e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(4); 1057-1060

Original Research Article

Drain Tip Culture: Would it Help us Predict and Prevent Surgical Site Infection after Orthopaedic Surgery?

Kirit L. Jadav[1], Himanshu Ladani[2]

[1]Assistant Professor, Department of Orthopedics, GMERS Medical College and Hospital, Junagadh, Gujarat, India

[2]Associate Professor, Department of Orthopedics, GMERS Medical College and Hospital, Junagadh, Gujarat, India

Received: 25-01-2024 / Revised: 23-02-2024 / Accepted: 26-03-2024

Corresponding Author: Dr. Himanshu Ladani

Conflict of interest: Nil

Abstract:

Background and Objective: Systematic cultures of drain tips or drainage fluids are commonly used by surgical teams for the early detection of SSI, even in the absence of clinical suspicion of infection. However, their prognostic values are controversial. Objective of the study was to evaluate the diagnostic value of drain tip culture in predicting surgical site infection.

Material and Methods: This study prospectively included 183 patients who undergoing into spine surgery at Central Orthocare Hospital, Junagadh. Patients with active infection in body excluded from study. Prophylactic antibiotic will be administered intra-operatively and postoperatively as per institute's protocol. Drains from surgical site will be removed when the volume of postoperative fluid drainage was less than 50 ml in the preceding 24 hours and drain tip will be sent for culture. Surgical site infection (SSI) will be defined according to Centers for Disease Control and Prevention criteria.

Results: Surgical Site Infection rate is 2.73 % in our study and out of 5 positive SSI one patient having MRSA while others having only clinical evidence of infection. Drain tip positive rate is 2.18 %. Association of DTC with SSI having high specificity and NPV of 98.31 % & 97.76 % respectively and low sensitivity & PPV of 20 % & 25 % respectively with p value less than 0.05.

Conclusion: We are unable to conclude that the result of a drain tip culture always indicates the presence or absence of an SSI. But with p value of less than 0.05 drain tip culture is significantly associated with surgical site infection with high specificity, high negative predictive value and low sensitivity & low positive predictive value.

Keywords: Drain tip culture, Orthopaedic Surgery, Surgical site infection.

Introduction

Surgical site infection (SSI) is an important operative complication with significant morbidity and represents an economic burden [1]. The reported incidence of SSI following spine surgery is in the range of 0.2% to 7.2% [2-6]. Given the elevated morbidity and neurologic dysfunction associated with delayed treatment, early detection and initiation of appropriate management is vital.

The contamination of the surgical site may occur during pre-operative, per-operative or post-operative periods. Surgical drainage can be used to prevent hematoma formation, and thus SSI, but can also be a risk factor for SSI [7]. Indeed, many studies have found an association between the presence of surgical drainage and SSI or between the drainage duration and the proportion of SSI [7,8,9]. Systematic cultures of drain tips or drainage fluids are commonly used by surgical teams for the early detection of SSI, even in the absence of clinical suspicion of infection. However, their prognostic values are controversial, and the collection and laboratory processing of these samples are costly and time-consuming [10].

SSIs are generally diagnosed by findings on physical examination such as localized tenderness, warmth, erythema, and edema or by increased levels of certain inflammatory markers including white blood cell count, erythrocyte sedimentation rate, and C-reactive protein.

Material and Methods

This study prospectively included 183 patients who underwent spinal surgery at Central Orthocare Hospital, Junagadh. All patients undergoing spine surgery at central orthocare Hospital, Junagadh and patients willing to give consent and participate in

the study are included in study. Patient not fulfilling inclusion criteria, patient not willing to participate in the study or not willing to sign the consent form, any active infection in the body and patients diagnosed with any infection of spineare excluded from study. Informed consent will be taken from patients undergoing study.

Prophylactic antibiotics will be administered intra-operatively and postoperatively as per institute's protocol. A close suction drainage system will apply in all the operations. A 12 Fr drain tube will placed subfascially and bring out through separate skin incision.

Drains from surgical site will be removed under sterile precaution when the volume of postoperative fluid drainage was less than 50 ml in the preceding 24 hours and drain tip will be sent for culture. Data from culture studies using the distal tip of the wound drain will be used for analysis. Even if the drain tip culture is positive, we will not administer additional antimicrobial agents without other signs suggestive of surgical site infection.

All patients will be treated with antimicrobial prophylaxis based on evidence-based guidelines and will be followed for at least 6 months after surgery. Post-operative visits will be at 15 days for stich removal, at 6 weeks, at 3 months and at 6 months to look for clinical sign of surgical site infection besides routine check-up. In case of suspected surgical site infection, wound swab would be collected and sent for microbiological analysis. Culture report to be recorded and treatment as per sensitivity report. Surgical site infection (SSI) will be defined according to Centers for Disease Control and Prevention criteria.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution. Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

SSIs were identified in 05 of the 183 patients (2.73 %). Bacteria are isolated from the surgical site in 01 cases (20 %) in which MRSA is isolated while other 4 cases of SSIs there is clinical evidence of infection but no any organisms are isolated. Table 1 shows the relationship between DTCs and SSI group.

