Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2014; 2(5B):1591-1595 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com **DOI:** 10.36347/sjams.2014.v02i05.018

Research Article

Evaluation of Abdominal Wall Closure Technique in Emergency Laparotomies at a Peripheral Hospital

Ibrahim S. Elkheir*, Saadeldin A. Idris
Associate professor, Department of Surgery, Faculty of Medicine, Alzaeim Alazhari University, Khartoum, Sudan

***Corresponding author**
Ibrahim S. Elkheir
Email: dr.ibrahim5@hotmail.com

Abstract: Abdominal wound closure technique should be efficient to perform, provide strength and be a barrier to infection. The method of closure of the abdominal wall is a critical aspect of an effective incision closure, in addition to the choice of suture material. The aim of the study was to report our experience with abdominal wound closure technique in peripheral hospital. A prospective, cohort study (June 2003- June 2010) conducted in Aldamazin Hospital, Sudan. It included patients who underwent laparotomy. All abdominal wall wounds were closed by standardized documented method of closure; mass closure using one loop continuous suture with delayed absorbable polygactin 910 (Vicryl). Data regarding postoperative complications was collected and managed statistically by SPSS computer program. The study included 206 patients; the indication for laparotomy was inflammatory, traumatic and neoplastic in 62.6%, 33% and 4.4% respectively**.** It was performed through vertical and transverse incisions in 159 (77.2%) and 47 (22.8%) respectively. Mean postoperative hospital stay was 9.1 ±3.6 days (Range 3— 30 days), and was affected by the postoperative course. Postoperative complications seen in 40.8% and it was affected by indication for surgery, p=0.01. The complications encountered were wound infection, sepsis, chest infection, DVT, wound dehiscence and incisional hernia in 29.6%, 6.8%, 3.4%, 1%, 0.5%, and 0.5% respectively. In conclusion, wound infections after abdominal surgery are still frequent types of nosocomial infections. Mass abdominal closure with continuous Vicryl suture and size modified to age and body built decreases postoperative complication.
Keywords: Laparotomy; Mass closure technique (MCT); Polygactin 910 (Vicryl); Complications.

INTRODUCTION

Laparotomy is a major surgical procedure, whether elective or emergency always remains the bread and butter of a general surgeon [1]. The choice of surgical incision to open the abdominal cavity can be based on patient, surgeon, or health care system criteria. From a patient's point of view pain and restriction of ingestion are important. Surgeons' main interests, aside from the quick and optimal exposure of the operative field, are time to open and close the abdomen, and frequency of burst abdomen, wound infection, postoperative pulmonary complications, and incisional hernias. For health economy, parameters such as duration of operation, length of hospital stay, and full physical and mental activity are relevant [2].

Despite advances in surgical technique and materials, abdominal fascial closure has remained a procedure that often reflects a surgeon's personal preference with a reliance on tradition and their experience [2, 3]. The best abdominal closure technique should be fast, easy, and cost-effective, while preventing both early and late complications [3]. Yet the ideal techniques and materials, although suggested by the surgical literature, have not been uniformly accepted [2, 3].

In general, two issues are discussed, as regards the method of the abdominal-wall closure, the continuous versus interrupted suturing and the layered versus mass-closure. Proponents of the interrupted closure may argue about the division of the stress at the points of sutures so that in an untoward event of any suture cut-through, the others maintain the wound integrity. Although it is a time consuming procedure, may require a great length of the suture material and tend to add multiple knots to the subcutaneous space those are likely to cause more pain to the patient postoperatively. Proponents of the continuous suturing method may evoke about the suture's "see saw effect" of adjusting to the dynamic stresses and strains occurring during one's physical movements. It is faster and cost effective and also minimizes the number of subcutaneous knots and the rate of incisional hernia formation [4]. Smead and Jones in 1900 and 1941 respectively described a mass closure technique and after that it was named Smead-Jones technique. Dudley, in 1970 had shown that mass

closure was superior to layered closure when using stainless steel wire [2, 5]. A critical element of effective incision closure is the choice of suture material. The smallest caliber suture that effectively reapproximates tissues should be selected [6]. The mechanical characteristics of different suture techniques have a direct influence on wound strength [7]. Vicryl is braided materials but are less reactive than silk or catgut because they are absorbed by hydrolysis [3]. The study was designed to examine two specific aspects of technique; mass closure and vicryl suture material, adopted in our department in abdominal wall closure to determine its validity in term of outcome in comparison with other methods in literature.

