

## Mechanism of femoral nerve palsy complicating percutaneous ilioinguinal field block

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### Summary

Femoral nerve palsy has been reported after percutaneous ilioinguinal field infiltration with general anaesthesia for inguinal herniorrhaphy. The mechanism whereby this could occur was studied in cadaver dissections. It was found that the plane between the transversus abdominis muscle and the transversalis fascia was continuous laterally with the tissue plane deep to the iliacus fascia, which is the plane containing the femoral nerve. Injection of methylene blue 1 ml into this plane resulted in pooling of dye around the femoral nerve. Femoral nerve palsy may result from infiltration of a sufficient volume of local anaesthetic into the plane between the transversus abdominis muscle and the transversalis fascia with tracking of the injectate deep to the iliacus fascia to affect the femoral nerve. This finding has important implications for the performance of a percutaneous ilioinguinal field block particularly in day surgery provision. (*Br. J. Anaesth.* 1997; 78: 314–316).

### Key words

Anaesthetic techniques, regional, inguinal. Complications, nerve palsy.

Transient femoral nerve palsy (FNP) has been reported after percutaneous ilioinguinal field block (PIIFB) for inguinal herniorrhaphy.<sup>1,2</sup> In all cases discharge from hospital was delayed and serious injury was sustained by one patient.<sup>2</sup> The femoral nerve lies on the posterior abdominal wall covered by the strong iliacus fascia<sup>3</sup> and it is unlikely that simple diffusion of the local anaesthetic agent through tissue layers could result in FNP. Sufficient local anaesthetic to cause block must enter the plane deep to the iliacus fascia and there are potentially two routes whereby this may occur: (i) local anaesthetic is infiltrated directly under the iliacus fascia around the femoral nerve; (ii) local anaesthetic tracks around tissue planes to enter this plane and involve the femoral nerve.

This cadaver study was carried out in an attempt to elucidate the most likely mechanism whereby this complication could occur.

### Methods and results

We examined 21 cadavers with the abdominal contents removed in this anatomical study. In all cases the posterior and anterolateral abdominal walls had been left untouched and the parietal layers were exposed medially. A standard approach<sup>4</sup> to a PIIFB was used with a 22-gauge short bevel spinal anaesthetic needle inserted vertically through the skin at a point 3 cm medial to the anterior superior iliac spine (ASIS). The muscle and fascial layers traversed by the needle were observed and their thickness measured. The distance in the transverse axis between the femoral nerve and the point at which the vertically inserted needle made contact with the posterior abdominal wall was also measured. In three cases, sequential injections of methylene blue 1 ml were carried out first into the plane superficial to the transversus abdominis muscle and subsequently into the plane between that muscle and the transversalis fascia to examine the direction and extent of spread.

### ABDOMINAL WALL

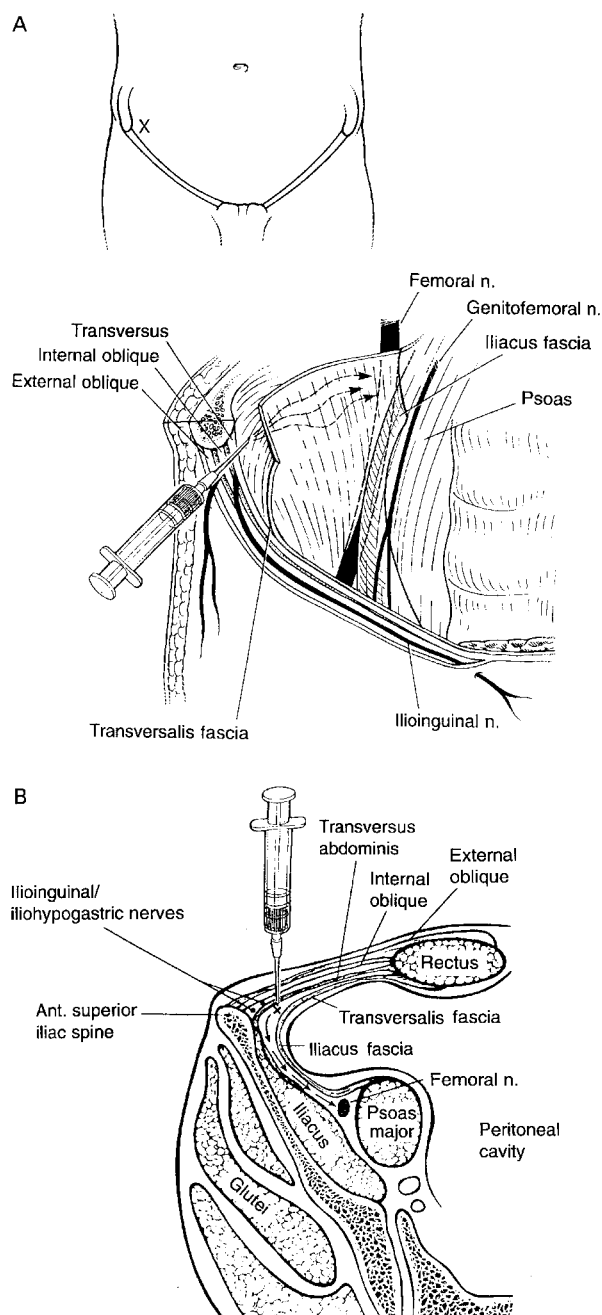
The layers traversed in passing the needle from the anterior to the posterior abdominal wall are skin, subcutaneous fat, external oblique aponeurosis, internal oblique and transversus abdominis muscles, transversalis fascia, extraperitoneal fat, iliacus fascia and finally the iliacus muscle itself. In all cases the combined thickness of the internal oblique and transversus abdominis was less than 5 mm.

