VOLUME-7, ISSUE-10, OCTOBER-2018 • PRINT ISSN No 2277 - 8160

Original Research Paper

Orthopaedics

RELATIONSHIP BETWEEN LENGTH OF OPERATING TIME AND SUPERFICIAL SURGICAL WOUND INFECTION AFTER INTERNAL FIXATION ON CLOSED LONG FRACTURE BASED ON SOUTHHAMPTON WOUND SCORING SYSTEM

Uncok Ramses D. Simanjuntak — PPDS Department of Surgery, Faculty of Medicine, University of North Sumatra

Aga Shahri Putera Ketaren* — Division of Orthopedic Surgery and Traumatology, Faculty of Medicine, University of North Sumatra, *Corresponding Author

Nino Nasution — Division of Orthopedic Surgery and Traumatology, Faculty of Medicine, University of North Sumatra

ABSTRACT

PRELIMINARY The rate of nosocomial infections in Indonesia continues to increase, infections that occur in wounds caused by invasive surgical procedures are generally called surgical wound infections (ILO). Trauma is a common health problem in developing countries. Increased trauma in the last 10 years has triggered a high incidence of fractures managed by internal fixation. The purpose of this study was to determine the relationship between duration of surgery and superficial surgical wound infection after internal fixation on closed long bone fractures based on Southampton Wound Scoring System at H. Adam Malik General Hospital Medan

Research methods This study was a descriptive analytic study with a cross sectional design, which is a study that aimed to determine the relationship between the length of time of surgery with superficial pasca surgery wound internal fixation in long bone fractures based on the assessment of Southampton wound scoring system in H. Adam Malik General Hospital Medan, and was carried out in September 2017 to July 2018.Data is then analyzed using the Spearman's correlation test.

Research result In this study found 21 people with long closed bone fractures (70%), and 7 women (30%). This is in line with most other studies. Doshi et al (2017) study in 787 samples reported 628 people (79.8%) were men. Other studies also mention men have a higher incidence of long fractures, namely 21.5 per 100,000 patients, compared with women with an incidence of 12.3 per 100,000 patients per year (Taki et al, 2017).

This study found that the average age of patients who experienced long bone fractures was 39.03 ± 16.951 years. This was not much different from previous studies which found the average age of patients with long bone fractures was 36.4 years (SD 14.7) (Yongu et al, 2014).

In this study femur fracture was found to be the most long bone fracture, 12 cases (40%), followed by 8 cases of tibia fracture (26.7%). This is in line with previous studies which found that the overall incidence of fractures in the upper limbs was 159 (95% CI: 152-166), whereas the incidence of fractures in the lower limbs was 247 (95% CI: 238-256) (Meling et al, 2009) Similarly, the study by Yongu et al (2014) in Nigeria found that femoral fractures were found in 55.6% of samples, followed by 21.1% of tibia and fibula fractures, and humeral fractures of 15.7%. To determine the relationship between the length of time of surgery and the incidence of post-ORIF superficial surgical wound infection in long closed bone fractures, Spearman's rho correlation test was performed. In this study we found the results of the Spearman rho correlation test found $p < 0.001$ and $r = 0.624$. That is, there is a correlation between the length of time of surgery and the incidence of post ORIF superficial surgical wound infection in long closed bone fractures, with moderate relationship strength (r between 0.6-0.79).

Conclusion The relationship between the length of time of surgery and the incidence of post-ORIF superficial surgical wound infection in long closed bone fractures. Short operating times can reduce the incidence of surgical area infections. To shorten the operating time, the surgeon must be able to evaluate the fracture in detail when preoperative.