Table 2 shows the demographic characteristics of patients. Mean age of surgery is 54.64 ± 14.24 years. Male/Female ratio is 85/98. Out of 183 patients 85 having Hypertension, 50 having Diabetes mellitus, 13 having thyroid problems, 13 having dyslipedemia and 07 having other comorbidities. In total, 29 patients underwent cervical surgery, 19 patients underwent thoracic surgery, and 150 patients underwent lumbosacral surgery.

Estimated operative time is 104.42 ± 57.69 minutes. Estimated blood loss is 199.69 ± 160.27 ml. There is total 74 cases of multilevel surgeries and 109 cases of single level surgery. Instrumentation done in 127 cases while 56 cases are uninstumented. Prediction of SSIs was possible based on a positive drain culture (Table 3). Out of 04 DTC positive patient 01 patient develop SSI while Total of 4 patients develops SSI with negative DTC.

Drain tip cultures had a sensitivity of 20%, specificity of 98.31 %, positive predictive value (PPV) of 25 %, and negative predictive value (NPV) of 97.76 % and p value of 0.005741 for detecting a wound infection. Out of 05 SSI positive patients 03 undergoing multilevel surgery while 02 undergoing single level surgery, 02 patients undergoing instrumentation while 03 patients undergoing uninstrumentation.

Table 1: Association between Drain Tip culture and Surgical Site Infection

	SSI Positive	SSI Negative	Total
DTC Positive	01	03	04
DTC Negative	04	175	179
Total	05	178	183
P Value		0.005741	

Table 2: Demographic factors, co-morbidities, peri-operative factors

Items	Number or mean ± SD (n = 178)
Demographics	
Age (Years)	54.64 ± 14.24
Sex (Male/Female)	85/98
Region of surgery*	
Cervical	29

Dorsal	19
Lumbosacral	150
Co-morbidities*	
Diabetes Mellitus	50
Hypertension	85
Thyroid	13
Dyslipedemia	13
Others	07
Surgery	
Operative Time (min)	104.42 ± 57.69
Estimated Blood Loss (ml)	199.69 ± 160.27
Multilevel	74
Single level	109
Insrumentation	127
Uninstrumentation	56
*There is some overlap	

Table 3: Prediction of SSIs Using Positive Drain Culture

Prediction of SSI	Percentile (%)
Sensitivity	20
Specificity	98.31
PPV	25
NPV	97.76

Table 4 : Relation of SSI with level of surgery and use of instrumentation

	Single Level	Multilevel	Instrumented	Uninstrumented
SSI Positive	02	03	02	03
SSI Negative	107	71	125	53

Discussion

Closed suction drainage is an established method that has the aim of preventing wound hematoma. A drain tip culture is a convenient and noninvasive method [11,12], but may not be appropriate as a routine test because the evaluation of infection may be unreliable [13]. It has also been suggested that bacteria identified in the SSI and in drain tip culture results may not necessarily match [14]. In addition, routine culture of all suction drain tips is expensive and hence may not be cost effective [15]. Thus, the appropriate strategy for use of drain tip cultures is unclear. Bacterial detection rates of 0%–10.8% have been reported in drain tip cultures in orthopedic surgery [12,14,16,17]. In our study bacterial detection rate in drain tip culture is 2.18 %. Previously, Sørensen and Sørensen [12] reported that early removal of the drain decreases the risk of retrograde migration of bacteria from the skin, and the frequency of positive drain tip cultures and the risk of infection are substantially increased if the drainage time is >6 days; thus, early removal of drains seems to be appropriate. Weinrauch [14] suggested that the low rate of culture-positive drain tips may partly be due to early removal, as well as to postoperative antibiotic prophylaxis while drains remain in place.

In orthopedic surgery, Sankar et al [18] found that suction tip cultures had a sensitivity of 75%, specificity of 97%, PPV of 50%, and NPV of 99% for prediction of SSIs. In spinal surgery with instrumentation, Nakayama et al [19] found a sensitivity of 60%, specificity of 98%, PPV of 60%, and NPV of 98% for prediction of deep SSIs using suction tip cultures. In our study has Sensitivity of 20 %, Specificity of 98.31 %, PPV of 25 % and NPV of 97.76 %. Thus only Specificity and NPV value match with previous studies.

Infections after spinal surgery are most commonly caused by Gram-positive organisms found on skin flora, most notably Staphylococcus aureus and Staphylococcus epidermidis (MSSE). [20] However, the incidence of infection with methicillin-resistant bacteria (including MRSA) is increasing, [21] and MRSA has also increased in postsurgical infection. [22] In our study organism isolated in SSI in only one patient and that organism is MRSA. There is no significant difference between use of instrumentation and uninsrumentation, no significant difference in level of surgery.

There are several limitations in this study, including the modest sample size, and different types of surgery included and inclusion of too many young patients.. We also only used a cultured drain tip, and the drain fluid was not cultured. In addition, it was difficult to determine whether contamination had occurred in a case with a

positive drain culture but no SSI. Regardless, if bacteria are detected on the drain tip, infection should be suspected and wound puncture and a bacterial culture test should be performed. Cases with detection of the same bacteria in the drain tip and bacterial culture test have a higher possibility of SSI and contamination of the drain tip is unlikely. We are unable to conclude that the result of a drain tip culture always indicates the presence or absence of an SSI. But with p value of less than 0.05 drain tip culture is significantly associated with surgical site infection with high specificity and high negative predicted value.

