Femoral And Saphenous Nerve Palsy Post-Total Knee Replacement

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Citation

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Abstract

Peripheral nerve injuries following surgery can have a significant impact on the rehabilitation process. We report a case of a 66-year old lady who was unable to straight leg raise and had altered sensation in the anterior thigh and medial leg compartment following a primary total knee replacement. Three weeks following surgery an electromyography and nerve conduction study was performed due to persistent symptoms and poor rehabilitation and this revealed femoral and saphenous nerve palsies. Our report is believed to be the first on femoral and saphenous nerve palsies following primary total knee replacement. We consider that tourniquet-induced nerve lesion can occur despite tourniquet time and pressure being in the acceptable safe range. Persistent poor rehabilitation following surgery using a tourniquet warrants further investigation to exclude peripheral nerve palsy.

INTRODUCTION

Peripheral nerve injuries due to orthopaedic surgery involving the knee is a recognised complication and this may affect the rehabilitation process. Paralysis of the sciatic nerve following knee ligament surgery, [1] peroneal nerve palsy following total knee arthroplasty [2] and tibial nerve palsy complicating anterior cruciate ligament reconstruction [3] have been reported. Femoral nerve palsy is more commonly seen in hip surgery compared to knee surgery. [4] We believe this is the first reported case of femoral and saphenous nerve palsy following primary total knee replacement with the use of a pneumatic tourniquet.

CASE REPORT

Our patient was a 66-year old lady with a history of severe bilateral osteoarthritis of the knee with neurologically intact lower limbs pre-operatively. The patient underwent a left primary total knee replacement under spinal anaesthesia. The operation was performed in a bloodless field using a pneumatic tourniquet. The tourniquet was inflated to 300 mmHg from the onset and was maintained at that pressure until completion of the procedure at 75 minutes. No intra-operative complications were noted.

First day post-surgery, the patient was unable to straight leg raise but dorsi-flexion and plantar flexion was normal. This was attributed to post-operative pain and was treated with regular analgesia. One week post-surgery, the patient was still unable to straight leg raise and this had impaired her rehabilitation process. Clinical examination demonstrated no quadriceps contraction and altered sensation in the anterior thigh and medial leg compartment.

An ultrasound scan at seven days following surgery reported an intact quadriceps tendon but was unable to exclude a small rupture. A computer tomography (CT) examination performed at 10 days post-knee replacement suggested a possible partial rupture of the quadriceps tendon, superior to its insertion at the patella. However, wound exploration revealed an intact repair of the quadriceps mechanism. Magnetic resonance imaging scan of the lumbar spine at two weeks post-surgery was normal. Electromyography (EMG) and nerve conduction study at three weeks post-total knee replacement revealed severe femoral nerve palsy with Wallerian degeneration and marked denervation in the left quadriceps. There were no motor units recordable under voluntary control in the left quadriceps (refer to Table 1) and no response recorded in the left saphenous nerve (refer to Table 2). Patient was discharged with out-patient physiotherapy and knee splint. The patient stopped using the knee splint after six weeks.

Figure 1

Table 1: Electromyographic examination performed three weeks after tourniquet use for left total knee replacement.

Muscle	*Activity at rest*	*Interference pattern*
Left vastus medialis	Continuous fibrillations	No motor units
Left vastus lateralis	Continuous fibrillations	No motor units
Left adductor magnus	Silent	Within normal range

Figure 2

Table 2: Nerve conduction study performed three weeks post-surgery.

Sensory nerves	*Latency (msec)*	*Amplitude (microvolts)*	*Velocity (metres/sec)*
Left sural	2.1	11.0	47.6
Left saphenous	No response		
Right saphenous	1.8	1.8	50.0

Clinical examination at four months follow-up showed an improvement in quadriceps power (4+/5) with extensor lag of 20 degrees. Sensory changes demonstrated previously showed a decreased area of paraesthesia. Range of movement of the knee joint was between 20 to 100 degrees and the patient was mobilising independently with one stick. EMG at four months revealed some improvement in femoral nerve function. Although motor units are readily recordable under voluntary control in vastus lateralis, this is not the case with vastus medialis. However, overall there has been some improvement. Due to the severity of nerve damage in this case, further improvement is likely to be slow.

DISCUSSION

Femoral nerve palsy is a rare but recognised complication of knee surgery. Reported causes include fluid extravasation with an infusion pump irrigation system [5] and tourniquet use [3, 4, 6].

Clinical diagnosis of peripheral nerve palsy following surgery can be difficult. Poor rehabilitation during the first week following surgery could be due to various reasons including post-operative pain, deep vein thrombosis, infected prosthesis, breakdown of tendon repair and patient's co-morbidities. In the absence of any obvious underlying pathology and persistent poor rehabilitation, peripheral nerve investigation should be considered. In our case, following the exclusion of a quadriceps tendon rupture with surgical exploration, an EMG was diagnostic for femoral and saphenous nerve palsies.

There have been case reports suggesting an association between peripheral nerve palsies and prolonged use of the pneumatic tourniquet. A recent report suggested the predominant cause of femoral nerve palsy was the prolonged use of the tourniquet; this being 280 minutes. [4] Saunders et al showed that 85% of patients who underwent knee arthrotomy had nerve palsy by EMG in cases where the tourniquet was used for more than an hour. [7] This was much higher compared to the 22% of patients who recorded nerve palsy in cases where the tourniquet time was less than 15 minutes. [7] This study also reported that the most commonly affected muscles were the quadriceps. [7] Some authors have suggested that two hours of consecutive tourniquet time is acceptable. [8] Klenermann reported that with regard to ischaemia-related nerve injuries, three hours should be regarded as the upper limit of safety. [9] In our case, we used a pneumatic tourniquet with a sustained pressure of 300 mmHg for 75 minutes, which is well within the acceptable safety range.

Clinical studies have shown that direct pressure exerted by the tourniquet is usually regarded as the aetiology of the nerve lesion. [9, 10, 11] However, some authors regard prolonged ischaemia as the main factor responsible for nerve palsies. [12] Reid et al showed that pressure needed to maintain a bloodless field for surgery was 255 mmHg for upper limb surgery and 305 mmHg for lower limb surgery. [13] There have been reports where tourniquet-induced nerve palsies have occurred as a result of an undesired increase in tourniquet pressure due to a faulty gauge. [14] In our case, the tourniquet pressure was maintained at 300 mmHg throughout surgery. Because the tourniquet pressure was well within the acceptable range, this is unlikely to be the predominant causative factor for our patient.

Our patient underwent a total knee replacement under spinal anaesthesia. Injury to the femoral nerve caused by spinal anaesthesia has not been previously described. The use of spinal anaesthesia is likely to affect a nerve root rather than a peripheral nerve. Hence, the clinical features would be specific to the affected dermatome and myotome. This was not the case in our patient.

CONCLUSION

Based on the literature, tourniquet-induced nerve damage is not uncommon. Peripheral nerve injury is likely to impair the rehabilitation process post-surgery. We consider the femoral and saphenous nerve palsies in our case were caused by the pneumatic tourniquet. Tourniquet-induced nerve injuries can occur despite the tourniquet pressure and time

applied within the defined safe limits. Clinicians should be aware of this possibility following surgery performed with a pneumatic tourniquet and consider investigating patients with clinical features of peripheral nerve lesions and/or persistent poor rehabilitation.

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