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Original Research Paper

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CORRELATIONBETWEEN EARLY INFECTION AND ONSET OF DEBRIDEMENT IN OPEN DIAPHYSIS FRACTURE PATIENT AT H. ADAM MALIK MEDAN GENERAL HOSPITAL

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ABSTRACT

Background: Open fracture is one of the orthopedic emergency so that must be treated immediately. Fracture isa discontinuity of bone structure, cartilage and growth plates caused by trauma and non-trauma. Not only is the fracture or separation of the cortex, the incidence of fracture more often results in complete damage and separate bone fragments (Solomon et al, 2010).

According to location, long bone fractures are divided into diaphysis, metaphysis, epiphysis, intraarticular and fracture dislocations. Based on epidemiological analysis 40% of open fractures occur in the lower extremity, namely diaphysis of the tibia and femur. While based on fracture grades, according to Gustillo and Anderson in 1976 divided into grade I, II, IIIA, IIIB and IIIC.

KEYWORDS :

The most common complication of open fracture is infection. The incidence of infection in open fracture wounds varies. Therefore, prevention of infection is one of the main goals in handling open fractures. Reported number of infections in open fractures, from 214 cases of open fractures, obtained 41% grade I, 11%grade II and 15%grade III. In this case, 65% were fractures in the lower limb, and after examination there were superficial infection by 4,5%, inner tissue infection by 3%, while osteomyelitis by 7%.

Protocol that sets the best time for debridement in open fractures in 6 hours of trauma to reduce the risk of infection (Fernandes et al, 2015). Tissues that have lost their blood supply can inhibit wound healing and are a good medium for germ growth. Therefore, dead tissue such as skin, subcutaneous fat, fascia, muscle, and small bone fragments must be excised and washed, that known as debridement (Salter, 1999).The time between trauma and debridement is sometimes greater than 6 hours, which is caused by various factors, including the need to treat other injuries before treatment of bone fractures because trauma patients who come with open fractures often have more severe injuries that need to be managed before debridement, delays in the transfer of patients from other medical units and logistical problems, such as the availability of operating theater (Fernandes et al, 2015).Therefore the researchers want to see the correlationbetween early infection and onset of debridement in open diaphysis fracture patient at H. Adam Malik Medan General Hospital.

Methods

This study is a cross sectional study by collecting the medical records, conducted in the Orthopaedic and Traumatology Department at the Faculty of Medicine Universitas Sumatera Utara/ H. Adam Malik Medan General Hospital. The study sample was 56 patients with open diaphysis fractures who entered through the emergency room and were performed debridement in emergency operating theater from January to December 2018 that met the inclusion and exclusion criteria.

The inclusion criterias of this study were patients with open diaphysis bone fractures who entered the hospital through ED, had been performed debridement at emergency operating theater, were administered antibiotics at admission and during hospital stay and had been given anti tetanus prophylaxis. The exclusion criteriasof this study were had been performed amputation as emergency management, patients who loss to follow up (died), patients with other comorbidities such as type 2 diabetes mellitus, kidney disease, blood clotting disorders and chronic obstructive pulmonary disease.

Data that taken from medical records were age, gender, mechanism of trauma, fractured bone, fracture classification according to Gustilo-Anderson, time between trauma and debridement, and length of stay. Then observed the signs of early infection from medical record follow-up within 30 days after debridement, ie erythema, warm skin, edema, or discharge secretions that indicate infection in the surgical wound and other additional diagnostic tests,ie leukocyte levels, erythrocyte sedimentation rate, and cultureresult.

Data that has been collected, processed and presented descriptively in the table or diagramform and explained with narration. To assess the correlation between variables used Chi Square test which is presented in the form of cross tabulation using the SPSS program ver. 20.

RESULTS

Characteristics of Study Samples

In this study, 56 subjects were diagnosed with open diaphysis fracture. The majority of open diaphysis fracture patients were male by 41 (73.2%) patients, with an average age of 34.46 years old, the most common open diaphysis fracture was tibia bone in 22 (39.3%) cases, with IIIA classification was 24 (42.9%) patients. The most frequent mechanism of trauma was a traffic accident by 46 (82.1%) cases. The average onset of debridement was 12.46 hours after the fracture occurred. The length of staywas 4–12 days with an average of 6.41 days. The characteristics of the study sample can be seen in Table 1.

