

# Epidural anesthesia for pediatric surgery in a university hospital in Saudi Arabia

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## ABSTRACT

**الأهداف:** تقديم حالات التخدير خارج الجافية في الأطفال بأمان وفعالية في مستشفى الملك خالد الجامعي.

**الطريقة:** أُجري هذا البحث في مستشفى الملك خالد الجامعي - الرياض - المملكة العربية السعودية، خلال الفترة ما بين أبريل 2007م وحتى ديسمبر 2007م. تم تحليل عمر المرضى، نوع العملية، مستوى التخدير تحت الجافية، طريقة التخدير، جرعة المادة المخدرة وجودتها.

**النتائج:** أظهرت النتائج أن 38 حالة تخدير تحت الجافية للأطفال بمتوسط عمر 3 سنوات  $\pm$  7 أشهر تمت تحت تخدير كامل لعمليات مختلفة. احتاج جميع المرضى إلى جرعات قليلة أو بدون جرعة من المسكنات المخدرة الأخرى. ولم يكن هناك أي مضاعفات أثناء العمليات أو بعدها.

**خاتمة:** يمكن اعتبار التخدير تحت الجافية للأطفال آمن وفعال أثناء العمليات الجراحية وأيضاً في تخفيف الألم بعدها.

**Objective:** To present the safety and efficacy of epidural blockade in children.

**Methods:** A respective review was carried out at the King Khalid University Hospital (KKUH), Riyadh, Saudi Arabia from April to December 2007. The patient age, type of surgery, epidural level block, technique, local anesthetic dose, and quality of epidural block were analyzed.

**Results:** Thirty-eight epidural blockades in children with a mean age of 3 years  $\pm$  7 months were performed under general anesthesia for different procedures. All patients had minimal, or no intravenous narcotic and exhibited hemodynamic stability. There were no intraoperative or postoperative complications.

**Conclusion:** Epidural anesthesia in children is safe and effective intraoperatively, as well as, for postoperative pain control.

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The popularity of epidural anesthesia as a supplement to general anesthesia in children has grown beyond the simple advantage, afforded by the avoidance of general anesthesia. The added benefits include a decrease in the intraoperative requirement for general anesthetic, reduction of parenteral opioids so as to limit the incidence of respiratory depression, and a reduction of stress hormone responses.<sup>1,2</sup> Its limited use in our institution is related to lack of experience, especially in the younger age group, and the common misconception, that it is not safe to use on an anesthetized child. This article presents our preliminary experience with the safety and efficacy of epidural blockade in children less than 6 years of age.

**Methods.** During the period of 9 months from April to December 2007, data were collected at the King Khalid University Hospital (KKUH), Riyadh, Kingdom of Saudi Arabia, regarding patient demographics, the type of surgery, and epidural level block performed, block technique, local anesthetic dose, and the quality of the regional anesthetic cases. Thirty-eight children (American Society of Anesthesiologists, grade I and II), aged one month to 5 years were scheduled for elective lower abdominal and lower limbs surgery were enrolled. We excluded children with history of allergy to local

anesthetic agents, bleeding disorders, infection at site of injection and emergency cases in this study. Patients were evaluated intraoperatively, in the post-anesthesia care unit (PACU), and on the first postoperative day, by either personal interview or telephone interview. Analysis of the electronic data was performed on the overall efficacy and safety profile in the pediatric population for epidural blockade under general anesthesia. The local Research Ethics Committee at the College of Medicine approved the study. The parents of these children gave written informed consent.

Data was presented as mean  $\pm$  sd. Data was analyzed using a statistical software package (Graphpad, version 13 for windows, San Diego, California, USA).

**Results.** During the study period, 38 epidural blockades in children aged one month-5 years [average 3 years  $\pm$  7 months] were performed at KCUH, excluding entire spinal-caudal blocks. Of these 38 blocks, 10 were extremity blocks performed primarily for general surgery, 16 were performed for orthopedic procedures, and 12 were blocks for urology surgery. The most commonly performed epidural blockade was at lumbar L4-5 (23 blocks), and caudal epidural blockade was performed in only 8 blocks. An air technique was used in all of the blocks using 19 gauge epidural kits, starting with bupivacaine 0.25% = 1cc / kg slowly and incrementally, and continuing at a bupivacaine concentration of 0.1% + fentanyl 2 mic/ml. A satisfactory epidural blockade was defined as one requiring no, or minimal intravenous narcotic during the procedure and hemodynamic stability. Nine patients had continuous infusion at the hospital ward, and were followed-up by the acute pain service. None of the 38 blocks exhibited any intra-operative or postoperative complications.

