Burst abdomen: should we change the concept, preliminary study

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Background
Burst abdomen represents one of the most frustrating and difficult postoperative complications encountered by surgeons who perform a significant volume of surgery. Burst abdomen occurs because of various preoperative, operative and postoperative factors, which can be prevented to some extent by being aware of them. The choice of incision for laparotomy depends on the area that needs to be exposed, the elective or emergency nature of the operation, and personal preference. Type of incision may, however, have an influence on the occurrence of postoperative wound complications, which is discussed in our study. There is little consensus in the literature as to whether a particular incision confers any advantage.

Objective
The purpose of this study was to provide an evidence-based consensus regarding the patients who underwent laparotomy for various intra-abdominal conditions included in our inclusion criteria and who developed burst abdomen in relation to the type of abdominal incision (vertical vs. transverse), as well as to know the rates of incidence, morbidity and mortality due to burst abdomen, and study other variables within the scope of postoperative complications. Other variables within the postoperative complications spectrum were also studied alongside the main one, burst abdomen.

Patients and methods
This is a prospective, randomized study (by card picking under supervision of the ward nurse) that compared the postoperative complications (mainly burst abdomen) after two main types of abdominal incisions, vertical and transverse, within a period of 12 months from October, 2015 to October, 2016. The study was conducted at the Emergency Unit, General Surgery Department, Kasr Al Ainy University Hospital, Faculty of Medicine, Cairo University. Sixty patients underwent open abdominal operations (exploration) after following distinctive inclusion and exclusion criteria. Thirty patients underwent vertical and thirty patients underwent transverse incisions. The main outcome measures were early complications such as burst abdomen, pulmonary complications and hospital stay.

Results
The transverse incision offers as good an access to most intra-abdominal structures as a vertical incision. The incidence of burst abdomen is higher in the vertical incision (midline) group, with 71.4% of the total patients suffering a burst abdomen. Respiratory complications occurred significantly in cases of burst abdomen ($P<0.001$). Hence, hospital stay was longer in cases of burst abdomen ($P<0.001$), which added to the economic burden.

Conclusion
Transverse incisions in abdominal surgery are based on better anatomical and physiological principles. It should be preferred, as the early postoperative period is associated with fewer complications (burst abdomen and pulmonary morbidity). A midline incision is still the incision of choice in conditions that require rapid intra-abdominal entry (such as trauma with suspected intra-abdominal haemorrhage).

Keywords:
burst abdomen, respiratory complications, transverse incision, vertical incision

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Introduction

Major abdominal surgery is an important part of current medical practice. The surgery is common, and is also responsible for significant utilization of hospital resources both in terms of funding

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and in terms of bed usage. Postoperative surgical complications represent one of the most frustrating and difficult outcomes experienced by surgeons who perform a significant volume of surgery [1].

The occurrence of burst abdomen increases the cost of treatment and is associated with lost work productivity, disruption of normal family life, and unanticipated stress to employers and society in general. This complication can present for a variety of reasons. A surgeon can perform a technically perfect operation in a patient who is severely compromised by the disease process and still encounter a complication. Similarly, surgical technical errors or choices may account for this operative complication [2].

In clinical practice the choice of incision is usually based on surgical preference rather than on patient criteria. Surgically, ease of access, time to open and close the abdomen, and incidence of postoperative complications (burst abdomen, wound infection, postoperative pulmonary complications and incisional hernias) are important. For the patient, however, pain and rapid return to normal function are important. From an economical point of view, the duration of operation and duration of hospital stay determine the cost [3].

The recent interest in accelerated discharge after abdominal surgery highlights the importance of a comparison of incision types as there is an assumption that transverse incisions contribute to more rapid recovery [4].

Surgical practice has evolved to include a variety of incisions to gain access to the abdominal cavity. Midline and transverse incisions are the two most common forms of incision used [5].

