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## Transient femoral neuropathy after knee ligament reconstruction and nerve stimulator-guided continuous femoral nerve block: a case series

Patients often develop a severe, but transient, quadriceps amyotrophy following anterior cruciate ligament (ACL) reconstruction [1]. We investigated whether or not this amyotrophy could be related to a femoral neuropathy induced by a pneumatic tourniquet [2] or by a continuous femoral nerve block [3].

After approval from our local research ethics committee, we performed a clinical neurological examination and an electrophysiological study before surgery to exclude pre-existing femoral neuropathy. We defined postoperative femoral neuropathy as an axon loss > 20%, associated with an absent H-reflex of the femoral

nerve and signs of denervation of the vastus medialis muscle. The H-reflex (or Hoffmann reflex) is a reflex reaction of muscles after incremental electrical stimulation of sensory fibres. Signs of denervation were scored as present when fibrillation potentials of the muscle were observed at rest [4]. In each case, a femoral nerve catheter was inserted with a nerve stimulator using Winnie's classic technique [5], followed by spinal or general anaesthesia. Follow-up neurological examinations and an electrophysiological study were scheduled at 4 weeks and 6 months after the ACL repair.

Seventeen ASA patients, of ASA physical status 1–2 and with a mean age of 26 years, completed the study. After surgery, all patients developed subjective weakness of the quadriceps muscle without neuropathic pain or paraes-

thesia; in 11 patients (65%), a significant reduction of the compound muscle action potentials was observed. Four patients (24%) had clinical criteria or electrophysiological signs of femoral neuropathy at 4 weeks but not at 6 months (Figs 8 and 9).

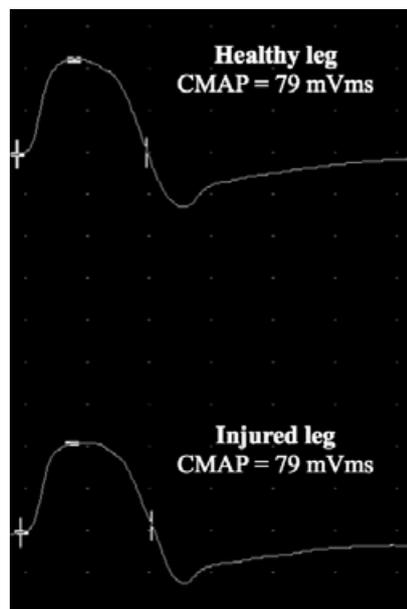
Acute neurological lesions from all causes occur in 8–14% of patients postoperatively [6, 7] and usually resolve to between 0.2% and 0.6% within 6–9 months postoperatively [6–10]. The explanation for the higher incidence we found at 4 weeks might be that we conducted a systematic investigation of neurological lesions even when patients were asymptomatic.

Our femoral neuropathies could be the result of the thigh tourniquets, which can produce a compression paralysis and muscle ischaemia [11]. The tourniquet times and pressures were in the upper limits of the usual recommendations. We may also have caused direct nerve trauma during the femoral nerve blocks.

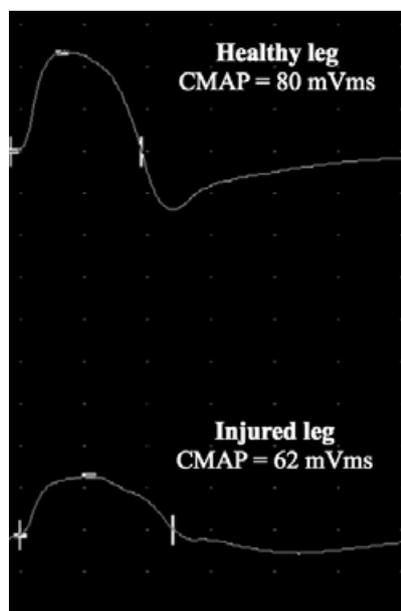
We confirmed with electrophysiological study that ACL reconstruction was followed by quadriceps amyotrophy in 11 patients; this muscle amyotrophy may be worsened by a femoral neuropathy. Further studies are needed to assess the incidence and aetiology of neuropathy according to the type of surgery and analgesia, as well as to assess the influence of these factors on recovery of quadriceps muscle strength after ACL reconstruction.

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**Figure 8** Pre-operative electrophysiological study of a patient with a postoperative femoral neuropathy. CMAP, compound muscle action potential.



**Figure 9** Postoperative electrophysiological study of the same patient. The axon loss ratio between the pre-operative and postoperative study of the same femoral nerve from the injured leg was calculated as:  $100 \times [\text{Pre}_{\text{CMAP}} - \text{Post}_{\text{CMAP}}] \div \text{Pre}_{\text{CMAP}} = 100 \times [79 - 62/79] = 22\%$ . CMAP, compound muscle action potential;  $\text{Pre}_{\text{CMAP}}$  and  $\text{Post}_{\text{CMAP}}$ , compound muscle action potential area of the injured side before and after surgery, respectively.

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## Wrong site medical intervention: another potential source for error

Incorrect site peripheral nerve blockade or surgery can be a devastating experience for the patient. Although these events are rare, the use of peripheral nerve blocks is increasing and so too is the number of incorrect site incidents [1]. Using a marker pen to draw an arrow with the intention of unambiguously identifying the operative site is standard practice and part of the World Health Organization's (WHO's) surgical checklist and National Patient Safety Agency (NPSA) guidelines [2, 3]. The WHO Surgical Safety Checklist Alert states; 'the anaesthetist should only proceed with a regional block when he/she has confirmed that the site for surgery has been marked' [3].

We report a case in which a 78-year-old patient was scheduled for a right-sided below-knee amputation. Pre-operative checks, including a

time-out procedure, confirmed the side of the operation and a single arrow was noted on the anteromedial aspect of the right thigh. The left lower limb was not exposed. Following spinal anaesthesia, continuous femoral and sciatic nerve blocks were placed on the right side and the sedated patient transferred to the operating room. When the sheets covering the patient's lower limbs were completely removed, arrows were observed on both lower limbs (Fig. 10). An arrowhead was also noted on the superomedial aspect of the left patella. Subsequent checks confirmed that the intended operative site was the right lower limb. We concluded that the arrow and arrowhead on the right lower limb had been accidentally transposed to the left leg when both lower limbs had been in close apposition sometime pre-operatively. Incorrect side surgery has been described as a 'never event' [4]. Although a rare event, the case described herein demonstrates that marking a limb with a single arrow sometimes fails to achieve the desired aim of unambiguously marking the operative site [2, 5]. Aside from confirming that both limbs are not marked, a similar incident may be avoided by marking the limb in an area where cross-transfer is less likely. Writing the side in a legible fashion beside the mark may also be helpful in avoiding confusion and wrong site medical interventions [5]. This case confirms that surgical site marking with an arrow alone may not always unambiguously identify the operative site and vigilance must still remain high before medical intervention to avoid wrong site regional nerve block or surgery.

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**Figure 10** Photograph showing arrows present on both lower limbs pre-operatively.

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