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Ultrasound-Guided Genicular Nerve Blocks for Tibial Plateau Surgery

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Abstract

The choice of regional anesthesia for tibial plateau surgery remains challenging due to the complex innervation of the knee joint and the variability in fracture patterns. While traditional regional anaesthesia techniques are commonly used, emerging evidence supports the role of motor-sparing genicular nerve blocks in acute knee trauma. We present a case of a 61-year-old patient with a left-sided tibial plateau fracture, who underwent surgical repair under general anesthesia, with ultrasound-guided genicular nerve blocks administered pre-operatively. The patient received general anaesthesia for the surgery. The patient achieved effective intraoperative and postoperative analgesia, reducing the need for systemic opioids. This case highlights the safety and efficacy of genicular nerve blocks as an adjunct for perioperative pain management in tibial plateau fractures. Given its demonstrated benefits in total knee arthroplasty and osteoarthritis management [1] [2], further studies are warranted to explore its role in acute orthopedic trauma.

Keywords

Genicular Nerve Block, Tibial Plateau Fracture, Ultrasound, Knee Pain, Pain Management

1. Introduction

Providing pain relief for tibial plateau surgery is challenging due to the complex innervation of the knee joint, which involves contributions from multiple nerves, including the femoral, sciatic, and obturator nerves [3] [4]. Traditionally, regional anesthesia techniques, such as femoral nerve blocks and adductor canal blocks, have been used for perioperative pain control, but they often involve motor blockade, which can delay early mobilization [1] [2].

Genicular nerve block (GNB) has emerged as a safe and effective alternative for

knee pain management while preserving motor function. This technique involves a single injection of local anesthetic targeting the superior lateral, superior medial, and inferior medial genicular nerves under ultrasound guidance [5] [6]. Studies have demonstrated efficacy in managing chronic knee pain due to osteoarthritis [3] and post-surgical pain following total knee arthroplasty [7] [8].

The use of ultrasound-guided (USG) GNB in the emergency department (ED) has been documented in case reports, showing its success in providing safe and effective analgesia for acute knee pain secondary to tibial plateau fractures [9] [10]. Additionally, regional anesthesia techniques, including nerve blocks, have been associated with reduced opioid consumption and improved pain control following tibial plateau fracture surgery [11] [12].

Despite its benefits, the intraoperative application of USG-GNB for surgical repair of tibial plateau fractures has not been widely reported. Here, we present the first documented case of ultrasound-guided GNB used perioperatively during open reduction and internal fixation (ORIF) of a tibial plateau fracture, highlighting its role in enhancing multimodal pain management strategies.

2. Case Report

A 61-year-old patient presented with left knee pain to the Emergency Department after a fall. The patient was alert, conscious and able to explain the event. The patient reported 9 out of 10 pain score (Numerical pain scoring) with movement. The physical examination showed a limited range of motion (ROM) on the left leg compared to the right. The CT scan showed a left sided lateral tibial plateau fracture (**Figure 1**). The fracture was stabilised with a long leg back slab above the knee. The patient was booked for open reduction and internal fixation surgery for the next day. The preoperative assessment showed no other co-morbidities.

Figure 1. CT scan of left knee showing tibial plateau fracture.

The patient was informed about the procedure of ultrasound-guided GNB and written informed consent was obtained from the patient for publication, in com-

pliance with ethical standards and institutional requirements. The patient was placed in supine position and the transducer was placed in coronal orientation on the medial and lateral aspects of the knee. The superolateral genicular artery was identified on ultrasound. Using this as a landmark, we identified the superolateral genicular nerve on ultrasound (Figure 2). Aseptic technique was used to perform ultrasound guided GNB. Superior medial genicular nerve (SMGN), superolateral genicular nerve (SLGN), inferomedial genicular nerve (IMGN) were anaesthetised with 1% lignocaine using a 22-gauge, 2-inch needle followed by 75 milligrams of levobupivacaine injection (15 mls of 0.25% levobupivacaine). Inferolateral genicular nerve was spared due to a potential risk of damage to the common peroneal nerve (Figure 3). The effect of the nerve block was assessed after 10 minutes, the patient reported a Numerical Pain Score of 0/10 both at rest and on movement. Intraoperatively she remained hemodynamically stable with no significant increases in heart rate or blood pressure, consistent with absence of nociceptive responses and a relaxed clinical state. Despite the effective block, general anaesthesia was administered to provide definitive anxiolysis and amnesia, guarantee absolute immobility and pharmacologic muscle relaxation for the surgical procedure. Postoperatively, the patient remained pain-free for 24 hours, requiring no analgesics including paracetamol or opioids and reported consistently low pain scores, demonstrating excellent comfort and cooperation.

