

Original Research Article

Practice of Regional Anesthesia in Pediatric Surgery at Brazzaville University Teaching Hospital, Republic of Congo: A Retrospective Observational Study

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Abstract: *Aim:* To describe the practice of regional anesthesia (RA) pediatric surgery at the Brazzaville University Teaching Hospital (CHU-B). *Patients and Methods:* The study was retrospective, observational and cross-sectional over 18 months including all the records of children aged 0 to 16 years operated on by pediatric surgeons under RA, with or without general anesthesia (GA), in the operating room of the CHU-B. Epidemiological, surgical, and anesthetic variables were analyzed using Excel 2016. *Results:* During the study period, 320 children underwent surgery, 43 of whom were operated on under RA (13.4%). The median age was 5 years, with a range from 2 months to 16 years (quartiles: 3 to 10 years). The sex ratio was 2.07. The main surgical indication was digestive wall surgery (69.8%), followed by urological surgery (30.2%). 81.4% of the surgeries were classified as Altemeier I. 60.5% of the children were classified as ASA 1. Preoperative hemostasis testing was performed in 69.8% of the children. Preoperative preparation was carried out in 11.6% of cases. GA was administered in 83.7% of cases. Caudal block (46.5%) was the most frequently used technique, followed by wall blocks (27.9%). Ultrasound was used in 15 children (34.9%), including one with neurostimulation. Bupivacaine (95.3%) was the most frequently used local anesthetic. We noted five cases of failure block (11.6%). The mean surgery time was 55.6 ± 34.8 minutes. *Conclusion:* RA is part of the early postoperative rehabilitation strategy. However, it remains very rarely performed at the CHU-B, particularly pediatric surgery.

Keywords: Regional Anesthesia, Pediatric Surgery, University Hospital of Brazzaville.

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INTRODUCTION

Since the 1950s, regional anesthesia (RA) has experienced incredible growth and has become the cornerstone of modern anesthesia because it allows for a multimodal approach to postoperative pain management (POP) in children [1, 2]. The development of equipment adapted to children's anatomy and the use of long-acting, less cardiotoxic local anesthetics (LAs) make it possible to perform these RA techniques easily, safely, and reliably in children. RA offers effective analgesia without the need for opioids [3, 4]. However, it is not widely used in pediatrics in developing countries.

The specific nature of pediatric anesthesia stems from anatomical, physiological, and

pharmacological particularities. Indeed, a child is not a miniature adult, but a growing organism with its own physiology and psychology [4, 5]. In developing countries in general, pediatric anesthesia remains far from safe due to limited access to care and a shortage of qualified personnel and equipment in healthcare facilities [6].

In Republic of Congo, Otiobanda *et al.*, reported that 11.3% of surgical procedures at the Brazzaville University Teaching Hospital (CHU-B) were pediatric in 2011; general anesthesia (GA) was the most frequently used technique (98.9%) [7]. However, there is no data on the use of RA in pediatrics by anesthesiologists and intensivists (AIs) in the Republic

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of Congo; this justified the undertaking of this study, whose overall objective is to describe the practice of RA in pediatric surgery in the operating room of the CHU-B.

PATIENTS ET METHODS

The RA study in pediatrics was designed and planned by the research team of the polyvalent Intensive Care Unit at the CHU-B, and approval from the ethics committee was not required. It was an observational, retrospective, cross-sectional and descriptive study conducted over an 18-month period from January 1, 2023, to June 30, 2024. Our study took place in the operating room of the CHU-B, a level 3 public health institution with a triple mission of care, research, and teaching. Our study population consisted of the written records of all children operated on by pediatric surgeons. We included, without distinction of sex, those who underwent locoregional anesthesia, with or without general anesthesia. Children whose records could not be located, were incomplete, or unusable were excluded from the study.

The operating suite is divided into two operating rooms for surgical and obstetric emergencies, seven operating rooms for scheduled procedures across all specialties, and two post-anesthesia care units (PACUs).

