

Can Triclosan-Coated Sutures and the Use of Double Gloves Reduce the Incidence of Surgical Site Infections?

Takeya Hara^{a, c}, Ai Miyoshi^a, Asuka Tanaka^a, Serika Kanao^a, Masumi Takeda^a, Mayuko Mimura^a, Takashi Miyatake^b, Masaaki Nagamatsu^a, Takeshi Yokoi^a

Abstract

Background: Postoperative surgical site infections (SSIs) are one of the most frequent complications after open abdominal surgery. Triclosan-coated sutures were said to be able to reduce its occurrence. In gynecologic surgery, SSIs of the vaginal stump are a frequent cause of postoperative fever. Double gloving is also said to contribute to the prevention of SSIs. We performed abdominal hysterectomy with double gloving and sutured the vagina stump with VICRYL PLUS[®], a Polyglactin 910 suture coated with triclosan, to prevent SSIs. We investigated whether triclosan-coated sutures coupled with double gloving could indeed reduce the incidence of SSIs following abdominal hysterectomy.

Methods: We retrospectively reviewed 384 cases of abdominal hysterectomies operated in our department between April 2013 and March 2015. In the first period (from April 2013 to March 2014), we performed 195 operations with single gloving and sutured the vaginal stump with VICRYL[®] (Polyglactin 910 suture without triclosan coat). In the second period (from April 2014 to March 2015), we performed 189 operations with double gloving and sutured the vaginal stump with VICRYL PLUS[®] (Polyglactin 910 suture with triclosan coat). The primary outcome is the incidence of SSIs.

Results: The two groups were comparable with respect to risk factors for SSIs. The incidences of SSIs in the first and second groups were 17 of 195 patients (8.7%) and eight of 189 patients (4.2%), respectively. The difference in the incidence of SSIs was not significant between the two groups ($P = 0.097$). The numbers of cases requiring postoperative antibiotic therapy in the first and second groups were 13 (6.7%) and 4 (2.1%). The incidence was higher in the control group ($P = 0.045$). None of the 189 cases needed drainage therapy or a re-operation.

Conclusion: It is possible that triclosan-coated sutures coupled with double gloving are able to reduce SSIs and prevent SSI aggravation.

Keywords: SSIs; Triclosan-coated sutures; Double gloves

Introduction

Surgical site infections (SSIs) are the most common health-care-associated complication. SSIs occur in 2-5% patients undergoing inpatient surgery [1, 2], and account for 20% of all health-care-associated infections in hospitalized patients [3]. According to the Centers for Disease Control (CDC), 66% of all SSIs are located at the site of incision and are either superficial or deep SSIs [4]. This would extend the length of hospital stay and thereby reduce the patient's quality of life. Furthermore, when compared to people who do not develop SSIs, there is an increase in risk of death in the perioperative period [5]. In this study, we examined whether SSIs were reduced with the use of double gloving and antimicrobial sutures in the vaginal stump.

The purpose of surgery gloves is to block the transfer and subsequent propagation of pathogenic microorganisms from healthcare workers to patients (or from patients to healthcare workers). However, in cases where surgeries run over a longer duration, the gloves often tear or break, increasing the risk of SSIs [6].

In the 1970s, surgical implants were often coated with an antibacterial substance. Triclosan is a broad-spectrum antiseptic that has been widely used for over 30 years. VICRYL PLUS[®] refers to Polyglactin 910 sutures coated with triclosan. It is highly effective against gram-positive bacteria, and has a bacteriostatic effect against *E. coli* [7]. Researches on the prevention of SSIs due to the use of antimicrobial sutures have been frequently reported. However, no reports have reported its usefulness in context of gynecological surgeries. In gynecologic surgery, SSIs of the vaginal stump are a frequent cause of postoperative fever [8, 9]. The treatment of the abscess located in the vaginal stump is often ineffective, requiring re-operation in some cases.

