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REVIEW

Orthogeriatric care: improving patient outcomes

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Abstract: Hip fractures are a very serious socio-economic problem in western countries. Since the 1950s, orthogeriatric units have introduced improvements in the care of geriatric patients admitted to hospital because of hip fractures. During this period, these units have reduced mean hospital stays, number of complications, and both in-hospital mortality and mortality over the middle term after hospital discharge, along with improvements in the quality of care and a reduction in costs. Likewise, a recent clinical trial has reported greater functional gains among the affected patients. Studies in this field have identified the prognostic factors present upon admission or manifesting themselves during admission and that increase the risk of patient mortality or disability. In addition, improved care afforded by orthogeriatric units has proved to reduce costs. Nevertheless, a number of management issues remain to be clarified, such as the optimum anesthetic, analgesic, and thromboprophylactic protocols; the type of diagnostic and therapeutic approach best suited to patients with cognitive problems; or the efficiency of the programs used in convalescence units or in home rehabilitation care. Randomized clinical trials are needed to consolidate the evidence in this regard.

Keywords: hip fractures, geriatric assessment, orthogeriatric care, recovery of function, mortality

Video abstract

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Introduction

Osteoporotic hip fractures are one of the main health problems in geriatric patients. A total of 1.3 million hip fractures were diagnosed in 1990,[1] and this figure is expected to increase to over 6 million by 2050.[2] A total of 80% of the fractures in women and 50% of those in men occur at over 70 years of age.[3] Ninety percent of the fractures are a result of falls from standing height.[4] The mortality rate can reach 10% during admission in hospital and 30% after 12 months.[5,6] Only 50% of those who survive recover the functional level they had before the accident[7,8] and 25% of the patients who were independent before the fall require admission to a home for the elderly.[9] The estimated socio-economic costs represent 0.1% of the global health care costs worldwide, reaching 1.4% in the more developed countries.[1] The mean age of patients with hip fracture[10] and the presence of comorbidity[11] are the main reasons warranting orthogeriatric comanagement of these individuals, which reduces the risk of perioperative complications, functional deterioration, and mortality.[12]

In this regard, geriatric joint trauma management units were introduced in the UK in the mid-twentieth century.[13] However, it is over the last 20 years that the design and implementation of coordinated perioperative models have increased.[14] Such coordinated patient care has been shown to reduce in-hospital complications,[15,16] hospital stay and readmissions,[17] disability, and in-hospital mortality.[16]

A recent editorial[18] considers that geriatric medicine improves our knowledge of the extra-traumatology factors that complicate the patient's course and influence the

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outcome of treatment. The clinical and social complexity of elderly patients demands close cooperation among the different professionals, with a different approach to management from that applicable to younger individuals.[19] In addition to the traditional goals of the orthogeriatric team, there is another crucial objective: patient enrollment in the most appropriate rehabilitation program in order to reduce the need for institutionalization and facilitate functional recovery and reintegration to the regular social setting of the patient.[19]

In this regard, correct assessment of the previous functional situation and maximum recovery of that situation are of vital importance. The high prevalence of disability following fracture can modify the natural patient referral process after hospital discharge,[20] and in this sense the management plan does not conclude with hospital discharge but rather comprises the continuation of patient care beyond the in-hospital process. The actions of the orthogeriatric team thus extend beyond the hospital setting, expanding the benefits of integral geriatric care.[19]

It is in the UK where the role of orthogeriatrics has been best defined to date, largely as a result of the development of the best practice tariff, introduced in 2010 with the purpose of improving the management of patients with hip fracture.[21] Presurgical and postsurgical cognitive assessments were subsequently also included.[22] The National Institute for Health and Care Excellence drafted a document on the quality care of patients with hip fracture, underscoring a series of high-quality indicators to be complied with in order to boost efficiency in the management of patients with hip fracture.[23]

The orthogeriatric care models agree on the suitability of care provided by multidisciplinary teams with knowledge of geriatrics, the advisability of early surgery, the need for a case manager (in this case a geriatrician) throughout the whole process, pain control, avoidance of the appearance or worsening of geriatric syndromes, and correct continuity of care after hospital discharge, thus attempting to recover the functional condition before the time of fracture.[24] Such orthogeriatric management has been validated by a recent meta-analysis.[25]

However, there are still issues requiring study and analysis, such as the optimum thromboprophylactic protocols, correct analgesic regimens, assessment and treatment of cognitive deterioration and nutritional conditions during the in-hospital period, improvement of patient mobility, and postsurgical rehabilitation.[24]

The present review aims to offer answers to some of these uncertainties regarding the orthogeriatric care of patients with hip fracture and attempts to clarify which measures have improved the management outcomes.

