Comparison of Subcuticular and Interrupted Suturing Methods for Skin Closure After Appendectomy: A Randomized Controlled Trial

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Abstract

Background: Confirmed evidences on superiority of subcuticular suturing compared to interrupted suturing method, in terms of postoperative complications such as wound infection, size of scar, or abscess formation is few.

Objectives: The present study aimed to compare absorbable subcuticular suturing supported with Steri-Strips™ to interrupted nonabsorbable suturing method after appendectomy.

Methods: In a randomized controlled trial, seventy patients with the diagnosis of acute appendicitis at Besat hospital, Hamadan University of Medical Sciences, Iran in the year 2016 were enrolled in the study and were randomly assigned into two groups. In the case group (n = 35), the wound suturing was done using subcuticular suturing supported by Steri-Strips™ and in the control group (n = 35), suturing was performed using interrupted mattress suture. All patients were visited at postoperative day one, seven, thirty and ninety.

Results: The width of the scar and the mean of severity of pain score at postoperative day seven in the case group were significantly shorter and lower than the control group (1.05 ± 0.66 vs. 3.62 ± 1.77 mm, $P < 0.001$ and 0.86 ± 0.81 vs. 1.40 ± 0.85 , $P = 0.008$, respectively). More significant number of patients in the case group were satisfied with their wound healing and scar status compared to the control group (91.42% vs. 71.42%, respectively, $P = 0.032$).

Conclusions: Skin closure using absorbable subcuticular suturing supported by Steri-Strips™ method in patients with uncomplicated appendicitis may be safe and feasible and may result in higher levels of patient satisfaction.

Keywords: Subcuticular, Interrupted, Suturing Technique, Appendectomy, Scar

1. Background

Nowadays laparoscopic appendectomy has become increasingly popular, even so, open appendectomy is still accepted as a simple and cost-effective operation (1-3). Suturing could be done using absorbable and non-absorbable material types. There is no need to remove absorbable sutures, hence, it is time saving and also helps in reducing patient anxiety after operation (4).

Absorbable sutures adheres the subcutaneous tissue adequately and hence eliminates dead space. In addition, it is placed into the dermis to minimize tension during wound healing. Commonly, absorbable sutures are used for subcuticular wound closure, which can offer better aesthetic outcomes (5, 6). If the suturing technique is performed under appropriate circumstances, it should eliminate dead space in subcutaneous tissues and minimize

tension, which causes wound separation (7, 8). Non absorbable sutures require removal post-operatively. It is used as deep suturing technique to provide prolonged mechanical support (9, 10).

Wound closure techniques for open appendectomy are not well studied. The most applied suturing methods are vertical mattress or simple interrupted sutures, which may be accompanied with high rates of scar formation (11). Subcuticular suturing technique supported by Steri-Strips™ is recommended in cases of uncomplicated appendicitis (12). Absorbable intradermal sutures seems to be superior to mattress suturing due to better aesthetic outcomes, lesser financial costs, higher patient satisfaction, as well as lower incidence of infectious complications (13-15). However, confirmed evidences on superiority of subcuticular suturing compared to interrupted suturing method in terms of postoperative complications such as wound infection, size

of scar, or abscess formation is few.

2. Objectives

We conducted this randomized single-blinded controlled study to compare wound healing and postoperative complications of closure of skin incision using absorbable subcuticular suturing supported by Steri-Strips™ to interrupted nonabsorbable suturing method after appendectomy in patients with uncomplicated appendicitis.

3. Methods

3.1. Patient Selection

A total of 70 consecutive patients with the diagnosis of acute appendicitis and candidate for emergent appendectomy at Besat hospital, Hamadan University of Medical Sciences, Hamadan, Iran, in the year 2016, were enrolled in the study. Besat hospital is a governmental, referral tertiary care, university hospital, where patients from the whole Hamadan province and neighboring provinces refer there routinely. The inclusion criteria included patients with the diagnosis of acute appendicitis diagnosed clinically having an Alvarado score of more than 7, or more than 5 with the help of computed tomography scan or ultrasound exam. The study exclusion criteria were patients with normal appendix or gangrenous appendicitis documented by the same independent pathologist and perforated or phlegmonous appendicitis revealed at the time of surgery. Past medical history of diabetes mellitus, immunodeficiency disorders, and body mass index of equal or more than 30 were the other exclusion criteria. The sample size of our study was calculated as Equation 1, considering the strength of 80% and type 1 error of 5%. A total of 70 patients were randomly assigned into 2 groups including case and control groups using simple randomization method by the computerized random number table. The CONSORT flow diagram showing the process of patient selection is depicted in [Figure 1](#).

