

Suction Drain Tip Cultures and Predictors of Surgical Site Infections in Hip Fractures

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Abstract: Suction drain tips, used routinely in major orthopaedic surgeries, are in close contact with the bone and implants, and are considered to be the ideal "swab" for detection of microbes in the wound during early postoperative period. We studied 156 subjects with hip fractures who had undergone surgical treatment and evaluated the pattern of microbial growth in the suction drain tip cultures. Risk factors for predicting the wound site infection were also analyzed. Statistically significant association was observed between suction tip culture positivity and wound infections. All co morbidities and diabetes mellitus as an independent variable were found to be associated with positive cultures. Though culture was less sensitive (57.1%) in predicting infection, With a specificity of 92.6% and negative predictive value of 97.9%, it can be used as an early predictor for close observation and follow up.

Keywords: suction drain, postoperative culture, wound infection, Hip fractures, Diabetes mellitus, co morbidities, microbial profile

1. Introduction

Surgical site infections in orthopaedic surgeries are disastrous and often lead to significant morbidity and mortality(1). Suction drains in orthopaedic surgeries tackle the wound haematoma, which is mainly implicated in harbouring microbes(2)(3)(4). Despite the wide use of suction drains in clean orthopaedic surgeries, its use still remains controversial(5). It is considered as a medium for entry of infection or may itself be a source of infection /decrease hosts immunity(6)(7). Some have suggested that there is increased post operative blood loss following drainage and necessitating blood transfusion(8)(9)(10)(11). Nevertheless, we routinely use closed suction drainage in our major surgeries.

Suction drain tips, which are in close contact with the bone and implants are considered to be the ideal "swab" for detection of microbes in the wound during early postoperative period(12). There are still controversies in the value of suction drain tip cultures in predicting early operative site infections(12)(13)(14)(15). This study aimed at the predictors of wound infection and microbial pattern in the suction drain tip culture in hip fracture surgeries.

2. Materials and Methods

In a retrospective analysis of data retrieved from the case records and electronic data base of Sree Gokulam Medical College and Research Foundation, Trivandrum in southern India, 156 subjects with hip fractures (fracture neck of femur (ICD 10: S72.0-S72.091) and trochanteric fracture (ICD 10: S72.1-S72.191)) were studied between 1st January 2011 and 31st July 2014. Using a structured questionnaire containing the variables such as age, gender, co morbidities, diabetes Mellitus, hypertension, renal dysfunction, Chronic obstructive pulmonary disease, Steroid intake, Asthma, coronary artery disease(CAD), cerebro vascular accident (CVA)/epilepsy, hip fracture types –NOF(neck of femur

fracture/TRO(trochanteric fracture), side of fracture(Rt/Lt), Total duration of hospital stay, duration of pre and Post operative stay, drain tip culture results, organism isolated, clinical infection at follow-ups were evaluated. Trochanteric fractures underwent dynamic hip screw fixation and fracture Neck of femur had hemi replacement arthroplasty. Closed suction drains used in all the patients were removed within 48 hours post surgery. We excluded patients who underwent other modalities of surgical fixation and those without suction drains.

2.1 Statistical Analysis

Association of study variables with outcome of culture positivity was analyzed by Chi square, Fischer's exact test and odds ratio with 95% confidence intervals using SPSS for windows version 17. Sensitivity, specificity, positive and negative predictive values of suction drain tip culture for predicting wound infection were calculated. Statistical significance was set at <0.05.

3. Results

3.1 Microbial Profile

The fracture subtype and culture positivity is given in Table 1. There was no association with any hip fracture subtype.

Table 1: Hip fracture sub types and culture positivity

| Hip fracture subtype | Culture positive | | Total |
|----------------------|------------------|-----|-------|
| | Yes | No | |
| Neck of femur | 6 | 54 | 60 |
| Trochanter | 9 | 87 | 96 |
| Total | 15 | 141 | 156 |

3.2 Culture positivity and clinical wound infection

The association between suction tip culture positivity and clinical wound infections is shown in Table 2 and Figure 1. There is significant association of tip culture positivity to predict clinical wound infections (p=.0017).

