Prolonged postoperative analgesia for arthrolysis of the elbow joint

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Summary
We describe the provision of postoperative analgesia for 6 days for a patient undergoing arthrolysis of the elbow joint. Mobilization of the elbow immediately after operation is essential to maintain movement achieved with surgery and this can be obtained only with effective pain relief. We used continuous infusion of 0.125% bupivacaine and subsequent addition of fentanyl to the infusate, via a catheter inserted supraclavicularly into the sheath of the brachial plexus. (Br. J. Anaesth. 1995; 74: 469-471)

Key words
Analgesia, postoperative. Surgery, orthopaedic.

The provision of postoperative pain relief for arthrolysis of the elbow joint presents the anaesthetist with a special challenge. The operation is performed on patients who have developed a stiff elbow secondary to trauma, and consists of division of soft tissues and removal of bone until a satisfactory range of movement has been achieved. After operation the limb is placed in a Kinetic continuous passive movement (cpm) machine (Cogema SA, F/08540, Tournes, France) which moves the elbow through the range of movement obtained at operation over several days in a controlled manner. Pain at both the time of surgery and during this passive mobilization period is severe. In the past, results of the operation have been disappointing because any pain results in muscle spasm and the elbow rapidly becomes stiff again. Thus postoperative pain relief must be profound and prolonged. We describe the perioperative management of such a problem using continuous supraclavicular brachial plexus infusion of 0.125 % bupivacaine.

Case report
A 47-yr-old female, 85 kg in weight, presented with a 3-yr history of progressive stiffness of her right elbow after a fracture of the distal humerus treated by open reduction and internal fixation. The fracture had healed but a previous arthrolysis had failed to improve her range of movement and flexion-extension was limited to 90-125°. Pronation and supination was also restricted. She consented to arthrolysis and preoperative assessment revealed that she was otherwise healthy.

Premedication comprised diazepam 15 mg orally, 2 h before operation. A 20-gauge i.v. cannula was inserted into a vein in the left forearm. A right supraclavicular brachial plexus block was performed using a modification of the Winnie and Collins technique [1]. The patient was placed in the supine position with the head turned to the left. The interscalene groove was identified and traced distally until the subclavian artery could be palpated easily. At this point, approximately 2.5 cm above the midpoint of the clavicle, the skin was infiltrated with 1 % lignocaine. An 18-gauge cannula from a Contiplex Katheter set (B. Braun Melsungen AG) was inserted downwards backwards and laterally, staying close to the artery and aiming for the mid-axillary point at the lower border of axilla until a "click" was heard and felt as the cannula entered the sheath of the brachial plexus.

The cannula was advanced slightly further in the same direction and the stylet was removed. Aspiration confirmed that the artery had not been punctured. Paraesthesiae were not elicited but correct placement of the cannula was confirmed by the click and lack of resistance to injection of a small amount of saline. A test dose of 2 % lignocaine 10 ml was injected and warmth, paraesthesiae and paresis of the limb were apparent after 10 min [2]. A catheter from the Katheter set was threaded through the cannula and the cannula was withdrawn. Sufficient length of the catheter was inserted to place the tip under the middle of the clavicle. The catheter was then firmly secured with an adhesive dressing. Another 10 ml of 2 % lignocaine and 0.5 % bupivacaine 20 ml with adrenaline 1:400000 were given via the catheter as a bolus. Full sensory and motor block of the limb was achieved within 30 min.

General anaesthesia was induced using propofol 150 mg and tracheal intubation facilitated with suxamethonium 100 mg. Anaesthesia was maintained with 60 % nitrous oxide and 1 % enflurane in oxygen, with supplementary doses of fentanyl and droperidol to a total of 100 μg and 5 mg, respectively. Surgery lasted 60 min. A patient-controlled analgesia (PCA) pump was set up in theatre for use after operation and contained morphine 50 mg and droperidol 10 mg in 50 ml of sterile water.

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Analgesia was total for the patient in the recovery room. A continuous infusion of 0.125% bupivacaine 16 ml h\(^{-1}\) was commenced into the plexus catheter using an Imed infusion pump. On return to the ward the arm was placed on a Kinnetc cpm machine and passive flexion–extension movements were begun. Over the next 24 h analgesia remained excellent and flexion of 95\(^\circ\) and extension of 70\(^\circ\) were achieved. The PCA machine was not used and the only supplementary analgesia was two doses of Tylex (paracetamol 500 mg with codeine 30 mg).

