

**The Predictors, Prevalence and Outcome of Burst Abdomen in Emergency Paediatric Surgical Centre.**

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**Background:** Combination of certain risk factors in children may predict burst abdomen, a preventable postoperative complication. We sought to determine the prevalence, outcome, and predictors of burst abdomen in emerging pediatric surgical centers.

**Methods:** Cases of laparotomy on children at two referral pediatric surgical centers in Nigeria between January 2002 and June 2009 were analyzed in a retrospective study that determined the prevalence, outcome, and predictors of burst abdomen.

**Results:** A prevalence rate of 31 (2.1%) was recorded among 1465 children who had open laparotomy. They were mainly neonates [19 (61.3%)] during index laparotomy with a mean age  $14.8 \pm 6.7$  months (range 2 days to 12 years), and a male: female ratio 1.5: 1 (18 males/12 females). Burst abdomen occurred between 4-10 days in 5 (3%) children after resection/anastomosis due to gangrenous/perforated bowels, 4 (5.5%) following colostomy creation, 3 (7.7%) after open reduction of intussusception, 2 (1.7%) of exploratory laparotomy, 3 (33.3%) after enterocutaneous fistula closure, 9 (39.1%) following primary closure of bowels perforation, 1 (20.0%) after drainage of intra-abdominal abscess, and 4 (1.9%) following resection of intra-abdominal malignant tumour. Only 54.8% children survived, 19.4% having incisional hernia and 12.9% ugly abdominal scars. Surgery on neonates, late referral, emergency laparotomy, infective indication, intraperitoneal soiling, inanition, and postoperative abdominal distension owing to protracted ileus that occurred in different combinations were predictive of burst abdomen in these cases.

**Conclusion:** The prevalence of burst abdomen is high with attendant poor outcome, but identifying the predictors may influence early institution of preventive measures.

## **Introduction**

Postoperative complications arising from a breach of the peritoneal cavity especially following open contaminated or dirty procedures are numerous<sup>1,2</sup>. Burst abdomen is one of the most dreaded life threatening complications owing to the associated rapid onset of often irreversible pathological sequelae. Early surgical consultation, the advent of minimally invasive abdominal surgery, and availability of facilities and manpower resulted in a reduction in the incidence of post laparotomy burst abdomen in many centers<sup>1-4</sup>. However, post laparotomy burst abdomen or wound dehiscence has continued as a major cause of post operative morbidity and mortality in emerging pediatric surgical centers, particularly in sub-Saharan Africa. Unlike the encouraging outcome recorded in more developed centers, associated mortality is very high in many developing countries due to infective complication and a lack of adequate facilities<sup>5,6</sup>.

Pre- and post-operative clinical conditions of a patient were reported, which to a large extent influenced the development of postoperative burst abdomen<sup>5,7,8</sup>. Foreign literatures drew attention to the possible risk factors that could precipitate post operative burst abdomen, and enumerated recent advances in treatment and outcome especially in adults<sup>1-3,9-12</sup>. There are, however, scant studies<sup>5,6</sup> outlining likely predictors of postoperative burst abdomen in children in developing countries where open laparotomy is still commonly done with associated high incidence of this complication. Early identification of predictors of imminent burst abdomen and institution of measures aimed at prevention could be very crucial in resource-poor regions.

Consequently, a retrospective study based on children who underwent open abdominal operation was undertaken at two emerging referral pediatric surgical centers in Nigeria. We aimed to determine the

current prevalence, outcome, and predictors of post operative burst abdomen in children in this African subregion which may be useful for early institution of preventive measures in similar settings.

### Patients and Methods

The study centers, University of Benin Teaching Hospital and Leadeks Medical Center, are emerging referral pediatric surgical centers in Nigeria. Owing to lack of facilities and manpower for laparoscopic operations, open abdominal surgeries were performed on children with abdominal surgical pathology during the period. This retrospective study on burst abdomen spanning January 2002 to June 2009 was commenced after due approval by the University of Benin Teaching Hospital Local Ethics Committee.

