

Recent Therapeutic Alternative Methods for Burst Abdomen and its Relation to Development of Incisional Hernia

Ahmed Abd El Aal Sultan¹, Hisham Wefky Anwar¹ and Islam Abd Elhaleem eldesoky²

¹Department of Surgery, Faculty of Medicine, Al-Azhar University and ²Department of Surgery, Military Production Hospital, Cairo, Egypt

*corresponding Authors: Ahmed Abd El Aal Sultan, E-mail: Dr.ahmedsultan@azhar.edu.eg and Hisham Wefky Anwar, E-mail: Hisham.wefky@yahoo.com

ABSTRACT

Background: Burst abdomen is considered one of the most challenging obstacles that facing general surgery. Studying the layers of the abdominal wall, and knowing the anatomy of the anterior abdominal wall, its arterial and nerve supply is the corner stone in management of that surgical problem, and in finding the best way how to close that defect.

Objective: The aims of the study were to evaluate and compare between recent therapeutic methods of burst abdomen after elective and emergency laparotomy as regard technical, function and to prevent its complication with its later development of incisional hernia.

Patients and Methods: This randomized prospective study was carried out at Al-Azhar University Hospitals and Military production hospital on 20 patients with post-lapraotomy burst abdomen in the period from January 2016 to October 2017. The patients were randomly classified according to the method of abdomen closure into 5 groups; 4 patients each: Group A: Closure with TI, TIE, TIES incisions and component separation technique. Group B: Simple mass closure with continuous sutures. Group C: Closure using a Pedicled Tensor Fascia Lata Flap. Group D: Vacuum assisted closure. Group E: Closure with gradual skin stretching by tension relief system (TRS).

Results: By the use of TI, TIE, TIES incisions and component separation technique, complete fascial closure was achieved in 3 patients (75%). By the use of mass closure, complete fascial closure was achieved in all patients (100%). By the use of the vacuum assisted closure, complete fascial closure was achieved in all patients (100%) but enterocutaneous fistula was encountered in one patient (25%).

By the use of the pedicled tensor fascia lata to close the abdomen, complete fascial closure was achieved in all patients (100%) but recurrence occurred in one patient (25%). By the use of the TRS, complete fascial closure was achieved in 2 patients (50%)

Conclusion: Mass closure with continuous suture seems to be the best method as the abdominal wall defect is not large as its simple, easy and cost effective.

Keywords: Burst Abdomen, Incisional Hernia, Mass closure, component separation.

INTRODUCTION

Burst abdomen is a serious postoperative complication that concerns many surgeons. The disruption of the wound tends to occur between the sixth and eighth day. Serosanguinous (pink) discharge from the wound is the most pathognomonic sign of impending wound disruption. Poor closure techniques, deep wound infections, increasing intra-abdominal pressure in the early postoperative period and poor metabolic state of the patient are the most common predisposing factors⁽¹⁾.

It is described as partial or complete disruption of an abdominal wound closure with or without protrusion of abdominal contents. Partial wound dehiscence is defined by separation of facial edges without evisceration and occasionally, fibrin covered intestinal loops. Complete wound dehiscence is defined as full separation of fascia and skin with evisceration of intestinal loops⁽²⁾.

Despite a better understanding of wound healing and good suturing techniques, the incidence of various wound complications, including a burst abdomen and incisional hernia, in later stages is

quite high in the case of an emergency laparotomy⁽³⁾.

The most frequent complications of burst abdomen include recurrence, mortality, and incisional hernia. Another complication is the occurrence of enterocutaneous fistula⁽⁴⁾.

It is important for the surgeon to know that wound healing demands oxygen consumption, normoglycemia and absence of toxic or septic factors, which reduces collagen synthesis and oxidative killing mechanisms of neutrophils⁽⁵⁾.

Management of dehisced wounds may include immediate re-operation if bowel is protruding from the wound. Mortality rates associated with dehiscence have been reported between 14–50%⁽⁶⁾.

The aims of the study were to evaluate and compare between recent therapeutic methods of burst abdomen after elective and emergency laparotomy as regard technical, function and to prevent its complication with its later development of incisional hernia.

