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SUBCUTICULAR WITH INTERRUPTED SUTURING; TECHNIQUE FOR ABDOMINAL WOUND CLOSURE

Mazin H AL-Hawaz[#], Mushtaq CH Abu-alhail[$] & Sabah S Jabir[@]

[#]CABS, Professor of Surgery, Department of Surgery, Basrah College of Medicine. [$]CABS, DGS, Specialist surgeon in Basrah General Hospital. [@]MB,CHB, Board candidate.

Abstract

Closure of the wound after surgery is a routine procedure and one of the first things that a surgeon in training should learn. A surgeon will successfully closes a thousand of wounds during his career, but the problem of wound infection remains challenging.

This study was conducted to compare between two methods of skin closure which are subcuticular alone and combined subcuticular with interrupted suturing regarding; wound infection, cosmesis &speed of wound closure.

Between December 2006 and October 2009, two hundred and two patients were admitted in Basrah General Hospital, department of surgery. They underwent elective abdominal operation and were randomized into two groups, group A (abdominal skin closure by subcuticular suturing only) and group B (combined subcuticular with interrupted suturing). There were 102 cases in the subcuticular group, 50 cases of them were males and 52 cases were females, while in group B there were 100 cases,42 cases of them were males and 58 cases were females. Mean age was 38.9 (range 4-66) for group A and 41.6 (range 8-67) for group B. The mean BMI was 25.2 (range 17.4-34.8) for group A and 26.4 (range 18.7-39) for group B.

Results: *Wound infection*: The total number of early wound infection for the six –weeks follow – up period was 12 cases (11.7%) for the subcuticular (group A),and 4 cases (4%) for the combined (group B)_(P=0.036). *Cosmoses*: There was no significant difference in cosmetic result in both groups. *Speed of wound closure:* Combined (group B) closure was accomplished at significantly faster rate (mean 35.6 sec/cm) than subcuticular (group A) closure (mean 46.8sec/cm) (p=0.001). Conclusion: From this study we conclude that the choice of technique for wound closure did not affect the final cosmetic outcome of the wound but the incidence of postoperative wound infection significantly reduced by combined subcuticular and interrupted suturing. The closure of wound is rapid in combined group than in subcuticular group alone.

Introduction

Through many millennia, various suture materials were used to hold body tissue together after surgery. Sutures were made of plant materials (flax, hemp, and cotton) or animal material (hair, tendon, arteries, muscle strips and nerve). African cultures used thrones and others used ant sutures by coaxing insects to bite wound edges with their jaws and subsequently twisting off insect's heads[1]. The earliest reports of surgical suture date back to 3000 BC in ancient Egypt and the oldest - suture in a mummy from 1100 BC. Today, most sutures are made of polymer fiber. Silk and gut sutures are the only material still though rarely in use from ancient time[2]. Wide array of suturing techniques exists for operative surgery. Wound closure can be achieved by a variety of, interrupted simple suturing, continuous simple suturing, vertical mattress, horizontal mattress and subcuticular suture technique[3,4].

Although the outcomes of surgical skin closure may be influenced by the indication for the procedure, the location of the surgical site, and associated intraoperative and

postoperative complications. The goal of any skin closure technique is to produce appropriate skin approximation and adequate healing with minimal wound complications, scarring, pain, and cost. The technique should be quick, cost-effective, simple, with maximizing wound cosmoses and patient satisfaction[5]. (Careful tissue handling during wound closure is important to minimize the risk of infection. Meticulous surgical technique, which avoids tissue necrosis and dead space, helps to ensure a favorable environment. Excessive foreign materials in the wound may increase the risk of infection. Source of wound infection may be from the theatre, the ward or the patient himself. The reduction of wound infection rates through careful wound closure and meticulous dressing protocols may have an important impact on morbidity rates, and hospital stay with the associated financial implications. Wound infections are a major cause of mortality and morbidity in surgical practice. Closure of the skin following surgery protects the underlying traumatized and devitalized structures from skin flora and external contamination[6].

