

EDITORIAL VIEW

Is regional anesthesia safe in children?

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ABSTRACT

There is a long history of using regional anesthesia in children. Even though, majority of the anesthesiologists still prefer general anesthesia (GA), the use of regional techniques is on a rise. Recent advances in regional block techniques and new equipments have enhanced the use of regional anesthesia in children and decreased complications. This brief review stresses that it is better not to prejudge and let us make sure that the regional anesthesia is in fact as safe as GA.

Key words: Regional anesthesia; Children; Complications

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Egyptians made use of regional anesthesia (RA) for circumcision during 2500 BC. After that there was a long gap of silence in the history, till Koller discovered in 1884 that cocaine can be used as a local anesthetic.¹ Later, Corning injected it into the epidural space in 1885² and August Bier subsequently followed suit in 1898 by using cocaine as a spinal anesthetic.³ He examined RA in children in 1899. Bainbridge also reported spinal anesthesia in children. The true credit of peripheral nerve block discovery is given to William Stewart Halstead and his assistant, Richard John Hall. These two surgeons described how they blocked various sensory nerves in themselves.⁴ Urologists described the usage of caudal analgesia in children. In the last couple of decades many researchers have described the need for analgesia in children. RA provides profound physiological states with least physiological perturbations. It is an effective alternative to systemic analgesics; often more relevant when systemic opiates are contraindicated (risk of opiate-induced respiratory depression or tolerance to analgesic effects of opiates in chronic pain). It is more effective against visceral pain than systemic opiates (e.g., bladder spasms following genitourinary surgery)^{5,6} and its use in children is about to increase.

Although in children it is usually used along with general anesthesia (GA), as a help in GA or as an effective postoperative analgesia technique, it can be applied as a substitute to GA when anatomic or physiologic changes make GA difficult or even dangerous. RA has been used as the sole technique for ex-premature surgery and

inguinal hernia repair, when spinal anesthesia or caudal blocks were used, and it has been reported to result in fewer episodes of apnea, hypoxemia, and bradycardia in this population. Infants and neonates run a rather higher risk of complications, and these age groups must stay in the hands of experienced doctors.⁶

RA remains the only option available in painful or invasive procedures when GA is not possible;⁷ including in children with neuromuscular, metabolic, cardiac or chronic lung disease, children at risk of malignant hyperthermia or in emergency situations when there is a high risk of aspiration. Concurrent use of RA and GA expose children to a lower risk of intravenous and inhalation drugs, because it will give the benefit of a lower anesthetic depth and less need for muscle relaxants, and there would be more comfortable emergence, faster wake-up times, sooner recovery as well as earlier return of appetite and gut function. It produces better operating conditions and decreases surgical blood loss (e.g. infraorbital nerve block in infants undergoing cleft lip repair or children undergoing tonsillectomy or use of caudal anesthesia in repair of hypospadias).⁶

Early recovery in children means early awakening after GA, early oral intake after operation, and no respiratory difficulties even after prolonged surgery. It is worthy for parents and children alike, and helps reduce or even eliminate hospital stay. Epidural catheterization for postoperative analgesia greatly reduces the need of NSAIDs or opioids after operation and puts the minds of the parent's as well as the staff at ease.⁸

Is regional anesthesia safe in children?

The use of RA in healthy children has to be treated with respect; risks and benefits must be carefully weighed and all precautions must be taken to avoid possible complications. First outcomes of the French-Language Society of Pediatric Anesthesiologists (ADARPEF) demonstrated that RA in children is safe and it is worth using due to its low risk, although in some children some techniques may be associated with a higher risk.⁹

RA is not always an easy game and some centers may have their limitations; anesthesia administrators may lack expertise in pediatric regional techniques; pediatric needles and catheters might not be available; and it might be that the GA is the routine, and the anesthesiologists and the staff feel more comfortable with it. Even some surgeons may also object to RA due to reasons best known to them. In anesthesiologists view, GA is quick and there is no possibility of neurological complications. Any adverse neurological event may easily be claimed to be a consequence of a regional technique.¹⁰

Caudal epidural anesthesia is the most current technique of RA in children. This technique is used in operative procedures on lower limbs and lower part of the abdomen. In upper extremity surgery other techniques, e.g. brachial plexus block or selective nerve blocks may be needed. In fact, in one-sided extremity operations, the use of peripheral nerve blocks will decrease the incidence of side effects due to neuraxial block like caudal epidural. There are many types of peripheral blocks that could very conveniently be used in children, e.g. sciatic nerve block, femoral nerve block, fascia iliaca block, popliteal nerve block, saphenous nerve block, brachial plexus blocks (all different approaches), rectus sheath nerve block, ilio-inguinal/ilio-hypogastric nerve block, transversus abdominus plane (TAP) block, paravertebral block, intrapleural infusion, and intercostal nerve blocks etc.⁵ To be successful, the anesthesiologist must be well familiar with the anatomy of the relevant nerves and the pharmacology of the drugs used.

