Incidence of Delayed Recovery from Femoral Nerve Block in Total Knee Arthroplasty

Thitima Chinachoti MD*, Wattanan Makarasara PhD, MD*
* Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Objective: Femoral nerve block has been proven as an effective analgesia for total knee arthroplasty (TKA). Delayed recovery from nerve block can result in serious complication during postoperative period. This prospective, single-center, observational study investigated the incidence in delayed recovery from femoral nerve block more than 24 hours postoperatively.

Material and Method: Two hundred and forty patients with femoral nerve block as part of anesthesia plan for elective unilateral TKA were recruited into study. Participants were assessed for sensory or motor impairment lasting longer than 24 hours post operation. Factors associated with delayed recovery form femoral nerve block were analyzed.

Results: Five patients (incidence = 2.08%) reported sensory or motor impairment more than 24 hours post operation. All of the patients could ambulate within 4 days post operation without permanent nerve injury or serious complication. Higher dose of local anesthetic agent using for femoral nerve block showed association with the delayed recovery (p-value = 0.01).

Conclusion: This study demonstrated 2.08% incidence in delayed recovery from femoral nerve block. High concentration and dose of local anesthetic agent may lead to fall during early ambulatory period.

Keywords: Neurological complication, Femoral nerve block, Total knee arthroplasty

J Med Assoc Thai 2016; 99 (5): 584-8
Full text. e-Journal: http://www.jmatonline.com

Multiple anesthetic techniques were selected for total knee arthroplasty (TKA). Femoral nerve block (FNB) has been proven as an effective anesthetic technique to reduce pain and accelerate rehabilitation after TKA[1]. While these studies have documented improved analgesia, various neuromuscular complications have been encountered. Incidences of neurological complications after FNB have been estimated approximately 0.03-2%[2]. Falls due to quadriceps weakness have been associated with wound dehiscence or even peri-prosthetic fractures in patients undergoing TKA with FNB[3,4]. These reports primarily refer to local complications within the distribution of the involved peripheral nerve.

In Siriraj Hospital approximately 1,000 TKA per year has been done, however incidence of postoperative neurological complication has not been reported. Therefore, we would like to explore the incidence of delayed recovery from FNB of more than 24 hours and related factors of the complication after FNB for TKA in Siriraj Hospital.

Correspondence to:
Chinachoti T, Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, 2 Wanglang Road, Bangkoksri, Bangkok 10700, Thailand.
Phone: +66-2-4197979, +66-2-4117990
E-mail: thitima.chn@mahidol.ac.th, sitci35@gmail.com

Material and Method
After approved by Siriraj Institutional Review Board [005/2557 (EC3)], this prospective observational study was performed. Patients scheduled for elective unilateral TKA in Siriraj Hospital during April 2014-March 2015 with FNB as a part of anesthetic plan were recruited into the study. Exclusion criteria included age less than 18 years old, contraindicated to FNB, allergic to local anesthetic drug, refused to attend the study, uncooperative or had pre-operative physical examination of neurological abnormality in lower extremities.

After obtained inform consent, standard technique for FNB was performed prior to surgery by resident or staff member of Anesthesiology Department, Faculty of Medicine Siriraj Hospital. Either ultrasonography or nerve stimulator was used to locate the femoral nerve. Basically, the patient was placed in the supine position. The groin on the operative side was exposed and prepped by using aseptic technique. A line was drawn between the anterior superior iliac spine and the pubic tubercle to identify the inguinal ligament. The femoral artery was marked. By using a nerve stimulator, a 22-gauge, 4-cm needle was advanced lateral to femoral artery. The amplitude of nerve stimulator was decreased to 0.5 mA while seeking maximal patellar ascension as the quadriceps contracts.
(frequency 2 Hz, pulse width 300 microseconds). If there were continued contraction when at 0.2 mA or less, the needle was withdrawn. By using ultrasonography, the femoral nerve and artery were visualized instead of seeking for quadriceps contractions by nerve stimulator. Type, volume and concentration of local anesthetic agent were based on anesthesiologist’s choice. The anesthetic agent was injected incrementally after negative aspiration. Presence or absence of paresthesia (defined as an electric shock-like sensation) or intravascular puncture during procedure was recorded. Intra-operative anesthetic record form and additional details of the FNB procedure were collected for further analysis.

Primary outcome of the study was delayed recovery from FNB at 24 hours after operation. We defined “delayed recovery” by presence of abnormal sensation (numbness or shock-like sensation) or inability flexion of hip joint as motor impairment of femoral nerve. At twenty-four hours after operation, patients were evaluated by a third year resident of a research team member. If abnormality was detected, the anesthesiologist and surgeon were reported. The standard treatments were set for the patient. Neurologist was consulted if neurological impairment persisted more than 48 hours to confirm diagnosis of nerve injury. Post operative follow-up of clinical symptoms was made daily until discharge from hospital. Factors associated with delayed recovery were analyzed. Other complications defined as fall in hospital, delayed in rehabilitation, catheter-associated infection and local anesthetic systemic toxicity are reported by both nurse note and evaluator.

