

Children Aged between 1 and 3 Years in Non-Cardiac Surgery and Postoperative Outcome

Claudine Kumba* 

Department of Pediatric and Obstetric Anesthesia and Critical Care, Hôpital Universitaire Necker Enfants Malades, Assistance Publique Hôpitaux de Paris, APHP, Université de Paris, Paris, France

***Corresponding Author:** Claudine Kumba, Department of Pediatric and Obstetric Anesthesia and Critical Care, Hôpital Universitaire Necker Enfants Malades, Assistance Publique Hôpitaux de Paris, APHP, Université de Paris, Paris, France.

Received: May 10, 2021; **Published:** May 28, 2021

ORCID: 0000-0002-9748-5141

Abstract

Background: An observational study conducted previously to determine predictors of postoperative outcome in pediatric abdominal surgery, orthopedics and neurosurgery revealed that factors which influenced postoperative evolution were multiple. These included American Society of Anesthesiologists (ASA) score, transfusion, age, emergency surgery and surgery.

Objectives: To describe outcomes in children aged between 1 and 3 years old included in the initial study.

Methods: Secondary analysis of the initial retrospective observational study in 594 patients with a mean age of 90.86 ± 71.80 months. The study was approved by the Ethics Committee under the registration number 2017-CK-5-R1.

Results: There were 79 children with a mean age of 22.04 ± 7.15 months. The majority of the patients (36.71%) were American Society of Anesthesiologists (ASA) grade 3. There were 37 neurosurgical (46.83%), 34 abdominal surgical (43.04%) and 8 orthopedic patients (10.13%).

The most common interventions were craniosynostosis in 16 patients (20.25%), intestinal resection in 13 patients (16.45%), intracerebral tumor resection in 7 patients (8.86%), neuroblastoma in 5 patients (6.30%), liver transplantation in 3 patients (3.79%) and renal transplantation in 2 patients (2.53%).

20 patients (25.32%) had intra-operative and or postoperative complications. 4 patients (5.06%) had re-operations. 2 patients (2.53%) had intra-operative broncho-laryngospasm. 3 (3.78%) patients had intra-operative hemorrhagic shock. 6 (7.59%) patients had cardio-circulatory failure. 4 (5.04%) had neurologic failure. 1.27% of the patients had postoperative hepatic failure (1 patient), postoperative multiple organ failure (1 patient), postoperative respiratory failure (1 patient), postoperative renal failure (1 patient). The most common postoperative infections were septicemia in 5 patients (6.33%), pulmonary sepsis in 3 patients (3.79%), abdominal sepsis in 1 patient (1.27%) and surgical wound sepsis in 1 patient (1.27%).

46 patients (58.23%) had intra-operative transfusion.

The rate of in-hospital mortality was 2.53% (2 patients).

Conclusion: 25% of the patients in this cohort had intra-operative and or postoperative complications. Outcome in surgical patients is multifactorial. Integrating goal directed therapies to optimize intra-operative patient management is one of the major keys to improve postoperative outcome in surgical patients.

Keywords: Children Aged between 1 and 3 Years; Non-Cardiac Surgery; Postoperative Outcome

Introduction

An observational study conducted earlier to determine predictors of postoperative outcome in non-cardiac surgical pediatric patients concluded that predictors of postoperative evolution were multiple [1]. These included American Society of Anesthesiologists (ASA) status, transfusion, age, emergency surgery and surgery. Postoperative outcome in this observational trial was defined as intra-operative and postoperative complications (organ failure and sepsis), re-surgery, mortality, length of stay in the intensive care unit (LOSICU), length of stay in hospital (LOS), total length of stay in hospital, TLOS (LOSICU+LOS) and length of mechanical ventilation (LMV).

Objective of the Study

The study presented in this article had the objective to describe these outcomes in children aged between one and three years old.

Materials and Methods

Description of intra-operative and postoperative outcomes in children between one and three years old included in the initial cohort of 594 patients aged 90.86 ± 71.80 months [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 one and three years old.

Exclusion criteria were children aged less than one year and older than three years.

Statistics were analyzed with XLSTAT 2020.4.1. software.

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

Results

General characteristics are described in table 1.

