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# ANESTHESIA FOR LEG AMPUTATION IN HIGH RISK PATIENTS

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## ABSTRACT
We report 16 high risk cases of leg amputation in 6 months, 12 by peripheral nerve blocks and 4 by general anesthesia, and discussed superiority of anesthetic methods, general or peripheral nerve block. Sixteen cases with American Society of Anesthesiologists physical status (ASA-PS) 3 or 4 for leg amputation were reported. Except for one patient, they were medicated with more than two anticoagulants and 11 patients had bleeding tendency. Thirteen patients received below knee amputation (BKA) and three patients received above knee amputation (AKA). Twelve patients received sciatic and femoral nerve blocks using ropivacaine and lidocaine then intravenous fentanyl and/or midazolam, and four received general anesthesia with inhalation anesthetics. Vasopressors were administered in 3/12 patients anesthetized by blocks and all patients by general anesthesia. Heart rate increased to more than 120 beats/min during surgery in all cases in general anesthesia. VAS scores in postoperative 12 hours after surgery was 0 to 3 in patients anesthetized with blocks and 4 to 7 in patients with general anesthesia. Phantom pain might be less in blocks. Femoral and sciatic nerve blocks with small dose of fentanyl and/or midazolam was better than general anesthesia in terms of hemodynamics during surgery and postoperative analgesia.

**KEYWORDS:** Lower leg, amputation, femoral nerve block, sciatic nerve block, general anesthesia.

## INTRODUCTION
Patients receiving leg amputation have a high mortality according to severe complications such as renal, liver, or cardiovascular diseases, diabetes mellitus, etc. [1] In these cases anesthetic method is important for their postoperative course. For lower extremity surgery, spinal or epidural anesthesia is commonly applied. However, many patients for leg amputation have severe cardiovascular diseases and have taken some anti-coagulants and/or anti-platelet agents, therefore, spinal and epidural anesthesia are out of choice. Recently, ultrasound and/or nerve stimulation guided peripheral nerve blocks are increasingly used for extremity surgery. Whether general anesthesia or peripheral nerve block is better for leg amputation in high risk patients is still controversial. [2-5] We report 16 high risk cases of leg amputation in 6 months, 12 by peripheral nerve blocks and 4 by general anesthesia, and discussed superiority of anesthetic methods, general or peripheral nerve block.

## CASE REPORTS
Sixteen cases with American Society of Anesthesiologists physical status (ASA-PS) 3 or 4, who received leg amputation in 6 months were reported. They were 41 to 86 years old, 14 males and two females, 31.2 kg to 75 kg in body weight, 144.9 cm to 171 cm in height (Table 1). They had renal, cardiovascular, liver, brain, or respiratory diseases or diabetes mellitus before surgery (Table 1).

Except for one patient, they were medicated with more than two anticoagulants and 11 patients had abnormally high levels of international normalized ratio of prothrombin time (PT-INR) and/or activated partial prothrombin time (aPTT), and two patients had platelet count less than 100000/μL before surgery (Table 2). Thirteen patients received below knee amputation (BKA) and three patients received above knee amputation (AKA) (Table 3).

Anesthetic method was selected by each anesthesiologist. Twelve patients received sciatic and femoral nerve blocks and four received general anesthesia (Table 3). Sciatic nerve block was performed by standard para sacral approach at Sim's position using ultrasound and nerve stimulator (starting at 1.5 mA decreased to 1.0 - 0.5 mA). Then position was changed to supine, and femoral nerve block was performed at just peripheral at inguinal ligament line using ultrasound and nerve stimulator (starting at 1.0 mA decreased to 0.5 mA). In both blocks, the combination of lidocaine and

ropivacaine were administered (Table 3). Effects of the blocks were checked by pin prick, then midazolam and/or fentanyl were administered under oxygen 3-4 L/min by a face mask. In 4 patients, general anesthesia was induced with propofol and fentanyl, and maintained with inhalation anesthetics and remifentanil (Table 3). Tourniquet was used in all patients to decrease bleeding during surgery. Vasopressors were administered in 3/12 patients anesthetized by blocks and all patients by general anesthesia (Table 4). Heart rate increased to more than 120 beats/min during surgery in all cases in general anesthesia.

