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# Continuous Femoral Catheter for Postoperative Analgesia After Total Knee Arthroplasty

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## ABSTRACT

**Introduction:** Postoperative pain management in the total knee replacement (TKR) represent a fundamental step for a positive outcome, allowing rapid mobilization, already on the first day. Further, continuous peripheral nerve block techniques have been reported to allow effective and safe control of acute postoperative pain, ensuring the implementation and completion of an accurate and intensive joint rehabilitation program. **Aim:** The aim of this study was to assess early mobility and compliance of patients that underwent TKR surgery using the femoral block. **Methods:** For the study, all patients that underwent TKR from 2015 to 2018 with ASA score between II-III was evaluated. Patients underwent vital parameters monitoring and were treated initially with midazolam (0.05mg / kg) e.v. combined sciatic block + femoral perineural catheter positioning using a peripheral nerve stimulation-assisted technique. **Results:** Intraoperatively, satisfactory analgesia was guaranteed in all patients, associated with a complete muscle relaxation of the affected limb. High patient compliance, associated with good control of acute postoperative pain was obtained in the first 24 hours after surgery (VAS 0- 1). The ROM outcomes were good in all rehabilitation stages, managing to reach 90 degrees bending on the seventh day with an average KSS score of 88-90. Patient satisfaction and impact on quality of life were assessed with the SF-36 showing average scores of 78. **Conclusion:** Continuous femoral nerve blocking ensures good postoperative analgesia in TKR allowing an early joint mobilization, a rapid functional recovery of the knee and increasing patient compliance during the post-operative rehabilitation program.

**Keywords:** Continuous femoral block, Knee Arthroplasty, Anesthesia, Loco-Regional Treatment, Outcomes.

## 1. INTRODUCTION

In recent years, anesthesia techniques in orthopedic surgery are receiving an increasingly considerable interest for loco-regional treatments, especially considering the increasingly advanced age of patients and associated comorbidities (1). Particularly, in the total knee replacement (TKR) surgery, the efficacy of appropriate postoperative analgesia is becoming more and more evident for the improvement of painful symptomatology and functional recovery (2). In fact, early passive knee motion represents a fundamental step following knee surgery. In fact, it is well known now that the rapid and correct knee mobilization is the most important factor able to positively influence the short and long term prognosis, improving the patient's compliance and quality of life, as well as the reduction of hospitalization time, and health costs (3, 4). This strategy has

to deal with the post-surgical pain, whose intensity may reduce the effectiveness of the post-operative rehabilitation program.

The commonly used options for postoperative analgesia in total knee prosthesis include local anesthetic infiltration, epidural anesthetic administration, single-shot or continuous femoral nerve block. Peripheral nerve block techniques allow effective and safe control of acute postoperative pain ensuring the completion of an accurate intensive joint rehabilitation program (7). These techniques also allow a prolonged analgesic action through the continuous infusion of local anesthetics. This could allow to plan a passive and active rehabilitation program, even for shorter or longer periods. Further, several studies have shown that the use of this type of analgesia significantly reduces pain, improves the range of motion (ROM), and also

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allows reduction of systemic analgesic drugs, and the undesirable effects resulting from prolonged use (8-12).

**2. AIM**

The aim of this study was to evaluate the functional recovery in patients treated for TKR with the femoral block. If there is an earlier ad integrum restriction, a lower hospital stay and above all a better quality of life due to lesser post-intervention pain.

**3. MATERIALS AND METHODS**

We performed a retrospective study on consecutive patients who were surgically treated with TKR from January 2015 to December 2018 at the “Vito Fazzi” Hospital (Lecce, Italy) (Table 1).

After continuous monitoring of vital parameters (pulse oximeter, ECG and non-invasive blood pressure) patients were sedated with Midazolam 0.05 mg/kg e.v. A blockage of the sciatic nerve and the femoral nerve was then performed with the insertion of a femoral perineural catheter to achieve a continuous block and manage postoperative analgesia. Both blocks were performed under ultrasound control by a nerve stimulator for peripheral nerve blocks (Stimuplex HNS 12 Braun). A proximal block of the subgluteal sciatic nerve was achieved with Levobupivacaine hydrochloride 0.5% 50 mg + clonidine 75 mcg + betamethasone 2 mg (15 ml of total volume). The femoral nerve was blocked with Levobupivacaine hydrochloride 0.5% 50 mg + clonidine 75 mcg + betamethasone 2 mg (15 ml total volume). After performing the single-shot bolus, the perineural catheter was inserted.

