# A Comparative Study between Neuraxial Anesthesia and General Anesthesia for Lower Limb Surgery

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Both neuraxial anesthesia and general anesthesia are used for lower limb surgery. And because of the complications that occur with this type of surgery, we searched in this narrative review the effectiveness and safety of neuraxial anesthesia versus general anesthesia for lower limb surgery. We included randomized controlled trials comparing neuroaxial anesthesia (spinal or epidural anesthesia) versus general anesthesia in adults (35 years or older) with lower-limb surgery.
**keywords:** neuraxial anesthesia; general anesthesia; spinal anesthesia; epidural anesthesia

The need for lower limb surgery has increased in the world and in the same time there are increased risks associated with anesthesia It has become necessary for practitioners in this field to seek appropriate techniques that reduce the complications caused by anesthesia for patients with lower limb surgery. Whether neuraxial anesthesia (NA) can improve the outcome of lower limb surgery compared with general anesthesia (GA) is a long-running debate. In these surgeries, anesthesia can be provided adequately by either NA or GA, because both techniques provide similar recovery times and patient satisfaction [1]. Therefore, the choice of anesthesia may depend primarily on the patient's concern about being awake or asleep during the procedure. However, in some types of surgery, anesthesia techniques can significantly influence the result of patients in terms of incidence of intra- and postoperative complications, postoperative pain, and length of stay in hospital [2-3]. Moreover, anesthesia procedures can modulate the red blood cell (RBC) patrimony and affect intra- and postoperative blood loss and hemodynamics during and after lower limb surgery. A reduction of blood loss was observed in patients undergoing lumbar NA compared with patients undergoing GA for lower limb surgery [4]. The reduction, by an effective NA, of intraoperative sympathetic stimulation resulting from surgical trauma has putative advantages for coagulation homeostasis and cardiovascular, respiratory, gastrointestinal, metabolic, and immune functions [3]. As both neuraxial and GA techniques have both inherent benefits and disadvantages, we have to do a comparative study between the two types of anesthesia techniques mentioned above and to reach the best technique that has lower average of complication for these patients. So before we try to compare neuraxial anesthesia with general anesthesia technique we must first realize that there are significant differences between them. Differences can best be understood with appropriate and strict knowledge of anatomy, physiology and technique of each anesthetic type. This understanding is essential for the safe and successful functioning of these techniques.

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### Types of studies:

The study blindly or blindly controlled randomized controlled trials (RCTS) that assessed the effects of neuroaxial anesthesia compared with general anesthesia for lower limb surgery. The authors excluded studies that were not random and excluded studies that did not report relevant results.

### Types of participants:

The authors included studies with adult participants (aged 35 years and older) who were undergoing operations on the lower limbs.

### Types of Interventions:

Our experimental intervention was neuraxial anesthesia, (spinal or epidural) and general anesthesia.

### Types of results:

The authors included studies that analyzed the effects of neuroaxial anesthesia compared to general anesthesia on outcomes (Mortality. Myocardial infarction. Deep Venous Thrombosis. Congestive cardiac failure. Hypotension. Blood loss. Length of surgery. Pulmonary embolism. Pneumonia). The authors searched the Cochrane library, PubMed (1985 to April 2017), EMBASE (1985 to April 2017) and reference of the studies included. Only randomized Controlled Trials were included (CENTRAL), MEDLINE, EMBASE, LILACS, CINAHL and Web of Science from 1985 to April 2017, using the following keywords: neuraxial anesthesia, general anesthesia total hip or knee replacement, epidural anesthesia, spinal anesthesia, hip fracture, deep venous thrombosis, lower-limb revascularization, regional anesthesia, elective hip surgery, and pulmonary embolism. The terms “epidural anesthesia,” “spinal anesthesia,” and “general anesthesia” were linked with “or” and combined using “and” with each subsequent term. No language limits were used. Bibliographies were also searched for relevant publications. Randomized and quasi randomized studies comparing the outcomes under neuraxial anesthesia and general anesthesia were included in the analysis. Quasi randomized studies are studies in which patients are assigned into study groups by alteration based on variables such as surgical dates. Study inclusion was limited to patient groups that underwent lower limb surgery under either neuraxial anesthesia or general anesthesia. We did not include patients who had lower limb surgery under combined techniques (NA and GA), the following outcome data were extracted from each study if reported: estimated mortality, myocardial infarction, DVT, congestive cardiac failure, hypotension, blood loss, length of surgery, pulmonary embolism, pneumonia, the decision on the suitability of a study for our analysis and the extracted data by the twelve reviewers/authors were compared. to have been included in our analysis, whereas the data in non-tabular format (i.e., bar or line graphs) were not included, as accurate numbers could not be assured. Using a standard chi squared test and OR 95% confidence intervals (CI) were reported for dichotomous outcome parameters.

