

EARLY EXCISION AND GRAFTING VERSUS CONSERVATIVE TREATMENT IN THE MANAGEMENT OF MAJOR BURNS: A COMPARATIVE STUDY

Plastic Surgery

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ABSTRACT

Background : Full thickness burns lose their eschar in 2-6 weeks through bacterial collagenase production and daily mechanical debridement¹. The practice of leaving these dead tissues only serves as a nidus for infection that can lead to the patient's death. Hence the standard procedure is surgical removal of eschar with grafting techniques.

Methods: A total of 50 patients divided in 25 patients in each group were included first group was managed conservatively and second underwent early excision and grafting within 5th day upto 10% TBSA.

Results: Early excision and grafting patients required significantly ($p=0.04$) more blood transfusions than conservatively managed patients. The mean hospital stay was significantly ($p=0.05$) lower by 10 days in early excision and grafting than conservatively managed.

Conclusion : Early Excision and Grafting group was found to have significantly shorter hospital stay with decreased painful debridement but required more blood transfusions than conservatively managed patients.

KEYWORDS

Early excision and Grafting.

INTRODUCTION

Early excision and grafting

The past 40 years have been witness to significant improvements in the overall care and prognosis of those suffering burn trauma². General improvements in topical antimicrobials, systemic antibiotics, improvements of critical care, maintenance of the patients nutritional status and improved wound care are all critical factors in improving survival in burned patients. At the heart of this success is an aggressive approach to burn wounds. This approach involves early operative removal of devitalized tissue and biological coverage of resultant wound³.

Conservative treatment of burn wound by daily washing removal of loose dead tissue and topical application of antibiotics cause superficial dermal burns to heal in 2 weeks and deep dermal full thickness burn to be ready for grafting in 3-8 weeks⁴.

In 1970, Janekovic suggested a procedure which was designed to remove the devitalized part of the dermis till a plane of healthy bleeding dermis was reached and resurfaced this by immediate autografting⁵. For deep burns the standard procedure nowadays is to surgically remove the eschar and graft the defect. Reports have shown benefit over serial debridement in terms of survival, blood loss and length of hospital stay^{6,7,8}. Availability of safer blood, better monitoring equipment and method, and a better understanding of the altered physiology and increased metabolic demands of patients and major burns has made this possible⁹. The ability to stabilize the patients within a few days of the injury has enabled the surgeon to excise deep burn wounds before invasive infection develops. The practice of leaving dead and devitalized tissue serves as a nidus for infection and is the principal source of complication in burn patient.

Dead tissue in the burn wounds act as a medium for bacterial growth. Antibiotics administered through the blood stream have difficulty in reaching the burn wounds due to poor blood supply of the dead and devitalized tissue. So dead skin must be removed as early as possible.

Early wound closure shortens hospital stay and duration of illness¹⁰. Early in the twentieth century, primary burn wound closure was attempted in patients with major burns but systemic instability, massive hemorrhage, graft loss, malnutrition and infection resulted in such high mortality rates that major burns excision were abandoned¹¹. Until a useful artificial skin is available it is difficult to prove that early excision improves mortality in patients with extensive burns (>60%TBSA). Recently, a dermal substitute made of collagen matrix combined with a glycosaminoglycan (chondroitin 6-sulphate

) that acts as a template for endogenous cells to reproduce a new dermis is a major step in the development of a permanent skin substitute.

More burn centres are practising early excision and grafting. The procedure is still limited due to difficulty in diagnosing depth of burns, limited donor sites and the difficulties involved in excision of three-dimensional areas such as the perineum, ears and nose.

Evidence supports the following conclusions:

- 1) Full thickness burn <20%TBSA and burns of indeterminate depth (deep partial versus full thickness) if treated by an experienced surgeon, can be safely excised and grafted with a decrease in hospital stay, cost and time away from work or school.
- 2) Early excision and grafting dramatically decreases the number of painful debridements.
- 3) Patients with burns between 20 and 40 percent TBSA will have fewer infectious complications if treated with early excision and grafting.

Review of Literature

In a study conducted by Herndon DN et al at the Shriners burn institute, 85 patients whose ages ranged from 17 to 55 years with >30% TBSA burns were randomly assigned to either early excision or topical antimicrobial therapy and skin grafting after spontaneous eschar separation. Mortality from burns without inhalation injury was significantly decreased by early excision from 45 to 9% in patients who were 17 to 30 years of age ($P < 0.025$)¹². No differences in mortality could be demonstrated between therapies in adults older than 30 years of age or with a concomitant inhalation injury. The mean length of hospital stay of survivors was less than one day per percent of TBSA burn in both children and adults¹².

