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BURNS

Article

COMPARISON OF HOSPITAL STAY OF BURN PATIENTS UNDERGOING EARLY TANGENTIAL EXCISION AND DELAYED TANGENTIAL EXCISION IN THE BURN UNIT OF CIPTO MANGUNKUSUMO HOSPITAL IN 2023 - 2024

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ABSTRACT

Background: Burns remain a major challenge in plastic surgery due to their high mortality and morbidity. Tangential excision, a surgical procedure to remove necrotic tissue while preserving viable tissue, should be performed as soon as possible, as it has been shown to decrease hospital stay in burns ≤30% TBSA. While the benefits of early excision have been demonstrated in smaller burns, evidence is lacking for larger burns and in resource-limited settings such as Indonesia. This study aimed to compare hospital stays of burn patients who underwent early versus delayed tangential excision.
Methods: This was a retrospective cohort study that included burn patients who were discharged alive and who underwent early or delayed tangential excision between January 2023 and December 2024. Subjects were divided into two groups: early excision and delayed excision. Data were analysed using the Mann-Whitney test to assess differences in hospital stay between the two groups.
Results: A total of 100 patients were included in this study, consisting of 63 patients who underwent early tangential excision and 37 patients who underwent delayed tangential excision. The median TBSA was 29.5% (range 10–71%). The median length of hospitalisation in the early excision group was lower than in the delayed excision group, although not statistically significant (20 [5–49] vs 20 [7–66]; p=0.274).
Conclusion: Although no statistically significant difference was observed, the trend toward shorter hospital stay in the early excision group provides important preliminary evidence to guide national burn protocols.
***Keywords**: Burns; Early tangential excision; Delayed tangential excision; Hospital stay*

Latar Belakang: Luka bakar tetap menjadi tantangan utama dalam bedah plastik karena tingginya angka mortalitas dan morbiditas. Eksisi tangensial, yaitu prosedur pembedahan untuk mengangkat jaringan nekrotik sekaligus mempertahankan jaringan yang masih viabel, sebaiknya dilakukan sesegera mungkin, karena telah terbukti dapat mempersingkat lama rawat inap pada luka bakar ≤30% TBSA. Meskipun manfaat eksisi dini telah dibuktikan pada luka bakar yang lebih kecil, bukti ilmiah untuk luka bakar yang lebih luas dan pada fasilitas dengan sumber daya terbatas seperti Indonesia masih belum memadai. Penelitian ini bertujuan untuk membandingkan lama rawat inap pasien luka bakar yang menjalani eksisi tangensial dini dengan eksisi tangensial tertunda.
Metode: Penelitian ini merupakan studi kohort retrospektif yang melibatkan pasien luka bakar yang dipulangkan dalam keadaan hidup dan menjalani eksisi tangensial dini maupun tertunda antara Januari 2023 hingga Desember 2024. Subjek dibagi menjadi dua kelompok: kelompok eksisi dini dan kelompok eksisi tertunda. Data dianalisis menggunakan uji Mann-Whitney untuk menilai perbedaan lama rawat inap antara kedua kelompok.
Hasil: Sebanyak 100 pasien diikutsertakan dalam penelitian ini, terdiri atas 63 pasien yang menjalani eksisi tangensial dini dan 37 pasien yang menjalani eksisi tangensial tertunda. Median TBSA adalah 29,5% (rentang 10–71%). Median lama rawat inap pada kelompok eksisi dini lebih rendah dibandingkan dengan kelompok eksisi tertunda, meskipun tidak bermakna secara statistik (20 [5–49] vs 20 [7–66]; p=0,274).
Simpulan: Meskipun tidak ditemukan perbedaan yang bermakna secara statistik, kecenderungan lama rawat inap yang lebih singkat pada kelompok eksisi dini memberikan bukti awal yang penting sebagai acuan dalam penyusunan protokol nasional penanganan luka bakar.
***Kata Kunci:** Luka bakar; Eksisi tangensial dini; Eksisi tangensial tertunda; Lama rawat inap*

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INTRODUCTION

Burn injuries are a commonly encountered condition but remain a major challenge in surgery due to their high morbidity and mortality. According to the World Health Organisation (WHO), there are 11 million burn cases annually, with approximately 180,000 deaths each year.[1] At Indonesia's national referral hospital, Dr Cipto Mangunkusumo Hospital (RSCM), there has been a significant increase in burn cases, especially in the burn unit. Over the past five years, 709 patients were hospitalised, representing a 171% increase from 2013–2017, with a mortality rate of 25.8%, most frequently associated with septic shock.[2]