**Discussion.** The development and progress of pediatric regional blockade have been slow for many reasons, particularly the potential risk of neural injury in anesthetized children. Other potential complications include intravascular injection, cardiac arrest, and seizures. The anesthesia literature safety data on pediatric central neuroaxial blocks had generally concluded that, overall, these techniques have extremely small complication rates.<sup>3,4</sup> The French Society of Pediatric Anesthesiologists in a one year study of 24,409 regional blocks in children revealed a complication rate of 1.5 per 1000 in 60% of the children receiving central blocks, and 0 per 1000 in 38% of the children who received peripheral nerve blocks.<sup>3</sup> Certain inherent features of pediatric anatomy and physiology add an additional level of safety to regional anesthesia. These features include the absence of a hypotensive response from

sympathectomy produced by the local anesthetic, which is often seen in adults, but only rarely in children. This effect may be a result of either the immature sympathetic nervous system in children younger than 5-8 years, or a result of the relatively small intravascular volume in the lower extremities, thereby limiting venous pooling.<sup>5</sup>

When performing regional techniques in pediatric patients, one should keep safety in mind, and be aware of the differences between adults and children with regard to anatomy, pharmacology, physiology, and appropriate dosing. Perhaps the most important difference between adult and pediatric pharmacology, is the increased risk of toxicity when using local anesthetic in the younger age groups. Infants younger than 2 months are particularly at risk because of immature hepatic metabolism, and decreased plasma proteins such as albumin and  $\alpha$ -1-acid glycoprotein.<sup>6</sup> All children may be at increased risk of local anesthetic toxicity because of the rapid increase in blood levels of local anesthetic, that may occur as a result of the relatively higher cardiac output and regional blood flow that are present in this age group.<sup>7,8</sup> Although the routine use of epinephrine for test dosing is controversial because of its lack of total reliability, the addition of epinephrine to the local anesthetic solution may be used to decrease the rapid vascular uptake that can occur at the site of injection. This effect was illustrated in a study that compared plain bupivacaine with bupivacaine and epinephrine 1:200,000 (5  $\mu$ g/mL) for a fascia iliac compartment block.<sup>9</sup> Furthermore, since the vast majority of children receive regional blocks while under general anesthesia, they are thus unable to describe the prodrome that occurs from intravascular injection of local anesthetic. Epinephrine 1:200,000 may aid in detecting the inadvertent intravascular delivery of local anesthetic before neurological or cardiac sequelae.<sup>10</sup> Whether or not epinephrine is added to the local anesthetic, it is important to remember that there is no good substitute for meticulous attention to the electrocardiogram for ST-T wave changes and slow, incremental dosing.<sup>11</sup> With proper attention paid to anatomy and pharmacology, and the appropriate equipment, Pediatric Anesthesiologists are able to efficiently administer safe and effective regional blocks. A limitation of this study is the number of pediatric patient under going for surgery is less than 20% of total patient at KCUH and need relatively long periods more than three years to collect large sample. In addition, there are a few anesthesiologist who are practicing epidural block in children. From this study, we found the epidural block has a lot of advantages as reducing anesthesia requirement, intravenous opioids and accelerate recovery.

In conclusion, regional anesthesia is commonly administered in adult patients, there remains some hesitation in applying these practices to children. With improvement in technique and refinement in equipment, these valuable treatments can now be applied to even the youngest patients. As with adult patients, regional anesthetic techniques and peripheral nerve blockade can be used instead of general anesthesia, as an adjunct to general anesthesia as a means of controlling the surgical stress response and avoiding the use of IV opioids, or to simply provide postoperative analgesia. A few institutions in the world offer formal pediatric regional anesthesia training. The goal of our pediatric anesthesia fellowship (PAF) program was to encourage regional anesthesia (central neuroaxial and peripheral nerve block). The intent of PAF is to improve the pediatric anesthesia service, particularly in terms of perioperative pain control, as well as to conduct clinical trials. Further studies in large number of patients are required in the future to provide details on how to optimize treatment.

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