Analysis of records of all children who had abdominal operations during the period was done. Findings, especially that of predictors of burst abdomen, were compared between children who had postoperative burst abdomen and those who did not. Data collated were age, sex, indication for index operation (including abdominal access/closure/suture materials), pattern of presentation, clinical state on arrival, preoperative morbidity, intra-operative findings, surgical procedure, post operative morbidity, time lag between index operation and occurrence of burst abdomen, closure, outcome and follow-up. Twelve of the children who had abdominal operation during the period but on whom sufficient data were not available because their case files could not be retrieved for analysis were excluded from the study.

**Statistical analysis:** The data obtained were analyzed using SPSS version 11 software package (SPSS, Chicago, IL, USA). Categorical data were analyzed using the Chi-square test with a p-value <0.05 regarded as being statistically significant.

### Results

A total 1465 abdominal operations were performed at the centers on children who were aged between 2 days and 16 years. The prevalence of burst abdomen recorded during the period was 2.1 %, occurring in 31 of the children. These 31 children of whom 19 were neonates during index abdominal operation had a mean age of  $14.8 \pm 6.7$  months (range 2 days to 12 years), with a male: female ratio 1.5: 1 (18 males/12 females). Burst abdomen was only recorded in 31 among 644 children who had some specific procedures and none in 821 who had other types of abdominal procedures. Therefore, of 165 children who had gangrenous/perforated bowels necessitating resection and anastomosis, 5 (3%) were complicated with postoperative burst abdomen. Burst abdomen was also a complication in 4 (5.5%) of 73 children who had colostomy created, 3 (7.7%) of 39 who had open reduction of intussusception, 2 (1.7%) following exploratory laparotomy in 121, and 3 (33.3%) among 9 cases who had closure of enterocutaneous fistula. Other cases in which burst abdomen occurred were 9 (39.1%) of 23 patients who had primary closure of bowels perforation, 1 (20.0%) of 5 who had drainage of intra-abdominal abscess, and 4 (1.9%) of 209 children who had laparotomy for resection of intra-abdominal malignant tumor (Table 1).

All the children had transverse abdominal access at index operation. The commonest suture used for fascia closure was polyglactin in 18 (58.1%) children, followed by nylon in 10 (32.2%). Three (9.7%) children with clean reduction of intussusception had fascia closure with rapidly absorbed polyglactin suture (*vicryl rapide*). This resulted in burst abdomen between the fourth and sixth postoperative day. The surgeon only discovered the difference between this product and conventional polyglactin suture following quick succession of burst abdomen in these cases in one center. The mean time lag from index abdominal operations to occurrence of burst abdomen in the 31 children ranged from 4 days after colostomy creation to 10 days following resection of intra- abdominal malignant tumor as shown in Table 1. Graphical representation as shown in Figure 1 revealed predictors of burst abdomen in the 644 children among whom 31 developed the complication. Occurrence of burst abdomen following the abdominal operations detailed in Table 1, were directly proportional to the number of predictors

