Chinese Journal of Traumatology 21 (2018) 20–26

Contents lists available at ScienceDirect

Chinese Journal of Traumatology

journal homepage: http://www.elsevier.com/locate/CJTEE

Original Article

Effect of retension sutures on abdominal pressure after abdominal surgery

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ARTICLE INFO

Article history:
Received 5 July 2017
Received in revised form
20 September 2017
Accepted 30 September 2017
Available online 31 January 2018

Keywords:
Sutures
Intra-abdominal pressure
Intra-abdominal hypertension
Abdominal compartment syndrome
Surgical wound dehiscence
Infection

ABSTRACT

Purpose: To evaluate the effect of retention sutures on abdominal pressure and postoperative prognosis in abdominal surgery patients.

Methods: This prospective cohort study included patients who were admitted to Daping Hospital from May 15, 2014 to October 11, 2014. A total of 57 patients were enrolled, including 18 patients in the "U" type retention suture group, 17 patients in the intermittent retention suture group, and 22 patients in non-retention suture group. The demographic data, clinical data and risk factors for abdominal wound dehiscence were recorded. The bladder pressure (IVP) was monitored preoperatively, intraoperatively, and four days postoperatively. Additionally, the incidence of abdominal wound dehiscence and infection 14 days after the operation was recorded.

Results: During the operation, the IVP decreased and then increased; it was at its lowest 1 h after the start of the operation (5.3 mmHg ± 3.2 mmHg) and peaked after tension-reducing (8.8 mmHg ± 4.0 mmHg). The IVP values in the "U" type retention suture group and intermittent retention suture group were higher than in the non-retention suture group 4 days after operation ($p < 0.005$). The Visual Analogue Scale (VAS) pain scores were 3.9 ± 2.2, 3.8 ± 2.0, and 3.0 ± 1.0 in the retention suture group, intermittent retention suture group and non-retention suture group, respectively. The VAS pain scores in the "U" type tension-reducing group and intermittent tension-reducing group were higher than in the non-tension-reducing group ($p < 0.005$).

Conclusion: Although retention sutures may reduce the incidence of postoperative wound dehiscence in abdominal surgery patients, they can increase the IVP and postoperative pain.

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Introduction

In 1952, silks were first used as intermittent retention sutures in midline-incision abdominal surgery.[1,2] In the 1980s, retention sutures were essential for closing abdominal incisions. Hubbard et al[3] found that patients in whom retention sutures were not used to close incisions had worse prognosis. Abdominal wound dehiscence is the most serious complication after abdominal surgery. Despite the progress in surgical techniques and the implementation of risk control measures in recent years, the mortality (approximately 10%–45%) caused by abdominal wound dehiscence is still high.[4–6] Relaxation suture refers to the reduction in laparotomy-closed abdominal incision, adopting absorption of suture without tension through the abdomen full-thickness suture abdominal incision, to reduce the tension of abdominal incision, a method for preventing abdominal incision dehiscence. Retention sutures reduce incision tension, provide sufficient blood supply and rapidly heal wound margin tissue in the absence of tension, avoid wound dehiscence, and reduce the incidence of wound infection. Retrospective studies have shown that retention sutures prevent abdominal wound dehiscence.[7–9] The indications for retention sutures included increased age, trauma, diabetes, uremia, cirrhosis, and malnutrition.[5,6,10–17]

Retention sutures may reduce abdominal wall compliance; however, the decreased abdominal wall compliance is one of the risk factors for abdominal hypertension.[18–21] Normal abdominal pressure is approximately 5–7 mmHg in healthy adults, approximately 10 mmHg in critically ill patients.[21–23] As abdominal pressure is found to be associated with abdominal complications, it has become increasingly important for postoperative management in abdominal surgery patients.[24–27] High IAP could damage organs inside and outside the abdominal cavity by reducing venous return, cardiac output, and end-organ perfusion of the

