

# The role of ultrasound guidance in pediatric caudal block

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## ABSTRACT

**الأهداف:** مقارنة الفاصل الزمني للإجراءات، والمضاعفات المحتملة، ومستويات الألم بعد العمليات الجراحية، والمسكنتات الإضافية، واقتئان المرضى بالموجات فوق الصوتية الموجهة وتطبيقات الإحصار العجزي القياسي.

**الطريقة:** أجريت هذه الدراسة بأثر رجعي في مستشفى جامعة جلال بايار، مانيسا، تركيا، خلال الفترة ما بين يناير وديسمبر 2014م، وشملت 78 طفلاً مريضاً. وطبق الإحصار العجزي على مجموعتين مختلفتين. كانت المجموعة الأولى تستخدم الموجات فوق الصوتية الموجهة، والأخرى تستخدم الطريقة المعيارية.

**النتائج:** كان الفاصل الزمني أقصر بشكل ملحوظ في مجموعة التطبيق المعيارية مقارنة مع مجموعة الموجات فوق الصوتية الموجهة ( $p=0.020$ ). وكانت قيم Wong-Baker FACES Pain Rating Scale التي تم الحصول عليها عند الدقة التسعين أقل إحصائياً في مجموعة التطبيق المعياري مقارنة مع مجموعة الموجات فوق الصوتية الموجهة ( $p=0.035$ ). لم يوجد أي فارق إحصائي كبير في المعاير بين المجموعتين. ولا ينبغي على أطباء التخدير بطبع الأطفال اعتبار الفاصل الزمني الأقصر للعملية لدى مجموعة التطبيق المعياري علامة مميزة وذلك لأن الاختلاف الزمني كان قصيراً كما الثواني.

**الخاتمة:** إن توجيه الموجات فوق الصوتية لتطبيقات الإحصار العجزي لا تزيد ولا تنقص نجاح العلاج. مع ذلك، يجب أن تكون هنالك حاجة إلى توجيه الموجات فوق الصوتية في الحالات التي يكون فيها كشف التشريح العجزي أمر صعب، خاصة من قبل الحفقان.

**Objectives:** To compare the time interval of the procedure, possible complications, post-operative pain levels, additional analgesics, and nurse satisfaction in ultrasonography-guided and standard caudal block applications.

**Methods:** This retrospective study was conducted in Celal Bayar University Hospital, Manisa, Turkey, between January and December 2014, included 78 pediatric patients. Caudal block was applied to 2 different groups; one with ultrasound guide, and the other using the standard method.

**Results:** The time interval of the procedure was significantly shorter in the standard application group compared with ultrasound-guided group ( $p=0.020$ ). Wong-Baker FACES Pain Rating Scale values obtained at the 90th minute was statistically lower in the standard application group compared with ultrasound-guided group ( $p=0.035$ ). No statistically significant difference was found on the other parameters between the 2 groups. The shorter time interval of the procedure at standard application group should not be considered as a distinctive mark by the pediatric anesthesiologists, because this time difference was as short as seconds.

**Conclusion:** Ultrasound guidance for caudal block applications would neither increase nor decrease the success of the treatment. However, ultrasound guidance should be needed in cases where the detection of sacral anatomy is difficult, especially by palpations.

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Caudal block is a common method used for intraoperative and post-operative pain relief in pediatric urologic and lower umbilical abdominal surgeries.<sup>1,2</sup> Caudal block use increased in pediatric cases due to its contributions to elective anesthesia, easy application, and low complication rate.<sup>3,4</sup> Furthermore, ultrasonography-guided caudal block becomes popular among pediatric anesthesiologists for promoting safety measures of the technique and lowering the complication rates.<sup>5,6</sup> In this study, we aimed to compare the duration

of the procedure and convenience for application of the block, level of post-operative analgesia, need of an additional dose of analgesics, and complication rates in ultrasonography-guided and standard caudal block applications. Additionally, we asked the follow-up nurses to assess the pediatric patients' condition in terms of pain control.