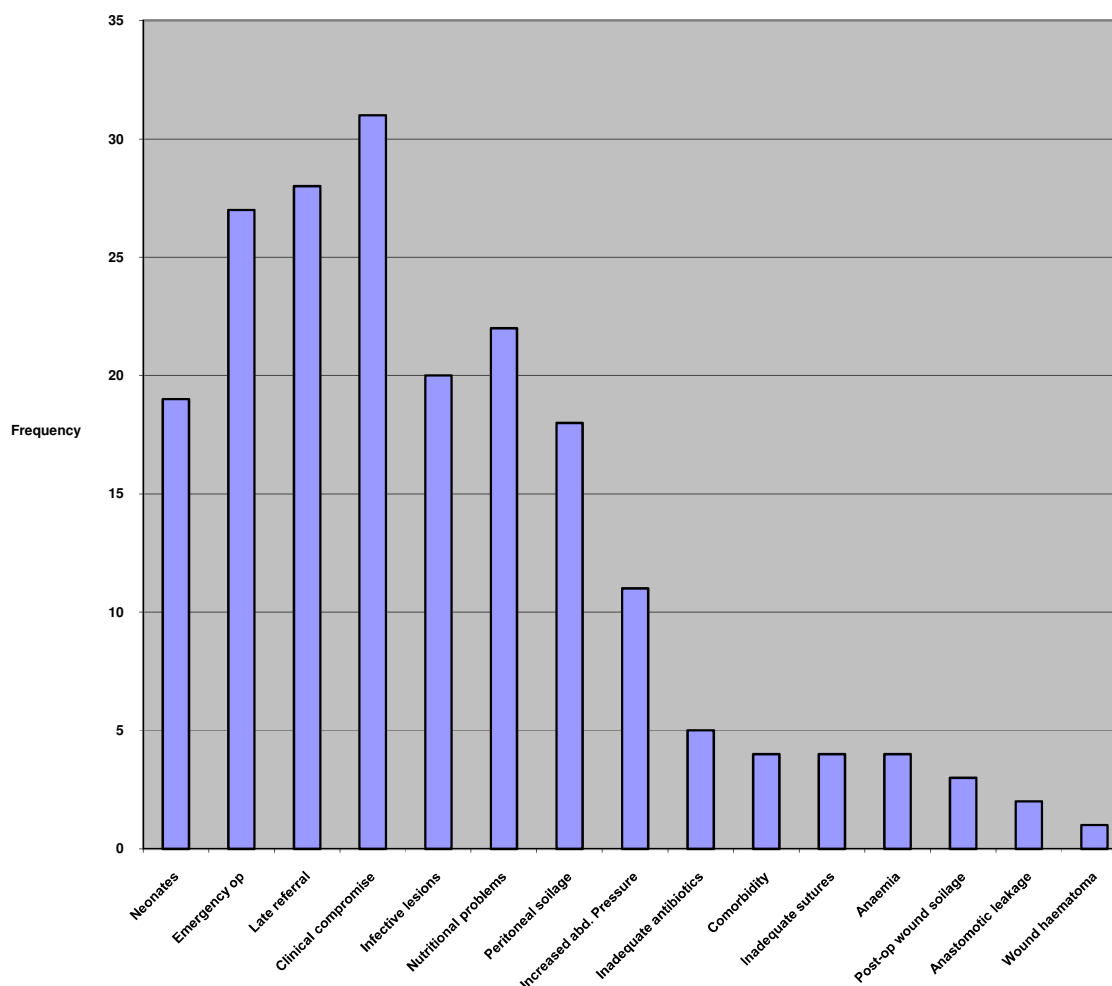
present in the patients pre- or postoperatively. Consequently, all the 31 children who were in very poor clinical state before and/or after surgery developed postoperative burst abdomen compared to the other children who had similar abdominal operations in stable clinical state ( $P < 0.0001$ ). Poor clinical state was due to very late presentation by 28 children necessitating emergency operation in 27, of whom 19 were neonates. Moreover, infective complication before laparotomy was recorded in 20 children, with 18 already having preoperative peritoneal soilage either from bowel gangrene/perforation or intra-abdominal abscess

**Table 1.** Prevalence, index procedures, and outcomes of burst abdomen during the period

| Surgical procedure                            | No of patients | No (%) with burst abdomen | Average time lag from operation to burst abdomen | [         | Outcomes of burst in 31 | of closure abdomen children | ]      |
|-----------------------------------------------|----------------|---------------------------|--------------------------------------------------|-----------|-------------------------|-----------------------------|--------|
|                                               |                |                           |                                                  | Excellent | Incisional hernia       | Scarred abdomen             | Deaths |
| Bowel resection and anastomosis               | 165            | 5 (3.0)                   | 5 days                                           | 1         | 1                       | 0                           | 3      |
| Colostomy creation                            | 73             | 4 (5.5)                   | 4 days                                           | 2         | 0                       | 0                           | 2      |
| Intussuception reduction                      | 39             | 3 (7.7)                   | 6 days                                           | 1         | 1                       | 1                           | 0      |
| Exploratory laparotomy                        | 121            | 2 (1.7)                   | 5 days                                           | 0         | 2                       | 0                           | 0      |
| Closure of enterocutaneous fistula            | 9              | 3 (33.3)                  | 7 days                                           | 0         | 0                       | 2                           | 1      |
| Closure of bowel perforation                  | 23             | 9 (39.1)                  | 8 days                                           | 2         | 2                       | 1                           | 4      |
| Drainage of intrabdominal abscess             | 5              | 1 (20.0)                  | 7 days                                           | 1         | 0                       | 0                           | 0      |
| Resection of malignant tumour                 | 209            | 4 (1.9)                   | 10 days                                          | 0         | 0                       | 0                           | 4      |
| Other abdominal operations without dehiscence | 821            | Nil                       | —                                                | —         | —                       | —                           | —      |

