

Continuous Axillary Brachial Plexus Blockade For Anesthesia And Postoperative Pain Relief: Three Cases And Three Techniques

A Kabalak, S Yoldas, Y Ataman

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Abstract

Continuous axillary brachial plexus block is a particularly suitable choice of anesthesia for upper extremity surgery and has additional benefits such as extended analgesia and sympathetic block during the postoperative period. Various techniques for entering the nerve sheath that surrounds the brachial plexus and providing extended analgesia have been described. Three patients presenting with various disorders of the upper extremity received continuous axillary brachial plexus block with various techniques for 2 to 5 days. Intermittent injections or infusion of bupivacaine was used to provide anesthesia and analgesia. The patients were satisfied with the anesthetic and analgesic effects of the block. Neither bupivacaine related systemic and neurological side effects nor technique-related complications were noted. Nerve functions recovered promptly after stopping the bolus injections or continuous infusions. It is concluded that continuous axillary brachial plexus blockade is a clinically safe and effective technique for anesthesia and postoperative pain relief.

INTRODUCTION

Axillary brachial plexus block has been carried out in surgical procedures for a) providing pain relief b) decreasing vasospasm in cases of upper extremity injuries c) or relief of neuromuscular disorders (1,2,3,4,5). Various techniques for entering the nerve sheath that surrounds the brachial plexus and providing extended analgesia have been described (1,2,4,5,6). Continuous axillary brachial plexus block is particularly a suitable choice of anesthesia for upper extremity surgery and provides extended analgesia and sympathetic block during postoperative period as well (2,3,4,5,6,7).

Our reports described insertion of a catheter before and during surgery for providing anesthesia and postoperative analgesia.

CASE REPORTS

CASE 1

A 20-year-old man referred to the neurosurgery clinic with rigidity, numbness, pain and muscular atrophy of the shoulder, elbow and small joints of right hand. Progressive loss of both motor and sensory functions was determined in right arm. He had sustained a shotgun wound two months ago and was suffering from right arm injury. He had been

operated urgently because of brachial vessel damage.

Axillary plexus exploration under general anesthesia was planned because of probable neural damage.

The patient had no circulatory or respiratory problems during general anesthesia and the surgery lasted two hours. Surgical release of the neurovascular sheath and fibrous bands and a 19-gauge epidural catheter (Epidural kit, B.Braun, Melsungen, Germany) was inserted while the plexus sheath was closed. At the end of surgery and anesthesia, 20 ml of 0.25 % bupivacaine (Marcaine, AstraZeneca, England) was injected through the catheter. The patient was transferred to the post anesthesia care unit after awakening. Thirty minutes later, he was able to mobilize his right arm passively without pain. Monitoring included pulse oximetry, non-invasive blood pressure measurement, and electrocardiography during first hour in post anesthesia care unit. He did not have any circulatory or respiratory problems and side effect related to local anesthetic within first hour.

20 ml of 0.25 % bupivacaine was injected four times a day and an additional dose was applied an hour before physiotherapy. The patient was able to mobilize his right arm fully in 5 days and catheter was removed. Full motor power and sensation returned within 12 hours.

We did not record any sign of bupivacaine related toxicity during this time. Total dose of bupivacaine was 250 mg /day. At the first month follow-up examination, his arm was painless and recovered uneventfully.

CASE 2

A 44-year-old woman referred to the neurosurgery clinic with signs of posttraumatic carpal tunnel syndrome on the right hand. Surgical section of the carpal ligament was planned. Continuous axillary brachial plexus block was performed for anesthesia and postoperative analgesia.

After securing intravenous access in the opposite arm and prior to operation, sedation was performed with intermittent midazolam 20 µg / kg (Dormicum, Roche, Switzerland) injection. Monitoring included pulse oximetry, non-invasive blood pressure measurement, and electrocardiography. The patient's arm was abducted less than 90°, rotated externally, and the elbow was flexed. The axillary artery was palpated as high as possible in the axilla, and a skin wheal was raised with 0.5 ml 1 % lidocaine (Aritmal 2 %, Biosel, Turkey). The cannula with needle (1 Contiplex D, B. Braun, Melsungen, Germany) was then inserted at a 30° angle to skin and directed towards the apex of the axilla (below the artery) until a definite click was felt as it pierced the axillary sheath. Correct placement within the axillary plexus sheath was confirmed by connecting a nerve stimulator (Stimuplex-S; B. Braun, Melsungen, Germany) to the end of the needle (finger movement). The stimulating current was 0.5 mA and the stimulus frequency to 2 Hz. The catheter was threaded through the cannula for 6 cm within the sheath. The cannula was removed, and the catheter was secured to the skin with adhesive tape. A microfilter (Minipack System 1; SIMS Portex) was attached to the catheter. A test dose of 4 ml of 1 % lidocaine was applied through the catheter and elicited numbness over the patient's left forearm and hand. Bupivacaine 0.5 % plain was applied through the catheter until full motor blockade was achieved (20 ml over 30 minutes). The surgery has lasted 45 minutes. The patient was pain-free during the postoperative 6 hours. Thereafter, 20 ml of 0.25 % bupivacaine was applied into the catheter every 6 hours. Her verbal pain rating was 2/10 compared with 6/10 before the axillary block. The muscle strength of her left hand recovered to grade 2 (0, no movement; 5, normal). The catheter was removed on the postoperative second day. Full motor power and sensation returned within 8 hours. Total dose of bupivacaine was 200 mg /day. One month later, the muscle strength of the patient's left hand was almost normal,

with no pain.

