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Intravenous regional anesthesia (IVRA) with forearm tourniquet for short-term hand surgery: A case report

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Abstract

Intravenous Regional Anesthesia (IVRA) was modified many times since its first use and these changes continue according to the type of surgery. A 36-year-old male patient was operated for trigger finger in the fascia of the first and second carpal bones. Because of the short operation time and for early detection of possible vascular or nerve damage after surgery, the IVRA method was used with the forearm tourniquet containing contrast agent. Forearm tourniquet can be preferred in short-term hand surgeries due to its advantages such as easy application, low side effect profile and early block recovery.

Keywords: IVRA, Forearm tourniquet, Contrast agent, Intraosseous passage, Local anesthetic toxicity

Introduction

The type of anesthesia achieved by adding a local anesthetic agent to the venous system of the extremity isolated from the general circulation using a tourniquet is called Intravenous Regional Anesthesia (IVRA). Although it was first used in 1908 by Karl August Bier for anesthesia of the area between two tourniquets, it is now used with the double-cuff tourniquet method, which is placed on the proximal part of the extremity after several modifications [1].

Because the use of local anesthetics is limited in the extremities, the aim of IVRA is to further reduce this area to cut the risk of toxicity in the case of a possible leak. Although tourniquet modification was used first in IVRA, this approach is no longer preferred due to toxicity concerns related to intraosseous leak. It is now reported that the use of a forearm tourniquet is as safe as the proximal tourniquet and that it can be reused in surgical practice [2].

In this case, we aimed to evaluate the adequacy of a reduced amount of local anesthetic using a forearm tourniquet for hand surgery and to detect a possible leak early.

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Case presentation

After obtaining written consent for the procedure and future publishing, a 36-year-old and 96 kg ASA II male patient was operated on from the first and second carpal bone fascia for trigger finger. Because the patient did not want general anesthesia, regional approaches were given priority. The need for a tourniquet for a bloodless surgical field was determined by the surgical team. IVRA was preferred for early control of vascular and nerve injury after surgery. The use of IVRA with a forearm tourniquet was planned to reduce the amount of local anesthetic and for early tourniquet deflation. A contrast agent was added to the local anesthetic solution to detect possible leakage. The tourniquet was kept ready in the proximal region for early intervention in the case of a possible leak.

Electrocardiogram, saturation, and non-invasive blood pressure monitoring of the patient were performed in the supine position. Ringer's Lactate infusion was started at 10 mL/kg after a 20-gauge venous cannula was placed on the dorsum of the contralateral extremity. Midazolam was administered at 0.02 mg/kg for sedation. A single-cuff pneumatic tourniquet was placed on the proximal of the extremity to be operated on, and a 21-gauge venous cannula was inserted from the dorsum of the hand. A manually adjustable tension cuff was placed on the forearm 10 cm above the wrist. The cuff was inflated to 250 mmHg after the extremity was properly wrapped using the Esmarch bandage and elevated for two minutes. A local anesthetic mixture containing 5 mL contrast agent (iohexol 3mg/mL, Omnipaque, GE Healthcare, USA), 5 mL of 2% lidocaine and 10 mL of 0.9% NaCl was administered. Serial radiological images were obtained to determine the distribution of local anesthetics and possible leaks.

Radiological images of the patient after the local anesthetic injection revealed that the solution did not pass above the cuff. A distal movement of the solution was observed without any intraosseous leaks. Sensory and motor block were achieved in the 5th minute pin-prick test, and the surgical procedure began (Figures 1, 2).

Pain was monitored using the Visual Analogue Scale (VAS). The VAS score was 2 in the first five minutes. The patient, who did not have pain in the surgical incision area, felt discomfort due to the compression around the tourniquet, and this was evaluated as tourniquet discomfort. Tourniquet discomfort resolved after the addition of fentanyl (1 mcg/kg) in the 10th minute. The z-plasty incision was performed along the contracture band, corresponding to the natural palmar and digital folds. After the neurovascular structures were identified, restrictive fasciae were excised. The finger circulation and nerve innervation of the patient were checked after the tourniquet was deflated. The total tourniquet time was 35 minutes.

