Original Article

Regional anaesthesia in paediatric surgery: results of 2200 children

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Abstract

Objectives: To evaluate paediatric regional anaesthesia applications in 2200 children at Diyarbakir Children's Hosptial, Turkey.

Methods: This is a cross-sectional study done from January 2005 and October 2009. Paediatric regional anaesthesia applications in 2200 children were retrospectively analysed and included in this study. Demographic data, operation type, choice of regional anaesthesia, local anaesthetics, adjuvant drugs, side effects and complications were recorded.

Results: Mean age was 6±4 years and mean weight 21.1±10.7 kg. There were 317 (14.4%) girls, and 1883 (85.6%) boys. Of the 2200 cases studied, 2088 (94%) received caudal epidural block, 59 (3%) received spinal block, 34 (%2) had lumbar epidural block and 19 (1%) received dorsal penile nerve block

Conclusion: In paediatric anaesthetic practice, caudal epidural block is used widely. However, paediatric regional anaesthesia should be supported and developed further by obtaining essential materials and devices. Variety of both neuraxial blocks and peripheral nerve blocks under sedation/general anaesthesia should also be increased.

Keywords: Regional anaesthesia, Children, Devolopment, Caudal anaesthesia, Levobupivacaine, Turkey (JPMA 61:782; 2011).

Introduction

Paediatric regional anaesthesia (PRA) and relevant techniques have been increasingly used in the recent two decades. Although regional anaesthesia (PRA) is the only choice in particular cases, PRA techniques are today being used widely in combination with general anaesthesia. In addition to the central neuroaxial blocks, peripheral nerve blocks are also being increasingly used under high resolution USG by some paediatric anaesthesia specialists.[1-5] Safety and efficacy of PRA today have been supported by reliable international data.[6]

Caudal epidural block (CEB) is one of the most preferred PRA methods for infants and children who need operations under umbilicus level, for example urogenital, rectal, inguinal, lower extremity surgeries. CEB is relatively easy to perform and provides efficient analgesia for both intraoperative and postoperative period.[7] Although there are some studies[8-10] which report caudal anaesthesia as the sole anaesthetic method in particular cases for infants and children, caudal anaesthesia is still combined with general anaesthesia[11-13] for most of the cases.

In this retrospective study, we evaluated the features of regional anaesthetic techniques performed in combination with sedation and/or general anaesthesia for infants and children undergoing operations under the umbilical level.

Patients and Methods

The study was performed at the Diyarbakir Children's Hospital.Ordu, Turkey adapting a cross-sectional design. Approval was obtained from the hospital's ethics committee. In total, 10891 cases between January 2005 and October 2009, were screened from the anaesthesia charts and 2200 regional blocks were selected. The data recorded included, patient's age, sex, weight, local anaesthetics and adjuvant drugs, type of surgery, region where applied- inguinal, urogenital, rectal and abdomen, and the annual distribution of regional anaesthesia techniques used in operations. In addition, also recorded, were unsuccessful interventions and complications such as subcutaneous injection, intravascular injection, dural and venous puncture, blood aspiration and bleeding at injection site.

Two anaesthesiology specialists of the clinic performed all the regional blocks. The patients had no contraindications to regional block or history of allergy to local anaesthetics. No regional block was planned for patients who had bleeding-clotting disorders, local infections, sepsis, abnormal vertebral anatomy, and low body weights (<2 kg).

Children between 0-6 months were ordered 4-hours-duration nil-per-oral (NPO). Whereas children over 6 months were advised 6 hours nil-per-oral (NPO) for elective cases. Blood pressure, heart rate, end tidal CO2 pressure and peripheral oxygen saturations were continously monitored

and recorded for all patients during the entire procedure.

The intravenous anaesthetic agents including Propofol, Thiopenthal, Ketamin were used for children with iv lines opened in paediatric surgery clinics, whereas inhalational induction with sevoflurane was preferred for children without iv lines. Airway was secured with laryngeal mask or endotracheal tube after mask ventilation with 50% O2 -50% N2O mixtures. For maintenance of anaesthesia, sevoflurane or desflurane was utilised. Except abdominal operations, no neuromuscular blocker drugs were administered. According to the type of regional anaesthesia, including left lateral decubitus position for caudal anaesthesia, sitting position or right/left lateral position for lumbar interventions; the patients were positioned in appropriate postures. Needle insertion field was cleaned with 10% povidone iodine as needed. Under sterile conditions for caudal epidural block CEB, convenient sized needles were used for (20, 22, 25 gauge) regional block. 0.25% levobupivacain 0.5 mL/kg was administered for children between 0-6 months. Whereas 0.7 mL/kg levobupivacain was administered for children over 6 months. Postoperative analgesia was evaluated with mCHEOPS scale. After surgery, patients were monitored in recovery room until motor block was over.

