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Original Article

Efficacy of Subcutaneous Closed Suction Drain In Reducing SSI After Exploration of the Common Bile Duct

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Abstract

Introduction: In surgical practice, surgical site infections (SSIs) continue to be a significant issue. The SSI rate following general abdominal surgery is still more than 15% despite preventive measures including antibiotic prophylaxis and anti-septic skin preparation. Following an open choledocholithotomy, this complication is also frequent. There is little information about the benefits of wound drainage in open choledocholithotomy, despite numerous trials demonstrating its effectiveness in lowering infection. The purpose of this study was to evaluate the efficacy of subcutaneous drain placement in reducing superficial SSI following open choledocholithotomy.

Methods: 44 patients who underwent open choledocholithotomy between January 2022 and December 2022 were included in the study after convenience sampling. Two groups of patients were created. Twenty-two patients (group I) had a subcutaneous drain, while 22 patients (group II) had no subcutaneous closed suction drain. All patients were diagnosed clinically and by doing imaging followed by open procedure of conventional choledocholithotomy. In the cohort with subcutaneous drain, daily subcutaneous drain collection was documented. Following surgery, each patient was assessed for the presence of wound dehiscence, superficial SSIs, and wound seromas and compared. The statistical program SPSS 22 Windows version 10 was applied for data analysis and presentation.

Results: Most of the patients were female 27 (61.36%). Among them 17(38.64%) cases were present in the 41-50 years of age group. Commonest risk factors were diabetes 7(31.82%), CKD 4(18.18%) and hypoalbuminemia 8(36.36%) in case groups. Surgical site infection (SSI) took place in 4(18.18%) patients among the group with subcutaneous drain and 13(59.09%) among the control cohort. Available organisms were *Staphylococcus Aureus* 8(36.36%) and *Escherichia Coli* 6(13.64%) in both groups, isolated from both bile culture and wound swab culture.

Conclusion: The prevention of superficial surgical site infection was positively impacted by the installation of a drain in the wound following an open choledocholithotomy by lowering the rate of SSIs and hospital stays.

Keywords: Subcutaneous suction drain, Surgical site infection, Open choledocholithotomy.

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Introduction

Open exploration of the common bile duct remains an important option in selected patients with large stone burden, difficult ductal anatomy, failed endoscopic clearance, or limited access to advanced minimally invasive services. However, the procedure is performed in a field that may be contaminated by infected bile, tissue edema, and local inflammation, all of which can compromise wound healing. In this setting, postoperative accumulation of blood, bile-stained fluid, or serous exudate within the subcutaneous plane may create a favorable environment for bacterial proliferation and subsequent superficial wound infection. Strategies that reduce dead space and evacuate fluid collections may therefore have a biologically plausible role in lowering the incidence of superficial SSI after open biliary surgery.

A closed subcutaneous suction drain may be particularly relevant in high-risk abdominal incisions because it continuously removes inflammatory exudate, decreases local tension, and may limit early bacterial colonization of the wound. Although this concept has been examined in other forms of abdominal surgery, evidence specific to open choledocholithotomy remains limited, and procedure-specific data are necessary because the microbiological profile and risk of bile contamination differ from those of colorectal or other hepatobiliary operations. On this basis, the present study was designed to compare postoperative wound outcomes between patients managed with and without a subcutaneous closed suction drain after open choledocholithotomy.

(Common bile duct stone) CBDS affects about 15% of patients with cholelithiasis; endoscopic retrograde cholangiopancreatography (ERCP) can remove smaller stones, whereas open or laparoscopic surgery is needed for bigger stones[1]. According to a recent paper[2], one of the most frequent side effects of abdominal surgery is surgical site infection (SSI), which is linked to considerable discomfort, morbidity, and expense. Surgical site infections (SSIs), including wound infections, are defined as infections in tissue spaces following a surgical procedure. Bile leaks and surgical site infections are common postoperative complications following open choledocholithotomy, directly impacting patient recovery. These factors are among the primary reasons for prolonged hospital stays and increased pain levels[3]. These remain a major problem for patients undergoing procedures despite advances in surgical techniques and medical care. SSIs have been shown to contribute up to 20% of nosocomial infections with an overall incidence of approximately 5% across all invasive surgical procedures[4]. Risk factors significantly associated with SSIs included diabetes, wound classification, pre-operative ASA scores, pre-procedure white blood cell count (WBC), type of surgery, the extent of blood loss, transfusion, duration of operation, risk index, indwelling urethral catheterand postoperative biliary drainage and abdominal drain[5,6]. It has been proposed that the use of closed subcutaneous suction vacuum drainage will result in a statistically significant reduction of wound infection in emergency surgery for peritonitis with perforated gut. The role of drainage in preventing wound infection has been widely debated. Recently, retrospective studies have revealed that multi-channel drains with side slits considerably reduce wound infection in colorectal and liver surgery[7]. There is also a benefit of using drains in high-risk patients, including patients with a contaminated wound, such as a drain in the wound in preventing SSI after open choledocholithotomy.