METHODOLOGY

This prospective, cohort study was approved by the local ethical committee. Starting in June 2003 for 7 years period, all patients irrespective to their age and sex who underwent a laparotomy was followed up for 3 years and screened for this Cohort. The study was conducted in Aldamazin Hospital, Blue Nile State, Sudan, which is a two hundred fifty bedded hospital, located in the remote district of Aldamazin, with limited health care facilities. After giving written informed consent, all patients included in the study underwent a standardized clinical pathway documented abdominal wall closure after abdominal surgery. All patients received antibiotic prophylaxis (standard antibiotics: metronidazole and ceftriaxone) within 30 minutes before the skin incision. Patients having procedures lasting longer than 4 hours received a second dose of antibiotics [8]. After skin disinfection with a povidone iodine, and sprit, the skin was incised with a scalpel. Subcutaneous tissue, and the fascia, were dissected with a diathermy and peritoneum opened with scissor. Patients with an organ space infection upon laparotomy underwent an abdominal lavage with normal saline solution 0.9% of at least 3 Liters.

Surgical procedures were carried out by the same surgical team, using the one loop continuous suture mass closure technique (MCT) [9], with a suture/wound length ratio of 4:1 [9-12], with a stitch length of approximately 1 cm, taking the fascia at approximately 1.5 cm distance from the midline incision [9]. Wound closure was started from the one end of the incision. Suture interval was 1 cm apart. All sutures passed through all musculoaponeurotic layers and peritoneum. The peritoneum was not closed separately. All wounds were closed with delayed absorbable polygactin 910 (Vicryl). The size of suture was age and body built dependent (Table 1).

Table 1: Suture material size used for abdominal wall closure (n=206)

Age group	Size of Polygactin 910 (Vicryl)
≤1 year	3/0
1- 3 years	2/0
3 - <12 years	0 or 1 (depend of patient's size)
≥12 years	2

Sutures were anchored at one corner of the wound with a 2x1x1x1 square knot and at the other end of the wound with a 2×1×1×1×1 square knot. The sutures were tied with just enough tension to loosely approximate the rectus sheath. All knots were positioned away from the incisional region in order not to interfere with the regenerative process. After the fascia was closed, the wound was rinsed with normal saline solution 0.9% to clean out blood and cell debris. Subcutaneous sutures were used in some occasions. The skin was closed with interrupted Nylon suture 3/0 or 2/0, and subsequently disinfected with povidone iodine in alcohol. Finally a sterile drape was applied to the wound and left in place. Then after, collected data was entered SPSS computer program and descriptive statistics were used. Demographic data was expressed as mean with 95% confidence intervals (CIs). In the case of quantitative data, Fisher's exact test (two-tailed) was used for differences in proportions. A *p*-value of ≤0.05 was considered significant.

RESULTS

Between Junes 2003 and 2009, the study initially included 227 consecutive patients admitted to our department that were screened to undergo open abdominal exploration and closure of the incision in a standardized fashion. Twenty one patients were lost follow up, so were excluded from the study. Only 206 patients were remained for final assessment. Their age ranged between 3 days — 84 years (24.3 ± 16.4 years), the majority 154 (74.8%) are more than 12 years. There was male predominance (Male 140 (68%) and female 66 (32%)) with a ratio of 2.1:1. The different indications of the abdominal conditions requiring emergency laparotomy were mentioned in Table 2.