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Peer review under responsibility of Daping Hospital and the Research Institute of Surgery of the Third Military Medical University.

https://doi.org/10.1016/j.cjtee.2017.08.008

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abdominal cavity.[22,28–30] High IAP not only affects wound healing and increases the rate of abdominal and abdominal wall infections but also leads to organ dysfunction involving the cardiovascular, respiratory, hepatic, renal, and intestinal systems.[31–34] Intra-abdominal hypertension (IAH) may worsen prognosis in some patients. Many studies have investigated the occurrence and effects of high IAP in emergency surgery (especially trauma) or critically ill patients.[35] Sugrue et al[36] studied emergency and elective abdominal surgery patients and found that 95% of patients undergoing elective abdominal surgery developed IAH within 72 h of surgery.

In the present study, we sought to investigate the effects of retention sutures on abdominal pressure and the postoperative prognosis in the perioperative period in patients undergoing elective abdominal surgery to provide insights for clinical work.

Materials and methods

Ethical approval

This study was approved by the Ethics Committee of the Third Military Medical University. All patients or their families signed an informed consent form.

Subjects

Trauma patients who were admitted to Daping Hospital during May 15, 2014 to October 11, 2014 and met the inclusion criteria were enrolled in this study.

The patient inclusion criteria were as follows: age ≥18 years and elective or emergency laparotomy procedures, accompanied by more than two incision cracking risk factors. The exclusion criteria were as follows: age less than 18 years; bladder abnormalities; bladder contractures; bladder cancer that makes it inappropriate to monitor IVP; and lack of consent by the patients or their families for participation in the study.

Methods

After admission to Daping Hospital, the patients were randomly divided into three groups: the "U" type retention suture group, the intermittent retention suture group and the non-retention suture group.

For the extraperitoneal intermittent retention suture, a 2# Dexon line was used to needle from the site to a 3–4-cm distance from the cut edge. The needle was withdrawn through the skin, subcutaneous tissue, rectus abdominis anterior sheath, rectus abdominal muscle, and rectus abdominis posterior sheath. Extraperitoneal needling was performed from the opposite parallel site of the incision, and the needle was passed through rectus abdominis posterior sheath, rectus abdominal muscle, rectus abdominis anterior sheath, and subcutaneous tissue. The needle was then withdrawn at a 3–4-cm distance from the cut edge. The needle was sutured every 10 cm, and the suture was buried temporarily without knotting. After completing the conventional stitching of the abdominal wall layers, the suture was knotted, and the knot was tightened with a rubber tube. We implemented percutaneous relaxation suture through the rubber hose, avoiding stylolite oppressing the skin directly (Fig. 1).

For the extraperitoneal "U" shaped retention suture, the needle was inserted into the ipsilateral skin from the site 10 cm from the needle point and 3–4 cm from the cut edge and passed through the peritoneum. The other methods were the same with the methods of intermittent retention suture (Fig. 2).

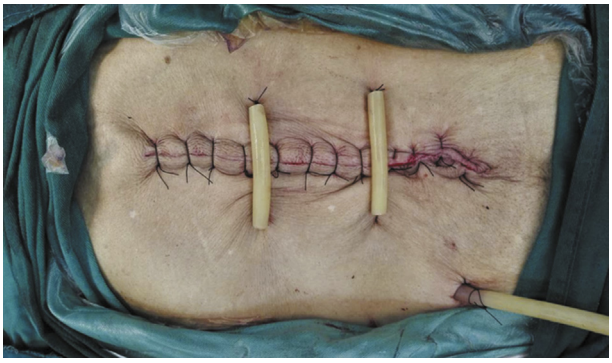

Fig. 1. The intermittent retention suture group.

Fig. 2. The "U" type retention suture group.