Methods

The present review was carried out by conducting an electronic search in OVID (Medline and Embase), combining the following MeSH keywords: "hip fractures" and "geriatric assessment", combined with "perioperative management" and "orthogeriatric care". The search was limited to publications in the last 5 years; in English, Spanish, and French; and in human subjects. A total of 177 articles were obtained, of which 86 were finally selected. The MeSH construction [Hip fractures] AND ([Geriatric assessment] OR "perioperative management") OR "orthogeriatric care" OR "geriatric syndromes") was used. Some additional instructions were added for certain specific objectives where necessary. In 14 cases, supplementary information was obtained in the form of references of the selected articles. Details of the evaluation and selection process of the items are shown in Figure 1.

The articles were selected by four investigators based on the following inclusion criteria: randomized clinical trials, cohort studies, case–control studies, observational studies,

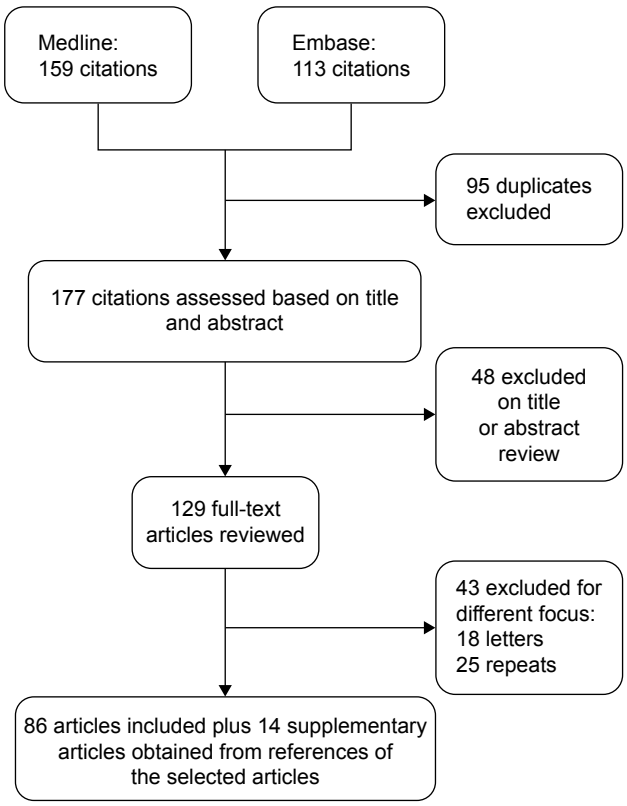

Figure 1 Flow chart study selection procedure used in literature search.

and before–after analyses in orthogeriatric units; population: geriatric patients with proximal femoral fracture; intervention: orthogeriatric treatment begun perioperatively; and outcomes: surgical delay, length of hospital stay, prognostic factors and mortality, functional recovery, geriatric syndromes, perioperative care such as renal function, anemia, second hip fracture and complications, surgical treatment, and costs.

The exclusion criteria were letters to the Editor, case reports, articles with no available abstract or those with only the abstract published, and studies meeting the inclusion criteria but with ≥50% of the study sample aged under 65 years (ie, predominantly non-geriatric). All the articles were reevaluated by the authors of the review, and final inclusion was restricted to those of sufficient quality to afford information pertinent to the objectives of this review.

The outcome measures examined were mortality, length of hospital stay, functional status, medical complications, destination after discharge, functional recovery, secondary prevention treatments, and readmissions.

Results

The efficiency and benefits of orthogeriatric care[14] indicate that the aforementioned multidisciplinary approach should be generalized. However, this patient care model has still not been implemented in many hospitals. The centralization of information in the form of national registries would facilitate the comparison of results between the traditional approach and orthogeriatric management and would allow us to define the benefits of the different implemented models.[18] The variants of the model coincide in underscoring the need for early geriatric clinical care and early surgical management,[26] since both these measures can reduce in-hospital morbidity–mortality.

A meta-analysis of 35 independent studies recruiting 191,873 patients described greater survival among patients who underwent early surgery (odds ratio [OR] 0.74; 95% confidence interval [CI] 0.67–0.81; $P<0.001$). Authors calculated odds of death with cutoff of surgical delay in 24 hours (OR 0.74 [95% CI 0.62–0.87; $P<0.001$]) and 48 hours (OR 0.75 [95% CI 0.68–0.81; $P=0.031$]). There was no difference in survival when the surgical delay cutoff was established in less than 12 and 96 hours, respectively.[27] (The most relevant results included in this review are summarized in Table 1.)

Previously, Vidan et al[28] found delays in surgery to be associated with increased mortality from day 6 after fracture. A meta-analysis of 16 observational studies (n=13,478) in turn showed surgery in the first 24 hours, versus in the first 72 hours, to reduce patient mortality.[29]

The main cause of surgical delays is the lack of available operating rooms.[28] Clinical stabilization, based on clinical recommendations and guidelines, on the part of the orthogeriatric teams can contribute to reduce such delays, increasing comorbidity diagnostic precision,[30] since the second most important cause of surgical delays is the presence of medical complications.[28]

Considering the need for early preoperative medical evaluation to avoid clinical contraindications to surgery, four reviews have recommended[31–34] comprehensive geriatric assessment with the purpose of adequately estimating perioperative risk and preventing complications. Likewise, in emphasizing the importance of early clinical care and homogeneity of the management objectives, we consider that the orthogeriatric clinical protocols should also implicate the emergency care service.