CASE 3

A 52-year-old woman referred to the orthopedic surgery and traumatology clinic with signs of carpal tunnel syndrome at the right hand. Continuous axillary brachial plexus block was planned for anesthesia and postoperative analgesia.

The patient's axillary brachial plexus block was performed in the same way as the second case. A test dose of 5 ml of 1 % lidocaine was applied through the catheter and elicited numbness over the patient's left forearm and hand. Bupivacaine 0.5 % plain was applied through the catheter until full motor blockade was achieved (20 ml over 30 minutes). The surgery has lasted 60 minutes. We connected the catheter to a patient controlled analgesia (PCA) device (Pain Management Provide, Abbott, USA) containing a 0.1 % bupivacaine solution four hours after the end of surgery. The basal dose for PCA was set to 2.5 mL / h, while the demand dose was 2.5 mL with lockout interval of 15 minutes. The patient was pain-free during postoperative 12 hours. On 17th hours, the muscle strength of her left hand recovered to grade 4 (0, no movement; 5, normal). The basal dose was discontinued after 12 hours (17 hours after blocked), and the demand dose was lowered to 1 mL, with a lockout interval of 10 minutes. The PCA was stopped and catheter was removed on postoperative second day. Full motor power and sensation returned within 12 hours. Total daily doses ranged from 160 to 218 mg /day. The patient was very satisfied with the anesthetic and analgesic effects of the block.

Negative bacterial cultures were obtained from the catheter tips in all the three cases. Neither bupivacaine related systemic and neurological side effects nor technique-related complications were observed.

DISCUSSION

Regional anesthesia is a new and interesting technique for upper extremity surgery and postoperative analgesia, providing a well-accepted and safe alternative or adjunct to general anesthesia.

The safety of continuous axillary brachial plexus block using intermittent injections and infusions with PCA device of local anesthetic solutions is well documented (^{1,2,3,4,5, 8}). The advantages of performing an axillary brachial plexus block via an axillary catheter include the opportunity to supplement a block during or after surgery (^{2,3}) and the

ability to administer the injection with the patient's arm by the side, resulting in better spread of local anesthetic (6). The present report describes continuous axillary brachial plexus blockade for anesthesia during surgery and analgesia during postoperative period in three cases.

The risks of prolonged axillary anesthesia and analgesia beyond those described for the single-injection technique are unknown (7). Catheters were left in the axillary plexus for up to 41 days without any untoward effects (9). Three of the patients described in this report had axillary plexus catheters for 2 and 5 days without any sequel. Catheter-related infection did not occur in our patients. This may be due to the finding of Rosenberg and Renkonen (10) that higher concentrations of bupivacaine (0.25 % and 0.5 %) significantly inhibit bacterial growth.

The combined use of catheter with bupivacaine, which is a local anesthetic, provides a longer period of analgesia (2,3,4). In our study, bupivacaine was administered in similar doses to the other studies (2,4,8) and it provided sufficient analgesia in all three cases. Continuous infusion of bupivacaine and higher doses of bupivacaine can cause Central Nervous System (CNS) toxicity. However, CNS toxicity is evident with plasma bupivacaine concentrations greater than 2 µg / ml following rapid intravenous injection (11). In our cases, bupivacaine was applied slowly within the axillary sheath and CNS toxicity did not occur in any patient. Bupivacaine may cause cumulative toxicity during continuous axillary brachial plexus blockade. It was not possible to measure bupivacaine levels in our cases, but the previous studies showed levels below 2 µg / ml for continuous interscalene block using an infusion rate of 0.1 mg / kg / hour and below 1.8 µg / ml for continuous axillary block using 25 mg / hour (12,13). Caution should be exercised in dosing patients with local anesthetics, especially those who may be more susceptible to side effects, although the safety of continuous axillary brachial plexus block has been established by other studies using similar dose ranges for 52-72 hours (2,8,12).

CONCLUSIONS

In conclusion, continuous axillary brachial plexus block via these three techniques provided a safe, effective, and well-

tolerated mode of anesthesia and postoperative analgesia for upper extremity surgery. Nerve function recovery is prompt after stopping the bolus injection or continuous infusions. Intermittent boluses and continuous infusions were equally effective on analgesia.

CORRESPONDENCE TO

Ayla A. Kabalak, MD Cigdem mah., 337.sok., Tugba apt., 5/2 Balgat, 06530, Ankara, Turkey E-mail: drayla2002@yahoo.com Telephone: (90-312) 286 1285 Fax: (90-312) 286 1285, (90-312) 225 1316

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Author Information

Ayla Kabalak

Senior Anesthesiologist, Department of Anesthesiology and Reanimation, Ankara Numune Research and Training Hospital

Suna Yoldas

Assistant Anesthesiologist, Department of Anesthesiology and Reanimation, Ankara Numune Research and Training Hospital

Yeliz Ataman

Assistant Anesthesiologist, Department of Anesthesiology and Reanimation, Ankara Numune Research and Training Hospital