Measurement of abdominal pressure

The Philips IntelliVue MP30 pressure transducer kit, Smiths medical single monitoring kit, and MX9505T were used. To ensure that the intra-operative pressure measurements did not affect the surgical procedure and its timeliness and continuity, abdominal pressure was measured using continuous bladder manometry. The patient was calm and placed in a complete supine position. A pressure transducer line was connected to the monitor and was assembled under sterile conditions. The pressure transducer was connected to the urine catheter, and normal saline was used to expel the air. The monitor was calibrated to a zero scale. An axillary line was set as the reference plane. After emptying the bladder by injecting 25 ml of 0.9% saline via the catheter, the monitoring set was switched to the patient side, and the IVP values were read after the end-expiratory digital readings were stable. The IVP was measured every 6 h before and after surgery; the highest daily value was recorded from admission to 4 days after the operation.

Recorded data

(1) Patient basic information including: age, the number of male patients, body mass index (BMI), APACHE II score, primary disease (trauma, gastrointestinal obstruction, gastrointestinal bleeding, gastrointestinal cancer, abdominal infection, other), surgery type (emergency surgery or elective surgery), specific operation (closure of a colonic stoma, gastrointestinal cancer surgery, gastrointestinal perforation repair, intestinal adhesion lysis, etc.), incision length, incision site (median incision, transrectal incision), wound dehiscence and the number of risk factors for infection.

(2) The risk factors for abdominal wound dehiscence including: age > 60 years, malnutrition or cachexia (hypoalbuminemia

or clinical cachexia), emergency surgery, intra-abdominal infections, advanced malignancies, use of corticosteroids within the recent 12 months (prednisone > 10 mg/d or equal doses for more than three months), uremia, hemodynamic instability (BP ≤ 90 mmHg), hemoglobin < 100 g/L (due to perioperative blood loss or anemia), abdominal distention (due to ascites or ileus), chronic lung disease, clinical jaundice (total bilirubin > 3 mg/dl) and diabetes.

(3) Intraoperative data: type of retention suture, IVP at various time points before the operation, after anesthesia, after the skin incision, after cutting of the subcutaneous tissue, after cutting of the rectus abdominis sheath, after cutting of the rectus abdominis guard, 1 h after the start of the operation, after closure of the rectus abdominis guard, after closure of the rectus abdominis sheath, after closure of the skin, after closure of the subcutaneous tissue, and after placement of the retention suture.

(4) The perioperative IVP was recorded before the operation, and 1 day, 2 days, 3 days, and 4 days after the operation.

(5) The prognostic indicators were as follows: wound dehiscence, infection, reoperation, length of postoperative hospital stay, total hospitalization time, postoperative anus exhaust time to removal of the stitches, and VAS pain score 1 day after the operation.

Statistical methods

Measurement data are expressed as the mean ± SD or median (interquartile range). Continuous variables with normal distribution were compared using *t*-test, and abnormally distributed variables were compared using the Wilcoxonrank sum test. Frequencies were compared using the Pearson Chi-Square test and Fisher's exact test. $p < 0.05$ was considered statistically significant. Data were compared using repeated measures generalized linear models. Paired *t*-test was used to compare the IVP between each group at various time points. $p < 0.05$ was considered statistically significant. SPSS 13.0 was used for the statistical analysis.

Results

A total of 57 patients were enrolled in the study, including 18 patients in the "U" type retention suture group, 17 patients in the intermittent retention suture group, and 22 patients in the retention suture group. Table 1 shows the demographic and clinical data (including age, the number of male patients, BMI, APACHE II score, the primary disease such as trauma, gastrointestinal obstruction, gastrointestinal bleeding, gastrointestinal tumors, abdominal infections, etc.), surgical procedures (emergency surgery, elective surgery), name of the surgical procedure (closure of colonic stoma, resection of gastrointestinal cancer, gastrointestinal perforation repair, intestinal adhesion lysis, others), incision length, incision site (median incision, transrectal incision), wound dehiscence, and the number of risk factors for infection. There was no significant difference among the three groups.