Materials and methods

This study was a prospective case-control study and conducted on 44 consecutive patients admitted in the Surgery department in the Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh in between January 2022 to December 2022. Then all patients were selected randomly and 22 patients were given negative suction drainage designed as case groups, other 22 patients did not have a subcutaneous drain as control group in open choledocholithotomy procedure. The age range of 20 to 60 years was included in this study. Patients with previous abdominal surgery, known malignant cases were excluded in this study. There were no ethical problems as before the study procedure was conducted, verbal consent of every patient was taken. Disagreed cases were not included in this study. Relevant information (according to the questionnaire) was taken from the patients and physical examinations were done in detail. In all cases, patients were evaluated clinically and with relevant investigations, followed by open choledocholithotomy. Negative suction drainage was placed in the subcutaneous space in 22 cases. Then follow up of every patient was done regularly, looking for wound complications like seroma formation, stitch infections, wound infections, wound disruption or burst abdomen. Then a comparison between the case and control groups was done. All the data were analyzed manually in view of the objective of this study. Frequency, distribution and proportions were calculated for the values. Results were published in tabulated form.

Result

The study included 44 patients who underwent open choledocholithotomy and were equally allocated into case and control groups. Baseline demographic features and major comorbid conditions were comparable between the two groups, allowing postoperative wound outcomes to be interpreted with less likelihood of major baseline imbalance. The findings are presented below in terms of patient characteristics, associated risk factors, incidence of surgical site infection, and distribution of bacterial isolates. (Table I)

Table I: Demography of patients (n=44)

Age (years)	No. of cases (n=22)	Percentage (%)	No. of control (n=22)	Percentage (%)
20-30	1	4.55	2	9.09
31-40	7	31.82	6	27.27
41-50	8	36.36	9	40.91
51-60	6	27.27	5	22.73
Sex				
Female	14	63.64	13	59.09
Male	8	36.36	9	40.41

The largest proportion of patients in both the case and control groups belonged to the 41–50 years age group, accounting for 36.36% and 40.91% respectively. Female patients predominated in both groups, representing 63.64% of the case group and 59.09% of the control group (Table I). Overall, the baseline demographic characteristics were broadly comparable between the two groups. (Table II).

Table II: Distribution of Comorbidity among Case and Control Groups (n=44)

Variables	No. of cases (n=22)	Percentage (%)	No. of control (n=22)	Percentage (%)
Diabetes				
Present	7	31.82	6	27.27
Absent	15	68.18	16	72.73
CKD				
Present	4	18.18	3	13.64
Absent	18	81.82	19	86.36
Hypoalbuminemia				
Present	8	36.36	9	40.91
Absent	14	63.64	13	59.09

Comorbidities like diabetes, chronic kidney disease, and hypoalbuminemia were present in both groups with only small differences in distribution. Diabetes was observed in 31.82% of cases and 27.27% of controls, while CKD was found in 18.18% and 13.64% respectively (Table II). Hypoalbuminemia was slightly more frequent in the control group (40.91%) than in the case group (36.36%), indicating that the comorbidity profile of the two groups was generally similar. (Table III)

Table III: Incidence of Surgical Site Infection in Case and Control Groups (n=44)

Variables		No. of cases (n=22)	Percentage (%)	No. of control (n=22)	Percentage (%)
Surgical Site Infection	Present	4	18.18	13	59.09
	Absent	18	81.82	9	40.91

Table IV: Distribution of Bacterial Isolates among Case and Control Groups (n=44)

Variables(Organisms)	No. of cases (n=22)	Percentage (%)	No. of control (n=22)	Percentage (%)
Absent	18	81.82	9	40.91
Staphylococcus aureus	2	9.09	6	27.27
Escherichia coli	2	9.09	4	18.18
Klebsiella	0	00	1	4.55
Pseudomonas	0	00	2	9.09

Table III reveals a markedly lower incidence of surgical site infection in the case group with subcutaneous drain compared with the control group without drain. SSI occurred in 4 patients (18.18%) in the case group, whereas 13 patients (59.09%) in the control group developed SSI. This finding suggests a substantial protective effect of subcutaneous closed suction drainage against postoperative wound infection (Table IV).