Aim of this study, is to compare between two methods of abdominal skin closure which are subcuticular alone, and combined subcuticular with interrupted suturing regarding wound infection, cosmetic, and speed of closure.

Patients and methods

Sample definition:

Between December 2006 & October 2009, two hundred two patients were admitted in Basrah general hospital, department of surgery who underwent elective abdominal operation were randomized in two groups, group A (abdominal skin closure by subcuticular suturing only), and group B (combined subcuticular with interrupted suturing). There were 102 cases in group A, 50 cases of them were males and 52 cases were females, while in group B there were 100 cases, 42 cases of them were males and 58 cases were females. Mean age was 38.9 (range 4-66) for group A and 41.6 (range 8-67) for group B. The mean BMI was 25.2 (range 17.4-34.8) for group A and 26.4 (range 18.7-39) for group B.

Exclusion

Factors that interfere with normal wound healing were excluded from this study. Patients with diabetes, uremia, jaundice, anemia (hemoglobin less than 9g/dl), steroid dependent, contaminated and dirty wounds, and also patient who did not complete the follow up, all were excluded from the study.

Definition of procedure

Patients were admitted 1-3 days before surgery according to the type of operation. Careful history, physical examination, and appropriate preoperative investigations were performed. Informed consent forms were signed by all patients or patients relative who are responsible before the operation. The surgeries to close the wounds were performed by two surgeons of comparable experience and skill levels. The skin, subcutaneous tissue and fascia were cut by sterile lancet. Abdominal skin incisions were closed with either traditional method of subcuticular suturing or with combined subcuticular and interrupted suturing. In the subcuticular suture technique, the subcutaneous tissues were approximated by absorbable multi-filament (polyglycolic acid 3/0) and the skin closure were performed with non absorbable monofilament (polypropy-lene 3/O), while with combined suture technique there was no approximation of subcutaneous tissue by absorbable

sutures but instead we used non absorbable monofilament (polypropylene 0) as interrupted mattress suturing (key sutures) that were not tied until the subcuticular suture was inserted and tied.

The distance between the key sutures ranged from (3-5) cm. Key sutures were removed in the fifth post operative day if there were no signs of wound infection.

Investigations "factors analysis":

In this study we concerned on clean and clean-contaminated wounds only. In the subcuticular group alone there were 59 wounds categorized as clean wounds and 43 wounds categorized as clean-contaminated wounds, while in the combined group there were 59 wounds categorized as clean wounds and 41 wounds categorized as clean-contaminated wounds. Post operative wound inspection was done after 3 days, at the time of stitches removal (10-14day), and at the end of 6th week. Early wound complications and late scar complications were recorded. At the operation theater the starting and finishing time of abdominal skin closure was recorded (sec/cm). Wound smear and aspiration culture were obtained from patients who developed signs of infection. Upon detection of bacteria, antibiotic sensitivity assessed and treatment initiated accordingly.

Definition of end points

Wounds infection were evaluated according to the specific wound site evaluation scheme[7].

Each wound was assigned a score of 0 to 7, in which 0 was the optimal post operative wound:

Grade 0; optimal wound appearance

Grade 1; one infection finding (erythema, edema, increased pain).

Grade 2; two infection findings.

Grade 3; three infection findings or haemoserous discharge.

Grade 4; two infection findings and haemoserous discharge.

Grade 5; three infection findings and haemoserous discharge.

Grade 6; two infection findings and purulent discharge.

Grade 7; three infection findings and purulent discharge.

The cosmetic appearance of each wound was graded by the patient, the surgeon and an independent observer. The assessment was made at the time of discharge and clinical following up visits 2 and 6 weeks postoperatively. The patient, the surgeon, and the independent assessor were unaware of each other's Grading. Verbal response scale was used for this process8. The verbal response scale had four options: poor, fair, good, and excellent. Wounds that have fair or poor cosmetic results are assessed as one group statistically and wounds that have good or excellent cosmetic results also assessed as one group statistically.

