The absolute number of repeat operations for complex intra-abdominal sepsis is not a useful predictor of non-survival

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Introduction:
When multiple repeat laparotomies are required to manage intra-abdominal sepsis, questions about futility of treatment frequently arise. This study focuses specifically on patients who required two or more repeat laparotomies and describes the spectrum of disease necessitating multiple repeat laparotomies and the associated outcomes in the hope of clarifying the issue.
Methods: This study was conducted over a 20-month period (December 2012 – July 2014) at Greys Hospital in Pietermaritzburg, South Africa. All surgical patients at Greys Hospital have admission, discharge and operative data prospectively entered into a computerised electronic registry, the Hybrid Medical Electronic Registry (HEMR). The ethics approval required to maintain this registry has been obtained from the Biomedical Research Ethics Committee (BCA221/13 BREC) of the University of KwaZulu-Natal and from the Research Unit of the Department of Health. Full ethical approval for this study was granted by the University of KwaZulu-Natal Biomedical Research Ethics Committee (BE047/14). All patients aged 13 years and older who needed at least two repeat laparotomies were included in the study. This included general surgical and trauma patients.
Results: During the study period, 72 patients required more than one repeat laparotomy and a total of 182 repeat laparotomy operations were performed on this patient cohort. Demographics showed a male predominance, with 54 (75%) being male and 18 (25%) being female patients. The average age was 39 years. General surgical patients accounted for 60% and trauma patients for 40% of the total. The majority of patients required only two repeat laparotomy (65 %), while two patients required a total of 6 repeat laparotomy each, both with an initial diagnosis of appendicitis and both these patients survived. Temporary abdominal closure (TAC) was performed in 26 (36%) of initial laparotomies, while 33 (46%) of patients had an open abdomen at the time of discharge or death. Sixty percent required intensive care or high care unit (ICU/HCU) admission and 53 patients (74%) had a total of 71 documented morbidities. Total mortality for this study was 21%, however there was no correlation between number of procedures and mortality.
Conclusion: The total number of procedures is associated with increased morbidity rates but not necessarily with increased mortality rates. This is important to consider when the issue of futility of treatment arises, as the absolute number of repeat laparotomies is a poor marker of futility and other factors must be considered.

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Introduction

Repeat laparotomy for intra-abdominal sepsis is associated with high rates of morbidity and mortality, and the available data suggests that these rates increase in tandem with the number of repeat operations.[1-3] This makes the decision to continue with an aggressive surgical approach a difficult one, as surgeons need to carefully weigh up the benefits and the risks associated with multiple repeat laparotomies. Often in the setting of a critically ill patient who requires extensive surgery to manage intra-abdominal sepsis, the issue of futility of treatment is raised. This debate generally becomes highly anecdotal and there are very few clinical series which can provide guidance on this topic. This study focuses specifically on patients who required two or more repeat laparotomies and describes the spectrum of disease necessitating repeat laparotomy and the associated outcomes. It is hoped that this will provide guidance to assist with surgical decision-making in this group of patients.

Methods

This study was conducted over a 20-month period (December 2012 – July 2014) at Greys Hospital in Pietermaritzburg, South Africa. Greys Hospital is a tertiary level hospital that drains the city of Pietermaritzburg and the western third of KwaZulu Natal Province. It serves a population of three million people and covers a large rural area. All surgical patients at Greys Hospital have admission, discharge and operative data prospectively entered into a computerised electronic registry, the Hybrid Medical Electronic Registry (HEMR).[4] Ethics approval to maintain this registry has been obtained from the Biomedical Research Ethics Committee (BCA221/13 BREC) of the University of KwaZulu-Natal and from the Research Unit of the Department of Health. Full ethical approval for this study was granted by the University of KwaZulu-Natal Biomedical Research Ethics Committee (BE047/14).

All patients aged 13 years and older who needed at least two repeat laparotomies were included in the study. This included both general surgical and trauma patients. Children younger than 13 years and those needing only a single repeat laparotomy were excluded. Data was exported from the registry into a spreadsheet application (Microsoft Excel©) and retrospectively analysed using basic statistical analyses. Analysis of the data included the following aspects: demographics, underlying diagnoses, urgency of initial laparotomy, rates of temporary abdominal closure and outcomes - specifically looking at need for admission to the intensive care unit or high care unit (ICU/HCU), significant documented morbidity and mortality rates.

