

# Role of ultrasound-guided continuous brachial plexus block in the management of neonatal ischemia in upper limb

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## ABSTRACT

Neonatal upper limb ischemia due to accidental arterial damage remains a major concern, which can lead to devastating complications if untreated. The primary objective of this case report is to emphasize the role of continuous infraclavicular brachial plexus block, the issues related with block performance in an ischemic hand, and the importance of ultrasound guidance in this particular case scenario. A 1.1 kg infant suffered from distal forearm ischemia due to accidental arterial damage, which was treated with brachial plexus block. An ultrasound-guided single shot block with 0.5 mL/kg of 0.25% bupivacaine was followed by ultrasound-guided catheter placement in the target area. A continuous infusion of 0.03% of bupivacaine at the rate of 0.5 mL/kg/hr (approx. 0.15 mg/kg/h of bupivacaine) was administered for 36 h. This treatment resulted in reversal of ischemia. Permanent ischemic damage was eventually confined to the tips of 4 fingers. We conclude that ultrasound-guided continuous infraclavicular block has a therapeutic role to play in the treatment of hand ischemia due to arterial damage and subsequent arterial spasm in neonates with added benefits.

**Key words:** Neonatal ischemia, ultrasound, infraclavicular block

## INTRODUCTION

An extensive literature review of 1045 cannulations of the radial artery in newborn infants showed that 6% of cases suffered transient ischemia and 0–5% had permanent ischemic damage.<sup>[1]</sup> Neonatal limb ischemia still presents considerable challenges in the management leading to damage of great magnitude, if not attended proactively. The treatment modalities are either nonsurgical such as thrombolysis, stellate ganglion block, brachial plexus block, or surgical such as thrombectomy depending on the cause.

Brachial plexus blocks are recommended for upper limb ischemia<sup>[2]</sup> and can be performed by various approaches and different modalities. This case is reviewed to emphasize the

use of ultrasound and its particular advantage in cases of vascular damage. In a distally ischemic limb any damage to the artery in its proximal portion could add to the existing damage.

## CASE REPORT

A premature (28 weeks preterm), female, 900 kg neonate was admitted in neonatal intensive care unit (NICU). The baby had gradually gained weight to 1.1 kg. During the fifth week of the NICU stay, following accidental arterial puncture, ischemic changes were noted on the right distal upper extremity as shown in Figure 1. The Doppler study of the affected hand showed absent pulsations distally till the brachial level. The decision to attempt an ultrasound-guided infraclavicular brachial plexus block was taken. Parents were explained the procedure and informed consent was obtained. The parents approved of reporting this case.

The block procedure was performed in NICU following application of routine monitors and midazolam 0.5 mg/kg was administered for sedation. Fentanyl 1 µg/kg was administered to provide analgesia for the block

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procedure. The infant was placed in supine position with the shoulder abducted and the arm placed along the body. The ultrasound probe (Micromax, 4 Sonosite Medical Systems Bothell, WA, USA, L 24 probe) was placed just inferior to the coracoid process, and a 19-gauge Tuohy needle (Portex, Smith's Medicak ASD, Inc. Keene, NH 03431, USA.) was placed in an in-plane approach [Figure 2]. This showed the parasagittal transverse scan of the infraclavicular region [Figure 2]. The axillary artery and the vein were identified. The lateral and medial brachial plexus cords were identified and 0.5 mL of 0.25% of bupivacaine was injected. A 23-gauge catheter was passed through the 19-gauge Tuohy needle. The neurovascular bundle was seen at the depth of 1 cm from the skin. The catheter was secured to the skin by transparent tapes at 2 cm marking. A continuous infusion syringe pump was attached to the catheter. It delivered 0.03% of bupivacaine at a rate of 0.5 mL/h (approx. 0.15 mg/kg/h of bupivacaine). The infusion was maintained for about 36 h when accidental dislodgement of catheter took place while the infant was being breastfed. Ischemic changes in the limb improved after a single bolus and steadily regressed with the infusion to be limited only to the finger tips [Figure 1].



**Figure 1:** Ischemia before the block and its course over 3 days



**Figure 2:** The placement of needle and the probe and parasagittal scan of the infraclavicular region. P maj – Pectoralis major; P min – Pectoralis minor; SA – Subclavian artery

## DISCUSSION

Although upper limb ischemia in neonates is uncommon, it has grave consequences. The treatment modalities range from systemic anticoagulation, systemic or topical vasodilators, and hyperbaric oxygen.<sup>[3]</sup> Interventional treatment includes thrombolysis and surgical thrombectomy<sup>[4]</sup> (if the etiology of ischemia is due to thrombosis), and lastly amputation. Surgical procedures are associated with the inherent issues of anesthesia in neonates and prematurity. The role of stellate ganglion block in the management of ischemia of hand caused by extravasation of vasopressors has been reported in adults.<sup>[5]</sup>

In the present case we have used continuous block technique, which can be performed in NICU with appropriate monitoring, sedation, and analgesia. The rationale behind successful vasodilatation following brachial plexus block (somatic block) can be explained by the fact that the postganglionic sympathetic fibers pursue a short course in the subclavian periarterial plexus and the main sympathetic supply of the vessels in the distal part of the limb is from the main somatic nerves of the limb.<sup>[6]</sup> Breschan *et al.*<sup>[2]</sup> reported successful use of single shot axillary brachial plexus block for treatment of severe forearm ischemia after arterial cannulation in an extremely low-birth weight infant.

Through our case report we have emphasized the use of single shot block followed by continuous infraclavicular brachial plexus block in infants. We choose this technique since the effect of single shot block is limited by its duration. Catheter placement renders a more sustained and prolonged effect of the block. The concomitant vasodilatation and increase in microvascular circulation facilitates the treatment of the reversible component of ischemia, that is, vasospasm. Infraclavicular area renders itself well for catheter fixation as compared with axilla because of its anatomic characteristics<sup>[7]</sup> and limited range of movements.<sup>[6]</sup>

Ultrasound guidance was used to enable us to perform the block under real-time image. Accidental trauma to the artery and the vein were avoided because they were continuously visualized during the block performance (accidental arterial punctures are known during blind techniques). We consider this aspect of immense importance because in a hand jeopardized due to distal vascular insufficiency any added vascular damage in the proximal portion would be a disaster.

In summary, this case shows that ultrasound-guided continuous brachial plexus block is a feasible treatment option in the management of neonatal ischemia in the upper limb.

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**How to cite this article:** Ponde VC, Shah DM, Mane S. Role of ultrasound-guided continuous brachial plexus block in the management of neonatal ischemia in upper limb. *Saudi J Anaesth* 2012;6:423-5.

**Source of Support:** Nil, **Conflict of Interest:** None declared.

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