

# Perioperative outcomes in the context of mode of anaesthesia for patients undergoing hip fracture surgery: systematic review and meta-analysis

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## Abstract

**Background:** Previous meta-analyses on the anaesthetic management of patients undergoing surgery for hip fracture have focused on randomized trials. Furthermore, heterogeneity in outcome reporting across the studies has made it difficult to inform best practice guidelines for patient care.

**Methods:** This systematic review examined how perioperative outcomes were reported and defined in the context of comparing modes of anaesthesia for hip fracture surgery. Outcomes were included from randomised and non-randomised studies published between January 2000 and July 2017. Meta-analyses were performed for regional versus general anaesthesia, with sensitivity analyses performed for spinal versus general anaesthesia.

**Results:** By including data from 15 large observational studies in this meta-analysis, we have increased the number of patients for whom outcomes were assessed from approximately 3000 to 202 000. There was no significant difference in 30-day mortality [Odds ratio (OR) 1.15; 95% confidence interval (CI) 1.01, 1.32;  $I^2$  87%;  $n=200\ 464$ ], prevalence of pneumonia (OR 1.10; 95% CI 0.93, 1.30;  $I^2$  43%;  $n=65\ 011$ ), acute myocardial infarction (OR 0.96; 95% CI 0.88, 1.05;  $I^2$  0%,  $n=64\ 904$ ), delirium (OR 1.07; 95% CI 0.72, 1.58;  $I^2$  93%,  $n=19\ 923$ ) or renal failure (OR 0.94; 95% CI 0.54, 1.64;  $I^2$  0%,  $n=27\ 873$ ) for regional compared to general anaesthesia.

There was a small statistically significant difference for length of stay (standardized mean difference  $-0.03$ ; 95% CI  $-0.05$ ,  $-0.02$ ;  $I^2$  0%;  $n=78\ 711$ ) favouring regional anaesthesia, which is unlikely to be clinically significant. Sensitivity analyses for the same outcomes examining spinal only vs general anaesthesia showed minor statistical significance for length of stay favouring spinal. We also present data highlighting the scale of the inconsistencies in reported outcomes across 32 studies, making evaluation in a standardized manner very difficult. As an example, mortality was reported in nine different ways throughout the studies.

**Conclusions:** We highlight the need for agreement on outcome definitions and for a minimum core outcome set to be measured and reported in hip fracture studies. This would strengthen the evidence-based approach to delivering optimal care.

**Key words:** anaesthesia; general; hip fractures; outcome measures; regional

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Approximately 1.6 million people worldwide sustain a hip fracture each year,<sup>1</sup> with over 76 000 of these occurring in the UK.<sup>1,2</sup> The risk of dying of such a fracture within 30 days is 7.1%.<sup>1</sup> With 70% of patients being above the age of 80 yr, 30% experiencing a reduction in functionality after a hip fracture,<sup>3</sup> and 20% suffering serious complications during their acute hospital stay,<sup>4</sup> there is a huge burden placed on the health service. The median cost per patient presenting with a hip fracture in the UK in 2011 was around £9500 for the acute phase of their treatment, with 76% of this attributed to ward costs, 14% for theatre costs, and 10% for investigations.<sup>5</sup> Additional costs of the follow-on treatment would increase this further. District general hospitals spend between £3.6 and £4.8 million per yr on the acute management of patients with hip fracture<sup>6</sup>; however, research to date has produced insufficient evidence to guide a key element in the early care for these patients, namely the anaesthetic management for their hip fracture surgery. Studies evaluating regional compared to general anaesthesia have generated inconsistent results when looking at mortality as a primary outcome. Systematic reviews previously aiming to evaluate this question have been limited by the small number and generally low quality of randomized trials. They also have excluded more recent large observational studies.