Table 2: Culture positivity and clinical wound infection

| Culture growth | | Clinical infection | | Total |
|----------------|-----|--------------------|-----|-------|
| | | Yes | No | |
| Yes | Yes | 4 | 11 | 15 |
| | No | 3 | 138 | 141 |
| Total | | 7 | 149 | 156 |

Fisher's Exact Test p=.0017 Sensitivity= 57.1 %, PPV=26.67% Specificity 92.61%, NPV=97.97%

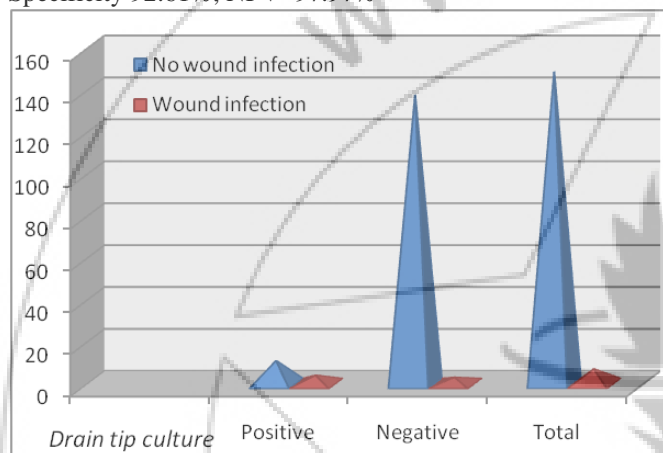


Figure 1: Culture positivity and clinical wound infection

3.2 Microbial pattern from drain tip culture

Figure 2 summarizes the pattern of organisms grown on suction tip cultures. Coagulase negative staphylococcus was isolated in 40% tips and Pseudomonas in 20%.

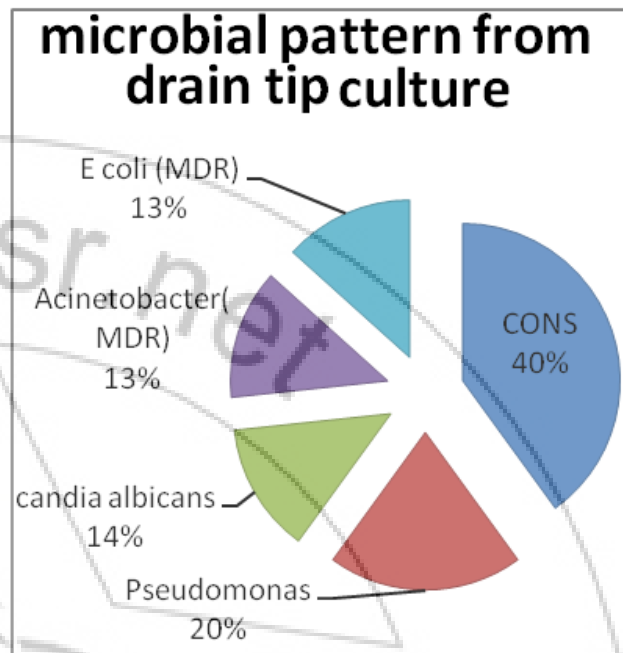


Figure 2: Microbial pattern in drain tip culture

3.3 Predictors for positive suction tip culture

The association between various predictors and culture growth is shown in Table3.

