

DEMOGRAPHIC CHARACTERISTICS OF BURN MORTALITY AND ITS RELATION TO TANGENTIAL EXCISION AT BURN UNIT OF CIPTO MANGUNKUSUMO NATIONAL GENERAL HOSPITAL

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ABSTRACT

Background: Burn injury is considered as major problem because of high mortality and morbidity. One of the several managements to decrease the mortality rate is wound excision. This study aimed to describe the characteristics of burn mortality in our burn unit and its association with timing of tangential excision.

Method: We collect data of burn patients who died in 2016 at Burn Unit of Cipto Mangunkusumo Hospital. We investigate the association of mortality and timing of tangential excision. The data were compared with other studies from online databases.

Result: Thirty-four burn patients died at RSCM Burn Unit from January - December 2016. 13 patients underwent early tangential excision, the rest had delayed or no tangential excision. Only length of stay (LOS) has statistically significant result. The early tangential excision group has significantly longer median LOS ($p=0.003$) compared to delayed tangential excision. From five relevant studies, three studies had higher mortality in early tangential excision group compared to delay group but fewer complications and shorter LOS. Two studies reported a significant reduction in mortality in early tangential excision group while culture positive wounds were more frequent in the delay group.

Conclusion: Mortality in our patients in early tangential excision group is fewer than the delayed one. The early tangential excision group has longer length of stay compared to delay tangential excision. Although there are pros and cons from the literature review, we suggest that early tangential excision should be done in burn patients.

Keywords: *Demographics, burns, mortality, tangential excision*

Latar Belakang: Luka bakar merupakan salah satu masalah utama karena mortalitas dan morbiditasnya yang tinggi. Salah satu dari beberapa manajemen untuk menurunkan angka kematian adalah eksisi luka. Artikel ini bertujuan untuk mendeskripsikan karakteristik pasien luka bakar pada unit luka bakar kami dan hubungannya dengan waktu dilakukannya eksisi tangensial.

Metodologi: Kami mengumpulkan data pasien luka bakar yang meninggal pada tahun 2016 di Unit Bakar Rumah Sakit Cipto Mangunkusumo. Kami menyelidiki hubungan antara mortalitas dan waktu eksisi tangensial. Data dibandingkan dengan dengan studi lain dari *online database*.

Hasil: Terdapat tiga puluh empat pasien luka bakar yang meninggal dari Januari - Desember 2016. 13 pasien menjalani eksisi tangensial awal, sedangkan sisanya tertunda atau tidak menjalani eksisi tangensial. Hanya lama tinggal yang memiliki hasil signifikan secara statistik. Kelompok eksisi tangensial awal memiliki median lama rawat inap yang lebih lama secara signifikan ($p = 0,003$) dibandingkan dengan penundaan eksisi tangensial. Dari 5 literatur yang relevan. Tiga studi menyatakan adanya mortalitas yang lebih tinggi pada kelompok eksisi tangensial awal dibandingkan dengan kelompok penundaan tetapi lebih sedikit komplikasi dan lama rawat inap yang lebih pendek. Dua penelitian melaporkan bahwa ada penurunan yang signifikan dalam mortalitas pada kelompok eksisi tangensial awal

Kesimpulan: Mortalitas terjadi lebih sedikit pada kelompok eksisi tangensial awal dibandingkan dengan yang tertunda. Kelompok eksisi tangensial awal memiliki lama rawat yang lebih lama dibandingkan dengan penundaan. Meskipun ada pro dan kontra dari tinjauan literatur, kami menyarankan bahwa eksisi tangensial awal harus dilakukan pada pasien luka bakar.

