

Predicting Surgical Site Infection by ‘Suction Drain Tip’ and ‘Drain Fluid’ Cultures: Are they Helpful?

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Abstract: Introduction: The aim of the study was to check the predictability of ‘suction drain tip’ and ‘drain fluid’ cultures for detecting their association with possible surgical site infection.

Material and Methods: This was an observational study conducted in Surgical Unit 1, Civil Hospital Karachi from February 2017 to November 2017. All post-operative patients having closed drains were included in the study excluding the patients who did not require drains in post-operative period. Cultures from drain fluid and drain tip were sent. The sensitivity, specificity, positive and negative predictive values were calculated.

Result: The predictability for surgical infections in positive drain tip cultures showed Sensitivity =100% and Specificity = 61%. With Positive Predictive Value = 30.3 % and Negative Predictive Value = 100%.

In drain fluid cultures the sensitivity was slightly low (85%) with Specificity = 76.3%. Positive Predictive Value = 37.8% and Negative Predictive Value = 96.8%.

Conclusion: We conclude that positive tip cultures and drain fluid can be important predictors of infection with high sensitivity but low specificity.

Keywords: Surgical site infections, Drain tip culture, Drain fluid culture, Diagnostic value, Hospital acquired infections, Positive predictive value.

INTRODUCTION

Surgical site infections (SSIs) are of universal concern among all surgical patients [1]. They are potential source of morbidity and mortality in patients undergoing any type of surgical procedure affecting not only patients’ quality of life but also increasing economic burden [2]. Even developed countries like USA have estimated costs to 3.3 billion dollars in this regard. This emphasizes the importance of having good prophylaxis along with the necessary protocols to avoid SSI and all the complications associated with them [3, 4].

Surgical site infections are also categorized as frequent presentation of hospital acquired infection (HAI). A HAI prevalence survey conducted in 2011; estimated SSI (21.8%) as the commonest HAIs followed by Pneumonia (21.7%) and gastrointestinal infections (17.1%) [5]. SSI impedes early recovery of patient and consequently affects the performance of a hospital, resulting in economic burden for the hospital.

In this regard different strategies have been used for the uplift patient care and safety by reducing rate of surgical site infection with help of an effective evidence based approach.

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Closed suction drainage is one of the strategy in which drains have been used in order to minimize post-operative hematoma and collection [6], hence minimizing the rate of surgical infections by reducing bacterial colonization [7]. Currently available data has been restricted to either orthopedic surgery or neuro- surgery and no separate study from general surgery has been reported in this regard. The main purpose of this study was to explore the possibility of predicting and identifying potential infection with drain fluid and tip culture.

MATERIAL AND METHODS

This was a observational study conducted in Civil Hospital, Karachi from February 2017 to November 2017. Sample size was calculated to be 138(n) with Confidence interval of 95% with margin of error of 1% (3) and Non-Probability consecutive sampling technique was used to obtain samples. All post-operative patients having closed drains were included in the study excluding the patients who did not require drains in post-operative period and patient with gross sepsis. Informed and written consents were obtained from patients. Prophylactic antibiotic injection Ceftriaxone 1 gm given at the time of induction, repeated on that same evening after return to either the ward, and then on the morning of the day following surgery. In patients undergoing exploratory

laparotomy related to Common bile duct or intestine, injection Amikacin 500mg and injection metronidazole 500mg was added for surgery and doses repeated when necessary.

During surgery area was disinfected by applying povidone-iodine scrub solution. All aseptic measures were taken during surgery. Aseptic dressing of wound site done with dry gauze, after completion of procedure. Drains were removed after they stopped draining or output was less than 50 ml in 24 hours. Drain tips were send to microbiology department after cutting their tip with a sterile scissor, about 5 cm from its far end and collected in sterile container. The residual fluid in Drain was also collected and sent to determine the presence of infection. SSI was graded according to criteria of center of disease control [1] and wound cultures were performed in patients who reported with signs and symptoms like including wound discharge, dehiscence, fever, chills or chronic pain within three month of follow up period. Data was collected using a pre-formed questionnaire. The data was analyzed by SPSS version 20.00. Fisher’s exact test and the chi-square test were used for categorical variables. The sensitivity, specificity, positive and negative predictive values were calculated. Continuous variable were represented by frequency, percentage, mean and standard deviation. A p-value of <0.05 was taken to indicate statistical significance.

