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Falls and major orthopaedic surgery with peripheral nerve blockade: a systematic review and meta-analysis

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Editor's key points

- The authors aimed to review an important issue of the risk of postoperative falls after peripheral nerve block.
- Only five studies qualified for meta-analysis; the patients had received lumbar plexus block or not.
- Continuous lumbar plexus block increased the risk of falls compared with non-continuous block or no block.
- The review, albeit involving a small number of studies, raises an important issue worthy of further research.

Summary. The objective of this systematic review with meta-analysis was to determine the risk for falls after major orthopaedic surgery with peripheral nerve blockade. Electronic databases from inception through January 2012 were searched. Eligible studies evaluated falls after peripheral nerve blockade in adult patients undergoing major lower extremity orthopaedic surgery. Independent reviewers working in duplicate extracted study characteristics, validity, and outcomes data. The Peto odds ratio (OR) with 95% confidence intervals (CIs) were estimated from each study that compared continuous lumbar plexus blockade with non-continuous blockade or no blockade using a fixed effects model. Ten studies (4014 patients) evaluated the number of falls as an outcome. Five studies did not contain comparison groups. The meta-analysis of five studies [four randomized controlled trials (RCTs) and one cohort] compared continuous lumbar plexus blockade (631 patients) with non-continuous blockade or no blockade (964 patients). Fourteen falls occurred in the continuous lumbar plexus block group when compared with five falls within the non-continuous block or no block group (attributable risk 1.7%; number needed to harm 59). Continuous lumbar plexus blockade was associated with a statistically significant increase in the risk for falls [Peto OR 3.85; 95% CI (1.52, 9.72); $P=0.005$; $I^2=0\%$]. Evidence was low (cohort) to high (RCTs) quality. Continuous lumbar plexus blockade in adult patients undergoing major lower extremity orthopaedic surgery increases the risk for postoperative falls compared with non-continuous blockade or no blockade. However, attributable risk was not outside the expected probability of postoperative falls after orthopaedic surgery.

Keywords: accidental falls; anaesthesia, conduction; arthroplasty, replacement, hip; arthroplasty, replacement, knee; muscle weakness; nerve block

Major lower extremity joint arthroplasties are common orthopaedic procedures requiring aggressive postoperative pain management to achieve successful functional outcomes such as participation in early physical therapy.[1 2] Peripheral nerve blockade has been shown to decrease hospital length of stay and provide superior pain control with fewer side-effects compared with epidural regional anaesthesia or patient-controlled i.v. opioid therapy.[3] However, there is controversy as to whether the benefits of peripheral nerve blockade come at the price of increasing the risk for postoperative falls.[3–11]

Falls in hospitalized patients are the focus of increasing attention. Postoperative falls can occur in as many as 1.6% of hospitalized surgical patients.[12] In 2008, the Centers for Medicare and Medicaid services included falls in the list of hospital-acquired conditions. Thus, if a fall occurs during an admission that hospital may not receive additional reimbursement for fall-associated costs.[13]

Falls may occur after orthopaedic surgery regardless of the presence of peripheral nerve blockade. Yet, prolonged quadriceps weakness resulting from lumbar plexus blockade may contribute to an increased fall risk.[6] The role of peripheral nerve blockade on postoperative fall risk has not been systematically studied. Furthermore, this specific clinical question has never been rigorously reviewed after a premeditated, transparent scientific methodology that allows the most valid analysis of the available literature. The aim of this systematic review with meta-analysis will be to advance our knowledge of falls occurring among patients who have undergone major orthopaedic lower extremity surgery with and without the presence of peripheral nerve blockade through quantitative and qualitative analysis of all available evidence.

Methods

A protocol-driven systematic review addressing the intervention peripheral nerve blockade in adult patients undergoing major orthopaedic lower extremity surgery adhered to the

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[14]

Eligibility criteria

Eligible studies were comparative studies, either randomized or observational, enrolling adult patients undergoing major orthopaedic lower extremity surgery who received peripheral nerve blockade. Included studies evaluated falls as an outcome. Major orthopaedic surgeries included total hip arthroplasty, total knee arthroplasty, and anterior cruciate ligament reconstruction. Studies included patients receiving peripheral nerve blockade via single injection, non-continuous blockade (catheter bolus with no greater than 24 h of infusion), continuous blockade (catheter infusions >24 h), or no nerve block. Peripheral nerve blockade for lower extremity surgery included lumbar plexus blockade via either psoas compartment block or femoral nerve block distal to the inguinal ligament, and any approach to proximal sciatic nerve blockade. All eligible studies were included regardless of size, language constraints, or quality assessment ratings. Strictly descriptive articles (e.g. reviews, commentaries or letters) were excluded.

