



Using quilting sutures in decreasing seroma formation after managing large ventral hernias: a comparative study

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Abstract

Purpose The aim of this study was to evaluate using quilting sutures in a prospective randomized controlled manner the decrease in the incidence of seroma formation among patients subjected to ventral hernia repair.

Methods The study was a prospective randomized controlled study. 370 patients with large ventral hernias were randomly distributed among two groups. Group A (control group) included 180 patients in whom the repair was done without quilting sutures. Group B (quilting group) included 190 patients, all performed with quilting. Method of dissection was unified as far as possible. All cases had an attached closed suction drain that was removed after two successive days of output ≤ 50 cc. The output of the suction drain was recorded; accumulation of clinically detected seroma after 1, 2 and 4 weeks of removal of the drain was monitored.

Results There was no statistical difference between both groups as regards the demographic data and the hernia characteristics. There was significantly smaller amount of output of the drains in every day of the first five postoperative days as well as the total amount of the output before drain removal in favor of the quilting group. Drains were removed earlier in group B. The incidence of clinically detected seroma was less in group B as well.

Conclusions Quilting sutures is an effective and easy technique to reduce post-ventral hernia seroma accumulation.

Keywords Ventral hernia · Seroma · Quilting · Abdominoplasty

Introduction

Among the most common surgical interventions is ventral hernia repair, which involves dissecting skin and subcutaneous tissue from the underlying sheath and muscle in an amount that varies depending on the hernia's size and the state of the abdominal wall musculature. A common complication of ventral hernia repair is seroma formation, which surgical drains can reduce but cannot prevent [1].

The amount of seroma formed is directly proportionate to the surface area dissected [2]. Small seromas can be managed conservatively, whereas large ones may require multiple aspirations with subsequent risk of introducing

infection that can be highly hazardous in the presence of synthetic mesh [1, 2]. Decreasing or obliterating the dead space created during hernia repair has long been considered a means to reduce seroma formation. Methods used to that end include inserting drains, injecting sclerosing material, using external compression, quilting sutures, or employing a combination of these procedures [3–8]. The concept of quilting sutures has effectively reduced seroma formation following other surgeries involving flap dissection with subsequent creation of dead space (e.g. latissimus dorsi flap harvesting) [9].

Aim

The aim of our prospective randomized controlled trial was to assess the effectiveness of quilting sutures in decreasing seroma accumulation in a large sample of patients subjected to ventral hernia repair, some of whom underwent abdominoplasty.

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Patients

The study included 370 patients treated for ventral hernias, including paraumbilical hernias and incisional hernias, from February 2015 to January 2018 in the Surgical Oncology Unit and Plastic Surgery Unit within the Faculty of Medicine at Alexandria University. All participants were candidates for elective hernioplasty or abdominoplasty involving mesh fixation and had dissected flaps more than 15 cm × 15 cm (> 225 cm²) in area, determined easily by the size of the mesh. To reduce the presence of other factors with possible role in seroma formation, the sample excluded patients with diabetes, with BMIs equal to or greater than 30, or who required emergency treatment.

Methods

The required approvals from the Ethics Committee at Alexandria University were obtained. Each participant signed an informed written consent form before enrolling in the study. We randomly distributed participants into two groups according to the closed envelope technique, which blinded them as to which group they represented.

Group A, ultimately consisting of 180 participants, received an intervention involving the standard technique without quilting, whereas group B, with 190 participants, received quilting sutures to reduce seroma formation.

All cases were done by “onlay” mesh repair, which generally entails dissecting the skin and subcutaneous tissues to expose the anterior rectus sheath and external oblique (Fig. 1). All interventions were performed by one of the contributing surgeons, using the same technique of flap dissection involving electrocoagulation with a combination of coagulation and cutting. Once the hernial sac was dissected and excised, the contents were reduced. Partial omentectomy was performed in some cases. No case indicated a need for bowel resection. Closure of the hernia defect involved using nonabsorbable sutures. Cases of abdominal wall weakness or divaricated recti (e.g., rectus muscle diastasis) required keel repair to reinforce the abdominal wall.

Consequently, a combined polyglecaprone and polypropylene mesh “ULTRAPRO®” was fixed by interrupted 2/0 non-absorbable “polypropylene” sutures. Cases involving abdominoplasty also entailed the excision of redundant skin and subcutaneous fat. Liposuction was not used in any of the cases.