Recording of additional treatment;

Peroperative and postoperative antibiotic prescription were recorded. all patients received an IV injection of 1gm cefotaxime at induction of anesthesia, followed by 1gm I.V cefotaxime every 12hrs until the drains were removed then replaced by oral antibiotics.

Statistical analysis: was made using Chi square test, accepting P value of less than 0.05 as statistically significant.

Results

Demographic data:

A total of 300 patients were available in the beginning of the study. At subsequent visits the number of patients declined gradually as some of them defaulted the follow –up. For this reason only 202 patient were available for analysis at 6th week.(Table I)

Table I: Number of follow up patients:

At beginning	2nd week	6th week
Defaulters		10	88
Patients available	300	290	202

Table II compare between both groups A and B with no significant difference at different time interval for the following parameters: number of patients, age, sex, BMI, and types of surgery.

Table II: General characteristics of the patients included in the study

	Group A	Group B	P
NO. of patients	**102**	**100**	**---**
Age(years)	**38.9 (range 4-66)**	**41.6 (range 8-67)**	**0.150**
Sex (male: female)	**50:52**	**42:58**	**0.195**
B.M.I	**25.2(range 17.4-34.8)**	**26.4 (range 18.7-39)**	**0.230**
clean operation	**59**	**59**	**---**
clean –contaminated operation	**43**	**41**	**---**

Clinical outcome:

1- Wound infection:

Postoperative wound inspection was performed daily and infection findings were assessed clinically on 3rd postoperative day. The total number of early wound infection for the six –weeks follow–up period was 12 cases (11.7%) for the subcuticular(group A), and 4 cases (4%) for the combined (group B),(P=0.036). Three of the 12cases in group A who developed wound infection had clean wounds while 9 of them had clean contaminated wounds. In group B, 2 cases of the patients who developed superficial wounds infection had clean wounds and another 2 cases had clean –contaminated wounds (tables III&IV).

Table III: Infection rate according to method of skin closure

		Infection		Total
		Yes	No	
Group A	**Count**	**12**	**90**	**102**
	%	**11.77%**	**88.23%**	**100%**
Group B	**Count**	**4**	**96**	**100**
	%	**4%**	**96%**	**100%**
Total	**Count**	**16**	**186**	**202**

P value=0.036

Table IV:Infection rate in relation to type of wound.

Group		Type of wound		Total
		Clean	Clean-contaminated	
	A	3	9	12
	B	2	2	4
Total		5	11	16

P value=0.365

The infection scores for the 4 patients in group B who developed superficial wound infection were 1 (3 patients) and 2 (1 patient). In group A the infection scores were 1 (3patients), 2 (6patients), and 3 (3 patients). Deep wound infection was not observed in both groups.

Eight of the 12 patients who developed superficial wound infection in group A had microbiologic proliferation in their wound culture: 2 had Escherichia coli and 6 had staphylococcus aureus, while 2 of the 4 in group B who developed infection had microbiologic proliferation in their wound culture, one had Escherichia coli and one had staphylococcus aureus. The remaining 4 patients in group A and 2 patients in group B did not have proliferation. None of the patients in either group required stitch removal. The patients with superficial wound infection in either group were discharge between 5-8 postoperative days. 2-Cosmetic appearance of wound:

There was no significant difference in cosmetic results in both groups: Tables V&VI) show the number of wounds that are scored as good or excellent by the patients, surgeons, and independent observer.

Table V: Cosmetic appearance of wound (verbal response) after 2 weeks.

	Group A	Group B	P value
2 weeks after surgery			
Patient	**83/102**	**80/100**	**0.472**
Surgeon	**87/102**	**85/100**	**0.555**
Independent observer	**90/102**	**88/100**	**0.565**

Table VI: Cosmetic appearance of wound (verbal response) after 6 weeks

	Group A	Group B	P value
6 weeks after surgery			
Patients	**94/102**	**93/100**	**0.179**
Surgeon	**90/102**	**89/100**	**0.435**
Independent observer	**94/102**	**92/100**	**0.255**

3-Speed of wound closure:

For comparison purposes, the time taken to close the wound was divided by the length of the wound in cm. Combined (group B) closure was accomplished at significantly faster rate (mean 35.6 sec/cm) than subcuticular (group A) closure (46.8sec/cm).

