

A New Method for Surgical Abdominal Mass Closure After Abdominal Fascial Dehiscence Using Nasogastric Tube and Hemovac Perforator: A Case-Series Study

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Abstract

Background As the challenge for finding the best abdominal incision closure technique continues, surgeons are aiming to minimize postoperative wound complications such as wound dehiscence and hernia as an acute or late manifestation. In order to achieve this goal, several abdominal opening and closure techniques have been tried. In this article, we describe a method in which we used a nasogastric tube (NGT) in mass closure for patients with fascial dehiscence.

Methods In this case-series study, a total number of 25 patients participated. All of the patients had abdominal dehiscence after a surgery and had to undergo for another. An NGT was used for abdominal closure. The patients were followed for a month and were examined for any signs and symptoms of fever, infection, pain, material expenses, closing time, and laboratory data. The data were analyzed using SPSS software V.22. Mean \pm SD and frequencies were used for describing the variables.

Results The mean NGT mass closure material expenses for each patient were 8400.00 ± 0.00 IRR (around 0.25 US dollars). The mean closure time after the operation was 13.08 ± 3.09 min. There was no evidence of infection among the patients as well as no other complications after the surgery in the 1-month study period.

Conclusion Abdominal mass closure with NG tube suturing technique is associated with reduced time required for closure of the incision, incidence of wound dehiscence, and the incidence of incisional hernia as well as infection, with a considerable low cost.

Introduction

Two of the major complications of laparotomy are abdominal dehiscence and incisional hernias. Results from several studies show that the incidence of fascial

dehiscence can vary between 0.2 and 5% in elective surgeries [1–3] and 8.5 and 45% in emergency procedures [1] based on their clinical settings [4, 5]. Wound dehiscence is associated with a 30% increased rate of morbidity and mortality [6–8], prolonged hospitalization, and a long-term risk of developing incisional hernia [9–11]. The chance of developing abdominal wall closure complications specifically incisional hernias is 9–20% [2, 10, 12].

As a result, for a better wound closure, the operation should be fast, efficient, esthetic, without tension or ischemia, comfortable for the patient, and technically easier for the surgeon. Therefore, one should follow the principles of wound closure [13]. Abdominal fascial closure complications are fairly common, especially in resource-limited countries like Tanzania [14] and Iran.

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Some studies show an advantage of interrupted retention suture closure in reducing the risk of abdominal dehiscence [15]. In the retention suture technique, the closing force is transmitted by different suture constructions [16, 17].

As the challenge for finding the best abdominal incision closure technique continues, surgeons are aiming to minimize postoperative wound complications such as wound dehiscence and hernia as an acute or late manifestation. In order to achieve this goal, several abdominal opening and closure techniques have been tried [18, 19].

In this article, we described a method in which we used a nasogastric tube instead of nylon retention sutures and compared the results with the standard tension suture method in mass closure for patients with fascial dehiscence.

Methods and materials

Participants

In this case-series study, a total number of 25 patients participated. The participants were selected by the following criteria: (1) they had undergone an elective or emergency abdominal surgery, (2) developed fascial dehiscence as a complication from the first surgery, (3) went through a secondary abdominal decompression surgery as soon as the fascial dehiscence was observed, and (4) the abdomen was repaired by the NGT mass closure method. Patients with hypoalbuminemia, high amounts of urea in blood, infection, malignancy, ascites, hyperbilirubinemia, and immunocompromised patients were considered ineligible to participate in the study. The participants were then followed for a month after the surgery. Daily clinical examinations were performed on participants for any signs and symptoms of ascites, abscess, cellulitis, and herniation. The patient's body temperature was taken twice a day. The wound was examined for discharges and then dressed by sterile gauzes and tapes, with sterile conditions met twice a day. The patients were checked for signs and symptoms of infection. The infection was defined if the following criteria was met: purulent drainage from the incision and at least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat. The amount of pain experienced by the patients was estimated by a pain scale ruler after the second surgery. The pain scale ruler numbers 7–10 were considered high amount of pain, numbers 3–6 were considered moderate amount of pain, and numbers 0–2 were considered low amount of pain. The patients were being treated with abdominal binder for the whole study period. The data regarding participants' age, gender, diabetes mellitus history, blood albumin, the time consumed for the NGT mass

closure procedure and expenses, and the amount of pain were gathered by a checklist. The patients were discharged if the following criteria were met: (1) if they could walk, (2) if they could defecate, and (3) if there was no post-prandial vomiting. The patients were discharged with abdominal support. A clinic appointment was given to patients as standard follow-up a month after the surgery to examine and remove the NGTs. There was no age consideration in selecting the patients.

Ethical approval

This study was ethically approved by the Ethics Committee of Iran University of Medical Sciences and Health Services. An informed consent was taken from the patients to participate in the study.