After the surgeon inserted a closed negative suction 14F drain into each participant, interventions by group



Fig. 1 Picture showing the plane of dissection for onlay repair. The mesh will be fixed to the anterior rectus sheath and external oblique aponeurosis

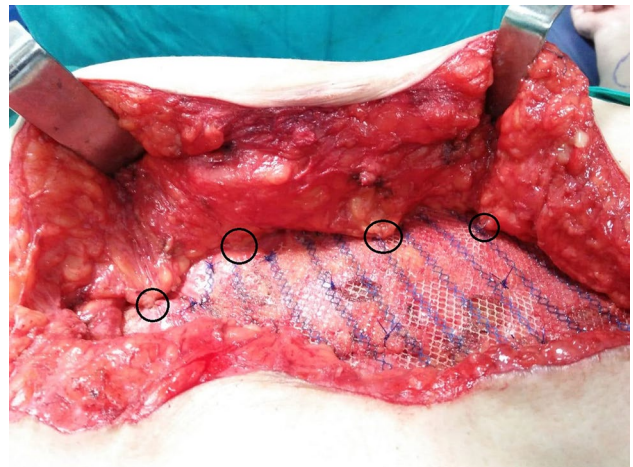


Fig. 2 Picture showing first row of interrupted absorbable quilting sutures between the subcutaneous tissue on one side and the underlying sheath and fixed mesh on the other side

diverged. Whereas participants in group A experienced the closure of subcutaneous tissue and skin, participants in group B experienced the obliteration of dead space. This was performed by application of multiple interrupted absorbable sutures between the subcutaneous tissue on one side and the underlying sheath and fixed mesh on the other side at a distance between the quilting sutures of 5–7 cm (Fig. 2). Thereafter, the surgeon closed the subcutaneous tissue and skin of participants in group B following the same method used in group A.

We monitored participants in both groups to assess the amount of daily drain output, the timing of drain removal, and the clinical detection of seromas 1, 2, and 4 weeks after removal. The attached drain was removed when the output was ≤ 50 cc for 2 days. We managed cases of seroma accumulation with frequent aspirations. Aspirated fluid was sent to culture and microbiological examination only if turbid and/or if infection was suspected.

Following surgery, we advised each participant to wear an abdominal binder for 6 weeks, reduce vigorous activity, and avoid straining factors.

Statistical analysis

Data analysis involved the use of the Statistical Package for the Social Sciences version 20.0 (IBM, Armonk, NY, USA). Qualitative data included number counts and percentages, whereas quantitative data included ranges (i.e., minimum to maximum), means and standard deviations, and medians. We set significance to 5%. Tests used included a Chi-square test to compare categorical variables between the groups, Student's *t* test to compare normally distributed quantitative variables between the groups, and Mann–Whitney *U* test to compare abnormally distributed quantitative variables between the groups.

Results

Table 1 presents the characteristics of the sample. Factors that might have contributed to seroma formation, including BMI, smoking, the use of steroids, and the use of oral anti-coagulants, made no statistically significant difference. Next, Table 2 presents the characteristics of hernias treated and their repair. Neither table indicates a statistically significant difference between groups A and B except regarding the type of hernia repaired. In particular, group A comprised mostly cases of de novo hernias ($n = 95$, 52.8%)—that is, paraumbilical hernias and epigastric hernias with or without divarication of the recti muscles—whereas group B had only 57 such cases (30%, $p < .001$) but a significant number of incisional ($p = .044$) and recurrent hernias ($p = .002$). Among other possible sources of difference, group A represented more cases of abdominoplasty than group B, although the difference was not significant nor was the between-group difference in the incidence of complications other than seromas (Table 2).

Seroma-related factors compared between group A and group B included daily monitoring of the output in drains or their removal during the first 5 days (i.e., whichever occurred first), the total amount of drain output before removal, the timing of removal, and the clinical detection of seromas 1, 2, and 4 weeks following removal (Table 3). During the first 5 days, when many participants were candidates for drain removal, group B not only indicated significantly less daily output than group A (Fig. 3) but also significantly less drain

Table 1 Comparison between the two studied groups according to patient characteristics

	Group A ($n = 180$)	Group B ($n = 190$)	p^*
Age (years)			
Mean \pm SD	47.2 \pm 6.4	47.5 \pm 6.3	0.585
Median (min.–max.)	49 (29–61)	50 (25–62)	
Gender			
Male	82 (45.6%)	95 (50%)	0.392
Female	98 (54.4%)	95 (50%)	
BMI (kg/m^2)			
Normal (< 25)	75 (41.7%)	83 (43.7%)	0.695
Overweight ($25 - < 30$)	105 (58.3%)	107 (56.3%)	
Mean \pm SD	25.6 \pm 2.4	25.6 \pm 2.4	0.948
Median (min.–max.)	25.6 (20–29.3)	25.6 (21.6–29.2)	
Comorbidities			
Smoking	39 (21.7%)	46 (24.2%)	0.561
Steroid use	3 (1.7%)	1 (0.5%)	0.360
Anticoagulant medications use	2 (1.1%)	0 (0%)	0.236