Giafre and his colleagues explained the procedural feasibility of peripheral block and claimed that it is free of side effects.¹¹ French-Language Society of Pediatric Anesthesiologists recommended strongly the usage of peripheral blocks and in selected cases it is recommended to be a good alternative to central nerve blocks.⁸ Although neuraxial blocks are very effective, but their side effects like urine retention, bilateral numbness and movement disability is quite unpleasant for the children. With the use of hydrophilic opiates like morphine and hydromorphone, side effects including itching, nausea, vomiting and respiratory depression may be cumbersome.

The use of ultrasound guidance (USG) has resulted in more accurate and effective blocks by allowing the block administrator to know clearly the anatomic location of the nerves and the adjacent muscles and the fascial

layers as well as visualizing the block needles path and the location of the needle tip while injecting.⁹ Recent advances in regional block techniques and introduction of new equipment (fine block needles, catheters and nerve stimulators) have enhanced the use of RA in children. Considering the simplicity of the use of USG and it being less invasive, successful blocks are now more probable, thus decreasing the side effects and improving the use of regional anesthesia in children. Safe dosage of the used RA drugs is a restrictive factor in some children. With the help of USG initiating a block has become quicker and the dosage of drugs have decreased.⁷

Usage of electrical stimulation and visualization of segmented catheter location under USG by has reduced the failure rate of the epidural analgesia from caudal until thoracic levels.¹² USG can confirm the needle depth while doing the loss of resistance technique.¹³ However, lack of expert US guided regional anesthesia (UGRA) teaching is the major reason that has caused pediatric UGRA to lag behind adult UGRA. Integration of USG imaging, target site, and needling skills are all important for safely performing the art of UGRA.¹⁴

Though most of the anesthesia techniques are well-documented in the literature, the implementation of these techniques into routine clinical practice is still lacking. Less experienced anesthesiologists may be reluctant to perform difficult blocks due to the associated risks, and the fear of medicolegal aspects. Continuous education and opportunities to learn practical aspects of the block techniques will help eliminate the fears and the taboos.

The Pediatric Regional Anesthesia Network (PRAN) was formed to collect data on all regional anesthetics performed by anesthesiologists in USA and all of the intraoperative and postoperative complications were recorded. Interestingly, out of 14,917 regional blocks that were performed on 13,725 patients, 95% were done under GA and 11,000 procedures consisted of a single anesthetic injection. The data showed that single injection blocks were safer than continuous blocks. The most frequently used single injection was caudal block (40%) and peripheral nerve blocks were used in 35%. 83% of upper extremity and 69% of lower extremity blocks were done by USG. There were no cases of death or serious complications. The most common complication in single injection procedures was block failure (2%) and in continuous block kinking or dislodgement of catheter with 9% of block failure. Neurological events were noted only in patients with lumbar or thoracic catheters. Regional networks like PRAN. may be useful for collection of data and thus improve the quality of procedures.¹⁵ PRAN registry suggests that peripheral nerve block and plexus blocks and infusions are safer than epidural analgesia in anesthetized kids. It is recommended to decreased

complications by using epinephrine for test dose only, preventing and controlling hypotension promptly, ruling out the placement of epidural catheter in subarachnoid space if severe hypotension occurs, thinking about intraneural injury if severe hypertension occurs, using saline instead of air for loss of resistance technique, doing thoracic injection under GA by nerve stimulation or fluoroscopy or USG, using dilute local anesthetic solutions and in dense sensory or motor block stopping infusion and observing the patient, if no regression occurred after 3 hours doing emergent spine magnetic resonance imaging(

MRI). Remember, the use of high dose of corticosteroids put the child on risk of epidural lipomatosis.¹⁶ Risk of serious complication of epidurals in infants and children was 1;1000 in a prospective survey on 10000 blocks done during 5 years by the Association of Pediatric Anesthetists of Great Britain & Ireland. This study supported use of continuous epidural anesthesia.¹⁷ A recent study by Valeria Mossetti indicated it is better not to prejudge and make sure that RA is as safe as GA.¹⁸ The time only will tell about what the future holds for the pediatric regional analgesia, but it is always better to be on the safe side.

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“The library is not a shrine for the worship of books. It is not a temple where literary incense must be burned or where one’s devotion to the bound book is expressed in ritual. A library, to modify the famous metaphor of Socrates, should be the delivery room for the birth of ideas - a place where history comes to life.”

- Norman COUSINS (1915-1990)