KEYWORDS : Operating Time, Surgical Wound Infection, Orif

PRELIMINARY

The number of nosocomial infections in Indonesia continues to increase, the results of a survey in 11 DKI Jakarta hospitals carried out by the Indonesian Infection Control Association and the Infection Disease Hospital Prof. Dr. Suliati Saroso Jakarta in 2003 received a number of nosocomial infections for urinary tract infections (UTI) 15.1%, surgical wound infections (ILO) 18.9%, 24.5% pneumonia, Peripheral Blood Flow Infection (IADP) 26.4%, other respiratory tract infections 15.1% (MOH, 2008). There are many factors that influence the risk of surgical wound infection, including surgery class, ASA value (American Society of Anesthesiologists), length of hospitalization before surgery, co-morbidity, risk index and implant installation (Ministry of Health, 2011).

Infection that occurs in wounds caused by an invasive surgical procedure is generally called surgical wound infection (ILO) in English called Surgical Site Infection (SSI). The ILO is one of the most important causes of nosocomial infection, where 1/3 of postoperative deaths are associated with surgical wound infections (NCC-WCH, 2008). Severe surgical wound infections (life-threatening) can occur 7-10 days postoperatively (NICE, 2008).

Trauma is a general health problem in developing countries as a result of accelerating urbanization and industrialization. Increased trauma in the last 10 years has triggered a high incidence of fractures that are managed with internal fixation (Doshi et al, 2012). Long bone fractures often occur due to significant traffic accidents and extreme sports. The humerus, ulna-radius, femur and tibia are long bone units, with tibia being the most common unit for fractures (Coughlin, 2005). Data show that around 25% of all cases of limb fractures are tibial fractures (Lua et al, 2017). Especially for closed fractures in long bones, there is a number of 1-4% of surgical wound infections (Gans, 2017).

There are three important features of susceptibility to infection, the first is the injury character (open / closed, degree of soft tissue damage, fracture energy degree, degree of vascular injury or contamination, and patient aspects which include age, diabetes, steroids, smoking, drug abuse or alcohol, and adherence), the second is the quality of surgery and facilities (surgical techniques, post-surgical care, and hygiene), and the third is the basic material used (the suitability of the material used, the character of the implant surface, implant design, number of cavities dead that may be formed, and borders next to moving tissues such as tendons) (Ovaska et al, 2011).

In a meta-analysis study of 2,214 cases of tibia plateau fractures treated ORIF, 219 cases of surgical wound infection were obtained.

The following parameters were identified as significant risk factors for the occurrence of post-ORIF surgical wound infection in tibial plateau fractures (p <0.05), including: open fracture compartment syndrome, length of surgery, smoking, and fixation (Shao et al, 2017)

In the Colman et al study, there were 309 cases studied with the results that, several risk factors such as age, sex, history of diabetes mellitus, cigarette consumption did not show a significant increase in the risk of surgical wound infection. While the degree of open fracture according to Gustillo's classification, the presence of fasciotomy in the case of complications of compartment syndrome, and the length of time an operation shows significant data in increasing the risk of surgical wound infection. (Colman et al, 2012).

The length of time an operation is a measure of the length of exposure to potential contamination, but also reflects the complexity of surgical procedures and techniques. This is defined as the time between the skin incision and the completion of skin closure. Overall, the duration of surgery over two hours increases the incidence of surgical wound infections, except for certain operations, such as vascular surgery, CABG and hepatobilers (Leong, 2006).

The longer the operating time, the more it increases the risk for surgical wound infection. This is supported in previous studies, which obtained data that the duration of surgery lasting more than two hours will increase the risk of infection (Gottrup F, 2005). The duration of surgery which increases the risk of surgical wound infection in total knee replacement is 127 minutes ± 45 minutes (p <0.001) (Peersman et al, 2005). Especially for internal fixation of tibia plateau fractures, the mean length of time that caused surgical wound infection was 2.8 hours (OR 1.78 and p <0.01). In other words, every increase of 1 hour the risk of surgical wound infection increased by about 78% (Colman et al, 2012). In other studies, there was an average operating time of 2.9 ± 1 hour which caused the incidence of surgical wound infection (Lin et al, 2013).

Assessment of surgical wound infections can be done with several systems, including assessment of the CDC (Center for Disease Control and Prevention), NHSN (National Healthcare Safety Network), ASEPSIS and Southhampton Wound Scoring System. The ASEPSIS method and Southhampton Wound Scoring System are the best scoring systems, and Southampton Wound Scoring System is simpler to use (Gottrup, 2005).