The International Society of Burn Injury (ISBI) aims for burn wound management to be within 0.5%–4% of total body surface area (TBSA) daily. Meanwhile, the American Burn Association (ABA) has established a treatment goal for optimising burn patient management, known as the "one day per percent burn rule," or 1% TBSA per day. Taylor et al. reported median global hospital stays for burn patients based on burn extent as follows: 3 (1–10) days for <25% TBSA, 29 (7–48) days for 25%–50% TBSA, 62 (41–93) days for 50%–75% TBSA, and 93 (58–141) days for >75% TBSA. The majority of patients at RSCM have burns involving more than 40% TBSA and are classified as second- to third-degree burns. The average stay for burn patients at RSCM is 15 days. However, there is no national data available in Indonesia concerning burn mortality or hospital length of stay.

In burn cases, tangential excision involves removing necrotic tissue while preserving as much viable tissue as possible, characterised by capillary vascularisation. The goal of tangential excision in burn management is to reduce the risk of bacterial infection of the skin, expose viable tissue for skin grafting, and facilitate the grafting process. Therefore, tangential excision should be performed as early as possible—referred to as early tangential excision—defined as excision within 5 days post-injury.[6]

Across various studies, the time cutoff for early tangential excision differs. Pietsch et al.[7] and Irei et al.[8] defined early tangential excision as being performed within seven days; if done after 7 days, it is considered delayed excision.[7,8] In clinical practice at RSCM's burn unit, early tangential excision is defined as being performed within 5 days after injury, while delayed tangential excision is defined as occurring more than 5 days post-injury. Several factors may contribute to delays in tangential excision, including limited resources, late patient presentation, and logistical challenges, resulting in delays of more than 5 days.[9]

A study by Ong et al.[10] demonstrated that early tangential excision significantly reduces both mortality rates and hospital length of stay. At RSCM's burn unit, physicians prioritise early tangential excision for all burn injury patients. This practice is based on a previous study that found early tangential excision reduced mortality.[11]

Furthermore, a study by Winarno et al.[11] demonstrated that excision within 5 days effectively reduced hospital stay, but their analysis was limited to patients with burns involving ≤30% TBSA. Therefore, evidence regarding the timing of excision in patients with larger burns (>30% TBSA) remains limited, especially in Indonesia. Previous studies have also reported conflicting results: while some showed that early excision reduces hospital stay and mortality, others found no significant benefit or even higher mortality associated with early intervention.10,12 These inconsistencies highlight the need for locally relevant data. Currently, there has been no assessment of early versus delayed tangential excision at RSCM's burn unit, particularly in patients with extensive burns. Such assessment is crucial not only for improving clinical decision-making but also for optimising the efficiency of burn unit resources. Therefore, this study aims to compare the length of hospital stay between burn patients undergoing early versus delayed tangential excision at RSCM's burn unit and to provide preliminary evidence that might inform clinical practice in resource-limited settings.

METHOD

This research employed a retrospective cohort study data collection. The study was conducted at the Dr. Cipto Mangunkusumo National General Hospital (RSCM) from January 2023 to December 2024.

The target population included burn patients in Indonesia who underwent early or

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delayed tangential excision. The accessible population was limited to those treated at RSCM between January 2023 and December 2024. The study sample consisted of patients from this population who met the inclusion criteria and did not meet any exclusion criteria.

Inclusion criteria were adult patients (aged ≥18 years) treated for burn injuries at the Burn Unit of RSCM who underwent either early or delayed tangential excision and were discharged alive. Patients were excluded if they had inhalation trauma, underwent prior tangential excision, left the hospital against medical advice, died during treatment, suffered from electrical or chemical burns, experienced additional traumatic injuries (e.g., limb trauma or fractures), or had incomplete medical records.

Data collection began after obtaining the necessary permissions from the Department of Plastic Surgery at RSCM. Patient registry records with a burn diagnosis were reviewed. The data collected included age, sex, length of hospital stay, total body surface area burned, burn depth, cause of the burn, and timing of the surgical procedure. Patients who satisfied all inclusion criteria and none of the exclusions were included in the study.

