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# *The use of lower extremity nerve blocks in children at the lower tibia for prolonged analgesia after foot corrective surgery*

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**Introduction** The use of lower extremity nerve blocks at the lower tibia was reviewed in children with congenital and acquired pathology to provide prolonged analgesia after a foot corrective surgery. **Material and methods** The study included 49 patients with congenital malformations (congenital clubfoot, flat and valgus foot, vertical talus, longitudinal ectromelia) who underwent corrective surgical procedures. Patients were divided into 2 groups. Sedation, drug-induced sleep, spinal anesthesia, regional anesthesia at the lower third of tibia were produced for the patients of index group. Control group had sedation, drug-induced sleep and spinal anesthesia. The Face, Legs, Activity, Cry, Consolability scale (FLACC) was used to assess pain in the children. In addition to that, a dose of opioid pain relievers (Tramadol) administered on the first postoperative day and satisfaction with anesthesia and analgesia were also considered. **Results** Index group showed longer-term FLACC scores at a low level with less consumption of narcotic and sedating drugs. No complications were observed with regional anesthesia of the foot. **Conclusion** Lower extremity peripheral nerve blockade at the lower third of tibia has shown to provide efficient postoperative analgesia in surgical correction of pediatric foot deformities.

**Keywords:** foot, regional anesthesia (RA), congenital malformations (CMF), surgical correction, spinal anesthesia (SA)

Pediatric congenital and acquired foot deformity correction is normally produced under general anesthesia or spinal anesthesia and sedation, to a lesser extent. A foot corrective surgery is rather traumatic with expressed postoperative pain [1, 2]. Expressed pain normally persists from 24 to 36 hours after the procedures [3, 4]. The patients require both non-opioid and opioid analgesics, and sedating medications.

Historically, pediatric anesthesia was long neglected as compared to adult patients. Newborns, infants, young children, and children suffer postoperative pain in the same way as adults. Assessing pain in young children can be challenging if they are non-verbal or have developmental disabilities [5]. Different pain scales are used to assess pain in children [6]. A review of the current anesthesiology literature reveals a tendency to combine general, local and regional anesthesia (RA) in pediatric practice [7, 8]. The use of regional anesthesia techniques considerably improves the quality of anesthesia and postoperative analgesia, reduce intraoperative and postoperative opioid and non-opioid requirements [9, 10]. Regional anesthesia improves blood flow in the operated tissues providing better healing conditions for intraoperatively injured tissues [2, 11]. RA is believed to be associated with less opioid consumption and fewer complications. The use of regional anesthesia for a foot corrective surgery improves postoperative pain management, in particular.

The objective of this review was to evaluate the efficacy and safety of regional anesthesia applied at the lower third of tibia for corrective foot surgery in children with congenital and acquired deformity.

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## MATERIAL AND METHODS

The study included 49 patients (mean age of 4.2 ± 0.5 years) who underwent correcting foot procedure for congenital and acquired deformity.

All patients had the surgery under spinal anesthesia and sedation with premedication (intramuscular injections of atropine, droperidol, tramadol at age-specific dosage variances, sevoflurane as an induction agent via a face mask) followed by peripheral nerve catheterization, spinal anesthesia with a 25G B. Braun needle, intrathecal anesthesia with Marcain Spinal (0.25 to 0.35 mg/kg) [12]. Drug-induced sleep was implemented intravenously with propofol (4 to 6 mg/kg/hour), antibiotics, haemostatic agents, paracetamol injected intravenously at age-specific dosage variances. Regional anesthesia of the foot was conducted with B.Braun nerve stimulator 0.375 % naropin injected at the ankle in index group.

An ankle block required anesthetization of five nerves including the superficial peroneal nerve, the deep peroneal nerve, the saphenous nerve, the sural nerve and the posterior tibial nerve [11, 13] with total naropin consumption of not more than 2.5 to 3 mg/kg [10, 14]. The patient woke up and transported to a ward. The patient's heart rate, blood pressure, and oxygen saturation were checked during the procedure. Anesthesia lasted for 73 ± 17 minutes on average, in both groups. The patients were randomized in 2 groups with or without regional anesthesia of the foot. No statistically significant differences in gender, age, a type of accompanying pathology and surgical intervention were observed between the groups. Control group (n = 25) had spinal anesthesia, sedation and drug-induced sleep. Index group (n = 24) included patients who had spinal anesthesia, sedation, drug-induced sleep and regional anesthesia of the foot.

Postoperative pain management of both groups was produced with intravenous injections of 50 % analgin every 6 hours; in-between, nurofen per os and opioids (tramadol) as requested.

The Face, Legs, Activity, Cry, Consolability scale (FLACC) was used to assess pain 1, 6, 12, 18, 24 hours after the surgery (**Table 2**).