Sample size was calculated by considered the primary outcome as a rare incidence event. Using the expected prevalence of neuropathy of 0.7% and power of 80%, the sample size of 230 was required to observe at least one critical event.

Quantitative variables were demonstrated as mean and standard deviation (SD). Nominal and ordinal variables were reported as frequencies and percentages. Incidence was reported as percentage and 95% confidence interval was calculated based on binomial distribution. Fisher exact test and Student’s t-test were used where appropriate. All data analyses were performed using R version 3.2.3 and the p-value less than 0.05 were considered as statistically significant.

Results

Demographic data of all patients was shown in Table 1. From complete neurological evaluation in 24 hours after FNB in 240 cases, five patients reported numbness or weakness of quadriceps 24 hours after FNB. Two patients had impaired pinprick and temperature sensation while other three patients showed motor weakness, which limited their ability to rehabilitation (Table 2). Therefore, we reported 2.08% (95% confidence interval 0.68-4.8%) incidence of delayed recovery from FNB. There was no permanent nerve injury reported. All of the patients could start rehabilitation within 72 hours after operation and showed full recovery within 4 days. There was no report of fall during hospital stay as well as any infection or local anesthetic systemic toxicity.

Factors associated with delayed recovery from FNB were analyzed (Table 3). The present study found no association between delayed in recovery to block performers, nerve localization technique or tourniquet time. However, higher dose of local anesthetic agent was associated with delayed in recovery from FNB (p-value = 0.0106) where 4 out of 5 patients with delayed recovery received higher dose of local anesthetic agent (20 ml of 0.5% bupivacaine).

Discussion

In previous studies, low incidences of neurological complications after FNB were reported. Most of the studies are retrospective studies and primarily aim at permanent nerve damage(2,6,7). In this study, we focus on delayed recovery from FNB more than 24 hours due to the time to start rehabilitation. TKA is a painful surgery that needs early mobilization.
**Table 2. Details of patients with delayed recovery from femoral nerve block more than 24 hours**

<table>
<thead>
<tr>
<th>#</th>
<th>Age (year)</th>
<th>Choice Performer</th>
<th>Femoral nerve block</th>
<th>TT (min)</th>
<th>Patient reported</th>
<th>Motor grade</th>
<th>Sensory impaired</th>
<th>Activity</th>
<th>Motor grade</th>
<th>Sensory impaired</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>68</td>
<td>Staff</td>
<td>US</td>
<td>-</td>
<td>0.5% bupivacaine 20 ml</td>
<td>50</td>
<td>Numb</td>
<td>Pinprick</td>
<td>Walk 2-3 step</td>
<td>V</td>
<td>None</td>
</tr>
<tr>
<td>B</td>
<td>72</td>
<td>Staff</td>
<td>NS</td>
<td>0.5</td>
<td>0.25% bupivacaine 20 ml</td>
<td>90</td>
<td>Numb</td>
<td>Temperature</td>
<td>Walk bedside</td>
<td>V</td>
<td>None</td>
</tr>
<tr>
<td>C</td>
<td>70</td>
<td>Staff</td>
<td>NS</td>
<td>0.3</td>
<td>0.5% bupivacaine 20 ml</td>
<td>100</td>
<td>Weak</td>
<td>IV</td>
<td>None</td>
<td>2-3 step</td>
<td>V</td>
</tr>
<tr>
<td>D</td>
<td>77</td>
<td>Resident</td>
<td>NS</td>
<td>0.3</td>
<td>0.5% bupivacaine 20 ml</td>
<td>80</td>
<td>Weak</td>
<td>IV</td>
<td>Temperature</td>
<td>Knee extension</td>
<td>V</td>
</tr>
<tr>
<td>E</td>
<td>80</td>
<td>Resident</td>
<td>NS</td>
<td>0.4</td>
<td>0.5% bupivacaine 20 ml</td>
<td>80</td>
<td>Weak</td>
<td>IV</td>
<td>None</td>
<td>Standing</td>
<td>IV</td>
</tr>
</tbody>
</table>

SB = spinal block; NS = nerve stimulator; US = ultrasonography; mA = minimum current use for nerve stimulator to located femoral nerve; TT = tourniquet time.

Motor grading based on medical research council muscle grading scale: I = flicker of movement, II = movement possible but cannot move against gravity, III = movement against gravity, IV = movement against moderate resistance, V = movement against full resistance.

Activity: The best activity that patient could do on rehabilitation.

