Femoral nerve block for pain management of femoral fractures in the emergency department: evidence based topic review

證據為本之論題：在急症室使用股神經傳導阻滯治療股骨折之痛楚

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Introduction

The incidence of femoral fracture in women and in men who were 70 years and older in Hong Kong in 1995 were 11/1000 and 5/1000 respectively.[1] Fractures of the femur are extremely painful and merit prompt attention to adequate analgesia by the emergency doctor. The efficacy and safety of regional femoral nerve block (FNB) versus systemic intravenous (IV) analgesic were reviewed. Evidence shows that femoral nerve block is effective and safe for acute care of femoral fracture in the emergency department.

Case

A 51-year-old lorry driver was trapped in the vehicle after a head-on collision with another vehicle. He was extricated by the ambulance crew and transported to the Emergency Department of Prince of Wales Hospital at 13:54 hour. Primary survey was completed at 13:56 hour and the patient was stable. Secondary survey revealed that he had a painful swollen right thigh. X-ray showed that he had a fracture of the right proximal femoral shaft. The patient was in excruciating pain and 7 mg of intravenous morphine was given at 14:12 hour. However, the pain was still unbearable especially during movement on examination. Femoral nerve block was performed at 14:57 hour with lignocaine 100 mg (10 ml, 1%) plus marcain (bupivacaine) 50 mg (10 ml, 0.5%) under aseptic technique. At 15:15 hour, there was almost complete pain relief, which resulted in the patient being more cooperative and comfortable during the subsequent assessment. He was then admitted to the orthopaedics ward with closed reduction and nailing performed to the right proximal femur on the same day. No complication from the femoral nerve block was recognised and the postoperative course was uneventful. He was discharged after 13 days.

Four-part question

To find out the best evidence concerning the efficiency and safety of femoral nerve block for acute pain management in patients with femoral shaft fracture, we generated a four-part question: -

In [an adult patient with a femoral shaft fracture] does [femoral nerve block] provide [more effective and safer analgesia] than [intravenous analgesia] for acute pain management?

Search strategy

Medline 1966-02/2005 using the OVID interface: (femoral fractures.mp OR exp femoral fractures) AND

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[femoral nerve block.mp OR (exp femoral nerve AND exp nerve block) OR exp anesthesia, local OR exp anesthesia, intravenous OR regional anesthetic.mp] Limit to "all adult (19 plus years)", human, English AND randomised controlled trial.

Search result

Nine papers were found, of which three were relevant for inclusion (see Table 1). For the six papers that were not included here, two of them studied on the nerve

Table 1. Summary of search findings

Author, date & country [Reference]	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weakness
Fletcher AK, 2003 UK[2]	50 patients with fractured neck of femur aged 63-89. 3-in-1 FNB (N=26) (20 ml 0.5% bupivacaine) vs IV morphine (N=24)	Prospective randomised controlled trial with blinded assessors	Mean pain score	Faster time to reach the lowest pain score: 2.88 h for patients with FNB vs 5.81 h for control patients (mean difference -2.93 h; 95% confidence interval [CI] -5.48 to -0.38 h)	Method of randomisation not stated
			Mean morphine dose per hour	FNB recipients required significantly less morphine per hour than control patients (mean of 0.49 mg/h vs 1.17 mg/h; mean difference -0.68 mg/h; 95% CI -1.23 to -0.12 mg/h)	
Haddad FS, 1995 UK[3]	50 patients with extracapsular fractures of the femoral neck aged 68-89. FNB (N=24) vs control (N=21) oral co-dydramol, intramuscular Voltarol and intramuscular pethidine	Prospective randomised controlled trial with blinded assessors	Average analgesic scores (range) in the first two hours after admission	Statistically significant difference in pain reduction at both 15 min (mean 4.8 vs 6.4, $p<0.05$) and 2 h (mean 3.7 vs 5.9, $p<0.01$) after FNB	Only extracapsular fractures included
			Analgesic requests in the first 24 hours after admission	Significant reduction in the requirement for intramuscular opiates (12 vs 35, $p<0.05$) in the FNB group	
Sia S, 2004 Italy[4]	20 patients with femoral shaft fractures aged 24-46. FNB (N=10) (lidocaine 1.5% 15 ml) vs IVA (N = 10) (IV fentanyl 3 µg/kg)	Prospective randomised controlled trial	VAS at positioning for spinal anaesthesia	FNB 0.5±0.5 vs IVA 3.3±1.4, $p<0.001$	No blinded assessors
			Time to perform spinal anaesthesia (min)	FNB 1.8±0.7 vs IVA 3.0±1.1, $p<0.05$	
			Quality of patient position (0 to 3)	FNB 2.8±0.4 vs IVA 1.6±0.7, $p< 0.005$	
			Patient acceptance (yes/no)	FNB 10/0 vs IVA 6/4, $p<0.005$	

FNB=femoral nerve block, IV=intravenous, IVA=intravenous analgesia

blockade by continuous infusion of anaesthetics, the other two on post-operative analgesia, another one stressed on the technique of ultrasound guidance, the remaining one was a comparative study of ketamine and relaxant anaesthesia.