Regarding scheduled procedures, only four operating rooms are open daily from 7:00 a.m. to 2:00 p.m., except on weekends and holidays. There is also a six-bed PACU equipped with four multiparameter monitors, a KONTRON IMAGIC AGILE® ultrasound machine, a Braun Stimuplex® HNS 12 neurostimulator, an intubation cart, and a cart containing emergency medications but lacking intralipids. With five pediatric surgeons, the pediatric surgery department only has two, sometimes three, operating days per week. During the study period, anesthesia team consisted of five AIs and 24 state-certified nurse anesthetists. Locoregional anesthesia techniques were performed by the anesthetic coordinator for the day in the operating room, assisted by the anesthesia team consisting of two nurse anesthetists

in the operating room, while adhering to aseptic techniques. All children had a pre-anesthetic consultation (PAC) at least 48 hours before the procedure and a pre-anesthetic visit (PAV) at least two hours before surgery. Upon admission to the operating room, the children were monitored and received intravenous fluids; some were placed on IVs after achieving Guedel stage 3 hypnosis via inhalational induction. When GA was administered, it was maintained throughout the RA procedure and surgery. In this case, an increase in heart rate (HR) or mean arterial pressure (MAP) > 30% of the reference value (before the start of RA) at the time of incision was considered a failure of RA and led to the administration of fentanyl (0.2 to 0.3 µg/kg).

Data were collected from operating room admission records (emergency and scheduled surgeries), patient anesthesia records, and postoperative prescription and monitoring sheets. A pre-established survey form was used. The following variables were studied: frequency, age, sex, surgical indications, Altemeier classes, American Society of Anesthesiologists (ASA) classification, preoperative assessment, preoperative preparation, anesthetic protocol, type of RA, LAs used, use of ultrasound, incidents/accidents, and duration of surgery.

We used Microsoft Excel 2016 software to create the database and develop the graphs. Quantitative variables were expressed as mean ± standard deviation and qualitative variables were expressed as count and percentage (%).

RESULTS

During our study period, 2,148 patients underwent surgery in the operating room of the CHU-B for both scheduled and emergency procedures, across all specialties. In pediatric surgery, we identified a total of 340 children who underwent surgery. Among these, 43 children received RA, representing a relative frequency of 13.4% of pediatric surgical procedures and 2.2% of all surgeries. After applying the selection criteria, these 43 children were included in our study (figure 1).

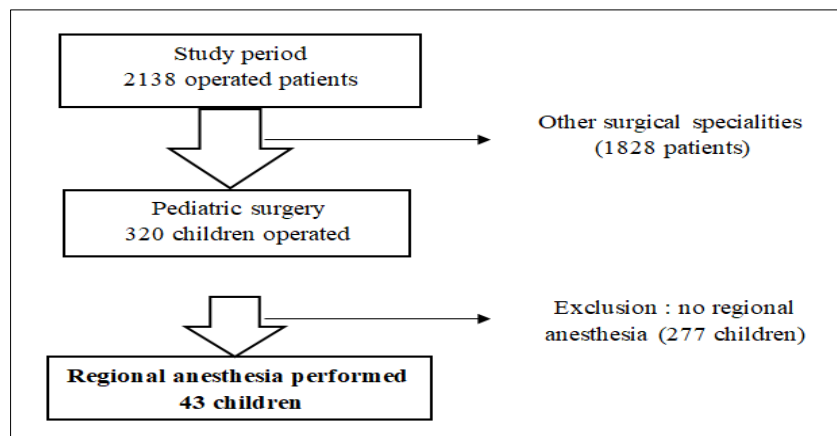


Figure 1: Flowchart of our study population

The median age was 5 years, with a range from two (2) months to 16 years (quartiles: 3 to 10 years). The 1- to 5-year-old age group was the most represented (41.9%). There was a male predominance (67.4%), resulting in a sex ratio of 2.07. The main surgical

indication was digestive wall surgery (69.8%), followed by urological surgery (20.9%). In 81.4% of cases, the surgeries were classified as Altemeier I. The mean surgical time was 55.6 ± 34.8 minutes (table 1)

Table 1: Distribution of children according to epidemiological and surgical data

	Effective (n = 43)	Percentage (%)
Age groups		
0 – 12 months	4	9.3
1 – 5 years	18	41.9
6 – 11 years	12	27.9
11 – 15 years	7	16.3
> 15 years	2	4.6
Genre		
Male	29	67.4
Surgical indications		
Digestive wall surgery	29	67.4
Urological surgery	9	21
Trauma syrgery	4	9.3
Proctological surgery	1	2.3
Altemeier classes		
I	35	81.4
II	7	16.3
III	0	0
IV	1	2.3

The children were classified as ASA 1 in 60.5% of cases. Preoperative hemostasis testing was performed in 69.8% of cases. Preoperative preparation was carried out in 11.6% of cases, including three pediatric consultations for complicated rhinopharyngitis and two preoperative blood transfusions for poorly tolerated anemia. GA was used in 83.7% of the children. Induction was predominantly inhalational (53.5%). Maintenance of anesthesia was achieved with halothane in all operated children. The laryngeal mask airway (72.1%) was the

primary method of upper airway management. Caudal block or anesthesia (46.5%) was the most frequently used RA technique, followed by wall blocks (30.2%). Ultrasound was used in 15 children (34.9%), including one with sentinel neurostimulation. Bupivacaine (95.3%) was the most frequently used LA. We noted five cases of failure block (11.6%), one case of intraoperative bleeding (2.3%) requiring a blood transfusion, and two cases of bradycardia (4.6%) requiring the administration of atropine (table 2).