As has been pointed out by an editorial,[14] another important advantage of such orthogeriatric care is the shortening of hospital stay, despite a lack of analyses by subgroups in different studies, based on the case mix referred to comorbidity and prior functional and social condition. Such shortening of stay is the result of continuously improving quality of care, reducing patient stay in emergency service, facilitating structured management, and incorporating new measures based on evidence.[35]

Geriatric syndromes

Delirium

The incidence of delirium in elderly individuals with hip fracture varies between 38% and 61% and is greater in patients with dementia.[36] In subjects without prior dementia or delirium, the incidence of delirium and nonspecific cognitive dysfunction is lower (21.3%),[37] and in such cases hypoactive delirium is the most common presentation.[38] Likewise, delirium is a risk factor for poorer survival 6 months after hospital discharge.[38]

The published interventions for the prevention and treatment of delirium combine different strategies, based on a multifactorial approach or proactive geriatric consultation and follow-up.[39] Different studies have reported a decrease in the incidence of delirium in the intervention group,[40,41] and even a shorter duration of delirium.[42] Data from the subanalysis of a clinical trial,[43] only including patients with delirium upon admission, described a significant decrease

Table 1 Summary of the some most relevant studies included in this review

Authors	Year	Country	Sample size	Inclusion criteria	Exclusion criteria	Study design	Conclusion summary	Level of evidence
Brunskill et al[88]	2015	UK	Six studies (2,722 participants)	Randomized controlled trials comparing red blood cell transfusion versus no transfusion or an alternative to transfusion, different transfusion protocols, or different transfusion thresholds in hip fracture patients	None specified	Meta-analysis	Liberal versus restricted threshold transfusion: no differences in mortality, at 30 days post-hip fracture surgery (RR 0.92, 95% CI 0.67–1.26) or at 60 days postsurgery (RR 1.08, 95% CI 0.80–1.44); no difference in functional recovery at 60 days; very low-quality evidence of a lower risk of myocardial infarction in the liberal transfusion threshold group (RR 0.59, 95% CI 0.36–0.96)	IA
Liu et al[68]	2015	People's Republic of China	Ten studies (986 patients)	Hip fracture	1) Patients with multiple systemic fractures or pathologic fractures; 2) data without standard deviations; 3) participants with hip fractures who had undergone nonsurgical treatment	Meta-analysis	Perioperative oral nutritional supplementation: higher total protein levels (SMD =1.56 [95% CI 1.06, 2.07]; *P*=0.00001); less complications after hip surgery (OR =0.49 [95% CI 0.32, 0.73]; *P*=0.0005); less wound infection (OR =0.17 [95% CI 0.04, 0.79]; *P*=0.02); less urinary tract infection (OR =0.22 [95% CI 0.05, 0.90]; *P*=0.03)	IA
Prestmo et al[97]	2015	Norway	1,077 patients	Hip fracture patients	None specified	Clinical trial	Functional recovery; mean SPPB scores at 4 months were 5.12 (SE 0.20) for comprehensive geriatric care and 4.38 (SE 0.20) for orthopedic care (between-group difference 0.74, 95% CI 0.18–1.30, *P*=0.010)	IB
Mazzola et al[111]	2015	Italy	275 patients	Hip fracture patients and comorbidity or multiple-drug treatment or use of oral anticoagulants or lack of social support	None specified	Longitudinal cohort study	6-month mortality factors: severe disability (OR 2.24, 95% CI 1.08–4.65) and postoperative delirium (OR 3.80, 95% CI 1.72–8.39)	IIB
Grigoryan et al[25]	2014	US	18 studies (9,094 patients)	Hip fracture studies Orthogeriatric multidisciplinary approach	Not English or Spanish studies; not control group studies; published as an abstract or letter; or published >20 years prior to the search period	Meta-analysis	Reduction of in-hospital mortality (RR 0.60; 95% CI 0.43, 0.84) and long-term mortality (RR 0.83; 95% CI 0.74, 0.94); reduction of length of stay (SMD −0.25; 95% CI −0.44, −0.05), particularly in the shared care model (SMD −0.61; 95% CI −0.95, −0.28)	IA