PATIENTS AND METHODS

This randomized prospective study included a total of 20 patients with post-laprotomy burst abdomen, attending at Al-Azhar University Hospitals and Military Production Hospital. Approval of the ethical committee of Faculty of Medicine, Al-Azhar University and a written informed consent from all the subjects were obtained. This study was conducted between January 2016 to October 2017.

Inclusion criteria: Patients presenting with burst abdomen after surgical intervention. Patients with various clinical conditions requiring closure of large abdominal wall defect after elective and emergency laparotomy for major abdominal surgery. Both sexes. Age: 20 – 60 years old.

Exclusion criteria: Asthmatic patients with chronic cough and chest infection. Impaired renal functions. Impaired hepatic function with ascites. Patients with severe sepsis. Recurrent cases.

Patients will be randomly categorized in 5 groups:

- Group A: closure of burst abdomen with TI, TIE, TIES Incisions and component separation technique.
- Group B: simple mass closure of burst abdomen with continuous suture.
- Group C: closure of burst abdomen Using a Pedicled Tensor Fascia Lata Flap.
- Group D: vacuum assisted closure.
- Group E: gradual skin stretching using tension relief system (TRS).

Preoperative evaluation, preparation and premedication:

Evaluation of the patients was carried out through: Proper history taking and clinical examination, to exclude cardiovascular, Respiratory and metabolic diseases.

Routine laboratory investigations included: Complete blood count (CBC), coagulation profile, fasting blood glucose, liver enzymes serum urea, creatinine, albumin and electrolytes and urine analysis.

Operative procedures: Closure of burst abdomen with TI, TIE, TIES Incisions and component separation technique. Simple mass closure of burst abdomen with continuous suture. Closure of burst abdomen Using a Pedicled Tensor Fascia Lata Flap. Vacuum assisted closure. Gradual skin stretching using tension relief system (TRS)

RESULTS

Demographic Data: **Table (1):**

The age in all patients ranged from 24 to 67 years with a mean of 48.2 ± 11.5 years. There was no statistical significant difference among the groups regarding the age by one-way ANOVA test. Male sex comprised 60% of the patients included in the study (12 patients). The difference between the groups was not significant. Co-morbidities were found in 16 patients (20%). The difference between the groups was not significant.

The following table shows the demographic data among the patients.

Table (1)

		Group A	Group B	Group C	Group D	Group E	Total	P
Age (Years)	Mean±SD	49±14	48.8±8	39.3±15	53.8±8	50±9.1	48.2±11.5	0.521
	Range	34-67	40-60	24-58	45-65	40-60	24-67	
Sex	Male	2 (50%)	1 (25%)	2 (50%)	4 (100%)	3 (75%)	12 (60%)	0.446
	Female	2 (50%)	3 (75%)	2 (50%)	0 (0%)	1 (25%)	8 (40%)	
Co morbidity	Yes	3 (75%)	4 (100%)	4 (100%)	2 (50%)	3 (75%)	16 (80%)	0.736
	No	1 (25%)	0 (0%)	0 (0%)	2 (50%)	1 (25%)	4 (20%)	

Hospitalization data. **Table (2):**

The mean hospital stay in all patients was 14.25 ± 10.8 days with a range of 6-42 days, It was the longest during the vacuum assisted closure (27.3 ± 11.4 days) and the shortest during the use of the pedicled tensor fascia lata flap (7 ± 0.8 days). The difference was statistically significant (**0.027**). The mortality occurred in 2 patients (10%) because of development of multiple organ failure due to sepsis.

The following table shows the hospital stay and the mortality occurred among the patients.