Mean age in months \pm standard deviation	22.04 \pm 7.15
Abdominal surgery n (%)	34 (43.04)
Neurosurgery n (%)	37 (46.83)
Orthopedic surgery n (%)	8 (10.13)
Emergency n (%)	23 (29.11)
Patients with intra-operative and or postoperative complications n (%)	20 (25.32)
Re-operation n (%)	4 (5.06)
Intra-operative broncho-laryngospasm n (%)	2 (2.53)
Intra-operative hemorrhagic shock n (%)	3 (3.78)
Postoperative cardio-circulatory failure n (%)	6 (7.59)
Postoperative hepatic failure n (%)	1 (1.27)
Postoperative multiple organ failure n (%)	1 (1.27)
Postoperative neurologic failure n (%)	4 (5.06)

Postoperative respiratory Failure n (%)	1 (1.27)
Postoperative renal Failure n (%)	1 (1.27)
Postoperative abdominal sepsis n (%)	1 (1.27)
Postoperative surgical wound sepsis n (%)	1 (1.27)
Postoperative pulmonary sepsis n (%)	3 (3.79)
Postoperative septicemia n (%)	5 (6.33)
In-hospital mortality n (%)	2 (2.53)
Transfusion n (%)	46 (58.23)
ASA 1 n (%)	11 (13.92)
ASA 2 n (%)	29 (36.71)
ASA 3 n (%)	31 (39.24)
ASA 4 n (%)	6 (7.59)
ASA 5 n (%)	2 (2.53)
Median LOSICU in days [interquartile range]	3 [2 - 7]
Median LOS in days [interquartile range]	4 [2 - 11]
Median TLOS in days [interquartile range]	7 [4 - 20]
Median LMV in days [interquartile range]	0 [0 - 0.5]
Mean preoperative hemoglobin levels in g/dL ± standard deviation	11.66 ± 1.99
Mean postoperative hemoglobin levels in g/dL ± standard deviation	11.42 ± 1.95

Table 1: General characteristics.

n = Number of patients.

There were 79 children with a mean age of 22.04 ± 7.15 months. The majority of the patients were American Society of Anesthesiologists (ASA) 3 corresponding to 31 patients (36.71%) There were 37 neurosurgical (46.83%), 34 abdominal surgical (43.04%) and 8 orthopedic patients (10.13%).

23 patients (29.11%) were urgent interventions.

Table 2 illustrates different surgical interventions.

Surgery	Number of patients (%)
Esophageal Atresia	1 (1.27)
Intra-cerebral biopsy	1 (1.27)
Frontal Cavernoma	1 (1.27)
Plaster/Corset	3 (3.79)
Decompressive craniectomy	1 (1.27)
Craniosynostosis	16 (20.25)
Ventriculostomy	1 (1.27)
Sub-dural hematoma drainage	1 (1.27)
Brain stem tumor resection	1 (1.27)
Limb tumor resection	3 (3.79)
Spinal cord tumor resection	2 (2.53)

Gastroscopy	1 (1.27)
Vertebral Laminectomy/Arthrodesis	1 (1.27)
Exploratory laparotomy	1 (1.27)
Laparotomy for volvulus	1 (1.27)
Pulmonary lobectomy	1 (1.27)
Chiari' s Malformation	2 (2.53)
Neuroblastoma	5 (6.30)
Nissen Gastrostomy	2 (2.53)
Polytrauma	1 (1.27)
Revascularisation/by-pass	1 (1.27)
Intracerebral tumor resection	7 (8.86)
Intestinal Resection	13 (16.45)
Intraventricular Stenting	1 (1.27)
Intracerebral genetic therapy for San Filipo syndrome	2 (2.53)
Liver Transplantation	3 (3.79)
Renal Transplantation	2 (2.53)
Hepatic tumor	2 (2.53)
Pelvic tumor	1 (1.27)
Sterno-cleido-mastoidian tenotomy	1 (1.27)

Table 2: Surgery.

The most common interventions were craniosynostosis in 16 patients (20.25%), intestinal resection in 13 patients (16.45%), intracerebral tumor resection in 7 patients (8.86%), neuroblastoma in 5 patients (6.30%), liver transplantation in 3 patients (3.79%) and renal transplantation in 2 patients (2.53%).