VAS scores in postoperative 12 hours after surgery was 0 to 3 in patients anesthetized with blocks and 4 to 7 in patients with general anesthesia (Table 4). Only one patient received BKA under femoral and sciatic nerve blocks died due to respiratory failure in one month after surgery (Table 4). However, he had no symptoms one week after surgery. We checked patient's records and found the description of phantom pain during stay at the hospital in one patients anesthetized with the blocks and three with general anesthesia.

**Table 1: Demographic data.**

| No | Age (years) | M/F | Body weight (kg) | Height (cm) | ASA-PS | Complication Renal | HD | CV | Liver | DM | Brain | Respiratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 65 | M | 51 | 158.5 | 3 | ● | ● | ● | | | | |
| 2 | 73 | M | 54.7 | 163 | 3 | ● | ● | ● | | ● | | |
| 3 | 75 | M | 49 | 168 | 4 | ● | ● | ● | ● | ● | ● | |
| 4 | 76 | M | 53 | 161 | 3 | ● | ● | ● | | | ● | |
| 5 | 78 | M | 32.5 | 147.9 | 3 | ● | ● | ● | ● | ● | | ● |
| 6 | 78 | M | 31.3 | 147.8 | 3 | ● | ● | ● | ● | ● | | ● |
| 7 | 78 | M | 31.2 | 148 | 3 | ● | ● | ● | ● | ● | | ● |
| 8 | 62 | M | 67.7 | 171 | 3 | ● | ● | ● | ● | ● | | ● |
| 9 | 83 | M | 43 | 159 | 3 | ● | ● | ● | ● | ● | | |
| 10 | 76 | M | 49.5 | 161.3 | 3 | ● | ● | ● | | | ● | |
| 11 | 81 | F | 61.3 | 144.9 | 3 | ● | | ● | | | | ● |
| 12 | 41 | M | 75 | 164.7 | 4 | ● | ● | ● | ● | ● | ● | |
| 13 | 73 | M | 53.4 | 166.5 | 4 | ● | ● | ● | ● | | ● | |
| 14 | 73 | M | 54 | 166.5 | 4 | ● | ● | ● | ● | | ● | |
| 15 | 86 | F | 53.4 | 149 | 3 | | | ● | | ● | | |
| 16 | 62 | M | 67.6 | 171 | 3 | ● | ● | ● | ● | ● | | |

M, male; F, female; ASA-PS, ASA physical status; HD, hemodialysis; CV, cardiovascular; DM, diabetes mellitus

**Table 2: Preoperative medicine and bleeding tendency.**

| No | Preoperative medicine | Platelet count (x $10^4$/ μL) | PT-INR | aPTT (sec) |
|---|---|---|---|---|
| 1 | aspirin, clopidogrel, warfarin, steroid | 11.5 | 1.32 | 57.6 |
| 2 | aspirin, sarpogrelate, warfarin, steroid | 23.1 | 2 | 41.1 |
| 3 | aspirin, clopidogrel | 16 | 1.59 | 42.5 |
| 4 | warfarin, cilostazol | 26.3 | 1.42 | 57.4 |
| 5 | aspirin, clopidogrel, warfarin | 8.2 | 1.23 | 58.1 |
| 6 | aspirin, clopidogrel, warfarin | 13.4 | 1.27 | 49.8 |
| 7 | aspirin, clopidogrel, warfarin | 7 | 1.07 | 32.9 |
| 8 | aspirin, ticlopidine | 16.7 | 1.14 | 33.5 |
| 9 | aspirin, clopidogrel | 23.8 | 1.17 | 36.9 |
| 10 | warfarin, cilostazol | 10.5 | 1.33 | 48.7 |
| 11 | aspirin, clopidogrel | 21.5 | 1.15 | 31.4 |
| 12 | aspirin, sarpogrelate | 8.1 | 1.22 | 96.3 |
| 13 | aspirin, clopidogrel | 13.7 | 1.84 | 49.4 |
| 14 | | 6.4 | 1.33 | 53.9 |
| 15 | aspirin, warfarin | 22.4 | 1.34 | 42.3 |
| 16 | aspirin, ticlopidine | 14.3 | 1.1 | 40.8 |

PT-INR, international normalized ratio of prothrombin time; aPTT, activated partial prothrombin time.