Table 1. Characteristics of Study Samples

Characteristics	Frequency (n)	Percentage (%)
Sex		
Male	41	73,2
Female	15	26,8
Age (y.o) (Mean(±SD))	34,46 (±12,856)	
Fractured bone		
Humerus	2	3,6
Radius	16	28,6
Ulna	2	3,6
Femur	8	14,3
Tibia	22	39,3
Fibula	6	10,7

Grade of open fracture		
I	3	5,4
II	10	17,9
IIIA	24	42,9
IIIB	19	33,9
Mechanism of trauma		
Traffic accident	46	82,1
Fall from height	5	8,9
Physical abuse	2	3,6
Struck down by heavy objects	3	5,4
Debridement onset (hour) (Mean (±SD))	(12,46(±10,523))	
Length of stay (day) (Mean(±SD))	(6,41(±1,735))	

It can also be seen the distribution of early infection incidence in the debridement onset > 6 hours and ≤ 6 hours groupbased on the grade of open fracture (Table 2).

Table 2 Distribution of Early Infection Incidence based on The Grade of Open Fracture

		Grade I		Grade II		Grade III	
		Early Infection	No Early Infection	Early Infection	No Early Infection	Early Infection	No Early Infection
Onset *Debridement*	>6 hrs	1	2	0	6	13	14
	≤ 6 hrs	0	0	0	4	3	13

Correlation between early infection and onset of debridement in open diaphysis fracture patient

The proportion of early infection in open diaphysis fractures patient at H. Adam Malik Medan General Hospital was 30.35%. To discover thecorrelation between early infection and onset of debridement in open diaphysis fracture patient, performed Chi square test. Chi square test result obtained a p value of 0.062 (Table 3), and in this study, the prevalence ratio is 2.59.

Table 3. Cross Tabulation between Onset of Debridement and Early Infection

		Early Infection		p Value
		Yes	No	
Onset ofDebridement	>6 hours	14	22	0,062
	≤ 6 hours	3	17	

RESULT

Characteristics of Study Samples

In this study, there were 41 (73.2%) males patient of open diaphysis fractures, and 15 (26.8%) females patient, with an average age of 34.46 years old. This is in line with most other studies. Study by Fernandes et al (2015) also found that the majority of their study samples were 118 (78.14%)maleand 33 (21.85%) female with an average age of patients was 31.76 (between 3- 87) years old (Fernandes et al. 2015). Another study found that the average age (SD) was 33.9 (16.3) years old, of which 79.0% of the samples were male (Srour et al. 2015). Other studies also state that male have a higher incidence of long bone fractures by 21.5 per 100,000 patients, compared with female with a incidence by 12.3 per 100,000 patients per year (Taki et al, 2017).

This study found tibial fractures (39.3%) were the most common open diaphysis fractures, followed by radius (28.6%), femur (14.3%), fibula (10.7%) and humerus and ulna (3.6% each). In the previous study, 76 tibia fractures were observed, which were the most affected bones (50.3%) (Fernandes et al. 2015). The most frequent fracture location of open fractures was tibia (48.3%), followed by femur (21.9%), radius-ulna (21.3%), and humerus (8.6%) (Srour et al. 2015).

According to the grade of open fracture, this study found that the most grade of open fracture were grade IIIA in 24 patients (42.9%). In line with Fernandes et al. (2015) who also found the fracture grade according to Gustilo-Anderson, namely 27 (17.88%) grade I, 42 (27.81%) gradeII, and 82 (54.30%) gradeIII were observed. Of these, 75 cases were gradeIIIA (49.66%), 2 cases gradeIIIB (1.32%), and 5 cases gradeIIIC (3.31%).

The most frequent mechanism of trauma is a traffic accident by 46 (82.1%) cases.Traffic accidents dominate the mechanism of trauma, involving 112 (74.18%) patients. Other mechanism of trauma are falling from height (7.95%), firearms injury (4.64%), sports injury (2.64%), physical abused (1.98%), crush injury (1.32 %), and most injuries (78.4%) are caused by blunt trauma (Fernandes et al. 2015).
In this study, the average onset of debridement was carried out at 12.46 hours after the fracture occurred. However, the reason for delaying debridement is not the focus of this study. In a study by Srour et al (2015), 64 (20.3%) patients underwent debridement within 6 hours after injury, 70 (22.2%) patients between 7 - 12 hours, 98 (31.1%) patients between 13 - 18 hours, and 83 (26.3%) patients between 19-24 hours.