**Table 1**

Anesthesia technique

| Operation performed | Index group (n = 24) | Control group (n = 25) |
|---|---|---|
| Corrective foot surgery | Spinal anesthesia + sedation, drug-induced sleep + RA of the foot | Spinal anesthesia + sedation, drug-induced sleep |

**Table 2**

Face, Legs, Activity, Cry, Consolability (FLACC) scale

| Categories | Description | Scores |
|---|---|---|
| Face | No particular expression or smile | 0 |
| | Occasional grimace or frown; withdrawn, disinterested | 1 |
| | Frequent to constant frown, clenched jaw. | 2 |
| Legs | Normal position or relaxed | 0 |
| | Uneasy, restless, tense | 1 |
| | Kicking or legs drawn up | 2 |
| Activity | Lying quietly, normal position, moves easily | 0 |
| | Squirming, shifting back and forth, tense | 1 |
| | Arched, rigid or jerking | 2 |
| Cry | No cry (awake or asleep) | 0 |
| | Moans or whimpers, occasional complaint | 1 |
| | Crying steadily, screams or sobs; frequent complaints | 2 |
| Consolability | Content, relaxed | 0 |
| | Reassured by occasional touching, hugging, or being talked to; distractable | 1 |
| | Difficult to console or comfort | 2 |
| Total | | |

A patient's cumulative intake of all drugs in the opioid class over 24 hours, mother's satisfaction with anesthesia and postoperative pain management ("poor", "fair", "good"), length of effective postoperative analgesia were taken into consideration. Complications after SA, regional anesthesia of the foot were also reviewed. Two-tailed Student's t-test was used to compare independent paired population means along with chi-square test to compare the data. The differences were statistically significant with confidence interval of 95 % with Bonferroni corrected for multiple comparisons. Microsoft Excel and RStudio were used to complete data analysis reports.

## RESULTS

Postoperative pain control was considered to be effective with less than 3 points on the FLACC scale. There were nearly no differences in FLACC scores at baseline in both study groups. Patients of control group showed critical values of pain one hour after surgery measuring 3.6 to 4.8 points on the FLACC scale 4 to 6 hours after surgery required administration of tramadol every 6 to 8 hours of the surgery with analgin and nurofen introduced in-between. Index group developed pain measuring 3.9 to 4.7 points on the FLACC scale 16 to 18 hours after surgery. No differences were found between the groups at 18 postoperative hours (**Table 3**).

Continuous effective postoperative anesthesia in index group was associated with preoperative regional anesthesia of the foot providing much better profile and length of pain management after corrective surgery.

Advantages of regional anesthesia of the foot were evidenced by consumption of opioids required for adequate anesthesia in early postoperative period. An average tramadol intake during the first 24 postoperative hours was 2.25 age-specific single doses (dosing should be adjusted as per kg of body weight) versus 3.72 age-specific single doses in the control group. The data indicated to the regional anesthesia of the foot as the factor providing better quality of postoperative pain management.

No anesthesia related complications were observed in both groups. No cases of critical hypotonia, toxicity with anesthetic agents, injury to peripheral nerves were reported [15, 16]. One patient of the control group developed pains in the spine at the level of spinal anesthesia that relieved the next day.

The quality of anesthesia and postoperative analgesia was scored on a three-point scale (poor, fair, good). 22 out of 24 (91.7 %) parents of the index group reported good quality, and the rest evaluated the quality as fair. 17 out of 25 (68 %) parents of the control group reported good quality, and the rest evaluated the quality as fair. 95.8 % of the index group would have chosen this type of anesthesia if another intervention is needed, the rest found it difficult to answer.

**Table 3**

Scoring with Face, Legs, Activity, Cry, Consolability (FLACC) scale, scores (M ± m, p)

| Time of assessment | Index group (n = 24) | Control group (n = 25) |
|---|---|---|
| Preoperatively | 1.5 ± 0.4 | 1.6 ± 0.5 |
| One hour after surgery | 2.1 ± 0.4 | 2.9 ± 0.6 |
| 6 hours after surgery | 2.2 ± 0.4* | 4.2 ± 0.6* |
| 12 hours after surgery | 2.4 ± 0.4* | 4.4 ± 0.3* |
| 18 hours after surgery | 4.3 ± 0.4 | 4.2 ± 0.4 |
| 24 hours after surgery | 4.4 ± 0.4 | 4.3 ± 0.4 |

*Statistically significant differences between index and control groups ($p < 0.05$).

## DISCUSSION

Over the last decade conduction anesthesia has become the mainstay of postoperative pain control in patients aged over 18 years who undergo foot corrective surgery. Anesthesia protocols for pediatric corrective foot surgeries are well established in our country. Postoperative pain interferes with wound healing and emotional health of a child and parents. Regional anesthesia provides effective

pain control in the first crucial 24 postoperative hours. Regional anesthesia of the foot has shown to be easy to apply, effective, safe, being not time-consuming. Less postoperative requirements in opioids and non-opioids were observed in patients of the index group (with regional anesthesia) with lower risk of complications related to the application.

## CONCLUSIONS

1. Regional anesthesia applied for corrective foot surgery improves profile and efficacy of postoperative analgesia and its length.

2. The usage of regional anesthesia at the foot level allows for reduction in opioid consumption (tramadol) in the first 24 postoperative hours with lower risk of adverse effects.

3. Neither complications nor adverse effects related to various types of anesthesia applied in both groups were reported.

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