Table 2 shows the risk factors for abdominal wound dehiscence and infection in the three groups (including age > 60 years, malnutrition or cachexia, emergency surgery, abdominal infections, advanced malignancies, use of corticosteroids, uremia, hemodynamic instability, hemoglobin < 100 g/L, abdominal distension, lung disease, clinical jaundice and diabetes). There were no significant differences among the three groups.

Table 3 shows the IVP at various time points in the three groups (before the operation, after anesthesia, after the skin incision, after cutting of the subcutaneous tissue, after cutting of the rectus abdominis sheath, after cutting of the rectus abdominis guard, 1 h after the start of the operation, after closure of the rectus abdominis guard, after closure of the rectus abdominis sheath, after closure of the skin, after closure of the subcutaneous tissue, and after placement of the retention suture). There was no significant difference at the various time points among the three groups. The comparison of IVP at each time point is as follows: the preoperative IVP (7.7 mmHg ± 3.7 mmHg) was higher than the IVP after anesthesia (6.8 mmHg ± 3.4 mmHg); the IVP after cutting of the rectus abdominis sheath (6.9 mmHg ± 3.5 mmHg) was higher than the IVP after cutting of the rectus abdominis guard (6.0 mmHg ± 3.1 mmHg); the IVP 1 h after the start of the operation (5.3 mmHg ± 3.2 mmHg)

Table 1
Demographic data.

Parameter	"U" type retention suture ($n = 18$)	Intermittent retention suture ($n = 17$)	Non- retention suture ($n = 22$)	Number of total patients	*p*
Age	61.4 ± 15.5	58.8 ± 15.9	51.8 ± 10.6	56.9 ± 14.3	0.082
Male (*n*, %)	9 (50.0)	10 (58.8)	17 (77.3)	38 (66.7)	0.186
BMI	21.6 ± 3.5	22.7 ± 3.7	21.8 ± 3.1	22.0 ± 3.4	0.557
APACHE II	5.3 ± 2.4	4.7 ± 3.3	4.6 ± 2.2	4.9 ± 2.6	0.650
Trauma	2	1	3	6	
Gastrointestinal obstruction	2	1	3	6	
Gastrointestinal bleeding	2	2	1	5	
Gastrointestinal tumors	11	10	13	34	0.988
Abdominal infection	1	2	2	5	
Other	0	1	0	1	
Surgical setting					
Emergency surgery	3	3	0	6	0.121
Elective surgery	15	14	22	51	0.121
Name of surgical procedure					
Closure of colonic stoma	2	3	4	9	0.805
Gastrointestinal tumor resection	13	12	16	31	0.989
Gastrointestinal perforation repair	2	1	1	4	0.704
Intestinal adhesion lysis	1	0	0	1	0.332
Other	0	1	1	2	0.604
Incision length	20.5 ± 7.8	17.5 ± 4.8	15.9 ± 4.6	17.8 ± 6.1	0.054
Incision site					
Median incision	11	9	13	33	0.497
Transrectal incision	7	8	9	24	0.878
Number of risk factors	4.1 ± 1.4	3.8 ± 1.7	3.5 ± 2.5	3.8 ± 1.9	0.572

Table 2
Risk factors for wound dehiscence [*n* (%)].

