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Limb amputation of an infant with transposition of great arteries using spinal anesthesia

Blind G. Al-Talabani, Twana M. Kareem, Seerwan O. Hasan, Jwan J. Rasheed

ABSTRACT

Introduction: Spinal and caudal anesthesia are useful anesthetic techniques for infants compared to general anesthesia. In case of infants lumbar puncture can be safely performed at or just below the intercristal line. Due to the presence of loose fatty tissues in the caudal extradural space, it becomes safe and easy to insert a cannula enabling easy cranial spread of local anesthetic drugs. Increased production and absorption of cerebrospinal fluid in infants lead to administration of higher doses of local anesthetics. However, this spinal and caudal anesthesia has lesser risk of post-operative apnea in infants compared to general anesthesia. Case Report: A three-month-old male infant, whose body weight was seven and half kilograms, was afflicted with ischemia which extended to half of his right leg. There was gangrene on his right big toe as well. These developments occurred after cardiac catheterization was implemented through right femoral vein cannulation. Due to high-risk of transposition of great arteries in general anesthesia, the surgeons finalized under spinal anesthesia in order to bypass the infected respiratory system, prevent aspiration because of full stomach, and to get better postoperative analgesia. Conclusion: Spinal anesthesia is an alternative option to general anesthesia in high risk patients owing to its safety. However, in case of spinal complications or failure of spinal anesthesia, the anesthetist should always get ready with the high risk general anesthesia.

Keywords: Amputation, Bupivacaine, Infant, Spinal anesthesia, Transposition of great arteries

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INTRODUCTION

Spinal Anesthesia (SA) is injection of anesthetic drugs to the subarachnoid space of the vertebral column in order to reduce and overcome risks and complications of General Anesthesia (GA), especially in high-risk patients.

We found very few literature on the application of SA for amputation of lower limb in high-risk infant and child patients [1, 2]. Gupta et al. [1] in their study mentioned the lower limb amputation as one of the indications for SA.

Herein, we describe the use of spinal anesthesia for limb amputation in an infant with gangrenous limb caused by femoral artery thrombosis following cardiac

catheterization for diagnosis and initial treatment of transposition of great arteries.

CASE REPORT

A three-month-old male infant, whose body weight was seven and half kilograms, was afflicted with ischemia which extended to half of his right leg. There was gangrene on his right big toe as well. These developments occurred after cardiac catheterization was implemented through right femoral vein cannulation. The infant had Transposition of Great Arteries (D-TGA) and restrictive Pulmonary Flow Obstruction (PFO). A Reshkind arterial septestomy was performed by a pediatric cardiologist 12 days before admission under the echocardiography guide. Thereafter, his transcutaneous oxygen saturation increased to 80–85% from 50%. An operation was planned to counter the situation, but he developed right foot ischemia after a few days due to catheterization. Following that, he was treated conservatively with the help of intravenous heparin, but he would not respond. The opinion of a vascular surgeon was then taken. The vascular surgeon diagnosed the condition as femoral artery embolization, and decided to perform embolectomy but failed. Finally, the infant was admitted to the Surgical Emergency Hospital of Sulaymaniyah city, Kurdistan region, on September 2015 for treatment of ischemia of right lower limb in Figure 1.

On examination, the patient was irritable, lethargic, cyanosed and dehydrated. He had black discoloration on the lower section of his right limb and gangrene on the right big toe. Saturation was around 65–70% despite providing five liters of oxygen through face mask. He was not fasting and had wheeziness in his chest, with bilateral basal crepitation and decreased air entry. His operation was postponed twice because of chest infection. Later, he was admitted to Surgical Emergency Hospital for amputation of right lower limb, but because of the high-risk of TGA in GA due to incomplete oxygen saturation in such congenital abnormality, we decided to go ahead with SA in order to bypass the infected respiratory system, prevent aspiration because of full stomach, and to get better postoperative analgesia.