Based on these data, researchers were motivated to find a relationship between the length of time of surgery with superficial surgical wound infection after internal fixation on closed long bone fractures based on Southampton Wound Scoring System in RSUP H. Adam Malik Medan.

METHOD

1. This research is a descriptive analytic study with cross-sectional design. Samples were collected through medical record data with inclusion criteria. Patients with closed long bone fractures performed internation fixation at RSUP H. Adam Malik in Medan from September 2017 to May 2018. Patients with patients with fractures requiring arthroplasty, comorbid metabolic disorders and disorders immunologist, who underwent radiotherapy or chemotherapy before, who had an infection before internal fixation was performed. Patients with compartment syndrome. Sampling was done by consecutive sampling. Minimum sample number calculated based on the formula:

$$n = \left\{\frac{(Z\alpha + Z\beta)(1-r)}{0.5\ln(1+r)}\right\}^2 + 3$$

$$n = \left\{\frac{(1{,}96 + 0{,}842)(1-0.6)}{0.5\ln(1+0.6)}\right\}^2 + 3$$

$$n = \left\{\frac{1{,}1208}{0.5\ln(1{,}6)}\right\}^2 + 3$$

$$n = 25{,}7 \approx 26 \text{ sample}$$

Information:

N = Minimum sample number
Zα = standard normal distribution value (table Z) = 1.96
Zβ = standard normal distribution value (table Z) = 0.842
r = correlation test strength = 0.6

Based on the formula above, the minimum sample size of this study is 26 people.

The collected data will be presented descriptively in the frequency distribution table. Data on post-fixation patients internally in long-closed bone fractures in outpatients in the Orthopedic and Traumatology section then carried out a bivariate analysis with Spearmans Correlation.

RESULTS

Sample Characteristics

In this study, 30 subjects were diagnosed with fractures covered in long bones. The majority of patients with closed long bone fractures are men, 21 people (70%), with an average age of 39.03 years. Long bone fractures most often found in this study were femoral fractures as many as 12 cases (40%), followed by 8 cases of tibia fractures (26.7%). Operating time is 75 to 210 minutes and Southampton scores between 0-5. The characteristics of the study sample are attached to Table 4.2.

Table 1. Characteristics of Research Samples

Karakteristik	Frekuensi (n)	Persentase (%)
Jenis kelamin		
Laki-laki	21	70
Perempuan	9	30
Usia (tahun)	39,03 (±16,951)[a]	
Tulang yang fraktur		
Humerus	3	10
Radius	3	10
Ulna	2	6,7
Femur	12	40
Tibia	8	26,7
Fibula	2	6,7
Lama operasi (menit)	120(75-210)[b]	
Skor Southampton	2(0-5)[b]	10
0	3	30
1	9	23,3
2	7	30
3	9	0
4	0	6,7
5	2	

Based on the results of bivariate analysis with spearman's rho correlation test, p value = 0.001 was obtained (p <0.05), which shows there is a relationship between the length of surgery and the incidence of post-fixation superficial surgical wound infection in closed long bone fractures.

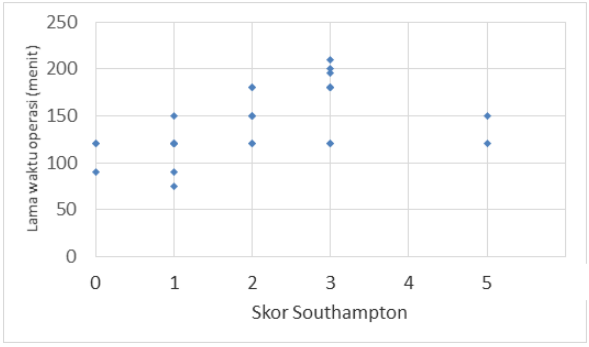

FIGURE 1. Data distribution duration of surgery with the incidence

of surgical wound infection

DISCUSSION

In this study found 21 people with long closed bone fractures (70%), and 7 women (30%). This is in line with most other studies. Doshi et al (2017) study in 787 samples reported 628 people (79.8%) were men. Other studies also mention men have a higher incidence of long fractures, namely 21.5 per 100,000 patients, compared with women with an incidence of 12.3 per 100,000 patients per year (Taki et al, 2017).