|              |             |                                 |          |                               |                               |                               |                                |
|--------------|-------------|---------------------------------|----------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|
| <b>Total</b> | <b>1465</b> | <b>31 /1465</b><br><b>(2.1)</b> | <b>—</b> | <b>7/31</b><br><b>(22.6%)</b> | <b>6/31</b><br><b>(19.4%)</b> | <b>4/31</b><br><b>(12.9%)</b> | <b>14/31</b><br><b>(45.2%)</b> |
|--------------|-------------|---------------------------------|----------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|

Fig.1: Relative frequency of predictors



formation. This resulted in 11 children having protracted post operative ileus that culminated in increased intra-abdominal pressure and eventual burst abdomen compared to other children in whom ileus was infrequent, minimal and responded to nasogastric bowel decompression ( $P<0.0001$ ). Similarly, inanition due to delayed return of normal bowel functions was compounded by unavailable total parenteral nutrition which resulted in poor and delayed wound healing in 22 children with predictable and/or inevitable burst abdomen. This was found to be significant statistically compared to the other children who were able to commence and tolerate adequate oral feeds within a week of index abdominal surgeries ( $P<0.0002$ ). Other rare risk factors such as unavailable adequate antibiotics, presence of co-morbid illness, anaemia, poor postoperative wound care with resultant contamination, anastomotic leakage and postoperative wound haematoma in combinations with the more common ones predicted imminent burst abdomen.

Emergency mass abdominal closure was undertaken in all the children within 1-4 hours of occurrence of burst abdomen. Outcomes of closure as shown in Table 1 were, however, very poor. This was

because 14 (45.2%) children, comprising 8 neonates and 6 older children died of multiple organs failure within 6-72 hours after closure despite active resuscitation. Of the 17 (54.8%) children who survived, 6 (19.4%) had incisional hernia that were successfully repaired 1-2 years later while 4 (12.9%) had ugly abdominal scars with only 7 (22.6%) recording excellent outcome.

### Discussion

Post laparotomy burst abdomen is a known complication globally with variation in incidence reported between centers<sup>5,7,11</sup>. Although technological advancement led to a significant reduction in developed countries where recent works<sup>3,4,7,10,11</sup> revealed incidence rate that varies between 0.8-1.4%, it remains high in many developing countries. In the absence of readily available figures on children for comparison, the prevalent rate of 2.1% recorded in this study corresponds with 2.5% reported two decades earlier in adults in this African subregion, suggesting a persistently higher incidence than in foreign reports. However, there was no appreciable difference in outcome reported<sup>7,10,11</sup> on children with post laparotomy burst abdomen in developed countries and findings in present study where only 54.8% children survived, with 19.4% having incisional hernia and 12.9% ugly abdominal scars. This shows a worldwide poor outcome owing to the rapid onset of often irreversible pathological sequelae in children which emphasize the importance of measures aimed at prevention. Similarly, the mean time lag of occurrence of burst abdomen that ranged between 4-10 postoperative days of index laparotomy in present review tallied with literatures<sup>3,7-13</sup>.