20 patients (25.32%) had intra-operative and or postoperative complications. 4 patients (5.06%) had re-operations. 2 patients (2.53%) had intra-operative broncho-laryngospasm. 3 (3.78%) patients had intra-operative hemorrhagic shock. 6 (7.59%) patients had cardio-circulatory failure. 4 (5.04%) had neurologic failure. 1.27% of the patients had postoperative hepatic failure (1 patient), postoperative multiple organ failure (1 patient), postoperative respiratory failure (1 patient), postoperative renal failure (1 patient). The most common postoperative infections were septicemia in 5 patients (6.33%), pulmonary sepsis in 3 patients (3.79%), abdominal sepsis in 1 patient (1.27%) and surgical wound sepsis in 1 patient (1.27%). The rate of in-hospital mortality was 2.53% (2 patients). Patients with fatal outcome had an American Society of Anesthesiologists (ASA) grade 5, were managed on an emergency basis, all were transfused, one had postoperative multi-organ failure with pulmonary sepsis and one had postoperative neurologic failure (Table 3).

Surgery	Age in months	ASA score	Co-morbidities	Intra-operative complications	Postoperative outcome	Delay of in-hospital mortality in days	Emergency	Transfusion
Ventriculos-tomy	28	5	Polytrauma	none	Multi-organ failure and pulmonary sepsis	17	Yes	Yes
Intra-cere-bral tumor resection	23	5	Intra-cerebral tumor	none	Neurologic failure	4	Yes	Yes

Table 3: Patients with fatal outcome.

46 patients (58.23%) had intra-operative transfusion. Postoperative median length of intensive care unit stay (LOSICU) was 3 days [2 - 7], postoperative median length of hospital stay (LOS) was 4 days [2 - 11], postoperative median total length of hospital stay (TLOS = LOSICU+LOS) was 7 days [4 - 20] and postoperative length of non-invasive or invasive mechanical ventilation (LMV) was 0 days [0 - 0.5].

Table 4 illustrates different outcomes among surgical interventions.

Surgery	Number of cases	Intra-operative hemorrhagic shock	Intra-operative broncho-laryngospasm	Postoperative neurologic failure	Postoperative respiratory failure	Postoperative cardiovascular failure	Postoperative renal failure	Postoperative hepatic failure	Postoperative multiple organ failure	Postoperative abdominal sepsis	Postoperative septicemia	Postoperative pulmonary sepsis	Postoperative surgical wound sepsis	In-hospital mortality	Re-operation	Transfusion
Esophageal atresia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intracerebral biopsy	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Frontal cavernoma	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Plaster/Corset	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Decompressive craniectomy	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1
Craniosynostosis	16	0	1	0	0	0	0	0	0	0	0	0	0	0	0	11
Ventriculostomy	1	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1
Sub-dural hematoma drainage	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brainstem tumor resection	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Limb tumor resection	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Spinal cord tumor resection	2	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Gastroscopy	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Vertebral laminectomy/arthrodesis	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Exploratory laprotomy	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Laparotomy for volvulus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pulmonary lobectomy	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Chiari's malformation	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Neuroblastoma	5	0	1	0	0	1	1	0	0	0	1	0	0	0	0	3
Nissen gastrotomy	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polytrauma	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Revascularisation/by-pass	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Intra-cerebral tumor resection	7	0	0	1	0	0	0	0	0	0	0	0	0	1	1	6
Intestinal resection	13	0	0	1	0	0	0	0	0	1	0	0	0	0	1	2
Intraventricular stenting	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sterno-cleido-mastoidian tenotomy	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intra-cerebral genetic therapy for San Filipo syndrome	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Liver transplantation	3	2	0	0	1	2	0	0	0	0	1	1	0	0	0	3
Renal transplantation	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Hepatic tumor	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Pelvic tumor	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1

Table 4: Outcomes per surgery.

Discussion

25% of the patients in this cohort had intra-operative and or postoperative complications.

The most common intra-operative complication was hemorrhagic shock which occurred in patients who underwent liver transplantation and 58% of the patients were transfused intra-operatively in this cohort which is not surprising since the most common surgical interventions were among those with a high risk of bleeding namely craniosynostosis, intra-cerebral brain tumor resection and liver transplantation. These results emphasize the necessity to integrate transfusion protocols guided with point of care tests to manage intra-operative blood products and optimize transfusion since these protocols are not yet available in our Hospital [2].