Qualitative data were described using number and percent and were compared using Chi-square test, Quantitatively distributed data were expressed in mean \pm SD and median (min.–max.) and were compared using Student's *t* test or Mann–Whitney test

*Statistically significant at $p \leq 0.05$

Table 2 Comparison between the two studied groups according to patient characteristics

	Group A (n = 180)	Group B (n = 190)	p
Hernia features			
Size of defect (cm ²)			
Mean ± SD	36.69 ± 19.09	35.97 ± 19.14	0.580
Median (min.–max.)	30.25 (16–148.8)	30.25 (16–144)	
Type of hernia			
Denovo	95 (52.8%)	57 (30%)	<0.001*
Incisional	63 (35%)	86 (45.3%)	0.044*
Recurrent	22 (12.2%)	47 (24.7%)	0.002*
Abdominoplasty cases	55 (30.6%)	42 (22.1%)	0.065
Complications other than seroma (wound dehiscence/flap necrosis/infection)	17 (9.4%)	20 (10.5%)	0.729

Qualitative data were described using number and percent and were compared using Chi-square test, quantitatively distributed data were expressed in mean ± SD and median (min.–max.) and were compared using Student's *t* test or Mann–Whitney test

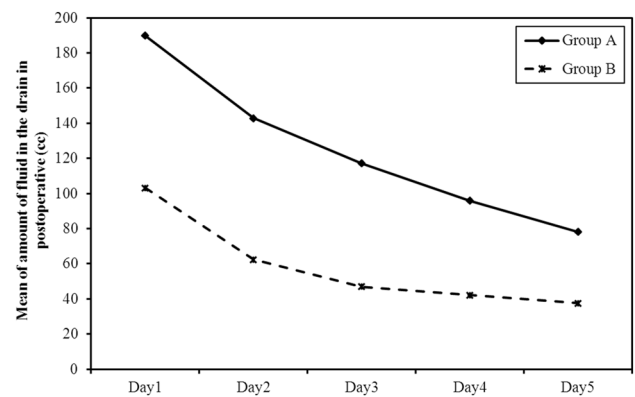
*Statistically significant at $p \leq 0.05$

Table 3 Comparison between the two studied groups according to amount of fluid in the drain in postoperative (cc)

Amount of fluid in the drain in postoperative (cc)	Group A	Group B	p
Day 1			
Mean ± SD	(n = 180) 189.8 ± 40.7	(n = 190) 103.2 ± 23.1	<0.001*
Median (min.–max.)	182.5 (95–300)	100 (55–200)	
Day 2			
Mean ± SD	(n = 180) 142.9 ± 36.9	(n = 190) 62.3 ± 25.2	<0.001*
Median (min.–max.)	145 (35–250)	60 (0–135)	
Day 3			
Mean ± SD	(n = 180) 117.2 ± 30.3	(n = 190) 46.9 ± 22.8	<0.001*
Median (min.–max.)	110 (40–190)	50 (0–110)	
Day 4			
Mean ± SD	(n = 180) 95.9 ± 26	(n = 126) 42.1 ± 17.5	<0.001*
Median (min.–max.)	92.5 (5–185)	45 (0–100)	
Day 5			
Mean ± SD	(n = 178) 78.1 ± 20	(n = 71) 37.6 ± 14.1	<0.001*
Median (min.–max.)	80 (30–135)	40 (10–80)	
Total amount			
Mean ± SD	(n = 180) 756.3 ± 219	(n = 190) 259.6 ± 109.4	<0.001*
Median (min.–max.)	740 (215–1560)	247.5 (95–720)	
Time of removal of the drain (days)			
Mean ± SD	7.6 ± 1.6	4.2 ± 1.1	<0.001*
Median (min.–max.)	7 (4–16)	4 (3–7)	
Occurrence of clinically detected seroma			
After 1 week	21 (11.7%)	5 (2.6%)	0.001*
After 2 weeks	11 (6.1%)	5 (2.6%)	0.100
After 4 weeks	4 (2.2%)	2 (1.1%)	0.438

Quantitatively distributed data were expressed in mean ± SD and median (min.–max.) and were compared using Mann–Whitney test

*Statistically significant at $p \leq 0.05$

**Fig. 3** Graph comparing the two studied groups according to the amount of fluid in the drain in postoperative (cc)

output before removal as well. Unsurprisingly, in terms of the timing of drain removal, group B also had an earlier median time of removal (4.2 ± 1.1 days) than group A (7.6 ± 1.6 days). Although group B additionally exhibited more seromas 1, 2, and 4 weeks after drain removal than group A, the difference was statistically significant only after a week.