The Emergency Unit, Department of Surgery, at Kasr Al Ainy University Hospital, Faculty of Medicine, Cairo University, faces the problem of burst abdomen frequently. This has led us to implement a different type of laparotomy incision to reach a better outcome. We also intended to evaluate the frequency of other variables within the scope of postoperative complications that are commonly encountered in our university hospital and could be related to the surgical procedure.

Patients and methods

A prospective, randomized study (by card picking under supervision of the ward nurse) was conducted on 60 patients who underwent exploratory laparotomy at the Emergency Unit, General Surgery Department, Kasr Al Ainy University Hospital, Faculty of Medicine, Cairo University, over a period of 12 months, from October, 2015 to October, 2016. The study cases were 30 patients who underwent vertical abdominal incision and another 30 patients who underwent transverse abdominal incision.

All patients were given an explanation of the study and about the investigative and operative procedures along with their merits and demerits, expected results and possible complications. The study did not involve any additional investigation or any significant risk as we followed the inclusion and exclusion criteria strictly. It did not impose an economic burden on the patients.

Selection of patients was based on certain inclusion criteria: all adult patient candidates for exploratory laparotomy aged 16 years and older with expected pathological and traumatic (whether blunt or penetrating abdominal trauma) aetiology of acute surgical abdomen that could withstand the longer duration of transverse incision were selected for the study. The patients' general condition was evaluated through haemodynamics, including the suspected upper and lower intra-abdominal pathology to evaluate the accessibility to different intra-abdominal organs. However, that was not the main outcome of our research. Trauma patients with haemodynamic instability and patients who had undergone a previous laparotomy were excluded. Those with trauma and hemodynamic instability were explored to control any source of bleeding. The paediatric age group was excluded from our study population. Primary outcome measures were surgical site infection, burst abdomen, respiratory complications and hospital stay. The data collection sheets were filled in by the investigators themselves. These sheets were designed to cover all aspects needed to be studied.

The patients' name, age, sex and address were noted. History of special habits of medical importance (smoking, hashish and tramadol addiction) and history of comorbidities in the form of diabetes mellitus, hypertension, cardiac condition, hepatic affection, renal impairment, asthma and BMI for morbid obesity were noted. Further, the date of admission, date of operation and date of discharge/ morbidity were recorded.

In each patient, detailed history taking was carried out for origin, duration and progress of the illness, past history and treatment. A complete physical examination was performed, and vital data and other

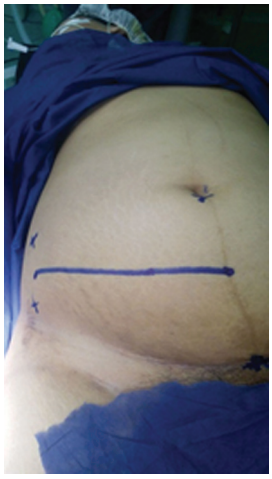
physical findings were obtained. A thorough systemic examination of the abdomen was performed. Patients were diagnosed on the basis of clinical symptoms, physical examination, haematological investigations, total lymphocyte count, haemoglobin, platelet count, serum creatinine, serum albumin and radiological investigations according to the need for each patient.

In each patient, the type of operative procedure starting from the type of abdominal incision, whether vertical or transverse (our main point of comparison in relation to burst abdomen incidence), and intraoperative findings were noted (Fig. 1). Postoperative complications such as acute systemic constitutional manifestations, surgical site infection, burst abdomen, respiratory complications, need for re-exploration, and mortality were noted, together with postoperative hospital stay.

Planning of the level of transverse incision was a little challenging as regards a supraumbilical or an infraumbilical approach to access the suspected site of pathology (upper or lower intra-abdomen), taking into our consideration the possibility of stoma. Stoma site selection whether in the upper or lower flap was not difficult as bowel exposure and resection procedure were technically attainable, giving good length to have a healthy and functioning stoma (Figs 2–4).