RESULTS

Our study included 138 patients with male to female ratio as 1:1. Minimum age was 16 years and Maximum age 60 years with mean age 38.77 years. Most of the patients did not develop surgical site infection 118(85.51%), deep site infection was seen in 1(0.72%) patient and 19(13.77%) patient developed superficial infection (Fig. 1).

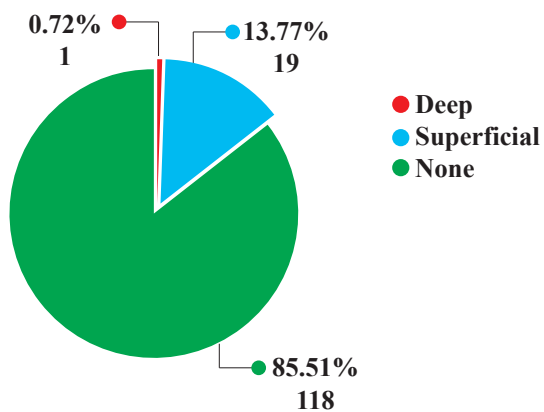


Fig. (1). Type of Surgical Site Infection.

Commonest surgical procedure performed was exploratory laparotomy in 79(57.25%) patients followed by laparoscopic cholecystectomy in 34(24.64%) patients and paraumbilical hernia repair in 16 (11.69%) patients (Fig. 2).

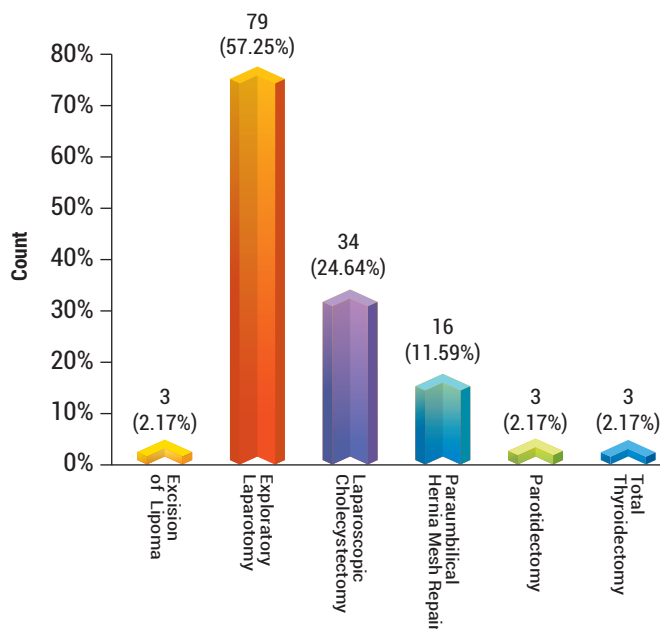


Fig. (2). Patients Included had these Procedures.

Most of the patients had single drain in 91(65.9%) patients, followed by 44(31.9%) patients with two drains. The mean interval for removing drains was 84 hours with minimum of 72 and maximum of 120 hour interval in removal of drain suction Tip Culture detected single type of microorganism in 77(55.80%) of cases and more than one type of microorganisms were detected in 4 cases (2.90%). No infectious agent was detected in 57 patients. Single type of microorganism was detected from drain fluid cultures In 36(26.09%) cases.

More than one type of microorganisms were detected in 32.17% of drain fluid samples.

Most of the cases (71.74%) showed no infectious agent. Most common organism identified from drain fluid cultures was *E.coli* in 11.9% followed by *Klebsiella* in 11.1% of patients.

Whereas, most commonly identified organism was *Klebsiella* (26.1%) followed by *E.coli* (15.2%) in in drain tip culture.

The predictability for surgical infections in positive drain tip cultures showed Sensitivity = 100% and Specificity = 61%; with Positive Predictive Value = 30.3 % and Negative Predictive Value = 100% (Table 1).

In drain fluid cultures the sensitivity was = 85% with Specificity = 76.3%; with Positive Predictive Value = 37.8% and Negative Predictive Value = 96.8% (Table 2).

Statistically significant relation was found between positive suction tip and drain fluid cultures with surgical site wound infection (p = 0.001).

Table 1. Relationship between Positive Drain Tip Culture and SSI.