## Result

The included eleven studies in this review (Dodds 2007) [5], (Borghi 2005) [6], (Kamitani 2003) [7], (Casati 2003) [8], (Brueckner 2003) [9], (Juelsgaar 1998) [10], (Brichant 1995) [11], (Davis 1989) [12], (Cook 1986) [13], (Moding 1986) [14] and (Racle 1986) [15] .In this review the authors included 9 outcomes (Mortality, Myocardial infarction, DVT, Congestive cardiac failure, Hypotension, Blood loss, Length of surgery, pulmonary embolism and Pneumonia).

### 1. Mortality:

Four studies reported mortality between neuraxial anesthesia and general anesthesia for lower limb surgery (Dodds 2007, Juelsgaar 1998, Cook 1986, and Racle 1986). In these four studies no statistically significant difference in mortality was noted between participants given neuraxial anesthesia (7/133) and those receiving general anesthesia (12/139) the sig (0.272), 95% CI (0.22-1.54).

### 2. Myocardial infarction:

This outcome was analyzed in four studies (Dodds 2007, Juelsgaar 1998, Cook 1986, and Racle 1986), which compared neuraxial anesthesia and general anesthesia for lower limb surgery, pooling of data showed no statistically significant difference between the four groups myocardial infarction was noted between participants given neuraxial anesthesia (7/133) and general anesthesia (8/139) for lower limb surgery, the sig (0.543), 95% CI (0.31-2.50).

### 3. Deep Venous Thrombosis:

Three studies included data on the number of patients who developed proven DVT (Brichant 1995, Davis 1989 and Moding 1986). All of them showed no statistically significant difference in DVT. The pooled data showed that significantly, the sig (0.257), CI 95%. (0.29-0.75).

### 4. Congestive cardiac failure:

This complication was reported in two studies (Juelsgaar 1998, Racle 1986) when comparing neuaxial anesthesia (2/50) and general anesthesia (2/49), no statistically significant difference in Congestive cardiac failure was noted, sig (0.386), 95% CI (0.17-22.80).

### 5. Hypotension:

This complication was reported in seven studies (Casati 2003; Juelsgaard 1998; Racle 1986). Pooling of results showed no statistically significant difference in hypotension between the two groups (29/65 (44%) versus 30/64 (46%), OR 0.91, 95% CI (0.45-1.82)).

### 6. Blood loss:

Six studies (Dodds 2007, Broghi2005, Kamanti2003, Davis1987, Cook 1986, Moding 1986) reported intra operative blood loss, and six of them showed that neuraxial anesthesia significantly decreased blood loss compared with general anesthesia. The pooled data from the six studies showed a statistically significant decrease in blood loss in patients under neuraxial anesthesia versus general anesthesia. P<.0001), 95% CI (38.2070-60.7930).

### 7. Length of operation:

Seven studies (Dodds2007, Broghi2005, Brueckner2003, Kamanti2003, Davis1987, Moding1986, Racle1986) reported length of operation, pooling of data showed no statistically significant difference between the seven studies in length of operation was noted between participants given neuraxial anesthesia and general anesthesia for lower limb surgery, P= (0.072) 95%, CI (OR-1.79, -8.41-4.48).