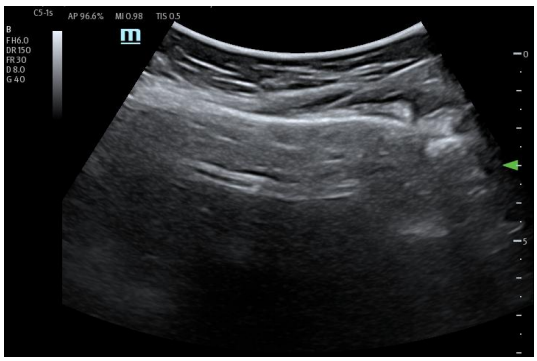

Figure 2. Superior lateral genicular artery is an important anatomical landmark accompanying superior-lateral genicular nerve.

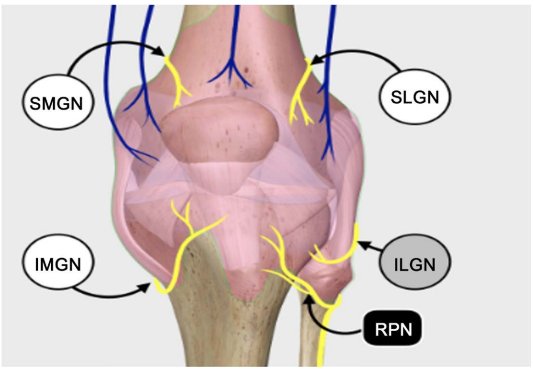

Figure 3. Genicular nerve anatomical distribution.

3. Discussion

In this report, we present a case of ultrasound-guided genicular nerve block (USG-GNB) used perioperatively for open reduction and internal fixation (ORIF) of a tibial plateau fracture. To our knowledge, this is the first reported case of perioperative GNB in this setting. The patient had a postoperative pain score of 0/10 for 24 hours, effectively minimizing opioid use and enhancing recovery.

Tibial plateau fractures can damage nearby vessels, nerves, and ligaments, often necessitating surgical intervention [13] [14]. Due to the complexity of the knee joint's innervation, achieving effective pain control remains challenging. The knee joint has a complex sensory innervation, with contributions from both the lumbar and sacral plexuses. The anterior knee capsule is primarily innervated by branches of the femoral, sciatic, and obturator nerves, whereas the posterior knee capsule is supplied by the popliteal nerve [5]. However, anatomical variations exist, and several terminal branches from these nerves interact with the bone to provide sensory input. Specifically, the terminal branches of the femoral, tibial, obturator, and saphenous nerves contribute to the formation of the genicular nerves, which selectively innervate the knee joint capsule while sparing motor function [5].

Peripheral nerve blocks are recognized as safe and effective in managing pain associated with tibial plateau fractures and may improve postoperative joint function compared with general or spinal anesthesia alone [13]. Studies have demonstrated that GNB can reduce local anesthetic requirements compared with alternative techniques in knee surgery [2]. Furthermore, preoperative use of GNB in total knee arthroplasty (TKA) has been associated with better analgesic outcomes and reduced anesthetic requirements compared to local infiltration techniques [6].

USG-GNB has been used in chronic knee pain management, particularly for osteoarthritis (OA). Demir *et al.* [5] reported its use in a 61-year-old patient with severe OA-related knee pain, who remained pain-free and off analgesics for 24 weeks post-GNB. Similarly, Tan *et al.* [8] concluded that USG-GNB provides safe and effective pain relief for up to six months in patients with chronic knee pain. Güler *et al.* [1] compared physical therapy versus USG-GNB and found that GNB significantly increased the physical capacity of OA patients, with effects lasting up to 12 weeks. Beyond OA, GNB has also been shown to be beneficial in inflammatory arthritides, with randomized trials reporting improved pain control and reduced steroid requirement in rheumatoid arthritis and juvenile idiopathic arthritis [3] [4]. Recent randomized, placebo-controlled data also add to the evidence base for GNB in knee OA [4].

Chronic pain is a well-documented complication following ORIF surgery for tibial plateau fractures and may contribute to long-term opioid dependence [12]. Regional anesthesia techniques, including GNB, have been shown to provide effective pain management while reducing opioid use for up to 90 days post-surgery [13]. Caldwell and Selepec [2] further demonstrated diminished opioid use in patients who underwent anterior cruciate ligament (ACL) reconstruction with a

GNB administered at the end of surgery.

Genicular nerve block may be particularly beneficial in elderly patients with multiple comorbidities who have contraindications to opioid use. Additionally, it may serve as a valuable alternative for patients with a history of substance misuse, reducing the risk of opioid dependence postoperatively.

4. Conclusion

This case highlights the novel use of USG-GNB as a perioperative pain management strategy in tibial plateau fracture surgery. Given its ability to provide effective pain relief, preserve motor function, and minimize opioid consumption, it may represent a valuable addition to multimodal analgesia protocols for knee surgeries. Future studies and clinical trials are warranted to further evaluate its long-term benefits and wider applicability in orthopedic trauma surgery.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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