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Research Article

Assessment of the Practice and Knowledge on Pediatric Anesthesia in Burkina Faso: A Multicenter Cross-Sectional Survey

Évaluation de la Pratique et des Connaissances en Anesthésie Pédiatrique au Burkina Faso : une Enquête Transversale Multicentrique

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ABSTRACT

Introduction. In developing countries, there is lack of knowledge about pediatric anesthesia while pediatric hospitals are scarce and do not fill all the needs. Therefore, anesthetic care for children is provided by doctors and nurses in general hospitals. The aim of this study was to assess their knowledge and practice regarding anesthetic management of children in Ouagadougou hospitals. **Methodology.** This was a descriptive multicenter cross-sectional study conducted from February 2024 to April 2024. A questionnaire was administered to doctors (MARs) and nurse anaesthetists (ISARs) in hospitals in the city of Ouagadougou. **Results.** We surveyed 178 anesthetists, including 23 MARs and 155 ISARs, giving a participation rate of 83%. They had an average professional experience of 14.01 +/- 7.66 years. The respondents had completed an internship in paediatric anaesthesia during their basic training (73.6%), lasting from one month (42.75%) or three months (41.98%). The majority (41.48%) practiced occasionally, mainly in general hospitals. General anesthesia was most used (95.32%) than locoregional (9.36%). Propofol (100%), fentanyl (99.42%) and sevoflurane (65.32%) were available according to respondents. Pulse oximeters were available to all and capnography for 69.16%. The staff reported experiencing more respiratory complications (bronchospasm 90.91%) and the time of onset was on awaking (85.63%). The overall level of knowledge was 50.56%. **Conclusion.** Regular practice, training in a pediatric hospital and availability of basic materials and equipment can help improve quality and security of care given to children undergoing surgery.

RÉSUMÉ

Introduction. Dans les pays en développement, l'anesthésie pédiatrique n'est pas encore bien connue et les hôpitaux pédiatriques, lorsqu'ils existent, ne répondent pas à tous les besoins. La prise en charge anesthésique des enfants est assurée par les médecins et les infirmières des hôpitaux généraux. Le but de cette étude était d'évaluer leurs connaissances et leurs pratiques concernant la prise en charge anesthésique des enfants dans les hôpitaux d'Ouagadougou. **Méthodologie.** Il s'agit d'une étude transversale descriptive multicentrique menée de février 2024 à avril 2024. Un questionnaire a été administré aux médecins (MAR) et aux infirmiers anesthésistes (ISAR) des hôpitaux de la ville d'Ouagadougou. **Résultats.** Nous avons pu interroger 178 anesthésistes, dont 23 MAR et 155 ISAR, soit un taux de participation de 83%. Ils avaient une expérience professionnelle moyenne de 14,01 +/- 7,66 ans. Les répondants avaient effectué un stage en anesthésie pédiatrique au cours de leur formation de base (73,6%), d'une durée d'un mois (42,75%) ou de trois mois (41,98%). La majorité (41,48%) pratiquait occasionnellement, principalement dans les hôpitaux généraux. L'anesthésie générale était la plus utilisée (95,32%) par rapport à l'anesthésie locorégionale (9,36%). Le propofol (100%), le fentanyl (99,42%) et le sévoflurane (65,32%) étaient disponibles selon les répondants. Les oxymètres de pouls étaient disponibles pour tous et la capnographie pour 69,16%. Le personnel a déclaré avoir rencontré plus de complications respiratoires (bronchospasme 90,91%) et le moment de l'apparition était au réveil (85,63%). Le niveau de connaissance global était de 50,56%. **Conclusion.** La pratique régulière, la formation dans un hôpital pédiatrique et la disponibilité du matériel et des équipements de base peuvent contribuer à améliorer la qualité et la sécurité des soins donnés aux enfants opérés.