**Table 3: Surgery and anesthesia.**

| No | Ope | Duration of surgery (min) | Bleeding (mL) | Femoral block | | Sciatic block | | Fentanyl (μg) | Midazolam (mg) | Anesthetics |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lidocaine (mg) | ropivacaine (mg) | lidocaine (mg) | ropivacaine (mg) | | | |
| 1 | R-BKA | 66 | 20 | 100 | 75 | 100 | 75 | 175 | 1 | |
| 2 | L-BKA | 93 | 200 | 100 | 75 | 120 | 90 | 175 | 0 | |
| 3 | L-BKA | 40 | 20 | 100 | 100 | 100 | 100 | 50 | 1 | |
| 4 | L-BKA | 65 | 20 | 100 | 100 | 150 | 150 | 100 | 3 | |
| 5 | R-BKA | 50 | 20 | 100 | 100 | 100 | 100 | 150 | 2 | |
| 6 | R-BKA | 198 | 135 | 100 | 100 | 150 | 150 | 100 | 1 | |
| 7 | R-BKA | 104 | 50 | 100 | 100 | 150 | 150 | 200 | 0 | |
| 8 | R-BKA | 103 | 70 | 100 | 100 | 150 | 150 | 150 | 2 | |
| 9 | R-AKA | 52 | 20 | 125 | 125 | 150 | 150 | 150 | 1 | |
| 10 | L-BKA | 49 | 140 | 75 | 75 | 100 | 10 | 50 | 0.5 | |
| 11 | R-BKA | 60 | 180 | 100 | 100 | 150 | 150 | 100 | 2 | |
| 12 | R-BKA | 30 | 20 | 0 | 500 | 0 | 100 | 100 | 2 | |
| 13 | R-BKA | 78 | 20 | | | | | 100 | | P, AOS, R |
| 14 | R-AKA | 90 | 300 | | | | | 100 | | P, AOS, R |
| 15 | R-AKA | 68 | 100 | | | | | 200 | | P, AOS, R |
| 16 | R-BKA | 100 | 50 | | | | | 100 | | P, GOS |

P, propofol; AOS, air-oxygen-sevoflurane; GOS, nitrous oxide-oxygen-sevoflurane; R, remifentanil; R, right; L, left; BKA, below knee amputation; AKA, above knee amputation

**Table 4: Outcomes.**

| No | Inotrope used during anesthesia | VAS at 3/6/12 hours after surgery | One week/month survival |
|---|---|---|---|
| 1 | phenylephrine | 0/0/1 | ●/● |
| 2 | | 1/1/3 | ●/● |
| 3 | nicorandil | 0/1/2 | ●/X (respiratory failure) |
| 4 | | 1/1/3 | ●/● |
| 5 | | 1/1/1 | ●/● |
| 6 | phenylephrine | 0/0/1 | ●/● |
| 7 | | 1/1/2 | ●/● |
| 8 | | 1/1/2 | ●/● |
| 9 | | 1/1/2 | ●/● |
| 10 | | 0/0/1 | ●/● |
| 11 | | 0/0/2 | ●/● |
| 12 | norepinephrine, ephedrine | 0/0/1 | ●/● |
| 13 | ephedrine | 5/6/5 | ●/● |
| 14 | ephedrine, phenylephrine, dopamine | 6/6/7 | ●/● |
| 15 | ephedrine, phenylephrine, dopamine, atropine | 5/6/4 | ●/● |
| 16 | ephedrine | 5/4/5 | ●/● |

VAS, visual analogue scale; VAS was rated between 0 and 10.

## DISCUSSION

We experienced 16 leg amputations, 3 AKA and 13 BKA. Four patients received general anesthesia and 12 received femoral and sciatic nerve blocks. One patient received BKA under blocks died in one month by respiratory failure, but others had no serious complications. All 4 patients in general anesthesia were administered vasopressor agents and heart rate was > 120 beats/min during surgery and had high postoperative VAS scores. Phantom pain was recorded in one patient with the blocks and three with general anesthesia.