Keywords: *Demographics, burns, mortality, tangential excision*

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BACKGROUND

Burns are one of the most devastating injuries in the world. All around the world, burns are considered one of the important causes of disability and mortality. Based on the report from World Health Organization (WHO), each year more than 300.000 people die from fire related injuries.¹ One of the major transformative concepts in burn care is excision and grafting. This is a surgical technique performed to remove the burn eschar and cover the exposed wound with autograft, allograft skin, or skin substitutes. The aim of this technique is to prevent or control the infection, conservation of all viable tissue, maintenance of form and function, timely closure of all wounds, early return to rehabilitative therapy, and decrease the mortality. Early excision and grafting fulfills all of these conditions.²⁻⁴

Few studies have assessed the association between burn mortality and the timing of early excision, and stated that early tangential excision can reduce mortality rate in burn patients.²⁻⁴ In reality, the number of mortality in our burn unit still quite high. Therefore, as one of the burns referral center in Indonesia (Cipto Mangunkusumo National General Hospital), we want to evaluate our procedure, especially tangential excision, whether early or delay tangential excision relate to mortality rate in our burn unit, using retrospective review of the death patients over a year period.

PATIENT AND METHOD

This study is retrospective observational analysis collected burn registry data at Cipto Mangunkusumo National General Hospital (RSCM). Our hospital serves as a referral center in Indonesia. Our Burn Unit have eight beds High Care Unit (HCU), two beds Intensive Care Unit (ICU), one Operating Theatre (OT), with one plastic surgeon and nurses certified with ICU, OT, and Burn. Our burn unit also have medical supporting group such as anesthesiologist, nutritionist, rehabilitation, internist, and pediatrician. Patients are admitted to the burn unit from emergency department with the initiation of fluid resuscitation using the Parkland Formula. Foley catheter was placed to monitor the adequacy of fluid resuscitation. Early tangential excision performed within seven days after injury. After seven days, we categorized into delay tangential excision.

Pre- and post-operatively patients undergo wound-dressing changes three days a week or when exudate leak in the gauze. We routinely use parafin gauze or silver sulfadiazine cream to dressed the patient, depending on the condition of the wound.

We collect demographic data of patients through burn registry. Specifically, data utilized in this study include age, gender, date of admission, mechanism of injury, time to presentation to hospital, percentage total body surface area (%TBSA), comorbidities, laboratory findings, date, and type of operative procedures, length of hospital stay, and date of death. All patients that death between January and December 2016 were included in this study.

We performed bivariate analysis to compare variables between mortality in early and delay tangential excision. Specific variables included age, gender, %TBSA, mechanism of injury, cause of death, length of stay, and time to presentation from injury. All statistical analysis was performed using SPSS v.20.0 (IBM Corp., Armonk, NY, USA). The Kruskal Wallis and Mann-Whitney test was used to compare the nonparametrical data and Fischer's Exact test was used to compare the qualitative data among two groups. A *p* value of less than 0.05 was regarded statistically significant.⁵

We search literature for the review from online databases: PubMed, Cochrane, and Burns Journal. We search literature about mortality in burn patients and the relation to timing of tangential excision. We limited the search on the date of publication for only 17 years and types of participants only in human. Then, we compared collected data with other studies through literature review.

PATIENT AND METHOD

Between January and December 2016, 146 burn patients were admitted to Burn Unit of Cipto Mangunkusumo National General Hospital. Among these patients, 34 patients were died during hospitalization. The demographic characteristics of the death patients described in Table 1.

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Table 1. Demographic characteristics of death patients

Characteristic	Total (%) (n=34)
Age categories: N (%)	
0-9 years	1 (2.9)
10-19 years	3 (8.8)
20-29 years	10 (29.4)
30-39 years	7 (20.6)
40-49 years	2 (5.9)
50-59 years	4 (11.8)
60-69 years	4 (11.8)
>70 years	3 (8.8)
Gender: N (%)	
Male	24 (70.6)
Female	10 (29.4)
%TBSA: N (%)	
<20%	2 (5.9)
20-39%	2 (5.9)
40-59%	14 (42.2)
60-79%	11 (32.4)
>80%	
Mechanism: N (%)	
Flame	29 (85.3)
Electrical	3 (8.8)
Chemical	2 (5.9)
Timing of excision	
Early	13 (38.2)
Delay	21 (61.8)
Cause of Death	
Multi organ failure (MOF)	2 (5.9)
Acute Respiratory Distress Syndrome (ARDS)	1 (2.9)
Burn shock	
Length of stay (days)	
Median (min-max)	10.50 (1-40)
Time to presentation from injury (days)	
Median (min-max)	1 (0-16)