Table 2: Distribution of operated children according to anesthetic data

	Effective (n = 43)	Percentage (%)
ASA classification		
ASA 1	26	60.5
ASA 2	17	39.5
Associated GA		
Yes	36	83.7
Laryngeal mask		
Laryngeal mask	31	72.1
Simple mask	1	2.3
Tracheal intubation	4	9.3
Induction types		
Inhalation	23	53.5
Intravenous	5	11.6
Mixed	8	18.6
RA types		
Caudal block	20	46.5
Wall block	13	30.2
Spinal anesthesia	6	14
Axillary block	3	7
Sciatic and femoral block	1	2.3

	Effective (n = 43)	Percentage (%)
Ultrasound guidance		
Yes	15	34.9
LA used		
Isobaric bupivacaine	41	95.3
Lidocaine	2	4.7
Events – accidents		
Failure block	5	11.6
Blessing requerrad transfusion	2	4.7
Low heart rythme	1	2.3

ASA: American Society of Anesthesiologists; GA: general anesthesia; RA: regional anesthesia; LA: local anesthetic

DISCUSSION

This study has certain limitations that must be considered for a better analysis and interpretation of our results. First, the retrospective nature of our study exposes us to a risk of bias in the analysis of anesthetic data and/or the existence of missing data. Furthermore, the single-center design and short duration of our study did not allow us to obtain a large enough sample size for greater statistical significance and to extrapolate the results to a national scale. Second, the lack of long-term postoperative follow-up prevented us from evaluating the effectiveness of postoperative analgesia and postoperative complications. Finally, the limited use of ultrasound and the heterogeneity of anesthetic practices according to the medical association may have influenced the success and failure rates of locoregional anesthesia. However, this study represents a first for RA in pediatrics and can serve as a basis for future research studies, preferably multicenter ones.

In our series, the frequency of RA in pediatric surgery was 13.4%. This result represents a significant improvement compared to previous local studies. Indeed, Otiobanda *et al.*, reported only 1.1% of RAs in their 2011 study on pediatric anesthesia practices at the CHU-B. Some African authors found comparable results ranging from 9.36% to 12.7% [6-9]. Other authors reported much higher rates [10-13]. In the Democratic Republic of Congo (DRC), much lower rates ranging from 3.8% to 7.5% were observed [14, 15]. This difference could be explained by our different settings and populations, the limited number of anesthesiologists in Africa, the difficulty in obtaining RA supplies and consumables, and the lack of specialized training in Anesthesia and Intensive Care in our country during the study period.

The median age was 5 years, with a range from two (2) months to 16 years (quartiles: 3 to 10 years). There was a male predominance (67.4%), resulting in a sex ratio of 2.07. Our results corroborate those reported in the literature [10-16]. This finding could be explained by the high volume of pediatric urological surgery in our study.

The main surgical indication was abdominal wall surgery (69.8%), followed by urological surgery (20.9%). Similar trends were observed in several Asian

and African series, notably Sleth *et al.*, in Bangladesh, Nze *et al.*, in Gabon, and Amengle *et al.*, in Cameroon [12-17]. However, Lahmouad *et al.*, found orthopedic surgery to be the main indication for locoregional anesthesia in pediatrics, followed by abdominal surgery in Morocco [11]. In France, anesthesia in otolaryngology represented the majority of procedures performed on children aged 1 to 4 years (64%) [3].