Taraldsen et al[101]	2014	Norway	317 patients	Hip fracture patients previously living in their own homes and able to walk 10 m	Patient with pathological fractures, multitrauma injuries, or short life expectancy	Clinical trial	Comprehensive geriatric care; better SPPB score, 1.6 (SD 2.0) versus 1.0 (SD 1.6); P=0.002	IB
Moja et al[27]	2012	Italy	35 studies (191,873 patients)	Hip fracture patients aged ≥65 years	None specified	Meta-analysis	Early hip surgery (1–2 days); lower risk of death (OR 0.74 [95% CI 0.67–0.81, P<0.001]); lower risk pressure sores (OR 0.48 [95% CI 0.38–0.60, P<0.001])	IA
Stenvall et al[43]	2012	Sweden	64 patients	Hip fracture	Rheumatoid arthritis, severe hip osteoarthritis, severe renal failure, pathological fracture, and being bedridden before the fracture	Clinical trial	Fewer postoperative complications in the intervention group: urinary tract infections 6 (21%) versus 23 (64%), P=0.001; nutritional problems 5 (18%) versus 16 (44%), P=0.025; postoperative delirium 19 (68%) versus 35 (97%), P=0.002; number of delirium days 3.2 (SD 4.1) versus 12.8 (SD 17.6), P=0.003	IB
Carson et al[86]	2011	US	2,016 patients	Hip fracture patients with clinical evidence of or risk factors for cardiovascular disease	Unable to walk without human assistance before hip fracture, declined blood transfusions, multiple trauma, pathologic hip fracture associated with cancer, acute myocardial infarction 30 days before randomization, symptoms associated with anemia, actively bleeding at the time of potential randomization	Clinical trial	Blood transfusion (OR in the liberal strategy group 1.01; 95% CI 0.84–1.22), absolute risk difference of 0.5 percentage points (95% CI −3.7–4.7); in-hospital acute coronary syndrome (absolute risk difference −0.9%; 99% CI −3.3–1.6), and death on 60-day follow-up (absolute risk difference 1.0%; 99% CI −1.9–4.0)	IB
Simunovic et al[29]	2010	Canada	Five observational studies (n=4,208)	Hip fracture patients	None	Meta-analysis	Earlier surgery; lower mortality risk (RR 0.81, 95% CI 0.68–0.96, P=0.01); reduced in-hospital pneumonia (RR 0.59, 95% CI 0.37–0.93, P=0.02); reduced pressure sores (RR 0.48, 95% CI 0.34–0.69, P<0.001)	IA

Notes: Levels of evidence for therapeutic studies: IA, systematic review (with homogeneity) of RCTs; IB, individual RCT (with narrow confidence intervals); IIB, individual cohort study (including low quality RCT, eg, <80% follow-up); II, small RCTs with unclear results.

Abbreviations: RR, risk ratio; CI, confidence interval; OR, odds ratio; SPPB, Short Physical Performance Battery; SE, standard error; SD, standard deviation; SMD, standard mean difference; RR, relative risk; RCT, randomized control trials.

in postoperative delirium in the orthogeriatric care group, together with a significant decrease in the incidence of urinary tract infections, nutritional problems, and the incidence of falls.

The incidence of delirium can be lowered by assigning patient rooms close to the common areas and rehabilitation facilities, and this measure, moreover, improves patient comfort and contributes to shortening hospital stay.[44] Proactive geriatric care, electrolyte normalization and adequate hydration, oxygenation, pain and constipation control, drug monitoring with reviewing of the psychoactive medication used, and early mobilization all contribute to reducing the incidence of delirium.[45]

Cognitive impairment

Forty percent of all elderly people admitted because of hip fracture suffer from some degree of cognitive impairment.[46] Functional recovery of patients with cognitive impairment and hip fracture is variable.[43] In this regard, a systematic review has found similar functional gains in patients with and without mild or moderate cognitive impairment.[47] In a cohort of 314 elderly patients admitted due to hip fracture, in which 43% suffered from cognitive impairment, walking capacity prior to fracture, the presence of pressure ulcers (bed sores), and the incidence of delirium were found to be more robust predictors of functional recovery than the degree of cognitive impairment.[48] In a study published by our group[49] on 1,258 patients with hip fracture, 30% were seen to have dementia prior to admission. The patients without cognitive impairment showed higher walking rates at discharge and after 6 and 12 months than the patients with mild, moderate, or severe dementia – independently of age, prior Barthel score, sex, Charlson score, or presence of delirium upon admission. The mortality rate at discharge and after 1, 6, and 12 months was also lower among the patients without dementia than among those with mild, moderate, or severe dementia. In the adjusted model, the differences remained significant only in the group with severe dementia. Patients with cognitive impairment obtain benefit from rehabilitation programs in orthogeriatric units that use a specific multidisciplinary approach and in rehabilitation centers after hospital discharge.[50]

Depression

The presence of depression and its treatment increase the risk of fractures[51] and have a negative impact on functional recovery and mortality. Moderate or severe depression upon admission results in poorer recovery at discharge,[52] and is predictive of a considerable increase in the institutionalization and mortality rates after 12 months.[53,54] Depression in patients with hip fracture has been associated with reductions in plasma dehydroepiandrostenedione and increases in cortisol levels, accelerating progression toward fragility. The cortisol and dehydroepiandrostenedione ratio is higher in individuals with hip fracture than in healthy elderly subjects, and this ratio is a possible mediator between hip fracture and health condition. A study has found post-hip fracture depression to be associated with poorer functional recovery and slower walking speed.[55] The screening of depression in these patients could contribute to ensuring better management of the problem and minimizing its negative impact on patient recovery.

