ORIGINAL ARTICLE

EFFECT OF INTRA-ABDOMINAL ABSORBABLE SUTURES ON SURGICAL SITE INFECTION

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ABSTRACT

Purpose: To establish whether the rates of surgical site infection (SSI) in gastrointestinal surgery are affected by the type of intra-abdominal suturing: sutureless, absorbable material (polyglactin: Vicryl), and silk.

Methods: We conducted SSI surveillance prospectively in our hospitla.

Results: The overall SSI rate was 14.4% (13/90). The SSI rates in the sutureless, Vicryl, and silk groups were 4.8, 14.8, and 16.4%, respectively, without significant differ-ences among the groups. In colorectal surgery, the SSI rate in the Vicryl group was 13.9%, which was significantly lower than that of the silk group (22.4%; P = 0.034). The incidence of deeper SSIs in the Vicryl group, including deep incisional and organ/space SSIs, was significantly lower than that in the silk group (P = 0.04). The SSI rates did not differ among the suture types overall, in gastric surgery, or in appendectomy.

Conclusion: Using intra-abdominal absorbable sutures instead of silk sutures may reduce the risk of SSI, but only in colorectal surgery.

Keywords: Absorbable suture, Surgical site infection, Gastrointestinal surgery

INTRODUCTION

Surgical site infection (SSI) accounts for about 15% of nosocomial infections [1]. It is the most common nosoco-mial infection in surgical patients, accounting for 37% [2] and occurring after 10–30% of gastrointestinal operations [3–5]. Surgical site infection causes physical and psycho-logical distress to patients, is a burden to medical staff, and incurs additional costs to healthcare services [1, 6].

The Centers for Disease Control and Prevention (CDC) National Nosocomial Infection Surveillance (NNIS) risk indices for SSI comprise three crucial measures: the American Society of Anesthesiologists (ASA) classifica-tion, wound classification, and length of the operation [7–9]. Surgical site infection rates correlate with the magnitude of the risk index for 77% (34/44) of the NNIS procedure categories [8]. The other significant risk factors reported so far are body mass index [3, 10], diabetes mellitus [11], pulmonary and cardiovascular diseases [12], smoking [12, 13], emergency operations [14], preoperative hair removal [6], and perioperative factors such as blood sugar level [15], oxygen administration [16, 17], and body temperature [18].

Significant differences were found in the SSI rates when different suture materials were used in fascia closure and intra-abdominal ligation, particularly in lower ali-mentary tract operations. Togo et al. [19] conducted a retrospective review of hepatectomy patients and reported that SSI rates decreased after the introduction of an intra-abdominal absorbable suture. However, the effect of intra-abdominal absorbable suture materials on the reduction of SSI has not been established. We report the results of our SSI surveillance study, focusing on the type of intra-abdominal suture material used in the Department of Surgery, SMIEMER, Surat.

METHODS

From Nov 2008 to March 2011, we collected pro-spective data on patients who underwent surgery for gas-trointestinal disease at the Department of Surgery, SMIMER Hospital. This surveillance included patients who underwent surgery on the abdominal alimentary tract, such as the gastroduodenum, small intestine, colorectum, and appendix. Esophageal, anal, pancreatic, and biliary tract operations were excluded from this surveillance, considering their complexities in peri-operative management, the importance of surgical technique on outcome, and their higher contamination rate. The medical records of patients undergoing elective or emergency procedures were reviewed to obtain perioperative and operative data, and

information about SSIs for up to 1 month postoperatively. The ASA classification was determined by an attending physician or anesthesiologist. The diagnosis and classification of SSI (superficial incisional, deep incisional, or organ/space SSI) and surgical wound classification (Class I, clean; Class II, clean–contaminated; Class III, contaminated; or Class IV, dirty–infected) were based on the CDC definitions [20]. The selection of intra-abdominal suture material—sutureless, or only Vicryl, or only silk—was decided by the surgeon, as well as by the method and the suture material used for fascial closure. Data were collected by the attending surgeons who were responsible for data accumulation and SSI evaluation.