The most common postoperative organ failure was cardio-circulatory followed by neurologic and the most common postoperative infection was septicemia. The majority of these patients had high ASA scores (3 or more). According to a recent study in children less than 60 weeks of postmenstrual age, intra-operative and postoperative morbidity rates have been reported to be 35.3% and 16.3% respectively [3]. This implies the necessity of integrating intra-operative patient management goal directed therapies with the objective to improve postoperative outcome [4-11]. Goal directed fluid and hemodynamic therapy protocols (GDFHT) are not a routine practice in our Hospital.

In-hospital mortality rate was 2.53% and it concerned 2 patients, one trauma patient and one patient with intracerebral tumor resection. Mortality rate in trauma patients with brain injury has been reported to vary between 9 - 25% [12] and in children with brain tumors it has been reported to vary between 1.4 - 2.7% [13]. In-hospital mortality rate in this cohort concerns a general pediatric surgical population with various surgical interventions which all have in-hospital mortality rates which vary according to studies and that makes the comparison with other trials difficult [3].

Conclusion

25% of the patients in this cohort had intra-operative and or postoperative complications; outcome in surgical patients is multifactorial. Intra-operative management optimization with goal directed therapies is one of the major keys to improve postoperative outcome in surgical patients.

Conflicts of Interest

The author declared no conflicts of interest.

Bibliography

1. Kumba C., *et al.* "Transfusion and Morbi-Mortality Factors: An Observational Descriptive Retrospective Pediatric Cohort Study". *Journal of Anesthesia and Critical Care: Open Access* 8.4 (2017): 00315.
2. Kumba C., *et al.* "A Systematic Review and Meta-analysis of Goal Directed Intra-Operative Transfusion Protocols Guided by Viscoelastic Methods and Perioperative Outcomes in Children". *International Journal of Recent Scientific Research* 10.3 (2019): 31466-31471.
3. Disma N., *et al.* "Morbidity and mortality after anaesthesia in early life: results of the European prospective multicentre observational study, neonate and children audit of anaesthesia practice in Europe (NECTARINE)". *British Journal of Anaesthesia* (2021).
4. Kumba C. "Physiology Principles Underlying Goal Directed Therapies in Children". *Research Pediatric Neonatology* 4.4 (2020): 000591.
5. Kumba C. "Rationale of Goal Directed Therapies in Children". *Advances in Pediatric Research* 7 (2020): 42.
6. Kumba C. "Do Goal Directed Therapies Improve Postoperative Outcome in Children? (Perioperative Goal Directed Fluid and Hemodynamic Therapy; Transfusion goal directed therapy using viscoelastic methods and enhanced recovery after surgery and Postoperative outcome): A Study Research Protocol". *Acta Scientific Paediatrics* 2.7 (2019): 17-19.
7. Kumba C. "Goal directed fluid and hemodynamic therapy and postoperative outcomes in children: Value of transthoracic echocardiographic aortic blood flow peak velocity variation: A multi-centre randomized controlled trial protocol". *Advances in Pediatric Research* 7 (2020): 35.
8. Kumba C. "Trans-Thoracic Echocardiographic Aortic Blood Flow Peak Velocity Variation, Distance Minute, Aortic Velocity Time Integral and Postoperative Outcome in Pediatric Surgical Patients-An Observational Pilot Study Protocol". *Open Journal of Internal Medicine* 10 (2020): 90-95.
9. Kumba C., *et al.* "A Systematic Review and Meta- Analysis of Intraoperative Goal Directed Fluid and Haemodynamic Therapy in Children and Postoperative Outcome". *The Journal of Emergency and Critical Care Medicine* 5.1 (2019): 1-9.
10. Kumba C., *et al.* "Rapid Recovery Pathways after Surgery in Children: A Systematic Review and Meta-Analysis". *Medical Journal of Clinical trials and Case Studies* 3.3 (2019): 000211.

11. Kumba C and Melot C. "The Era of Goal Directed Therapies in Paediatric Anaesthesia and Critical Care". *EC Emergency Medicine and Critical Care* 3.5 (2019): 306-309.
12. Chen CC., *et al.* "Predictors of In-Hospital Mortality for School-Aged Children with Severe Traumatic Brain Injury". *Brain Science* 11 (2021): 136.
13. Hankinson TC and Dudley RW. ""Short-term mortality following surgical" procedures for the diagnosis of pediatric brain tumors: outcome analysis in 5533 children from SEER, 2004–2011". *Journal of Neurosurgery: Pediatrics* 17 (2016): 289-297.

Volume 10 Issue 6 June 2021

©All rights reserved by Claudine Kumba.