Results

Of this total group, 72 patients went on to require two or more repeat laparotomies and a total of 182 repeat laparotomies were performed on this patient cohort. Demographics showed a male predominance with 54 (75%) male patients and 18 (25%) female patients. The average age was 39 years. Of the total patients, 43 (60%) were general surgical patients, while 29 (40%) were trauma patients. Table 1 outlines the most common underlying diagnoses in the general surgical and trauma groups, with appendicitis and penetrating abdominal trauma (gunshot and stabbings) being the most common diagnoses in each group respectively. Of the 72 initial laparotomies, 33 (46%) were planned and 39 (54%) were unplanned. The majority of patients required only two repeat laparotomies (65%), while two patients required a total of 6 repeat laparotomies each, both with an initial diagnosis of appendicitis, and both these patients survived. Figure 1 gives a breakdown of the number of operations needed per patient. Of the initial laparotomies, 6 (8%) were performed for elective procedures, which were complicated mostly by anastomotic breakdown and mesh sepsis, and subsequently required multiple repeat laparotomies, whilst the remaining 66 (92%) were for emergencies.

Of these emergency surgeries, 13 (20%) were damage control trauma operations in haemodynamically unstable patients, with 12 operations performed for bowel content contamination and sepsis, and only one performed predominantly for active bleeding, which required pack removal at repeat laparotomy. The average time between operations was 159 hours. Of the 182 repeat laparotomies performed, a total of 20 (11%) were truly negative repeat laparotomies where the patient did not benefit from the operation. Temporary abdominal closure (TAC) was performed in 26 (36%) of the initial laparotomies, while 33 (46%) patients had an open abdomen at the time of discharge or death. Table 2 compares the rates of temporary abdominal closure (open abdomen) at initial laparotomy and open sheath after last repeat laparotomy (at discharge or death) in relation to the number of repeat laparotomies needed per patient.

Table 1. Outline of underlying diagnoses necessitating multiple repeat laparotomy

Underlying Diagnosis	Incidence
General Surgery (n = 43)	
Appendicitis	10 (23%)
Malignancies	6 (14%)
Peptic Ulcer Disease	4 (9%)
Herniae	4 (9%)
Adhesive Bowel Obstruction	4 (9%)
Intestinal infections (tuberculosis, amoebiasis, mucormycosis)	3 (7%)
Diverticular Disease	1 (2%)
Caecal volvulus	1 (2%)
Intussusception	1 (2%)
Gallbladder empyema	1 (2%)
Definitive diagnosis never established	4 (9%)
Other	4 (9%)
Trauma (n = 29)	
Gunshot Abdomen	10 (34%)
Stab Abdomen	10 (34%)
Blunt Abdominal Trauma	9 (31%)

Table 2. Comparison of open sheath at index laparotomy and at time of discharge or death, in relation to number of repeat laparotomies needed per patient

No. Of Repeat laparotomies	Open Sheath at Index Laparotomy	Open Sheath at Discharge/ Death
Total (n = 72)	26 (36%)	33 (46%)
2 Repeat laparotomies (n = 47)	17 (36%)	18 (38%)
3 Repeat laparotomies (n = 15)	6 (40%)	9 (60%)
>3 Repeat laparotomies (n = 10)	3 (30%)	6 (60%)

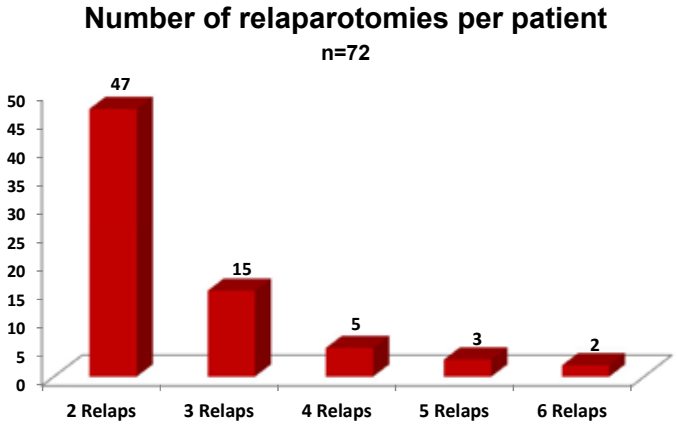

Figure 1. Breakdown of the number of repeat laparotomy needed per patient

Outcomes

Fourty-three patients (60%) required ICU/HCU admission and 53 patients (74%) had a total of 71 documented morbidities. Table 3 outlines incidence of specific morbidities. Total mortality for this study was 21%. Mortality rates peaked at three repeat laparotomies but declined quite dramatically thereafter. Table 4 compares the outcomes in relation to number of repeat laparotomies needed per patient.