HIGHLIGHTS

What is known of the subject

In developing countries, pediatric anesthesia is not yet well known and the few pediatric hospitals do not fill all the needs. Most of tern, anesthetic care for children is provided by doctors and nurses in general hospitals.

The aim of our study

Knowledge and practice regarding anesthetic management of children in hospitals of Ouagadougou.

Key results

1. The respondents had an average professional experience of 14.01 +/- 7.66 years.
2. They had completed an internship in paediatric anaesthesia during their basic training (73.6%), lasting from one month (42.75%) to three months (41.98%).
3. The majority (41.48%) practiced occasionally, mainly in general hospitals.
4. General anesthesia was more used (95.32%) than locoregional (9.36%). The rate of availability was as follows: propofol (100%), fentanyl (99.42%) and sevoflurane (65.32. Pulse oximeters were always available while capnography was available for 69.16% of respondents.
5. The staff reported experiencing more respiratory complications (bronchospasm 90.91%) and the time of onset was on awaking (85.63%). The overall level of knowledge was 50.56%.

Implications for future practices and policies

Regular practice, training in a pediatric hospital and availability of basic materials and equipment can help improve quality and security of care given to children undergoing surgery.

INTRODUCTION

Pediatric anesthesia requires appropriate training and availability of a specific equipped environment to ensure safety and optimal perioperative care. The needs of neonates, infants and young children are fundamentally different from those of the adults due to their anatomical, physiological and pharmacological particularities, as well as specific childhood conditions [1,2]. In addition, those particularities expose them to a higher risk of perioperative critical events that require unplanned immediate interventions to prevent the occurrence of disability or death [3]. Modern pediatric anesthesia in developed countries has become very safe due to recent advances in pharmacology, intensive care, and training [4]. Pediatric anesthesia is runed by a staff with specific skills. Children and adolescents are intended to be cared for, whenever possible, by a doctor specialized in children and a paramedical staff with experience and know-how in reception and care of children [5]. However, in Low and middle incomes countries (LMICs), such as Sub Saharan African countries, the context in which pediatric anesthesia is performed is different. Samaké B. and col. in Mali 2011, Mouzou and co. in Togo in 2016, Amengle and col. in Cameroon (2019) respectively reported 12%, 31%, 33.1 % of perioperative anesthetic incidents [6–8]. Recently in Benin (2021), Akodjénou and col. found that the prevalence of anesthetic incidents and/or accidents was 23.7% with a rate of 29 cardiac arrests per 10.000 anesthetics and an intraoperative mortality rate of 29 per 10.000 anesthetics[9]. Morbidity and mortality surveys showed that an occasional practice and the inexperience of the anesthetist are important risk factors. In Burkina Faso, the practice of pediatric anesthesia faces the same challenges with a medical demography of 23 anesthesiologist for 18.3 million habitants, and the majority of them practice in general hospitals [10]. The country has a single pediatric hospital with pediatric anesthesia and intensive care activities, and several general hospitals with a staff working on both adults and children. The pediatric hospital does not cover all the needs, and has limitations in terms of infrastructure and staff dedicated to pediatric anesthesia and surgery. In these conditions, the physicians and nurses in charge of anesthetic care of children must face some obstacles in their daily activities despite their efforts to provide a safe and qualitative anesthesia. This study aimed to assess the skills and knowledge of these key actors in paediatric anesthesia, the difficulties they encounter and the solutions they propose to improve their practice.