Discussion

Berry was the first to publish the use of femoral nerve block in patients with fractured shaft of femur in 1977.[5] Other than the effect of pain relief, Berry had an experience that the relief of severe leg pain in a patient drew attention to left hypochondrial pain associated with a ruptured spleen.

Technique

There are two possible techniques described. Firstly, 'simple' femoral nerve block, and secondly, three-in-one femoral nerve block.

'Simple' femoral nerve block is good for patient with fractured shaft of femur. It is performed with the patient in the supine position; and the skin is prepared in an aseptic fashion (Figure 1).[6] The femoral artery is palpated 1 cm below the inguinal ligament. With the non-dominant hand placed firmly on the artery, a 1.25 cm, 22 g needle, attached to an extension tube set-up and a 20-ml syringe, is inserted 1 cm lateral to the artery at a 90 degree angle to the skin and underlying vessel. The needle is advanced until the needle pulsates laterally or paraesthesia is elicited, and then it is withdrawn a few millimetres. After aspiration is done to reduce the risk of intravascular injection, 10 to 20 ml of anaesthetic can then be injected. The anaesthetic will diffuse around and into the nerve bundle to achieve analgesic effect.

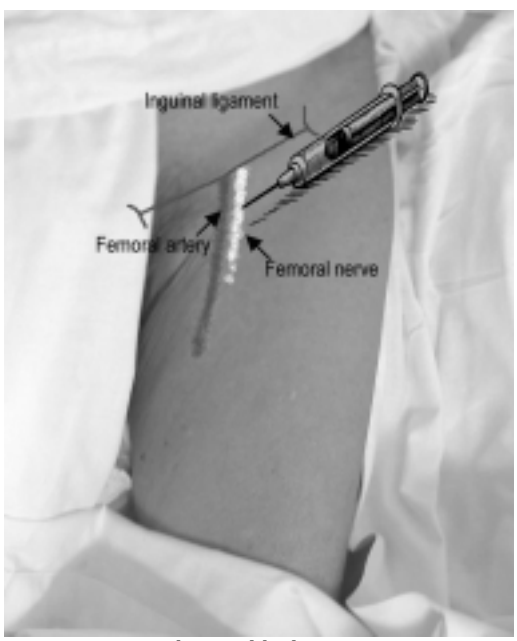

Figure 1. Femoral nerve block.

The choice of anaesthetics is determined by the duration of the anaesthesia required, and the size and health of the patient (Table 2). For blocks of 2 to 4 hours, lignocaine and mepivacaine of the amount recommended can be used.[7] Bupivacaine provides a longer duration of action of 6 to 8 hours. The addition of 5 micrograms adrenaline per millilitre prolongs the duration and lowers the plasma concentration of the local anaesthetics by 20% to 30%.

Three-in-one block is good for patient with fracture neck of femur. It is a very similar procedure to FNB with the same puncture site while it requires a larger amount of anaesthetic solution, a slightly different angle of injection of the anaesthetic and requires compression distal to the injection site for five minutes after the injection. It is believed that the anaesthetic ascends to the level of the lumbar plexus along the

Table 2. Equipment and anaesthetics[6,7]

Equipment	6 gauze sponges
	4 towels
	1 antiseptic-solution receptacle
	1 receptacle for saline flush solution
	1 anaesthetic-solution receptacle (30-ml capacity)
	1 30-ml syringe for nerve block injection
	1 three-way stopcock
	1 IV extension tubing set
	1 18-G needle for withdrawing anaesthetic from the vial
	1 1.25-cm 22-G needle for nerve block
Anaesthetics	Lignocaine 4.5 mg/kg (1.0% - 1.5%)
	or
	Mepivacaine 7 mg/kg (1.0% - 2.0%)
	or
	Bupivacaine 2-3 mg/kg (0.25% - 0.375%)

nerve sheath sandwiched between the quadratus lumborum and iliopsoas muscles to involve the obturator and lateral femoral cutaneous nerves. It can provide improved analgesia for the upper thigh and the knee joint.

Analgesic efficacy

As illustrated in Table 1, FNB is more efficient in pain reduction comparing with IV morphine alone. Pain significantly decreased within 15 minutes after the block was performed and it sustained to at least two hours, and the effect was also statistically superior to systemic analgesia. Femoral nerve block was shown to provide a greater degree of pain reduction than intramuscular opiate. It also has better patient acceptance than IV fentanyl.

Safety

The complications of FNB include nerve injury, intravascular injection, haematoma, infection, systemic toxicity, limb injury, allergy and overdose.[6] There are no data on the complication rate of nerve blocks performed in the emergency department. Complications usually result from poor technique. The use of a nerve stimulator should be able to increase the accuracy of the procedure so as to reduce complications.[8]

In the patient with femoral fracture there may be associated high-energy multiple trauma. The administering of narcotic analgesics has a risk of dose-dependent respiratory depression, which is undesirable. Femoral nerve block has no such contraindications that can preclude the use of narcotics in multiple trauma or elderly patients.

Conclusion

Femoral nerve block is an efficient and safe procedure for pain management in patients with femoral fractures. The complication rate is low if performed properly. It is recommended that FNB be considered in femoral fractures at emergency departments in Hong Kong.

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