Deaths

Fifteen deaths were encountered during this study. Of these 10 (67%) were male and the average age was 43.8 years. The cause of death was overwhelming sepsis with evidence of multi-organ dysfunction in 11 patients (73%) with a further 3 patients dying suddenly and unexpectedly in the ward of unknown causes, and one dying of a fatal cardiac arrhythmia. A total of 13 patients (87%) had an open abdomen at the time of death. In 7 patients (47%) a decision to withdraw active care was made.

Table 3. Outline of specified morbidities.

Specified Morbidity (n = 71)	Incidence
Surgical Site Infection	16 (23%)
Anastomotic Leak	13 (18%)
Nosocomial Pneumonia	10 (14%)
Acute Kidney Injury	9 (13%)
Iatrogenic Injury	7 (10%)
Enterocutaneous Fistulae	3 (4%)
Iatrogenic Pneumothorax	2 (3%)
Mesh Sepsis	2 (3%)
Acute Coronary Syndrome	2 (3%)
Other*	5 (7%)

*Other: Central line sepsis (1), Bowel evisceration (1), Deep vein thrombosis (1), Biloma formation (1), Haemorrhage from colostomy (1)

Table 4. Comparison of outcomes in relation to number of repeat laparotomies needed per patient

No. of repeat laparotomies	ICU Admission	Morbidity	Mortality
Total (n = 72)	43 (60%)	53 (74%)	15 (21%)
2 Repeat laparotomies (n = 47)	30 (64%)	34 (72%)	10 (21%)
3 Repeat laparotomies (n = 15)	8 (53%)	12 (80%)	5 (33%)
>3 Repeat laparotomies (n = 10)	5 (50%)	7 (70%)	0 (0%)

Discussion

Patients with complex intra-abdominal sepsis who require multiple repeat laparotomies are a high-risk group and decision-making in this cohort is difficult. Surgeons need to carefully weigh up the potential risks and benefits when deciding on further operative intervention. Our data is different to that from the developed world in that the patients in our series are predominantly young and mostly male. Furthermore, the index pathologies are overwhelmingly benign in nature with acute appendicitis and penetrating trauma being the most common diagnoses necessitating multiple repeat laparotomies. The spectrum in the developed world in contrast consists mainly of older patients, with diverticular disease and malignancy being far more prominent diagnoses and hence the outcome is poorer.[5-7]

Rates of TAC at the index procedure are roughly equal across all groups, yet open abdomen rates are significantly higher in patients needing more than two repeat laparotomies. The same is true for all other surgical morbidities which increase with increasing numbers of repeat laparotomy. However, the converse appears to be the case with mortality rates. In general, mortality rates in this series appear to be much lower than suggested by international developed-world data. This almost certainly reflects the young age of the patients and the benign nature of the index pathologies. The rate of mortality increases significantly once more than two repeat laparotomies are needed, yet begins to decline in patients who require more than three repeat laparotomies. All patients who required more than three repeat laparotomies in this series ultimately survived. This may reflect selection bias, as patients who develop intractable multiple organ failure select themselves out as poor surgical candidates and do not undergo such aggressive surgery. It suggests that the need for further surgery must not be seen as a predictor of survival. This means that decisions as to the futility of further surgical intervention in patients with complex intra-abdominal sepsis must take into account other factors apart from the number of procedures.

Our approach to abdominal sepsis is an aggressive one and we rely on repeat operation to achieve appropriate

source control. Repeat operation in a critically ill patient is not a benign procedure and our data shows that multiple repeat laparotomy is associated with dramatically increased levels of morbidity. Although interventional radiology may allow for percutaneous drainage of discreet collections and, despite improved access to advanced radiology, its role in the management of complex sepsis in our setting is currently unclear and still evolving.

Our data suggests that surgical futility is a difficult concept to quantify and that prior to deciding that further surgical treatment is futile, clinicians must consider a number of different parameters. These include the physiological reserve of the patient as well as the technical challenges of re-exploring a hostile abdomen. The absolute number of repeat laparotomies in itself is not a reliable indicator of futility.

Conclusion

Patients who require multiple repeat laparotomies are a high risk group of patients. In our setting, the spectrum is younger patients with benign index pathologies and for these reasons our mortality rates are lower than those reported from the developed world. Multiple repeat laparotomy is associated with increased morbidity but with decreased mortality rates. This is important to consider when the issue of futility of treatment arises, as the absolute number of repeat laparotomies is a poor marker of futility and other factors must be considered.

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