MEDICAL RESEARCH REPORTS

Med Res Rep 2023;6(2):85-90
https://doi.org/10.55517/mrr.1293408

ORIGINAL ARTICLE

Evaluation of Factors Associated With Surgical Wound Infections in Lumbar Instrumentation Surgery

Mustafa Cemil KILINÇ[1], Baran Can ALPERGİN[2], Bekir TUNÇ[1]

[1] Hitit University, Erol Olçok Education and Research Hospital, Department of Neurosurgery, Çorum/Türkiye
[2] Ankara University, School of Medicine, Department of Neurosurgery, Ankara/Türkiye

ÖZET

Amaç: Lomber enstrümantasyon cerrahisini takiben yara iyileşmesi süreci ile ilişkili birçok faktör vardır. Bunların başında beyin omurilik sıvısı fistülü, ameliyat süresi, kanama miktarı, diyabet, obezite, sigara kullanımı, hemoglobin düşüklüğü, steroid kullanılması, eşlik eden malignite varlığı gelmektedir. Bu çalışmada hastaya ait risk faktörlerinden bağımsız olarak, operasyon süresi ve ortaya çıkan eritrosit süspansiyonu transfüzyon ihtiyacının yara iyileşmesine olan etkisinin incelenmesi araştırılmıştır. **Yöntem:** 2020-2022 yılları arasında 4 seviye ve altında lomber enstrümantasyon cerrahisi uygulanan 490 hasta çalışmaya dahil edilmiştir. Hastaların 362'si kadın 128'i erkektir. Ortalama cerrahi süre ve eritrosit süspansiyon ihtiyacı parametrelerinin cerrahi alan enfeksiyonu gelişmesi üzerine olan etkisi araştırılmıştır. **Bulgular**: 14 hastada (%2,8) kesi yeri enfeksiyonu görülmüştür. Kesi yeri enfeksiyonu gelişen 14 hastanın 12'sini ES verilmiş olan hastalar oluşturmaktadır. Kesi yeri enfeksiyonu gelişen 14 hastanın operasyon süresi ortalaması 120 dakika olarak bulunmuş iken, kesi yeri enfeksiyonu olmayan grupta ortalama ameliyat süresi 90 dakika olarak bulunmuştur. Kesi yeri enfeksiyonu ile eritrosit süspansiyonu transfüzyonu arasında anlamlı ilişki vardır ve eritrosit transfüzyonu verilmiş olanlarda kesi yeri enfeksiyonu ile karşılaşılması oranı daha yüksektir ($p<0,001$). Kesi yeri enfeksiyonu gelişmesi ile operasyon süresi uzaması açısından bakıldığında ise görülmektedir ki enfeksiyon gelişenlerde ortalama ameliyat süresi daha uzundur. ($p=0,001$) **Sonuç:** Hastaya bağlı risk faktörlerinden bağımsız olarak bakıldığında; cerrahi süresinin kısa olması ve eritrosit süspansiyonu transfüzyon ihtiyacı gerekmemesi yara yeri enfeksiyonunu azaltmaktadır.
Anahtar kelimeler: Cerrahi süre, Eritrosit süspansiyonu, Kesi yeri enfeksiyonu