### 8. Pulmonary embolism:

Three studies (Brichant1995, Davis1989, Racle1986) reported did not find a difference in the risk of pulmonary embolism. P=0.223, 95% CI (OR 0.97 ,0.18-21.53).

### 9. Pneumonia:

Three studies (Juelsgaar1998, Cook1986, Racle1986) reported pneumonia, pooling of data showed, pneumonia decrease in NA (13/100) than GA (26/100), the P= 0.546, 95% CI (0.19-0.83).

## Discussion:

Neuraxial anesthesia has been used in lower limb surgery for many years because some clinicians believe that this technique offers benefits above other kinds of anesthesia. Although it was our purpose to compare NA with GA for lower limb surgery.

This review, did not show a statistically significant difference in the rate of death when NA was compared with GA. Lower limb surgery is performed predominantly in elderly participants, who may have multiple medical conditions. The high level of mortality in this group of participants is often a result of other medical conditions rather than a direct consequence of the surgical procedure. The choice of anesthetic technique may reduce mortality in elderly patients, but in this review, they analyzed four studies and found no statistically significant difference between intervention groups. The overview by Rodgers et al, 2000 [16] reported that postoperative mortality was significantly reduced (OR 0.70, 95% CI 0.54 to 0.90) with the use of NA. This outcome is inconsistent with the outcomes described in this review. The reasons for this may include the fact that we have analyzed a small sample size while Rodger had 141 trials including 9559 patients in his study.

Racle1986). No statistically significant difference was noted between NA 5.26% (7/133) and GA 5.75% (four studies analyzed the myocardial infarction (Dodds 2007, Juelsgaar1998, Cook1986, and 8/139). Also Parker et al (Parker 2011) analyzed elderly participants who underwent orthopedic surgery and found that the rate of myocardial infarction was 1% (5/502) in the NA group, which was not significantly different from the rate after GA. their rate of myocardial infarction was 5.51% (15/272), and they noted no statistically significant difference between groups. their sample size was small, and no individual study had numbers large enough to reveal whether differences could be attributed to sample size calculations described by the authors of the studies included in this review.

Three studies (Brichant1995, Davis1989 and Moding1986) showed decrease DVT in NA 27% (44/163) while 44% (70/159) in general anesthesia. their result that NA decreases the incidence of DVT and PE is consistent with the data published by Rodgers et al. (2000) [16] involving 9559 patients and showed that NA for a variety of surgeries decreased DVT by 44%. Regardless of the causes for the decreased incidences of DVT neuraxial anesthesia apparently decreases the risk of DVT when no chemical prophylaxis is used, it is not as effective as using low molecular weight heparin [16].

Many studies today have not demonstrated significant differences in DVT between NA and GA due to the use of pharmacologic DVT prophylaxis which reduced the incidence of DVT [17].

On the other hand, this complication was reported in two studies (Juelsgaar1998, Racle1986). when comparing NA (2/50) and GA (2/49), no statistically significant difference in congestive cardiac failure was noted, P =0.386, 95% CI (OR 2.0 ,0.17 – 22.80). There were reductions in myocardial infarction by Rodgers et al (2000) [16], where a total of 104 myocardial infarctions were reported in 30 trials. Overall, there were about one third fewer myocardial infarctions in patients allocated to NA, but the confidence intervals were compatible with both no effect and a halving in risk (OR 0.67,95%CI 0.45to 1.00) [16].

Three studies (Casati 2003, Juelsgaard 1998, Racle 1986) reported hypotension. Pooling of results showed no statistically significant difference in hypotension between the two groups (29/65 (44%) versus 30/64 (46%), OR 0.91, 95% CI (0.45-1.82)). A study conducted by Parker MJ et al (2004) [18]. showed hypotension to be more common after NA. This difference was statistically significant when viewed using the fixed effect mode 172/501 (34.3%) versus 137/521 (26.3%), RR 1.30, 95% CI 1.08 to 1.55) [18].