Table (2):

		Group A	Group B	Group C	Group D	Group E	Total	P
Hospital Stay (days)	<i>Mean±SD</i>	10.7±2.5	17.5±15.2	7±0.8	27.3±11.4	8.8±1.7	14.25±10.8	0.027**
	<i>Range</i>	8-14	8-40	6-8	16-42	7-11	6-42	
Mortality	<i>Yes</i>	1 (25%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)	2 (10%)	0.931
	<i>No</i>	3 (75%)	4 (100%)	3 (75%)	4 (100%)	4 (100%)	18 (90%)	

Follow-up data. **Table (3):**

The difference among the groups regarding the occurrence of complete fascial closure, the recurrence of the burst abdomen, the formation of enterocutaneous fistula and the development of incisional hernia were not statistically significant (p 0.683, 0.302, 0.966 and 0.489 respectively).

By the use of TI, TIE, TIES incisions and component separation technique, complete fascial closure was achieved in 3 patients (75%). No recurrence or fistula was encountered by this technique. Incisional hernia occurred in one patient (25%).

By the use of mass closure, complete fascial closure was achieved in all patients (100%). No recurrence, fistula or incisional hernia was encountered by this technique.

By the use of the pedicled tensor fascia lata to close the abdomen, complete fascial closure was achieved in all patients (100%) but recurrence occurred in one patient (25%) and incisional hernia was developed in another patient (25%). No fistula was encountered by this technique.

By the use of the vacuum assisted closure, complete fascial closure was achieved in all patients (100%) but enterocutaneous fistula was encountered in one patient (25%) and incisional hernia was developed in another patient (25%). No recurrence was encountered in those patients.

By the use of the TRS, complete fascial closure was achieved in 2 patients (50%) but no patient developed enterocutaneous fistula. Recurrence occurred in one patient (25%) and incisional hernia was developed in another patient (25%).

The following table shows the data among the patients after discharge from the hospital.

Table (3):

		Group A	Group B	Group C	Group D	Group E	Total	P
Complete fascial closure	<i>Yes</i>	3 (75%)	4 (100%)	4 (100%)	4 (100%)	2 (50%)	17 (85%)	0.683
	<i>No</i>	1 (25%)	0 (0%)	0 (0%)	0 (0%)	2 (50%)	3 (15%)	
Recurrence	<i>Yes</i>	0 (0%)	0 (0%)	1 (25%)	0 (0%)	1 (25%)	2 (10%)	0.302
	<i>No</i>	4 (100%)	4 (100%)	3 (75%)	4 (100%)	3 (75%)	18 (90%)	
Fistula formation	<i>Yes</i>	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	1 (5%)	0.966
	<i>No</i>	4 (100%)	4 (100%)	4 (100%)	3 (75%)	4 (100%)	19 (95%)	
Incisional Hernia	<i>Yes</i>	1 (25%)	0 (0%)	3 (75%)	1 (25%)	1 (25%)	6 (30%)	0.489
	<i>No</i>	3 (75%)	4 (100%)	1 (25%)	3 (75%)	3 (75%)	14 (70%)	

DISCUSSION

Burst abdomen is described as partial or complete disruption of an abdominal wound closure with or without protrusion and evisceration of abdominal contents. In partial dehiscence, only the superficial layers or part of the tissue layers reopen. In complete wound dehiscence, all layers of the wound thickness are separated, revealing the underlying tissue and organs, which may protrude out of the separated wound. It is one amongst the most feared post-operative complications for the surgeons and is of greatest regard because of risk of burst abdomen, the need for immediate

intervention, and the possibility of repeat dehiscence, surgical site infection, and incisional hernia formation⁽⁷⁾.

Many risk factors are accountable for wound dehiscence such as surgeries in emergency set up, intra-abdominal bacterial infection, malnutrition, decreased Hb, elderly age >65 years, systemic co-morbidities (uremia, diabetes mellitus)⁽⁸⁾.

Good knowledge of these risk factors is compulsory for prophylaxis. Mortality and morbidity in the form of increased hospital stay, long term repeated consultations, with extra burden

on health care resources can be reduced by highlighting the risk factors for wound dehiscence, the incidence rate and prophylactic measures to prevent or reduce the incidence of wound dehiscence⁽⁹⁾.

In this study we have discussed the recent therapeutic methods for management of burst abdomen and the incidence of burst abdomen according to these methods.