E. Kisslaoglu et al. at the Plastic and Reconstructive surgery at the Gata Haydarapasa Teaching Hospital Istanbul, in a period of 7 years treated 32 out of 54 patients with early excision and grafting. Their follow up results in terms of mortality and morbidity rates were compared. In addition to improvement in the prognosis, early excision and grafting procedures decreased the duration of hospitalization and cost of treatment¹¹.

Still JM Jr. et. al. at the Burn Unit Augusta Regional Medical Centre, over a period of 1 year, subjected 130 patients to early excision and grafting and 48 patients to delayed grafting. The patients in the early excision group had a significantly shorter hospital stay without adverse

effects on clinical outcome¹⁰.

Gray DT et. al. at the University of Washington Burn Centre compare the results of early surgical excision and autografting to those of autografting after spontaneous separation and bedside debridement of 72 patients. Excised patients had shorter duration of hospital stay and lower rates of burn wound sepsis and serious burn wound contamination, and less use potentially toxic antibiotics. They concluded that EEG in young, otherwise healthy patients with 20 to 40 percent TBSA burn that are likely to heal within 3 weeks is more effective than the more traditional management of slow wound separation and debridement¹³.

Finley RK Jr. et. al. treated 41 patients at Miami Valley Hospital by EEG. Their hospital stay was less than that of patients treated and reported to the National Institute of Burn Medicine, who were treated conservatively¹⁴.

In a study by Engrav LN et. al., compared to non-operative treatment, EEG of 22 patients with indeterminate burns of less than 20% TBSA resulted in an average shorter hospital stay, lower cost and less time away from work than 25 patients treated non-operatively. They concluded that in otherwise healthy patients with dermal burns of indeterminate depth less than 20% TBSA, EEG is the preferred form of treatment¹⁵.

Elderly patients have significantly higher mortality rates than younger patients with similar burns over the TBSA¹⁶. Two theories exist regarding treatments of burns in the elderly, a traditional approach to limit physiological stress by avoidance of operative intervention in the early post burn stage and eschar excision and wound closure within first week of hospital stay¹⁷.

Kirn DS et.al. examined retrospectively the outcome in patients 70 years or older, hospitalized in the University of Kentucky Burn Unit between 1975 and 1995. EEG had been done in 28 patients and 34 were managed conservatively. The mortality rate was 57% in the first group and 41% in the second group. They concluded that management of elderly patients by EEG was of no benefit may have resulted in higher mortality rate.

In a study by M.Kara et.al. at the Dept of Surgery, University of Toronto, 52 consecutive patients over the age of 65 years were evaluated. 18 patients were subjected to early excision and 34 patients were excised after 7 days. They concluded that elderly patients represent a high risk population and that early surgical excision results in fewer episodes of infections and a reduction in hospital stay but does not significantly improve survival¹⁸.

A retrospective analysis by T.Housinger et. al. of 55 patients, more than 60 years of age, revealed that conservatively managed burn patients had fewer complications, a shorter hospital stay and functional results equal to the operative group¹⁹.

F Zdravic et. al. analyzed 2409 burn patients treated by early excision over a period of 12 years at the burn unit in Ljubljana. The results although greatly superior to the classical approach, show that early removal of burned tissue before the fifth post burn day does not solve the problem in all cases. In burns exceeding 40% body surface area or in smaller burns affecting patients in unfavorable age and health groups, the above method is not so easy to apply because of problems involving a number of factors. It is important to work out a strategy for each individual case. The author shows that the improvement of diagnosis and understanding of the deep dermal burn will lead to better results²⁰.

While the technique of Early Excision & Grafting has many advantages in the treatment of thermal injuries, it is not without significant complication. Hemorrhage can be alarming as can the metabolic stress of larger surgical procedure in an effort to minimize these complications. GD Warden et.al. had developed a two stage technique for excision and grafting of burn wounds. This technique employs layered excision of eschar, followed by an overnight stabilization period for restoration of normal body temperature and blood volume. Continuous soaking of excised areas promotes hemostasis, and insures a viable base for autografting performed on the following day²¹.

