

Antibiotic Prophylaxis and Incisional Surgical Site Infection Following Colorectal Cancer Surgery: An Analysis of 330 Cases

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Objective: To evaluate the rate of incisional surgical site infection (SSI) following colorectal cancer surgery in a university hospital and to determine whether duration of prophylactic antibiotic administration can affect the development of this complication.

Material and Method: The medical records of 330 patients with colorectal cancer undergoing elective oncological resection between 2003 and 2006 at Siriraj Hospital were reviewed. Patients were divided into two groups according to the duration of antibiotic administration; group A: prophylactic antibiotics were discontinued within 24 hours after surgery and group B: antibiotics administration was extended beyond 24 hours after surgery. Data including rate of incisional SSI were analyzed.

Results: There were 180 males and 150 females, with a mean age of 63 years. There were 126 patients (38%) in group A and 204 patients (62%) in group B. There was no statistical difference in patient characteristics and tumor-related variables between the two groups, except tumor location. Overall rate of incisional SSI was 14.5%. The rate of incisional SSI was not statistically different between the two groups (group A 11.1% vs. group B 16.7%, $p = 0.22$). Patients with incisional SSI had a significantly longer hospital stay than patients without incisional SSI (15.9 vs. 8.3 days, $p < 0.001$).

Conclusion: This present study found the overall rate of incisional SSI following colorectal surgery to be 14.5%. There was no significant difference in the rate of this complication between the two groups. Thus, surgeons should be encouraged to use a shorter duration of antibiotics to prevent the emergence of antibiotic-resistant bacterial infection and reduce hospital expenditure.

Keywords: Antibiotic prophylaxis, Surgical site infection, Wound infection, Colorectal cancer

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Incisional surgical site infection (SSI) is the most common complication following colorectal surgery. The incidence of incisional SSI in patients with colorectal cancer ranges from 10-46 percent^(1,2), depending on patient characteristics and the diagnostic criteria. Although incisional SSI is not associated with high mortality, it burdens cost of health care and prolongs hospitalization.

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Antibiotic prophylaxis reduces the rate of incisional SSI in gastrointestinal surgery, but a great deal of variation exists regarding the duration of antibiotic administration. According to the Centers for Disease Control and Prevention (CDC) guideline in 1999⁽³⁾, prophylactic antibiotics should have a bactericidal activity against the most probable intraoperative contaminants, and should be given intravenously 30-60 minutes prior to the incision and discontinued within 24 hours after surgery. In Thailand, standardized national guidelines of antibiotic prophylaxis for colorectal surgery have not yet been established and many surgeons are not acquainted with the principle

of antibiotic prophylaxis, resulting in unnecessary and inappropriate use of antibiotics. Moreover, the large intestine is known to bear many bacteria, both aerobic and anaerobic, thus some surgeons tend to provide longer antibiotic administration.

The objectives of the present study were to evaluate the rate of incisional SSI following colorectal cancer surgery in a university hospital, and to determine whether duration of prophylactic antibiotic administration can affect the development of this complication.

Material and Method

Medical records of 330 patients with colorectal cancer undergoing elective oncological resection between January 2003 and December 2006 at the Department of Surgery, Faculty of Medicine Siriraj Hospital, Bangkok, Thailand were reviewed. Patients were excluded if they had non-primary wound closure, underwent emergency operations or died within the first 48 hours after surgery. Patients with documentation of intraoperative gross contamination resulting in receiving longer period of antibiotic administration (therapeutic intention) were also excluded. The present study was approved by the Institutional Ethics Committee and informed consent was obtained from all the patients.

All patients with rectal cancer and most patients with colon cancer underwent preoperative mechanical bowel preparation. Preoperative intravenous antibiotics, usually β -lactam plus β -lactamase inhibitor or the third generation cephalosporin plus metronidazole, were administered by an anesthesiologist after induction of general anesthesia. In case of operation time longer than 4 hours or massive blood loss, an additional dose of antibiotics may be given during the operation. Standard oncological resection was performed either laparoscopic or open approach. Duration of postoperative antibiotics was solely based on the surgeon's own discretion.

Patients would be discharged from the hospital if they had no fever, good appetite and able to ambulate well. In case of patients with incisional SSI, they would be discharged if the incisional SSI was well controlled and could be managed in the outpatient setting safely. All patients were scheduled for follow-up at 30 days postoperatively.

The data collected included age and gender, body mass index (BMI), American Society of Anesthesiologist (ASA) status, location and original Dukes stage of the tumor (stage A-C), duration of antibiotic

administration, and the development of incisional SSI. Both superficial and deep incisional SSI were diagnosed using CDC criteria⁽⁴⁾. Patients were divided into two groups according to the duration of antibiotic administration; group A: prophylactic antibiotics were discontinued within 24 hours after surgery and group B: antibiotic administration was extended beyond 24 hours after surgery.