Parameter	"U" type retention suture ($n = 18$)	Intermittent retention suture ($n = 17$)	Non-retention suture ($n = 22$)	Number of total patients	*p*
Age > 60 years	11 (61.1)	9 (52.9)	8 (26.4)	28 (49.1)	0.277
Malnutrition or cachexia	14 (77.8)	12 (70.6)	9 (40.9)	35 (61.4)	0.038
Emergency surgery	3 (16.7)	3 (17.6)	0 (0)	6 (10.5)	0.121
Abdominal infections	5 (27.8)	1 (5.9)	2 (11.8)	8 (14.0)	0.123
Cancer	0 (0)	0 (0)	1 (4.5)	1 (1.6)	0.445
Use of glucocorticoids	3 (16.7)	0 (0)	1 (4.5)	4 (7.0)	0.132
Uremia	0 (0)	0 (0)	0 (0)	0 (0)	
Hemodynamic instability	5 (27.8)	1 (5.9)	0 (0)	6 (10.5)	0.013
Hemoglobin < 100 g/L	14 (77.8)	12 (70.6)	11 (50.0)	37 (64.9)	0.158
Abdominal distension	10 (55.6)	8 (47.1)	6 (27.3)	24 (42.1)	0.174
Pulmonary diseases	3 (16.7)	1 (5.9)	1 (4.5)	5 (8.8)	0.355
Jaundice	17 (94.4)	16 (94.1)	20 (90.9)	53 (93.0)	0.888
Diabetes	2 (11.1)	2 (11.7)	0 (0)	4 (7.0)	0.258

Table 3
Intraoperative IVP.

Time point	"U" type tension-reducing	Intermittent tension-reducing	Non-tension-reducing	Number of patients	*p* (between adjacent step)	*p* (among the three groups)
Preoperation	7.8 ± 4.4	8.3 ± 3.4	7.1 ± 3.5	7.7 ± 3.7		0.6275
After anesthesia	7.2 ± 3.8	7.2 ± 3.0	6.3 ± 3.4	6.8 ± 3.4	<0.001	0.6615
After cutting of the skin	7.6 ± 3.9	7.1 ± 3.2	6.4 ± 3.2	6.9 ± 3.4	0.1802	0.5429
After cutting of the subcutaneous tissue	7.6 ± 4.1	7.1 ± 3.1	6.4 ± 3.4	7.0 ± 3.5	0.4845	0.5592
After cutting of the rectus abdominis sheath	7.4 ± 3.8	7.1 ± 3.3	6.2 ± 3.3	6.9 ± 3.5	0.0735	0.4899
After cutting of the rectus abdominis guard	6.2 ± 3.3	6.1 ± 3.1	5.7 ± 3.0	6.0 ± 3.1	<0.001	0.8617
1 h after start of the operation	5.3 ± 3.6	5.6 ± 3.5	5.1 ± 2.8	5.3 ± 3.2	0.0216	0.9119
After closure of the rectus abdominis guard	6.7 ± 3.2	6.8 ± 2.9	7.2 ± 2.9	6.9 ± 3.0	<0.001	0.8559
After closure of the rectus abdominis sheath	6.9 ± 3.5	7.4 ± 2.7	7.5 ± 3.0	7.3 ± 3.0	0.002	0.8368
After closure of the subcutaneous tissue	7.1 ± 3.5	7.9 ± 2.9	7.8 ± 2.9	7.6 ± 3.1	0.0007	0.6253
After closure of the skin	7.5 ± 3.8	7.8 ± 3.0	8.1 ± 3.1	7.8 ± 3.3	0.0219	0.8532
After tension-reducing	8.4 ± 4.4	9.2 ± 3.5		8.8 ± 4.0	<0.001	0.5884

was lower than the IVP after closure of the rectus abdominis guard (6.9 mmHg ± 3.0 mmHg); the IVP after closure of the rectus abdominis guard (6.9 mmHg ± 3.0 mmHg) was lower than the IVP after closure of the rectus abdominis sheath (7.3 mmHg ± 3.0 mmHg); the IVP after closure of the rectus abdominis sheath (7.3 mmHg ± 3.0 mmHg) was lower than the IVP after closure of the subcutaneous tissue (7.6 mmHg ± 3.1 mmHg); the IVP after closure of the skin (7.8 mmHg ± 3.3 mmHg) was lower than the IVP after tension-reducing (8.8 mmHg ± 4.0 mmHg). $p < 0.005$ was considered to be statistically significant. The IVP during the operation first decreased and then increased; it was lowest 1 h after the start of the operation and was highest after tension-reducing (Fig. 3). The peri-operative IVP values in the "U" type retention suture group were as follows (Table 4 and Fig. 4).