Employment of electrosurgery, with elimination of excessive blood loss immediate autografting has been advised. Immediate graft take was excellent on electrosurgical wounds after primary burn excision in a study by RJ Lewis et.al²². Poor graft take is another major problem which can be reduced by maintaining proper hemostasis.

TECHNICAL CONSIDERATIONS:

Excision of more than 10%TBSA should be done in well equipped setups only. Without tourniquets, blood loss may be alarming. Graft loss may result in devastating consequences. Excellent monitoring, care, physiotherapy, nutritional support, anaesthesia and 24 hours physician coverage are mandatory.

Timing:

It is advantageous to perform excisional procedures as early as possible after the patients is hemodynamically stable and prior to wound degeneration. This allows the wound to be closed before infection and softening of the wound occurs. It also favours donor sites to be recropped as soon as possible.

This is generally between the second and fifth day post burn. It is rarely carried out after the eighth day. Any burn projected to take longer than 3 weeks to heal is a candidate for excision within the first post burn week¹⁶.

TYPES OF EXCISION:

There are several methods of performing burn wound excision, each applicable to a particular depth of burns.

Fascial Excision:

This involves excision of all burn skin down to muscle fascia (sometimes even including the muscle fascia). It is carried out for very deep burn (charred flame burn, prolonged contact burns, molten metal burns, electrical burns) or for patients with very large, life threatening full thickness burn. It is done either with a scalpel or an electrocautery.

Tangential (sequential) excision :

This involves shaving of very thin layers of burn eschar with a power or hand driven dermatome to reach viable tissue. A bed of viable dermis or subcutaneous tissue or fascia is obtained which is pinkish white, shiny and bleeds briskly from punctate bleeders¹⁷.

MATERIALS & METHODS:

Study Design:

This hospital based, prospective & comparative study was conducted at the burn unit, under the Dept. of Plastic surgery, S.S.K.M Hospital & I.P.G.M.E.&R over a period from January, 2013 to June, 2014.

Patients with recent burns admitted through ER will be taken into consideration for selecting the cases as study population.

Inclusion criteria:

- (1) Patients between 15 and 55 years of age.
- (2) Patients sustaining 2nd and 3rd degree burns involving up to 30% TBSA

Exclusion criteria:

- (1) Patients with inhalation injury
- (2) Patients presenting late i.e., after 5 days

Methods:

A total of 50 patients were included in the study. There were two study groups comprising of 25 patients each. The first group consisted of burn patients who were treated conservatively and the second group consisted of patients who were subjected to early excision and grafting. Patients with 11-20% TBSA burns (2nd or 3rd) involved hand, foot, perineum, mouth, joints etc.

- (1) Detailed history to be taken for medicolegal purposes.
- (2) Physical examination including calculation of burnt area
- (3) Resuscitation
- (4) Investigation: Blood for Hb%, TC, DC, PCV, RBS, Serum Urea, Creatinine, Na⁺, K⁺.
- (5) After hemodynamic stability patient will be entitled (with taking proper consent) for EEG under general anaesthesia. Early Excision & Grafting will be done within 5th day of injury. In the 1st sitting only up to 10% of TBSA will be excised (priority will be given to burns of cosmetically and functionally important areas such as, face, neck, axilla, hand, foot, joints etc) and wound will be covered with meshed or sheet STSG immediately. Left over

wound will be excised and grafted on another sitting 5-7 days after the 1st Excision and Grafting.

- (6) Conservatively managed group will be treated with alternate day or every 3rd day dressing with topical antibiotics till the eschar began to separate. Their wounds will be mechanically debrided during dressing and under general anaesthesia whenever it is feasible and the raw areas will be left to granulate. When granulation will become free of debris and relatively uninfected, STSG will be applied to close wound.
- (7) All the informations about the patients will be meticulously recorded, including the investigation values, amount of blood transfusions, the day of surgery, the percentage of area excision, the % of area grafting, the number of sessions, the length of hospital stay and the outcome.
- (8) The age group and the percentage TBSA burnt were compared for homogeneity of the two groups. Fisher's Exact Test by Epi Info-version 6 was used to analyze the statistical significance between two groups regarding blood transfusion required or not to the patients. Two-way ANOVA test was used to analyze the statistical significance between two groups regarding hospital stay. A p-value of <0.05 was taken as statistically significant.

