



## Original Article

# Unplanned intensive care unit admission after general anaesthesia in children: A single centre retrospective analysis



John Mitchell <sup>a,\*</sup>, Stephan Clément de Clety <sup>b</sup>, Edith Collard <sup>a</sup>, Marc De Kock <sup>c</sup>,  
Thierry Detaille <sup>b</sup>, Laurent Houtekie <sup>b</sup>, Laurence Jadin <sup>a</sup>, Laurent Bairy <sup>a</sup>,  
Francis Veyckemans <sup>c</sup>

<sup>a</sup> Department of anaesthesiology, CHU Dinant-Godinne, avenue G.-Therasse 1, 5530 Yvoir, Belgium

<sup>b</sup> Paediatric ICU, cliniques universitaires Saint-Luc, avenue Hippocrate 10, 1200 Bruxelles, Belgium

<sup>c</sup> Department of anaesthesiology, cliniques universitaires Saint-Luc, avenue Hippocrate 10, 1200 Bruxelles, Belgium

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## ABSTRACT

**Objectives:** To determine the main causes for unplanned admission of children to the paediatric intensive care unit (PICU) following anaesthesia in our centre. To compare the results with previous publications and propose a data sheet for the prospective collection of such information.

**Methods:** Inclusion criteria were any patient under 16 years who had an unplanned post-anaesthetic admission to the PICU from 1999 to 2010 in our university hospital. Age, ASA score, type of procedure, origin and causes of the incident(s) that prompted admission and time of the admission decision were recorded.

**Results:** Out of a total of 44,559 paediatric interventions performed under anaesthesia during the study period, 85 were followed with an unplanned admission to the PICU: 67% of patients were younger than 5 years old. Their ASA status distribution from I to IV was 13, 47, 39 and 1%, respectively. The cause of admission was anaesthetic, surgical or mixed in 50, 37 and 13% of cases, respectively. The main causes of anaesthesia-related admission were respiratory or airway management problems (44%) and cardiac catheterisation complications (29%). In 62%, the admission decision was taken in the operating room.

**Conclusion:** Unplanned admission to the PICU after general anaesthesia is a rare event. In our series, most cases were less than 5 years old and were associated with at least one comorbidity. The main cause of admission was respiratory distress and the main type of procedure associated with admission was cardiac catheterisation.

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## 1. Introduction

To date, most studies on morbidity and mortality in paediatric anaesthesia have been based on the incidence of cardiac arrest [1], operative mortality or the voluntary reporting of complications [2]. When a systematic and voluntary reporting system for incidents is not available or unreliable, unscheduled admission rates for intensive care after anaesthesia can be used as an indirect

indicator [3] for identifying and collecting the most serious complications. These complications can be a source of significant morbidity. Besides an overall calculation of incidences, this analysis can also be used to determine the causes of such complications and define their possible prevention in order to reduce their consequences and improve the quality of care. The causes for these complications may be related to the patient's own status (e.g. comorbidities), to anaesthetic management or to the type of procedure performed, whether surgical or not. Finally, knowing the frequency of these admissions can be used to adjust the necessary resources in paediatric intensive care units (PICUs).

Paediatric data on unplanned admissions to PICUs following general anaesthesia are rare. To our knowledge, four studies dealing with this topic have been published so far: the reported incidence of unplanned admissions was 0.2%, 0.1%, 0.6% and 0.6% for the papers published by Downey and O'Connell, Kurowski and

\* Corresponding author. Tel.: +32 81 423907.

E-mail addresses: johnmitchell0277@yahoo.fr (J. Mitchell), stephan.clementdelety@uclouvain.be (S. Clément de Clety), edith.collard@uclouvain.be (E. Collard), marc.dekock@uclouvain.be (M. De Kock), thierry.detaille@uclouvain.be (T. Detaille), laurent.houtekie@uclouvain.be (L. Houtekie), laurence.jadin@uclouvain.be (L. Jadin), laurent.bairy@uclouvain.be (L. Bairy), francis.veyckemans@uclouvain.be (F. Veyckemans).

Sims, DaSilva et al. and Gibson et al., respectively [4–7]. We analysed the experience of a Belgian university hospital over a period of twelve years. The aims of this retrospective analysis were:

- to describe the epidemiology of unplanned PICU admissions in our hospital case-mix (in terms of paediatric patients and procedures);
- to determine the procedures and techniques that increased the risk of such events [4–7].

Finally, we also aimed at developing a prospective, computerized, data collection sheet, which would allow us to carry out a prospective and ongoing annual evaluation in order to improve the way we plan our post-anaesthesia PICU admissions. Another objective was to propose this tool as a template to other European hospitals in order to combine data, analyse larger numbers of patients and allow every participating hospital to position itself in relation to trans-group averages and medians.