To investigate the prevention of SSIs, we performed abdominal hysterectomy with the use of double gloving and sutured the vaginal stump with VICRYL PLUS[®], and compared

Manuscript accepted for publication February 06, 2017

^aDepartment of Obstetrics and Gynecology, Kaizuka City Hospital, 3-10-20 Hori Kaizuka-shi, Osaka 597-0015, Japan

^bDepartment of Obstetrics and Gynecology, Osaka Police Hospital, 10-31 Kitayamachou Tennoujiku Osaka-shi, Osaka 543-0035, Japan

^cCorresponding Author: Takeya Hara, Department of Obstetrics and Gynecology, Kaizuka City Hospital, 3-10-20 Hori Kaizuka-shi, Osaka 597-0015, Japan. Email: tttake.0303@gmail.com

doi: <https://doi.org/10.14740/jcgo429w>

Table 1. Demographic Data of Patients

Parameter	First period	Second period	P value
Total number	195	189	
Age (years)	50 ± 11.1	51 ± 11.0	0.44
BMI (kg/m ²)	23.5 ± 4.2	23.9 ± 4.5	0.56
Renal insufficiency	0	0	
Diabetes mellitus	9	11	0.65
Current or previous smoker	44	31	0.16
COPD	0	0	
Immunosuppression drugs	0	0	
Emergency surgery	5	11	0.13
Anemia (Hb < 11.0 g/dL)	39	39	0.9

BMI: body mass index; COPD: chronic obstructive pulmonary disease.

the outcome with hysterectomies without these maneuvers.

Methods

Patients and methods

A total of 384 patients who underwent abdominal hysterectomies between April 2013 and March 2015 in the Department of Obstetrics and Gynecology of Kaizuka City Hospital in Osaka, Japan, registered for the study. In the first period (from April 2013 to March 2014), we performed 195 operations with single gloving and sutured the vaginal stump with VICRYL® (Polyglactin 910 suture without triclosan coat). In the second period (from April 2014 to March 2015), we performed 189 operations with double gloving and sutured the vaginal stump with VICRYL PLUS® (Polyglactin 910 suture with triclosan coat).

All patients underwent shaving immediately before surgery. Skin disinfection was carried out using the 10% povidone-iodine solution. If patients were allergic to iodine, chlorhexidine was used instead. All patients received prophylactic intravenous antibiotics, a cephalosporin, before incision and every 3 h during the operation. The skin was incised with a scalpel. Subcutaneous tissue, fascia and peritoneum were dissected with an electric knife.

Peritoneal closure was achieved by continuous suture. Fascia and subcutaneous suture were achieved by interrupted suture. Dermal suture was achieved by continuous or interrupted suture. We washed the pelvis with approximately 1,000 - 2,000 mL of saline before peritoneum closure, and then washed the subcutaneous tissue with approximately 200 - 300 mL of saline about before dermal suture.

Evaluation

SSIs were identified according to the Centers for Disease Control and Prevention criteria guidelines from 1999 [10]. After surgery, patients were followed up daily during their hospital

stay by the attending physician. We evaluated patients for 30 days after surgery. The primary outcome was the incidence of SSIs.

Statistical analysis

Differences between the two groups were calculated using the Mann-Whitney U test for continuous variables or the Fisher exact test for categorical variables, using JSTAT (version 16.1, <http://toukeijstat.web.fc2.com/>). The significance level was set at P = 0.05.

Results

Comparison of patient demographics and perioperative status

Patient demographics in both groups and the risk factors of SSIs are summarized in Table 1. There were no statistically significant differences between two groups. Anemia was defined as hemoglobin concentration of less than 11.0 g/dL. The perioperative data for both groups are summarized in Table 2. There were no statistically significant differences between the two groups as well.

Incidence of SSIs

The incidence of SSIs in the first period (group with single gloving and without triclosan) was 17 of 195 patients (8.7%) and that in the second period (group with double gloving and with triclosan) was eight of 189 patients (4.2%) (Table 3). There were no statistically significant differences between the two groups (P = 0.097). When the SSIs were further distinguished into superficial SSIs and organ space SSIs, there were also no statistically significant differences between the two groups with respect to superficial SSIs (2.5% in the first period

Table 2. Perioperative Status of Patients

Parameter	First period	Second period	P value
Blood loss (mL)	365 ± 357	476 ± 720	0.74
OR time (min)	196 ± 93	207 ± 112	0.8
Benign diseases	108	106	0.92
Malignant diseases	87	83	0.92
Type of surgery			
TAH	142	147	0.29
TAH + LN	32	23	0.25
RH/SRH	21	19	0.87

TAH: total abdominal hysterectomy; LN: lymphadenectomy; RH: radical hysterectomy; SRH: semi-radical hysterectomy.

and 1.6% in the second period, $P = 0.72$) and organ space SSIs (6.2% in the first period and 2.6% in the second period, $P = 0.14$). Deep SSIs were not observed in both groups. In the first and second periods, 13 of 195 patients (6.7%) and four of 189 patients (2.1%) respectively required antibiotic treatment. The frequency in the second period was significantly less than in the first period ($P = 0.045$) (Table 3). Re-operation and drainage were not performed in both groups.

