

Closed Drainage of the Incisional Surgical Site Infections Prevent Wound Disruption in Colorectal Surgery

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Abstract: Incisional surgical site infection (ISSI) in colorectal surgery is the most frequent complication which increases morbidity, hospital stay and cost. In the case of ISSI, drainage of the wound is necessary. This study aimed to investigate possible efficacy of subcutaneous suction drains on preventing open wound treatment. We conducted a prospective trial in 154 patients who had colorectal surgery at a single institution. A subcutaneous suction drain was inserted following the closure of facial structures and the drain was established with negative pressure pursuant to the closure of the skin. The average duration period of drains in patients was determined to be 5.3 (4-15) days. A total of 21 (13.1%) patients developed incisional surgical site infection within the postoperative period with associated purulent drainage from the drain. Evisceration occurred in one patient who developed wound infection and this patient was reoperated. Open drainage of the wound was required in only two patients. In the other 19 (90.4%) patients with ISSI, the drains were maintained until a day, healthy wound was confirmed and without opening the wound. Routine subcutaneous, closed, vacuum drainage of the incisions in colorectal surgery results in very low rates of ISSI that necessitates open wound treatment.

Key words: Postoperative wound infection • Colorectal surgery • Suction drainage

INTRODUCTION

Nosocomial infections are the most frequent complications observed in surgical patients. Colorectal surgery is associated with the highest rates of infective complications, especially surgical site infections, because opening of the colorectum causes contamination of the operative field with microorganisms originating from endogenous sources ; thus increases the chance of developing postoperative infective complications. It is reported that without antibiotic prophylaxis, wound infection after colorectal surgery develops in approximately 40% of the patients. This rate decreases approximately to 11% after routine use of mechanical bowel preparation and antibiotic prophylaxis [1-3].

When ISSI develops, the wound is drained, cultures are obtained and antibiotics are usually stated. In the last decade, the number of studies aiming to decrease ISSI related morbidity accumulated and efforts were involved to determine the risk factors of this issue [4-7]. These infections occur in colorectal surgery despite all kinds of measures and may induce wound disruption or incisional

hernia, cause patient discomfort and bad cosmetic result, prolong hospital stay and increase cost [2,8-10].

The purpose of this investigation is to evaluate whether the insertion of a subcutaneous suction drain may contribute to the clinical progress and if it may eliminate when superficial ISSI is develops, we need to open the wound in cases of ISSI after colorectal surgery.

MATERIALS AND METHODS

A total of 154 patients who underwent open colorectal surgery from January 2005 to June 2006, were included in the study. Demographic and clinical variables were recorded at admission. Variables for each patient included: age, gender, diagnosis, history of diabetes mellitus, preoperative albumin level, preoperative steroid use, mechanical bowel preparation, use of prophylactic antibiotics, type of operation (elective or emergency), procedure performed, need for intraoperative transfusion and use and type of stoma. Exclusion criteria were immunologic diseases or immunosuppressive therapy except for steroids, history of chronic alcohol or drug

abuse, or chronic renal insufficiency. Also, laparoscopic operations, operations via rectum or perineum and simple stoma closures were not included. The study was approved by the local ethical committee and informed consent was obtained.

The need for open wound treatment served as the primary end point.

Operative Techniques: One day before surgery, all elective patients underwent mechanical bowel preparation with oral laxatives (Fleet® phosphosoda, Kozmed, Istanbul, Turkey). The patients were routinely shaven in the operative suit prior to surgical site preparation. After induction of anesthesia, all patients received cefuroxime 1 g and metranidazole 0.5 g and if the operation exceeded 4 h after the initial dose repeated doses were administered. All operations were carried out by or under the supervision of one of the consultants. Abdominal incisions were closed with # 1 loop polydioxanone (PDS, Ethicon, Edinburg, UK) monofilament absorbable suture. The wound was then irrigated with saline and a suction drain (heamovac) was inserted which taken out of the wound through a separate stab incision. The skin was reapproximated with staples in all patients with no subcutaneous sutures. All stomas were created after the skin closure.

