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Review Article

Review of perioperative falls

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Abstract

Falls are a known public health problem, and there is increasing recognition of the importance of perioperative falls for risk prediction and quality assessment. Our objective was to review existing literature regarding the occurrence, injuries, and risk factors of preoperative and postoperative falls. A systematized search of PubMed entries between 1947 and November 2015 produced 24 articles that met inclusion criteria. Most studied orthopaedic surgery patients older than 65 yr. Four were rated 'good' quality. Interrater reliability for the quality assessment was moderate ($\kappa = 0.77$). In the 3–12 months before surgery, the proportion of preoperative patients who fell ranged from 24 to 48%. Injuries were common (70%). The rate of postoperative falls ranged from 0.8 to 16.3 per 1000 person-days, with a gradual decline in the months after surgery. Injuries from postoperative falls occurred in 10–70% of fallers, and 5–20% experienced a severe injury. Risk factors were not well studied. Prospective studies reported a higher percentage of falls and fall-related injuries than retrospective studies, suggesting that there may be underdetection of falls and injuries with retrospective studies. Perioperative falls were more common than falls reported in the general community, even up to 12 months after surgery. Surgery-related falls may therefore occur beyond the hospitalization period. Future studies should use a prospective design, validated definitions, and broader populations to study perioperative falls. In particular, investigations of risk factors and follow-up after hospitalization are needed.

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Key words: accidental falls; ; preoperative period; ; postoperative period

A fall is 'an unexpected event in which the participants come to rest on the ground, floor, or lower level'.[1] Considerable evidence shows that falls in the community and on inpatient wards are common and are physically, mentally, and financially costly.[2–9] Given the co-morbid state of surgical patients, preoperative and postoperative falls are likely to be common and costly. Yet historically, these falls have received little attention.

Evidence is emerging about the importance of falls before and after surgery. In 2013, a study showed that preoperative falls are associated with postoperative outcomes such as complications and readmission.[10] According to a study by our group, preoperative falls are twice as common as falls in the general community, and they relate to patients' functional dependence and quality of life.[11] Thus, a history of preoperative falls potentially functions as a useful barometer of surgical risk.

By contributing to many in-hospital and postdischarge falls, postoperative falls are becoming a quality assessment target. Worldwide, health-care quality and improvement organizations have begun to target reduction of inpatient falls. For example, the National Institutes for Health and Care Excellence issued guidelines for inpatient fall reduction in 2013, and the Joint Commission (United States) established inpatient falls as one of its key safety goals in 2015.[12–13] Thus, falls in the hospital have become an important quality metric, and surgery is a known risk factor for these falls.[14–16] Evidence also suggests that the majority of falls in the first months after surgery are surgery related.[17] Therefore, to capture all postoperative falls, study of both inpatient and outpatient periods seems prudent.

Despite the importance of preoperative and postoperative falls, a review of falls before and after surgery has never been

conducted. Therefore, the objective of this article was to review the occurrence of preoperative and postoperative falls in the adult surgical population based on published literature in both inpatient and outpatient settings. A secondary aim was to report injuries and risk factors associated with those falls. Understanding these key facets of perioperative falls might help to guide future studies and interventions to prevent them.

Methods

Details of the protocol for this review were registered on PROSPERO and can be accessed online.[18]

Inclusion criteria

Participants of interest were adult patients undergoing surgery. Papers exclusively studying limb amputees, stroke patients, or patients with Parkinson's disease were excluded because these are narrow, non-generalizable populations that probably have different fall mechanisms and characteristics.

To increase data retrieval, both interventional and descriptive studies were included. The minimal length of follow-up was set at 24 h. The maximal gap between surgery and falls measurement (either preoperative or postoperative) was set at 3 months.

The main outcome of interest was quantification of falls before or after surgery. To be included, articles also needed to describe at least one characteristic of the fallers or falls. If an article failed to quantify falls or clearly state that all patients had undergone surgery, it was excluded. Likewise, articles that only quantified falls but did not characterize them in any way were excluded. Studies where the sole exposure of interest was femoral nerve block were not included because this topic has received numerous previous reviews.[19–29]

Study designs of interest included meta-analyses, randomized controlled trials, cohort studies, or case–control studies. Substudies of included articles that did not provide any additional falls data were excluded.