To facilitate complete intraoperative anesthesia, the blocking of the obturator and the lateral femoral cutaneous nerve was associated to obtain a “three in one” block, respectively with 25 mg Levobupivacaine hydrochloride 0.5% in 10 ml total volume. The duration of surgery was 70’ on average (70’ ± 20’) and intraoperative management was supported by spontaneous breathing with midazolam 0.05-0.1 mg / Kg e.v. Postoperative analgesia was obtained by continuous infusion on a perineural femoral catheter, through an elastomeric pump, of 0.125% levobupivacaine hydrochloride in a volume of 5-7 ml / h for a minimum duration of 72h (Table 2). All patients were clinically evaluated at 1, 3, 6 and 12 months after surgery. The following parameters were evaluated:

- VAS scale (Visual Analogic Scale) for pain assessment before surgery, at time 0, 8, 24 hours; successively on the second, on the third day, and at discharge. The analgesic controls were performed at fixed times and physiotherapy sessions.

- KSS (Knee Society Score and Range of Motion assessment) for knee function and its recovery of complete articulation, performed by means of a questionnaire and careful physical analysis. The knee function was defined as excellent with a score greater than 85, good between 70 and 84, moderate between 60 and 69 and reduced with a score of less than 59. The needs of using support devices, deformities and incomplete extension were also evaluated.

- Questionnaire SF-36 for the evaluation of patient satisfaction and quality of life: it evaluates, through 36 questions, the subjective perception of the individual in relation to health concepts related to levels of activity and well-being. It contains 8 multiple questioning scales called AF (Physical activity), RF (Role and physical health), DF (Physical pain), SG (Health in general), VT (Vitality); AS (Social Activities), RE (Role and Emotional State), MS (Mental Health) and ranges from 0 to 100 points. The questionnaire was submitted at discharge.

- Request for rescue medications in the postoperative period.

**4. RESULTS**

A total of 250 patients were enrolled in this study. Seven patients were excluded for various reasons: two did not attend the follow-up after hospital discharge, one patient underwent surgery for other causes, one could not be reached and three refused further participation. A total of 243 patients completed the 12-month follow-up analysis. During the intraoperative stage the peripheral block ensured the achievement of an anesthetic, analgesic and muscle resolution plan sufficient for the achievement of arthroplasty with high compliance of patients who received only a slight sedation in spontaneous breathing. No patient required general anesthesia or opioid administration during the intraoperative stage.

Postoperative pain was well controlled with a mean VAS score at rest of 1 in the first 24 h. All patients started an early rehabilitation program with passive mobilization on the first postoperative day. The VAS during passive knee mobilization was 2 (± 2) on the first 24 h. On the second and third day, a VAS at rest of 1-2 and in movement of 2-3 was recorded. 86 patients showed a reduction in quadriceps muscle strength, but no accidental falls were recorded. For 25 out of 243 patients it was necessary to use rescue medications (NSAIDs in

| INCLUSION CRITERIA |            |
|--------------------|------------|
| Number of patients | 250        |
| Numbers of men     | 103        |
| Number of women    | 147        |
| Middle age         | 69 (58-80) |
| ASA Score          | II-III     |

**Table 1. Number of patients included in the study performed from 2015 to 2018**

| Pre-Operative Anesthesia | Sedation  | Midazolam 0,05 mg/Kg e.v.  |
|--------------------------|---|--|
|                          | Sciatic nerve block / Femoral nerve block                     | Levopubivacaine hydrochloride 0.5% 50 mg + Clonidine 75 mcg + Betamethasone 2 mg in 15 ml total volume |
|                          | Obturator nerve block and lateral femorocutaneous nerve block | Levopubivacaine hydrochloride 0.5% 25 mg in 10 ml total volume   |
| Post-Operative analgesia | Continuous infusion of perineural femoral catheter            | Levopubivacaina chlorhydrate 0.125% in a volume of 7 ml / h for a minimum duration of 72h              |

