovery pathway.

Table 4: Complications

Scar	**Conservative (n =20)**		**Excision and Grafting (n=20)**	
	n	**%**	**n**	**%**
Scar	16	80	12	60
Hypertrophic Scar	8	40	5	25
Keloid	7	35	5	25
Postburn	11	55	6	30

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

Contracture				
Deformity	5	25	2	10

Analysis of complications revealed that Group B experienced fewer adverse outcomes than Group A. In Group A, 80% of patients developed scars, 40% had hypertrophic scars, 35% developed keloids, 55% experienced postburn contractures, and 25% developed deformities. In contrast, Group B showed a reduced complication profile, with 60% of patients developing scars, 25% having hypertrophic scars, 25% developing keloids, 30% experiencing postburn contractures, and only 10% presenting with deformities. These findings underscore the efficacy of early excision and grafting in minimizing postburn complications, including hypertrophic scarring, contractures, and deformities, compared to conservative management.

Table 5: Level of Satisfaction with treatment

Satisfaction	**Conservative (n =20)**		**Excision and Grafting (n=20)**	
	n	**%**	**n**	**%**
Satisfied	6	30	14	70
Neutral	7	35	4	20
Dis-satisfied	7	35	2	10
P = 0.033				

The level of patient satisfaction differed significantly between the two treatment groups, with those in the early excision and grafting group (Group B) reporting higher satisfaction rates than those in the conservative management group (Group A).

In Group A, satisfaction was relatively low, with only 30% of patients expressing satisfaction, while 35% felt neutral about their treatment, and another 35% were dissatisfied. Conversely, Group B demonstrated a more favorable satisfaction outcome, with 70% of patients reporting satisfaction with their treatment. Among the remaining participants in this group, 20% felt neutral, and only 10% expressed dissatisfaction. The statistical analysis yielded a significant p-value of 0.033, indicating that early excision and grafting contributed to higher patient satisfaction compared to conservative management. This higher satisfaction rate in Group B may be attributable to reduced hospital stay, quicker wound healing, and a lower incidence of postburn complications.

4. DISCUSSION:

The present study, conducted at the Department of Surgery, Gajra Raja Medical College, Gwalior, enrolled a total of 40 patients to compare and evaluate the outcomes associated with early excision and grafting versus conservative management in thermal burn patients. The sample was equally divided into two groups, with 20 patients each undergoing either early excision and grafting or conservative treatment. The duration of hospital stay for patients with thermal burns was significantly different between the conservative management group and the early excision and grafting group. In the conservative management group, the mean hospital stays of 28 days (SD 10.7). In contrast, the early excision and grafting group had mean hospital stay of 21 days (SD 10.8) (p-value 0.0315).

These findings suggest that early excision and grafting significantly reduce the duration of hospital stay compared to conservative management. This reduction in hospital

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

stay is crucial as it implies faster recovery and less resource utilization, which can have substantial implications for both patients and healthcare systems. Shorter hospital stays can reduce the risk of hospital-acquired infections and other complications, improve patient throughput, and lower healthcare costs.

Comparing these results with the findings of Ong YS et al. (2006), our study aligns with their observation that early excision and grafting shorten hospital stays[16]. Additionally, Miroshnychenko A et al. (2021) reported that early surgical intervention could reduce hospital stays, further supporting our findings[17]. These consistent results across studies highlight the benefits of early excision and grafting in managing thermal burns, emphasizing the need for its consideration in clinical practice to optimize patient outcomes and resource utilization.

The duration of complete wound healing showed a significant difference between the conservative management group and the early excision and grafting group. In the conservative management group, the mean duration for complete healing in this group was 46.5 days (SD 6.3). In contrast, the early excision and grafting group the mean duration for complete healing in the early excision and grafting group was 35.6 days (SD 5.1) (p-value of 0.008). When compared with previous studies, Nathani N et al. (2018) also found that early excision and grafting resulted in better outcomes, including faster wound healing, compared to conservative treatment[18]. Similarly, Ong YS et al. (2006) reported that early excision and grafting not only reduced hospital stays but also contributed to quicker wound recovery[16]. These consistent findings reinforce the advantages of early surgical intervention in burn management. The results from this study, combined with those from past research, strongly support the adoption of early excision and grafting as a standard treatment approach for thermal burns. By significantly reducing the duration of wound healing, early excision and grafting can improve patient outcomes, decrease the length of hospital stays, and reduce the overall burden on healthcare systems.