PATIENTS AND METHODS

This was a descriptive transversal study conducted from February 2024 to April 2024 with prospective data collected from anesthesia physicians and nurses practicing in different operating rooms of general public hospitals in Ouagadougou, the capital city of Burkina Faso. An exhaustive sample was drawn up, including all doctors and nurses in anesthesia and intensive care, practicing in a hospital in Ouagadougou, present on the period of the survey. A questionnaire has been drawn up for this purpose. The variables studied were: socio-demographic characteristics of anesthesia physicians and nurses, data relating to their practice of pediatric anesthesia, data relating to the knowledge on pediatric anesthesia and the difficulties encountered. To assess knowledge on pediatric anesthesia we used several criteria to obtain a knowledge score. The criteria covered preoperative assessment and preparation, the rules and principles of anesthetic management in the operating theatre and postoperative care. One point was scored for each correct answer and zero point for each incorrect answer. The sum of the points was calculated for each individual practitioner and a median of the scores obtained was determined. Participants with a score greater than or equal to the median were considered to have good knowledge, while those with a score below the median were considered to have poor knowledge. To reduce response bias, the aim of the study and the need for real-life response was explained to participants. The data collected were grouped and analyzed using the statistical analysis software Excel 2016 and R 4.4.2.

The protocol has been submitted to Burkina Faso's National Health Research Ethics Committee for validation. Confidentiality and anonymity were respected, informed consent was obtained, and the study was conducted in accordance with the principles of good clinical practice.

RESULTS

Upon completing our survey in five general hospitals and one pediatric hospital in Ouagadougou, we included 178 practitioners. Of these, 24 (13.48%) were doctors and 154 (86.52%) were nurses, all specialized in anesthesia and resuscitation. The survey achieved 83% participation rate. Figure 1 illustrates the distribution of participation rates across the hospitals.

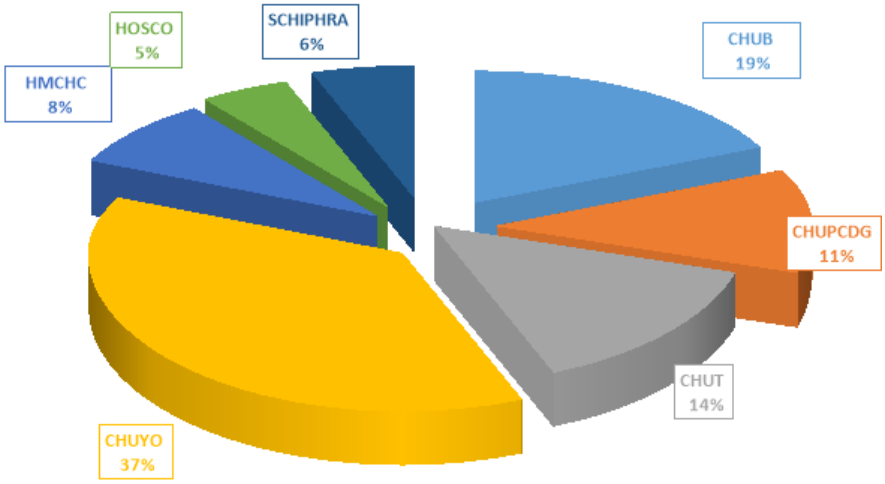

Figure 1. Distribution of included practitioners by site
CHUYO: Yalgado Ouedraogo teaching hospital; CHUT: Tengandogo Teaching hospital; CHUPCDG: Charles De Gaulle Petdiatric teaching hospital; CHUB : Bogodogo teaching hospital; SCHIPHRA : private confessional hospital; HOSCO : Saint-Camille hospital of Ouagadougou (confessional); HMCHC : Capitaine Hassane Coulibaly military hospital.

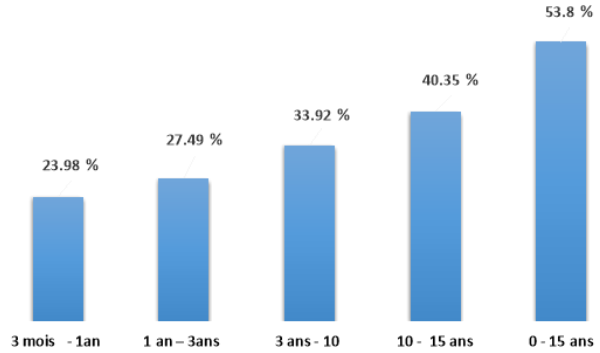

Figure 2: Distribution of respondents according to age range of children undergoing anesthesia (n=178)