All data were prepared and complied using SPSS computer program (version 10.0 for Windows). Mean and standard deviation or number (percentage) of each parameter was assessed. The Kolmogorov-Smirnov test was used to test for the pattern of data distribution. Unpaired *t*-test was used to compare data between the two groups when they were in normal distribution pattern. Mann-Whitney U test was used when this was not the case. Pearson chi-square test or Fisher's exact test was used for categorical data. A *p*-value of less than 0.05 was considered statistically significant.

Results

There were 180 males and 150 females, with a mean age of 63 years (range 23-89). There were 126 patients (38%) in group A and 204 patients (62%) in group B. Tumors were classified into original Dukes stage A 19%, stage B 26% and stage C 55%. There was no statistical difference in patient characteristics and tumor-related variables between the two groups, except tumor location (Table 1). However, location of the tumor was not a predictor for development of incisional SSI (12% in colon cancer vs. 16% in rectal cancer, *p* = 0.39).

Overall rate of incisional SSI was 14.5%; 47 patients developed superficial incisional SSI, and one patient had deep incisional SSI which required surgical intervention. The rate of incisional SSI was not statistically different between the two groups (group A 11.1% vs. group B 16.7%, *p* = 0.22). Patients with incisional SSI had a significantly longer hospital stay than patients without incisional SSI (15.9 vs. 8.3 days, *p* < 0.001).

Discussion

The overall rate of incisional SSI following elective colorectal resection in the present study was 14.5%. This was comparable to other large studies from developed countries, such as the United Kingdom (8-33%)^(5,6), the United States of America (8-20%)^(7,8), Canada (15-24%)⁽⁹⁾ and Japan (4-30%)^(10,11). It was also similar to the incidence rates reported from countries

Table 1. Patients' characteristics, tumor-related variables, incidence of incisional SSI and length of hospital stay in the patients of group A and group B. Values were given as number (percentage) or mean \pm SD

	Group A (n = 126)	Group B (n = 204)	p-value
Age (years)	63.4 \pm 13.1	62.0 \pm 12.4	0.32
Male	61 (48)	119 (58)	0.10
BMI (kg/m ²)	22.0 \pm 3.7	22.7 \pm 3.6	0.10
ASA status			0.85
I	34 (27)	54 (26)	
II	80 (63)	134 (66)	
III	12 (10)	16 (8)	
Tumor location			0.001
Colon	63 (50)	62 (30)	
Rectum	63 (50)	142 (70)	
Dukes stage			0.33
A	21 (17)	43 (21)	
B	38 (30)	47 (23)	
C	67 (53)	114 (56)	
Incisional SSI	14 (11.1)	34 (16.7)	0.22

in Southeast Asia such as Vietnam (14-20%)⁽¹²⁾. The differences in patient characteristics, surgical procedures, hospital settings, surveillance program, and criteria for diagnosis of incisional SSI could explain the various incidence of SSI among countries.

The surveillance programs for incisional SSI should include the period of 30 days after the operation because 50-80% of incisional SSI was reported after the patients were discharged^(13,14). Therefore, surgical patients should be scheduled for post-discharge follow-up visit and surveillance for SSI, especially in patients undergoing colon resection or laparoscopic operation in which the length of stay is typically short.

The number of patients receiving prophylactic antibiotics beyond 24 hours after the operation was significantly greater in rectal cancer than those with colon cancer. This may be because the surgeons were more cautious about the higher rate of incisional SSI in rectal surgery than colon surgery as reported in the literature^(15,16). However, there is no evidence that prolonged administration of antibiotics can minimize the incidence of incisional SSI^(17,18).

One of the crucial principles of antibiotic prophylaxis is that tissue concentration of antibiotics around the incisional wound should be sufficiently high enough when bacterial contamination develops. This concept was supported by a recent study of Zelentisky et al⁽¹⁹⁾, in which antibiotic concentration at

the time of surgical closure was an independent risk factor for incisional SSI. Administration of prophylactic antibiotics beyond 24 hours after the operation is therefore unnecessary unless uncontrolled gross contamination during the operation occurs. In the present study, there was no statistically significant difference of incisional SSI between two different duration of antibiotics administration, and antibiotic prophylaxis was inappropriately prolonged in 62% of the patients (as classified into group B).

Similar to other studies^(20,21), incisional SSI has a negative impact on the length of hospitalization. The additional length of hospital stay attributable to SSI ranged from 3.3 to 21 days⁽²²⁾, depending on types of surgical procedures and patients' co-morbidities.

