Journal Pre-proof


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PII: S0104-0014(21)00077-4

DOI: https://doi.org/10.1016/j.bjane.2020.12.024

Reference: BJANE 744067

To appear in: *Brazilian Journal of Anesthesiology (English edition)*

Received Date: 13 October 2020

Please cite this article as: { doi: https://doi.org/

**BJAN-D-20-00290 - Letter to the Editor**

# Regional analgesia technique for postoperative analgesia in total knee arthroplasty: Have we hit the bull's eye yet?

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Received 13 October 2020; accepted 24 December 2020

*Dear Editor*,

Total knee replacement (TKR) is one of the most commonly performed elective lower limb orthopedic surgeries. It is associated with moderate postoperative pain in 30% and severe pain in 60% of the patients.[1] Inadequate and poorly treated postoperative pain affects the rehabilitation process by decreasing the range of motion, delaying early ambulation, prolonging the length of hospital stay and overall patient satisfaction. It may also be associated with several complications like myocardial ischemia, decreased pulmonary function, increased risk of infection, thromboembolism, and chronic pain development.

To provide optimal postoperative analgesia, the knowledge of the pain generating components and their neural innervations is essential (Fig. 1A-B). The preoperative pain originates mainly from intra-articular elements due to damaged cartilage stimulating free nerve endings and nociceptors (Fig. 1C). The primary pain generating components following TKR surgery include skin/subcutaneous tissue over the incision area, medial retinaculum, periosteal rim of the cut bones, remnant of the anterior joint capsule, cut nerves along the surgical dissection area, microfractures and inflammation.[2] Structures like the anterior capsule,

synovium, meniscus, cruciate, intra-articular ligaments, periosteum of the knee joint, and prepatellar fat pads are removed during the surgery and hence do not contribute to pain generation (Fig. 1C-D). The posterior capsule of the knee joint remains untouched, and the intra-articular components contributing to the posterior knee pain are removed during surgery. Thus, postoperative knee pain is mainly contributed by anterior knee components as compared to the posterior elements.

The anterior knee is innervated by branches from the femoral nerve (FN) and anterior division of obturator nerve (ON) through the subsartorial plexus and peripatellar plexus. The posterior knee and intra-articular structures are innervated from the branches of the sciatic nerve and posterior division of ON through the popliteal plexus. The adductor canal block (ACB) is given in the true adductor canal (AC) beyond the apex of the femoral triangle. The AC is bounded medially by the vasoadductor membrane (VAM), which is absent in the femoral triangle. Extrapolating from the dye studies, a local anesthetic (LA) injection into the AC below the VAM enters the adductor hiatus and finally reaches the popliteal region. Thus, ACB targets the saphenous nerve directly and popliteal plexus indirectly.[3] However, the subsartorial plexus and nerve to vastus medialis, which provide important innervation to the anterior knee, lie above the VAM and outside the AC, do not get involved ACB.

The infiltration between the popliteal artery and the capsule of the knee joint (iPACK) and local infiltration analgesia (LIA) was also described as an additional tool in the multimodal management of pain in patients undergoing TKR. The iPACK targets the popliteal plexus, whereas the LIA involves a pericapsular, periarticular, and subcutaneous infiltration covering anterior and posterior innervations of the knee joint, depending upon the correct placement of LA. The iPACK directly and ACB indirectly blocks the popliteal plexus, which covers the intra-articular and posterior elements effectively but leaves the anterior knee pain undertreated. This could be one reason for not achieving optimal pain relief or reducing perioperative opioid consumption in literature.

Enhanced recovery after surgery (ERAS) has provided evidence-based perioperative care protocol to improve the quality of patient care and minimize complications, thereby improving outcomes of various surgeries, including TKR. Since RA options like distal femoral triangle block, ACB, selective tibial nerve block, LIA, and iPaCK are considered motor-sparing blocks,[4] they have been recommended over femoral and sciatic nerve blocks. The femoral and sciatic nerve blocks are not suitable for ERAS protocols as they are associated with quadriceps and hamstring weakness, respectively, leading to the risk of falls.[5]

Multimodal systemic analgesia using different routes also plays an essential role in controlling the inflammatory process, dealing with the neuropathic component of pain, and thus reducing its severity. The factors other than anesthesia and surgical techniques that influence postoperative pain include the patient's age, sex, comorbidities, pain threshold, and severity of preoperative pain.[1] Besides, the patients' postoperative activity level, the use and duration of tourniquet exsanguinations, preoperative consumption of opioids, opioid-induced hyperalgesia, opioid dependence/resistance/tolerance can also affect the severity of postoperative pain. A thorough assessment of postoperative pain is necessary to determine the actual cause of pain and prompt management. In our experience, we found that the patient develops tourniquet pain over the anterior/posterior aspect of the thigh due to regression of spinal level at 4-6 hours. Many times, patients confuse this with anterior/posterior knee pain. Hence, a thorough postoperative pain assessment is required to determine the cause of pain and rectify mistakes.

