

Postoperative outcome in children aged between 3 and 6 years in abdominal surgery, neurosurgery and orthopedics

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Keypoints

The study presented here had the objective to describe postoperative outcome in patients in abdominal surgery, neurosurgery and orthopedics. In our Hospital, intra-operative goal directed therapies are not in routine use for intra-operative optimization therefore the results of this study encourage to develop these therapies for postoperative outcome improvement.

Abstract

Objective

Introduction

Previously published studies have revealed the multifactorial characteristics of predictors of postoperative outcome in surgical pediatric patients. We have undertaken a detailed description of these outcomes with regard to age.

Objective: To describe postoperative outcomes in children aged between 3 and 6 years in children included in the initial retrospective observational study in children in neurosurgery, abdominal and orthopedic surgery.

Material and Methods

Secondary analysis of children between 3 and 6 years included in the initial retrospective study. The study was approved by the Ethics Committee.

Results

There were 72 children included with a mean age of 52.2 ± 10.3 months.

50% of the patients (36) were ASA grade 3. 15 patients (20.8%) underwent an emergency intervention. The most common surgical interventions were intracerebral tumor resection in 11 patients (15.3%), neuroblastoma in 8 patients (11.1%), scoliosis in 7 patients (9.7%),

craniosynostosis in 6 patients (8.3%), intestinal resection in 5 patients (6.9%), pelvic osteotomy in 4 patients (5.6%) and exploratory laparotomy in 4 patients (5.5%). There were 20 patients (27.8%) who presented intra-operative and or postoperative complications. 4 patients (5.6%) had intra-operative hemorrhagic shock. The most common postoperative organ dysfunctions were respiratory failure in 5 patients (6.9%) and cardio-circulatory failure in 3 patients (4.2%). The most common postoperative infections were pulmonary sepsis in 3 patients (4.2%), abdominal sepsis in 3 patients (4.2%) septicemia in 3 patients (4.2%). 6 (8.3%) patients had re-operations. 43 (59.7%) patients were transfused intra-operatively. In-hospital mortality rate was 2.8% (2 patients). Median total length of hospital stay was 10 days [4-23.5].

Conclusion

27.8% of the patients presented with intra-operative and or postoperative complications. These patients were in majority ASA grade 3, that is to say high risk patients. Predictors of postoperative outcome are multifactorial, it is time to reconsider integrating goal directed therapies in high risk patients undergoing high risk interventions to improve postoperative outcome.

Keywords

Children aged between 3 and 6 years, neurosurgery, abdominal surgery, orthopedic surgery, postoperative outcome, goal directed therapies

Introduction

In a previously published observational retrospective study in pediatric neurosurgery, abdominal and orthopedic surgery, American Society of Anesthesiologists score (ASA), transfusion, age, emergency situations and surgery were identified as predictors of postoperative outcomes (1). ASA score was the predictor of in-hospital mortality. ASA, age, emergency situations, transfusion and the type of surgery were independent predictors of postoperative complications in terms of organ failure and infections in this study (1). A detailed analysis was conducted separately among pediatric patients in neurosurgery, abdominal and orthopedic surgery which found the same predictors of postoperative (2,3,4).

The study described in this manuscript has the objective to describe postoperative outcome in children aged between 3 and 6 years old included in the initial retrospective study. Similar secondary analyses have been undertaken to describe these outcomes in pre-terms, non-premature infants aged under 1 year old, infants aged between 1 and 3 years, children aged between 6 and 10 years and children between 10 and 18 years.

Material and Methods

Secondary analysis of children between 3 and 6 years old included in the initial study (1).

The study was declared to the CNIL, National Commission for Computer Science and Liberties on 21 February 2017 under the registration number 2028257 v0. The Ethics Committee of Necker approved the study on 21 March 2017 under the registration number 2017-CK-5-R1. Patients were included retrospectively from 1 January 2014 to 17 May 2017.

Inclusion criteria were children aged between 3 and 6 years old.

Exclusion criteria were children aged less than 3 years old and children older than 6 years.

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Statistics were analyzed with XLSTAT 2020.4.1 software.

Continuous variables were described in means ± standard deviation or medians with interquartile ranges. Categorical variables were described in proportions.