Table 2. Demographic characteristic analysis between early (≤ 7 days after injury) and Delayed (>7 days after injury) tangential excision

	Early Tangential Excision (<i>n</i> = 13)	Delayed Tangential Excision (<i>n</i> = 21)	<i>p</i> value
Age categories: N (%)			
0-9 years	0	1	0.498 ^k
10-19 years	2	1	
20-29 years	3	7	
30-39 years	4	3	
40-49 years	0	2	
50-59 years	2	2	
60-69 years	2	2	
>70 years	0	3	
Gender: N (%)			
Male	11	13	0.251 ^f
Female	2	8	
%TBSA: N (%)			
<20%	2	0	0.268 ^k
20-39%	1	1	
40-59%	6	8	
60-79%	2	9	
>80%	2	3	
Mechanism: N (%)			
Flame	12	17	0.509 ^k
Electrical	1	2	
Chemical	0	2	
Cause of Death			
Multi organ failure (MOF)	13	18	0.372 ^k
Acute Respiratory Distress Syndrome (ARDS)	0	2	
Burn shock	0	1	
Length of stay (days)			
Median (min-max)	12 (7-40)	6 (1-19)	0.003 ^m
Time to presentation from injury (days)			
Median (min-max)	1 (0-5)	1 (0-16)	0.768 ^m