References

1. Chahoud J, Kanafani Z, Kanj SS. Surgical site infections following spine surgery: eliminating the controversies in the diagnosis. Front Med (Lausanne) 2014; 1:7.
2. Gaynes RP, Culver DH, Horan TC, et al. Surgical site infection (SSI) rates in the United States, 1992–1998: the National Nosocomial Infections Surveillance System basic SSI risk index. Clin Infect Dis 2001; 33 (suppl 2):S69–77.
3. O'Toole JE, Eichholz KM, Fessler RG. Surgical site infection rates after minimally invasive spinal surgery. J Neurosurg Spine 2009; 11:471–6.
4. Smith JS, Shaffrey CI, Sansur CA, et al. Rates of infection after spine surgery based on 108,419 procedures: a report from the Scoliosis Research Society Morbidity and Mortality Committee. Spine (Phila Pa 1976) 2011; 36:556–63.
5. Olsen MA, Mayfield J, Lauryssen C, et al. Risk factors for surgical site infection in spinal surgery. J Neurosurg 2003; 98: 149–55.
6. Weinstein MA, McCabe JP, Cammisa FP. Postoperative spinal wound infection: a review of 2,391 consecutive index procedures. J Spinal Disord 2000; 13:422–6.
7. Reiffel AJ, Barie PS, Spector JA. A Multi-Disciplinary Review of the Potential Association between Closed-Suction Drains and Surgical Site Infection. Surg Infect 2013; 14:244-269. https://doi.org/10.1089/sur.2011. 126.
8. Barbadoro P, Marmorale C, Recanatini C, Mazzarini G, Pellegrini I, D'Errico MM, et al. May the drain be a way in for microbes in surgical infections? Am J Infect Control 2016 Mar 1; 44:283-288. https://doi.org/10.1016/j.ajic.2015.10.012.
9. Tschudin-Sutter S, Meinke R, Schuhmacher H, Dangel M, Eckstein F, Reuthebuch O, et al. Drainage days-an independent risk factor for serious sternal wound infections after cardiac surgery: a case control study. Am J Infect Control 2013; 41:1264-1267. https://doi.org/10.1016/j.ajic.2013.03.311.
10. Ahn J-S, Lee H-J, Park E, Park I-Y, Lee JW. Suction Drain Tip Culture after Spine Surgery: Can It Predict a Surgical Site Infection? Asian Spine J 2015; 9:863-868. https://doi.org/10.4184/asj.2015.9.6.863.
11. Lindgren U, Elmros T, Holm SE. Bacteria in hip surgery. A study of routine aerobic and anaerobic cultivation from skin and closed suction wound drains. Acta Orthop Scand. 1976; 47:320–323.
12. Sørensen AI, Sørensen TS. Bacterial growth on suction drain tips. Prospective study of 489 clean orthopedic operations. Acta Orthop Scand. 1991; 62:451–454.
13. Petsatodis G, Parziali M, Christodoulou AG, et al. Prognostic value of suction drain tip culture in determining joint infection in primary and non-infected revision total hip arthroplasty: a prospective comparative study and review of the literature. Arch Orthop Trauma Surg. 2009; 129:1645–1649.
14. Weinrauch P. Diagnostic value of routine drain tip culture in primary joint arthroplasty. ANZ J Surg. 2005; 75:887–888.
15. Bernard L, Pron B, Vuagnat A, et al. Groupe d'Etude sur l'Oste´ ite. The value of suction drainage fluid culture during aseptic and septic orthopedic surgery: a prospective study of 901 patients. Clin Infect Dis. 2002; 34:46–49.
16. Overgaard S, Thomsen NO, Kulinski B, et al. Closed suction drainage after hip arthroplasty. Prospective study of bacterial contamination in 81 cases. Acta Orthop Scand. 1993; 64:417–420.
17. Girvent R, Marti D, Mun˜ oz JM. The clinical significance of suction drainage cultures. Acta Orthop Belg. 1994; 60:290–292.
18. Sankar B, Ray P, Rai J. Suction drain tip culture in orthopaedic surgery: a prospective study of 214 clean operations. Int Orthop. 2004; 28:311–314.
19. Nakayama Y, Tsuji T, Asazuma T, et al. Evaluation of the usefulness of bacterial culture of drainage tube tip in spinal instrumentation surgery. Natl Defense Med J. 2005; 52:79–82.
20. Nagashima H, Yamane K, Nishi T, et al. Recent trends in spinal infections: retrospective analysis of patients treated during the past 50 years. Int Orthop. 2010; 34:395–399.
21. Chen AF, Chivukula S, Jacobs LJ, et al. What is the prevalence of MRSA colonization in elective spine cases? Clin Orthop Relat Res. 2012; 470:2684–2689.
22. 22. Humphreys H. Staphylococcus aureus: the enduring pathogen in surgery. Surgeon. 2012; 10:357–360.