Intervention

The suggested nasogastric tube suturing method in this study was at first considered after an unexpected lack of resources in Firouzgar hospital. In this method, one ultraviolet sterilized black NGT (10FG) was used instead of common nylon sutures and one Hemovac perforator was used as a needle. These perforators can be resterilized and used multiple times. The suturing technique used in this study is the same as simple interrupting suture technique, and the NGTs were tied. The Hemovac perforator was attached to the NG tube. The Hemovac perforated the skin, hypoderm, and the rectus abdominis muscle. Then, the procedure was performed vice versa. The NG tube was pulled so that the fascia, on both sides, would accommodate together. Each patient received 4–5 NGT sutures with the distance of 4–5 cm. the NGT was cut by surgical scissors after making sure that there is enough room for tying them tight enough. After tying, the NGTs were pulled with slight force to see whether the tie is tight enough and the two sides of these sutures would not part. The fascia was sutured by absorbable threads. The performed steps are shown in Figs. 1, 2, 3, and 4. The delayed skin closure by far-and-near suturing technique was used in patients if needed; otherwise, we let the skin to close by secondary intention.

Statistical methods

The gathered data by the checklist were entered into SPSS software V.22. For describing the quantitative variables, mean \pm SD was used, and for describing the qualitative variables, frequencies were used.

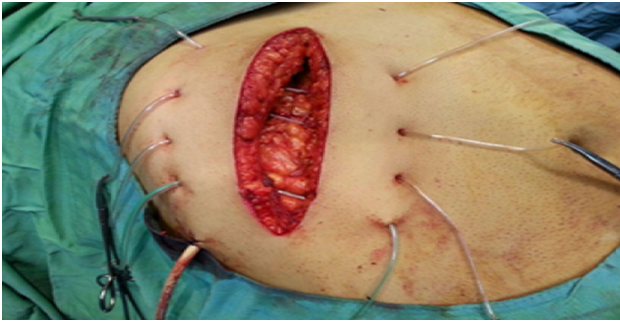


Fig. 1 NGT goes through the skin, muscles, and fascia and then comes off from the other side



Fig. 2 NGT will be knotted like common interrupted sutures



Fig. 3 NGT sutures, 25 days after the surgery

Results

The mean age of participants was 71.12 ± 13.48 with the minimum of 19 and the maximum of 89. Among the patients, ten (40%) were male and 15 (60%) were female. On the history review of diabetes mellitus, 18 (72%) of the patients did not suffer from diabetes and seven (28%) had the history (Table 1).



Fig. 4 Skin scars after removal

The mean amount of albumin in the blood of patients was 3.90 ± 0.59 with the minimum of 3 and the maximum of 4.9. Among the patients, seven (28%) estimated their pain levels to be high, another seven reported their pain to be moderate, and 11 (44%) had experienced low amounts of pain after the second surgery.

Out of 25 patients, eight (32%) were admitted for colorectal surgery, one had diverticulitis, one suffered from Crohn's disease, and the rest had colon cancer. Seven (28%) had diagnosed with other cancers, two had pancreatic cancer, five suffered from gastric cancer, the rest was admitted for other surgeries, and three patients were admitted due to gastrointestinal (GI) obstruction, three due to GI bleeding, and four due to abdominal trauma.

The mean NGT mass closure material expenses for each patient were 8400.00 ± 0.00 IRR (around 0.25 US dollars). It is estimated that if the retention sutures technique would have been used on patients, the cost for each patient would have been around 7 US dollars.

The mean closure time after the operation was 13.08 ± 3.09 min with the maximum of 18 and minimum of 8 min.

The patients were discharged after median 15 days ranging from 11 to 23 after second surgery.

There was no evidence of infection among the patients as well as no other complications after the surgery in the 1-month study period.

After 1 month, all of the patients had their NGT sutures removed and discharged with abdominal binders.

Discussion

This study shows that the NG tube technique for abdomen closure is an effective technique since none of the patients suffered from infection after the operation. This might be

