〈Regular Article〉

Impact of surgical adhesion barrier on significant adhesion during a repeat cesarean section

Wataru SAITO[1)], Yukiko HAZAMA[1)], Satomi SYODA[2)], Ryo MATSUMOTO[1)], Keiko MATSUMOTO[1)], Mika SUGIHARA[1)], Tsuyoshi ISHIDA[1)], Takafumi NAKAMURA[1)], Koichiro SHIMOYA[1)]

1) Department of Obstetrics and Gynecology 1,
2) Sixth Year Medical Student in fiscal year of 2021, Kawasaki Medical School

ABSTRACT Background: Post-cesarean adhesions are associated with delayed infant delivery and infertility. In this retrospective study, we analyzed the effects of hyaluronic acid-carboxymethylcellulose (HA/CMC) membranes on postoperative adhesion during cesarean section.

Methods: Sixty-seven patients were divided into the surgical adhesion barrier used (n = 28) and not-used group (n = 39). We compared the severity of adhesion at the repeat cesarean section, as well the following variables: operation and incision delivery time, blood loss, and postoperative infection between both groups. The severity of adhesion was analyzed using the Zühike's adhesion score between the abdominal wall and uterine corpus, and the Steinleitner's uterine adhesion score.

Results: We found that the Zühike's adhesion score between the abdominal wall and corpus of the uterus in the surgical adhesion barrier used group was significantly lower than that of the not-used group (0.46 ± 0.2 and 1.0 ± 0.2, respectively) (p = 0.04). The Steinleitner's uterine adhesion score of the surgical adhesion barrier used group was lower than that of the not-used group (0.5 ± 0.3 and 1.3 ± 0.3, respectively), but not significantly (p = 0.07).

Discussion: We concluded that the surgical adhesion barrier was effective in preventing postoperative adhesion formation during cesarean sections. However, further investigations are necessary to reveal the usefulness of the surgical adhesion barrier during cesarean section, including its cost-effectiveness. doi：10.11482/KMJ-E202248049 *(Accepted on April 12, 2022)*

Key words：Adhesion barrier, Cesarean section, Hyaluronic acid-carboxymethylcellulose membrane, Steinleitner's uterine adhesion score, Zühike's adhesion score

Corresponding author
Koichiro Shimoya
Department of Obstetrics and Gynecology 1, Kawasaki Medical School, 577 Matsushima, Kurashiki, 701-0192, Japan.
Phone : 81 86 462 1111
Fax : 81 86 462 1199
E-mail: shimoya@med.kawasaki-m.ac.jp

INTRODUCTION

It is well known that 95% of post-abdominal surgery patients experience adhesions during repeat abdominal operation[1]. Abdominal adhesions can induce ileus, chronic pain, and infertility[2-4]. The mechanism of adhesion has been revealed in previous studies[5], however its occurrence is still difficult to control and it represents an important postoperative complication.

Cesarean section is one of the most frequently performed surgical procedures worldwide, with a rate generally ranging between 5% and over 30% of all deliveries in the USA[6]. In addition, the ratio of cesarean sections in Japan is approximately 20%[7]. Post-cesarean adhesions are associated with delayed infant delivery[8]. Several procedures have been investigated to reduce postoperative adhesions in cesarean section[9]. We previously reported that non-closure of the peritoneum during cesarean delivery decreases the formation of abdominal adhesions[10]. Moreover, several adhesion preventive materials have been used in abdominal operations to decrease adhesion formation. Three types of surgical adhesion barriers are generally used in Japan. The first is hyaluronic acid-carboxymethylcellulose (HA/CMC) combined with a bioresorbable membrane (Seprafilm; Genzyme, Cambridge, MA, USA), which has been modified to prolong its retention time in the body. The second is oxidized regenerated cellulose (Interceed; ETHICON Women's Health and Urology, Somerville, NJ, USA), which is an absorbable adhesive barrier. Lastly, expanded polytetrafluoroethylene (ePTFE, Gore-Tex Surgical Membrane; W.L. Gore Corp., Flagstaff, AZ), a non-absorbable adhesion barrier that must be sutured to the tissue[11]. Several reports about the association between surgical adhesion barriers and postoperative adhesion during cesarean section exist; however, the effectiveness of this association remains controversial. In the present retrospective study, we analyzed the effects of sodium HA/CMC on postoperative adhesions during a cesarean section.

SUBJECTS AND METHODS

We selected 438 cesarean section cases from the Kawasaki Medical School Hospital between 2006 and 2016. We then enrolled 67 cases of repeat cesarean sections, which were performed at our institute at both the previous and repeat cesarean sections.