The laparotomies incision was depend on the preoperative diagnosis and patient's age. It was performed through vertical and transverse incisions in 159 (77.2%) and 47 (22.8%) respectively (Table 3).

The intraoperative findings are explored in Table 4.

In 93 (45.1%) of patients blood was transfused during the perioperative period, because of severe blood loss. Their mean hospital stay postoperatively was 9.1 ±3.6 days (Range 3— 30 days). It was affected by the postoperative course.

The incidence of postoperative complications was 40.8% (84 patients). The main complication encountered in these patients was wound infection that developed in 61 (29.6%), it was superficial in 20.9% and deep in 18 8.7%.

It required longer duration of antibiotics or removal of some skin stitches as a method of drainage with repeated dressings. All patients' wounds healed satisfactory with no further complications within 1 month.

Sepsis was seen in 12 (6.8%), so required longer duration of antibiotics. Chest infection was encountered in 7 (3.4%) of patients in spite of the early chest physiotherapy program. DVT prophylaxis was given on base of indication, in spite that 2 (1%) patients developed DVT during their hospital stay. Other complication encountered was abdominal evisceration was developed in 1 (0.5%) patient.

No incisional hernias were encountered in the first 3 months. Only one (0.5%) incisional hernia occurred within the follow up period (Table 5).

Development of complications was affected by indication for surgery; inflammatory versus traumatic and most of these complications encountered in the group of patients when the indication for laparotomy was inflammatory as p=0.01, but not affected by patient's age as p value was > 0.05.

Table 2: Preoperative diagnosis (n=206)

Aetiology	Diagnosis	Frequency	Percentage (%)
Inflammatory (n=129)	Intestinal obstruction	87	42.2
	Perforated viscus	42	20.4
Traumatic (n=68)	Stab wound	41	19.9
	Gun shot	14	6.8
	Blunt abdominal trauma	12	5.8
	RTA	1	0.5
Neoplastic (n=9)	Abdominal mass	2	1
	Ectopic pregnancy	4	1.9
	Ovarian cyst	3	1.5

Table 3: Laparotomy incision (n=206)

Incisions		No.	%
Vertical (n=159)	Midline	132	64.1
	Paramedian	27	13.1
Transverse (n=47)	Upper	46	22.3
	Lower	1	0.5
Total		206	100.0

Table 4: Intraoperative findings (n=206)

	Frequency (Percentage)	
Small bowel	91 (44.2)	Injury 65(31.5%)
		Intussception 16(7.8%)
		Perforated DU 7(3.4%)
		Internal hernia 2(1%)
		Adhesive obstruction 1(0.5%)
Large bowel	61 (29.6%)	Injury 25(12.1%)
		Sigmoid volvulous 20 (9.7%)
		Intussception 16(7.8%)
Stomach	39 (18.9%)	Injury 30(14.6%)
		Pyloric stenosis 5(2.4%)
		Perforated GU 4(1.9%)
Appendix	29 (14.1%)	Inflamed 1(0.5%)
		Perforated 28(13.6%)
Liver injury	19 (9.2%)	
Spleenic injury	14 (6.8%)	
Diaphragmatic injury	7 (3.4%)	
Bladder injury	5 (2.4%)	
Ectopic pregnancy	4 (1.9%)	
Uterine injury	3 (1.5%)	
Ovarian cyst	3 (1.5%)	Lt ovarian cyst 2(1%)
		Ruptured Rt ovarian cyst 1(0.5%)
Pancreatitis	3 (1.5%)	Haemorrhagic 2(1%)
		Acute 1 (0.5%)
Lung injury	1 (0.5%)	
Mickel's diverticulum	1 (0.5%)	
Perforated GB*	1 (0.5%)	
Lymphangioma	1 (0.5%)	

* GB; Gall bladder

Table 5: Complications encountered after laparotomy (n=206)