$$N = \frac{(z_1 + z_2)^2 [P_1(1 - P_1)P_2(1 - P_2)]}{(P_1 - P_2)^2} \quad (1)$$

3.2. Surgery

All surgeries were performed by the same surgeon. The McBurney's incision was used for all patients. This line is a 2 inch long oblique incision, which crosses a line from the anterior iliac spine to the umbilicus nearly at right angles and lies almost 1 inch from the anterior iliac spine, and its upper one-third lies above that line. External oblique fibers were cut and the internal oblique and the transverse

muscle fibers were split in the direction of the fibers. Peritoneum was picked up with the haemostats and cut in the line of skin incision. The taenia of the caecum was held with a Babcock's forceps and the appendix was pulled into the wound with the use of 2 Babcock's forceps. A window was made in the mesoappendix and ties were applied and the appendix was excised. After ensuring homeostasis, layers of peritoneum, muscle, and fascia were sutured separately and then subcutaneous layer was washed with 500 cc of normal saline. Then, in the case group (n = 35), wound suturing was done using subcuticular suturing with an absorbable 4/0 monofilament monocryl suture supported by 3 Steri-Strips™ and in the control group (n = 35), suturing was done using 3 interrupted mattress sutures with a non-absorbable 4/0 nylon sutures.

3.3. Study Protocol

Informed consent was obtained from each patient after explaining the probable advantages and disadvantages of wound suturing using subcuticular or interrupted mattress sutures. The study was approved by the ethics committee of Hamadan University of Medical Sciences and registered in the Iranian registry of clinical trials with the registration number of IRCT2013040812948N1.

All patients were visited by the same surgeon at postoperative days 1, 7, 30, and 90. Stitches were removed at the postoperative day 7 visit. In all visits, the data regarding severity of pain was recorded using visual analogue scale (VAS) scored between 0 for the lowest level of pain, and 10 for the most severe pain. In the visit at postoperative day 90, the data regarding width of the surgical site scar assessed by the same ruler, wound infection defined as surgical site erythema and/or discharge, wound dehiscence, subcutaneous abscess formation, and patient satisfaction with the surgical site scar was recorded prospectively.

3.4. Statistical Analyses

Statistical analyses were performed using statistical software (IBM SPSS Statistics for Windows, Version 20.0, IBM Corp., Armonk, NY, USA). The Fischer exact test was used for analyses of qualitative data and the independent t-test was used for comparison of quantitative data. Non-parametric data were analyzed with Kruskal-Wallis test. P values of less than .05 were considered statistically significant.

4. Results

During the study, 70 patients with the mean age of 23.2 ± 8.9 years (range = 8 - 45), including 42 males (60%) were

Figure 1. CONSORT 2010 Flow Diagram

enrolled in the study. The demographic data of the patients in each group is shown in Table 1, which was not significantly different between the 2 groups.

Table 1. Demographic Data of the Patients in Each Group^a

	Case Group (n = 35)	Control Group (n = 35)	P Value
Gender, male	20	22	0.81
Age, y	22.4 ± 10	24 ± 7.6	0.46
Body mass index, kg/m ²	24 ± 4	24 ± 3	0.92

^aValues are expressed as means ± standard deviations.

In all patients, the median of width of scar was 1.65 (interquartile range = 0.9 - 3.2). Only 1 patient who was in the case group experienced subcutaneous abscess formation at postoperative day 5, which was treated successfully with local drainage. Only 2 patients in the control group experienced wound dehiscence a day after removing stitches. In 1 of the patients, the dehiscence included an angle of the surgical site and in the other it included a half-length of the surgical site. Both were hospitalized and treated successfully with daily dressing change and the surgical site was secondarily closed. No evidence of wound infection was revealed in any of the patients. The data regarding width of surgical site scar, wound dehiscence, subcutaneous abscess formation, patient satisfaction with the surgical site scar, and severity of pain at each visit in each

group is shown in Tables 2 and Figure 2.