The leg above the knee is supplied by the femoral, lateral cutaneous femoral, sciatic, and obturator nerves, and leg below the knee is supplied by the sciatic and femoral nerves. Therefore, for AKA, femoral, lateral cutaneous femoral, sciatic, and obturator nerves,[6] and for BKA, sciatic and femoral nerves should be blocked. To block 4 nerves will take much times and need high doses of local anesthetic, and increases the risk of local anesthetic toxicity. It was reported that AKA was successfully done under high inguinal femoral, sciatic, and lateral cutaneous femoral blocks in a patients with sepsis, thrombocytopenia, and severe respiratory infection.[7]

Baddoo reported 10 cases of leg amputations. For patients of AKA, sciatic nerve block and three-in-one block or psoas compartment lumbar plexus block were used, and patients had stable hemodynamics and postoperative analgesia lasted for hours.[8] Kinugawa et al.[9] had a case of AKA successfully managed with light general anesthesia and femoral, sciatic, and obturator nerve blocks. Chia et al.[10] showed an AKA patients successfully operated under femoral and sciatic nerve blocks. We have only one AKA patient anesthetized with femoral and sciatic nerve block with small dose of fentanyl and midazolam, but there was no perioperative complications. Therefore, for AKA, femoral and sciatic nerve blocks might be a choice when combined with small dose of fentanyl and midazolam. Baddoo said that for patients with BKA, sciatic and femoral nerve blocks were successfully used.[8] Ferraro et al. reported 2 cases successfully treated with femoral and sciatic nerve blocks for foot and knee surgery without any complications, who had taken anticoagulants and PT-INR more than 3.0.[11] One patient who died due to respiratory failure had no symptoms one week after surgery, therefore, we considered his death had no relation with anesthesia. In our 12 cases of BKA, femoral and sciatic nerve blocks were used with small dosed of fentanyl and/or midazolam without any complications. Therefore, for both AKA and BKA, femoral and nerve blocks might be enough when combined with small doses of fentanyl and/or midazolam.

The difference of anesthesia, general or regional had no effects on perioperative outcomes after leg amputation.[5] Pisansky et al.[2] also showed that the type of anesthesia, regional (spinal, epidural or nerve block) or general did not affect mortality, and cardiac, pulmonary, infectious, and bleeding complications after leg amputation. However, 30-day mortality was reported to be slightly higher in general anesthesia than nerve blocks, but not statistically significant.[12] Postoperative complications such as myocardial infarction, pneumonia, sepsis, wound infection and stump necrosis were larger in general anesthesia than spinal anesthesia, but not statistically significant.[13] However, other reports showed superiority of regional anesthesia. In lower leg amputation, 30-day mortality was significantly higher under general anesthesia than regional anesthesia.[4] Chery et al.[3] reported that regional anesthesia had lower incidence of postoperative pulmonary complications and arrhythmia in leg amputation. The patients who received spinal anesthesia had significantly lower rates of surgical complications, re-operations and intensive care unit admissions than those received general anesthesia in lower leg amputation.[13] Regional anesthesia decreases physiologic response to surgical stress, and catecholamine and cortisol levels, and sympathetic block induces peripheral vasodilation to increase blood flow. In addition, regional anesthesia avoids invasive tracheal intubation and mechanical ventilation. [14,15] These might be the reason why regional anesthesia was better than general anesthesia. We had only 16 cases, therefore we could not confirm which was better for leg amputation. However, all patients with general anesthesia received vasopressors during surgery to keep blood pressure and significant tachycardia was observed. Therefore, it was suggested that femoral and sciatic nerve blocks with small dose of fentanyl was better than general anesthesia from the point of view of hemodynamics during surgery.

One of the concerns of leg amputation is phantom pain. Phantom pain and stump pain were more common in general anesthesia than in regional anesthesia till 6 month after leg amputation, later on the results were opposite. [16] Sahin et al. [17] reported that phantom and stump pain after leg amputation was less in epidural anesthesia or peripheral nerve block than in general or spinal anesthesia in the first postoperative week, but the difference disappeared in 14 to 17 months. [17] Peri-operative epidural or per-neural infusion of local anesthetics in leg amputation is useful for postoperative pain and phantom pain.[18] Borghi et al.[19] also showed that continuous femoral and sciatic nerve blocks after leg amputation decreased phantom limb pain and sensation.[19] We did not use continuous infusion because patients had bleeding tendency and had a risk of infection due to malnutrition and/or diabetes mellitus. We checked VAS scores until 12 hours after surgery and just checked patient's records for phantom and stump pain. Therefore, we could not say superiority of each anesthetic method in prevention of phantom pain. However, it seemed that femoral and sciatic nerve blocks were more effective than general anesthesia to prevent phantom pain.

In conclusion, our experience of 16 leg amputation in patients with ASA-PS 3 or 4 suggested femoral and sciatic nerve blocks with small dose of fentanyl and/or midazolam was better than general anesthesia in terms of hemodynamics during surgery and postoperative analgesia.

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