All midline vertical incisions were closed by continuous suture of mass closure using Prolene no. 1, reinforced by interrupted sutures of mass closure using Vicryl no. 1 or 0 with no peritoneal closure. We followed the recommended stitch interval and the tissue bite size to be 1 cm average with a range between 1 and 2 cm together with suture-length to incision-length ratio almost 4 : 1 or greater for this continuous mass closure. The subcutaneous tissue was closed using Vicryl 2/0 on a rounded needle and finally the skin was closed using interrupted sutures of silk 2/0. Transverse incisions were closed (with no peritoneal

Figure 1



Marking of the site of transverse incision preoperatively.

Figure 2

Stoma formation through the upper flap of a supraumbilical incision.

Figure 3

Complicated acute appendicitis with transverse incision.

Figure 4

Hepatic flexure exposure through transverse incision.

closure) using continuous suture of Vicryl no. 1 for the muscles and posterior rectus sheath and continuous suture of Prolene no. 1 for the anterior rectus sheath. The rest of the layers were closed as previously mentioned in closing the vertical incision. The same steps that were followed in vertical incisions as regards the stitch interval and the tissue bite size together with suture-length to incision-length ratio were followed in transverse incisions.

During the postoperative period all patients were closely monitored every day until discharge from the hospital. If any symptom or sign of infection appeared during this period, proper investigation was conducted. If any collection of pus was noted, it was drained out and sent for culture and sensitivity testing. Proper antibiotic was given to every patient preoperatively (prophylactic antibiotic for all cases was Ceftriaxone) and postoperatively. The antibiotic was changed when necessary after getting the report of the culture and sensitivity tests. The main outcome of the study was observation of the occurrence of burst abdomen after following proper operative steps and precautions (Fig. 5).

Statistical methods

The collected data were coded, tabulated and statistically analysed using IBM statistical package for the social sciences (SPSS) statistics software (version 22.0, 2013; IBM Corp., Chicago, Illinois, USA).

Descriptive statistics were analysed for quantitative data as minimum and maximum of the range, as well as mean±SD for quantitative normally distributed data and median and first and third interquartile range for quantitative non-normally distributed data. Qualitative data were presented as number and percentage. Inferential analyses were conducted for quantitative variables using the independent *t*-test in cases of two independent groups with normally distributed data and the Mann–Whitney *U*-test in cases of two independent groups with non-normally distributed data. In qualitative data, inferential analyses for independent variables were performed using Fisher's exact test for variables with small expected numbers. The level of significance was taken at *P* value of less than 0.05.

Figure 5

Burst abdomen in midline vertical incision.

Results

This prospective, randomized study was conducted to find a consensus on which exploratory abdominal incision is better (vertical or transverse) and its repercussion on the incidence of burst abdomen as the main dependent variable in our study. This would go alongside reporting of other postoperative complications.

Demographic distribution of the patients

The ages of the studied patients ranged from 16 to 75 years (mean age 33 years). BMI ranged between 29 and 42, with a mean of 33.1. Male sex represented 38 (63.3%) patients, whereas female sex represented 22 (36.7%) patients. Special habits recorded were smoking, hashish and tramadol addictions (Table 1).

Out of 60 patients, only 18 had comorbidities, which included hypertension, diabetes mellitus, chronic obstructive pulmonary disease, cardiovascular disease, liver disease, asthma and morbid obesity (Table 2).

Table 1 Demographic and special habits among the studied cases (total=60)

Variables	Mean±SD (range) or *n* (%)
Age (years)	33.0±12.7 (16.0–75.0)
BMI (kg/m^2)	33.1±3.2 (29.0–42.0)
Sex	
Male	38 (63.3)
Female	22 (36.7)
Smoking	25 (41.7)
Hashish	12 (20)
Tramadol	6 (10)

Table 2 Comorbidities at admission among the studied cases (total=60)

	N (%)
HTN	5 (8.3)
DM	5 (8.3)
Liver disease (HCV, cirrhosis)	2 (3.3)
COPD	2 (3.3)
CVD	3 (5)
Morbid obesity	1 (1.7)

COPD, chronic obstructive pulmonary disease; CVD, cardiovascular disease; DM, diabetes mellitus; HCV, hepatitis C virus; HTN, hypertension.