Before induction, brachial and radial arteries were palpated; appropriate sized sleeves were used to measure systolic blood pressures. After regional block, level of blockage and systolic blood pressure were recorded every 5 minutes until end of the operation. Level of anaesthesia was determined by compressing skin with a clamp. Except patients who were given opioids as adjuvants, per oral feeding was started at 3 hours after surgery.

After general anaesthesia induction, lumbar epidural block (LEB) was performed at left lateral position under aseptic conditions. At the crossing point where the line between cristae iliaca crosses columna vertebralis, Tuohy tip epidural needle was inserted at L4-L5 or L5-S1 level. Epidural space was reached by pressure-loss technique. 0.7 mL/kg 0.25% levobupivacain injection was performed with caution.

After general anaesthesia induction, spinal block (SB) was performed at appropriate position under aseptic conditions. At the lumbar 4-5 level for children over 10 kg, 0.1 mL/kg 0.5% bupivacain was injected into subarachnoid space.

Dorsal penile nerve block (DPNB) after general anaesthesia, was performed at an appropriate (supine) position under aseptic conditions. A 25G needle was used and half of the 0.5 mL/kg 0.25% levobupivacain was injected into the left triangular area (the other half to the right) under superficial fascia (symphisis pubis, membraneous layer of superficial fascia and corpus cavernosum) bilaterally.

Data was entered in SPSS (Statistical Package for Social Sciences) for Windows 17.0 and evaluated. Descriptive statistical methods including frequency analysis, cross-table analysis, percentage, mean, standard deviation were calculated.

Results

Demographic features of children of the study population were as follows; 7 were newborns (0-28 days), average age was 6 ±4 years , mean weight was 21.1 ±10.7 Kg . Of the total number of children, 317 (14.4%) were females and 1883 (85.6%) were males.

Of the 2200 cases included in this study, 2088 (94%) received CEB, 59 (3%) SB, 34 (2%) LEB and 19 (1%) DPNB (Table-1). SB was performed under sedation, whereas other regional blocks under general anaesthesia.

Table-1: Distribution of patients, operations and regional blocks.

Operation type	DPNB	LEB	CEB	SB	Total
Circumcision	19	0	184	2	205 (%9.3)
Inguinal hernia	0	1	985	15	1001 (%45.5)
Hydrocoele	0	0	244	1	245 (%11.1)
Undescended testis	0	0	142	1	143 (%6.5)
Hypospadias*	0	0	155	2	157 (%7.1)
Appendectomy	0	24	302	37	363 (%16.5)
Umblical hernia	0	5	30	1	36 (1.6)
Invagination	0	3	6	0	9 (%0.4)
Anal process †	0	1	9	0	10 (%0.45)
Cordon cyst	0	0	31	0	31 (%1.4)
Total	19 (1%)	34 (2%)	2088 (94%)	59 (3%)	2200

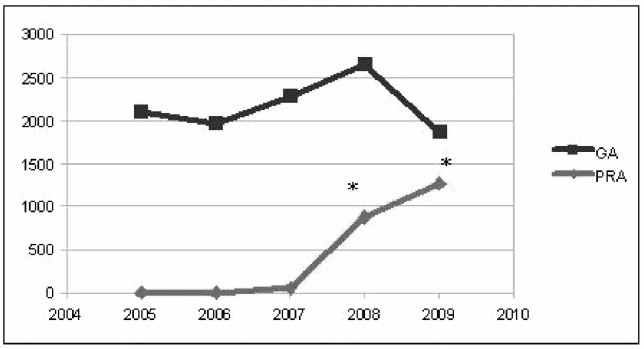
*Snodgrass repair, †polyp excision, psarp: posterior sagittal anorectoplasty, perianal fistula repair, imperforated anus:anoplasty.
DPNB= Dorsal Penile Nerve Block; LEB= Lumbar Epidural Block; CEB= Caudal Epidural block; SB= Spinal Block.