Discussion

There are many studies describing the preventive effect of antimicrobial sutures for the fascial suture on the occurrence of SSIs [11, 12]. However, a meta-analysis of randomized clinical trials has reported that antibacterial sutures do not in fact prevent SSIs [13]. It is thus controversial as to whether antibacterial sutures are indeed able to prevent SSIs.

In the field of gynecology, there has not been any study reporting the benefits of suturing the vaginal stump with VICRYL PLUS®. In our study, there is a possibility that SSIs can be reduced either by suturing the vaginal stump with antimicrobial sutures, or by double gloving.

As mentioned above, VICRYL PLUS® has an antibacterial efficacy against gram-positive cocci and a bacteriostatic effect against *E. coli*. For intra-abdominal abscess in gynecology, Soper reported the numbers of bacteria isolated from 759

cases as 1,256 media in aerobic and 1,187 media in anaerobic bacteria, respectively [14]. The number of gram-positive bacteria and *E. coli* was 598 media [13-15]. These accounted for 24% of all bacteria. As part of the pathogenesis of vaginal stump abscess, we hypothesized that bleeding from the sutured stump forms a hematoma that subsequently gets infected with bacteria in the abdomen. As such, it was believed that there is potential in reducing bacterial infections in the vaginal stump sutured using VICRYL PLUS®.

With regard to the efficacy of double gloving, the WHO Guidelines for Safe Surgery 2009 stated that “8-15% of surgical gloves are torn or punctured during procedures. No difference in SSI rates was observed when gloves were damaged or not during surgery, and the use of two pairs of gloves (double gloving) did not decrease the rates” [16-18]. However, evidence from a prospective observational study of 4,147 cases of gastrointestinal surgery, vascular surgery and trauma surgery by Misteli et al challenged this claim. The frequency of SSI occurrence was reported to occur in 51 of 677 cases (7.5%) when gloves were damaged, but 137 of 3,470 cases (3.9%) when gloves were not damaged. Although not statistically significant, there was a tendency for the occurrence of SSIs to increase upon glove damage example [6]. Since introducing double gloving in our department, we have found a tendency toward a decline in occurrence of SSIs.

We are unable to specifically identify the factor contributing to the reduction of SSIs since the introduction of VICRYL

Table 3. Incidence of Surgical Site Infections (SSIs)

	First period	Second period	P value
Total patients	195	189	
SSIs	17 (8.7%)	8 (4.2%)	0.097
Superficial SSIs	5 (2.5%)	3 (1.6%)	0.72
Deep SSIs	0	0	
Organ space SSIs	12 (6.2%)	5 (2.6%)	0.14
Antibiotic treatment	13 (6.7%)	4 (2.1%)	0.045
Reoperation/drainage	0	0	

SSIs: surgical site infections.

PLUS® and double gloving started simultaneously. However, we believe that double gloving was important in the reduction of superficial SSIs because the procedure for abdominal closure was identical in both periods. Moreover, some literature support the effectiveness of double gloving for the reduction of SSIs.

The only statistical significance in our study was the number of cases requiring antibiotic treatment. We performed antibiotics therapy only in cases of fever (38 °C or higher). Afebrile patients with SSIs only received wound cleaning. This result suggests that suturing the vaginal stump with both VICRYL PLUS® and double gloving can prevent the aggravation of SSIs.

The sites of infection in the abdominal total hysterectomy for benign gynecologic disease were identified: urinary tract (4%), wound (3%), unknown fever (3%) and vaginal infection (0.2%), and intra-abdominal infection (0.1%) [19]. In this study, both the superficial SSIs and organ space SSIs showed there is a slightly higher trend compared to the occurrence frequency described above. One possible cause for this is that both benign and malignant diseases are included in this study. As such, the operation duration was inevitably longer resulting in a greater risk of bacterial infection.

Another limitation of this study to consider is that the bacterial culture was not routinely examined. At the beginning of the antibiotic therapies in several postoperative febrile cases, the abscess was too small to be aspirated. It is thus difficult to retrospectively identify the causative bacteria of the SSIs. The causative microbes of superficial SSIs have not been investigated as well.