The independent variable was the type of tangential excision (early or delayed), and the dependent variable was the length of hospital stay. Potential confounding variables included patient age, sex, burn surface area, burn depth, and burn cause. To minimise data entry errors, patient information was independently verified by two researchers. No missing data were found for the key variables analysed. We used bivariate analysis to compare groups. However, factors such as TBSA and comorbidities may have influenced the outcomes, and future studies should employ multivariate methods to adjust for these confounders.

All data were compiled in Microsoft Excel and analysed using IBM SPSS Statistics version 2.0. Descriptive statistics were provided for all variables. Categorical data were reported as proportions, while numerical data were described using means and standard deviations for normally distributed data, or medians and ranges for skewed data. Normality was assessed with the Kolmogorov-Smirnov test. Bivariate analysis between numerical and categorical variables employed the independent t-test for normally distributed data or the Mann–Whitney test for non-normal data. Associations between categorical variables were analysed using the Chi-Square test. All results were presented in tables and/or graphs as appropriate.

RESULTS

A total of 100 burn patients who survived until hospital discharge and received either early tangential excision or delayed tangential excision at the Burn Unit of Dr Cipto Mangunkusumo Hospital (ULB RSCM) from January 2023 to December 2024 were included in this study. Most subjects were male (70%) with a mean age of 38.98±12.49 years. The median total body surface area (TBSA) affected by burns was 29.5% (range, 10–71%), with most burns being full-thickness. Of the 100 patients included, 63% underwent early excision, with a median excision time of 3 days, while delayed excision had a median of 8 days. Median length of hospital stay was 20 days (95% CI: 18–22) for early excision and 20 days (95% CI: 19–23) for delayed excision (p = 0.274). Although the difference was not statistically significant, patients in the early excision group demonstrated a trend toward shorter hospitalisation. Most patients did not exceed the expected hospital stay duration based on the "One day per per cent burn rule" established by Taylor et al.[21] Some reasons for delayed tangential excision among certain patients included late referrals from previous hospitals or patients not presenting immediately after the onset of the burn injury. Additional subject characteristics are presented in Table 1.

Table 1. Characteristics of burn patients undergoing tangential excision

Variable	Total (N = 100)	Tangential excision	
		Early (N = 63)	Delayed (N = 37)
Sex			
Male, n (%)	70 (70.0)	47 (74.6)	23 (62.1)
Female, n (%)	30 (30.0)	16 (25.4)	14 (37.9)
Age (years), mean ± SD	38.98 ± 12.49	37.41 ± 12.41	41.65 ± 12.35

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Variable	Total (N = 100)	Tangential excision	
		Early (N = 63)	Delayed (N = 37)
Hospital stay (days), median (range)	20 (5-66)	20 (5-49)	20 (7-66)
Prolonged hospital stay (ABA rule)			
Yes, n (%)	16 (16.0)	8 (12.7)	8 (21.6)
No, n (%)	84 (84.0)	55 (87.3)	29 (78.4)
Burn surface area (% TBSA), median; range)	29.5 (10-71)	30 (10-71)	29 (11-58)
Burn wound degree, n (%)			
Superficial thickness	0 (0.0)	0 (0.0)	0 (0.0)
Partial thickness	1 (1.0)	1 (1.6)	0 (0.0)
Deep thickness	19 (19.0)	11 (17.5)	8 (21.6)
Full thickness	80 (80.0)	51 (81.0)	29 (78.4)
Day of tangential excision, median (range)	5 (1-21)	3 (1-5)	8 (6-21)

Bivariate analyses were performed using the independent t-test or Mann–Whitney test for numerical variables, depending on data distribution, and the Chi-Square test for categorical variables. The median length of hospital stay was shorter in the early excision group compared to the delayed group (20 [5–49] vs. 20 [7–66] days), although the difference was not statistically significant (p = 0.274; 95% CI: 18–22 vs. 19–23 days). The results of the bivariate analyses for other clinical and demographic variables are summarised in Table 2.