ABSTRACT

Aim: Many factors are related to wound healing after lumbar instrumentation surgery. These include cerebrospinal fluid fistula, duration of surgery, amount of bleeding, diabetes, obesity, being a smoker, low haemoglobin levels, steroid administration, and accompanying malignancy. This study aims to investigate the effect of surgery duration and the need for erythrocyte suspension transfusion on wound healing, regardless of the patient's risk factors. **Methods:** 490 patients who underwent lumbar instrumentation surgery at four levels or below by a single surgeon between 2020 and 2022 were included in the study. 362 of 492 patients were female, and 128 were male. The relationship between the average surgical duration, erythrocyte suspension requirement parameters, and surgical wound infection rates was investigated. **Results:** Surgical wound infection was observed in 14 patients (2.8%). Of these 14 patients, 12 had a history of erythrocyte suspension transfusion. The average surgical duration for the 14 patients with surgical wound infection was 120 minutes, while 90 minutes for the group without surgical wound infection. There is a correlation between erythrocyte suspension transfusion and surgical wound infection, with a higher infection rate observed in patients with an erythrocyte transfusion history ($p<0.001$). Additionally, there is a correlation between the development of surgical wound infection and prolonged surgical duration, as patients who experience an infection tend to have longer surgical durations ($p=0.001$). **Conclusion:** Considered independently of patient-related risk factors, short surgical time and no need for erythrocyte suspension transfusion reduce wound infection.
Keywords: Surgical duration, Erythrocyte suspension, Surgical wound infection

Cite this article as: Kılınç MC, Alpergin BC, Bekir B. Evaluation of Factors Associated With Surgical Wound Infections in Lumbar Instrumentation Surgery. Medical Research Reports 2023; 6(2):85-90

Corresponding Author: Baran Can Alpergin **Correspondence Adress:** Ankara University Faculty of Medicine, Department of Neurosurgery, 06100, Ankara/Türkiye Mail: balpergin@gmail.com Received: 06.05.2023; Accepted: 12.06.2023

INTRODUCTION

Postoperative surgical wound infections after lumbar instrumentation surgery are among the most challenging complications that require extended hospitalization. Obesity, diabetes, smoking, malignancy, steroid use, malnutrition, and poor hygiene can affect wound healing after surgery (1, 2). Moreover, the size of the surgical area, amount of bleeding, duration of surgery, cerebrospinal fluid (CSF) leakage into the surgical site due to dural injury, and the use of prophylactic or postoperative antibiotics also affect the surgical wound infections (3-5). The most common microorganisms that cause surgical wound infections are Staphylococcus aureus, Staphylococcus epidermidis, and methicillin-resistant Staphylococci (6). The aim of this study was to show the critical role of decreasing the duration of the surgical procedure and minimizing the utilization of erythrocyte suspension (ES) transfusions to effectively lower the incidence of surgical wound infections after lumbar spinal surgery.

MATERIAL AND METHODS

Between 2020 and 2022, 490 patients who had undergone surgery and instrumented for four lumbar vertebral levels or below were included in the study. The mean operative duration, ES transfusion history distributions, and mean age and gender distribution of patients were measured.

As part of the preoperative protocol, all patients were administered a prophylactic dose of cefazolin to ensure surgical prophylaxis. Posterior opening for skin and muscles was performed after appropriate surgical field sterilization. Lumbar instrumentation under fluoroscopic guidance, total laminectomy, and foraminotomy was performed using a microsurgical technique. In patients who developed cerebrospinal fluid leakage due to dural tears during the surgery, routine dural repair was performed. After surgical procedures were completed, drains were inserted in 434 patients, and the operation was completed. Patients with drains were monitored with the drain for two days after surgery, and then the drain was removed under appropriate sterile conditions. Patients, on average, remained hospitalized for four days following the surgery. Patients who experienced cerebrospinal fluid leakage during the surgery or received 1 unit or more of erythrocyte suspension were given prophylactic cefazolin (2x1 gram intravenously) for three days post-surgery.

The surgical duration and need for ES transfusion during the operation were investigated and noted based on the surgical records and patients' files. In addition, the relationship between operation time and transfusion history parameters, and the development of surgical wound infections was investigated.

This retrospective study was approved by the Clinical Research Ethics Committee of Ankara University (Confirmation date 21/03/2022, no. I04-164-22).

Statistical Analysis:

SPSS 22.0 software program for Windows used for statistical analysis. The Mann-Whitney U test was used to find the relationship between infection and surgical duration, and the Chi-square test was used to assess the association between infection and ES transfusion. Statistical significance was defined as a p-value of less than 0.05.