Conclusion

Triclosan-coated sutures coupled with double gloving show potential in the ability to reduce SSIs and prevent SSIs from becoming severe.

Conflicts of Interest

The authors report no conflicts of interest.

Financial Support

There is no funding source for this research.

Disclosure

These findings were presented at the 68th Annual Congress of the Japan Society of Obstetrics and Gynecology, April 22 to 24, 2016 held in Tokyo, Japan.

References

1. Cruse P. Wound infection surveillance. *Rev Infect Dis.* 1981;3(4):734-737.
2. Graves EJ. National Hospital Discharge Survey. *Vital Health Stat* 13. 1989;99:1-60.
3. Klevens RM, Edwards JR, Richards CL, Jr., Horan TC, Gaynes RP, Pollock DA, Cardo DM. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep.* 2007;122(2):160-166.
4. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. *Infect Control Hosp Epidemiol.* 1992;13(10):606-608.
5. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infect Control Hosp Epidemiol.* 1999;20(11):725-730.
6. Misteli H, Weber WP, Reck S, Rosenthal R, Zwahlen M, Fueglistaler P, Bolli MK, et al. Surgical glove perforation and the risk of surgical site infection. *Arch Surg.* 2009;144(6):553-558; discussion 558.
7. Gomez-Alonso A, Garcia-Criado FJ, Parreno-Manchado FC, Garcia-Sanchez JE, Garcia-Sanchez E, Parreno-Manchado A, Zambrano-Cuadrado Y. Study of the efficacy of Coated VICRYL Plus Antibacterial suture (coated Polyglactin 910 suture with Triclosan) in two animal models of general surgery. *J Infect.* 2007;54(1):82-88.
8. Choojit W, Ruangkriss T. Surgical wound infections in gynaecology at Rajvithi Hospital 1989-1990. *J Med Assoc Thai.* 1995;78(Suppl 2):S78-80.
9. Vinkomin V. Vaginal scrub prophylaxis in abdominal hysterectomy. *Southeast Asian J Trop Med Public Health.* 1995;26(1):188-192.
10. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol.* 1999;20(4):250-278; quiz 279-280.
11. Justinger C, Slotta JE, Ningel S, Graber S, Kollmar O, Schilling MK. Surgical-site infection after abdominal wall closure with triclosan-impregnated polydioxanone sutures: results of a randomized clinical pathway facilitated trial (NCT00998907). *Surgery.* 2013;154(3):589-595.
12. Nakamura T, Kashimura N, Noji T, Suzuki O, Ambo Y, Nakamura F, Kishida A. Triclosan-coated sutures reduce the incidence of wound infections and the costs after colorectal surgery: a randomized controlled trial. *Surgery.* 2013;153(4):576-583.
13. Diener MK, Knebel P, Kieser M, Schuler P, Schiergens TS, Atanassov V, Neudecker J, et al. Effectiveness of triclosan-coated PDS Plus versus uncoated PDS II sutures for prevention of surgical site infection after abdominal wall closure: the randomised controlled PROUD trial. *Lancet.* 2014;384(9938):142-152.
14. Soper DE. Bacterial vaginosis and postoperative infections. *Am J Obstet Gynecol.* 1993;169(2 Pt 2):467-469.
15. Duff P, Park RC. Antibiotic prophylaxis in vaginal hysterectomy: a review. *Obstet Gynecol.* 1980;55(5 Suppl):193S-202S.

16. Al-Habdan I, Sadat-Ali M. Glove perforation in pediatric orthopedic practice. *J Pediatr Orthop.* 2003;23(6):791-793.
17. Alrawi S, Houshan L, Satheesan R, Raju R, Cunningham J, Acinapura A. Glove reinforcement: an alternative to double gloving. *Infect Control Hosp Epidemiol.* 2001;22(8):526-527.
18. Dodds RD, Guy PJ, Peacock AM, Duffy SR, Barker SG, Thomas MH. Surgical glove perforation. *Br J Surg.* 1988;75(10):966-968.
19. Makinen J, Johansson J, Tomas C, Tomas E, Heinonen PK, Laatikainen T, Kauko M, et al. Morbidity of 10 110 hysterectomies by type of approach. *Hum Reprod.* 2001;16(7):1473-1478.