In this study the duration of treatment was found to be 4-12 days with an average of 6.41 days. This is in contrast to previous studies which found that the average length of stay was 21 ± 13 days (Enninghorst et al. 2011).

Relationship of Early Infection Events with Onset of Debridement in Patients with Open Diaphysis Fracture

The management of open fractures has become a controversial topic. In hospitals that treat patients suffering from trauma, there is a consensus that the initial management of these fractures is ideally carried out in less than 6 hours. This theory is based on Friedrich's research which used soil and dust as infectious agents for wounds in experimental animals. In his study he showed that the initial phase of bacterial growth in contaminated wounds ended in 6 to 8 hours after inoculation. After this time, debridement will be less effective to control infection in the wound. Friedrich then recommended circumferential cleaning and excision within 6 hours.

This study found a value of p = 0.062 in the analysis of the relationship of the incidence of early infection with the onset of debridement in patients with open diaphysis fracture, meaning that the researchers did not find a significant association between the incidence of early infection and onset of debridement in patients with open diaphysis fracture in H. Adam Malik Hospital Medan. Although there is a possibility of type II errors (due to the limited number of cases) in this study, we did not find statistical significance between the onset of debridement and the incidence of early infection.

But in this study, the value of the prevalence ratio was 2.28. This means, the group with onset of debridement> 6 hours had a 2-fold greater risk factor for infection compared to the group with onset of debridement ≤ 6 hours.

This is in line with several limited retrospective and prospective studies that examined the effectiveness of early debridement only in tibial fractures. In a retrospective analysis of 103 patients with open tibial fracture, Khatod et al. (2003) found no increase in the incidence of infection in patients undergoing debridement in less than 6 hours compared to those who underwent debridement after 6 hours. Similarly, Tripuraneni et al. (2008) showed in a retrospective review of 206 patients with open tibial fractures that there was no difference in the results of infection based on debridement of less than 6 hours, 6 to 12 hours, and 12 to 24 hours. Enninghorst et al. (2011) prospectively demonstrated in a study of 89 patients that open tibial fracture debridement within an average of 8 hours, which concluded that fracture degrees were the only determinant of infectious complications in patients with blunt trauma. There was no difference in infectious complications between the early debridement group (≤6 hours) and delayed debridement (> 6 hours).

In a retrospective study of 67 patients with third degree open tibial

fracture, Singh et al (2012) showed no significant difference in infection rates for early debridement (≤6 hours) compared to delayed debridement (> 6 hours). Pollak (2010) showed in a prospective study of 307 patients with lower limb grade III Gustilo open fractures that there was no difference in infectious complications for 3 groups of debridement time (<5 hours, 5-10 hours, and> 10 hours). In England, Al-Arabi et al (2007) showed in a prospective study of 237 patients with long bone fractures over a 9-year period that there was no difference in rates of infectious complications for debridement of less than 6 hours or more than 6 hours. The study by Fernandes et al. found that there were 20 (13.24%) cases of infection in total, of which, 7 cases (35%) were in the group that had debridement in the first 6 hours.

For various reasons, debridement cannot always be done in the first 6 hours. In some cases, debridement was carried out by surgeons and anesthetists who were exhausted at inappropriate times (Landrigan et al 2004). Waiting times between 6 and 24 hours for surgical management of fractures can allow better preoperative planning of the procedure, better assessment of the severity of the associated injury, resulting in adequate clinical stabilization. In the current literature, there is no scientific evidence reporting that late debridement affects the incidence of infection (Mathes et al. 2006).

The weakness of this study is that this research is a cross sectional study with data taken from medical records, so that there are still confounding factors that can affect the results of the study, such as degrees of fracture, contamination that occurs in wounds before debridement, operator of debridement, and wound care during outpatient care.

CONCLUSION

There was no significant relationship between the incidence of early infection and onset of debridement in patients with open diaphysis fracture at H. Adam Malik General Hospital Medan (p value = 0.062). Patients with onset of debridement> 6 hours have two times the risk of early infection compared with the onset of debridement ≤ 6 hours in patients with open diaphysis fracture at H. Adam Malik General Hospital Medan (prevalence ratio value = 2.59)

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