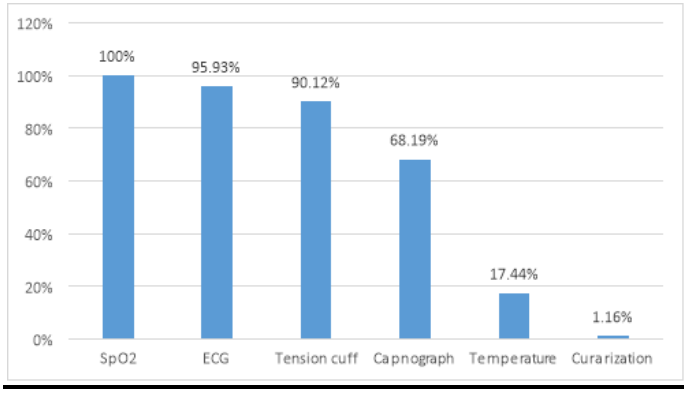

Figure 3. Distribution of available intraoperative monitoring devices according to respondents (n = 178)

The sex ratio was 1.2, and 55.62% of participants were aged between 41 and 50 years.

Tableau I. Distribution of the staff based on most encountered complications (n=178)

Intraoperative complications	N	%
Respiratory complications	155	92,81
Laryngospasm	51	33,12
Bronchospasm	140	90,91
Inhalation of gastric contents	14	9,09
Post-extubation stridor	48	31,17
Cardiovascular complications	135	80,84
Bradycardia	117	87,31
Arterial hypotension	62	46,27
Arrhythmia	15	11,19
Shock	7	5,22
Allergic complications	4	2,4

** The same respondent may experience many complications.*

Table II. Distribution of respondents who had a good knowledge according to perioperative management criteria.

Caractéristiques	N	%
Essential elements of CPA	81	45,51
Preoperative fasting	42	23,6
Criteria for postponing anesthesia in children	122	68,54
Delayed anesthesia in children	56	31,46
Anesthetic premedication drugs	110	61,8
Recommended PONV score in children	1	0,56
PONV prevention drugs	80	44,94
Guedel steps indicator at anesthesia induction	63	35,39
Guedel stage for IV line placement	38	21,35
Halogen indicated for inhalational induction	110	61,8
Vascular filling dosage in children	27	15,17
Rule for calculating basic needs in children	55	30,9
Ideal intraoperative solution for children	75	42,13
Formula for calculating basic water requirement in children	14	7,87
Postoperative analgesics	6	3,37
Clinical signs of decurarization in children	74	41,57

The mean duration of professional practice among the participants was 14.01 years, with a standard deviation of 7.66 years. During basic training, 22 (12.36%) of the respondents had not received a specific module on pediatric anesthesia and resuscitation , and 47 (26.4%) had not undertaken a pediatric anesthesia internship, in contrast to 131 (73.6%) who had internships of various lengths. None of the respondents had completed a fellowship in pediatric anesthesia. However, 27 (15.17%) had participated in a SAFE Pediatric course, and 13 (7.3%) had received continuing education other than SAFE Pediatric. Additionally, 28 (15.82%) had attended a conference on pediatric anesthesia. Out of 176 participants, 41 (23.3%) practiced pediatric anesthesia daily, 58 (32.95%) weekly and 73 (41.48%) occasionally (less than four children monthly). A portion of 2.27% (4 respondants) had never treated children in the operating theater. The majority of respondents, 53.8%, provided anesthesia to the 0-15 years old group, with 40.35% catering exclusively to the 10-15 years old group. Anesthesia for ear, nose, and throat surgeries was the most prevalent (73 - 58.87%), followed by visceral surgeries (42 - 33.87%).