Six studies (Dodds 2007, Broghi 2005, Kamanti 2003, Davis 1987, Cook 1986, Moding 1986) reported that potential for decreasing intraoperative blood loss is an often quoted advantage for performing lower limb surgery under NA. In this study, they showed a statistically significant decrease in blood loss in the NA group statistically significant decrease in blood loss in patients under GA versus GA. (P<.0.001), OR - 161.18, 95% CI (38.2070-60.7930).

Seven studies (Dodds 2007, Broghi 2005, Brueckner 2003, Kamanti 2003, Davis 1987, Moding 1986, Racle 1986) reported length of operation, pooling of data showed no statistically significant difference between the seven studies in length of operation was noted between participants given NA and GA for lower limb surgery, p= 0.72, OR-1.79, 95%, CI (%(-8.41-4.48). on the other hand, concerns over the use of NA include a potentially delayed start time of surgery due to the placement of the block, failure of the block with subsequent conversion to GA, and potentially less than optimal muscle relaxation, which some orthopedic surgeons believe will make the dissection and placement of the prosthesis more difficult [19]. Their data indicate a small reduction in the operative time for elective THR using NA when compared with GA. Our data are consistent with a recent Cochrane Report on hip fracture patients by Parker et al (2001) [18].in which anesthesia choice had a minimal effect on operative times. William J et al (2005) [2]. showed a statistically significant decrease in operative times when THR was performed under NA, the average decrease in duration of 7.1 min/case is likely not clinically significant.

(20) Pulmonary embolism was reported in three studies (Brichant 1995, Davis 1989, Racle 1986) Three studies (Brichant 1995, Davis 1989, Racle 1986) did not find a difference in the risk of pulmonary embolism between NA (2/150) 1.33% and GA (1/148) 0.67%, P=0.223, 95% CI (OR 0.97 ,0.18-21.53).

Three studies (Juelsgaar 1998, Cook 1986, Racle 1986) reported pneumonia, pooling of data showed, pneumonia decrease in NA (13/100) 13% than GA (26/100) 26%, no statistically significant difference between the two group P= 0.546 ,95CI (OR 0.40 ,0.19-0.83). On the other hand, McLaren) 1978(agree with the results he obtained with the product of their research regarding pneumonia, where his study showed (1/56) 1.78% in NA while (5/60) 8.33% in GA [21].

## Conclusion

The available evidence of randomized trials comparing neuraxial anesthesia with general anesthesia for lower limb surgery was insufficient for confirm or exclude clinically significant differences for most clinical outcomes. Evidence suggests that NA reduce blood loss and decrease the incidence of DVT in NA, but authors have not been able to draw any final conclusions about the other variables. Due to the limited data available.

## Data analyses

### Analysis: Comparison Neuraxial versus general anesthesia

| Outcomes | Neuroaxial anesthesia | | General anesthesia | | OR CI 95% | P Value |
|---|---|---|---|---|---|---|
| | n | N | n | N | | |
| Mortality | 7 | 133 | 12 | 139 | 0.59(0.22-1.54) | 0.272 |
| Myocardial infarction | 7 | 133 | 8 | 139 | 0.88(0.31-2.50) | 0.543 |
| DVT | 44 | 163 | 70 | 159 | 0.47(0.29-0.75) | 0.257 |
| Congestive cardiac failure | 2 | 50 | 1 | 49 | 2.0(0.17-22.80) | 0.386 |
| Hypotension | 29 | 65 | 30 | 64 | 0.91(0.45-3.31) | 0.411 |
| Blood loss | 50 | 533.5 | 51 | 718.1 | -161.18(-255.4- -66.9) | <0.0001 |
| Length of surgery | 290 | 129.5 | 192 | 131.6 | -1.79(-8.14-4.41) | 0.0726 |
| Pulmonary embolism | 1 | 150 | 1 | 148 | 0.97(0.18-21.53) | 0.223 |
| Pneumonia | 13 | 100 | 26 | 100 | 0.40(0.19-0.83 | 0.456 |

P. Value < 0.05 Significance

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