Some limitations of the present study, which are mainly inherent to retrospective medical record review, should be addressed. Firstly, the retrospective design is unable to control potential confounding variables that may affect SSI. Secondly, the diagnosis of SSI could be different among the surgeons although CDC criteria were applied⁽⁴⁾. Further prospective studies are therefore required.

Conclusion

This present study found the overall rate of incisional SSI following colorectal surgery to be 14.5%, and antibiotic administration of longer than 24 hours postoperatively may not decrease the rate of this complication. Thus, surgeons should be encouraged to use using a shorter duration of antibiotics in order to prevent the emergence of antibiotic-resistant bacterial infection and reduce hospital expenditure.

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การให้ยาปฏิชีวนะเพื่อป้องกันการติดเชื้อบริเวณแผลผ่าตัด ภายหลังจากผ่าตัดมะเร็งลำไส้ใหญ่ และลำไส้ตรง จากการวิเคราะห์ผู้ป่วย 330 ราย

วรุตม์ โฉ่หิรัวัฒน์, ตรินทร์ โฉ่หิรัวัฒน์

วัตถุประสงค์: หาอัตราการติดเชื้อบริเวณแผลผ่าตัดซึ่งเกิดตามหลังการผ่าตัดมะเร็งลำไส้ใหญ่และลำไส้ตรง ในโรงพยาบาลมหาวิทยาลัย เพื่อพิจารณาว่า ระยะเวลาความนานของเวลาที่ให้ยาปฏิชีวนะเพื่อป้องกันการติดเชื้อ จะมีผลต่อการเกิดการติดเชื้อบริเวณแผลผ่าตัดหรือไม่

วัสดุและวิธีการ: ศึกษาเวชระเบียนของผู้ป่วยจำนวน 330 ราย ที่ได้รับการผ่าตัดเพื่อรักษาโรคมะเร็งลำไส้ใหญ่ และลำไส้ตรง ในโรงพยาบาลศิริราช ช่วงปีพุทธศักราช 2546-2549 แบ่งผู้ป่วยเป็น 2 กลุ่ม ตามความนานของเวลาที่รับยาปฏิชีวนะเพื่อป้องกันการติดเชื้อ ได้แก่ กลุ่ม A ซึ่งหยุดยาภายใน 24 ชั่วโมงหลังผ่าตัด และกลุ่ม B ซึ่งได้ยานานเกิน 24 ชั่วโมงหลังผ่าตัด วิเคราะห์ข้อมูลต่าง ๆ รวมทั้งการติดเชื้อที่แผลผ่าตัด

ผลการศึกษา: ผู้ป่วยเป็นชาย 180 คน หญิง 150 คน อายุเฉลี่ย 63 ปี จัดอยู่ในกลุ่ม A 126 คน (38%) และกลุ่ม B 204 คน (62%) ไม่มีความแตกต่างทางสถิติระหว่างผู้ป่วยทั้ง 2 กลุ่มในแง่ลักษณะผู้ป่วยและตัวแปรเกี่ยวกับก่อนมะเร็ง ยกเว้นตำแหน่งมะเร็ง อัตราการเกิดแผลผ่าตัดติดเชื้อในผู้ป่วยทั้งหมดเท่ากับ 14.5% การเกิดแผลผ่าตัดติดเชื้อไม่แตกต่างกันในผู้ป่วยทั้ง 2 กลุ่ม (กลุ่ม A 11.1%, กลุ่ม B 16.7%, $p = 0.22$) ผู้ป่วยที่มีแผลผ่าตัดติดเชื้ออยู่ในโรงพยาบาลนานกว่าผู้ที่ไม่ได้มีแผลผ่าตัดติดเชื้อ (15.9 ต่อ 8.3 วัน, $p < 0.001$)

สรุป: การศึกษาเวชระเบียนย้อนหลังในผู้ป่วยที่ผ่าตัดมะเร็งลำไส้ใหญ่และลำไส้ตรง ซึ่งทุกรายได้รับยาปฏิชีวนะเพื่อป้องกันการติดเชื้อ พบอัตราการเกิดแผลผ่าตัดติดเชื้อ เท่ากับ 14.5% โดยไม่มีความแตกต่างระหว่างกลุ่มที่หยุดยาปฏิชีวนะภายใน 24 ชั่วโมงหลังผ่าตัด กับกลุ่มที่ได้รับยาปฏิชีวนะนานกว่า 24 ชั่วโมงหลังผ่าตัด ดังนั้นในการให้ยาปฏิชีวนะเพื่อป้องกันการติดเชื้อในการผ่าตัด ศัลยแพทย์น่าจะหยุดยานี้ได้ภายใน 24 ชั่วโมงหลังผ่าตัด เพื่อป้องกันการเกิดเชื้อดื้อยา และลดค่าใช้จ่ายที่ไม่จำเป็น