Patients presented as either pathological or traumatic. Different types of procedures were included in the study. Appendectomy was the most commonly encountered procedure, with an incidence of 38.3% (23 patients). Regarding the type of the incision used, midline laparotomy was equal to transverse incision as it was planned from the beginning of the study. Wound classes included in the study were I and II. Class II wounds were the most prevalent (51 patients) (Table 3).

The most frequent complication was discharge, followed by surgical site infection (SSI) and respiratory complications (Table 4 and Fig. 6).

Table 5 and Fig. 7 show that burst abdomen cases had significantly higher BMI compared with Non-burst abdomen cases.

Table 3 Surgical details among the studied cases (total=60)

Variables	*N* (%)
Indications	
Pathology	58 (96.7)
Trauma	2 (3.3)
Incisions	
Transverse	30 (50)
Midline	25 (41.7)
Lower mid	4 (6.7)
Right paramedian	1 (1.7)
Procedures	
Appendectomy	23 (38.3)
Intestinal resection	20 (33.3)
PU patch	3 (5)
Adhesiolysis	3 (5)
Herniorrhaphy	3 (5)
Delivery	4 (6.7)
Oophorectomy	3 (5)
Milking FB	1 (1.7)
Diversions	
Any	9 (15)
Lower flab	4 (6.7)
Left	5 (8.3)
Wound classes	
I	9 (15)
II	51 (85)

FB, foreign body, PU, peptic ulcer.

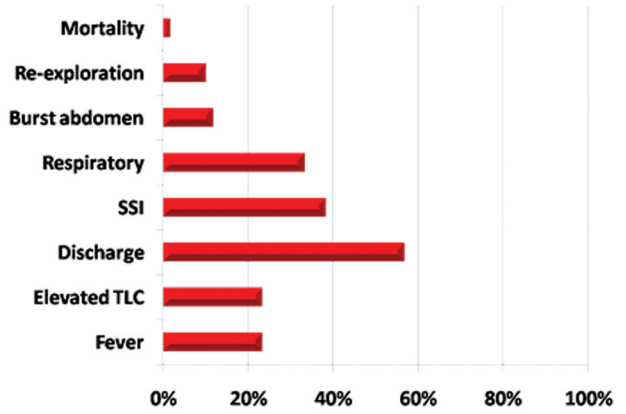
As shown in Table 6, DM was present in two cases out of seven that had burst abdomen, meanwhile, one case showed morbid obesity. Table 7 represents the following results, burst abdomen occurred in seven patients out of 60 and was higher in cases that were explored through vertical (midline) incision, with an incidence of 71.4%. Also, the incidence of burst abdomen in relation to surgical procedure was highest in cases with intestinal resection (71.4%). As regards the

Table 4 Complications after surgery among the studied cases (total=60)

Variables	*N* (%) or median (IQR) (range)
Fever	14 (23.3)
Elevated TLC	14 (23.3)
Discharge	34 (56.7)
SSI	23 (38.3)
Respiratory	20 (33.3)
Burst abdomen	7 (11.7)
Re-exploration	6 (10.0)
Mortality	1 (1.7)
Fever day	4.0 (3.0–7.5) (3.0–10.0)
Elevated TLC day	4.5 (3.8–7.0) (2.0–10.0)
Discharge day	4.0 (0.0–6.0) (0.0–10.0)
SSI day	5.0 (4.0–8.0) (3.0–10.0)
Stay	5.0 (3.0–9.0) (1.0–36.0)

IQR, third–first interquartile range; TLC, total leucocyte count.

Figure 6



Complications after surgery among the studied cases. TLC, total leucocyte count.