Results

Table 1 illustrates the general characteristics. There were 72 children included with a mean age of 52.2±10.3 months. There were 29 (40.3%) patients in abdominal surgery, 28 (38.9%) patients in neurosurgery and 15 (20.8%) in orthopedic surgery.

Table 1. General characteristics

Characteristics	N=72
Mean age in months±standard deviation	52.2±10.3
Abdominal surgery n (%)	29(40.3)
Neurosurgery n (%)	28(38.9)
Orthopedic surgery n (%)	15(20.8)
Elective surgery n (%)	57(79.2)
Emergency surgery n (%)	15(20.8)
Re-surgery n (%)	6(8.3)
Patients with intra-operative and or postoperative complications (organ failure and or sepsis) n (%)	20(27.8)
Intra-operative hemorrhagic shock n (%)	4(5.6)
Postoperative respiratory failure n (%)	5(6.9)
Postoperative cardio-circulatory failure n (%)	3(4.2)
Postoperative neurologic failure n (%)	1(1.4)
Postoperative renal failure n (%)	1(1.4)
Postoperative miscellaneous n (%)	1(1.4)
Postoperative multi-organ failure n (%)	1(1.4)
Postoperative hemorrhagic shock n (%)	1(1.4)
Postoperative pulmonary sepsis n (%)	3(4.2)
Postoperative abdominal sepsis n (%)	3(4.2)
Postoperative septicemia n (%)	3(4.2)
Postoperative surgical wound sepsis n (%)	2(2.8)
Urinary sepsis n (%)	2(2.8)
In hospital Mortality n (%)	2(2.8)
Transfusion n (%)	43(59.7)
Mean preoperative hemoglobin levels± standard deviation g/dL	11.1±1.6
Mean postoperative hemoglobin levels ± standard deviation g/dL	10.9±1.6
ASA I n (%)	4(5.6)
ASA II n (%)	23(31.9)
ASA III n (%)	36(50)
ASA IV n (%)	8(11.1)
ASA V n (%)	1(1.4)
Median length of intensive care unit stay in days [interquartile range]	3.5[1-8.3]
Median length of hospital stay in days [interquartile range]	5[2-15]
Median total length of hospital stay in days [interquartile range]	10[4-23.5]
Median length of mechanical ventilation (invasive or non-invasive) in days [interquartile range]	0[0-1]

Table 2. Surgery.

Surgery	Number of cases (%)
Arachnoid cyst	1(1.4)
Basal skull schwannoma	1(1.4)
Central venous catheter	1(1.4)
Chiari's Malformation	2(2.8)
Conjoined twin separation	1(1.4)
Cranioplasty	1(1.4)
Craniosynostosis	6(8.3)
Cryopreservation	1(1.4)
Decompressive craniectomy	1(1.4)
Esophageal atresia	1(1.4)
Exploratory laparotomy	4(5.6)
Extradural hematoma drainage	2(2.8)
Intestinal resection	5(6.9)
Intracerebral tumor resection	11(15.3)
Limb tumor resection	2(2.8)
Liver transplantation	2(2.8)
Neuroblastoma	8(11.1)
Nissen gastrostomy	1(1.4)
Pelvic osteotomy	4(5.6)
Plaster/Corset	1(1.4)
Polytrauma	1(1.4)
Pulmonary Lobectomy	1(1.4)
Renal transplantation	2(2.8)
Revascularization/by-Pass	3(4.2)
Scoliosis	7(9.7)
Sub-dural empyema drainage	1(1.4)
Vertebral laminectomy/Arthrodesis	1(1.4)

The most common surgical interventions were intracerebral tumor resection in 11 patients (15.3%), neuroblastoma in 8 patients (11.1%), scoliosis in 7 patients (9.7%), craniosynostosis in 6 patients (8.3%), intestinal resection in 5 patients (6.9%), pelvic osteotomy in 4 patients (5.6%) and exploratory laparotomy in 4 patients (5.5%). 50% of the patients (36) were ASA grade 3. 15 patients (20.8%) underwent an emergency intervention.