Table 1 Gathered patients' data in 1-month period

Case number	Gender	Age	Infection	Albumin	Diabetes mellitus	Pain scale	Closure time (min)	Operation
1	Female	77	No infection	4.4	No	Low	10	Diverticulitis
2	Male	79	No infection	4.1	No	Low	11	Gastric cancer
3	Female	78	No infection	4.5	No	Moderate	12	Gastric cancer
4	Male	74	No infection	3.6	No	Moderate	14	Upper GI bleeding
5	Female	72	No infection	3.5	No	Low	15	Upper GI bleeding
6	Male	70	No infection	3.1	No	Moderate	9	Pancreatic cancer
7	Female	81	No infection	3.9	No	High	11	Colon cancer
8	Male	89	No infection	3.8	No	High	14	Colon cancer
9	Female	80	No infection	4.9	No	Moderate	10	Trauma
10	Female	66	No infection	4.6	Yes	High	15	Trauma
11	Female	77	No infection	4.7	Yes	Low	18	GI obstruction
12	Male	69	No infection	4.4	No	High	15	Gastric cancer
13	Male	70	No infection	4.9	No	Low	12	Colon cancer
14	Male	19	No infection	3.7	No	High	12	Gastric cancer
15	Male	45	No infection	4.7	Yes	Moderate	13	Crohn's disease
16	Female	67	No infection	4	Yes	High	16	GI obstruction
17	Male	68	No infection	3.5	Yes	Low	10	GI obstruction
18	Male	69	No infection	3.2	No	High	9	Gastric cancer
19	Male	70	No infection	3.1	No	High	8	Colon cancer
20	Male	72	No infection	3.9	Yes	Moderate	17	Trauma
21	Female	76	No infection	3.8	Yes	Low	18	Upper GI bleeding
22	Male	79	No infection	3.3	No	High	11	Colon cancer
23	Female	80	No infection	3.2	No	High	18	Pancreatic cancer
24	Male	78	No infection	3.7	No	High	12	Colon cancer
25	Male	73	No infection	3	No	Moderate	17	Trauma

owing to the fact that the patients' wounds remained open after the procedure. None of our patients had hypoalbuminemia, but 28% of them were suffering from diabetes. This study demonstrated not only a very low cost for the patients relating to materials, but also much less time was spent to close the abdomen (13.08 ± 3.09). In the 1-month follow-up, no patient developed any complications such as hernia and fascial dehiscence.

There were not any situations where we had to tighten the closure. And no compartment syndrome was observed. After observing dehiscence, the patients were taken immediately to surgery. Unfortunately, the average time after surgery for the dehiscence to occur and the reason for dehiscence was not recorded in this study. Also all of the patients had an appointment, 1 month after the surgery. It is possible that the NGTs could have been removed sooner than the 1-month clinic follow-up.

Despite advances in surgical materials and techniques, abdominal fascia closure is considered a procedure that often reflects a surgeon's personal preference with reliance on not necessarily evidential experience. However, availability, cost, and knowledge are three key factors in

selection of a specific suture material [13, 20, 21]. The whole idea of using the NG tube suturing as an abdominal closure technique came from the time that the sanctions against Iranian government made it almost impossible to transact funds to obtain proper materials. As the NGTs and Hemovac perforators were plentiful, this technique was resurrected with modifications. Although the experienced surgeons had used this technique in 8-year war versus Iraq before the sanctions, the indication and settings of using NGTs were different; first in the war era, this technique offered a swift way to close the abdomen after laparotomy and had the advantage of a second operation in the referral hospitals if needed. Second, in this study the NGTs were used to close the fascia instead of retention sutures, but the aim of using this technique at that time, was to close the abdomen as fast as possible. Third, in this study a more controlled environment was provided considering the patients' preparations and care, before, during, and after surgery. Unfortunately, there are no evidences of pervious use of this technique.

The optimum suturing technique should aim to prevent wound dehiscence and incisional hernia without increasing

wound infection rate [12, 22]. In Chalya et al. research, 42.2% of patients which had undergone mass closure demonstrated definite infection, while in current research none of the patients were diagnosed with surgical site infection as a complication. This difference could be due to the sterile conditions, wound dressing changes, and the fact that the wound was remained open.

In case of suture materials, there is an ongoing discussion about using mono- or multifilament sutures to prevent surgical site infections. Compared to monofilament, the use of multifilament sutures has been reported to be associated with increased incidence of surgical site infections. There are studies which reported that there is no association between multifilament suture and surgical site infections [22, 23]. It has been assumed that in multifilament sutures a phagocyte dysfunction occurs which bacteria can escape in the interstices between the threads. It is probable that the lower rate of surgical site infection in monofilament had been observed for that specific reason [24, 25]. The results of this study demonstrated better results in case of infection than both mono- and multifilament suture materials.

The authors suggest that a randomized controlled clinical trial study should be designed to further investigate the NG tube technique advantages. One of the limitations of this study was the case selection; since the participants' first surgeries were not similar, the results of this study cannot be generalized. The other limitation that our study had was that the patients were followed up for a month. It is suggested that another study with a longer follow-up period and a better sampling method should be designed. It is possible that in case of infection, the authors of this article have been biased.

In conclusion, abdominal mass closure with NG tube suturing technique is associated with reduced time required for closure of the incision, incidence of wound dehiscence, and the incidence of incisional hernia as well as infection in 1-month follow-up period, with a considerable low cost. The only problem with this technique seems to be the pain which can be managed by proper analgesic therapy.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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