Constipation

Constipation is common among patients admitted due to hip fracture and is related to immobilization, loss of intimacy, and use of certain drug substances. In turn, constipation is associated with postoperative complications, a longer mean stay, and higher costs. Nevertheless, the condition is often underdiagnosed.[56] Approximately 70% of all patients develop constipation during the first postoperative days, and 62% continue to suffer from the problem up to 1 month after surgery.[57] The recommended options to prevent constipation comprise the use of laxatives, an increase in fiber and liquid intake, and the favoring of mobility.[58]

Malnutrition

Protein–calorie malnutrition increases the risk of falls and fractures. Moreover, the nutritional condition of elderly people with hip fractures tends to worsen during admission, and malnutrition is common among hip fracture patients,[59] thereby increasing the risk of complications, mean stay, mortality, and costs. Furthermore, malnutrition is more frequent in elderly individuals with greater comorbidity and functional and cognitive deterioration.[60] The detection of malnutrition is important, though the application of rapid detection tools for this purpose is insufficient.[61] Nutritional intervention in the postoperative period of these patients does afford clinical benefits in the form of a shorter stay, fewer complications, lesser mortality, and more stable quality of life.[62–66] Exhaustive care in the home after hospital discharge, with the inclusion of nutritional measures, significantly improves the nutritional condition of the patients and their functional capacity.[67] A recent meta-analysis on perioperative oral nutritional supplementation in elderly patients with hip surgery based on ten studies described a positive effect on serum total protein levels, with a decrease in the number

of complications and wound, respiratory and urinary tract infections, though no significant differences in mortality were recorded.[68]

Swallowing problems can result in denutrition, dehydration, aspiration pneumonia, a longer stay in hospital, and increased costs.[69] In one study, 27.7% of the patients who previously had no swallowing problems developed oropharyngeal dysphagia 72 hours after hip fracture surgery – this condition being associated with the presence of prior neurological and/or respiratory illness, postoperative delirium, age, and previous institutionalization.[70] The development of dysphagia in the postoperative period is of multifactorial origin, and screening measures should be adopted, particularly in more fragile patients.

Urinary retention and urinary incontinence

In a recent study,[71] 51.3% of the patients admitted because of hip fracture suffered urinary retention with the need for bladder catheterization – retention in turn being associated with the presence of diabetes, urinary infection, and delirium. Hip fracture likewise has been related to an increased prevalence of urinary incontinence (UI).[72] Incontinence after surgery has been associated with the use of drugs and anesthetic agents, appearance of urinary retention and/or infection, constipation, and difficulty in gaining access to bathroom, among other factors. The presence of UI can have a negative impact on functional recovery.[73] In one study,[74] 11% of the patients presented incontinence 72 hours after surgery, and the problem was associated with delirium, urinary infection, cognitive impairment, and depressive symptoms. Furthermore, 12 months after the operation, the patients had poorer function and greater institutionalization and mortality rates than the patients without UI. The probability of developing incontinence during hospitalization has been associated with previous institutionalization, delirium, previous need for medical devices, and walking dependency.[75] At 6 months after discharge, the prevalence of incontinence remains high, though after 2 years of follow-up it has been shown that UI, together with personal hygiene and eating, is one of the basic aspects that is most amenable to improvement.[76,77] UI should be taken into account by orthogeriatric teams, though the evidence of the efficacy of specific management during admission is not convincing.[78]

Pressure sores

In a study carried out in several European countries, the prevalence of pressure sores (PSs) in elderly people admitted due to hip fracture was 10% upon admission and 22% at discharge – most of them being of grade I. The factors associated with PSs at discharge were patient age over 70 years, dehydration, moist skin, total Braden score, nutritional status, existence of sensory defects, and presence of diabetes and/or lung disease.[79] Other studies have also reported an association with delays in surgery;[80] moreover, the presence of such ulcers prolongs hospital stay.[81] The use of appropriate clinical pathways in patient care can reduce the incidence of PSs by more than 50%.[82] Devices for elevating the heels and the use of pressure-redistributing mattresses have been found to be effective in some studies,[83] though other publications with low PS incidence have failed to observe benefits.[84] Surgical delay is related to the incidence of PSs, and a meta-analysis mentioned showed a reduction of risk of PSs related to shorter surgical delay (OR 0.48, [95% CI 0.38–0.60; I^2=0%]).[27]