Table 5 Comparison between cases with and without burst abdomen regarding demographic data and special habits

Variables	Burst (*N*=7)	Not (*N*=53)	*P*	OR (95% CI)
Age (years)	35.6±15.2	32.7±12.4	0.575[a]	–
BMI (kg/m^2)	35.9±4.0	32.8±2.9	0.013[a*]	–
Sex [*n* (%)]				
Male	6.0 (85.7)	32 (60.4)	0.246[b]	3.94 (0.44–35.09)
Female	1 (14.3)	21 (39.6)		
Smoking [*n* (%)]	3 (42.9)	22 (41.5)	1.000[b]	1.06 (0.21–5.20)
Hashish [*n* (%)]	2 (28.6)	10 (18.9)	0.619[b]	1.72 (0.29–10.18)
Tramadol [*n* (%)]	1 (14.3)	5 (9.4)	0.541[b]	1.60 (0.16–16.10)

CI, confidence interval; OR, odds ratio. [a]Independent *t*-test. [b]Fisher's exact test. [*]Significant.

Table 6 Comparison between cases with and without burst abdomen regarding comorbidities at admission

Variables	Burst (*N*=7) [*n* (%)]	Not (*N*=53) [*n* (%)]	*P*[a]	OR (95% CI)
HTN	0 (0.0)	5 (9.4)	1.000	–
DM	2 (28.6)	3 (5.7)	0.099	6.67 (0.89–49.83)
CLD	0 (0.0)	2 (3.8)	1.000	–
COPD	0 (0.0)	2 (3.8)	1.000	–
CVD	0 (0.0)	3 (5.7)	1.000	–
Morbid obesity	1 (14.3)	0 (0.0)	0.117	–

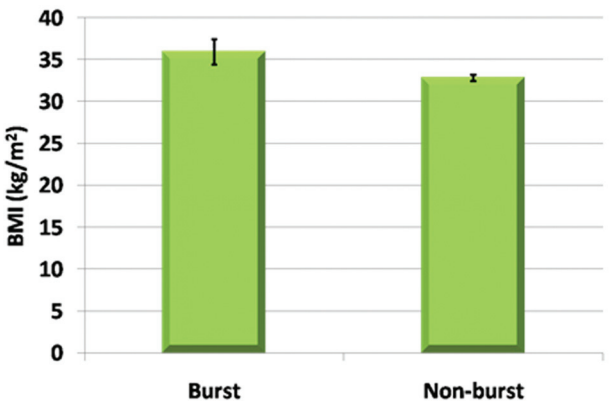
CI, confidence interval; COPD, chronic obstructive pulmonary disease; CLD, chronic liver disease; CVD, cardiovascular disease; DM, diabetes mellitus; HTN, hypertension; OR, odds ratio. [a]Fisher's exact test.

Table 7 Comparison between cases with and without burst abdomen regarding surgical details

Variables	Burst (*N*=7) [*n* (%)]	Not (*N*=53) [*n* (%)]	*P*[a]	OR (95% CI)
Indications				
Pathology	6 (85.7)	52 (98.1)	0.221	0.12 (0.01–2.09)
Trauma	1 (14.3)	1 (1.9)		
Incisions				
Transverse	2 (28.6)	28 (52.8)	0.424	0.36 (0.06–2.01)
Midline	5 (71.4)	20 (37.7)	0.117	4.13 (0.73–23.30)
Lower mid	0 (0.0)	4 (7.5)	1.000	–
Right paramedian	0 (0.0)	1 (1.9)	1.000	–
Procedures				
Appendectomy	1 (14.3)	22 (41.5)	0.233	0.23 (0.03–2.09)
Intestinal resection	5 (71.4)	15 (28.3)	0.036*	6.33 (1.11–36.28)
Perforated peptic ulcer	0 (0.0)	3 (5.7)	1.000	–
Adhesiolysis	1 (14.3)	2 (3.8)	0.315	4.25 (0.33–54.17)
Herniorrhaphy	0 (0.0)	3 (5.7)	1.000	–
Delivery	0 (0.0)	4 (7.5)	1.000	–
Oophorectomy	0 (0.0)	3 (5.7)	1.000	–
Milking FB	0 (0.0)	1 (1.9)	1.000	–
Diversions				
Any	4 (57.1)	5 (9.4)	0.007*	12.80 (2.21–74.22)
Lower flab	1 (14.3)	2 (3.8)	0.315	4.25 (0.33–54.17)
Left	3 (42.9)	3 (5.7)	0.017*	12.50 (1.88–83.31)
Wound classes				
I	1 (14.3)	8 (15.1)	1.000	0.94 (0.10–8.86)
II	6 (85.7)	45 (84.9)		