Discussion

Often occurring after hernioplasty for ventral hernias, seromas contain fluid of mostly serum, liquefied fat, and lymphatic fluid [10]. Although the etiology of seromas remains poorly understood, many factors clearly contribute to their occurrence, including the patient's body size (i.e., BMI) and comorbidities, the technique of dissection, field hemostasis, tissue handling, hernia size, and the surgeon's volume [1, 10].

Other factors include the surface area of dissected flaps and potential dead space created as a result. This is possibly due to more tissue injury or the disruption of minor lymphatics given the enlarged area of dissection, which increases the accumulation of liquefied fat, serum, and fluid [1, 2, 10].

To assess seroma accumulation, we performed clinical examinations but did not use radiology. Because ultrasound is highly sensitive to seroma accumulation, with a diagnostic yield of more than 90%, such subclinical seromas are liable to increase the incidence of unnecessary interventions (i.e., aspirations) and, in turn, the risk of infection [11]. Alternatively, factors suggesting seroma were the presence of abnormal bulging over the dissected area, fluid thrill, patient discomfort, stretched skin, and/or sense of skin tension.

Following surgery, we advised each participant to wear an abdominal binder during daily activity for the first 6 weeks to alleviate pain and enhance ambulation. Another advantage of abdominal binders is their capacity to reduce seroma formation and recurrence [12]. Worth mentioning here is that we instructed participants to not wear binders tightly—just fitting—given their possible role in reducing lung function and increasing the risk of DVT [12].

We sought to unify the mode of dissection using diathermy, which combined the cutting mode (i.e., dissection and elevation of flaps) and the coagulation mode (i.e., for hemostasis), to not influence seroma formation due to the use of different methods of flap elevation [13, 14]. Although other authors have described how dissection on a subfascial plane (i.e., superficial to the scrape's fascia) can decrease seroma formation by minimizing the major lymph trunk injury [15], this was not the standard technique adopted by us [15].

Pollock and Pollock retrospectively reviewed the use of “progressive tension sutures” in nearly 600 cases of abdominoplasty and ultimately advised against using surgical drains in cases of abdominoplasty, even if liposuction was performed [16, 17]. Antonetti and Antonetti [18] made a similar suggestion following their large retrospective study of more than 500 abdominoplasties.

In their prospective study with 21 female patients indicated for abdominoplasty and quilting sutures, Nahas et al. attached drains only for the first 48 h post-surgery and used ultrasound to detect the occurrence of seroma. Ultimately, they also recommended using quilting sutures to decrease seroma formation [19], as have Khan et al. and Baroudi and Ferreira in other similar studies [20–22].

One of the few prospective randomized trials was that done by Andrades et al. on 60 female patients divided into 4 equal groups [23]. They indicated no significant difference in the incidence of seroma formation between quilted groups without drains, the non-quilted group with drains attached, and the quilted group with drains attached.

Other researchers have examined the use of sclerosing or sealant material to decrease the incidence of seroma accumulation after ventral hernia repair with encouraging results [24–27]. Other studies combined the use of a sealant material together with the quilting for preventing seroma after latissimus dorsi flap dissection with good results [28]. On the other hand, a comparative study by Bercial et al. reported a higher incidence of seroma in the sealant group than in the quilted group [29]. Yet, the commercial availability, as well as the cost of the sealant material, is to be questioned at my institution (same issue raised by Azoury et al.) [30].

Conclusions

The results of our prospective randomized controlled trial with a relatively large group of patients safely suggest using quilting sutures, an unsophisticated technique requiring no special materials or supplementary tools, during ventral hernia repair.

Compliance with ethical standards

Conflict of interest The authors of this manuscript certify that they have NO affiliations with or involvement in any organization or entity with any financial interest or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Ethical approval This study was approved by the ethical committee of Faculty of Medicine, University of Alexandria.

Human and animal rights The study including human participants has been performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments.

Informed consent Informed written consent was signed and obtained from all individual patients before being enrolled in the study.

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