Perioperative care

Renal function

Patients with low glomerular filtration rates present with increased comorbidity, lower hemoglobin (Hb) concentrations upon admission, longer surgical delays, and greater incidence of delirium. At hospital discharge, individuals with higher glomerular filtration rates yield higher motor Functional Independence Measure (FIM) scores. Likewise, low plasma urea levels upon admission have been associated with greater recovery of the motor FIM score and higher total score at discharge.[85]

Anemia

The management of anemia in geriatric patients with hip fracture is subject to controversy. Upon admission to hospital, ~80% of all fracture patients have Hb values below 11 g/dL. A clinical trial[86] randomized patients with hip fracture and anemia to two transfusion thresholds (8 and 10 g/dL, respectively) and no differences were observed in mortality after 30 days or in walking capacity after 60 days. Conversely, Gregersen et al[87] randomized patients to two transfusion thresholds in a clinical trial: restrictive (Hb <9.7 g/dL) and liberal (Hb <11.3 g/dL). There were no functional improvement differences, but 30-day and 90-day mortality was higher with the restrictive strategy, hazard ratio =2.4 (95% CI 1.1–5.2; P=0.03) and hazard ratio =2.0 (95% CI 1.1–3.6; P=0.01), respectively. A Cochrane review and meta-analysis[88] of 2,722 patients found no differences when two thresholds for red blood cell transfusion were compared: a liberal strategy to maintain a Hb concentration of usually 10 g/dL versus a more restrictive strategy based

on symptoms of anemia or a lower Hb concentration, usually 8 g/dL. There was no evidence of a difference between a liberal versus restricted threshold transfusion in mortality at 30 days post-hip fracture surgery or at 60 days postsurgery; neither was there in functional recovery at 60 days. There was low quality evidence of no difference between the transfusion thresholds in postoperative morbidity for the following complications: thromboembolism, stroke, wound infection, respiratory infection (pneumonia), and new diagnosis of congestive heart failure. There was very low-quality evidence of a lower risk of myocardial infarction in the liberal compared with the restrictive transfusion threshold group (risk ratio 0.59, 95% CI 0.36–0.96; three trials; 2,217 participants). Authors concluded that the available evidence does not support the use of liberal red blood cell transfusion thresholds based on a 10 g/dL Hb trigger. Intravenous iron[89] has not been found to reduce the transfusion rate, hospital stay, complications, or infections.

Second hip fracture

Many studies have shown that osteoporosis is underdiagnosed and hence undertreated in patients with hip fracture. In this regard, hip fracture represents an opportunity for starting early prevention of new fractures.[90] Patients who have suffered hip fracture are at a greater risk of new falls and fractures than the general population. Low scores (≤14 points) on the Norton scale, used to evaluate the risk of PSs, are associated with increased mortality, greater risk of postoperative complications such as urinary infections, and up to threefold higher risk of new falls.[91,92] In a population-based 7-year follow-up study of 87,415 patients with a first hip fracture, the incidence of a second hip fracture was 9.2% – the annual risk in patients aged 75 years or older being 4.1%.[93] In this study, the presence of obesity, diabetes, arterial hypertension, dyslipidemia, cerebrovascular disease, and/or vision problems was associated with an increased risk of a second fracture, while bisphosphonate therapy was associated with a lesser risk. The most common strategies for avoiding such situations include changes in lifestyle, drug treatment, and prevention of falls.[94]

Functional recovery

The fundamental aim of orthogeriatric units is to restore the previous independence of the patient.[33] Each day of immobilization makes it more difficult to reach this aim due to diminished muscle mass and strength, increased joint stiffness and pain, and loss of confidence – with the consequent fear of falls. A recent meta-analysis[25] has evidenced shortened hospital stay and lesser mortality in orthogeriatric units, with no differences in functional recovery. Another meta-analysis[95] likewise observed no improvement in the long-term functional outcomes in the orthogeriatric models.

A retrospective cohort study of 1,257 patients with hip fracture recorded a 68% community reincorporation rate after rehabilitation. Likewise, they presented fewer comorbidities, shorter hospital stay, and better functional and cognitive conditions. Use of the motor FIM score made it possible to predict which patients could return home.[96]

A randomized clinical trial[97] found functional gain to be greater in the orthogeriatric care group than among the patients receiving routine trauma care during the follow-up period. At 1 month after discharge, the patients in the orthogeriatric care group presented with a higher Short Physical Performance Battery score; after 4 months this was also accompanied by better cognitive function, greater independence, lesser fear of falls, and better quality of life. In addition, after 12 months, improved scores were observed on the Geriatric Depression Scale. The mean hospital stay was longer in this group, with a larger percentage of patients sent home after hospital discharge.