Table 2. Bivariate analysis of patient characteristics by timing of tangential excision

Variable	Tangential excision		p-value
	Early (N = 63)	Delayed (N = 37)	
Sex			
Male, n (%)	47 (74.6)	23 (62.2)	0.190[a]
Female, n (%)	16 (25.4)	14 (37.8)	
Age (years), mean ± SD	37.41 ± 12.41	41.65 ± 12.35	0.633[b]
Hospital stay (days), median (range)	20 (5-49)	20 (7-66)	0.274[c]
Prolonged hospital stay (ABA rule)			
Yes, n (%)	8 (12.7)	8 (21.6)	0.240[a]
No, n (%)	55 (87.3)	29 (78.4)	
Burn surface area (% TBSA), median (range)	30 (10-71)	29 (11-58)	0.449[c]
Burn wound degree, n (%)			0.664[a]
Superficial thickness	0 (0.0)	0 (0.0)	
Partial thickness	1 (1.6)	0 (0.0)	
Deep thickness	11 (17.5)	8 (21.6)	
Full thickness	51 (81.0)	29 (78.4)	

Notes: [a]*Chi-Square,* [b]*Independent T-test,* [c]*Mann-Whitney*

DISCUSSION

This study sought to determine whether early tangential excision reduces hospital stay among burn patients at Indonesia's national referral center. Although no statistically significant difference was detected, patients in the early excision group consistently showed a trend toward shorter hospitalization.

This study included 100 burn patients who survived until hospital discharge and received either early or delayed tangential excision at RSCM between January 2023 and December 2024. The majority of subjects were male (70%) with a mean age of 38.98 ± 12.49 years. This finding aligns with the study by Hayashi et al.[13], who also reported a predominance of male subjects. Similarly, Ayaz et al.[13] found that 62.2% of burn patients were male. In addition, the mean age in this study is consistent with that reported by Pathak et al.[14], who found a mean age of 42.6 ± 18.6 years among burn patients. A study by

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Mahalingam et al.[15] on the demographic profile of burn patients at a tertiary hospital in India found that most were in the productive adult age group (20–64 years). That study also found that the majority of subjects were male (51%).[15]

The median TBSA of burns sustained by subjects in this study was 29.5% (range 10–71%), with most burns being full-thickness. The extent and depth of burns reported in various studies vary widely. Pathak et al.[14] found a mean TBSA of 15.1 ± 3.8%, with 14.8 ± 4.2% being second- to fourth-degree burns.[14] Mahalingam et al.[15] reported that 54.7% of patients had burns covering 10–30% TBSA, with most cases being second-degree burns.[15] Each study uses different categorisations of burn extent and degree, depending on the researchers.

The median length of hospital stay among patients who underwent tangential excision was 20 days (range 5–66). Wardhana et al.[16] reported a median hospital stay of 11 days (range 1–26) in burn patients who underwent tangential excision. Meanwhile, Baraka et al.[17] found a median length of stay of 8 days (range 5–11). Dolp et al.[18] reported a median length of stay of 20 days (range 15–33) in burn patients who underwent tangential excision. The length of stay observed in this study is longer than in some previous studies, possibly due to differences in patient conditions included in each study. Nevertheless, most studies report a median hospital stay of more than one week, which is attributed to the time required for burn wound healing, consistent with the pathophysiology of burn recovery.[19,20]

Furthermore, although the median hospital stay in this study is longer than in previous reports, most subjects did not experience prolonged hospitalisation according to the "One day per per cent burn rule" proposed by Taylor et al.[21.] This indicates that the longer length of stay was also due to the extensive burn areas experienced by subjects in this study.

When evaluated against the American Burn Association (ABA) "one day per cent burn" rule, only 16% of patients in this study experienced prolonged hospitalisation. The proportion was lower in the early excision group (12.7%) compared to the delayed group (21.6%), although the difference was not statistically significant ($p = 0.240$). This rule was designed to encourage early excision and immediate grafting to shorten hospitalisation, thereby improving patient flow and resource use in burn units. The trend observed in our study suggests that early tangential excision facilitates better compliance with this benchmark, even though other clinical factors, such as burn size, comorbidities, infections, and delayed referrals, may have contributed to prolonged stays in both groups.

A total of 63% of subjects underwent early tangential excision. The median number of days to tangential excision was 5 (range 1–21). Wardhana et al.[16] defined early tangential excision as being performed within 5 days of the burn injury, and delayed excision as performed after 5 days. In their study, 76.2% of subjects underwent early tangential excision, and 23.8% underwent delayed excision.[16] Meanwhile, Baraka et al. categorised the timing of burn care into >12 hours and ≤12 hours, and found that only 29.5% of subjects received care after >12 hours.[17] Different studies use varying classification systems due to the lack of a universal consensus on the cutoff for early versus delayed excision. The timeliness of intervention is also influenced by available resources and facilities, which vary across study centres and contribute to differences in outcomes.