Spinal anesthesia was performed after obtaining parental consent. The patient was placed in the lateral decubitus position with flexion of knee and hip joints, and extension of neck in order to prevent airway obstruction. The area was cleaned with disinfectant solution and a spinal needle of 26 FG was used. Hyperbaric bupivacaine (0.5%) was used and the dose was calculated in accordance with his body weight, which was 3.75 mg (0.5 mg/Kg). Spinal anesthesia was given in the midline of the lumbar region at L4-L5 interspace in the first attempt, and the subarachnoid placement was confirmed with free flow of Cerebrospinal Fluid (CSF). Then, the patient was placed in supine position and a five-minute wait period was observed. Loss of sensation was confirmed when the patient's skin was pinched but no discomfort was experienced by him. The lower extremities were paralyzed.

Thereafter, the orthopedic surgeon initiated the operation. During the operation, five liters of oxygen was provided via nasal cannula, the saturation was 75-80%, pulse rate was between 120-140 beat per minutes and the blood pressure was stable considering his age. There were no visible sign of pain and the patient did not appear to be agitated. Displayed is the image of the knee amputation of the right lower limb in Figure 2. The operation was concluded in 75 minutes. Then, the patient was transferred to intensive care unit, where he stayed for one day; he was fully conscious and stable with no accompanying pain. Later, he was transferred to the orthopedic ward.

DISCUSSION

Spinal anesthesia became increasingly popular among neonates and infants after Abajian et al study [2, 3] concerning abdomen (below umbilicus) [2, 4–5] and lower limbs' operations [3, 6] in 1984. Performing operations for infants with major risks, like in our patient with D-TGA and PFO, presents considerable challenges [3]. Patient under spinal anaesthesia have lower incidence

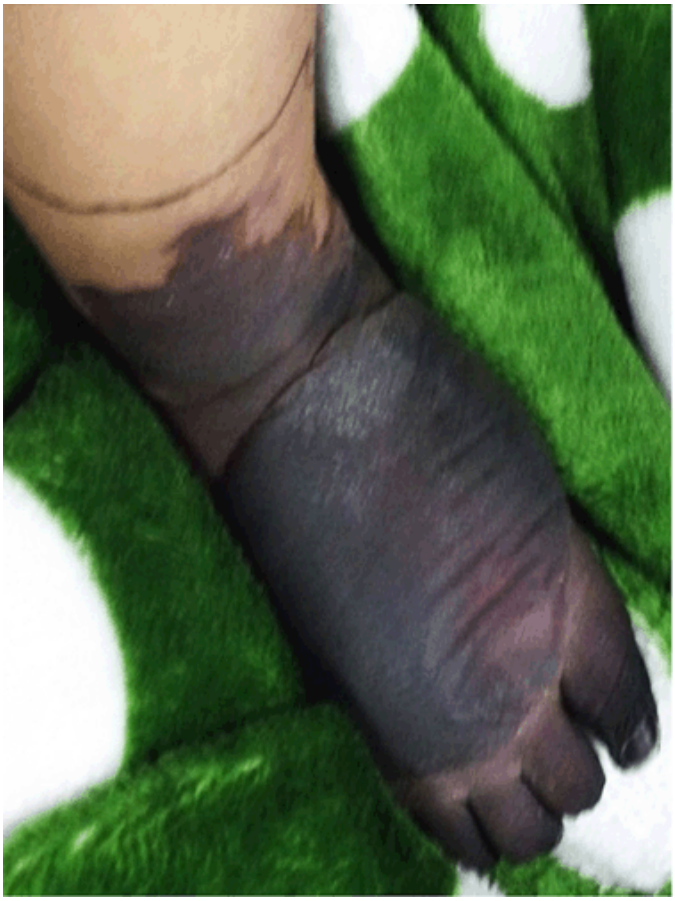

Figure 1: Right lower limb ischemia and gangrene.