---

**Conclusion**

Our study demonstrated 2.08% incidence in delayed recovery more than 24 hours after FNB. Higher delayed recovery more than 24 hours after FNB. Higher doses of local anesthetic agent may be associated with delayed recovery. Under estimated neurological deficit, especially motor weakness after FNB, serious complications cannot occur. Early ambulation, especially within 24 hours after operation, should be performed to prevent early mobilization. Underestimated neurological deficit, especially motor weakness, without early mobilization especially early mobilization, especially after FNB, cannot occur. Early ambulation, especially within 24 hours after operation, should be performed to prevent early mobilization. Underestimated neurological deficit, especially motor weakness, without early mobilization especially after FNB, cannot occur. Early ambulation, especially within 24 hours after operation, should be performed to prevent early mobilization. Underestimated neurological deficit, especially motor weakness, without early mobilization especially after FNB, cannot occur. Early ambulation, especially within 24 hours after operation, should be performed to prevent early mobilization.
Table 3. Factors associated with delayed recovery from femoral nerve block

<table>
<thead>
<tr>
<th>Compared factor</th>
<th>Non-neuropathy (n = 235)</th>
<th>Neuropathy (n = 5)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice of anesthesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal block</td>
<td>222</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>General anesthesia</td>
<td>13</td>
<td>0</td>
<td>1.000*</td>
</tr>
<tr>
<td>Femoral nerve block</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrasonography guide</td>
<td>110</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Nerve stimulator guide</td>
<td>125</td>
<td>4</td>
<td>0.3769*</td>
</tr>
<tr>
<td>Mean ± SD of minimum NS current (amp)</td>
<td>0.37±0.11</td>
<td>0.37±0.094</td>
<td>0.9058*</td>
</tr>
<tr>
<td>Range minimum NS current (amp)</td>
<td>0.25-0.8</td>
<td>0.3-0.5</td>
<td></td>
</tr>
<tr>
<td>Performer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff</td>
<td>96</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Residence</td>
<td>139</td>
<td>2</td>
<td>0.4059*</td>
</tr>
<tr>
<td>Tourniquet time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD tourniquet time (min)</td>
<td>97.17±28.25</td>
<td>80 (18.70)</td>
<td>0.2563*</td>
</tr>
<tr>
<td>Local anesthetic agent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50% bupivacaine 20 ml (100 mg)</td>
<td>46</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>0.25% bupivacaine 20 ml (50 mg)</td>
<td>166</td>
<td>1</td>
<td>0.0106**</td>
</tr>
<tr>
<td>Others</td>
<td>23</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

NS = nerve stimulator
* Fisher exact test p-value; * Student t-test p-value; ** Fisher exact test p-value compared between 0.5% bupivacaine 20 ml vs. 0.25% bupivacaine 20 ml

concentration of local anesthetic agent showed higher incidence of delayed recovery. Fall prevention program needed for unexpected weakness of quadriceps in early ambulation after TKA.

What is already known on this topic?
Prolong motor block after FNB for TKA can cause a serious complication.

What this study adds?
Incidence of delayed recovery with quantitative assessment of motor and sensory impairment after femoral nerve block 24 hours post operation. The incidence of 2.08% is high enough to be a definite risk of falling in the early ambulatory period.

Acknowledgements
The authors gratefully acknowledge all anesthetic teams in orthopedic surgery suits for their cooperation and as well as Miss Nichapat Sooksri and Miss Chusana Rungjindamai, research assistants, for their entire paper work.

Potential conflicts of interest
None.

References
11. Lynch J. Prolonged motor weakness after femoral nerve block with bupivacaine 0.5%. Anaesthesia 1990; 45: 421.

การศึกษาลุ่มต้นของการกระจายการออกจากกล้าเนื้อที่หัวคอก้าน อาการกรื่นอาหารนิวเคลียร์VES สำหรับฟื้นฟู

ผู้มีผล: การศึกษาที่เริ่มต้นและผู้เป็นผู้รักษาได้เกิดขึ้นเกี่ยวกับการผูกคลื่นเสียงจากกล้าเนื้อที่หัวคอก้าน 1080 ราย ได้ทำการผ่ากระดูกศีรษะหรือผ่ากระดูกที่มีเส้นทางไปจนถึง 24 ราย อาการหลังการผ่า

ผลการศึกษา: อาการที่เกิดขึ้นวันแรก 5 ราย หรือคิดเป็นลูกคิวการระลอก 2.08 ผลของการศึกษาของ 24 ราย ผลการผ่ากระดูกศีรษะ 5 ราย อาการหลังการผ่ากระดูกศีรษะใน 4 ราย อาการหลังการผ่ากระดูกศีรษะใน 4 ราย อาการหลังการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย

การศึกษาที่เกิดขึ้นวันแรก 5 ราย หรือคิดเป็นลูกคิวการระลอก 2.08 ผลของการศึกษาของ 24 ราย ผลการผ่ากระดูกศีรษะ 5 ราย อาการหลังการผ่ากระดูกศีรษะใน 4 ราย อาการหลังการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูกศีรษะใน 4 ราย ผลการผ่ากระดูม