This study found that the range of hospital stay for burn patients who underwent early tangential excision was shorter compared to those who underwent delayed excision, although the difference was not statistically significant (20 [5–49] vs. 20 [7–66], $p = 0.274$). Nevertheless, the hospital stay was shorter in the early excision group. Hayashi et al.[12] also reported that the average hospital stay was shorter in patients who underwent early excision than in those who underwent delayed excision, but the difference was not statistically significant (68.9 ± 93.4 vs 75.7 ± 81.3, $p = 0.084$).[12] Wardhana et al. found a significant difference in length of stay between patients who underwent early (<5 days) and delayed (≥5 days) excision (9.81 ± 6.41 vs 15.8 ± 5.67; $p = 0.012$).[16]

Although not statistically significant, the difference in hospital stay between the two excision groups is clinically meaningful for both hospital management and patients. Furthermore, the findings of this study indicate that patients who underwent early excision had shorter hospital stays than those who underwent delayed excision.

These results differ from previous studies that found a significant correlation between hospital stay and the type of tangential excision.

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A meta-analysis of multiple randomised controlled trials (RCTs) by Miroshnychenko et al. found that early tangential excision significantly reduced hospital stay.[22] The difference in findings between this study and prior research may be due to different thresholds used to define early excision. In this study, the cutoff was 5 days, whereas in many RCTs included in the meta-analysis, it was less than 72 hours. The variation in these thresholds is also influenced by the guidelines adopted by each study centre.

This study has both strengths and limitations. It confirms the findings of previous research showing shorter hospital stays among patients undergoing early tangential excision, although the difference was not statistically significant. The threshold for defining early excision in this study could potentially be narrowed to 1–3 days, as suggested in prior studies. However, this study has several limitations. It was conducted at a single centre, the national referral hospital, where patients tend to have more complex conditions. This is evidenced by the fact that most subjects had full-thickness burns with a wide range of TBSA involvement (10%–71%).

Additionally, this study did not analyse the presence of comorbidities in patients. These factors reflect real clinical practice, where burn care—regardless of depth or extent—requires tangential excision to be performed as early as possible. Prior studies that found shorter hospital stays with early excision were often limited to patients with superficial partial-thickness burns and <30% TBSA, making them less representative of real-world cases. Therefore, further research involving subgroup analysis by burn extent is warranted to determine the effect of early excision across specific TBSA ranges.

Moreover, some subjects were referred patients who had already received treatment at other hospitals, meaning their initial therapy was not standardised, despite the fact that early burn treatment significantly impacts outcomes, including hospital stay. Nevertheless, this study attempted to minimise this limitation by excluding patients who died during treatment. Future studies with a cohort design and larger sample size could improve and validate the findings of this research. If the sample size is insufficient, a case-control study design may also be considered.

Despite its limitations, this study is the first to provide data on excision timing among patients with burns exceeding 30% TBSA in Indonesia. These findings suggest that narrowing the definition of early excision to 1–3 days, as recommended in previous literature, may result in stronger effects on hospital stay. In the context of Indonesia's national referral hospital, where late referrals and limited operating room availability are common challenges, these findings highlight the importance of optimising workflow to enable earlier excision whenever possible. From a policy perspective, standardising referral protocols and prioritising operating room allocation for burn patients could help reduce delays beyond the 5-day threshold. Implementing a national guideline that encourages excision within 3 days of injury, supported by sufficient surgical and anaesthetic resources, may improve patient outcomes and decrease healthcare costs. Therefore, this study not only contributes to the global discourse on burn care but also offers locally relevant insights to inform health policy and clinical practice in resource-limited settings.

CONCLUSION

This study found no statistically significant difference in hospital stay between early and delayed tangential excision, although early excision showed a trend toward shorter hospitalisation. Most patients were young adult males with extensive burns, and overall hospital stay remained within acceptable limits based on ABA guidelines. These findings underscore the need for prospective studies focusing on specific TBSA subgroups and support the development of national protocols that prioritise earlier excision and standardised referral systems to optimise burn care in resource-limited settings.

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