The value of a particular abdominal fascial closure technique may be measured by the incidence of early and late wound complications, and the best abdominal closure technique should be fast, easy, and cost-effective, while preventing both early and late complications⁽¹⁰⁾.

Mass closure of burst abdomen with continuous suture seems to be the best methods for closure as its easy, fast and cost effective with least complications, so continuous mass closure is the ideal technique for the closure of burst abdomen with a non-absorbable polypropylene suture material, in the absence of patient confounding factors like hypoproteinemia, surgical site infection and no large gap between wound edges⁽¹¹⁾.

In the management of burst abdomen with intraperitoneal sepsis, treatment by Vacuum assisted wound closure techniques changed the outcome of these critically ill patients significantly⁽¹²⁾.

In our study, complete fascial closure was achieved in all patients (100%) but enterocutaneous fistula was encountered in one patient (25%).

The purpose of treatment is to achieve synergistic effects of edema reduction, drainage of peritoneal fluid and fascial traction⁽¹³⁾. By this delayed primary closure, rates of more than 80 % can be achieved⁽¹⁴⁾.

The continuous negative pressure leads to a sufficient drainage of peritoneal fluids and prevents abdominal compartment syndrome. On the other hand, the perfusion of the intestinal and retroperitoneal organs is preserved. The most severe complications in the treatment of the OA are the frozen abdomen followed by entero-atmospheric fistulas⁽¹⁵⁾.

The use of a special sheet for covering the intestine prevents these complications in the majority of the cases⁽¹⁶⁾.

The results of the literature suggest that NPWT is associated with the highest rates of fascial closure and the lowest mortality⁽¹²⁾

Primary fascial closure rates of higher than 90% have been reported with the combination of commercial vacuum-assisted closure system and polypropylene mesh (VACM) generating continuous fascial traction⁽¹⁷⁾.

Although new topical negative pressure TAC systems are effective and associated with very high fascial closure rates, at times the abdominal

wall, in particular with an ongoing critical illness, remains immobile and the fascia laterally retracted. In these situations, adjunctive measure as component separation technique is needed to reach primary fascial closure⁽¹⁸⁾.

This technique offers increased flexibility of the abdominal wall and enhances its mobility toward midline to cover the defect⁽¹⁹⁾.

Furthermore, Saulis and Dumanian showed that CS decreases significantly postoperative recurrence of complex ventral hernias⁽²⁰⁾.

In our study component separation technique results in high rates of fascial closure as Primary fascial closure was achieved in 75% and no fistula formation.

Leppäniemi et al. demonstrates CS to be a feasible method for assisting delayed primary fascial closure in critically ill surgical patients treated for OA with high closure rate. postoperative subcutaneous hemorrhage, seroma in the area where CS was performed and skin necrosis are common complication⁽¹⁸⁾.

To reduce seroma formation, closed suction drains should be placed in the subcutaneous tissue until the space is obliterated. These closed suction drains should be stripped regularly in the early postoperative period and are typically removed when less than 30 mL in a 24-hour period has been recorded. In addition, external compression with abdominal binders may aid in the abdominal wall and skin flap adherence and may hinder fluid collection formation.

Reconstructing large, contaminated abdominal wall defects poses a great challenge to surgeons due to the relative contraindication against using synthetic materials. Successful management of these defects requires restoration of abdominal wall integrity under tension-free repair, and this goal is generally accomplished by using autologous tissues⁽²¹⁾.

The TFL flap is a myofasciocutaneous flap first described by Wangenstein in 1934 for abdominal wall reconstruction⁽²²⁾. This flap was utilized more extensively after further description by **Nahai et al.**⁽²³⁾.

As a pedicled flap with a strong fascial layer, it has been extremely useful for contaminated abdominal wounds in the past. While some consider the TFL to be an effective tissue that negates the use of mesh with its potential complications⁽²¹⁾.

In our study complete fascial closure was achieved in all patients (100%) but recurrence occurred in one patient (25%) and incisional hernia was developed in another patient (25%) with no fistula formation. some consider the TFL to be an effective tissue that negates the use of mesh with its potential

complications, Shestak et al and Koshima et al found that myofascial pedicled flaps are denervated with subsequent atrophy of the muscle⁽²⁴⁾.