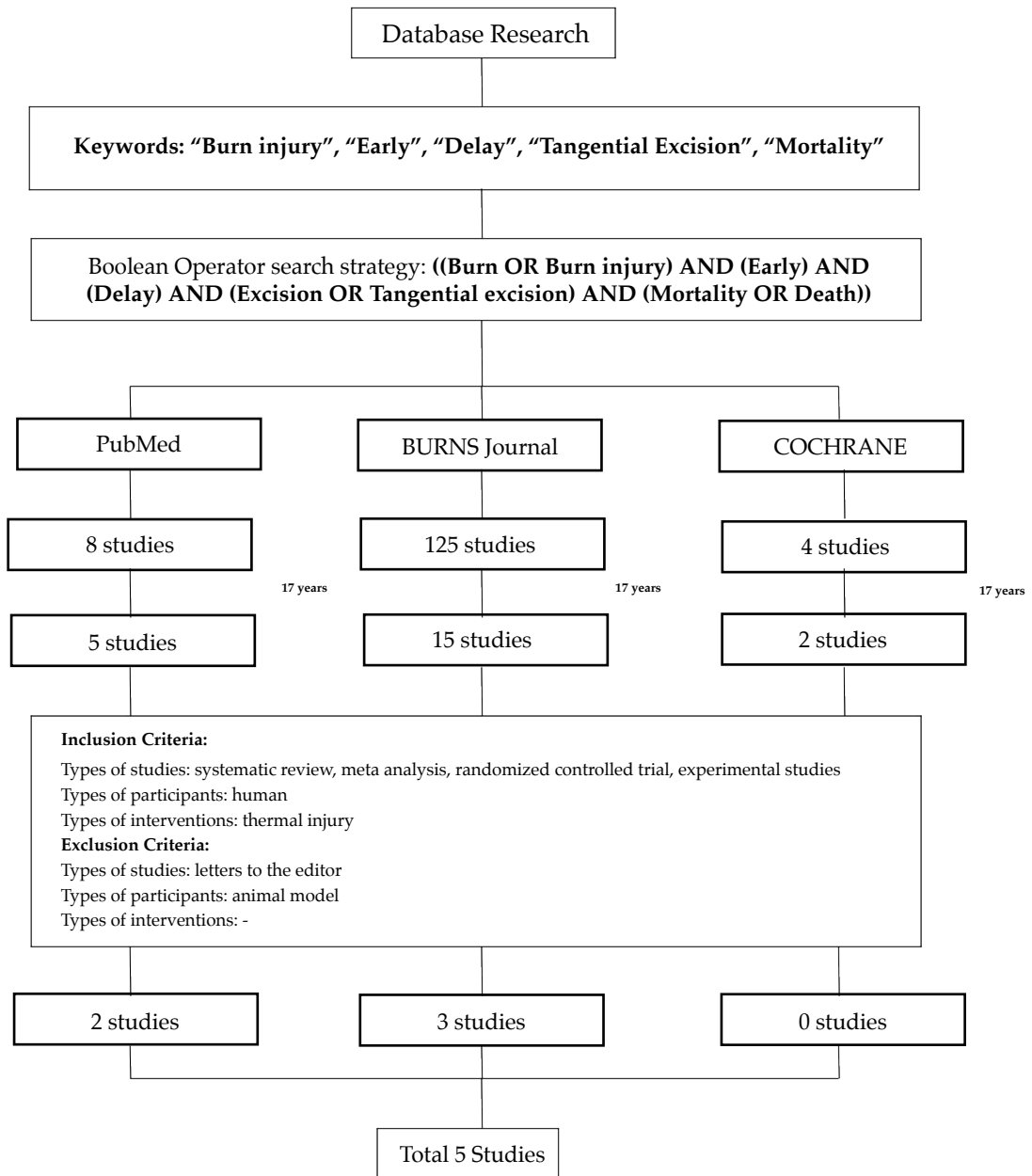


Figure 1. Detailed search history diagram

Author	Total Patient	Total Death Patient	Mortality			Cause of Death	Summary
			Early Tangential Excision Patient	Delay Tangential Excision Patient	No Tangential Excision (Conservative)		
Saaig ¹⁵ (2012)	120	4	0 of 60 (0%)	4 of 60 (6,67%)	N/A	Sepsis (100%)	<ul style="list-style-type: none"> • Culture positive wounds were more frequent in the delayed excision group • Shorter duration of antibiotic treatment in early excision group. Graft take in patients was significantly better with early excision • Significant shortening of post-graft hospital stay in patients who had undergone early excision and grafting
Xiao-Wu ¹³ (2002)	157	20	13 of 128 (10%)	7 of 29 (24,1%)	N/A	Sepsis (3), pulmonary complication (5), burn shock and renal failure (2), cerebral edema (2), cardiac arrest (1)	<ul style="list-style-type: none"> • Primary wound excision more than 48 hours after injury significantly increased the incidence of wound bacterial and fungal contamination, invasive wound infection, and sepsis
Hollander ¹⁶ (2013)	462	42	8 of 53 (15,1%) (p<0,08)	9 of 203 (4,4%) (p<0,08)	25 of 206 (12,1%)	Sepsis	<ul style="list-style-type: none"> • Early excision patients have higher mortality, but fewer complication. • Early excision patients spend fewer days in burn unit. • Significantly larger median size of burn a more serious burned cohort
Gallaher ² (2015)	905	156	23 of 91 (25,3%) (p=0,001)	17 of 184 (9,2%) (p=0,001)	116 of 630 (18,4%) (p=0,004)	Sepsis	<ul style="list-style-type: none"> • Early excision and grafting in a resource-poor area in sub-Saharan Africa is associated with a significant increase in mortality • Delaying the timing of early excision and grafting of burn patients in a resource-poor setting past burn day may confer a survival advantages • The late excision group had a significantly longer median length of stay, 20 days versus 41 days (p<0,0000) and had higher incidence of fever with 139 patients (71,3%) compared to 56 patients (28,7%) in early group (p=0,016)

Ong Yee Siang ¹⁰ (2005)	290	91	39 of 146 RR 0,73 (26,7%) (95% CI 0,52-1,01)	N/A	52 of 144 (36,1%)	N/A	<ul style="list-style-type: none"> • Reduction in mortality with early excision • Significant reduction in mortality with early excision in patients without inhalational injury (RR 0,36, 95% CI 0, 20-0,65) • Statistically significant increase in blood transfusion requirement in patients who had early excision of burns (SMD 1,65 95% CI 0,51 to 2,80) • The Length of hospital stay was significantly shorter in patients who had early excision of burns compared to those who did not (SMD 8,89, 95% CI 14,28 to 3,50)
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DISCUSSION