### DISTANCE FROM THE FEMORAL NERVE

Mean distance from the needle point to the femoral nerve along the posterior abdominal wall was 4.5 (95% confidence interval 0.3) cm in female cadavers ( $n=11$ ) and 3.2 (0.3) cm in males ( $n=9$ ). This difference between the sexes was highly significant ( $P<0.0001$  Student's *t*-test).

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**Figure 1** A: Three-dimensional schematic representation of the body layers at the level of the anterior superior iliac spine and observed direction of spread of injectate after injection deep to the transversus abdominis muscle. B: Cross-sectional diagram of the pelvis at the level of the ASIS demonstrating reflection of the transversalis fascia as the iliacus fascia and the femoral nerve lying in the natural gutter lateral to the psoas.

#### METHYLENE BLUE INJECTION

Injection of methylene blue 1 ml in the plane superficial to the transversus abdominis resulted in little dispersion of the injectate with discolouration remaining confined to the plane between that muscle and internal oblique. The transversalis fascia in all cases was continuous with and reflected laterally as the iliacus fascia (fig. 1). Injection of methylene blue 1 ml in the plane deep to the transversus abdominis involved advancement of the needle tip approximately 2–3 mm. Dye was seen consistently in all cases track-

ing medially and slightly cephalad under the iliacus fascia. Elevation of the iliacus fascia showed the dye pooling around the main trunk of the femoral nerve and other branches of the lumbar plexus.

#### Comment

PIIFB is often used before inguinal herniorrhaphy as an adjunct to general anaesthesia to allow lighter anaesthesia in the perioperative period and for relief of postoperative pain. The technique carries morbidity as there have been five reported cases of prolonged FNP, with one patient suffering serious injury from a subsequent fall.<sup>2</sup> The incidence of FNP complicating PIIFB is uncertain but given the increasing trend towards day surgery provision, the incidence and associated morbidity of this complication, that is delayed ambulation, seems likely to increase. The ilioinguinal and iliohypogastric nerves lie initially between the transversus abdominis and the internal oblique, piercing the internal oblique at a variable distance medial to the ASIS to lie between the external oblique aponeurosis and internal oblique.<sup>3</sup> As segmental nerves (L1) they have a cutaneous distribution and also supply the parietal peritoneum; thus blockade of these nerves provides good analgesia after inguinal herniorrhaphy. The femoral nerve arises from the anterior rami of the lumbar nerves L2, 3 and 4 in the lumbar plexus. It emerges under the iliacus fascia at the lateral border of the psoas major to lie in a natural gutter between that muscle and the iliacus (fig. 1). We have seen from our dissections that dye injected into the plane between the muscles of the abdominal trunk, that is the correct plane for infiltration, remains confined to that plane. However, when injected deep to the transversus abdominis the dye tracks towards the femoral nerve under the iliacus fascia which is continuous laterally with the transversalis fascia. While this study has demonstrated an anatomical mechanism for spread of local anaesthetic solution if injected in a plane too deep, we can make no definitive comment on the volume of injectate or rate of injection required to result in FNP. It must be noted that spread in the cadaver was achieved using only 1 ml of dye. Even allowing for differences in tissue conditions *in vivo* it seems likely that should sufficient local anaesthetic enter this plane, in the supine position the bony and fascial attachments of the fascial plane inferolaterally (to the ASIS and inguinal ligament) would cause tracking medially and pooling around the femoral nerve with resultant FNP.

An alternative explanation for the observed FNP is that the local anaesthetic is instilled directly around the nerve. Whereas it is not possible to totally discount this mechanism, we have seen from this study that the needle would have to be directed approximately 3–4 cm more medially than is recommended and this would therefore be unlikely. Of interest is the finding of a difference in the distance from the site of injection to the femoral nerve between males and females. The clinical significance of this is that FNP after PIIFB may be less likely to occur in females than males.

Our findings suggest that in a PIIFB for inguinal

hernia repair, care should be taken to avoid injecting local anaesthetic deep to the transversus abdominis. This could be achieved by infiltrating the superficial layers, that is the skin and external oblique aponeurosis percutaneously and infiltrating the deeper layers and the ilioinguinal nerve under direct vision after exposure by the surgical incision. Should an entirely percutaneous approach be used, it is essential that the patient is informed of the potential risks, that nursing staff are informed and appropriate precautions are taken to prevent injury resulting from subsequent lower limb weakness.

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