

Exploratory Laparotomy and Intestinal Resection in Children: Intraoperative Goal Directed Therapy and Intraoperative and Postoperative Outcomes

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Short Report

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Abstract

Background: Reported independent predictors of intraoperative and postoperative complications were age, American Society of Anesthesiologists Score (ASA), emergency situations, surgery and transfusion. ASA was the independent predictor of mortality. We conducted a secondary analysis of the initial retrospective study in patients who underwent exploratory laparotomy and intestinal resection.

Objectives: To describe intraoperative and postoperative outcomes in patients who underwent exploratory laparotomy and intestinal resection in the initial study and to implement improvement protocols for intraoperative and postoperative optimization.

Methods: Secondary analysis of the initial study. The Ethics Committee approved the study.

Results: There were 54 patients with a median age of 15.5[0-172] months. Thirty-seven (68.5%) patients underwent intestinal resection, nine (16.7%) underwent exploratory laparotomy, and eight (16.8%) underwent laparotomy for volvulus.

Fourteen (25.9%) patients had intraoperative and/or postoperative complications. Two (3.7%) patients had intraoperative hemorrhagic shock. Two (3.7%) patients had postoperative cardio-circulatory failure. Three (5.6%) had postoperative respiratory failure. One (1.8%) patient had postoperative multiple organ failure and neurologic failure. Three (5.6%) patients had postoperative abdominal sepsis. One (1.8%) patient had postoperative multiple organ sepsis and neuromeningeal sepsis. Four (7.4%) patients had postoperative pulmonary sepsis. Two (3.7%) had postoperative septicemia. Six (11.1%) patients had reoperations. Seventeen (31.5%) patients had intraoperative transfusion. The in-hospital mortality rate was 3.7% in two patients.

Conclusion: Intraoperative goal-directed therapies need to be developed and included in these surgical settings for intraoperative and postoperative optimization.

Introduction

Intraoperative and postoperative outcomes in children have been reported to be multifactorial (1,2,3,4). Reported independent predictors of intraoperative and postoperative complications were age, American Society of Anesthesiologists Score (ASA), emergency situations, surgery and transfusion (1,2,3,4). ASA was the independent predictor of mortality (1).

Intraoperative and postoperative complications in pediatric surgical settings with regard to age have been described previously (5,6,7,8,9,10). When considering the entire initial cohort of 594 patients, the overall rate of patients with intraoperative and/or postoperative complications was 23.9% (1). The most reported intraoperative complication was hemorrhagic shock, with an overall rate of 3.9% (1). The most commonly reported postoperative organ failure was neurologic, followed by respiratory, cardio-circulatory and multiple organ failure, with overall rates of 4.2, 3.5, 3 and 1.5%, respectively (1). The most commonly reported postoperative infection was septicemia, followed by pulmonary sepsis, abdominal sepsis, surgical wound sepsis and urinary sepsis, with overall rates of 3.7, 2.9, 2.7, 2 and 1.3%, respectively (1). Overall transfusion rate was 49.2%. Overall rate of reoperation was 7.2%. The rate of emergency interventions was 22.9%. Overall in-hospital mortality rate was 1.9%.

We conducted a secondary analysis of this initial cohort with the objective of describing intraoperative and postoperative outcomes in patients who underwent exploratory laparotomy and intestinal resection. The secondary objective was to propose and implement intraoperative optimization management for postoperative outcome improvement in surgical these surgical settings.

Methods And Materials

A secondary analysis of patients who underwent exploratory laparotomy and intestinal resection was included in the initial study (1).

The study was declared to the National Commission for Computer Science and Liberties (CNIL) under registration number 2028257 v0 on 21 February 2017 and approved by the Ethics Committee of Necker under registration number 2017-CK-5-R1 on 21 March 2017.

The inclusion criteria were patients who underwent exploratory laparotomy or intestinal resection and aged less than 18 years old included in the initial study.