Early mobilization after the operation is essential since it reduces the incidence of delirium and pneumonia, improves function, and is associated with lesser mortality.[98]

However, a few studies have examined the relationship between inpatient bed rest and functional outcomes. A prospective cohort study of 532 patients examined the relationship between immobility, function, and mortality in patients with hip fracture. Such patients experienced an average of 5.2 days of immobility. Compared with patients with a longer duration of immobility (ie, at the 90th percentile) in adjusted analyses, patients at the 10th percentile of immobility had a lower 6-month mortality (−5.4%; 95% CI −10.9% to −1.0%) and a better FIM score for locomotion (0.99 points; 95% CI 0.3−1.7 points). The adverse association of immobility was strongest in patients using personal assistance or supervision with locomotion at baseline (difference in 6-month mortality between the 90th and 10th percentile of immobility was −17.1% [P=0.004] for this group and only 1.2% [P=0.38] for patients independent in locomotion at baseline).[99]

A study on early mobilization investigated the effect of early ambulation (EA) after hip fracture surgery on patient and hospital outcomes. Randomization was either EA (first walk postoperative day 1 or 2) or delayed ambulation (first walk postoperative day 3 or 4). At 1 week postsurgery, patients in the EA group walked further distance than those in the delayed ambulation group (34.70 m [range, r=5–103]

versus 29.71 m [r=0–150], P=0.03) and required less assistance to transfer (26.3% versus 50%, P=0.009).[100]

A subanalysis of a randomized controlled trial, the Trondheim Hip Fracture Trial, compared physical behavior and function during the first postoperative days for hip fracture patients managed with comprehensive geriatric care with those managed with orthopedic care. The comprehensive geriatric care participants had significantly more upright time (mean 57.6 versus 45.1 minute, P=0.016), higher number of upright events (24.1 [SD =22.1] versus 19.0 [SD =16.5], P=0.005), and better Short Physical Performance Battery scores (1.6 [SD =2.0] versus 1.0 [SD =1.6], P=0.002) than the orthopedic care participants.[101]

Surgical treatment

In patients with subcapital fractures, total arthroplasty versus hemiarthroplasty offers more lasting functional results and better pain control, despite a greater risk of complications (mainly luxation).[102] Surgery must take into account the patient's mental condition, social situation, level of dependency, and quality of bone in deciding the type of operation. Minimally invasive surgical techniques reduce bleeding and transfusion needs versus conventional surgery.[103] In a recent meta-analysis, the minimally invasive dynamic hip screw technique in elderly patients with intertrochanteric fractures has been found to be safe and effective, with a more limited blood loss, shorter hospital stay, less pain, and greater functional gain versus the conventional technique.[104] However, a later study[105] has failed to record fewer transfusion needs or lower mortality after 1 year when comparing treatment in the form of percutaneous compression plating (PCCP) versus dynamic hip screw. Likewise, there appeared to be no differences in clinical effectiveness when comparing PCCP with the proximal femoral nail antirotation technique, though PCCP resulted in lesser blood loss and shorter surgical times.[106]

General, epidural, or spinal anesthesia in elderly patients with hip fracture exerts no influence upon the incidence of delirium or cognitive impairment, duration of stay, patient destination at discharge, or mortality after 1 year.[107]

Prognostic factors and mortality

Several studies on orthogeriatric care units have shown a reduction in mortality. These studies have also linked a number of prognostic factors with mortality in elderly patients admitted to hospital with hip fractures. Early identification and specific treatment of these factors could help to reduce hip fracture patients mortality. The results of a meta-analysis showed orthogeriatric collaboration to be associated with a significant decrease in in-hospital mortality and mortality over the long term,[25] with a shorter stay in hospital. No improvements were observed in terms of the incidence of delirium, reductions in surgical delay, or functional recovery.

A comparative study has shown that the presence of orthogeriatric unit reduces the 30-day adjusted mortality rate and mean duration of stay.[108] The mortality rate and mean stay can be predicted using the Multidimensional Prognostic Index, which contemplates functional, cognitive, nutritional, social, and clinical information and predicts mortality in patients presenting a series of clinical conditions. A study has found high Multidimensional Prognostic Index scores to be associated with longer hospital stays and poorer survival rates.[109] A retrospective study analyzed the main comorbidities found in patients admitted due to hip fracture and their influence on mortality. A 12-month post-discharge mortality predictive model, based on comorbidities, included patient age, cognitive impairment, and surgical delay, and was able to explain 26% of the variability in mortality. A second model, based on the complications, included patient age and respiratory complications, and was likewise able to explain 26% of the variability in mortality.[110]