Search strategy

A librarian experienced in systematic reviews (see Acknowledgements) helped to develop the search criteria, with the objective of mapping published literature in a 'systematized' fashion.[30] PubMed was subsequently searched for studies published between 1947 and November 18, 2015 using the following query: ("Preoperative Period"[Mesh] OR pre-operation* OR post-operation* OR pre-operative OR post-operative OR pre-surger* OR post-surger* OR preoperative OR postoperative OR "Postoperative Period"[Mesh]) AND (("Accidental Falls"[Mesh])OR (fall*[tiab] AND incidence*)) NOT ("Editorial" [Publication Type] OR "Letter" [Publication Type] OR "Comment" [Publication Type]). Articles in English or with English translation were considered. V.L.K. reviewed the 1168 titles and their reference lists, along with papers recommended by falls experts.

Data extraction

V.L.K. extracted relevant data, including study design, follow-up, sample size, surgery type, population, and outcomes. The principal outcome of interest was occurrence of falls, which was reported either as a percentage or as an incidence in 1000 person-days, depending on the study. The other two prespecified outcomes of interest were fall-related injuries and risk factors for falls. As studies reporting such data are primarily descriptive or have aims unrelated to the outcomes of interest, the risk of publication bias is low.

Quality assessment

Using a validated, 14-item National Institutes of Health Quality Assessment Tool (NIH QAT), two authors (V.L.K. and M.S.A.) independently assessed the quality of each article.[3132] To improve clarity of the assessment tool before scoring, the two reviewers agreed on the definition of the exposure(s) for each article and scored a test paper together.[19] They also predefined two of the NIH QAT items as follows. High-quality falls outcome measurement (NIH QAT item no. 11) involved prospective collection at roughly monthly intervals.[1] Appropriate risk factor assessment (NIH QAT item no. 14) used regression modelling with appropriate confounders and at least eight outcomes events per variable.[33] The two reviewers then proceeded to score each paper separately.

Classifying the study 'exposure' and 'outcome' for the quality assessment tool was difficult for many of the studies, which complicated the scoring process. For example, some studies defined inpatient falls as the outcome, whereas others defined postoperative falls in general as the outcome. A 4 day follow-up is a sufficient time period to observe inpatient falls (received 'yes' for NIH QAT item no. 7). However, the same 4 day period is not sufficient to observe postoperative falls because the first days after surgery are a period of low mobility when fewer falls may be observed (received 'no' for NIH QAT item no. 7).[34 35]

Through discussion, the two main reviewers resolved the majority of the discrepancies. A third author (T.M.W.) adjudicated any remaining inconsistencies. Cut-offs for 'good' and 'fair' quality studies were arbitrarily set *a priori* as at least 70 and 50% of possible points, respectively. Defining 0, 1, and not applicable (N/A) as three nominal categories, the reliability of the quality assessment between the two reviewers was calculated using the κ statistic.[36] The κ-value was calculated using SAS/STAT- software, Version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

As shown by the flow chart in Fig. 1, 23 articles were excluded for meeting at least one exclusion criterion,[1929 37–48] whereas 24 met all inclusion criteria and were included for review.[10–1517 34 35 49–66] These articles included one randomized controlled trial (with two related studies), 10 prospective cohort studies, 10 retrospective cohort studies, one case–control study, and one cross-sectional study. The majority involved older adults undergoing orthopaedic surgery, especially total knee arthroplasty and hip fracture surgery.

Table 1 shows the data that were extracted for each study. The studies were heterogeneous in study design, follow-up, definitions of falls and injuries, surgery type, and patient criteria. For example, nine postoperative falls studies followed patients after hospitalization, whereas 12 measured only the immediate hospitalization period. In addition, six preoperative articles and 10 postoperative articles expressed falls as a percentage instead of a rate. This is a problematic practice when combining results from varying follow-up periods.[1] Studies also used several different definitions of falls. These definitions ranged from no definition at all to 'unintentionally coming to rest on the ground, floor, or other lower level'[60] or 'a sudden, involuntary, and unexpected landing on the ground or assumption of the horizontal