This study found that the average age of patients who experienced long bone fractures was 39.03 ± 16.951 years. This was not much different from previous studies which found the average age of patients with long bone fractures was 36.4 years (SD 14.7) (Yongu et al, 2014).

In this study femur fracture was found to be the most long bone fracture, 12 cases (40%), followed by 8 cases of tibia fracture (26.7%). This is in line with previous studies which found that the overall incidence of fractures in the upper limbs was 159 (95% CI: 152-166), whereas the incidence of fractures in the lower limbs was 247 (95% CI: 238-256) (Meling et al, 2009) Similarly, the study by Yongu et al (2014) in Nigeria found that femoral fractures were found in 55.6% of samples, followed by 21.1% of tibia and fibula fractures, and humeral fractures of 15.7%.

An ideal analysis of the causes of postoperative infections must certainly consider innumerable variables including patient characteristics, operating room environment, preparation and drapping of surgical locations, antibiotic administration, surgical techniques and postoperative care (Ren et al, 2015). Because it is not possible to thoroughly examine each variable that might influence the incidence of surgical wound infection, this study focuses on the length of surgery, where surgeons can still control it.

To determine the relationship between the length of time of surgery and the incidence of post-ORIF superficial surgical wound infection in long closed bone fractures, Spearman's rho correlation test was performed. In this study we found the results of the Spearman rho correlation test found $p < 0.001$ and $r = 0.624$. That is, there is a correlation between the length of time of surgery and the incidence of post ORIF superficial surgical wound infection in long closed bone fractures, with moderate relationship strength (r between 0.6-0.79).

The duration of surgery is one of the factors that contribute to the occurrence of post-ORIF surgical wound infections. Some previous studies are also in line with this study, which states that every 30 minutes of additional operating time contribute to an increase in the incidence of infection by 2.5% (Harrop et al, 2012; Procter et al, 2010). The study by Colman et al (2013) in patients with plateau tibia fractures also found that each additional 1 hour of surgery, the risk of postoperative surgical wound infection increased by about 78%. The duration of surgery is associated with the complexity of the operation. Complex surgery requires longer incisions, more extensive exposure, and has wider damaged soft tissue, and longer operating times also result in increased exposure to airborne pathogens and increased ischemia and necrosis. These factors contribute to the incidence of surgical wound infection (Shao et al, 2017).

In addition, there are many variables that affect operating time, including preoperative planning, surgeon experience, surgeon fatigue, operating room staff experience, equipment availability, characteristics of soft tissue, patient habitus, and fracture difficulties. Some of these variables can be manipulated and which cannot be manipulated, so surgeons must be aware of the effect of the length of time they operate on surgical wound infections and optimize their workflow. Therefore, further research is needed to find out the role of the above factors for the occurrence of surgical wound infections (Colman et al, 2014).

In conclusion, a short operation time can reduce the incidence of surgical area infection. To shorten the operating time, the surgeon must be able to evaluate the fracture in detail when preoperative.

CONCLUSION

Based on the results of the analysis of the data obtained, the conclusions that can be drawn in this study is that there is a significant relationship between the length of time of surgery with the incidence of superficial surgical wound infection after internal fixation of closed long bone fractures based on Southampton Wound Scoring System <0.001 with moderate correlation strength (r = 0.624; r = 0.6-0.8).