The exclusion criteria were patients who did not undergo exploratory laparotomy or intestinal resection and were aged more than 18 years old.

Patients were included retrospectively from 1 January 2014 to 17 May 2017.

Statistics were analyzed with XLSTAT 2020.4.1. software. Continuous variables were expressed as medians with ranges or means with standard deviations. Categorical variables were described in proportions.

Results

Table 1 illustrates general characteristics.

There were 54 patients with a median age of 15.5[0-172] months and a median weight of 6.4[1.4-42] kilograms. There were four (7.4%), twenty-four (44.4%), twenty-two (40.7%) and four (7.4%) American Society of Anesthesiologists grade 1, 2, 3 and 4 patients, respectively. Thirty-two (59.3%) patients had an emergent intervention. Fourteen (25.9%) patients had intraoperative and/or postoperative complications. Two (3.7%) patients had intraoperative hemorrhagic shock. Two (3.7%) patients had postoperative cardio-circulatory failure. Three (5.6%) had postoperative respiratory failure. One (1.8%) patient had postoperative multiple organ failure and neurologic failure. Three (5.6%) patients had postoperative abdominal sepsis. One (1.8%) patient had postoperative multiple organ sepsis and neuromeningeal sepsis. Four (7.4%) patients had postoperative pulmonary sepsis. Two (3.7%) had postoperative septicemia. Six (11.1%) patients had reoperations. Seventeen (31.5%) patients had intraoperative transfusion with packed red blood cells (PRBCs) and/or fresh frozen plasma (FFP) and/or concentrated platelet units (CUPs). The mean preoperative and postoperative hemoglobin levels were 12.6 ± 3.3 g/dL and 11.3 ± 1.9 g/dL, respectively.

The median crystalloid and colloid volumes were 1287.5[60-3100] ml and 0[0-1000] ml, respectively.

The median length of intensive care unit stay (LOSICU) was 5[0-77] days. The median length of hospital stay (LOS) was 7[0-101] days. The median total length of hospital stay (TLOS=LOSICU+LOS) was 15[4-178] days. The median length of mechanical ventilation (LMV) was 0[0-28] days.

The in-hospital mortality rate was 3.7% in two patients. All patients with fatal outcomes had a comorbidity, namely, congenital heart disease, one patient had a laparotomy for volvulus, one patient had an intestinal resection, and all were managed on an emergency basis. One patient died on postoperative day 63, and the second patient died on postoperative day 75. Table 2 illustrates the characteristics of patients with fatal outcomes.

Table 3 illustrates surgery.

Thirty-seven (68.5%) patients underwent intestinal resection, nine (16.7%) underwent exploratory laparotomy, and eight (16.8%) underwent laparotomy for volvulus.

Table 4 illustrates the co-morbidities.

The most common comorbidities were congenital coagulation disorders in ten (18.5%) patients, congenital heart disease in four (7.4%) patients, necrotizing enterocolitis in four (7.4%) patients, cancer in three (5.6%) patients, Hirschsprung's disease in three (5.6%) patients and hepatic failure, intestinal pseudoocclusion, neurofibromatosis, and preterm births in two (3.7%) patients.

Discussion And Conclusion

The rate of patients with intraoperative and/or postoperative complications in this secondary analysis was comparable to that in the initial cohort. The results of this secondary analysis highlight that morbidity in patients who underwent exploratory laparotomy and intestinal resection is high. Intraoperative optimization with goal-directed therapies could contribute to upgrading postoperative outcomes in these surgical settings (11,12,13,14,15,16,17,18,19,20,21). Similar conclusions have been drawn in major surgical settings and where goal-directed therapies need to be developed and applied systematically to improve postoperative outcomes (22,23,24,25).

Intraoperative goal-directed therapies need to be developed and included in these surgical settings for intraoperative and postoperative optimization.

Declarations

Conflicts of Interest: The author declared no conflicts of interest.