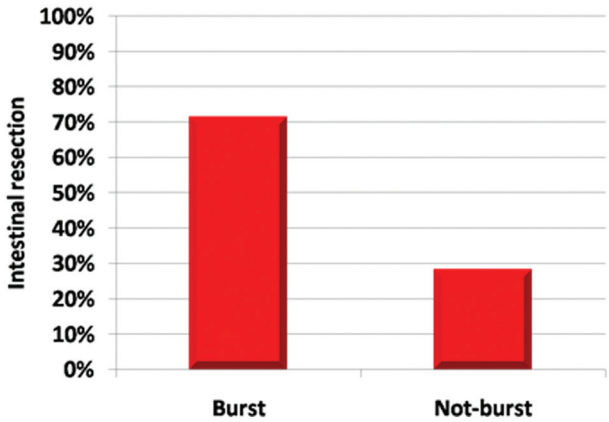
CI, confidence interval; OR, odds ratio. [a]Fisher's exact test. *Significant.

Figure 7



Comparison between cases with and without burst abdomen with regard to BMI.

Figure 8



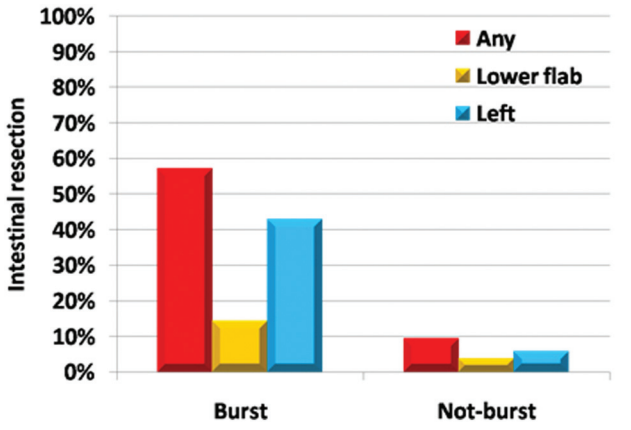
Comparison between cases with and without burst abdomen with regard to intestinal resection.

Table 8 Comparison between cases with and without burst abdomen regarding complications after surgery

Variables	Burst (*N*=7) [*n* (%)]	Not (*N*=53) [*n* (%)]	*P*	OR (95% CI)
Fever	5 (71.4)	9 (17.0)	0.006[*,a]	12.22 (2.04–73.19)
Elevated TLC	6 (85.7)	8 (15.1)	<0.001[*,a]	33.75 (3.57–319.13)
Discharge	7 (100.0)	27 (50.9)	0.016[*,a]	–
SSI	5 (71.4)	18 (34.0)	0.095[a]	4.86 (0.86–27.57)
RR (95% CI)				
Respiratory	7 (100.0)	13 (24.5)	<0.001[*,a]	–
Re-exploration	2 (28.6)	4 (7.5)	0.140[a]	3.60 (0.88–14.69)
Mortality	1 (14.3)	0 (0.0)	0.117[a]	–
Fever day	4.0 (3.0–4.0)	4.0 (3.5–9.5)	0.220[b]	–
Elevated TLC day	4.5 (3.5–7.0)	4.5 (3.3–8.8)	0.312[b]	–
Discharge day	4.0 (4.0–6.0)	4.0 (0.0–6.0)	0.417[b]	–
SSI day	5.0 (4.0–7.5)	5.0 (4.0–10.0)	0.706[b]	–
Stay	30.0 (23.0–35.0)	4.0 (3.0–7.5)	<0.001[*,b]	–