RESULTS

Among the 490 patients who underwent surgery, 14 (2.8%) developed surgical wound infections on average 3 days (3 ± 1.06) after surgery. A microbial etiological agent identification was pursued by collecting wound swab cultures from patients who developed a surgical wound infection. According to the Department of infectious diseases recommendations, these patients were treated with antimicrobial agents. Of the 14 patients with surgical wound infection, 4 had Staphylococcus epidermidis growth in their wound cultures. Microbial growth was not detected in the swab cultures obtained from the remaining ten patients. None of these patients required wound debridement during follow-up, and all 14 patients achieved wound healing after an average of four weeks of intravenous antibiotic treatment (Table 1).

Table 1. The distribution of patients in the wound infection and non-infection groups

	SWI (+)	SWI (-)
	14	476
Patients (F/M)	(10/4)	(352/124)
Average age(F/M)	(63.2/60.4)	(60.1/58.7)
Number of patients who developed CSF leak	2	10
Surgical duration (minutes)	120 ± 30	90 ± 30
Number of patients who received ES transfusion	12	78

F: Female, M: Male, SWI: Surgical wound infection, CSF: Cerebrospinal fluid, ES: Erythrocyte suspension

A total of 90 patients required ES transfusion, and among these 90 patients, 78 did not develop surgical wound infections, while 12 patients developed surgical wound infections. The results obtained from this study indicate that among the total of 14 patients who developed surgical wound infections, 12 had a history of ES transfusion. There is a relationship

between the development of infection and the history of ES transfusion ($p<0.001$), and infection rates are higher in patients who received ES transfusion.

The average surgical duration was 90 minutes (90 ± 29.96) in 476 patients who did not develop surgical wound infections, whereas, in 14 patients who developed surgical wound infections, the average surgical time was found to be 120 minutes (120 ± 28.82). There is a correlation between the development of infection and the length of surgical time; surgical time is longer in patients who develop wound infections ($p=0.001$).

DISCUSSION

Our study found that the mean surgical duration was calculated as 120 ± 30 minutes, shorter than the durations reported in the literature. For the 14 patients who had surgical wound infections, the mean surgery time was 120 minutes. In patients who did not develop surgical wound infection, the mean surgery time was 90 minutes. As surgical duration increases, the risk of infection also increases. Prolonged surgical duration also indirectly leads to the need for ES transfusion, which further increases the risk of wound infection. These findings align with previous studies reported in the literature. Prolonged surgical duration, increased bleeding, and the need for ES transfusion increases the risk of surgical wound infection.

There have been numerous investigations in the literature regarding the occurrence of surgical wound infections after spinal instrumentation. Xing et al. reported a systematic review of 36 studies and identified 46 risk factors for the development of infections (7). The incidence of surgical wound infections following spinal instrumentation varies widely across different case series, ranging from 1% to 10%. This wide range can be attributed to numerous independent factors affecting wound healing and variations in the number of patients included in each study (7). Liu et al. identified age, diabetes, use of hormones, and drainage duration of more than two days as independent risk factors that affect the occurrence of surgical site infections. In their series of 296 cases, the number of surgical site infections was reported to be 29 (9.8%) (1). Deng et al., which included a series of 2252 cases, reported that male gender, diabetes, and the presence of coronary artery disease increase the risk of surgical site infections following spinal instrumentation surgery (8). Hijaz-Gomes et al. reported a surgical site infection rate of 3.9% in their study that included 892 patients and noted that patients with an operative duration exceeding 150 minutes had a higher incidence of surgical wound infection (9). Kim et al. similarly reported an increased risk of infection with longer spinal surgeries. In their study of patients undergoing single-level lumbar fusion, the average surgical time was reported to be 197 ± 105 minutes, and it was emphasized that surgeries lasting longer than 5 hours might require re-operation due to surgical infection (10).