Early tangential excision are now considered as the standard surgical management of burn injuries.⁶ Tangential excision was introduced for the first time by Janzekovic in 1970. This procedure involved removal only the necrotic areas of burnt tissue then covered the exposed tissue with split thickness skin graft immediately. All layers of necrotic tissue are excised until a viable tissue is reached, as indicated by capillary bleeding.⁷

The optimal timing to do tangential excision still remains controversial. Some studies have reported that early tangential excision can be started after initial assessment and once the patient hemodynamically stable.⁷ Other studies described early tangential excision to range from 24 hours to within 6 days of the burn.⁸⁻¹⁰ In our burn unit, early tangential excision performed on 48 hours until 7 days after injury.

Studies have been demonstrated that tangential excision can reduce mortality. The mechanism for tangential excision of burns is by removing the eschar, it decreases the release of pro-inflammatory mediators and colonization of bacteria to the wound. Besides that, by covering the exposed tissue with skin graft, it reduces fluid loss and metabolic demand, and protects the wound from exposure to infectious organisms. These condition reducing the occurrence of systemic inflammatory response syndrome (SIRS), sepsis, and multi-organ failure 11-14. In addition to improvement in prognosis, early excision and grafting procedures have been shown to decrease the duration of hospitalization, incidence of metabolic

complications, burn wound contamination, post-burn contractures, and cost of burn treatment.

In our study, only 13 patients (38.2%) underwent early tangential excision, while the rest (n=21; 61.8%) were delayed or no tangential excision. This is because of the haemodynamic of the patients still unstable, therefore we have to wait until the patient possible to do the operations. Besides that, it can also happen because the patient itself not immediately went to hospital or delay of referring to our burn unit.

From our data, early tangential excision group has significantly longer median length of stay (12 days vs 6 days, p=0.003) compared to delay tangential excision. This result similar with study from Hollander et al¹⁶, but different from Gallaher et al². This condition is because we already did early tangential excision to the patients, but not immediately covered it with split thickness skin graft. We only have limited human resources and facilities, hence we can not do the skin graft immediately after early tangential excision. Our burn unit only have one operating room with minimal operating room's nurses. Besides that, we also did not have allograft to close the defect. Therefore, patients with early tangential excision in our study had longer length of stay than delay tangential excision group, although in the end the patient died due to not immediately covered by skin graft. The role of skin coverage after tangential excision was important in treating burn patients. Study from Gallagher et al² and Ong et al¹¹ stated that there is statistically significant increase in blood transfusion requirements in patients who had early excision of burns.

Saaq et al¹⁵ and Xiao-Wu et al¹⁴ stated that delay tangential excision group increase the incidence of bacterial infection, contamination, invasive wound infection, and sepsis. This might explain the reason for sepsis and multi organ failure as the major cause of death in burn patients, including in our patients. From all of this study, we can conclude that early excision patients have higher mortality, but fewer complication.

The limitation of our study is the number of patient that was includes in our study is too small, so in the analytical statistic, the distribution of the data tend to be not normal. Secondly, we did not include the surviving patients, hence we can not compare the survival based on timing of tangential excision. Moreover, the characteristic of patients in our study are diverse, so there are biases in subject similarity and process; and some confounding elements have not been taken into consideration like inhalation injury and burns depth and also the preoperative condition of the patients, which could have affected the results. Therefore we suggest to increase the number of patient and include all patients, both surviving and deceased patients, for further research. We can also investigate when sepsis first occurred in patients to determine whether sepsis follows early tangential excision or happen even before tangential excision done.

CONCLUSION

From data presented, mortality in our Burn Unit is fewer in early tangential excision group compared to delayed one. The early tangential excision group has longer length of stay compared to delayed tangential excision. Although there are pros and cons from the literature review, we suggest that early tangential excision should be done in burn patient, and covered the exposed wound with allograft, early definitive closure (autograft), and control the hypermetabolism condition.

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