

# Evaluation of caudal anesthesia performed in conscious infants for lower abdominal surgeries

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## ABSTRACT

**الأهداف:** يمكن استعمال التخدير الموضعي بدلاً عن التخدير العام عندما تزيد تغييرات ما قبل الظهور التشريحي أو الفسيولوجي من خطورة التخدير العام. استخدمنا جرعة مفردة من التخدير الذيلي فوق الأم الجافية بدون التخدير العام لجميع الأطفال الرضع المرشحين لإجراء عملية في الجزء السفلي من البطن وعند خطورة عالية من حدوث انقطاع النفس بعد العملية الجراحية. أجرينا دراسة مراقبة لممارستنا وذلك لتقييم تحمل وكفاءة هذه التقنية.

**الطريقة:** أعطي 35 طفل رضيع تراوحت أعمارهم ما بين 2-13 أسبوع ومتوسط حملهم 35 أسبوعاً، أعطوا جرعة مفردة من التخدير الذيلي فوق الأم الجافية (عقار بوبيفاسين) بدون تسكين. تمت معالجة مجموعة الأطفال بمستشفى تيريز العام للأطفال في الفترة ما بين ديسمبر إلى مارس عام 2007م. قمنا بتقييم تخدير الأطفال (نقاط بيكلر للألم) ومتغيرات ضغط الدم ومعدل سرعة القلب وانقطاع النفس خلال 24 ساعة بعد العملية الجراحية. تمت مقارنة كل مريض مع نفسه بواسطة الاختبار.

**النتائج:** تعرضوا المرضى لألم لذلك تم إعطائهم التخدير العام. كان هنالك 23 حالة من بين 35 حالة معدل القلب و20 حالة ضغط الدم الانقباضي و17 حالة ضغط الدم الانبساطي لم يتعرضوا الى تغييرات ملحوظة. لم يصب أي من المرضى بانقطاع النفس. استدعت حالة أربعة مرضى إلى المساعدة التخديرية لساعتين ومريضين لثلاث ساعات ونصف وتسعة مرضى لأربع ساعات بعد العملية الجراحية.

**خاتمة:** تظهر الدراسة أن جرعة مفردة من التخدير الذيلي يمكن استخدامها بنجاح في الأطفال اليقظين لجراحة الجزء السفلي من البطن البسيطة كما يمكنها أن تخفف من الألم بعد العملية الجراحية لهؤلاء الأطفال الرضع.

**Objectives:** To assess the tolerance and efficiency of caudal anesthesia in infants undergoing lower abdominal surgery.

**Methods:** Thirty-five infants aged 2-13 weeks with a median gestational age of 35 weeks, were given single dose caudal epidural anesthesia (with bupivacaine) without sedation. This group of babies was treated at the Tabriz Children General Hospital between December 2006 and

March 2007. We evaluated patients> analgesia (Beclere pain scale), blood pressure, heart rate changes, and apnea during the 24-hour postoperative period. Each patient was self-compared by Run test.

**Results:** Three patients had pain requiring induction of general anesthesia. Out of 35 cases, 23 patients had non-significant changes in heart rate, 20 patients had non-significant changes in systolic blood pressure, and 17 patients had non-significant changes in diastolic blood pressure. None of the patients experienced apnea. Four patients required postoperative analgesic support for 2 hours, 2 patients for 3.5 hours, and 9 patients for 4 hours.

**Conclusion:** The present study shows that single dose caudal block can be used successfully in conscious babies for minor lower abdominal surgery, and may also facilitate postoperative pain management.

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Young children lack the ability to communicate their analgesic needs and are unable to use a patient-controlled analgesic device, therefore, regional anesthetic techniques are preferred for relief of postoperative pain. These techniques can also be used instead of general anesthesia when preexisting anatomic or physiologic alterations increase the risks of general anesthesia.<sup>1</sup> The most popular regional anesthetic technique in pediatric patients is the caudal epidural block.<sup>1,2</sup> Infants and neonates, especially ex premature infants, are at risk of apnea after surgery performed under general anesthesia. One of the most common surgeries in these infants are inguinal hernias and due to a high risk of bowel

incarceration, early surgical repair is indicated.<sup>3</sup> In our center, we use single dose caudal epidural without general anesthesia for all neonates and infants undergoing lower abdominal surgery at high risk of postoperative apnea. We performed a prospective observational study of our practice, to assess the tolerance, and the efficiency of this technique.

**Methods.** The Tabriz Medical School Ethics Committee approved this study and informed written consent was obtained from each participants parents. This study was conducted in the Children General Hospital (CGH), which is the main university children's hospital for the Azerbaijan region in Tabriz, Iran. Thirty-five infants, who were given single dose caudal epidural anesthesia without sedation for inguinal hernia repair or circumcision from December 2006 to March 2007, were prospectively studied. Infants' age at presentation ranged between 2-13 weeks with a median gestational age of 35 weeks. They were all candidates for unilateral or bilateral inguinal hernia repair or circumcision. No premedication was given. Feeding ceased 4 hours before surgery. An intravenous cannula was placed. Children received 2.5% Dextrose in Ringer solution at a rate of 15 ml/kg/h for the first hour and then 4 ml/kg/h until feeding was restarted. Intraoperative monitoring consisted of electrocardiogram, pulse oximeter, and non-invasive blood pressure. A trained assistant held the infants in the left lateral position with the hips flexed. After preparing and dropping, caudal puncture was performed with a 22-gauge needle. An aspiration test was then used to detect blood or cerebrospinal fluid, one ml/kg of bupivacaine 0.25% was given. The babies had a pacifier during surgery to keep them calm. Prematurity was defined as newborns delivered after the 20th completed week of gestation and before full term with a weight of 500-2499 gm at birth. Bradycardia was defined as a heart rate of less than 100 beat/min. Desaturation was defined as a SpO<sub>2</sub> below 90%. Prolonged apnea was defined as a respiratory pause with bradycardia, requiring stimulation or ventilation with face mask. Blocks were judged adequate (15-20 minute after block) by lack of response to a painful stimulus as demonstrated by the absence of movement and crying following pinching of the skin in the surgical field. The Beclere scale for pain assessment in neonates was used to evaluate the efficiency of analgesia during and after surgery.<sup>4</sup> This scale has 5 items, scored from 0-3, based on facial activity, movement, and posture of the body, quality of sleep, relationship with the examiner, and efficiency of measures of comforting, the Beclere scale suggests, that a treatment for pain is administered when the score is higher than 10. We evaluated analgesia, blood pressure, heart rate changes, and apnea during the 24 postoperative hours. Data are expressed as mean  $\pm$  SD. Run test was used to evaluate any changes in heart rate, systolic blood pressure, and diastolic blood pressure, and each patient was self-compared. For each

