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Internal tension sutures, a novel method of midline laparotomy closure in high risk patients

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Abstract

Objectives: The objective of the present study was to introduce a novel technique of laparotomy closure with internal tension sutures in patients with a high risk of wound dehiscence providing better patient and wound outcomes.

Study design: Prospective cross sectional study.

Place and duration of the study: Surgical E unit, Department of Surgery, Khyber Teaching Hospital, Peshawar from November 2012 to May 2017.

Materials and methods: In the current study, 250 male and female high risk patients who underwent mid line laparotomy for various indications, were subjected to abdominal wall closure with buried internal tension sutures technique with Vicryl 1/0. Patients' demographics and outcome measures were recorded on a standardized proforma. Statistical analysis was performed using SPSS version 20 with proportions and mean±SD calculated for categorical and continuous variables, respectively.

Results: A total of 212 patients were analyzed with a male to female ratio of 4:3. Mean age was 36±16.42 years. Up to 165 (77.8%) cases were operated on elective list while 47 (22.2%) were operated in emergency. The mean VAS was 4.1±2.2 SD. Ninety one percent of patients achieved excellent wound outcome without any complication withonly 9% developing the varied complications. Adverse effect, most common was wound infection =4.71% and only 2.35% developed incisional hernia.

Conclusion: Internal tension sutures showed excellent results in terms of low rate of infection, wound dehiscence and incisional hernia occurrence making it an ideal closure technique for all patients.

Keywords: laparotomy, internal tension sutures, incisional hernia, wound dehiscence

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Introduction:

A surgically created wound is an anatomical disruption of tissues, which follows the three stages of wound healing. Optimal healing is dependent on both the patient's characteristics as well as the surgical technique. Midline laparotomy/ celiotomy is a frequently performed operation in general surgical practice. Adverse wound outcomes such as dehiscence, infection, necrosis, non-healing, incisional hernia following laparotomy are attributed to certain patient characteristics, intra-operative variables and post-operative factors.

A part from the pre and postoperative patient factors the important intraoperative factors accounting for the various wound strength issues are surgeon's expertise, operating time, type of incision, suturing technique and material used, and nature of procedures. The number of wound dehiscence has increased significantly. Various sutures and suturing techniques have been devised with the aim of achieving favorable wound healing on one hand and thus avoiding dreadful complications such as abdominal wall dehiscence and incisional hernia on the other.[1-5]

A variety of suture materials and techniques

have been described in the surgical literature including inverted vertical mattress technique, anatomical repair, mass closure, single layer closure, tension sutures,interrupted Smead-Jones technique and continuous with intermittent Aberdeen knot technique[3] Tension sutures are popular in this regard, with some variations in technique these reinforcing stitches, involving all layers of the abdominal wall, are used to minimize the tension on the primary closure.

Tension sutures can be external and internal (buried). External tension sutures, in contrast to the internal counterpart, have been reported to have adverse effects in terms of post-operative pain, poor cosmetic outcome, damage to internal organs.

Very little work has been done on the alternate internal buried variety of tension suturing which is looked as a promising way forward so far midline abdominal would closure is concerned especially in high risk patients .

This study was thus carried out to evaluate this novel technique of abdominal wall closures in terms of the morbid outcomes of laparotomy wounds and thus prove as a basis for selection of an alternate effective surgical technique.

Methods and Materials:

This prospective cross sectional study carried out in surgical E ward, Khyber Teaching Hospital, Peshawar. The duration of the study was of 4 and a half years (November 2012 to May 2017). The objective of the study was to evaluate the outcome of abdominal wall closure with the internal tension suturing technique in terms of the various outcomes. Before the study was initiated an approval was obtained from the ethical committee of the hospital.

A series of 250 patients presenting to the general surgical OPD and emergency surgical departments requiring midline laparotomies were included in the study. During the study 20 patients were lost to follow-up while 18 patients died during the 1 year follow-up period thus final sample size was 212. Both high risk male and female patients more than 13 years old were included such as those with acute abdomen due to perforated viscus (perforated duodenum, enteric perforation, ruptured appendix), Intestinal obstruction, fire arm injury or stab wound to abdomen, intra-abdominal malignancies, pancreatitis. Patients with history of previous laparotomies, incisional hernias, cirrhosis and ascites were excluded from the study.

An informed consent was taken from all the patients after explaining the procedure fully, in case of critically ill patients, the consent was taken from immediate relative. All patients underwent laparotomy under general anesthesia with standard protocols, using upper or lower midline incisions.[6] Abdominal cavity wash with 6 liters saline, placement of sub hepatic or pelvic drain, pre-operative antibiotic at induction.

At the time of closure, some dissection was carried out at both sides of midline wound to create space between the anterior rectus sheath below and subcutaneous fat above, then full thickness continuous stitches were taken with Vicryl 1/0 following Jenkins rule (suture length four times the length of incision)with mass closure technique (including peritoneum and rectus sheath), and bites were taken 1cm from wound edge and at 1cm interval. After 5 continuous sutures one internal tension suture was taken in a simple interrupted manner approximately 1.5 cm from the margins including all layers of the anterior abdominal wall excluding skin and subcutaneous tissues. At least 3 to 4 such internal tension sutures were taken 5cm apart from each other. The tension sutures were tied sequentially once they were crossed by the continuous sutures. Finally the skin incision was closed using staples or Prolene 2/0 suture and anti-septic dressing was applied. Some patients requiring intensive care were shifted to ICU while the rest were looked after in the ward.