This systematic review aimed to identify studies of patients undergoing emergency hip fracture surgery in the context of the type of anaesthesia administered. It aimed to explore how perioperative hip fracture outcomes were defined and reported across these studies.<sup>7–9</sup> In an attempt to use the large amount of available data from observational studies, meta-analyses were performed to compare various outcomes in the context of general vs regional anaesthesia, with sensitivity analyses for general anaesthesia vs spinal only anaesthesia, drawing on data from both randomized and non-randomized studies. In performing the meta-analyses, we recognized the inconsistency and heterogeneity in outcome reporting, causing difficulty in pooling results from the various trials and observational studies for comparison. Importantly, this limits the ability to evaluate interventions used in perioperative care for patients with a hip fracture and to provide best practice recommendations,<sup>7,10,11</sup> and attributes partly to the minimal change in 30-day mortality for hip fracture patients over the past 5 yr within the UK.

## Methods

Initially in this systematic review a quantitative analysis addressing the intervention of regional or general anaesthesia for hip fracture surgery was performed following the principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.<sup>12,13</sup> A further sensitivity analysis for those cases wherein spinal anaesthesia was the sole technique vs general anaesthesia was also performed.

Secondly, based on a protocol previously registered on Prospero [33405],<sup>14</sup> the review identifies how outcome measures pertaining to mode of anaesthesia for hip fracture surgery have been reported.

## Literature search

A search of Ovid EMBASE, Ovid MEDLINE, and the Cumulative Index to Nursing Allied Health Literature (CINAHL) databases, the Cochrane Central Register for Controlled Trials, Clinical Trials.gov, the ISRCTN registry, as well as grey literature for articles published from January 2000 to July 2017 was performed to focus on the most recent studies reflective of modern anaesthetic techniques. Search terms were applied to both subject headings and as keywords and restricted to human studies and English language only. Terms included:

- Hip Fracture or (hip adj5 fractur\*)
- Femur Fracture or (femur adj5 fractur\*)
- Anesthesia, General/'general an?esthe\*\*
- Anesthesia, Spinal/'neuraxial an?esthe\*\* 'regional an?esthe\*\*
- Postoperative Complications/
- Pneumonia/'pulmonary complication\*\* Pulmonary Atelectasis/hypoxi\*
- Acute kidney injury/or kidney tubular necrosis, acute/renal Insufficiency/'renal failure\*\*/'kidney failure\*\*
- Myocardial infarction/or shock, cardiogenic/
- Delirium/(post?operative adj5 confus\*)

Additional studies were identified by hand-searching the reference sections of all eligible studies and previously published review articles.<sup>15</sup>

Randomized trials and observational studies, both prospective and retrospective, were eligible for this review. Studies were included if they reported perioperative outcomes in the context of comparing modes of anaesthesia for hip fracture surgery regardless of the presence or specifics of any study intervention. For quantitative analysis, only the studies that examined regional compared with general anaesthesia were included. Those studies wherein a spinal anaesthetic was performed as a sole technique compared to a general anaesthetic were included in a subsequent sensitivity analysis. All eligible studies were included regardless of size and results restricted to full-text articles.

Study selection was based on independent screening of the titles and abstracts in the initial search by two investigators (C.O. and L.M.). Identified studies underwent a full text review by the same two reviewers working independently and in duplicate to assess eligibility. Disagreement regarding study eligibility was discussed and resolved through consultation with a third author (M.S.). Case reports and case series were excluded, as were studies concerning elective hip surgery.

Two authors (C.O. and L.M.) independently assessed the risk of bias of individual studies according to the Cochrane Risk of Bias Tool for randomized controlled trials (RCTs),<sup>16</sup> or the Cochrane Risk of Bias Tool for non-randomized studies for the observational studies.<sup>17</sup> Studies were assigned a low risk of bias, high risk of bias, or unclear risk of bias for each domain in the Cochrane tools as per [Appendices 1 and 2](#).

The same two independent reviewers extracted data from the eligible full-text articles. This included study characteristics such as author, year of publication, country, study design, study participants, sample size, and intervention as presented in [Table 1](#). Details relating to all outcome measures reported

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