The children were classified as ASA 1 in 60.5% of cases. Our results are consistent with data from the African and international literature [7-16]. GA was combined with RA in 83.7% of the children who underwent surgery. Comparable proportions were found in several series, notably Bouh Kouesseu *et al.*, (81.1%) in Côte d'Ivoire, Essola *et al.*, (79.8%) in Gabon, and Akodjènou *et al.*, (70%) in Benin [10-18]. However, Nze *et al.*, and Boumas *et al.*, reported only 22.4% and 56.2%, respectively, of children operated on with GA combined with RA in Gabon [12-19]. Other authors in industrialized countries found higher rates, exceeding 95% [1-3]. In pediatric anesthesia, GA is the most frequently used technique, according to the literature [6-19]. RA combined with GA is strongly recommended in young children because it ensures the child's immobility, facilitating the administration of RA, as well as the child's comfort and safety, while optimizing peri- and postoperative analgesia.

In our study, caudal block (46.5%) was the most common RA technique, followed by wall blocks (30.2%). Our result is higher than that found in Benin (34.96%), Gabon (16%), and Togo (8%) [9-12]. This rate is significantly higher than that currently reported in France, where only 9% of children undergoing surgery receive caudal anesthesia, whereas this rate represented 50% of pediatric RA procedures in France in previous years [3]. In Morocco, caudal block accounted for less than 1% of LRA procedures [11]. Caudal block is the equivalent of epidural anesthesia (EDA) administered via the lower sacral route through the sacrococcygeal membrane and provides analgesia extending from the umbilicus to the feet [3]. In our series, all caudal anesthetics were performed using anatomical landmarks, a simple and effective technique for subumbilical surgeries.

In our series, the use of ultrasound was reported in 15 children (34.9%) who underwent abdominal wall and peripheral nerve blocks, including one with sentinel nerve stimulation. This result is low compared to that of Lahmouad *et al.*, in Morocco, where all pediatric RA procedures (100%) were performed under ultrasound guidance, with 25.3% using sentinel nerve stimulation [11]. Elombila *et al.*, at CHU-B reported a 45.5% rate of ultrasound-guided regional anesthesia of the upper limb in patients aged 12 years and older, 65% of whom received sentinel nerve stimulation [20]. In children, the use of ultrasound for RA has seen increasing interest in recent years [3, 4]. The main advantage in children is the ability to visualize the different anatomical structures and to know, with relative precision, the position of the needle tip; other advantages for peripheral nerve blocks include a faster onset of sensory and motor blocks, a longer duration of sensory block, a better block success rate, and a reduction in the volume of LA injected [3, 4]. The low usage in our series is explained by the availability of suitable equipment and the training of practitioners.

Bupivacaine (95.3%) was the most frequently used LA. Several studies, particularly from Africa, support our findings [9-21]. In industrialized countries, ropivacaine remains the most widely used LA for RA in general, and in pediatric surgery in particular [4]. This result could be explained by the availability and accessibility of bupivacaine on the local market, and its lower cost. However, the use of long-acting LAs (ropivacaine, levobupivacaine) is less cardiotoxic and provides analgesic relief of equivalent duration and intensity while reducing its side effects [3, 4].

We noted five cases of failure (11.6%). This result is comparable to that reported by Maikassoua *et al.*, (11.38%) in Niger in their study on the management of POP in children [21]. Our result is lower than that reported by Lahmouad *et al.*, (18.75%) in Morocco [11]. However, much lower rates had been reported in the literature. Indeed, Lanchon *et al.*, in France noted a 4.9% failure rate of RA in children who underwent surgery [4]. This difference could be explained by the limited use of ultrasound in our series and the medical team's inexperience in pediatric anesthesia, as no member had more than 6 months of specific training in pediatric anesthesia. Currently, the use of ultrasound-guided puncture has significantly improved the success rate, especially in cases of sacral bone malformations and in newborns where the dural sac is located approximately 1 cm from the puncture site [15].

CONCLUSION

Regional anesthesia is playing an increasingly important role in anesthetic management for pediatric surgery at the CHU-B and is part of the early postoperative rehabilitation strategy. However, it remains relatively uncommon in the CHU-B operating room, particularly in pediatric surgery. Primarily

combined with GA, RA in pediatrics is used in abdominal wall surgeries and is dominated by caudal anesthesia and abdominal wall blocks. Despite the limited use of ultrasound and a significant failure rate, the results observed in our study demonstrate the gradual development of pediatric RA in our practice. Improving the pediatric surgical facilities, enhancing training for the medical team, and expanding the use of ultrasound could contribute to optimizing the practice and safety of these techniques at CHU-B.

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Ethical Approval: Approval from the Ethics Committee was not required for the preparation of this work.

Author Contributions: All authors contributed to the revision of the topic, the design and acquisition of literature, and the analysis and interpretation of the literature. Finally, all authors read and approved the submitted manuscript.

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