Antibiotic, nutritional, fluid and analgesic requirements were met adequately for all patients. Early post-operative pain was recorded using VAS after 24 hours of surgery, regular dressings were done and wound was checked for any

Table 1:. Indications for laparotomy

Indications	Cases	Frequency
Peritonitis	65	30.6%
Perforated duodenum	20	
Perforated ileum	28	
Ruptured appendix	17	
Intestinal obstruction	30	14.1%
Tumor	08	
Adhesions/bands	16	
Volvulus	06	
Intra-abdominal collection	10	4.71%
Trauma	25	11.8%
Fire arm Injury	10	
Penetrating Stab wound	04	
Blunt trauma(solid organ)	11	
Mesenteric Ischemia	5	2.36%
Intra-abdominal malignancy	45	21.22%
Others		
(pancreatitis, obstructive jaundice)	32	15.1%
TOTAL	212	100%

Table 2: Outcome of internal tension sutures

Outcome follow up wise	Number of patients	Percentage
Complete Wound healing	194	91.5%
1st week		
• Wound infection	10	4.71%
7th post op day		
• Partial dehiscence	02	0.94%
• Complete dehiscence (burst abdomen)	Zero	Zero
At 2 weeks		
• Stitch sinus/granuloma	01	0.47%
• Chronic wound pain	Zero	Zero
6 months follow up		
• Poor cosmesis	Zero	Zero
12 months follow up		
• Incisional hernia	05	2.35%
Total	212	100%

signs or symptoms of surgical site infection. All patients were evaluated for any sero-sanguineous discharge and if present, they underwent an ultrasound on 7th post-operative day to exclude/confirm wound dehiscence. Patients were followed up in OPD at 2 weeks for chronic wound pain and stitch sinus/granuloma, then at 6 months for scar cosmesis and at 12 months postoperatively for incisional hernia. All patients were advised to wear abdominal belt for 6 months. Exclusion criteria was strictly followed to control the confounding variables.

Statistical Analysis:
The data was analyzed using SPSS version 20 for windows. Continuous variables were presented as Mean±SD while categorical variables were expressed with frequency and percentages using 95% confidence interval.

Results:
Out of the total 250 selected patients 38 patients were lost to follow up. A total of 212 patients were thus subjected to the final analysis. There were 121 males and 91 females (M/F ratio 4:3). The overall mean age was 36±16.42 years. Around 165 (77.8%) patients were operated on elective morning list while 47 (22.2%) were operated in emergency.

The mean VAS was only recorded from 180 patients who were stable at 24 hours to respond to this variable and was found to be 4.1±2.2. Details of the various indications for laparotomy in the present study are depicted in Table 1.

Post-operative outcome of internal tension sutures in each patient is listed in Table 2. It was found that 194 (91.5%) patients had an excellent wound outcome without any complication. Up to 16 (8.5%)patients developed a variety of adverse wound outcomes such as surgical site infection (4.71%). Most patients who developed wound infection were either operated in emergency or were labeled as having clean contaminated or dirty wounds per-operatively. Only 5 patients i.e. 2.35% developed incisional hernia on 12th month follow-up.

Discussion:
In our study the most common indication for laparotomy was peritonitis secondary to perforation of a viscous. In few cases the patients were timely diagnosed and managed but in majority of the cases patient delay owing to various reasons resulted in late diagnosis and optimal management jeopardizing uneventful outcome.

A study by Rink and Goldschmidt confirmed that postoperative pain was overall more severe

with tension sutures. Patients with tension sutures developed local complications of the sutures and 21 of the 44 patients needed their sutures be removed prematurely due to intolerable pain. Abdulretha in his study found that external tension sutures were very painful especially during first 24 hours with mean VAS 7.3 ±2.31.[6-9] In contrast the present study showed that internal tension sutures produce lesser pain with mean VAS at 24 hours to be 4.1± 2.2.

The current study shows that 4.71% patients developed surgical site infection. This is in contrast to the findings in other studies which reported a higher rate of surgical site infection.[1,6-12] Others however yielded results corroborating our final analysis.[9,13,14] Acceptable explanation for the lower surgical site infection rate may be relatively younger age group of the patients in the present study with a competent immune system.

The external tension sutures not only cause significant pain but also delay patient's mobility and hamper breathing ability. In addition they act as foreign bodies or portals of infection. In high risk patients who are already immunocompromised, anaemic, and have a poor nutritional status wound healing is further delayed. This delayed healing and infection in turn are responsible for wound dehiscence or burst abdomen. External tension sutures which provide a false sense of security in turn put the patient at risk.

Thus it is a two way sword if tied very tightly it may cause damage to the skin and abdominal layers especially in the obese and if tied too loose may predispose to failure. Various attempts have been made to exclude the skin from the damage utilizing most commonly rubber bolsters or drip set pieces for incorporation in sutures. Smith described a method of removable buried retention sutures.

Recommendations:
Future studies need to be carried out comparing internal with external tension sutures.

Conclusions:
Interrupted buried/internal tension sutures with vicryl 1/0 is a novel technique of abdominal closure in high risk laparotomies with excellent results, low rate of infection, wound dehiscence and incisional hernia making it an ideal closure technique for all patients.

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Role and contribution of authors:
Dr Muhammad Imran Khan, collected the data, references and wrote the initial writeup.

Dr Jawad Khalil, critically review the article, made the changes in introdution, results and in conclusion.

Dr Maryam Alam Khan, collected the data, references and helped in introduction, conclusion writing.

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