The sodium HA/CMC (Seprafilm, Genzyme, Cambridge, MA) surgical adhesion barriers were randomly used in previous cesarean sections. A standard surgical technique was performed during the previous surgery through an abdominal incision. The skin incision for previous cesarean section is chosen as median or transverse abdominal incision, depending on the case, and the same site is incised for repeat caesarean sections. The transverse lower segment uterine incision was closed using two layers of polyglactin sutures (Vicryl, Ethicone INC). When a surgical adhesion barrier is used, after irrigation of the abdominal cavity to remove residual intra-abdominal blood depots, two sheets of surgical adhesion barrier were attached on the corpus of the uterus surface and the transverse lower segment uterine incision site. This study was approved by the Ethics Committee of Kawasaki Medical School (No. 2479).

The 67 patients were divided into two groups: the previous surgical adhesion barrier (n = 28) and the non-used group (n = 39). We compared the severity of adhesion at the repeat cesarean section, as well as the operation and incision delivery time, blood loss, and postoperative infection between both groups. Febrile morbidity was defined as a temperature above 38℃ for 2 days excluding the first 24 hours. Total blood loss was determined by adding the volume of aspiration during the operation to the gauze blood loss.

We have considered two assessment methods

in the present study as shown in Tables 1 and 2. The severity of adhesion was analyzed using the Zühike's adhesion score[12] between the abdominal wall and corpus of the uterus (Table 1) and the Steinleitner's uterine adhesion score (Table 2)[13]. Steinleitner's uterine adhesion score is based on 'part', 'degree' and 'scope'. The score is expressed as the sum of the scores for each of the three items.

Zühike's adhesion score is a factor involved in the time to reach the abdominal cavity. Steinleitner's uterine adhesion score is a peri-uterine adhesion and can be a factor and assessment associated with subsequent fertility and organ damage.

The data were analyzed using the JMP software (Ver. 9.0.0; SAS Institute, Tokyo, Japan) software. Normality was tested using the Shapiro - Wilk test. To compare the two groups, we used the Mann - Whitney test, Student's t-test, and chi-square test. Data represent the mean ± SD. Statistical significance was set at $p < 0.05$.

RESULTS

As shown in Table 3, there were no significant differences in the two groups' characteristics. Table 4 demonstrates the outcomes of both groups at the repeat cesarean section. There were no significant differences in the incision delivery time, estimated blood loss, operative time, or maximum CRP level. There were also no differences in the incidence

Table 1. Adhesion score to the abdominal wall wound below by Zühike *et al.*

Score	Degree of adhesion	
0	No adhesions	
1	Thin-film adhesions	Bluntly and easily detachable
2	Somewhat strong adhesion	Sometimes sharp detachment is necessary
3	strong adhesion	Sharp exfoliation required throughout.
4	Very strong adhesion	Dissection is accompanied by organ damage

Table 2. Adhesion score to uterus by Steinleitner *et al.*

Score	Part of adhesion	Degree of adhesion	Scope of adhesion
0	No adhesions	No adhesions	No adhesions
1	Adhesions in the uterus	Thin-film adhesions	Less than 50% of damaged surface
2	Adhesions between the uterus and the bowel or pelvic sidewalls	Thickened adhesions	More than 50% of damaged surface

Table 3. Characteristics of patients (N = 67)

	Study group (n = 28)	Control group (n = 39)	Significance
Age (years)	32.0 ± 1.0	31.3 ± 0.8	NS[a]
Body weight (kg)	62.4 ± 2.3	64.3 ± 1.9	NS[a]
First/Second C/S	20 / 8	30 / 9	NS[b]
Indication of C/S (planned/emergent)	16 / 12	15 / 24	NS[b]
・repeated C/S	7	8	
・placental abruption	1	2	
・malpresentation	7	6	
・non-reassuirng fetal status	4	11	
・placenta previa	1	1	
・dystocia	4	7	
・post myomectomy	1	1	
・other reasons	3	3	

(C/S: cesarean section) (a: Student's t-test, b: chi-square test)

Table 4. Results of both groups

	Study Group (n = 28)	Control Group (n = 39)	*P* value
Incision delivery time (minutes)	14.9 ± 1.4	14.8 ± 1.2	NS[a]
Estimated blood loss (ml)	643.3 ± 74.5	764.6 ± 63.1	NS[a]
Operation time (minutes)	83.1 ± 4.3	80.3 ± 3.6	NS[a]
Maximum CRP	5.4 ± 0.4	4.6 ± 0.4	NS[a]
Severity of adhesion			
Zühike's score	0.46 ± 0.2	1.0 ± 0.2	0.04[a]
Steinleitner's score	0.5 ± 0.3	1.3 ± 0.3	0.07[a]