**Methods.** This retrospective study was conducted in Celal Bayar University Hospital, Manisa, Turkey between January and December 2014. The study included 78 pediatric cases between the ages of 2 and 10, who underwent urologic surgery, after the approval of the university ethics committee, and written informed consent obtained from all parents. Cases that received routine midazolam (0.5 mg/kg oral) sedation were administered atropine (15 µg/kg) and fentanyl (2 µg/kg) after obtaining vascular access, following induction of anesthesia was accomplished with mask ventilation using 8% sevoflurane in 50/50% oxygen/nitrogen oxide followed by laryngeal mask airway placement. The rate of inhaled gases during anesthesia maintenance was adjusted as follows: oxygen/nitrogen oxide 50/50% with sevoflurane value of 1-1.5 vol%. When the surgery ended, patients were rotated to left lateral recumbent position. After iodine containing skin preparation and draping, caudal block was applied to 2 different groups; one with ultrasound guide (7.5 MHz Linear prop, Esaote My Lab 30cv, Florence, Italy), and the other using the standard method, all patients received 0.3 ml/kg local anesthetics (0.5% bupivacaine + 2% prilocaine). A senior pediatric anesthetist experienced in ultrasound-guided regional anesthesia performed all applications.

In both groups, the time interval of the procedure (time between the needle's contact with and removal from the skin) was recorded. Dose of local anesthetics and possible complications resulting from caudal block were also recorded. Patients were taken to post-anesthesia care unit after waking up. Pain levels at the 30th, 60th, 180th, and 360th minutes of post-operative period were assessed using Wong-Baker FACES Pain Rating Scale (WBPRS) questionnaire.<sup>7</sup> The patients were taken to the pediatric surgery ward, where pain condition and nurse satisfaction were assessed using a 4-article scale, namely; reporting the condition as "perfect", "good", "moderate", and "bad". A pediatric

surgery nurse who was blinded to the study groups recorded the observations during this period. The possible need (WBPRS score 4 and more than 4) for an additional dose of analgesics (paracetamol 15 mg/kg oral) in post-operative period was also compared.

**Statistical analysis.** Statistical data were analyzed using Statistical Package for Social Sciences version 15 (SPSS Inc., Chicago, IL, USA), independent samples were analyzed by T-test and Chi-square test.  $P<0.05$  was considered statistically significant.

**Results.** Evaluation of the demographic data revealed no statistically significant difference between the 2 groups. The doses of local anesthetics and the number of puncture attempts were not statistically different between the 2 groups (Table 1). The time interval of the procedure was significantly shorter in the standard application group compared with the ultrasound-guided group ( $p=0.020$ ). No statistically significant difference was found between the 30th, 180th, and 360th minutes of the application when the WBPRS values were evaluated. The WBPRS values obtained at the 90th minute were statistically lower in the standard application group compared with the ultrasound-guided group ( $p=0.035$ ) (Table 1). Pain control was similar in remaining observations. When the nurse satisfactions were evaluated during the post-operative period in both groups, the ultrasound-guided group reported 43.3% "perfect", 36.7% "good"; and a total of 80% satisfactory pain control (Table 2). On the other hand, pain control was expressed as "moderate" in 16.7%, and "bad" in 3.3% patients in this group. Standard application group reported 31.3% full satisfaction, and 43.8% revealed "good" rating, a total of 75.1% success in pain control. Of the same group, 20.8% stated "tolerable", and 4.2% reported dissatisfied pain control (Table 2). Evaluation of the post-operative additional analgesic need showed that 23% of the patients in the ultrasound group received the additional doses, and 76% did not require an extra dose. In the standard application group, an additional analgesic was administered to 20.8%, and the rest, 79.2% stated no such requirement. No possible complication was observed in association with additional doses (Table 2).

**Discussion.** Caudal block, mostly preferred in pediatric urologic surgical operations prevents post-operative pain in pediatric patients, and increases the success of surgical intervention by improving healing, and preventing the stress response related to pain.<sup>8-10</sup> We evaluated the post-operative pain control in pediatric patients that underwent standard or

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ultrasound-guided caudal block, which is already a routine part of our practice.

The convenience of caudal block technique and the contributions of ultrasound guidance on caudal block application have been discussed previously. The impact of ultrasound-guided on the time interval of the caudal block procedure has not been published before, this is the strength of the present study.<sup>11-13</sup> The time between the needle's contact with and removal from the skin of caudal block applied without ultrasound guidance was found to be statistically shorter in this study. However, this difference was recorded in seconds therefore; it should not be considered as a distinctive mark by the pediatric anesthesiologists.