Study identification

An electronic search strategy specialist with expertise in conducting systematic reviews (P.J.E.) and content expert investigators conducted an electronic search through Ovid MEDLINE, Ovid EMBASE, EBSCO CINAHL, Thompson Reuters Web of Science, and the Cochrane Central Register of Controlled Trials from database inception through January 2012. The search cross-referenced keywords including: Arthroplasty, Replacement, Hip; Arthroplasty, Replacement, Knee; hip prosthesis/or knee prosthesis; Anaesthesia, Conduction and/or Nerve Block; Muscle weakness and/or Muscle Hypotonia; Accidental Falls and/or falls; Nerve Block; Postoperative complications; and Humans. A revised search yielded 59 new abstracts not retrieved in the original search strategy based on two articles as benchmarks with keywords focusing on the delivery mechanism (peripheral nerve catheter) rather than nerve block.[4 11] A summary of the search strategies is available as Appendix. Additional studies were identified by review of the reference sections of all eligible studies and solicitation from content experts. Unpublished data were requested from authors of randomized controlled trials (RCTs) where the comparison groups included peripheral nerve blockade. Only original studies were used for data collection.

Candidacy was based on independent review of each of the abstracts by two study investigators (R.L.J. and C.B.M.). Eligibility of potential candidate studies (as determined by either reviewer) underwent full-text review by the two reviewers working independently and in duplicate. The reviewers calibrated their judgements. Disagreements were harmonized by consensus. Agreement was measured using κ-statistics.

Data collection

Two reviewers (S.L.K. and R.L.J.) working independently and using replicate electronic data collection tools extracted all data from the full-text versions of eligible studies. Study characteristics included author, publication year, sample size, study population (age), type of major lower extremity surgery, intervention, study design, primary anaesthetic type, patient fall outcome data, and outcome data on falls resulting in death or serious disability. To evaluate falls, the number of patient falls was considered as the event (outcome of interest) rather than the absolute number of falls. Discrepancies in data collection were resolved by consensus first, followed by verification by a third co-investigator (C.B.M.) not involved with the data extraction process. Data that could not be extracted were listed as not reported (NR). Attempts were made to decrease the effect of reporting bias by requesting missing data and data inconsistency explanations by methodically contacting the authors of included studies.

Study quality was independently assessed by two reviewers (R.L.J. and S.L.K.). The Cochrane Collaboration Risk Assessment Tool[15] was used to evaluate the risk of bias for RCT evidence. The loss to follow-up, intention to treat, and imbalances at baseline were also assessed on included RCTs. The Newcastle–Ottawa quality assessment tool[16] was used to evaluate quality of observational studies; no scoring system was derived for this tool.

Statistical analysis

A qualitative synthesis was performed for studies that reported data not comparable by formal meta-analysis. Meta-analysis used a fixed effects model to pool dichotomous variables. The Peto odds ratios (ORs) and 95% confidence intervals (CIs) were calculated among studies which evaluated continuous lumbar plexus blockade compared with non-continuous blockade or no block. Data analysis abided by the guidelines set out by the Cochrane Collaboration regarding statistical methods.[17] OR values of >1.00 were associated with an increased risk for fall. In all cases, two-tailed *P*-values of <0.05 were considered significant. The number needed to harm (NNH) was calculated as the inverse of attributable risk. Statistical heterogeneity of the data was quantified using I^2 statistic which estimates the percentage of total variation across studies that is not attributed to chance.[18 19] I^2 values of <25% represent low heterogeneity. Forest plots were used to show point estimates and CI of individual included studies. Publication bias was assessed using funnel plots. Sensitivity analyses were performed on the results of the meta-analyses by: (i) using a random effects model, (ii) including eligible retrospective data, and (iii) removing individual study data, one at a time. All statistical analyses were conducted using Review Manager [RevMan (Computer program), Version 5.1. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2011].