Table 5 shows the prognostic indicators, including wound dehiscence, wound infection, reoperation, postoperative length of hospital stay, total hospitalization time, exhaust time, time to removal of the stitches, and VAS pain score on the first day after the operation. The VAS pain scores on the first day after the operation in the retention suture group, intermittent retention suture group and non-retention suture group were 3.9 ± 2.2, 3.8 ± 2.0, and 3.0 ± 1.0, respectively, which was higher in the "U" type retention suture group and the intermittent retention suture group compared to the non-retention suture group. $p < 0.005$ was considered to be statistically significant. There were no significant differences in other indicators among the three groups.

Discussion

The main goal of resuture tension is to prevent wound dehiscence, especially for abdominal wounds. Studies have shown that retention sutures reduce the incidence of wound dehiscence, and it is recommended as a treatment method for fascial dehiscence.[37,38] Some surgeons recommend the use of retention sutures to reduce the incidence of wound dehiscence.[8,39–41] Zhamak et al[9] found that the placement of prophylactic sutures can reduce the incidence of wound dehiscence in high-risk patients after midline

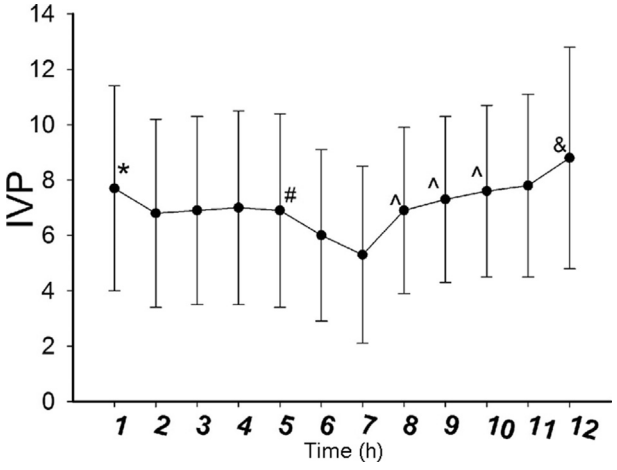

Fig. 3. Changes in IVP at various time points during the operation. * represents preoperative IVP > IVP after anesthesia, $p < 0.005$; # represents IVP after cutting of the rectus abdominis sheath < IVP after cutting of the rectus abdominis guard, $p < 0.005$; ^ represents IVP at 1 h after beginning operation < IVP after closure of the rectus abdominis guard, IVP after closure of the rectus abdominis sheath < IVP after closure of the subcutaneous tissue, $p < 0.005$; & represents IVP after closure of the skin < IVP after retention-reducing, $p < 0.005$.

Table 4
Perioperative IVP.

	Preoperation	After tension reducing	Postoperative day 1	Postoperative day 2	Postoperative day 3	Postoperative day 4
"U" type tension-reducing	7.8 ± 4.4	11.2 ± 3.8	13.8 ± 4.0	12.1 ± 3.8	11.4 ± 3.4	9.5 ± 2.9
Intermittent tension-reducing	8.3 ± 3.4	11.3 ± 2.9	13.9 ± 3.2	12.7 ± 3.0	11.5 ± 3.1	9.7 ± 2.5
Non-tension-reducing	7.1 ± 3.5	8.2 ± 3.1	7.9 ± 3.2	7.6 ± 3.0	7.4 ± 2.5	6.2 ± 2.4
Number of patients	7.7 ± 3.7	8.2 ± 3.1	7.9 ± 3.2	7.6 ± 3.0	7.4 ± 2.5	6.2 ± 2.4
p (among the three groups)	0.628	0.006	<0.001	<0.001	<0.001	<0.001