Possible complications of caudal block include failure to block, inadvertent subarachnoid injection, and bleeding.<sup>14</sup> Numerous researchers stated that caudal block is a safe post-operative pain management method.<sup>15,16</sup> Our study supported the statements above, showing no complication relating to the application of caudal block and both methods were regarded as safe.

Pain follow-ups during 6 hour in the post-operative period were conducted with WBFPRS and only in 90th minute of the post-operative period, a positive statistically significant difference was observed in the pain score of the standard application group. Despite the significant difference, the  $1.90 \pm 1.49$  WBFPRS value in ultrasound-guided group and  $1.33 \pm 0.83$  WBFPRS in the standard application group indicated that, required analgesia levels were provided in both groups.

Nurses' role in treatment and support of pediatric patients is undeniable during the post-operative period. This study aimed to ask nurses to assess the analgesic levels developing in association with the methods applied to the post-operative cases. Nurses' assessment detected the results that provide the sufficient level of pain control success for both groups with 75.1% "perfect" and "good" in the standard application group, and 80% in the ultrasound-guided group. These data indicate that nurse satisfaction surpasses the sufficient level in both groups.

**Table 1** - Demographic and clinical characteristics of patients with ultrasound guide and no ultrasound guide.

Characteristics	Ultrasound-guided group (n=30)	Standard application group (n=48)	P-value
Age, years, mean $\pm$ SD	$5.65 \pm 3.65$	$5.02 \pm 2.65$	0.417
Weight, kg, mean $\pm$ SD	$22.96 \pm 9.20$	$21.22 \pm 7.49$	0.365
ASA	I/28, II/2	I/45, II/3	
<i>Gender, n (%)</i>			
Male	20 (66.6)	31 (64.5)	
Female	10 (33.3)	17 (65.4)	0.85
<i>Local anesthetics volume, ml, mean<math>\pm</math>SD</i>			
Bupivacaine	$1.583 \pm 0.52$	$1.739 \pm 0.49$	
Prilocaine	$2.716 \pm 0.65$	$2.479 \pm 0.61$	
Puncture count, (mean $\pm$ SD)	$1.06 \pm 0.25$	$1.10 \pm 0.3$	0.579
Procedure time interval, sec., mean $\pm$ SD	$41.60 \pm 32.62$	$26.08 \pm 15.63$	0.020*
WBFPRS 30 (min.)	$2.16 \pm 1.85$	$2.87 \pm 2.41$	0.174
WBFPRS 90 (min.)	$1.90 \pm 1.49$	$1.33 \pm 0.83$	0.035*
WBFPRS 180 (min.)	$1.06 \pm 1.48$	$0.66 \pm 0.59$	0.168
WBFPRS 360 (min.)	$0.56 \pm 0.77$	$0.64 \pm 0.56$	0.630
Complication	0	0	

\*P<0.05 indicates a significant difference between ultrasound guide and no ultrasound guide groups,  
ASA - American Society of Anesthesiologists, WBFPRS - Wong-Baker FACES Pain Rating Scale,  
SD - standard deviation

**Table 2** - Post-operative nurse satisfaction and additional analgesic requirement.

Variables	Ultrasound-guided group (n=30) n (%)	Standard application group (n=48) n (%)
<i>Satisfaction rate</i>		
Perfect	13 (43.3)	15 (31.3)
Good	11 (36.7)	21 (43.8)
Moderate	5 (16.7)	10 (20.8)
Bad	1 (3.3)	2 (4.2)
<i>Additional analgesic</i>		
Yes	7 (23.0)	10 (20.8)
No	23 (76.0)	38 (79.2)

In the present study, 76% of the ultrasound-guided group and 79.2% of the standard application group showed no need for an additional dose of analgesics, and both methods provided the required analgesic levels. Kaya et al<sup>17</sup> investigated the effects of caudal bupivacaine and levobupivacaine on post-operative pain control and found that 26.6% of the bupivacaine injected patients needed additional analgesics, this ratio was 20% in levobupivacaine received patients; these data comply with our results in the present study.

In conclusion, we believe that ultrasound guidance for caudal block applications would neither increase, nor decrease the success of treatment. However, we think that ultrasound guidance should be needed in cases where the detection of sacral anatomy is difficult, especially by palpations.

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