The patient was taken to PACU in the postoperative period and observed for one hour. He was hemodynamically stable and did not show any toxic symptoms. His postoperative VAS scores were less than 2, and rescue analgesics were not required.

Figure 1: Injection of the local anesthetic solution

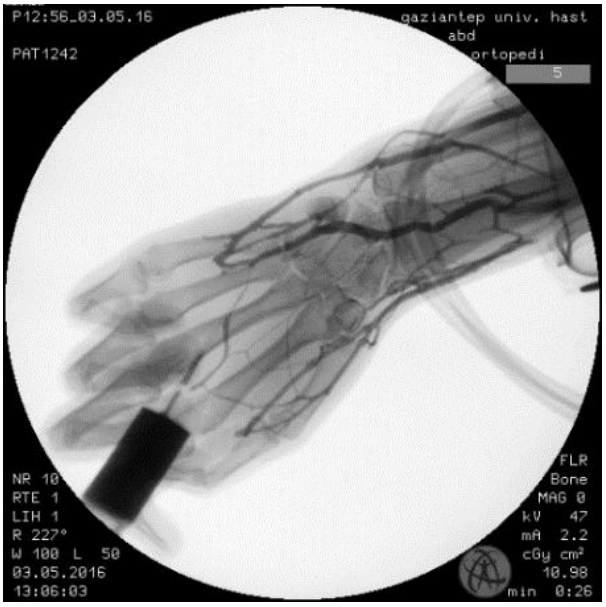
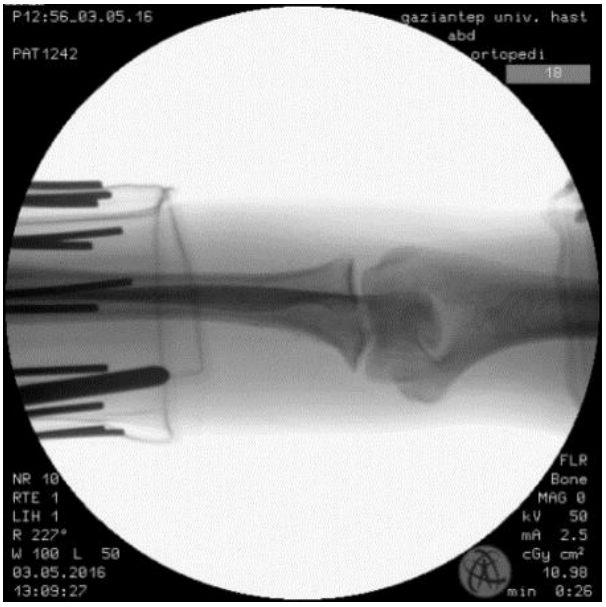


Figure 2: No intraosseous leak was observed



Discussion

IVRA is currently rarely preferred because of the increasing use of ultrasound-guided regional methods. Due to the long motor recovery time after peripheral nerve block, it is not preferred in the evaluation of possible nerve damage. However, it also has various advantages, such as easy application, a lower side effect profile and early block recovery time and can be a priority in cases such as the one presented [3].

The proximal double-cuff tourniquet method is the most widely used IVRA approach. To manage tourniquet pain, the distal cuff is inflated, and the proximal cuff is deflated [4]. More local anesthetic agents and sedo-analgesia are used after tourniquet pain develops; however, this approach may pose a risk in terms of early tourniquet deflation in distal region operations and short surgeries. Risks during surgery can be minimized by limiting the ischemic area and reducing the amount of local anesthetic with the forearm tourniquet even in the event of possible leakage [5].

The aim of this procedure was to reduce the amount of local anesthetic used with a forearm tourniquet, and leaks were assessed with a contrast agent. Tourniquet discomfort was

controlled with intravenous rescue analgesics. There was no leakage due to the use of the forearm tourniquet. There were no toxic symptoms.

Conclusion

IVRA can be optimized with alternative adaptations in extremity surgery. The forearm tourniquet can be preferred in short-term hand surgeries because it is easy to apply, has a low risk of toxicity and provides an early block recovery time.

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