In all 1659 (75.4%) patients received levobupivacain as sole local anaesthetic and 464 (21.1%) had bupivacain as sole local anaesthesic. The number of patients who received levobupivacain plus morphine was 41, levobupivacain plus fentanyl was 7, levobupivacain plus adrenalin was 6 and only one had levobupivacain plus lidocain. On the contrary 16 patients received bupivacain plus morphine. Complications of levobupivacain plus morphine were as follows; 10 patients had nausea-vomiting, 2 had itching, 1 patient experienced longer-lasting motor block. None of the patients in levobupivacain plus morphine group had respiratory depression. Technical complications of regional blocks were as follows; 101 patients had dural puncture, subcutaneous infiltration, venous rupture, sacral hiatus anomalies during CEB. There was no complication encountered during LEB. Complications of DPNB group were as follows;1 patient had bleeding at injection site and another patient had venous rupture. We could not perform SB in 3 patients, and another

Table-2: Technical complications of regional blocks and number of patients.

Regional block	Complications	number of patients
CEB	Obesity	26
	Subcutaneous infiltration	31
	Dural puncture	4
	Venous rupture	40
LEB	—	—
DPNB	Blood aspiration	1
	Bleeding at injection site	1
SB	Unsuccessfull intervention	3

CEB= Caudal Epidural block; LEB= Lumbar Epidural Block; DPNB= Dorsal Penile Nerve Block; SB= Spinal Block.



GA: general anesthesia; PRA: pediatric regional anaesthesia. *Increasing of PRA numbers can be seen. Most (94%) of them are CEB.

Figure: Development of Paediatric regional anesthesia.

6 patients had insufficient level of sensorial block. Therefore general anaesthesia was inducted for these 9 patients. Three patients had hypotension during SB (Table-2).

PRA was performed for 2 patients in 2005; 1 patient in 2006; 53 patients in 2007; 867 patients in 2008 and 1277 patients in first 9 months of 2009 (Figure).

Discussion

Regional anaesthesia is being used more frequently in the paediatric population for relieving post-operative pain in children of all age groups undergoing sub-diaphragmatic surgeries. Our study on a large cohort of children, especially those older than 6 months, showed PRA to be a procedure with a high success rate and low incidence of adverse events.

If performed by experienced anaesthetists, caudal epidural block (CEB) is preferred as it is an easy, simple and safe anaesthetic technique. This is more so in infants and children where CEB is being preferred worldwide. CEB is easier to perform in younger children because there is low viscosity (lipid) tissue between epidural space and skin. Also, it is an effective method. CEB provides analgesia depending on the local anaesthetic type and duration of action with single caudal injection technique. In a study by Uguralp et al.[11] Bupivacain provided 2-4 hour long efficient analgesia with 2-2.5 mg/kg epidural doses and children required no additional analgesic in early postoperative period after inguinal surgeries. However, in our study, we preferred levobupivacain (not bupivacain); because of its lesser motor block, longer-lasting sensorial block, lesser central nervous system side effects and lesser cardio toxicity than bupivacain. In total, 464 (21.1%) of our patients received bupivacain, whereas 1659 (75.4%) received levobupivacain. Adrenaline is no longer preferred as an adjuvant in order to lengthen bupivacain's duration of action,[8] as it has adverse effects and is not suggested. However morphine, fentanyl, ketamine, neostigmine and clonidine are still preferred today as adjuvants.[2,14,15] In this study, we used mostly opioids as adjuvant (71 (80%) patients); with morphine being the most preferred adjuvant (41 (57%) patients).

Epidural anaesthesia significantly reduces blood loss in various major surgical interventions. Likewise, our 155 CEB patients had significantly lesser blood loss than patients subjected to general anaesthesia. Our 2 SB patients had also lesser blood loss than patients under sole general anaesthesia. Postoperatively, the most important reason which delays discharge of the patient is postoperative pain, nausea and vomiting. Therefore, efficient techniques with lesser side effects are being chosen. Especially during hypospadias surgery and Snodgrass repair, our 155 CEB patients had significantly lesser bleeding, better operational conditions, shorter operation time, lesser general anaesthetic need and faster recovery. Postoperative analgesia requirement was also minimal.