The level of patient satisfaction with the treatment received was significantly higher in the early excision and grafting group compared to the conservative management group. In the conservative management group, 30% of patients (n=6) reported being satisfied with their treatment, 35% (n=7) felt neutral, and 35% (n=7) were dissatisfied. In contrast, in the early excision and grafting group, 70% of patients (n=14) reported satisfaction, 20% (n=4) felt neutral, and only 10% (n=2) were dissatisfied. The statistical analysis revealed a significant difference between the two groups, with a p-value of 0.033.

Comparing these findings with past studies, Nathani N et al. (2018) found that early excision and grafting resulted in better outcomes for patients with burns covering less than 30% of the body surface area[18]. This study reported improved clinical outcomes and reduced complications, which likely contribute to higher patient satisfaction, mirroring our findings. Similarly, Ong YS et al. (2006) conducted a meta-analysis showing that early excision and grafting not only reduced mortality rates but also shortened hospital stays, factors that contribute to overall patient satisfaction[16]. The reduced hospital stay and improved recovery times observed in their study are consistent with the higher satisfaction levels reported in our study for the early excision and grafting group. The study by Miroshnychenko A et al. (2021) also supports these findings, as their systematic review suggested that early surgical intervention could lead to better functional and cosmetic outcomes. Furthermore, Moussa A et al. (2021) highlighted the benefits of early excision within 24 hours, noting reduced ICU stays and mechanical ventilation needs.

In the conservative management group, 25% of patients (n=5) developed deformities, and in the early excision and grafting group, deformities were observed in 10% of patients (n=2) .

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

The lower incidence of deformities in the early excision and grafting group suggests that this treatment approach may be more effective in preventing post-burn deformities compared to conservative management. These findings are consistent with previous studies that have highlighted the benefits of early excision and grafting in reducing complications and improving outcomes for burn patients. Nathani N et al. (2018) reported that early resection and grafting of burns involving less than 30% TBSA resulted in better clinical outcomes, which likely includes a lower incidence of deformities[18]. This aligns with our findings, suggesting that early surgical intervention can help prevent deformities by promoting better wound healing and minimizing the extent of tissue damage. Ong YS et al. (2006) conducted a meta-analysis that demonstrated the advantages of early excision and grafting in reducing mortality and shortening hospital stays[16]. While their study did not specifically focus on deformities, the improved clinical outcomes and faster recovery associated with early excision and grafting can be inferred to contribute to a lower incidence of deformities, as observed in our study. Miroshnychenko A et al. (2021) also found that early surgical intervention could lead to better functional and cosmetic outcomes, which would include a reduction in the development of deformities[17]. Their systematic review indicated that early excision and grafting may result in improved patient-important outcomes, supporting our observation that this treatment approach is associated with fewer deformities compared to conservative management. Furthermore, Moussa A et al. (2021) highlighted the benefits of early excision within 24 hours in reducing ICU stays and mechanical ventilation needs, which can contribute to overall better recovery and fewer complications such as deformities[19].

The incidence of postburn contracture varied significantly between the two treatment groups in this study. In the conservative management group, 55% of patients (n=11) developed postburn contractures, while in the early excision and grafting group, only 30% of patients (n=6) experienced postburn contractures. These findings suggest that early excision and grafting are associated with a lower incidence of postburn contracture compared to conservative management. These results are consistent with previous studies highlighting the benefits of early excision and grafting in reducing the incidence of postburn complications. Nathani N et al. (2018) reported that early resection and grafting of burns involving less than 30% TBSA resulted in better clinical outcomes, which likely includes a reduced incidence of postburn contractures[18]. This aligns with our findings, suggesting that early surgical intervention can help prevent contractures by promoting better wound healing and reducing scar formation.. Miroshnychenko A et al. (2021) found that early surgical intervention could lead to better functional and cosmetic outcomes, which would include a reduction in the development of contractures[17]. Their systematic review indicated that early excision and grafting may result in improved patient-important outcomes, supporting our observation that this treatment approach is associated with fewer contractures compared to conservative management.

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ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

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