Table III. Distribution of respondents according to difficulties encountered

Characteristics	N	%
Infrastructure		
No SSPI	18	29,51
No specific pediatric operating room	47	77,05
Equipment available		
Always	1	0,97
Often	100	97,09
Rarely	2	1,94
Drugs available		
Always	0	00
Often	1	1,18
Rarely	84	98,82
Human resources		
Insufficient	58	71,6
Trained	2	2,47
Untrained	46	56,79

Out of the respondents, 163 (95.32%) administered general anesthesia while 16 (9.36%) performed locoregional anesthesia, predominantly spinal anesthesia and 54 (31.58%) combined both techniques. Induction was exclusively inhalatory or intravenous for 26 (15.29%) and 113 (66.47%) of the practitioners respectively and combined for 149 (87.65%) of them. No general hospital possessed a pediatric anesthesia specialist or a dedicated pediatric anesthesia room. Propofol was the hypnotic present in every hospital. Fentanyl was accessible to 144 (84.21%) of respondents who had morphinics (173), and rocuronium was available to 134 (94.37%). Pulse oximetry was present for intraoperative monitoring in all operating room. Figure n°3 shows the availability of monitoring parameters in their hospitals according to the respondents. Respiratory complications were reported by 90.91% of respondents, while cardiovascular complications, such as bradycardia, were noted by 87.31%. Table 1 illustrates the distribution of practitioners by the type of complication encountered. These complications were encountered on awakening from anaesthesia by 85.63% of staff and on induction by 61.68%. Sixty-two (38.7%) participants practiced prevention of postoperative nausea and vomiting. The most commonly used molecule was dexamethasone. One hundred and two (67.55%) participants replied that they often give premedication before anesthesia. The molecules used were benzodiazepines (diazepam and rarely midazolam), ketamine and very rarely clonidine. Seventy-seven (68.14%) surveyed practionners used surgical drapes to prevent hypothermia, 23.89% stopped air conditioning, 22.12% used heat lamps, and three (2.65%) used caps. A specific trolley designed for pediatric use was available according to 24.43% of respondants. The overall level of knowledge was good for ninety (50.56%) of total surveyed staff. In general hospitals, the level was good for 45.91%, and in the

pediatric hospital for 94.44%. Table n° II illustrates the distribution of respondents who had a good knowledge of perioperative management. The respondents indicated challenges faced in pediatric anesthesia practice. A large majority, 98.82%, said that they had encountered shortages of pharmaceutical products (standard and pediatric formulations), whereas 97.09% noted that equipment was only often (not always) available.