No bacterial growth was absent in most patients of the case group (81.82%) but in a smaller proportion of the control group (40.91%) (Table IV). Among the identified organisms, *Staphylococcus aureus* was the most common isolate, especially in the control group (27.27%), followed by *Escherichia coli*. *Klebsiella* and *Pseudomonas* were isolated only in the control group, further indicating a greater burden of postoperative wound infection among patients without subcutaneous drainage.

Discussion

The principal finding of this study is the substantially lower rate of superficial SSI in patients managed with a subcutaneous closed suction drain compared with those without drainage. This difference may be explained by continuous removal of subcutaneous fluid, reduction of dead space, and limitation of local tissue maceration, all of which are recognized contributors to bacterial growth and impaired wound healing. In open biliary surgery, where bile contamination and inflammatory tissue handling may increase wound vulnerability, these local mechanical effects are likely to be particularly important. The observed reduction in culture positivity in the drain group further supports the possibility that subcutaneous drainage modified the wound environment in a manner unfavorable to microbial persistence.

The distribution of age, sex, diabetes, chronic kidney disease, and hypoalbuminemia was broadly similar across the two groups, suggesting that the difference in wound infection was unlikely to be explained solely by these measured baseline factors. Nonetheless, the study should be interpreted in light of its modest sample size, single-center setting, and non-probability sampling approach, which may limit generalizability and statistical precision. Even so, the consistency of the observed trend across SSI occurrence and bacterial isolation supports the clinical relevance of the intervention. Larger prospective studies with standardized perioperative protocols would be useful to confirm the magnitude of benefit and to identify patient subgroups most likely to gain from routine subcutaneous drainage after open choledo-cholithotomy.

Various risk factors contribute to the development of incisional SSI during the postoperative period. To reduce incisional SSI after open abdominal surgery, mechanical preventors, such as subcutaneous wound drainage[8,9] or negative-pressure wound therapy (NPWT)[10,11] have been tried; however, conclusive results have not been obtained[12,13]. Incisional SSI after laparotomy often occurs after colorectal surgery or abdominal cavity contamination and it is often accompanied by organ/space SSI[14,15].

Total 44 patients were included in this study. The commonest population were female 27 (61.36%). The commonest age group of 41-50 years and it was 8(36.36%) in case group and 9(40.91%) in control groups. Harish et al. showed 26(52%) patients under 40 years and 24(48%) patients above 40 years in the cases group while there were 28(56%) patients below 40 years and 22(44%) patients in the control group. There was no significant difference in the age distribution between the two groups in the study[16].

The study showed common risk factors of developing SSI were diabetes 7(31.82%), CKD 4(18.18%) and hypoalbuminemia 8(36.36%) in case groups. Malone et al showed risk factors for causing SSI were diabetic mellitus, hypoalbuminemia (ALB 30 g/L), anaemia (Hb 10 g/L). The prevalence of SSI was higher in patients with a duration of surgery >=5 hours. Romy et al revealed the prevalence of SSI was higher in patients with albumin levels <=3. The prevalence of SSI was higher in patients with hemoglobin levels[17,18].

The study revealed surgical site infection (SSI) in case groups 4(18.18%) and control groups 13(59.09%). Haris et al found that SSI rates came up to 14% in patients with a subcutaneous drain and 42% in those without a drain[16].

In our study, the available organisms were *Staphylococcus Aureus* 8(18.18%) and *Escherichia Coli* 6(13.64%) in both groups. Suragul and his colleagues[19] have stated that the cause of SSI was polymicrobial with 48% positive cultures. The most common organisms being *Enterococcus, E. coli,* and *Klebsiella pneumonia* which are the normal inhabitants of the intestines causing SSI in abdominal surgeries.

The ethical standard conforms with the standard surgical practice. This study was not funded.

Conclusion

Open surgery, acute inflammation, older age, continuous suturing, and biliary tract infection significantly increase the risk of postoperative bile leakage. Bile leakage was also identified as a strong independent predictor of incisional infection after open choledocholithotomy.

Surgical site infections (SSIs) after abdominal surgery are difficult and distressing to manage. Hematoma, seroma, and dead space within the surgical incision further increase the risk of infection by harbouring microbial agents. This study showed that the use of subcutaneous suction drains considerably reduced the likelihood of postoperative wound infection.

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