**Table 2. Pre-operative and post-operative anesthesia**

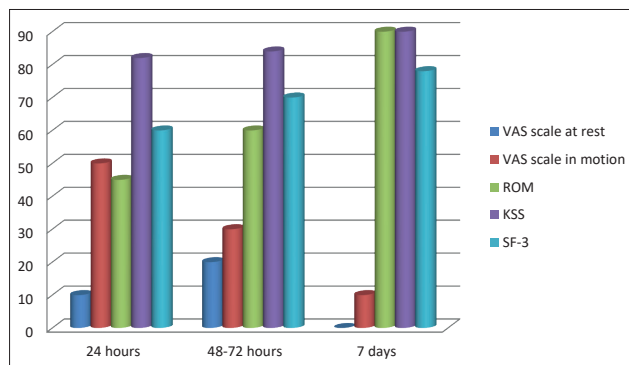


Figure 1. VAS scale at rest, in motion, ROM °, KSS, SF-3 at 24 hours, at 72 hours and after 7 days

17 cases and tramadol in 8 cases), due to the shifting of the perineural catheter during the postoperative nursing maneuvers. The ROM was good at all rehabilitative stages, managing to reach 90 degrees bending on the seventh day with an average KSS score of 88-90. There was a good degree of patient satisfaction and a positive impact on quality of life through the SF-36 evaluation with an average score of 78 (Figure 1).

### 5. DISCUSSION

The sensitive knee innervation is given for the most part by the femoral nerve and the sciatic nerve which covers respectively the anterior and posterior knee area. To allow opioid-free anesthesia not associated with subarachnoid anesthesia, it is essential to block the afferent obturator and lateral femoral cutaneous nerves (13-15). The use of the combined technique with nerve stimulation under ultrasound vision has allowed increasing the sensitivity and specificity of the blocks reducing the incidence of intraneural injections with consequent axonal damage. Further, the implementation of the continuous femoral block compared to the single-shot allowed to reach an excellent analgesic plan for the early passive mobilization of the joint, which otherwise would have been possible in the presence of intense postoperative pain. This has been reported to have significant consequences on the reduction of thromboembolic, functional and vascular complications (16).

The superiority of the continuous femoral block (BCNF) in knee arthroplasty has been demonstrated both in the single-shot (BSSNF) and in the continuous epidural (EC) (17). In addition, it has been shown that the BCNF gives better analgesia and is associated with minor complications such as hyposthenia, arterial hypotension and urinary retention compared to EC (18). Compared to BSSNF, there is a longer duration of analgesia and greater personalization of the analgesic intervention for a rehabilitation program. However, a lower weakness of the quadriceps muscle (one of the main causes of pain in the postoperative stage of the knee prosthesis) is detected, with a greater risk of falls, especially in older subjects. To overcome this setback, several studies suggest replacing the BCNF with a continuous adductor canal block (19). In the present study, we have not noted accidental falls due to excessive weakness of the quadriceps muscle [20]. The use of betamethasone and clonidine as adjuvants of

the local anesthetic has allowed a prolongation of the analgesic effect with moderate doses of levobupivacaine and a minor impact on motor function.

Several perioperative variables, therefore, have been associated with postoperative recovery of knee function, including preoperative knee mobility, HSS score, postoperative pain, early ambulation and persistent passive motion. We believe that another important variable is represented by the perioperative analgesia. The research focused on relieving postoperative pain. Early pain treatment reduces the risk of postoperative complications, such as deep venous thromboembolic conditions, nosocomial pulmonary infections and pulmonary embolism, and accelerates knee recovery. Effective pain control allows the early start of rehabilitation, which improves joint function and provides a better prognosis than those resulting in patients unable to initiate physical therapy due to severe pain. Postoperative anesthesia and analgesia are used for relatively short periods of time. It is not known whether administration of anesthesia and pain management have a medium-term impact on the outcome of the knee after TKA.

Aveline et al. suggested that postoperative pain after TKA was a risk factor for chronic exercise pain and that 48-hour postoperative ketamine administration could accelerate joint recovery. Several authors have suggested limiting pain management to the perioperative period but few studies have been conducted to evaluate efficacy in the medium term.

### 6. CONCLUSIONS

In the present study it was observed that the peripheral nerve block has guaranteed both a perfect control of analgesia and intraoperative muscle resolution and good control of postoperative pain, allowing an early mobilization of the knee. Postoperative analgesia for 48 hours not only has a positive impact during the perioperative period but also significantly influences the early recovery of the knee. Active functional rehabilitation facilitates muscle isometric contraction and relaxation, increases blood circulation and muscle strength, reduces the risk of deep vein thrombosis and facilitates flexion exercise. Passive rehabilitation helps the knee to regain mobility. The beginning of the activity in early times, therefore, is the goal to be pursued in patients treated with TKA, since it reduces the risk of scar formation; allows a greater range of movement, decreases joint stiffness and increases joint function (21-23).

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