DISCUSSION

The aim of this study was to assess anesthetist's practices and knowledge on pediatric anesthetic management in Burkina Faso. There were a number of difficulties that could have led to bias. The study could not be carried out in all hospitals in Burkina Faso, so the results cannot reflect the practices and knowledge of all anesthesia practitioners in the country. Nevertheless, the study sites represented the main reference training centers for the large majority of practitioners. The interviewer was not always present during the completion of the questionnaire, particularly with regard to the assessment of knowledge, which could introduce a response bias. To reduce this bias, the aims of the study and the need for real-life responses were explained to the participants. However these various biases do not detract from the value of the data collected in the main training centers, as these data can still provide valuable information and serve as a basis for future studies. This study find out that practitioners in general hospitals are less trained and have insufficient knowledge in pediatric anesthesia. Their conditions of practice are characterized by lack of equipment, materials, supplies, drugs and disposables for pediatric anesthesia. Pediatric anesthesia is a safe procedure if performed by competent and well-trained health care providers within an organizational environment committed to provide suitable equipment and sufficient personnel for continuous perioperative monitoring and care [4]. However, such conditions are rarely met in low-income countries like Burkina Faso. Children have a significantly higher peri-operative risk in low-income countries than in high resource settings [11–13]. The reasons are multifactorial, and include: increased severity of illness due to limited access to surgery; shortage of equipment and drug supplies, low numbers of physician anesthetists, limited training for non-physician providers, limited continuing professional development opportunities [4]. The importance of specialized training in pediatric anesthesia is crucial [12,14]. In our survey the majority of respondents had received a specific module on pediatric anesthesia during the basic training (87.64%). However, this training was essentially theoretical, and most of the practitioners, even if they did benefit from an internship in pediatric anesthesia, did not have sufficient time to acquire the skills required for a safe practice. It is imperative to extend the length of obligatory internships and promote specific continuing education. The accessibility and popularization of SAFE Paediatric courses could be a key step in improving the training of paediatric anaesthetists [12]. In the same context, occasional practice of pediatric anesthesia has been identified as an important factor in morbidity and mortality [15,16]. Regular pediatric anesthesia practice is essential for safe pediatric anesthesia. The French Society of Anaesthesia, Critical Care and perioperative Medicine (SFAR) and the French-speaking Paediatric Anaesthesia and Intensive Care Association recommend that all anaesthetists practicing paediatric anesthesia should have a regular activity specifically in pediatric anesthesia (at least half a day per week), and should update their knowledge and maintain their skills in paediatric anesthesia by means of individual training programs [14]. In this study, the respondents had no specific paediatric anaesthesia equipment in 89.33% of cases, and only 24.43% had a paediatric anaesthesia trolley. None of the hospitals had all the necessary monitoring equipment but pulse oximetry was used in 100% of cases. The lack of technical resources is a common problem in paediatric anaesthesia practice in low-income countries [9,17,18]. Anaesthetic management of children requires an age appropriate environment, to provide a certain level of safety. Learned societies recommend that anaesthesia for children should be performed in an operating room with equipment adapted to the child's weight and age, and with a paediatric sector in the post-operative monitoring room, in order to group the staff and equipment specific to the care of children [14]. General anesthesia (GA) was the main anesthetic technique practiced. The high prevalence of GA could be explained by the predominance of types of surgery that cannot be performed under local or locoregional anaesthesia. Indeed, ENT surgery performed only in general hospitals was the most common (58.87%), followed by visceral surgery (33.87%) performed mainly in paediatric hospitals. Induction by inhalation combined with intravenous drugs was most commonly used (87.65%) in children aged 0-10 years. Amengle and co. In Cameroon, Mouzou and co. in Togo, and Akodjènou and co in Benin reported similar results, in smaller proportions [8,9,19]. Fear of needles explains why inhalational induction is commonly used in paediatric anaesthesia. It enables the patient to fall asleep quickly, due to the specific pharmacological and physiological characteristics of the child, and makes it easier to set up peripheral venous access [20,30]. Sevoflurane is the preferred halogen for induction in children, offering interesting pharmacological properties [20]. However, the availability of this product is not effective in our hospitals, according to the practitioners, and for the structures which had it, frequent stock-outs were noted.

Locoregional anesthesia (LRA) was rarely used (9.36%) and only perimedullar blocks were used, in conjunction with general anesthesia. Peripheral blocks were not used in our study. The practice of LRA is limited by constraints such as equipment availability and practitioner experience, and further training [10,29,30,31]; LRA offers excellent quality of analgesia and can be implemented with limited resources, hence the importance of its integration into routine practice for the benefit of patients. Effectively, the use of LRA in pediatrics reduces the need for intraoperative anesthetic agents and postoperative analgesics. LRA and GA complement each other to provide optimal management of surgical stress, not only in terms of physiological