REFERENCES

1. Brunicardi FC et al, 2010. Schwartz's Principles of Surgery. 10th edition. New York: Mc Graw Hill Education. p241-51
2. Colman M et al, 2013. Prolonged operative time increases infection rate in tibial plateau fractures. NIH Public Access Author Manuscript.Vol. 44, No.2.p 249-252.
3. Depkes RI, 2008. Pedoman Manajerial Pencegahan dan Pengendalian Infeksi di Rumah Sakit dan Fasilitas Pelayanan Kesehatan Lainnya.Departemen Kesehatan Republik Indonesia.
4. Doshi P et al, 2017. Incidence of infection following internal fixation of open and closed tibia fractures in India (INFINITI): a multi-centre observational cohort study. BMC Musculoskeletal Disorders. Vol. 18, p 156-9.
5. Egol KA, Koval KJ, Zuckerman JD, 2010. The Handbook of Fractures.4th Edition.Philadelphia: Wolters Kluwer | Lippincott Williams & Wilkins.
6. Gans, 2017.Current practice of antibiotic prophylaxis for surgical fixation of closed long bone fractures: a survey of 297 members of the Orthopaedic Trauma Association.Patient Safety in Surgery. Vol 11, No.2.
7. Gottrup F, 2005. An Overview of Surgical Site Infections: Aetiology, Incidence, and Risk Factors. EWMA Journal. Vol. 5, No. 2.
8. Hogan BV, 2011. Surgery induced immunosuppression. The Surgeon. Vol 9, p38-43.
9. Kemenkes, 2011.Pedoman Surveilans Infeksi. Kementrian Kesehatan Republik Indonesia.
10. Leong G, 2006. Duration of operation as a risk factor for surgical site infection: comparison of English and US data. Elsevier: Journal of Hospital Infection. 63rd Edition.
11. Lua JYC et al, 2017. Complication of Open Tibia Fracture Management: Risk Factors and Treatment. Malaysian Orthopaedic Journal. Vol. 11, No. 1.
12. Meling T, Harboe K, Soreide K. 2009. Incidence of traumatic long-bone fractures requiring in-hospital management: A prospective age- and gender-specific analysis of 4890 fractures. International Journal of the Care of the Injured. Vol. 40. p1212-19
13. Moore KL, Agur AMR, Dalley AF, 2014.Essential Clinical Anatomy. 5th ed. Philadelphia:Lippincott Williams & Wilkins.
14. NICE, 2008. Surgical Site Infection: Prevention and Treatment of surgical site infection. National Institute for Health and Care Excellence Guideline.
15. Ovaska, 2011. Postoperative infection – removal of screws and plates?. Suomen Ortopedia Ja Traumatologia. Vol. 34.
16. Peersman G et al, 2006. Prolonged Operative Time Correlates with Increased Infection Rate After Total Knee Arthroplasty. New York: The Hospital for Special Surgery. Vol 2.p70-2.
17. SA Health, 2016. Surgical Site Infection (SSI) Surveiallance. Departement of Health, Government of South Australia.
18. Shao J et al, 2017. Incidence and Risk Factors for Surgical Site Infection after Open Reduction And Internal Fixation of Tibial Plateau Fractures: a Meta-analysis.International Journal of Surgery.
19. Solomon L, Warwick D, Selvadurai N, 2010. Apley's System of Orthopaedics and Fractures.9th edition. London: Hodder Arnold.
20. Stranding S, 2016.Gray's Anatomy: The Anatomical Basis of Clinical Practice.41th edition. London: Elsevier.
21. Vilensky JA, 2009. Rohen's Photographic Anatomy: Lower Limb. Indiana: Lippincot Williams & Wilkins. p.94-9.
22. Walraven & Musselman, 2013. The Surgical Site Infection Risk Score (SSIRS): A Model to Predict the Risk of Surgical Site Infections. PMC US National Library of Medicine.
23. Welsh A, 2008.Surgical Site Infection: Prevention and Treatment of surgical site infection. London: National Collaborating Centre for Women's and Children's Health
24. Yongu WT, Amaefula T, Elachi IC, et al. 2014. Indications and outcome of Open Reduction and Internal Fixation of Long Bones in Benue State North Central Nigeria. Sudan Journal of Medical Sciences. Vol.14.