Many pre- and postoperative risk factors, especially the indication for the index operation, have been identified that could predispose a patient to developing post laparotomy burst abdomen<sup>3,4,7,10-12</sup>. The majority of 1465 children had some of these risk factors in this review but burst abdomen occurred only in 2.1%. Therefore, neither the indication for index operation nor presence of other risk factor alone was enough to precipitate burst abdomen. A combination of many preventable risk factors as seen in this and other studies<sup>3,7-13</sup> were predictable of imminent burst abdomen. In this study, clean abdominal procedures on 821 (56%) children were not complicated with postoperative burst abdomen during the period. This postoperative complication occurred only in 31 among the 644 (44%) children who had gangrenous/perforated bowels necessitating resection and anastomosis, children who had colostomy created, open reduction of intussusception, exploratory laparotomy following trauma and acute abdomen, closure of enterocutaneous fistula, primary closure of bowels perforation, and laparotomy for resection of intra-abdominal malignancy. Therefore, infective and malignant indications for index laparotomy were the major predictors requiring just a combination with two or more of the other identified risk factors to precipitate burst abdomen.

Consequently, in these 31 index operations, burst abdomen was predictable and could possibly have been prevented were the common combinations of the risk factors taken into consideration. Notably, neonates undergoing open laparotomy were particularly at risk<sup>3,4,10</sup>. Their inadequate response to abdominal surgical pathology was compounded by late presentation, a frequent denominator and a major determinant of poor outcome in many developing countries. This allowed enough time for compromised clinical conditions and infective complications to set. As a result, laparotomy on clinically compromised neonates who constituted 61.3% of cases in this series was a major predictor of burst abdomen<sup>7,8</sup>. Emergency operation on clinically unstable patients is associated with many avoidable complications, even more so on neonates. Previous reports<sup>3,7,8,12</sup> indicated that neonates who underwent emergency laparotomy were more likely to develop postoperative burst abdomen which corresponded with finding in index study.

The importance of parenteral nutrition support for surgical patients, particularly neonates, who are unable to commence adequate early oral intake owing to surgical bowel disease has been emphasized by many authors<sup>14,15</sup>. Delayed wound healing is one of the many serious complications of inanition as recorded in index cases that were complicated with burst abdomen. Identification of inanition as a predictor of burst abdomen, provision and commencement of affordable nutritional supplement would

have prevented this complication. Pre- or postoperative intra-peritoneal and wound soilages which were common in this series are known to cause postoperative peritonitis and wound infection. Infection delayed wound healing, peritonitis caused paralytic ileus that negatively influenced postoperative bowel functions, and the ensuing abdominal distension culminated in avoidable burst abdomen. Early surgical treatment, provision of total parenteral nutrition support, prolonged nasogastric bowel decompression, and use of broad spectrum antibiotics in at risk children, especially neonates, are preventable measures emphasized in literatures<sup>2,3,13,16,17</sup>.

Many authors reported that vertical abdominal access are more commonly associated with postoperative abdominal evisceration while others did not record any significant predisposition in children who had single layer or mass closure of abdominal wounds<sup>10,12,18,19</sup>. These were not contributory factors in this review as all the children had transverse abdominal access at index operations and the types of closure were found to be adequate. However, although the choice of sutures were to a large extent adequate, the inadvertent use of a wrong polyglactin material called for caution as noted in other reports<sup>7,8,20</sup>. Despite the associated abdominal scars and incisional hernia recorded, mass closure of burst abdomen as done in this study agreed with reports in other centers<sup>6,19</sup>. The limitation of this study is that it addressed complication that occurs following open laparotomy at a time when laparoscopic laparotomy has been popularized; thereby limiting its relevance to developing countries.

### Conclusion

- The prevalence of burst abdomen is still high in this setting with associated poor outcome.
- Emergency laparotomy on neonates consequent on late referral that allowed infective complications to set in, extensive preoperative intraperitoneal soiling, the presence of inanition, and prolonged postoperative abdominal distension owing to protracted ileus were sure predictors of burst abdomen in this series.
- Early referral, prompt surgical intervention, and use of the right sutures to close fascia in clinically stable children are advised.
- In children with a combination of the predictors of burst abdomen as recorded in this review, provision of total parenteral nutrition, prolonged nasogastric bowels decompression, and adequate selection of antibiotics are important additional preventive measures.

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