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Incidence, characteristics, and predictive factors for medication errors in paediatric anaesthesia: a prospective incident monitoring study

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Abstract

Background: Medication errors are not uncommon in hospitalized patients. Paediatric patients may have increased risk for medication errors related to complexity of weight-based dosing calculations or problems with drug preparation and dilution. This study aimed to determine the incidence of medication errors in paediatric anaesthesia in a university paediatric hospital, and to identify their characteristics and potential predictive factors.

Methods: This prospective incident monitoring study was conducted between November 2015 and January 2016 in an exclusively paediatric surgical centre. Children <18 yr undergoing general anaesthesia were consecutively included. For each procedure, an incident form was completed by the attending anaesthetist on an anonymous and voluntary basis.

Results: Incident forms were completed in 1400 (73%) of the 1925 general anaesthetics performed during the study period with 37 reporting at least one medication error (2.6%). Drugs most commonly involved in medication errors were opioids and antibiotics. Incorrect dose was the most frequently reported type of error (n=27, 67.5%), with dilution error involved in 7/27 (26%) cases of incorrect dose. Duration of procedure >120 min was the only factor independently associated with medication error [adjusted odds ratio: 4 (95% confidence interval: 2–8); P=0.0001].

Conclusions: Medication errors are not uncommon in paediatric anaesthesia. Identification of the mechanisms related to medication errors might allow preventive measures that can be assessed in further studies.

Keywords: anaesthesia; general; errors; medication; paediatrics

Medication errors are an all too common occurrence in hospitalized patients that can lead to severe, but preventable, iatrogenic harm.[1] In the paediatric population, the rate of medication errors varies considerably among studies, depending on the definition used and care setting.[2,3] Several studies have been performed regarding drug administration

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Editor's key points

- A prospective indent monitoring study was performed at a single French paediatric hospital to determine the rate and nature of medication errors in paediatric patients.
- At least one medication error was reported in 2.6% of 1400 case reports (one per 38 cases) frequently involving incorrect dose or dilution errors, most commonly involving administration of opioids or antibiotics.
- Identification and mitigation of the factors contributing to this high error rate is necessary.

and medication errors during anaesthesia in adults.[4–9] Rates of medication errors ranged from 1/900 to 1/130 anaesthetic procedures, with one error occurring for every 20 perioperative medication administrations.[6,8,10] The most frequent medication errors are substitution, incorrect dose or omission, and main factors reported as contributing to errors are haste or pressure to proceed, distraction, and inattention.[4,7] Surgical case type, patient physical status, and level of provider experience may also play a role in the adult.[4,7]

Epidemiology of medication errors has been less assessed in paediatric anaesthesia. Weight-based dosing calculations and use of several drug dilutions can lead to increased risk for medication errors in this setting. In a recent retrospective analysis, the most frequent medication error was administration of an incorrect dose, which would have been preventable in almost all cases.[11] We performed a prospective single centre incident monitoring study to determine the incidence and characteristics of medication errors in a university paediatric hospital.

Methods

Design and approval

This prospective study was conducted between November 3, 2015 and January 31, 2016 after approval from the institutional review board (Comité de Protection des Personnes Sud-Est II, IRB number 00009118). The methodology followed the recommendations of the STrengthening the Reporting of Observational studies in Epidemiology (STROBE) statement.[12] The study was performed in the nine operating rooms of a large university paediatric hospital in Lyon, France. Surgical cases encompass a full spectrum of surgical care, except cardiac surgery, and represent about 9000 surgical procedures per year. We prospectively enrolled all consecutive children aged <18 yr undergoing general anaesthesia during the study period.

Organization of anaesthetic care

The anaesthetic team was composed of a senior anaesthetist and a nurse anaesthetist. Trainees in anaesthesia may take part in the procedure, as resident anaesthetists, student nurse anaesthetists or both. For each anaesthetic procedure, the nurse anaesthetist prepares the drugs according to the senior anaesthetist's prescription. All drugs are prepared in the operating room or in the recovery room from the vial or ampoule; no prefilled syringes are used. Each syringe and bottle for infusion should be labelled, using whenever possible a coloured label according to the pharmacological class in accordance with international colour coding.[13–15] These labels are provided by the manufacturer for some drugs, and rolls of coloured adhesive labels were also available in each operating room and recovery room (blue for opioids, yellow for i.v. induction agents, orange for benzodiazepines, violet for vasopressors, red for neuromuscular blocking agents, and uncoloured for other drugs) when no label was provided by the manufacturer. The practitioner should write the name of the drug drawn into the syringe (if not pre-printed) and the dilution with the unit on the label, according to French guidelines and the recommendations of the French National Authority for Health.[16]

Nurse and senior anaesthetists are both able to manage the airway, to insert peripheral venous access and to inject drugs, according to the senior anaesthetist's prescription. Only the senior anaesthetist can perform regional anaesthesia. In the recovery room, drugs were administered by a registered nurse, according to the prescription of the senior anaesthetist in charge of the patient. Medications administered and medical acts performed are all manually recorded or selected into a pre-defined list within the computerized anaesthesia file of each patient.

Definitions

Medication error was defined as a 'failure in the drug treatment process that leads to, or has the potential to lead to, harm to the patient and includes an act of omission or commission'.[17,18] Medication error can be related to omission (drug not administered or administered late), substitution (incorrect drug administered instead of intended drug), repetition (extra dose of intended drug given), incorrect dose (incorrect concentration, amount, or rate of infusion of the drug administered), insertion (drug administered that was not attended at that time or at any stage), and incorrect route.[4,6]

Protocol

Before the beginning of the study, all the members of the anaesthesia department (senior anaesthetists, nurse anaesthetists, and recovery room nurses) received comprehensive information as to the significance and aims of the study, definitions of terms for data collection, and were encouraged to participate in the study. Posters were displayed in each operating room and in the recovery room to remind practitioners to complete and submit their forms.

During the study period, for each patient undergoing a procedure under general anaesthesia, the senior anaesthetist in charge of the patient completed an incident form before discharge of the patient from the recovery room, according to their observations and to statements of the nurse anaesthetist, recovery room nurse, and, if any, trainees, regarding occurrence of any medication error during the procedure or in the recovery room. Incident forms were designed to elicit both voluntary and anonymous responses as to the occurrence or not of a medication error, the type of medication error, the drug involved, the member of the team responsible for the error, the place the medication error occurred (operating theatre or recovery room), mechanisms of the error, and its consequences for the patient. Factors that may have contributed to the medication error were also recorded, including disturbance, pressure to proceed related to emergency, fatigue, preparation and administration by two distinct professionals, lack of standardization for dilution, similar packaging, and other. Factors potentially associated with