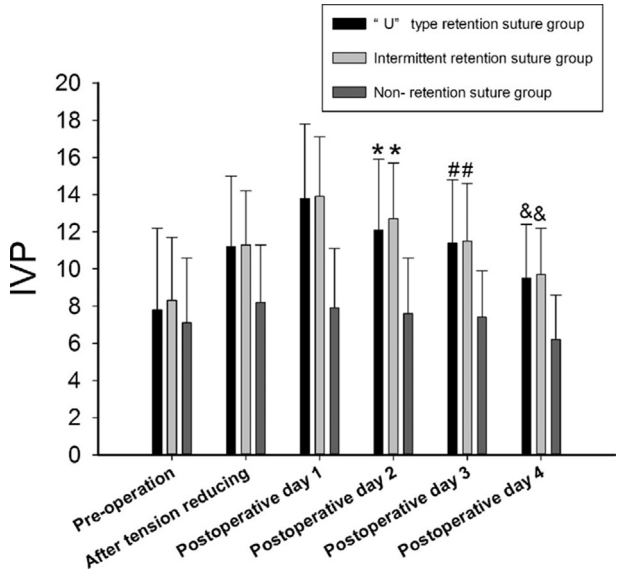

Fig. 4. Changes in IVP during the perioperative period. * represents IVP on the first day after the operation, the "U" type retention suture and intermittent retention suture groups > non-retention suture group, $p < 0.005$; the IVP on the second day after the operation, the "U" type retention suture and intermittent retention suture groups > non-retention suture group, $p < 0.005$; the IVP on the third day after the operation, the "U" type retention suture and intermittent retention suture groups > non-retention suture group, $p < 0.005$; the IVP on the fourth day after the operation, the "U" type retention suture and intermittent retention suture groups > non-retention suture group, $p < 0.005$.

laparotomy. However, our research showed that retention suture techniques do not reduce the incidence of postoperative wound dehiscence in abdominal surgery patients. Compared to our study, Zhamak et al did not compare the difference in body mass index (BMI) between the two groups, but obese patients were more prone to abdominal wound dehiscence.[17,42,43] Moreover, some studies reported that retention suture techniques do not prevent the occurrence of postoperative abdominal wound dehiscence.[3,11,44] Poole et al[11] noted that retention sutures were not essential if the fascia was properly closed. Haxton[44] assessed the wound dehiscence tension in animal experiments and found that retention sutures with midline incisions or median incisions did not prevent wound dehiscence. Hubbard et al[3] reported that retention sutures do not reduce the incidence of wound dehiscence in midline incision patients. To prevent the incidence of wound dehiscence in abdominal surgery patients, more attention should be paid to the suture material, the surgeon's technique, closure of the fascia layer by layer, the prophylactic use of antibiotics, and the control of incision sepsis.[9] Additionally, An abdominal dehiscence risk index to identify patients who were at high risk of wound dehiscence and to prevent perioperative wound dehiscence has been used in the early stages.[10] However, due to the complications related to retention sutures such as secondary pain, postoperative discomfort, and skin softening, it is not recommended as a routine treatment in abdominal surgery. The research of Gurleyik et al[45] indicated that retention sutures can increase abdominal pressure, which was reported to be a risk factor for abdominal wound dehiscence. In addition, abdominal hypertension can delay the return to a normal diet by mouth in elective abdominal surgery patients,[46] increase the rate of re-operation in patients with abdominal trauma,[47] and even result in abdominal cavity organ dysfunction.[28–30,48,49] High IAP reduces abdominal blood flow, which causes local edema and necrosis. Abdominal muscle and fascia ischemia can lead to infectious and non-infectious complications (such as wound dehiscence, hernia, and necrotizing fasciitis).[50]