RESULTS:

A total of 50 patients were included in the study during a period of 18 months from January 2013 to June 2014, at the burn unit, Dept. of Plastic Surgery, I.P.G.M.E.&R. And S.S.K.M. Hospital.

The results obtained are as follows:

1) Blood Transfusion:

All the patients of Early excision and Grafting group must required blood transfusion, where as in Conservative group with 11-20% burnt area, only 4(40%) patients required blood transfusion (p-value is 0.003) and in Conservative group with 21-30 %TBSA burn 10 out of 15 (66.67%) patients required blood transfusion. These differences are statistically significant (p-value is 0.04).

Table 1 : No of patients required Blood Transfusion (BT)

% of TBSA involved	Early Excision & Grafting group		Conservative group	
	No of patient Req. BT	No of patient Not req. BT	No of patient Req. BT	No of patient Not req. BT
11-20	11	0	4	6
21-30	14	0	10	5

Blood Transfusion Required

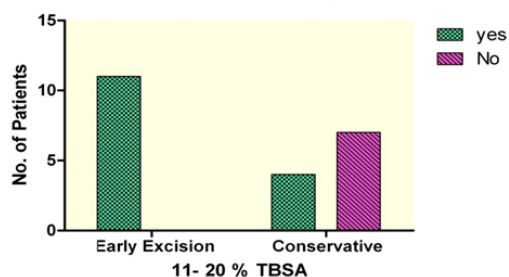


Figure 1: Bar Diagram showing No. of patients required blood transfusion in both group of patients with burn injury involving 11-20%TBSA.

Blood Transfusion Required

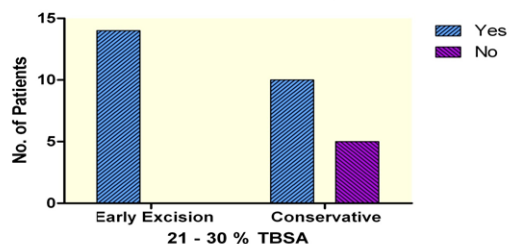


Figure 2: Bar Diagram showing No. of patients required blood transfusion in both group of patients with burn injury involving 21-30%TBSA.

2) Hospital stay:

A) Patients sustained burns involving 11-20% TBSA

The mean hospital stay in the Early Excision & Grafting group of patient with 11-20% burnt area was 22.8 days (± 5 days) and in the conservative group with same burnt area was 32.7 days (± 7 days). The difference in the length of stay was statistically significant (p-value of 0.02).

In the Early Excision & Grafting group, in majority of patients 9 (80%) the hospital stay was <29 days.

But in conservative group, only in 40% of patients the hospital stay was <29 days.

Table 2 : Hospital stay in Two groups of Patients with 11-20% TBSA Burns:

Duration (Days)	Early excision & grafting group		CONSERVATIVE group	
	No of patients	%	No of patients	%
10-19	4	36.36	1	10
20-29	5	45.46	3	30
30-39	2	18.18	6	60
TOTAL	11	100	10	100

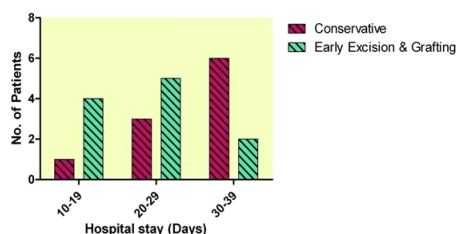


Figure 3 : Bar Diagram Showing Hospital Stay Between Two Groups of patients sustained Burn injury involving 11-20% of TBSA.

B) Hospital stay in patients sustained Burns involving 21-30% TBSA:

The mean hospital stay in the Early Excision & Grafting group of patient with 21-30% burnt area was 25.5 days (± 6.4 days) and in the conservative group with same burnt area was 36.8 days (± 10.5 days). The difference in the length of stay was statistically significant (p-value of 0.005).

In the Early Excision & Grafting group, in majority of patients 10 (70%) the hospital stay was <29 days.

But in conservative group, only in 27% (4) of patients the hospital stay was <29 days.