Discussion

The first report of the use of subcuticular sutures for wound repair was in 1889[9].

The factors which have to be considered in making a comparison of different types of wound closure are:

The infection rate. The final cosmetic

result. The ease and speed with which the skin closure is completed.

Many of these factors became especially significant when considering abdominal skin incisions.

For the first parameter, that is, infection rate: Several wounds are often contaminated with bacteria, but few became infected. The progression from contamination to infection is a complex process dependent upon a large number of factors, one of which is the presence of suture material in the subcutaneous tissues[10-12].

Infection is often considered as the worst complication of a sutured wound, and bacteria usually multiply in the area where necrosis is present or blood is being pooled into the wound bed[13].

Wound infections are usually exogenous in origin, but some predisposing factors, such as poor hygiene, contamination of the suture material, wound hematoma, or necrotic tissue (sometimes due to exceeding traction of the suture or poor vascular supply) favors exogenous or endogenous bacterial proliferation[14].

Challenges to obtaining appropriate post-hospital discharge surveillance of infection rates include the lack of a validated method of ascertaining cases of wound infection post discharge and a large variation in definitions of wound infection and population characteristics[15].

Based on a recently published metaanalysis which reviewed six randomized trials on subcutaneous suture in obstetric patients, closure of the subcutaneous tissue with thickness 2 cm, are generally of poor quality and therefore do not allow for evidence-based recommendations as to the best method[16,17].

A recent prospective randomized controlled trial demonstrated no significant change in the incidence of overall wound complications independent from the closure or no closure of the subcutaneous tissues in women with 3 cm or more subcutaneous fat[18].

In our study we found that the wound infection rate in group A was 11.7% compared with4% in group B (P value=0.036) and it may be due to obliteration of the dead space in group A.

There are three possible explanations:

Firstly, the tying of sutures may strangulate tissue resulting in multiplication of bacteria in necrotic areas; these bacteria are isolated from host's immune system which is dependent upon an intact blood and oxygen supply[4].

Secondly, there is evidence to show that the ability of sutures to potentiate infection varies with nature of the material used[10,11], and that physical and chemical properties play a part. Natural material such as Catgut, Silk and Cotton encourage infections to a significantly greater extent than synthetics[19]. Braided sutures are associated with higher infection rate than monofilament[20], and this may be due to the fact that bacteria lodged in the interstices of the braided sutures are protected from phagocytosis.

The bacterial adherence properties of sutures correlate with their propensity to encourage infections; nylon attracts fewer bacteria than most other materials[19].

Finally, chemical composition may be important, it has been suggested that some sutures such as nylon and polyglycolic acid plus may release antibacterial substance in the tissues[11]. Conversely, it is possible that other materials, because of their chemical nature, interfere with the processes of chemotaxis, opsonization and phagocytosis[19].

For the second outcome measured that is, cosmesis was comparable in both groups. This showed that the methods of wound closure had no bearing on

long term scar complaints, either on the 14th day, or 6th week after surgery.

For the third parameter, that is, speed of wound closure, the combined closure was accomplished at faster rate compared to the subcuticular group alone. The reason of this difference exists most likely due to the following factors:

Time was spent while waiting for the assistant to cut the suture in the obliteration of the dead space in subcuticular group.

Extra time spent on tying the multiple knots in the obliteration of the dead space compared with 2- 3 knots (key sutures) in combined groups. From this study we concluded that incidence of post-operative wound infection significantly reduced by combined subcuticular and interrupted suturing.

The choice of technique for wound closure did not affect the final cosmetic outcome of the wound.

The closure of wound is more rapid in combined group than in subcuticular group. We would suggest that future studies on abdominal skin closure should include careful evaluation of the technique that have been recommended to reduce the wound infection. Until additional studies are available, the surgeons are free to select the technique of their preference.

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