Drains (except for the 3 patients who were reoperated) were kept routinely at least for 5 days and later they were pulled out unless the output exceeded 20cc/day. Direct microscopic examination and culturing was applied to cases having purulent drainage. Antibiotherapy, to which the multiplying microorganism is sensitive, was used in patients having systemic infection evidence. The patients were called routinely for outpatient clinical control on the 14th and 30th postoperative days.

Wound infection was defined according to the guidelines of the Center for Disease Control and Prevention (CDC) [11]. An infection was determined if it occurred within 30 days after the operation and involved skin or subcutaneous tissue or deep soft tissues. Patients with wound infection had to satisfy at least one of the following: 1) purulent drainage from the drain or wound, 2) isolation of microorganism from the drain output, 3) one of the following signs: pain, tenderness, swelling, redness or hotness in the site of incision. The wounds were examined every day by an attending surgeon until discharge. Wound opening was decided by the colorectal consultant group.

Statistical analysis was performed by using SPSS for Windows (version 12.0; SPSS Inc, Chicago, IL). Continuous variables were tested for normal distribution. If normally distributed, results were given as mean or otherwise as median (range). Differences between groups were tested using independent *t*-test, student *t*-test or Mann-Whitney *U* test, as appropriate. Categorical data were analyzed using Fisher's exact test [12].

RESULTS

From January 2005 to June 2006, 154 consecutive patients (95 males) with a mean age of 54.4 years (20-92 years) were included in the study. Of the 154 patients, 113 (73.4%) had cancer, 13 (8.4%) had inflammatory bowel disease, 4 (2.6%) had diverticular disease and 24 (15.6%) had other diagnose necessitating colorectal surgery. The patient characteristics and surgical procedures are outlined in Table 1. The most

Table 1: Patient characteristics and operative procedures

Charesteristic	No SSI (n:133)	Incisional SSI (n: 21)	P
Age (years)	53.88±12.9	56.14±13.6	NS
Gender			
Male	83(62%)	12(57.1%)	NS
Female	50(38%)	9(42.9%)	
Comorbidities			
D.M.	24(18%)	4(19.1%)	NS
Preoperative albumin (g/dl)	3.47±0.61	3.56±0.69	NS
Preop. Steroid use	3(2.2%)	3(14.3%)	NS
Use of Prophylaxis	133(100%)	21(100%)	
Use of Mechanical bowel prep.	101(76%)	17(80.9%)	NS
Diagnosis			
Cancer	98 (73.6%)	15(71.4%)	NS
IBD	10(7.5%)	3(14.3%)	NS
Diverticular disease	4(3%)	-	--
Other	21(15.8%)	3(14.3%)	NS
Preop ASA score			
ASA (Grade 1-2)	112 (84.2%)	13(61.9%)	:.0001
ASA (Grade 3-5)	21(15.8%)	8(38.1%)	
Type of operation			
Elective	101(76%)	17(80.9%)	
Emergency	32(24%)	4(19.1%)	NS
Procedure performed			NS
LAR	39(29.3%)	5(23.8%)	
Left H.C. (Sig.rezeksiyon)	26(19.5%)	3(14.3%)	
Total Colectomy	20(15%)	3(14.3%)	
Right H.C	18(13.5%)	2(9.5%)	
APR	16(12%)	4(19.1%)	
Hartman's operation	13(9.7%)	2(9.5%)	
Other	22(16.5%)	2(9.5%)	
Use and Type of stoma			NS
No stoma	82(61.6%)	11(52.3%)	
Ileostomy	9(6.8%)	4(19.1%)	
Colostomy	42(31.6%)	6(28.6%)	
Number of patients need of intraop. transfusion	19(14.2%)	10(47.6%)	:.001

Values are mean±SD or absolute numbers (%)

common type of procedure performed was low anterior resection in 39 patients (25.3%), followed by left-hemi colectomy in 26 (16.8%), total colectomy in 20 (13%), right-hemi colectomy in 18 (11.8%), abdominoperineal resection (APR) in 16 (10.4%) and Hartman's procedure in 13 (8.4%). The remaining 22 (14.3%) had other operations including segmental resections or stoma creation due to unresectable cancer. A stoma (either colostomy or ileostomy) was created in 61 patients (39.6%). Postoperatively, pneumonia developed in 9 patients (5.8%), arrhythmia in 4 patients, sepsis in 2 patients, anastomotic leakage in 2 patients and pulmonary embolism in 1 patient. Therefore, operative complications other than incisional SSI were seen in a total of 18 patients (11.6%). Three patients were reoperated, two for an anastomotic leak with peritonitis and the other for a wound rupture.