RESULTS

We accumulated data for 90 surgical patients. The age distribution was 7–96 years and 59.4% of the patients were male. The procedures studied included gastric surgery, defined as gastrectomy (n = 24); colorectal surgery, defined as colorectal resection (n = 39); appendectomy (n = 10); and other operations, including wedge resection of the alimentary tract, adhesi-olysis, resection of small intestine, bypass surgery, and perforation repair (n = 17). The overall SSI rate was 14.4% (13/90).

Incidence of SSI according to the intra-abdominal suture material

We did not find any difference in the SSI rates according to the type of intra-abdominal suture material used for gastric surgery, appendectomy, and other operations. However, in colorectal surgery, the SSI rate was significantly lower in the Vicryl group than in the silk group; at 13.9 versus 22.4% (P = 0.034; Table 1). In the Vicryl group, the incidence of deeper SSI, including deep incisional and organ/space SSI, was 2.5%, which was significantly lower than the 10.6% in the silk group (P = 0.04; Table 2).

Table 1: Type of operation and surgical site infection rates according to intra-abdominal sutures

Type of operation	Intra-abdominal sutures		
	Sutureless	Vicryl	Silk
All operations (90)	4.8 (6)	14.2 (45)	16.4 (38)
Gastric surgery (24)	6.3 (2)	10.1 (12)	9.6 (10)
Colorectal surgery (39)	8.7 (3)	13.9 (20)*	22.4 (16)
Appendectomy (10)	0 (1)	23.3 (4)	14.6 (5)
Others (17)	0 (1)	16.3 (9)	13.9 (7)

Number in parentheses indicates number of patients. Gastric surgery indicates gastrectomy. Colorectal surgery indicates colorectal resection, * P = 0.034 versus silk

In colorectal surgery, ASA classification, emergency, operation time, blood loss, laparoscopic surgery, wound classification, and intra-abdominal suture material were considered to be the most significant factors for SSI by univariate analysis (Table 3). These significant factors were analyzed using a multivariate test in relation to SSI. Laparoscopic surgery, including laparoscope-assisted surgery and sutureless surgery, which differ from open surgery in terms of the suture material used in the abdomen, were excluded from the analysis. Thus we analyzed 32 of the total 39 colorectal surgery cases.

Table 2: Site of surgical site infection and intra-abdominal sutures in colorectal surgery

Intra-abdominal sutures	Site of SSI		
	Superficial	Deep and organ/space	Unknown
Vicryl (20)	2	1 (2.5%)*	1
Silk (16)	2	2 (10.6%)	0

Number in parentheses indicates number of patients, * P = 0.04

DISCUSSION

Surgeons have long believed that contamination during surgery is the primary reason for postoperative wound infection. Thus we use various aseptic surgical techniques to prevent intraoperative contamination and postoperative infection. In 1999, the CDC established guidelines for the prevention of SSI [20]. Surveillance of SSI has also clarified the risk factors, such as ASA classification, wound classification, length of operation, and other previously described factors. These factors relate to microbial infec-tion and defense mechanisms by blood and oxygen supply to the surgical site [3, 12, 17]. It is also important to recognize that we can control many of these risk factors, such as operation times, patients' smoking habits, timing and method of hair removal, oxygen administration, and control of body temperature.

Foreign materials, especially silk or necrotic tissue, are known to accelerate inflammation and infection [20]. Studies on the relationship between suture material and wound infection show that the dose of contaminating Staphylococcus aureus cocci required to produce infection was much lower when silk was present at the operation site [21].

Since 1970, several studies have been conducted to compare the wound complication rates between silk and absorbable synthetic sutures. Suture sinus was more frequently associated with silk sutures than with absorbable sutures in gastrointestinal fascia closure [22] and neurosurgery; however, no difference was found in the rate of wound infection in these studies [23].