There were 20 patients (27.8%) who presented intra-operative and or postoperative complications. 4 patients (5.6%) had intra-operative hemorrhagic shock, 5 patients (6.9%) had postoperative respiratory failure, 3 (4.2%) had postoperative cardio-circulatory failure, 1 (1.4%) had postoperative neurologic failure, 1(1.4%) had

postoperative renal failure, 1(1.4%) had postoperative multiple organ failure and 1 (1.4%) had postoperative hemorrhagic shock. 3 (4.2%) patients had postoperative pulmonary sepsis, 3 (4.2%) had postoperative abdominal sepsis, 3 (4.2%) had postoperative septicemia, 2 (2.8%) had postoperative surgical wound sepsis and 2 (2.8%) had postoperative urinary sepsis. 6 (8.3%) patients had re-operations. 43 (59.7%) patients were transfused intra-operatively.

There were 2 (2.8%) in-hospital deaths (table 3). One had a liver transplantation and had intra-operative hemorrhagic shock with postoperative cardio-circulatory failure and abdominal sepsis; the second patient was a trauma patient who underwent an exploratory laparotomy and presented intra-operative hemorrhagic shock with post-operative multiple organ failure.

The two deceased patients were ASA grade 4 and 5.

Median total length of hospital stay was 10 days [4-23.5].

Table 4 illustrates co-morbidities. The most common co-morbidity was intracerebral tumor in 8 patients (11.1%), cancer in 6 patients (8.3%), hepatic failure in 4 patients (5.6%), coagulation congenital disorder and Chiari's malformation in 3 patients (4.2%).

Table 3. Patients with fatal outcome

Surgery	Age months	ASA score	Co-morbidities	Intra-operative complications	Postoperative outcome	Delay of in-hospital mortality in days	Emergency	Transfusion
Liver transplantation	62	4	Hepatic failure	Hemorrhagic shock	Cardio-circulatory failure and abdominal sepsis	86	Yes	Yes
Exploratory laparotomy	39	5	Polytrauma	Hemorrhagic shock	Multiple organ failure	1	Yes	Yes

Table 4. Co-morbidities

Co-morbidity	Number of patients (%)
Apert syndrome	1(1.4)
Arthritis	2(2.8)
Bourneville's sclerosis	1(1.4)
Cancer	6(8.3)
Cerebral aneurysm/ cerebral arterio-venous malformation	1(1.4)
Cerebral anoxic lesions	2(2.8)
Chiari's malformation	3(4.2)
Chronic renal failure	2(2.8)
Congenital coagulation disorder	3(4.2)
Congenital heart disease	2(2.8)
Crouzon syndrome	2(2.8)
Epilepsia	1(1.4)
Ewing sarcoma	1(1.4)
Hepatic failure	4(5.6)
Hepatoblastoma	1(1.4)
Hirschprung	1(1.4)
Intracerebral tumor	8(11.1)
Intracranial hypertension	1(1.4)
Meningeal carcinomatosis	1(1.4)
Myelomeningocele	1(1.4)
Neurofibromatosis	2(2.8)
Osteogenesis imperfecta	1(1.4)
Polymalformative syndrome	1(1.4)
Polytrauma	1(1.4)
Transplantation	1(1.4)
Vertebral hypoplasia/cyphosis/scoliosis	1(1.4)

Discussion and conclusion

In this secondary analysis of children aged between 3 and 6 years in major neurosurgery, abdominal and orthopedic surgery, 27.8% of the patients presented with intra-operative and or postoperative complications. These patients were in majority ASA grade 3, that is to say high risk patients. Predictors of postoperative outcome are multifactorial as demonstrated in previous studies (1,2,3,4).

It is time to reconsider integrating goal directed therapies in high risk patients undergoing high risk interventions to improve postoperative outcome (5,6,7,8,9,10,11,12,13). In our Hospital, goal directed therapies are not a routine practice and the results of this study should be an engine to implement these changes. Intra-operative goal directed therapies have the objective to optimize intra-operative patient management with the aim to improve postoperative outcome in surgical children. Intra-operative goal directed therapies include fluid and hemodynamic therapy with validated tools in children, goal directed transfusion protocols with point of care tests to guide blood product administration and enhanced recovery after surgery protocols (5,6,7,8,9,10,11,12,13).

Conflicts of Interest:

The author declared no conflicts of interest

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