Table 3: Association between various predictors and culture growth

| Predicting factors | | Clinical infection | | | | Total | | χ^2 | p | odds | 95 % CI | |
|--------------------|----------|--------------------|------|-----|------|-------|------|----------|--------|-------|---------|-------|
| | | Yes | No | N | % | N | % | | | | | |
| Age | <75 | 5 | 33.3 | 62 | 44 | 67 | 42.9 | 0.626 | 0.429 | | | |
| | ≥75 | 10 | 66.7 | 79 | 56 | 89 | 57.1 | | | | | |
| Gender | Male | 5 | 33.3 | 33 | 23.4 | 38 | 24.4 | 0.725 | 0.394 | | | |
| | Female | 10 | 66.7 | 108 | 76.6 | 118 | 75.6 | | | | | |
| Co morbidities | Yes | 15 | 100 | 95 | 67.4 | 110 | 70.5 | 6.94 | 0.008 | | | |
| | No | 0 | 0 | 46 | 32.6 | 46 | 29.5 | | | | | |
| Diabetes Mellitus | Yes | 11 | 73.3 | 55 | 39 | 66 | 42.3 | 6.545 | 0.011 | 4.3 | 1.3 | 14.18 |
| | No | 4 | 26.7 | 86 | 61 | 90 | 57.7 | | | | | |
| Hypertension | Yes | 9 | 60 | 69 | 48.9 | 78 | 50 | 0.664 | 0.415 | | | |
| | No | 6 | 40 | 72 | 51.1 | 78 | 50 | | | | | |
| Renal Disease | Yes | 1 | 6.7 | 6 | 4.3 | 7 | 4.5 | 0.184 | 0.668 | | | |
| | No | 14 | 93.3 | 135 | 95.7 | 149 | 95.5 | | | | | |
| COPD### | Yes | 1 | 6.7 | 12 | 8.5 | 13 | 8.3 | 0.06 | 0.806 | | | |
| | No | 14 | 93.3 | 129 | 91.5 | 143 | 91.7 | | | | | |
| Steroid use | Yes | 1 | 6.7 | 7 | 5 | 8 | 5.1 | 0.081 | 0.776 | | | |
| | No | 14 | 93.3 | 134 | 95 | 148 | 94.9 | | | | | |
| Asthma | Yes | 0 | 0 | 7 | 5 | 7 | 4.5 | 0.78 | 0.377 | | | |
| | No | 15 | 100 | 134 | 95 | 149 | 95.5 | | | | | |
| CAD#### | Yes | 3 | 20 | 11 | 7.8 | 14 | 9 | 2.47 | 0.116 | | | |
| | No | 12 | 80 | 130 | 92.2 | 142 | 91 | | | | | |
| Clinical infection | Yes | 4 | 26.7 | 3 | 2.1 | 7 | 4.5 | 19.05 | <0.001 | 16.73 | 3.32 | 84.36 |
| | No | 11 | 73.3 | 138 | 97.9 | 149 | 95.5 | | | | | |
| CVA*/Epilepsy | CVA | 2 | 13.3 | 22 | 15.6 | 24 | 15.4 | | | | | |
| | Epilepsy | 0 | 0 | 5 | 3.5 | 5 | 3.2 | | | | | |

| | | | | | | | | | | | | |
|----------------------------|----------|----|------|----|------|----|------|-------|-------|--|--|--|
| Type of fracture | NOF | 6 | 40 | 54 | 38.3 | 60 | 38.5 | 0.017 | 0.897 | | | |
| | TRO | 9 | 60 | 87 | 61.7 | 96 | 61.5 | | | | | |
| Total hospital stay (days) | <14 | 10 | 66.7 | 81 | 57.4 | 91 | 58.3 | 0.474 | 0.491 | | | |
| | ≥14 | 5 | 33.3 | 60 | 42.6 | 65 | 41.7 | | | | | |
| Duration of Post OP stay | <10 days | 10 | 66.7 | 68 | 48.2 | 78 | 50 | 1.844 | 0.174 | | | |
| | ≥10 days | 5 | 33.3 | 73 | 51.8 | 78 | 50 | | | | | |

Co morbidities as a whole and diabetes mellitus as an independent variable were found to be associated with positive suction tip culture growths.

4. Discussion

Our study of 156 subjects with hip fractures (87 fracture neck of femur and 54 trochanteric fracture) had 15 drain tip culture positive subjects. The rate of positive culture from tip (9.6%) was higher than that of Parker et al (16) and Shankar et al (12) and lesser than the one reported by Girvent et al (15). The routine administration of intravenous antibiotic prophylaxis for three post operative days and the technique of drain removal and culture might have been the cause for this variation (8). The rate of post operative infection was 4.4% and was comparable to the other reported series (12)(17).

Pattern of growth identified were coagulase negative staphylococcus (40%); 20% with pseudomonas and 13.3% each of MDR E -coli, acinetobacter and Candida albicans. There was no association between fracture subtypes and culture positivity. Cultures were positive in four of the seven wounds that got infected (sensitivity= 57.1 %). Out of the 15 cases with positive cultures, clinical wound infection was noted in 4 cases (PPV=26.67%). Three out of 141 cases with negative cultures developed wound infections (NPV=97.97%). Out of 149 cases without infection, 11 had positive culture tip results (specificity 92.61%).

Our study is in concordance with those reported by Sorensen et al (14) and Sankar et al (12) and had statistically significant association between suction tip culture positivity and wound infections (p=.0017) in contrast to the series of Willemen et al & Girvent et al (15) and Overgaard et al. Of the seven infections noted in our series, three had deep infections which required debridement and intravenous antibiotics and 4 had superficial infections which responded with antibiotic treatment alone.

Co morbidities as a whole was found to be positively associated with culture positivity similar to those reported in the literature(18)(19)(20). Association with diabetes as an independent variable was found in our series, and was found to be widely reported(18–20,20,21,22).

Even though the sensitivity of suction tip cultures is low, with a specificity of 92.6% and negative predictive value of 97.9%, we can utilize this test as an early indicator to keep the susceptible patients with co morbidities like diabetes under close supervision for any possible early intervention.

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