These flaps may become too thin to tolerate high abdominal pressures, increasing the risk of recurrent abdominal wall hernias. Carlson et al reported that the recurrence rate for herniation after repair with the TFL flap was around 45%⁽²⁵⁾.

To strengthen the repair, Shestak et al advocated reinforcement with synthetic mesh. Therefore, we believe that strengthening the flap repair by incorporating mesh into the flap enhances the effectiveness of this repair⁽²⁶⁾.

There have been several prior reports of using mesh to reinforce reconstruction of the abdominal wall with the TFL flap. Rifaat et al reported placing synthetic Prolene mesh between omentum and flap to reinforce bilateral island TFL flaps in four out of five cases of repairing large abdominal wall defect. No herniations were reported postoperatively, and no complications of infection, extrusion or fistula occurred⁽²¹⁾.

These results compare favourably with the work of Mathes et al in which the combined use of mesh and flap for full thickness defects in six cases resulted in no hernia recurrences⁽²⁶⁾.

Gradual skin stretching using tension relief system (TRS) is one of the methods of closure of abdominal wall defect. A series of midline crossing elastomers were inserted through the full thickness of the abdominal wall at a distance of approximately 5 cm from the medial fascial margin. The elastomers are aligned about 3–5 cm apart across the defect and fixed to button anchors on both sides of the OA. The optimal tension was obtained by stretching the elastomers 1.5–2 times their tension-free length. When all the wound edges reapproximated completely, the fascia were sutured one by one with PDS 1–0.

Skin closure was performed 1–3 days after fascial closure, if there was no sign of infection at the wound site. Approximately 1 week after fascial closure, the ABRA anchors were removed one by one⁽²⁷⁾.

In our study complete fascial closure was achieved in 2 patients (50%) but no patient developed enterocutaneous fistula. Recurrence occurred in one patient (25%) and incisional hernia was developed in another patient (25%).

Study by **Haddock et al.** fascial closure rate by Abdominal Reapproximation Anchor system for management of open abdomen was 75%, incisional hernia was 20% and no enterocutaneous fistula⁽²⁸⁾.

Skin breakdown and ulceration have also been reported at anchor sites with the ABRA; however, we found only superficial wounds developed occasionally and healed easily without complications.

CONCLUSION

It could be concluded that Prevention of burst abdomen is the best method from the start by :

- 1-Improvement of the general condition of the patient
- 2-hyperalimentation
- 3-eradication of infection
- 4-augmentation of closure by tension suture
- 5-closure by non-absorbable suture

For management of a case of burst abdomen we advise a method that is simple, easy, fast and cost effective .

Mass closure with continuous suture seems to be the best method as the abdominal wall defect is not large as its simple ,easy and cost effective .For prevention of incisional hernia, augmentation with tension suture is effective.

Vacuum assisted wound closure has a great role in the management of burst abdomen especially when there is intraperitoneal sepsis as it has the advantage of drainage of peritoneal fluid and fascial traction.

the side effect of vac is fistula formation, the use of a special sheet for covering the intestine prevents these complications. Prolonged hospital stay, cost are although the drawbacks of vacuum.

component separation technique although has a great role in the management of burst abdomen especially when there is large defect that is difficult to be closed with primary closure . this technique offers increased flexibility of the abdominal wall and enhances its mobility toward midline to cover the defect. The side effects of CST are incisional hernia and seroma formation. To reduce seroma, suction drains and external compression by abdominal binder are effective.

Tensor fascia lata flap plays a great role in reconstructing large, contaminated abdominal wall defects under tension-free repair when synthetic materials are contraindicated. The side effects of TFL are recurrence of burst abdomen, large scar at the thigh and incisional hernia.

Gradual skin stretching using tension relief system (TRS) is one of the methods of closure of abdominal wall defect. TRS downgrades the surgical complexity, operating time is reduced and hospital stay can be substantially shortened. Skin breakdown and ulceration are the side effect of this method.

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