Indication		Wound infection	Sepsis	Chest infection	DVT	Burst abdomen	Incisional hernia	Total
Inflammatory	Perforated viscus	22 (10.7%)	4 (1.9%)	3 (1.5%)	1 (0.5%)	1 (0.5%)	1 (0.5%)	32 (15.5%)
	Intestinal obstruction	17 (8.3%)	1 (0.5%)	3 (1.5%)	—	—	—	21 (10.2%)
	Total	39 (18.9%)	5 (2.4%)	6 (2.9%)	1 (0.5%)	1 (0.5%)	1 (0.5%)	53 (25.7%)
Traumatic	Stab wound	17 (8.2%)	3 (1.5%)	1 (0.5%)	1 (0.5%)	—	—	22 (10.7%)
	Gun shot	04 (1.9%)	04 (1.9%)	—	—	—	—	8 (3.8%)
	Blunt trauma	01 (0.5%)	—	—	—	—	—	1 (0.5%)
	Total	22 (10.7%)	7 (3.5%)	1 (0.5%)	1 (0.5%)	—	—	31 (15.1%)
Total		61 (29.6%)	12 (5.8%)	7 (3.5%)	2 (1%)	1 (0.5%)	1 (0.5%)	84 (40.8%)
P value		0.000	0.000	0.7	0.7	0.06	0.06	0.01

DISCUSSION

In our practice we adopted the suture length to wound length ratio of 4:1, this practice is supported by prospective experimental and clinical studies [9-12]. We tailored the suture size for each patient depends on patient's age and body built. Most of the studies in the current surgical literature employ a number 0 or larger size suture to close the fascia. It should be noted, however one study found no greater incidence of wound dehiscence, compared with studies in which surgeons use heavier gauge sutures, when they used size 2-0 suture material to close the fascia. The double-loop closure method provides the most tensile strength, but in one study, it was associated with a significantly increased rate of pulmonary complications and postoperative death, possibly related to decreased compliance of the abdominal wall. The suture thickness chosen must provide adequate tensile strength as well as adequate elasticity to accommodate an increase in intra-abdominal pressure in the postoperative period [3]. Our adoption of mass closure is supported by 2 meta-analyses [13,14].

Out of the 206 cases, 84 post-operative complications were encountered with incidence of 40.8%. Green G. *et al*. [15] in their study reported 70% higher incidence of post laparotomy complication.

Surgical site infections (SSIs) are among the most common health care associated complications. They contribute to secondary patient morbidity and mortality and significantly increase the cost of care [16]. The incidence of wound infection in the current study was 29.6% which is higher than that reported incidence by Green G. *et al*. [15]. On other hand, sepsis developed in 5.8% in this series, this was in concordance with Green G. *et al*. [15] when the incidence of sepsis was 46%.

Postoperative complete wound dehiscence, being an unfortunate and also a very serious complication [17], and no single cause being responsible: rather it is a multi-factorial problem [2]. It is associated with high morbidity and mortality, despite the most sophisticated intensive care these patients receive today [17]. Our reported incidence was in acceptance with the internationally reported incidence. The incidence of dehiscence ranges from 0 to 6% in different patient series [17,18].

Incisional hernia is a frequent complication of abdominal wall closure with a reported incidence of between 5% and 15% following vertical midline incisions at one-year follow-up [2,13,14].

The incidence of incisional hernia in our study was 0.5% and interestingly comparable with the internationally reported incidence. Recently published 2 meta-analyses have confirmed a statistically significant reduction in hernia formation and dehiscence with mass closure. Continuous closure minimizes the number of knots and has been shown to be associated with an equivalent or lower incisional hernia rate [13, 14].

Similarly both meta analysis supported mass closure when compared with layered closure [13, 14].

CONCLUSION

Wound infections after abdominal surgery are still frequent types of nosocomial infections. This study confirmed previous findings of studies as mass closure decreases postoperative complication rate in patients having a laparotomy.