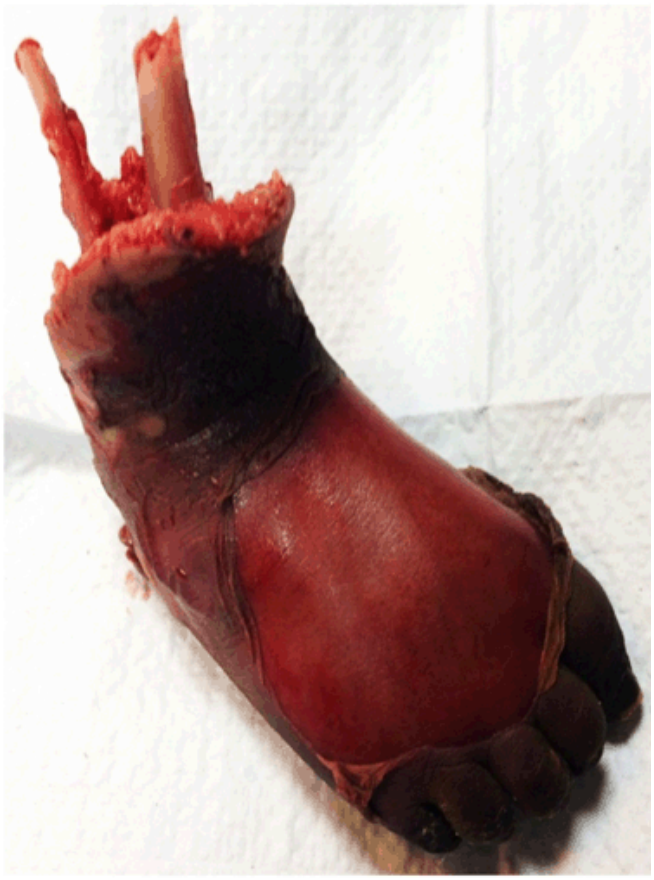

Figure 2: Amputation of right lower limb below knee.

of apnea, hypoxemia and bradycardia [2, 3, 6–10] when compared to general anesthesia [6, 8]. The level of sympathetic blockage is the pivotal factor which governs the heart rate and blood pressure, post spinal anesthesia. According to Dohi et al. [11] the hemodynamic and cardiac stability was observed in patients within the age group of five years. This is because of the less well developed sympathetic nervous system or a lower extremity blood volume in these age group of patients compared to adults. Hence, less or no incidence of bradycardia was observed in these age group under spinal anesthesia in a perioperative setting.

There is no role of preload replacement of fluid in children below five-years old as adults because of immaturity of the sympathetic nervous system. A relatively small peripheral pooling of blood and a compensatory decrease in vagal efferent function is preventing drops in the blood pressure and pulse rates [1, 2].

Single dose SA is of partial value because of its limited duration of action in which its upper limit is 90 minutes [3–5], and it is also unable to provide for postoperative analgesia [3]. Spinal anesthesia in infant has markedly shorter duration than adults [3, 6], which may be due to the anatomical fact such as CSF volume distribution in infants is more than in adults (4 vs. 2 mL.Kg^{-1}), and they also have relatively increased surface area of spinal cord and its nerve roots [9]. Adding epinephrine to the anesthetic drugs to prolong the duration has been questioned because it may cause ischemia of the cord [1].

Tetracaine [1, 3, 9], bupivacaine [1, 4, 9], ropivacaine [1–2], L-bupivacaine [1], and lidocaine [6] have been used for SA in children. Baricity of the local anesthetic agent will alter its distribution and effect. Hyperbaricity in adult is safe and effective but in pediatric patients, both hyperbaric and isobaric solutions have similar effect [1–2].

Indications for SA include major risk factors for GA such as prematurity [1–3, 9], and when there is a need to reduce complications of GA such as apnea, hypoxemia and bradycardia. It is also useful when the resources are limited like inadequate amount of oxygen, insufficient drugs and nurses, and limited space in hospital, i.e., it is cost-effective [1–2, 6]. Contraindications include: refusal by the parent [2, 4], coagulopathy, infection at the site of Lumbar Puncture (LP), and intracranial mass lesions [2, 4, 6, 9]. Complications such as aseptic meningitis are rare [5] and were not present in our patient. Failure rate was reported as 5–15% [1].

Spinal anesthesia is proved to be an effective, safe and easy technique for infants with high risk factor in a perioperative setting. SA can be used for lower limb surgeries like the patient in our study with major risk factors of TGA, chest infection, and full stomach.

CONCLUSION

Spinal anesthesia is a safe technique in a perioperative settings in lower limb surgeries as well as infants.

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Author Contributions

Blind G. Al-Talabani – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Twana M. Kareem – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Seerwan O. Hasan – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Jwan J. Rasheed – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor of Submission

The corresponding author is the guarantor of submission.

Source of Support

None.

Consent Statement

Written informed consent was obtained from the patient for publication of this case report.

Conflict of Interest

Authors declare no conflict of interest.