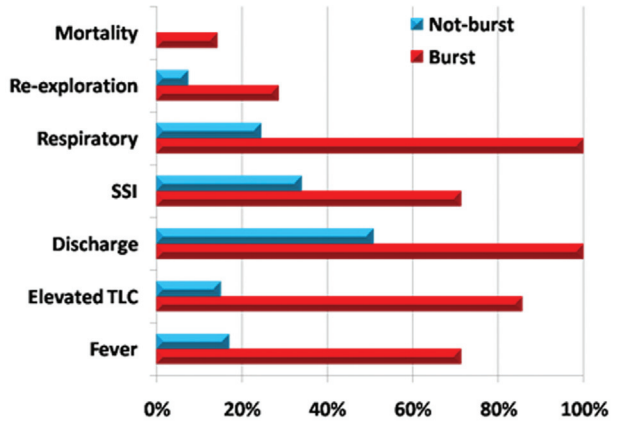
CI, confidence interval; OR, odds ratio; RR, relative risk; TLC, total leucocyte count. [a]Fisher's exact test. [b]Mann–Whitney test. [*]Significant.

Figure 9



Comparison between cases with and without burst abdomen with regard to diversion.

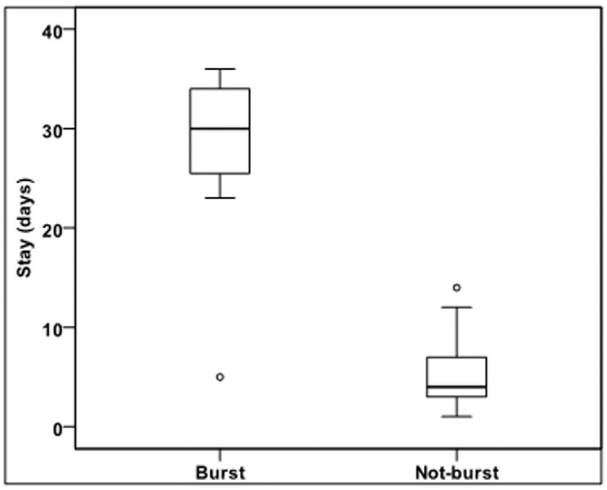
Figure 10



Comparison between cases with and without burst abdomen with regard to complications after surgery. TLC, total leucocyte count.

percentage of wound class II represented in cases of burst abdomen, it was 85.7%. Figs 8 and 9 show that burst abdomen caseshad significantly more frequent intestinal

Figure 11



Comparison between cases with and without burst abdomen with regard to hospital stay.

resection anddiversion compared with non-burst abdomen cases.

Table 8 and Figs 10 and 11 show that burst abdomen patients had fever significantly more frequently, elevated total leucocyte count, discharge and respiratory complications and significantly longer duration of hospital stay than did Non-burst abdomen cases.

Discussion

The choice of incision for abdominal access is controversial. Although many randomized controlled trials have favoured a transverse or oblique incision over a midline incision in terms of complication rates and recovery, the individual study results are by no means universal. Data suggest that a transverse incision may result in fewer complications [1].

The midline incision is generally preferred by surgeons because of its ease, speed and excellent exposure. However, as was evidenced in our current study, midline incision is associated with increased post-operative complications compared with transverse incision. This is evidenced in our study by having seven cases of burst abdomen out of 60 cases and is higher in cases that were explored through vertical (midline) incision (five cases) with a 71.4% incidence among burst abdomen cases. This result concurs with that of Burger *et al.* [6], who found that vertical abdominal incision is associated with more post-operative complications in terms of burst abdomen and respiratory complications.