One of the most important topics under discussion is to imply regional anaesthetic techniques under general anaesthesia or not. Vast majority of the children will definitely need sedation and/or general anaesthesia during regional anaesthetic techniques. Therefore, the choice of the technique (general or regional) is very important. There might be two kinds of risks in combination of the general and regional anaesthetics. The epidemiological study of Lacroix[16] has been published. They reported that Paediatric Regional Anaesthesia techniques can also be implicated under general anaesthesia. In 1994; 5604 (95.4%) cases of total 5870 PRA cases were conducted under general anaesthesia. Whereas in 2006; 7601 (96.4%) cases of total 7883 PRA cases were conducted under general anaesthesia. Together with 50 paediatric anaesthetists, Krane et al[18] published an announcement in an international review. Those authors were all in consensus that regional blocks would be more safe, reliable and ethical in an anaesthetized child. An awake, constantly crying and excited child would definitely be less suitable for regional techniques.[6,17]

Brenner et al[12] administered propofol infusion during caudal block in infants, preterms and postconceptional 46

week old newborns. They encountered severe intraoperative respiratory complications, apnoea at the beginning of the procedure and at the postoperative periods. A total of 3.5% patients had apnoea and they had to be ventilated with a mask until spontaneous respiration commenced. Therefore, some authors recommend awake regional techniques for these age groups.[8,12] Gerber and Weiss[9] reported that there is no significant disadvantage of performing regional anaesthesia under light general anaesthesia than awake techniques (especially for preterm infants). However, overall consensus was declared; regional anaesthetic techniques under general anaesthesia should be preferred for children over 2 years age.

Bosenberg and Ivani[18] reported that children are different from adults, and they are not just smaller version of adults. Various parameters should be taken into consideration and therefore sedation and/or general anaesthesia must be absolutely provided during regional anaesthesia. Likewise, our conclusion is similar. We performed regional blocks (2141 patients) under general anaesthesia except SB (spinal blocks total 59 patients). Our SB patients received sedation. There was insufficient level of block in 3 of our SB patients therefore we inducted general anesthesia.

Giaufre et al[1] evaluated more than 24000 PRA cases in a one-year-survey study. They found that 89% of these cases were performed in combination with general anaesthesia/sedation. In addition, they reported that only 0.9/1000 complications were encountered, and there were no irreversible sequels or deaths. Furthermore, the same study suggested that peripheral nerve blocks are safer than neuroaxial blocks. Half of the complications resulted from inappropriate tools for children and insufficient devices. Likewise, there were no irreversible sequels or deaths in our study. However our complication rate was relatively high (4.8%). This was attributed to inappropriate tools and devices for children. Considering that only one surgical department exists in our hospital, peripheral blocks were limited with only DPNB. Penile surgeries like circumcision and phimosis were the only indications for DPNB. DPNB provides analgesia throughout the operation and postoperative period. We preferred DPNB in 19 circumcision cases and encountered 2 complications. PRA can be performed at all age groups in advanced medical centers. Furthermore, the rate of PRA with peripheral nerve blocks increased from 38% in 1996 to 66% in 2009.[2] Different surgical departments will start to perform various operations soon in our hospital; it is therefore anticipated that other regional anaesthetic interventions will also be started. PRA developed in our hospital in the last 3 years. Among these PRA techniques, CEB (94%) constitutes the vast majority of all the interventions. According to the national literature (in Turkey), application of PRA[7,19-21] techniques has a much slower progress and development compared to other developed countries.[1-3,6]

The ratio of PRA cases under general anaesthesia seem to be increasing day by day. With the use of ultrasonography (USG) it is decreased under general anaesthesia.[22-24] There are also some published reports in last 5 years; the success of block is increased, complications are less and total need of local anaesthetic in our country which show successful use of USG during PRA.[25,26]

In conclusion, paediatric epidural techniques are very similar to adult regional anaesthetic techniques. Today, caudal approach to the epidural space is widely used in paediatric surgery as it provides easy, efficient and safe analgesia. CEB is well-established in paediatric anaesthesia practice. Other neuraxial interventions and peripheral nerve blocks under sedation/general anaesthesia should also be used more frequently. PRA if augmented with new technologies can be designed to accomplish the block more accurately.

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