## 2. Materials and methods

After Committee of Biomedical Ethics approval of the *Cliniques Universitaires Saint-Luc (Commission Facultaire d’Ethique biomédicale)* of the Faculty of Medicine of the Catholic University of Louvain, Belgium B403201111118 No. ref 2011/16MAR/136, President Professor J.M. Maloteaux, favourable opinion dated March 28, 2011), the annual lists of all admissions to the PICU, from 1999 to 2010 included, were analysed. These lists were used to record the following for each admission: detailed patient information (name, date of birth, origin, time and date of admission, length of stay in the PICU and destination after discharge) and the reason for admission. All surgical specialties were performed in our institution, including heart surgery, solid organ transplantation and neurosurgery. Our hospital is a university hospital with 990 beds including 105 paediatric beds (including 10 PICUs and 15 neonatal intensive care units). Only burned children were not treated in our institution.

Our criteria for planned postoperative admissions to the PICU were:

- for emergency cases: neurotrauma, major trauma, generalised peritonitis, sepsis;
- for elective surgeries:
  - child already in the PICU before surgery,
  - cardiovascular and thoracic surgery: open or closed cardiac surgery, thoracotomy,
  - cardiac catheterisation: interventional procedure (except intravascular closure of shunts in children and adolescents),
  - abdominal and urological surgery: transplant surgery, major intra-abdominal surgery, major urological surgery (e.g., vesical exstrophy), surgery in ASA 3 patients (polyhandicap, severe epilepsy),
  - orthopaedic surgery: scoliosis,
  - plastic surgery: child considered at high risk for respiratory problems (e.g. Pierre Robin), skin surgery involving a large surface of the body (e.g., giant nevus excision),
  - ENT surgery: laryngeal or tracheal surgery, severe sleep apnoea syndrome,
  - neurosurgery: any intracranial surgery (except simple ventricular shunting).

Our study looked for all patients under the age of sixteen years who underwent anaesthesia and whose admission to the PICU was not planned at the time of induction of anaesthesia. To help identifying

patients whose admission was unplanned preoperatively, a first selection was made based on the cause of admission to the PICU.

Exclusion criteria were patients:

- admitted for medical reasons;
- directly admitted from the emergency department or transferred from another hospital;
- already staying in the PICU prior to general anaesthesia;
- whose unplanned admission resulted from preoperative communication problems about the need for an elective admission;
- whose admission occurred more than 24 hours after anaesthesia.

After this preliminary selection, we reviewed the medical record of the short-listed patients. This included the PICU hospitalisation report, the entire hospital stay, the paper or electronic anaesthesia record and finally, the preoperative anaesthesia report. If there was any doubt about the cause of the unplanned admission of a patient, a consensus was made by the two main investigators of the study (J.M. and F.V.).

The following data were collected: patient age (in completed months), ASA physical status, origin of the incident (anaesthetic, surgical or mixed), type of incident that led to the admission, type of invasive procedure, timing as well as place where the decision to transfer the patient to the PICU was taken (in the operating room, recovery room or in the hospital unit) and the elective or emergency status of the procedure leading to admission. We chose the child’s ASA status because, although imperfect, it is used in everyday clinical practice and validated as an anaesthetic risk indicator for increased lengths of stay and mortality [8]. An incident linked to an interventional procedure was classified as surgical.

Statistics: we performed only descriptive statistics with values expressed as means with standard deviations, and when necessary, extreme values.

## 3. Results

During the twelve-year study period, 44,559 patients under sixteen years of age underwent general anaesthesia and 7077 were admitted to the PICU. In 3276 cases (40.6%), the admission took place in the immediate postoperative period; 85 were unplanned admissions, representing 1.2% of all PICU admissions, 2.59% of PICU admissions after general anaesthesia and 0.2% of all general anaesthesia performed during this period in this age group. The distribution according to age groups is shown in [Table 1](#): 67% of children were under the age of five and 55% were male.

There was an annual variation in the number of unplanned admissions ranging from a minimum of 2 patients in 2006 to a maximum of 13 patients in 2009. This represented a percentage of all PICU admissions ranging from 0.3% in 2006 to 2.1% in 2009 and a percentage of PICU admissions after general anaesthesia ranging from 1.0% in 2006 to 4.7% in 2009 ([Table 2](#)).

The ASA status distribution from I to IV of these 85 patients was 13%, 47%, 39% and 1%, respectively: in other words, 60% of cases were ASA I or II.

Regarding the causes motivating admission to the PICU, we observed that:

**Table 1**  
Age distribution of unplanned admissions in the PICU.

	n (%)
< 1 years	31 (36)
From 1 to 4 years	26 (31)
From 5 to 8 years	8 (9)
From 9 to 12 years	12 (14)
> 13 years to 16 years	8 (9)

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