Cross Tab					
			Surgical Site Infection		
			No	Yes	
Suction Tip Cultures Poitiveness	No	Count % within Surgical Site Infection	72 61.0% ^a	0 0.0% ^b	72 52.2%
	Yes	Count % within Surgical Site Infection	46 39.0% ^c	20 ^d 100.0%	66 47.8%
Total		Count % within Surgical Site Infection	118 100.0%	20 100.0%	138 100.0%

a. Specificity or True Negative.

b. False Negative.

c. False Positive.

d. Sensitivity / True Positive.

POSITIVE PREDICTIVE VALUE* = $nTP / nTP + nFP \times 100 = 20 / 20 + 46 \times 100 = 30.30\%$.

NEGATIVE PREDICTIVE VALUE* = $nTN / nTN + nFN \times 100 = 72 / 72 + 0 \times 100 = 100\%$.

Table 2. Relationship between Positive Drain Fluid Culture and SSI.

Cross Tab					
			Surgical Site Infection		
			No	Yes	
Drain Fluid Culture Positiveness	No	Count % within Surgical Site Infection	90 76.3% ^a	3 15.0% ^b	93 67.4%
	Yes	Count % within Surgical Site Infection	28 23.7% ^c	17 85.0% ^d	45 32.6%
Total		Count % within Surgical Site Infection	118 100.0%	20 100.0%	138 100.0%

a. Specificity or True Negative.

b. False Negative.

c. False Positive.

d. Sensitivity / True Positive.

POSITIVE PREDICTIVE VALUE* = $nTP / nTP + nFP \times 100 = 17 / 17 + 28 \times 100 = 37.8\%$.

NEGATIVE PREDICTIVE VALUE* = $nTN / nTN + nFN \times 100 = 90 / 90 + 3 \times 100 = 96.8\%$.

DISCUSSION

The prime purpose of our study were to determine the diagnostic value of suction drain tip culture for predicting SSI and explicate the association between the bacterial species cultured from the drain tip and the occurrence of SSI.

The most common procedure which developed was emergency laparotomy which developed wound infection [8]. The time duration of drain removal varied from 48 hours to

120 hours with average of 84 hours. In another study, it was concluded that earlier removal of drain was associated with less chances of intra-abdominal collections [9]. Similarly in another study duration of drain removal was found to be a risk factor for infections [10].

In orthopedic researches staph aureus was found to be most frequent organism, nevertheless in our study, the most common organism identified was *E.coli* followed by *Klebsiella* [11].

However, the most interesting finding in our study was statistically significant relation between incidence of a positive suction tip and drain fluid cultures with surgical site wound infection ($p = 0.001$). Our results were similar to the results observed by in a study by Sankar *et al.* [6], in which significant association was found between Incidence of suction tip culture positivity and the incidence of wound site infection. Conversely, in another study on orthopedic patients undergoing surgery, no statistically significant relation between incidence of a positive drain fluid culture and wound infection was observed [12]. Similarly, studies by Girvent *et al.*, Willemen *et al.* and Overgaard *et al.* who analyzed 72, 41 and 81 patients respectively, after different orthopedic operations, found no relation between positive tip culture and wound infection [13-15]. None of these studies mention drain fluid. Moreover study conducted by Bernard *et al.* concluded that, for aseptic orthopedic surgery, Suction drain fluid culture is not useful in detecting postoperative infection (sensitivity 25% and specificity 99% [16], on the other hand for septic orthopedic surgery, it is of clinical importance (sensitivity 81% and specificity 96%). Parallel to the finding of study conducted on orthopedic patients, another study surgery found that suction drain tip culture analysis was a poor predictor of SSI after primary posterior spine surgery. The association between the incidences of a positive drain tip culture and the development of SSI was not statistically significant ($p = 0.195$) [17].

There were a few limitations in our study. It was a single center study with small sample size therefore a multicenter study is required to validate the findings of our study.

However, despite limitations of this study, to the best of our knowledge this is the first study of its type to determine possibly of SSI by drain tip culture and drain fluid culture to be conducted in patients operated at department of general surgery.

CONCLUSION

Our study suggest that suction drain tip and drain fluid culture analysis could be a good predictor of SSI a negative culture report virtually rules out the possibility of infection. A positive report of culture would be a great help for the surgical team to keep a close watch on the wound behavior and intervene earlier, if necessary.

CONFLICT OF INTEREST

Declared None.

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