Table 3 : Hospital stay in Two groups of Patients with 21-30% of TBSA Burns:

Duration (Days)	Early excision & grafting group		CONSERVATIVE group	
	No of patients	%	No of patients	%
10-19	3	21.43	2	13.32
20-29	7	49.98	2	13.32
30-39	3	21.43	5	33.34
40-49	1	7.14	6	40
TOTAL	14	100	15	100

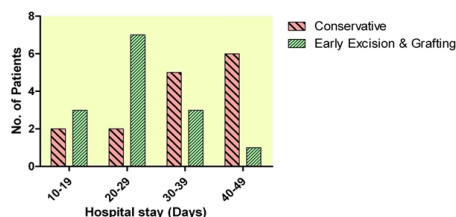


Figure 4: Bar Diagram Showing Hospital Stay Between Two Groups of patients sustained Burn injury involving 21-30% of TBSA

DISCUSSION

The skin is the largest human body organ and when burned, produces an important depression in the immune response which in turn

frequently leads to a multi-organ dysfunction syndrome with or without the presence of sepsis. If left in place, burn eschar maintains the inflammatory response of the patients and eventually develops invasive infection that many times is lethal.²³

Survival after burn injury has been steadily increasing during the last two decades. Risk factors identified for death following thermal injury are age greater than 60 yrs, inhalation injury and burned body surface area more than 80%²⁴

Despite all the recent advances in burn care, massive burn still presents a high mortality and morbidity. Early excision and grafting is currently the standard of care for deep partial thickness and full thickness burn.

In this study 21 patients(42%) had sustained 11-20%TBSA burn and 29 patient had sustained 21-30%TBSA burn. Burns >30% TBSA were not included in the study. The latter were excluded from the study as following excision of large surface area we are unable to graft the area with autologous skin.

The advantages of early excision and grafting in the treatment of limited full thickness burns has been clearly established.²⁵

Primary excision has reduced mortality, morbidity, and later reconstructive measures by a factor of 50% when compared to results obtained by awaiting spontaneous separation of eschar with late grafting.²⁶

All the patients of Early excision and Grafting group must required blood transfusion, where as in Conservative group with 11-20% burnt area, only 4(40%) patients required blood transfusion and in Conservative group with 21-30 %TBSA burn 10 out of 15 (66.67%) patients required blood transfusion. These differences are statistically significant (p-value <0.05).

The mean hospital stay was also shortened by early excision and grafting as shown in other studies by Still JM Jr.et.al.¹² Deitch EA et. al. and Finley RK Jr.et.al.¹⁴

Patients with 11-20% TBSA burn, the mean hospital stay in the early excision and grafting group was 22.8 days (± 5 days) and in conservative group the same was 32.7 (± 7) days. (p-value is 0.02).

Patients with 21-30% TBSA burns, the mean hospital stay in the Early Excision & Grafting group was 25.5 days (± 6.4 days) and in the conservative group was 36.8 days (± 10.5 days). The difference in the length of stay was statistically significant (p-value of 0.005).

In Early Excision & Grafting group the minimum length of hospital stay was 16 days and the maximum was 41 days. The majority stayed for less than 24 days but there were 4 patients who had to be re-grafted due to 2nd sitting grafting in three cases (as the deep burnt area were >10%TBSA in those patients) and graft loss in one case and stayed for a longer period resulting in a higher mean hospital stay. So it is important to ensure that proper graft take occurs in the excised areas in order to avoid repeated sessions of grafting so that hospital stay is shortened.

Clinical Photographs



Figure 5 Tangential excision being performed



Figure 6 : Photograph of a conservatively treated patient showing well granulation over left upper limb on Day 28 following regular dressing and mechanical debridement



Figure 7: Conservatively treated patient in figure 2 with late grafting-shows good graft take on Day 35



Figure 8 : Top most inset : Day5 pre-operative; Middle inset : Day5 early excision & STSG; Lower most inset : complete healing



Figure 9: Upper 2 inset intraoperative picture on day 5 with early excision and grafting and lower inset after complete healing.



Figure 10 : Conservatively treated patient with late STSG on Day 37

CONCLUSION

This prospective study was carried out to compare the two modalities of treatment of burn injuries involving upto 30 % TBSA. The first group consisting of 25 patients was treated conservatively and other group comprising of 25 patients were subjected to Early Excision and Grafting. It was seen in the study that the patients in the group in whom early excision and grafting was done, had a shorter hospital stay than the patients treated conservatively.

Blood transfusion amount and episode was more in Early Excision Grafting than conservative group but that was statistically significant. Early Excision and Grafting decreases the number of painful debridements.

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