To conclude, the ideal RA technique for TKR should be procedure-specific, motor-sparing, opioid-sparing, and should adequately cover both anterior and posterior components of knee pain. Although we have arrows in the form of different RA techniques, we are yet to hit the bull's eye to provide optimal analgesia and minimize the complications.

**Conflicts of interest**

The authors declare no conflicts of interest.

**References**

1. Krishna Prasad GV. Postoperative analgesia techniques after total knee arthroplasty: A narrative review. Saudi J Anaesth. 2020;14:85-90.

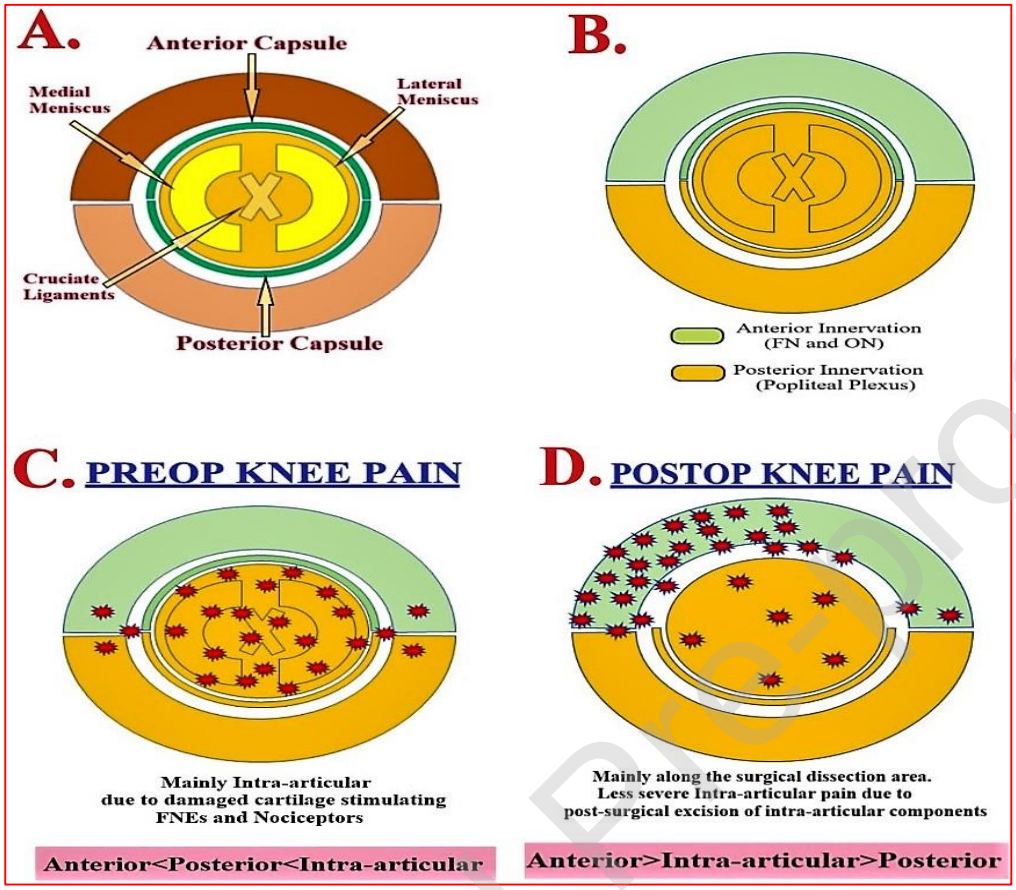
2. Franco CD, Buvanendran A, Petersohn JD, et al. Innervation of the anterior capsule of the human knee: implications for radiofrequency ablation. Reg Anesth Pain Med. 2015;40:363-8.

3. Vora MU, Nicholas TA, Kassel CA, et al. Adductor canal block for knee surgical procedures: review article. J Clin Anesth. 2016;35:295-303.

4. Sogbein OA, Sondekoppam RV, Bryant D, et al. Ultrasound-Guided motor-sparing knee blocks for postoperative analgesia following total knee arthroplasty: a randomized blinded study. J Bone Joint Surg Am. 2017;99:1274-81.

5. Soffin EM, YaDeau JT. Enhanced recovery after surgery for primary hip and knee arthroplasty: a review of the evidence. British Journal of Anaesthesia. 2016;117:iii62–iii72.

**Figure 1** Knee Joint Preop and Postop Pain Generation and Innervations. A, schematic diagram of the knee joint and intra-articular components; B, innervation of the knee joint; C, preoperative pain generation with innervations; D, postoperative pain generation with innervations.




FN, femoral nerve, ON, obturator nerve, FNEs, free nerve endings.