On the other hand, Grantcharov and Rosenberg [3] stated that their initial review suggested that other short-term and long-term complications of surgery showed no difference between vertical and transverse incisions; however, the inclusion of more recent trials on cadavers and animals suggested that a transverse incision is more resistant to rupture. The updated review continues to illustrate a trend to a lower rate of wound dehiscence with transverse incisions. Additionally, Hoer *et al.* [7] suggested that it takes more than 2 years for 75% of incisional hernias to occur. The review now includes three trials with longer (but not necessarily sufficient) follow-up [2,8,9].

The incidence of burst abdomen in relation to the surgical procedure was highest in patients who had undergone intestinal resection (71.4%) (P=0.036) among our study cases. The percentage of wound class II represented in cases of burst abdomen was 85.7%. Furthermore, we found that burst abdomen had a significantly greater relation to intestinal resection and diversion than did patients who had not experienced burst abdomen. However, a larger study is required that concentrates on specific procedures and specific opening and closing techniques. It is very difficult to standardize these parameters. Proske *et al.* [10] discussed the impact of surgical procedure on the incidence of burst abdomen and emphasized the difficulty in standardization of the parameters impacting the outcome as regards complications.

The effects of transverse approach on pulmonary function appear to be real. Further data available from more recent trials add to the evidence, with all studies that analysed pulmonary function showing the advantage of a transverse incision approach [11]. This goes alongside the results of our study, as respiratory complications showed up in the seven cases of burst abdomen (P<0.001); five out of them were explored through vertical midline incision.

However, Mimica *et al.* [11] discussed the pulmonary compromise and whether it could be related to the cranial extent of the upper midline incision for abdominal surgery. This cranial extent of the incision may be an alternative explanation to the heterogeneity seen in some comparisons. This was suggested as a relevant topic for future work, particularly if a transverse incision allows a significantly lower incision and a more effective block with the common use of epidurals for pain relief. Such a study has now been carried out and adds to the evidence that upper abdominal incisions are more painful and affect respiratory function more than do lower abdominal incisions.

There are possible explanations for the high wound dehiscence and burst abdomen rate after midline laparotomy. First, contraction of abdominal wall muscles retracts wound edges laterally. Second, the avascular nature of the midline incision may impair wound healing. Third, the fibres of the linea alba, which are continuous with abdominal wall muscle aponeuroses, cross the midline mostly in transverse or oblique directions. Therefore, a vertical incision cuts most of them perpendicularly [6].When a transverse incision is used, Langer's lines of cleavage are followed, as well as the direction of most oblique and transverse muscle fibres, nerves and segmental blood vessels. Therefore, dissection of segmental blood vessels and nerves is limited. Further, contraction of the abdominal wall muscles (due to coughing or vomiting) does not increase tension on the wound as these forces parallel the transverse operational wound. In addition, unlike the midline incision wound, the transverse incision wound is situated in richly vascularized muscular tissue, which may benefit wound healing [6]. The updated review continues to show a trend towards a lower rate of wound dehiscence with transverse incisions, bearing in mind the data from Hoer *et al.* [7].

Conclusion

The use of a transverse or midline incision remains the choice of the individual surgeon. A midline incision is still the incision of choice in an emergency situation, allowing rapid entry into the peritoneal cavity and access to all organs. It is also the incision of choice in patients with an increased probability of relaparotomy or when a potential stoma site would be compromised by a transverse incision in a patient who is likely to need one. However, the

increased incidence of wound dehiscence and burst abdomen should influence the surgeon to favour a transverse incision. Also, the possible increased pain and compromise on pulmonary function with a midline incision may prompt the operating surgeon to use a transverse incision in high-risk patients, particularly in obese patients or in those with chronic obstructive airway disease.

Recommendations

A larger study is required that concentrates on specific procedures and specific opening and closing techniques. It is, however, very difficult to standardize these parameters. The effect of incision on patients with chronic obstructive airway disease has not been studied fully. These are the patients most likely to develop respiratory compromise after abdominal surgery and indeed wound rupture and it may be in this group that a large difference in complications is seen.

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Conflicts of interest

There are no conflicts of interest.

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