It also added that the delayed absorbable polygactin 910 (Vicryl) sutures with suitable sizes provide temporary wound support, until the wound heals well enough to withstand the normal stress.

REFERENCES

1. Murtaza B, Saeed S, Sharif MA; Postoperative complications in emergency versus elective laparotomies at a peripheral hospital. J Ayub Med Coll Abbottabad., 2010; 22(3): 42-47.
2. Idris SA., Ali AQ, Shalayel MH, Idris TA, Alegail IMA; Design of a multi-centre study to evaluate frequency and risk factors for wound dehiscence/burst abdomen: a study of 1683 major midline laparotomies. Sudan Medical Monitor, 2010; 5(4): 185-191.
3. Ceydeli A, Rucinski J, Wise L; Finding the best abdominal closure: an evidence-based review of the literature. Current Surgery, 2005; 62(2): 220-225.
4. Jategaonkar PA, Yadav SP; Double-lock technique: a simple method to secure abdominal wall closure. Journal of the College of Physicians and Surgeons Pakistan, 2013; 23(8): 581-582.
5. Dudley HAF; Layered and mass closure of the abdominal wall—a theoretical and experimental analysis. Br J Surg., 1970; 57: 664-667.
6. Kreszinger M, Delimar D, Kos J, Jovanov N, Vnuk D, Matičić D *et al*.; Wound strength after midline laparotomy: a comparison of four closure techniques in rats. Veterinarski Arhiv., 2007; 77(5): 397-408.
7. Pearl ML, Rayburn WF; Choosing abdominal incision and closure techniques. J Reprod Med., 2000; 49: 662.
8. Wacha H, Hoyme U, Isenmann R, Kujath P, Lebert C, Naber K. *et al*.; Perioperative antibiotika-prophylaxe. Chemother J., 2010; 19: 70-84.
9. Bolli M, Schilling M; Incision and closure of the abdominal wall. Chirurg., 2006; 77: 408-413.
10. Jenkins TPN; The burst abdominal wound: a mechanical approach. Br J Surg., 1976; 63: 873-876.
11. Israelsson LA, Jinsson T; Suture length to wound length ratio and healing of midline laparotomy incisions. Br J Surg., 1993; 80: 1284-1286.
12. Varshney S, Manek P, Johnson CD; Six-fold suture: wound length ratio for abdominal closure. Ann R Coll Surg Engl., 1999; 81: 333-336.
13. Van't Riet M, Steyerberg EW, Nellensteyn J, Bonjer HJ, Jeekel J; Meta-analysis of techniques for closure of midline abdominal incisions. Br J Surg., 2002; 89: 1350-1356.
14. Rucinski J, Margolis M, Panagopoulos G, Wise L; Closure of the abdominal midline fascia: meta-analysis delineates the optimal technique. Am Surg., 2001; 67: 421-426.
15. Green G, Shaikh I, Fernandes R, Wegstapel H; Emergency laparotomy in octogenarians: A 5-year study of morbidity and mortality. World J Gastrointest Surg., 2013; 5(7): 216-221.
16. Justinger C, Slotta JE, Ningel S, Gröber S, Kollmar O, Schilling MK; Surgical-site infection after abdominal wall closure with triclosan-impregnated polydioxanone sutures: Results of a randomized clinical pathway facilitated trial. Surgery, 2013; 154(3): 589-595.
17. Murtaza B, Khan NA, Sharif MA, Malik IB, Mahmood A; Modified midline abdominal wound closure technique in complicated/high risk laparotomies. Journal of the College of Physicians and Surgeons Pakistan, 2010; 20(1): 37-41.
18. El-Sharkawy H, Helmy H, Hefnawy E; Midline abdominal wound closure a randomized prospective study of 105 patients comparing continuous vs. interrupted suture techniques. Kasr El Aini Journal of Surgery, 2007; 8(1): 47-54.