In the present surveillance of suture materials, Vicryl was used for 50% of the seromuscular sutures and intraabdominal ligatures, which was an overall increase from our previous surveillance [4], in which Vicryl was used for 28% of seromuscular sutures and only 16% of ligatures. A significant decrease in the SSI rate was

found when Vicryl was used instead of silk for intra-abdominal suture, especially in colorectal surgery, and the 8.5% reduction was thought to have a great effect. In the Vicryl group the ratio of deeper SSI, including deep incisional SSI and organ/space SSI, in relation to all SSIs was 17.8%, which was lower than 47.2% for silk (P = 0.04). These data may support the effect of intra-abdominal absorbable suture material in lowering SSI rates.

Table 3: Patients' characteristics, operative variables, and surgical site infection rates in colorectal surgery

Factors	All patients	SSI		% SSI	P value
		(-)	(?)		
Age (years)	67 ± 12	66.9 ± 11.7	68.4 ± 11.2	NS	
Sex					
Male	21	17	3	16.3	NS
Female	18	15	3	17.7	
Smoking status					
None/cessation C1 month	33	27	6	16.8	NS
Cessation \1 month/smoker	6	5	1	18.0	
Hair removal					
None/removed on operation day	24	20	4	17.4	NS
Removed the day before operation	15	12	2	16.2	
ASA classification					
1, 2	33	28	5	15.4	0.049
C3	6	4	2	25.9	
Emergency					
Elective	35	30	5	14.8	\0.001
Emergency	4	2	1	36.8	
Operation time (min)	195 ± 104.6	192.6 ± 99	219.0 ± 104		\0.05
BT	291	248	43	14.8	0.047
[T	98	75	23	23.5	
Unknown	1	1	0	0	
Blood loss (g)	257 ± 476	238 ± 443	413 ± 607		\0.05
Laparoscopic or assisted surgery					
Yes	34	28	6	18.8	0.018a
No	5	5	0	4.1	
Wound classification					
II	35	30	5	13.1	\0.001
III, IV	4	2	2	50.0	
Intra-abdominal suture material					
Sutureless	2	2	0	8.7	
Vicryl	20	17	3	13.9	0.034*
Silk	16	13	4	22.4	
Fascial suture material					
Absorbable	36	30	6	17.0	NS
Nonabsorbable	2	2	0	16.7	

T is the approximate 75th percentile of the duration of the specific operation; 240 min for colorectal operation
* versus silk, [a] Yates' correction

The multivariate analysis failed to identify the suture material as an independent risk factor. The difference in SSI rates might also be related to each hospital's effort to reduce nosocomial infections. A randomized control study is needed to clarify how significantly absorbable suture material decreases the rate of SSI.

The present study did not reveal a significant difference in SSI according to intra-abdominal suture materials used in gastric surgery or appendectomy. In gastric surgery, the percentage of contaminated or dirty-infected operations (wound classes III and IV) was 0.8%, which was lower than the 10% seen in colorectal surgery. The different wound contamination rates would relate to the lower incidence of SSI in gastric surgery, which might hide a small difference in SSI according to suture materials. In appendectomy, the proportion of wound classification III and IV was 51.2% in the Vicryl group, whereas it was 37.5% in the silk group. We believe this is why there was no difference in the incidence of SSI according to suture materials in gastric surgery or appendectomy.

In summary, according to our analysis of this SSI surveillance, the factors that influenced the SSI rate after gastrointestinal surgery were age, ASA classification, emergency operations, duration of surgery, blood loss, laparoscopic procedures, wound

classification, type of operation, and intra-abdominal suture material. As many factors influenced postoperative infection, further studies focusing on aspects of perioperative management such as the type and duration of antibiotics [24] are necessary in this field. Our SSI surveillance with special reference to suture material provided evidence that using an absorbable suture instead of silk as intra-abdominal suture material reduced the SSI rate, especially in colorectal surgery. A well-designed randomized controlled trial is needed to establish whether using intra-abdominal absorbable suture material does indeed reduce the incidence of SSI.

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