Table 2. Postoperative Data in Each Group^a

Postoperative Data	Case Group (n = 35)	Control Group (n = 35)	P Value
The width of scar, mm	0.9 (0.7 - 1)*	3.2 (2.2 - 4.5)	< 0.001
Subcutaneous abscess	1	0	0.999
Wound dehiscence	0	2	0.42
Patients satisfied with their scars	32	25	0.032
Severity of pain (VAS score)			
POD 1	3 (2 - 4)	3 (2 - 4)	0.203
POD 7	1 (0 - 1)	1 (1 - 2)	0.008
POD 30	0 (0)	0 (0)	0.397
POD 90	0	0 (0)	0.317

Abbreviations: POD, postoperative day; VAS, visual analogue scale.

^aValues are expressed as medians (interquartile range).

Figure 2. The Graph of Comparing the 95% Confidence Intervals of Width of Scar in the Case and Control Groups

5. Discussion

In our study, the patients with uncomplicated appendicitis, in whom the skin incision after appendectomy was closed using absorbable subcuticular suturing supported with Steri-Strips™ method, were more satisfied compared to the control group in terms of cosmesis and width of surgical site scar and also experienced lower levels of pain. Although rare, the occurrence of wound dehiscence and sub-

cutaneous abscess formation were not significantly different between the 2 groups. It should be noted that all of our participants were lacking systemic diseases, which could possibly affect wound healing.

Reducing the costs and increasing patient satisfaction and final cosmetic outcome are some of the benefits of absorbable sutures (13-15). The use of absorbable subcuticular suturing has been favorable and recommended as a safe and even better method, compared to interrupted nonabsorbable suturing in different types of surgeries, especially in pediatrics (16, 17). Similar to our study, Onwuanyi et al. compared subcuticular to interrupted transdermal nonabsorbable suturing in wound closure after appendectomy in patients with uncomplicated appendicitis. Although they found significantly more complications such as pain, itching, and scar hypertrophy in the interrupted closure group, the overall infection rate was evenly distributed in both groups. The conclusion was that the subcuticular method is safe at any age and offers a cost-effective and time saving advantage (18). In a recent study by Tanaka et al. the incidence of wound complications in elective colon cancer surgery did not increase when using subcuticular suturing and the patients preferred this method, citing better cosmetic results and less pain (19). Foster et al., showed that wound infection rates were higher when absorbable subcuticular sutures were used in appendectomy (20). In a meta-analysis by Sajid et al. review of 10 randomized controlled trials demonstrated that the use of absorbable suture was similar to non-absorbable suture for skin closure in terms of surgical site infection and other operative morbidities. Furthermore, absorbable suture did not increase the risk of skin wound dehiscence but rather lead to a reduced risk of wound dehiscence compared to non-absorbable suture (21). In a systematic review by Gurusamy et al. in order to compare the benefits and harms of continuous compared with interrupted skin closure techniques in participants undergoing non-obstetric surgery and superficial wound, dehiscence may be reduced by using continuous subcuticular sutures (22). As shown by Serour et al. application of absorbable subcuticular suture was safe in pediatric appendectomies (17). Similarly, Kotaluoto et al. demonstrated that there was no difference between continuous absorbable intradermal suturing and nonabsorbable sutures in terms of wound infections in adult patients. They also recommended continuous absorbable suturing in complicated appendectomies without increased risk of wound infections (11). Pauniah et al. showed that there was no difference in the inflammatory markers or the wound appearance in nonabsorbable interrupted versus absorbable continuous skin closure in pediatrics that underwent appendectomy. However, partial wound dehiscence after stitch removal was reported in

a number of children (16). Macas et al. compared subcuticular suturing with absorbable material to the conventional suturing method in patients with acute uncomplicated appendicitis and came to a conclusion that the subcuticular suture approximates cellular tissue better, therefore avoiding the formation of seromas (23).

5.1. Conclusions

Closure of skin incision using subcuticular suturing supported with Steri-Strips™ method after appendectomy in patients with uncomplicated appendicitis may be safe and feasible and may result in better cosmesis and lower levels of pain. However, there is dubiety about the outcome because of the quality of the evidence. Moreover, the nature of the suture material used in the study may have led to this observation, as the continuous suturing technique used absorbable suture material that did not need to be removed, whereas the comparator used interrupted non-absorbable sutures that did need to be removed. Further well-designed trials at low risk of bias are necessary to determine which type of suturing is better.

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