When examining the most extensive case series in the literature investigating the association between ES transfusion and spinal

surgical site infection, Kato et al. reported that the transfusion of ES is a risk factor for surgical wound infections (4). Likewise, Woods et al. observed a higher incidence of surgical wound infections in patients who received red blood cell transfusions. In their study of 1799 patients, the surgical site infection rate was 3.1% (11). In their analysis of 3,721 cases, Jannsen et al. highlighted an increase in spinal surgical site wounds and urinary tract infections in patients with a transfusion history of ES. The study included 45 patients who received ES, with 1 unit given to 40 patients and two units given to 5 patients. Of these patients, 6 developed surgical site infections (12).

CONCLUSION

Prolonged surgical duration and the need for erythrocyte transfusion are associated with developing surgical wound infections. Conversely, reducing the operation time and blood loss can lower the occurrence of surgical wound infections.

Funding: This research was not funded.

Conflict of Interest Statement: The authors have no conflict of interest regarding the article.

References

1. Liu C, Qian ZG, Sun QC. [Analysis of risk factors of postoperative wound infection in lumbar spondylolisthesis]. Zhongguo Gu Shang. 2019;32(10):882-5.
2. Meng F, Cao J, Meng X. Risk factors for surgical site infections following spinal surgery. J Clin Neurosci. 2015;22(12):1862-6.
3. Guerin P, El Fegoun AB, Obeid I, Gille O, Lelong L, Luc S, et al. Incidental durotomy during spine surgery: incidence, management, and complications. A retrospective review. Injury. 2012;43(4):397-401.
4. Kato S, Chikuda H, Ohya J, Oichi T, Matsui H, Fushimi K, et al. Risk of infectious complications associated with blood transfusion in elective spinal surgery-a propensity score-matched analysis. Spine J. 2016;16(1):55-60.
5. Kim B, Moon SH, Moon ES, Kim HS, Park JO, Cho IJ, et al. Antibiotic Microbial Prophylaxis for Spinal Surgery: Comparison between 48 and 72-Hour AMP Protocols. Asian Spine J. 2010;4(2):71-6.
6. Zhou J, Wang R, Huo X, Xiong W, Kang L, Xue Y. Incidence of Surgical Site Infection After Spine Surgery: A Systematic Review and Meta-analysis. Spine (Phila Pa 1976). 2020;45(3):208-16.
7. Xing D, Ma JX, Ma XL, Song DH, Wang J, Chen Y, et al. A methodological, systematic review of evidence-based independent risk factors for surgical site infections after spinal surgery. Eur Spine J. 2013;22(3):605-15.
8. Deng H, Chan AK, Ammanuel S, Chan AY, Oh T, Skrehot HC, et al. Risk factors for deep surgical site infection following thoracolumbar spinal surgery. J Neurosurg Spine. 2019;32(2):292-301.
9. Hijas-Gomez AI, Egea-Gamez RM, Martinez-Martin J, Gonzalez-Diaz R, Losada-Vinas JI, Rodriguez-Caravaca G. Surgical Wound Infection Rates and Risk Factors in Spinal Fusion in a University Teaching Hospital in Madrid, Spain. Spine (Phila Pa 1976). 2017;42(10):748-54.
10. Kim BD, Hsu WK, De Oliveira GS, Jr., Saha S, Kim JY. Operative duration as an independent risk factor for postoperative complications in single-level lumbar fusion: an analysis of 4588 surgical cases. Spine (Phila Pa 1976). 2014;39(6):510-20.
11. Woods BI, Rosario BL, Chen A, Waters JH, Donaldson W, 3rd, Kang J, et al. The association between perioperative allogeneic transfusion volume and postoperative infection in patients following lumbar spine surgery. J Bone Joint Surg Am. 2013;95(23):2105-10.

12. Janssen SJ, Braun Y, Wood KB, Cha TD, Schwab JH. Allogeneic blood transfusions and postoperative infections after lumbar spine surgery. Spine J. 2015;15(5):901-9.