On day 2 after operation, the patient found that attempts to increase the passive range of movement were painful and this was not controlled by increasing the plexus infusion rate to 20 ml h\(^{-1}\). Fentanyl 0.2 \(\mu\)g ml\(^{-1}\) was added to the infusion and the patient subsequently became pain-free. Passive movement of the elbow was increased further without pain returning. Indeed the limb block itself intensified and the patient could not move her fingers which she had been able to do before fentanyl was added. The infusion rate was therefore reduced in stages to 12 ml h\(^{-1}\) and analgesia remained excellent with the patient requiring only nocturnal doses of Tylex until day 6 after operation. At this time the elbow could be flexed to 110\(^\circ\) and extended to 40\(^\circ\). The infusion was discontinued and, on removing the catheter, no evidence of infection at or around the puncture site was evident.

The patient described her pain as being of moderate intensity on a verbal rating scale for 4 h on the second day after operation, before fentanyl was added to the infusedate. She reported either no pain or only mild pain both before and after this period.

Active mobilization, under the supervision of the physiotherapy department, was then commenced. The patient's pain remained well controlled with Tylex alone and she was discharged home on day 14 after operation. At follow-up in the outpatient clinic after 3 months her range of movement for flexion and extension was 70–130\(^\circ\) and for pronation and supination 45–0\(^\circ\).

**Discussion**

Postoperative pain relief was provided effectively for 6 days after arthrolysis of the elbow, using a continuous infusion of 0.125% bupivacaine into the brachial plexus via an interscalene approach [1]. This allowed continuous passive movement of the operated elbow, avoiding muscle spasm from pain and maintaining the range of movement of the elbow. This cannot be achieved with routine opioid analgesia.

Pain relief in the postoperative period by continuous infusion of local anaesthetic solutions by the axillary approach has recently been described for distraction arthroplasty of the elbow [3]. SuprACLavicular catheters are less prone to infection and are easier to secure in comparison with axillary catheters. The degree and consistency of pain relief obtained with continuous infusion of bupivacaine at lower concentrations but in higher volume were noted to be superior to the relief obtained when small volumes of more concentrated solutions were either infused continuously or given as bolus injections [unpublished observation].

Potential side effects of the technique are pneumothorax, infection, toxic reactions to the local anaesthetic agent and ipsilateral hemidiaphragm paralysis [4]. The position of the cervical pleura may be marked out by a line, convex upwards, from the sternoclavicular joint to the junction of the medial and middle thirds of the clavicle, the summit of the curve being 2–3 cm above the medial third of the clavicle [5]. Insertion of the cannula near the midpoint of the clavicle (lateral to the position of the pleura) and its advance in a lateral and caudal direction towards the mid-axillary point at the lower border of the axilla avoids pleural puncture and consequent pneumothorax. Strict aseptic technique minimizes the incidence of infection. Secure fixation of the catheter with an adhesive dressing prevents possible dislodgement of the catheter [3]. The use of a nerve stimulator to locate the position of cannula into the brachial plexus sheath will ensure its accurate placement.

No signs of toxicity of bupivacaine were reported in our patient. Blood concentrations of bupivacaine were not measured. Pere, Tuominen and Rosenberg [6] reported that plasma concentrations of bupivacaine and its metabolites did not reach toxic levels when continuous interscalene brachial plexus block was obtained for 48 h with 0.25%, bupivacaine. Bupivacaine was infused at a rate of 0.25 mg kg\(^{-1}\) h\(^{-1}\). In our patient 0.125% bupivacaine was infused at a rate of 0.18–0.29 mg kg\(^{-1}\) h\(^{-1}\). Plasma concentrations of bupivacaine and its metabolites after prolonged infusion of the drug merit further study.

The addition of fentanyl 0.2 \(\mu\)g ml\(^{-1}\) to the solution for infusion increased the degree of analgesia and intensified the block. This multimodal analgesia [7] enabled us to reduce the rate of infusion and hence the total dose of bupivacaine administered. Fentanyl has been shown to have potent and long lasting antinociceptive effects after injection into the brachial plexus sheath of the rat [8]. We have used this method of providing pain relief for major surgery on the elbow joint in 10 other patients. Fentanyl was added either to the initial bolus injection or to the infusedate of bupivacaine in seven patients. Four of these patients developed intense motor block of the upper limb, which was not expected [9].

**References**