(a: Student's t-test)

of postoperative complications between the two groups, such as fever, anemia, endometritis, wound infection, urinary tract infection, pneumonia, ileus, and antibiotic use. As shown in Table 4, the Zühike's adhesion score between the abdominal wall and corpus of the uterus of the surgical adhesion barrier was significantly lower than that of the non-used group (0.46 ± 0.2 and 1.0 ± 0.2, respectively) (p = 0.04). The Steinleitner's uterine adhesion score of the surgical adhesion barrier was lower than that of the non-used group (0.5 ± 0.3 and 1.3 ± 0.3, respectively), but not significantly (p = 0.07). These results were included in both the second and third cesarean sections. We compared the severity of adhesion in the surgical adhesion barrier (n = 20) to that in the non-used group (n = 30) at the second cesarean section. The Zühike's adhesion score of the surgical adhesion barrier at the second cesarean section was also significantly lower than that of the non-used group (0.3 ± 0.2 and 0.9 ± 0.2, respectively; p = 0.02). The Steinleitner's score of the surgical adhesion barrier used was lower than that of the non-used group (0.5 ± 0.4 and 1.3 ± 0.3, respectively), but not significantly (p = 0.09). We also compared the severity of adhesion in the surgical adhesion barrier (n = 8) to that of the non-used group (n = 9) at the third cesarean section. There were no significant differences in the Zühike's adhesion and Steinleitner's score between the surgical adhesion barrier and the non-used group at the third cesarean section.

DISCUSSION

Several approaches to prevent postoperative adhesions, such as operative procedures, medical treatment[11, 14], and pharmacological agents[15–17], were reported. However, there are no established methods to prevent postoperative adhesions. Because cesarean section is a unique operation, which can be repeated in the future, it is particularly important to prevent adhesion to avoid any adverse outcome at the repeat section. Post-cesarean adhesions are associated with delayed delivery of infants during repeat cesarean delivery[8].

To prevent the formation of postoperative adhesions, surgical adhesion barriers are widely used during cesarean section. Sodium HA/CMC, and oxidized regenerated cellulose were used as absorbable adhesion barriers during cesarean sections. Several reports have demonstrated the effectiveness of the surgical adhesion barrier in preventing adhesion[18–20]. However, the evidence is limited because of the sample size, and several studies have reported that the surgical adhesion barrier was not effective during cesarean section. The present study revealed that sodium HA/CMC had protective effects against the formation of postoperative adhesions during cesarean delivery, especially during the first cesarean section. Zühike's adhesion score is considered to be a factor involved in the time to reach the abdominal cavity, and a smaller degree of adhesion may contribute to easier surgery and fewer surgical complications during re-

operation. In addition, Steinleitner's uterine adhesion score is a peri-uterine adhesion score, which can be evaluated as a factor related to the next fertility and organ damage, and the use of sodium HA/CMC may contribute to the ease of surgery and reduction of surgical complications during re-operation, although no significant difference was observed in the present study. A trend towards reduced adhesions has been observed, which may contribute to a reduction in fertility and the risk of organ damage during re-operation.

Previous reports have demonstrated that the use of a surgical adhesion barrier is related to a shortage of operative time and incision-delivery time. However, in the present study, there were no significant differences in the incision delivery time, estimated blood loss, operation time, or maximum CRP. The reason might be that repeat cesarean section is performed by several doctors, such as resident doctors and junior fellows, because our institute is an educational hospital.

A recent randomized controlled study of HA/CMC at cesarean section revealed that this membrane was effective in preventing adhesion formation[21]. A prospective cohort study also demonstrated the association between the use of the HA/CMC adhesion barrier and decreased adhesion during repeat cesarean section[22]. Our results were compatible with the previous reports.

In conclusion, the surgical adhesion barrier was effective in preventing the formation of postoperative adhesions during cesarean sections. Limitations of the study include the fact that Zühike's score was lower in the non-user group, as there was no difference in the clinical outcome, although Zühike's score showed a difference between the use and non-use of the anti-adhesive sodium HA/CMC. There is a possibility of a bias against the use of anti-adhesive agents during caesarean section, and a possibility of information bias due to the open-labelled study design. However, Albright *et al*. reported that cost-effective analysis is critical for the use of a surgical adhesion barrier[23]. Similarly, Roy *et al*. reported the economic impact of using an adhesion barrier in gynecologic surgeries[24]. Therefore, further investigations are necessary to reveal the usefulness of the surgical adhesion barrier at cesarean section, including its cost-effectiveness.

DISCLOSURE

None declared.

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