During the postoperative period, 21 patients (13.6%) were diagnosed to develop superficial ISSI. American Society of Anesthesiologists Physical Status Classification (ASA classification) higher than 2 and need for intraoperative transfusion were found as independent risk factors of ISSI ($P=0.001$ and $P=0.01$ respectively). Other parameters such as age or gender co-morbid conditions lacked significance comparing the incisional SSI and no SSI groups. While the incidence rate of ISSI was higher in patients who underwent APR or ileostomy, this result was not significant. The microbiological cultures suggested that, wound infections were generally caused by *Staphylococcus aureus*, *Pseudomonas aeruginosa* or enteral microbes (*Escherichia coli*, *Enterococcus faecalis* or *Klebsiella pneumoniae*).

In two patients with ISSI, suction drains could not counterbalance the infection and the wounds had to be surgically drained due to persistent local and/or systemic signs of infection. In the other 19 patients (90.4%), the process was completed through closed drainage without the need for open drainage of the wound.

DISCUSSION

Incisional SSI after colorectal operations is the most common postoperative complication and it is an obvious inconvenience for both the patient and the surgeon. Although there is a wide range of frequencies reported, from 3% to 30%, the average rate for wound infection is roughly 10% in colorectal surgery [1,2,13,14]. It was shown that increased body mass index (BMI), higher ASA score, prolonged operation, or intraoperative hypotension were independently predict development of ISSI [1,2]. In our study, ISSI rate was found to be 13.6%.

In this study, we found out that a preoperative ASA score above 2 and intraoperative transfusion were independently effective on ISSI development ($P=0.001$ and $P=0.01$ respectively). No difference was determined between ISSI and non-ISSI groups in terms of diabetes, steroid usage, level of preoperative albumin and application of urgent or elective operation.

Most of the time, the drainage of the wound by opening it up is necessary in cases who develop ISSI. As a result, ISSI development is a costly complication causing patient's discomfort and the occurrence of a bad scar tissue, creating predisposition for the formation of hernia in the long term and prolonging hospital stay [15,16]. In a superficial ISSI to be developed with a subcutaneously inserted suction drain, closed drainage of the material with negative pressure is provided and additionally, rapid antibiotic therapy can be implemented as a result of microbiological investigation. Hence, through primary wound closure good cosmetic result can be obtained and hospitalization period and overall cost are decreased. Furthermore, it was shown that application of negative pressure has positive effects on the healing of the wound and formation of granulation tissue [17].

Surgeons usually use subcutaneous drains to prevent the formation of seroma and hematoma and especially to eliminate the dead-space occurring in obese patients having thick subcutaneous fat tissue [9,18]. On the other hand, according to some surgeons, placement of drains predisposes the area to infection and prolongs hospital stay [19]. This might be valid in clean surgical treatments having relatively shorter periods of hospital stay, such as thyroid and breast surgery. However, there is much more contamination in colorectal resections and the risk of wound infection is clearly stated; the patients stay in hospital for 4-5 days. Hence, it was thought that subcutaneous suction drains to be used in colorectal surgery would not prolong the hospital stay and not create a predisposition to site infection in patients who don't develop wound infection.

A total of 21 patients (13.6%) who had colorectal surgery were diagnosed to develop superficial ISSI in our study. By the using of subcutaneous suction drains, open wound treatment was not necessitated in 19 patients and only two patients were required to opening of the wound.

In conclusion, we suggest that insertion of subcutaneous suction drains at the end of operation could provide effective drainage of the purulent material from the wound without need of open drainage and ISSI related complications can be avoided in colorectal surgery.

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