Funding: None

Author contributions: Claudine Kumba conceptualized and designed the study and drafted the initial manuscript. She designed the data collection instruments, collected data, carried out initial and final analyses.

Ethics Approval: This study received approval from the Ethics Committee of Necker on 21 March 2017 under registration number 2017-CK-5-R1 and waived patient consent.

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Tables

Characteristic	N=54
Median age [range] in months	15.5[0-172]
Median weight [range] in kilograms	6.4[1.4-42]
ASA I n (%)	4(7.4)
ASA II n (%)	24(44.4)
ASA III n (%)	22(40.7)
ASA IV n (%)	4(7.4)
Emergency surgery n (%)	32(59.3)
Elective surgery n (%)	22(40.7)
Re-operation n (%)	6(11.1)
Patients with intra-operative and or postoperative complications (organ failure or sepsis) n (%)	14(25.9)
Intraoperative hemorrhagic shock n (%)	2(3.7)
Postoperative cardio-circulatory failure n (%)	2(3.7)
Postoperative respiratory failure n (%)	3(5.6)
Postoperative multiple organ failure n (%)	1(1.8)
Postoperative neurologic failure n (%)	1(1.8)
Postoperative abdominal sepsis n (%)	3(5.6)
Postoperative multiple organ sepsis n (%)	1(1.8)
Postoperative neuro-meningeal sepsis n (%)	1 (1.8)
Postoperative pulmonary sepsis n (%)	4 (7.4)
Postoperative septicemia n (%)	2(3.7)
In-hospital mortality n (%)	2(3.7)
Transfusion n (%)	17(31.5)
Median packed red blood cells volume in ml [range]	0[0-5]
Median fresh frozen plasma volume in ml [range]	0[0-2]
Median concentrated platelet units [range]	0[0-2]
Mean preoperative hemoglobin levels \pm standard deviation in g/dL	12.6 \pm 3.3
Mean postoperative hemoglobin levels \pm standard deviation in g/dL	11.3 \pm 1.9
Median crystalloid volume in ml [range]	1287.5[60-3100]
Median colloid volume in ml [range]	0[0-1000]
Median length of intensive care unit stay in days [range]	5[0-77]
Median length of hospital stay in days [range]	7[0-101]
Median total length of hospital stay in days [range]	15[4-178]
Median total length of mechanical ventilation in days [range]	0[0-28]

Table 1 General characteristics

Table 2 Patients with fatal outcome

Surgery	Age in months	ASA score	Co-morbidities	Intra-operative complications	Postoperative outcome	Delay of in-hospital mortality in days	Emergency	Transfusion
Laparotomy for volvulus	1	4	Congenital Heart Disease	0	Multiple Organ Sepsis	75	1	No
Intestinal Resection	0	3	Congenital Heart Disease	0	Multiple Organ Failure and Neuro-meningeal sepsis	63	1	1

Table 3 Surgery

Surgery	Number of (%)
Intestinal resection	37 (68.5)
Exploratory laparotomy	9 (16.7)
Laparotomy for Volvulus	8 (14.8)

Table 4 Co-morbidities

Co-morbidity	Number of patients(%)
Bronchodysplasia	1(1.8)
Cancer	3(5.6)
Congenital coagulation disorder	10(18.5)
Congenital heart disease	4(7.4)
Crohn's disease	1(1.8)
Duodenal atresia	1(1.8)
Former preterm	1(1.8)
Hepatic failure	2(3.7)
Hepatoblastoma	1(1.8)
Hirschprung	3(5.6)
Intestinal pseudo-occlusion	2(3.7)
Necrotizing enterocolitis	4(7.4)
Neurofibromatosis	2(3.7)
Polymalformation syndrome	1(1.8)
Polytrauma	1(1.8)
Pre-term	2(3.7)
Pre-term+Necrotizing enterocolitis	2(3.7)
Transplantation	1(1.8)