The mechanism of increased abdominal pressure that results from retention sutures may be associated with abdominal wall compliance. Recently, increasing numbers of scholars in the fields of surgery, trauma and critical care ascribe great importance to abdominal compliance. The World Society of the Abdominal Compartment Syndrome (WSACS) defines abdominal compliance as the measurement of the level of abdominal cavity expansion, which is determined by the elasticity of the abdominal wall and the mediastinum.[21] A study on 76 pregnant women indicated that abdominal wall compliance was negatively associated with gestational age and BMI.[51] Mutoh et al[52] reported that IAH increases with reduced abdominal wall compliance. Van Ramshorst[53] measured the abdominal wall tension (AWT) of two dead bodies and found a notable correlation between AWT and IAP. In subsequent experiments, they found that the IAP of dead bodies was closely related to AWT.[54] In vivo measurements showed that the AWT of men was 31% higher than that of women, AWT increases from exhalation to inhalation with the Valsalva maneuver and that AWT is highest in

Table 5
Prognostic indicators.

Item	"U" type retention suture ($n = 18$)	Intermittent retention suture ($n = 17$)	Non-retention suture ($n = 22$)	Number of total patients	p
Wound dehiscence (n, %)	0 (0)	0 (0)	3 (13.6)	3 (5.3)	0.032
Incision infection (n, %)	1 (5.6)	2 (11.8)	2 (9.1)	5 (22.7)	0.808
Re-operation (n, %)	1 (5.6)	0 (0)	2 (9.1)	3 (5.3)	0.451
Initial flatus time	3.8 ± 1.8	3.6 ± 2.4	3.6 ± 1.0	3.7 ± 1.7	0.964
Time to removal of the stitches	17.6 ± 8.0	18.2 ± 10.7	15.3 ± 4.4	16.9 ± 7.9	0.466
Pain VAS on the first day after operation	3.9 ± 2.2	3.8 ± 2.0	3.0 ± 1.0	3.5 ± 1.8	<0.001
Postoperative hospitalization	18.7 ± 8.1	18.4 ± 10.8	13.3 ± 6.5	16.5 ± 8.7	0.086
Total hospitalization time	25.6 ± 9.8	22.4 ± 11.6	16.9 ± 6.5	21.3 ± 9.8	0.016

the standing position, followed by the supine and sitting positions.[55] BMI does not affect AWT.[55] A recent study on abdominal compliance considered the abdominal cavity as a cylindrical pressure container and described the relationship between AWT and IAP as follows: abdominal tension = [(IAP-external pressure) × radius]/ abdominal wall thickness.[22,56] The abdominal wall compliance is the reciprocal of the abdominal wall tension; hence, we infer that abdominal wall compliance is negatively related to IAP.[57] The common factors for reducing abdominal compliance include burn scabbing, abdominal wall hematoma, tight closure, the use of Velcro abdominal binders, repair, contraction of injured muscle, and positive-pressure ventilation.[55] Abdominal retention sutures could reduce abdominal wall compliance, leading to the elevated baseline IAP.

In addition, the wound dehiscence rate after abdominal surgery was 0.4%–3.5%, which was much lower than the IAH incidence after abdominal surgery (12%) reported in other studies.[5–7,11,37,46,58,59]

Based on the above evidence, we emphasize the reduction of the mechanical limits of the abdominal wall by removing tension sutures to improve the compliance of the abdominal wall, to reduce abdominal pressure and to avoid such complications as IAH or ACS in the early stages.

Conclusion

Although retention sutures may reduce the incidence of wound dehiscence in abdominal surgery patients, it may increase IVP and postoperative pain. It should cautiously applied in patients with a high risk of intra-abdominal hypertension, and IVP should be monitored.

Limitations

The abdominal pressure was detected by the continuous measurement of bladder pressure, which may affect the accuracy of the measurement results. With this measurement, the change in the abdominal cavity volume is not measured, and the trends in the perioperative abdominal wall compliance cannot be quantitatively observed. Further research is needed to study the relationship between abdominal cavity and abdominal pressure volume to help us understand the effects of high abdominal cavity volume on IAP and peripheral organs and to provide guidance for our future clinical and basic science research.

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