patient the ongoing heart rate, systolic and diastolic blood pressure was analyzed. There are 5 types of changes: 1. Random (non-significant). 2. Clustering. 3. Trends. 4. Mixture. 5. Oscillation.

Minitab software, run test, and for *p*-value calculation one sample proportion test was used.

**Results.** Characteristics of the patient population are shown in Table 1. Puncture was successful at the first attempt in 29 patients, due to technical difficulties, or blood during the aspiration test, 4 infants required 2 attempts, and 2 required 3. Two patients had pain so general anesthesia was induced, one patient had pain during peritoneal traction and was intubated and general anesthesia induced. The mean duration of caudal anesthesia was sufficient in all successful blocks. None of the patients experienced apnea. From 35 cases, 23 had random changes in heart rate, and 12 had non-random changes (*p*=0.240). In 75% of cases, the heart rate changes were random (CI = 48-81%), 20 cases had random changes in systolic blood pressure, and 15 had non-random changes. In 75% of cases, the systolic blood pressure changes were random (CI 44-79%). Seventeen cases had random changes in diastolic blood pressure, and 18 cases had non-random changes in diastolic blood pressure. In 70% of cases, the diastolic blood pressure changes were random (CI=35-71%). When comparing heart rate, systolic blood pressure, diastolic blood pressure, 20 minutes after caudal (before incision) with 25 minutes after caudal (just after incision), there was no significant change in heart rate (*p*=0.57), diastolic blood pressure (*p*=0.216), and systolic blood pressure (*p*=0.06). Four patients 2 hours, 2 patients 3.5 hours, and 9 patients 4 hours postoperatively required analgesic support. Feeding started immediately after surgery, and patients were discharged from the hospital on the same day on rectal Acetaminophen 15 mg/kg every 6 hours for up to 48 hours.

**Discussion.** The present study shows that single dose caudal anesthesia can be used successfully in conscious babies for minor lower abdominal surgery, and also may facilitate post operative pain management of those

**Table 1 -** Characteristics of the patient population at the time of surgery. Results are expressed as mean $\pm$ SD.

Characteristics	Values
Age (weeks)	7.71 $\pm$ 5.01
Gestational age (weeks)	36 $\pm$ 3.20
Body weight (g)	4416.67 $\pm$ 1048.41
<i>Type of surgery</i>	
Hernia unilateral/bilateral	21
Circumcision	6
Others	7
Duration of surgery (min)	29.12 $\pm$ 9.88
Duration of analgesia (min)	210 $\pm$ 20.03

infants. Former premature infants of less than 50-60 week post conceptional age are at risk of life-threatening apnea following general anesthesia. The high incidence of life threatening respiratory complication after general anesthesia decreased after awake regional anesthesia. There are reports of awake spinal anesthesia in conscious ex-premature infants for inguinal herniotomy, however, caudal anesthesia for these patients is less popular.<sup>5</sup> Caudal block with Bupivacaine can provide adequate analgesia with minimal motor blockade for these procedures during and after operation in infants.<sup>6</sup>

We report very low pain scores during surgery, confirming the efficiency of the procedure. It seems that awake caudal anesthesia is well tolerated by infants, however, the patience and technical skill of the surgeon and anesthesiologist is very important. Eleven infants required more than one caudal puncture. This could be related to movements of the infants. Single dose caudal local anesthesia has a limited duration of action, but in our cases all of the successful blocks were sufficient for the duration of surgery. Only 3 patients from 35 required general anesthesia.

Single shot caudal anesthesia has also been used in ex-premature infants as the sole anesthetic to decrease the incidence of postoperative apnea and to avoid the use of general anesthesia and narcotics.<sup>7</sup> A previous study,<sup>8</sup> indicated that caudal anesthesia suppresses the metabolic and endocrine responses to stress associated with lower abdominal, and genitourinary surgery in children.<sup>8</sup> In our study, 20/35 had random systolic blood pressure changes, 17/35 had random diastolic blood pressure changes, and 23/35 had random heart rate changes (non significant). So there was no hemodynamic or reflex response to the surgical procedures in any of the successful blocks. Post operatively the babies seemed to be comfortable, sleeping most of the time after feeding was started (immediately after surgery). Only 6 patients required analgesic support for up to 4 hours postoperatively. Physiologic immaturity of

respiratory musculature, and the central respiratory control center leads to an increased risk of apnea and respiratory complications following general anesthesia in neonates.<sup>9</sup>

In summary, caudal epidural block can be performed in conscious high-risk infants, and may be recommended for anesthetic management of those infants. The main advantage of the procedure is to facilitate the management of the postoperative period, without compromising the baby's comfort intra operatively.

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