response to tissue aggression, but also in terms of psychological response to an anxiety-provoking situation [21]. Anesthesia is a medical procedure that can be complicated by adverse events. The risk of complications is particularly high in pediatric practice, due to the versatility of the activity, the weight difference between patients, the sharing of adult/child activities, and the anatomical and physiological specificities of the child. Respiratory complications are the most frequently encountered complications in pediatric anesthesia [9,22,23]. This is the case in the present survey. The APRICOT study has extensively identified the risk factors for these complications, categorizing them into patient-related, practice-related, and practitioner-related risk factors [23]. The presence of an experienced anesthetist reduces the morbidity of these respiratory complications [24]. The higher knowledge scores observed in pediatric hospitals compared to general hospitals underline the importance of regular, specialized practice. Indeed, regular exposure to pediatric anesthesia procedures is likely to help improve the skills of pediatric hospital staff. Shortcomings in terms of preoperative anesthetic preparation mainly concerned the essential elements of the anesthesia consultation (54.49%), postponement criteria (68.54%), postponement times (31.46%) for anesthesia in children, and the recommended score for preventing nausea and vomiting in children. However, it is essential to assess risks and anticipate complications, in order to better prepare for surgery. Guedel's stages, although less used today due to the rapid action of modern anesthetics, remain a fundamental element in the history of anesthesiology. Historically, they were described to assess the depth of anesthesia with agents such as ether or chloroform, but the introduction of intravenous agents has made this classification less relevant [25]. However, an understanding of these stages may still be useful in avoiding serious respiratory complications and ensuring safe anesthesia management [20]. The aim of perioperative fluid and electrolyte intake (HEI) is to maintain a basic physiological state, despite variations induced pre-, intra- and immediate postoperatively. These variations may be related preoperatively to the pathology justifying the surgical management, for example in the case of pyloric stenosis (dehydration and hypochloremic alkalosis) or an occlusive syndrome with the formation of a third sector [2]. The importance of knowledge of hydration protocols in pediatrics is crucial. According to Nancy et col [26], although the majority of practitioners are familiar with basic fluid requirements, fewer understand the optimal choice of fluids during the operative period. This gap in understanding can lead to errors in fluid management, resulting in risks of overload or hypovolemia. It is therefore essential to reinforce the training of healthcare professionals in hydration protocols adapted to children, to guarantee their safety and well-being. The efficient management of postoperative pain in children is a rewarding but difficult challenge [27]. It is crucial to recognize the importance of adequate management of postoperative pain in children, which includes a deep understanding of the various analgesics available. Treatment protocols must be adapted to the age and specific needs of the child, taking into account current recommendations and validated pain assessment scales [28]. Good communication with the child and his family is also essential to reduce anxiety and the need for analgesics. Finally, educating healthcare professionals about analgesic options other than paracetamol is necessary to improve the management of postoperative pain in children. The challenges facing general and pediatric hospitals in terms of infrastructure and resources are significant as shown by the results of our survey on the subject. The absence of specialized equipment for paediatric care, such as suitable operating rooms and intensive care units, and the shortage of paediatric medical equipment, highlight a critical need for improvement. In addition, the lack of trained staff and the unavailability of specific anesthetic drugs for children underline the need for constant training and better resource management. These problems, if left unresolved, can compromise the quality of care provided to young patients. Pediatric anesthesia care requires special attention and adapted equipment. SFAR and ADARPEF recommendations underline the importance of having dedicated post-interventional monitoring rooms and operating rooms for pediatrics, equipped with specific anesthesia equipment [14]. These measures are designed to guarantee optimum safety and precise monitoring of young patients, taking into account their weight and age. Continuous training of medical staff and the permanent availability of drugs and preventive equipment are also crucial to maintaining a high standard of care.

CONCLUSION

Pediatric anesthesia is a delicate specialty requiring specific training and practice. This survey underlines the importance of thorough training and regular practical experience to ensure the safety of young patients. The data we collected clearly indicate that gaps exist in current training, with a significant number of practitioners not having received sufficient specialist training. This highlights the need for educational reform, where mandatory training modules and longer, more frequent placements in paediatric anaesthesia should be introduced. In addition, the creation of a suitable environment and the provision of sufficient resources are essential to maintain a high level of competence and minimize the risk of complications. This study, the first of its kind, makes a significant contribution to the discussion on improving training standards in paediatric anaesthesia, a subject of vital importance for children's health.

DECLARATIONS

Conflict of interests

The authors declare no conflict of interest

Financing

The work was carried out with own funds

Ethical considerations

All stages of the work were carried out in compliance with the Declaration of Helsinki.

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