Another prospective study divided the patients into two age groups (85–89 and >90 years). The older group showed greater mortality. The factors associated with mortality after 6 months were severe disability and postoperative delirium.[111] A retrospective study evaluated the activity of an orthogeriatric care unit of geriatric patients diagnosed with hip fracture between 2004 and 2008. Male sex, Barthel score, heart failure, and cognitive impairment were seen to be associated with an increased mortality risk. With regard to function, 63.7%, 77.4%, and 80.1% of the patients had recovered walking capacity at discharge, 1 month, and 6 months after fracture, respectively. The factors associated with poorer functional recovery included cognitive impairment, functional condition, age, cerebrovascular events, Charlson score, and delirium during hospital admission.[112]

Controversies of the orthogeriatric care model

Different studies[103–115] have confirmed that the orthogeriatric care model reduces mean stay and mortality. An analysis[116] divided the patients with hip fracture into two age groups (65–84 versus ≥85 years). The older group showed greater comorbidity and higher prevalence of cognitive impairment, which were not associated with longer surgical delays,

though both the length of hospital stay and mortality rate (in-hospital and 30 days and 12 months after discharge) were greater; the percentage of patients entering homes for the elderly after discharge was also higher. The authors concluded that patients aged 85 years or older are high-risk patients and merit specific clinical management. Another retrospective study[117] compared the results corresponding to 6 months before the start of activities of an orthogeriatric team versus the findings 6 months after the start of such activities. The orthogeriatric team activities resulted in shortened stay and increase in the adoption of secondary fracture prevention measures.

A study has analyzed the changes recorded in a department after the introduction of a clinical pathway in hip fractures. The initiative was found to result in a shortened stay and a lesser probability of complications during hospital admission.[118] Similar results have been obtained in another study[35] where the introduction of a multidisciplinary management model with preoperative geriatric assessment and daily geriatric clinical care resulted in an increased percentage of patients operated upon within the first 48 hours and a reduction in hospital stay.

However, these data may be interfered with by circumstances that alter routine care, such as weekends. In this regard, a retrospective study of 2,989 consecutive individuals compared patient care on working days versus care provided on weekends. A significant association with mortality after 30 days was observed in the patients admitted on weekends, despite the absence of greater mortality associated with surgery performed on weekends.[119]

Costs

A study described the compared cost-utility analysis and orthogeriatric care model versus an interconsultation orthogeriatric department. This paper found orthogeriatric care to offer greater cost-effectiveness since the orthogeriatric care model used 23% fewer resources per patient ($14,919 versus $19,363) and avoided 0.226 disability-adjusted life years per patient, adding quality-adjusted life years by lowering the cost of institutionalization per patient, with a reduction of mortality after 1 year.[120] A retrospective cohort study in turn compared orthogeriatric care versus routine trauma care, and found the former to result in mean savings of $13,737 per patient, with a decrease in mortality after 12 months.[121] Lastly, a randomized, prospective intervention study comparing the care provided in an orthogeriatric unit versus the care provided in a traumatology ward with interconsultation geriatric management found the patients treated in the orthogeriatric unit to have a greater probability of starting rehabilitation in the acute cases ward, with greater recovery of walking capacity, earlier surgery, and shorter hospital stay. All these implied an estimated process cost saving of €1,207-€1,633 per patient, including the avoided stays which is an estimated saving of €3,741 per year.[122]

Future perspectives and lines of research

It is interesting to mention some recent publications that have evaluated the presence of sarcopenia in patients with hip fracture, in both the acute phase and in the subacute and chronic phases. In a recent study, the prevalence of sarcopenia in patients admitted due to hip fracture was 17.1% (12.4% in males and 18.3% in females).[123] In this regard, patients with sarcopenia suffer greater functional loss at discharge. The observed prevalence is low in comparison with the data obtained in other studies.[124]

Another important point requiring consideration is the difference in predicted function and survival after hip fracture in institutionalized patients. A retrospective cohort of 60,111 patients found that 36.2% of the patients died in the first 180 days after fracture. Of the patients who were not fully dependent before fracture, a total of 53.5% either died or became totally dependent in the first 180 days – the prognosis being poorer in individuals with severe cognitive impairment, subjects over 90 years of age, patients who had not received surgical treatment for the fracture.[125]

Conclusion

Orthogeriatric units improve the quality standards of care of geriatric patients with hip fracture, such as survival and functional recovery rates, thereby also reducing the length of stay and costs. Some clinical trials and meta-analyses published over the last 5 years support this evidence. Nevertheless, there are still gaps in knowledge regarding specific clinical issues, such as the best approach to pain, choice of certain surgical procedures, Hb threshold for blood transfusion, or measures to reduce the incidence of blood transfusions during hospital admission, and the continuity of care in concrete situations, such as cognitive impairment or institutionalization. Future studies are needed to help answer these questions.

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Author contributions

Francisco José Tarazona-Santabalbina and Ángel Belenguer-Varea carried out a selected keyword search and conceived and designed this study. They selected the articles and drafted the manuscript in collaboration Eduardo Rovira and David Cuesta-Peredó. All authors contributed toward data analysis, drafting and critically revising the paper and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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