Perioperative Management of Elderly Patients with **Hip Fracture**

Jacques Boddaert, M.D., Ph.D., Mathieu Raux, M.D., Ph.D., Frédéric Khiami, M.D., Bruno Riou, M.D., Ph.D.



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ORLDWIDE 1.6 million patients suffer from hip fracture every year, and this number has increased by 25% every decade as the population continues to grow.¹ Nevertheless, a decrease in hip fracture rate has been recently observed, particularly in women (up to -24% in women older than 85 yr), owing to several factors including awareness about osteoporosis and the danger of falls.² Hip fracture has devastating consequences in the elderly patients and thus is associated with a poor outcome. This contrasts markedly with the relatively simple surgical procedures needed for treatment. One third of elderly patients with hip fracture are dead 1 yr later and, in surviving patients, hip fractures have a negative effect on daily life activities and quality of life.1-3

The elderly patients with hip fracture remain a medical challenge for the anesthesiologist, mainly because of the frequent and numerous comorbidities encountered; moreover, the incidence of these comorbidities has increased during the past years.² Many improvements have been introduced in the care of these patients, including improved surgical devices, earlier mobilization, prophylactic administration of antibiotics and anticoagulant, as well as increased rate of admission into rehabilitation unit. Nevertheless, the mortality rate has plateaued since 1998.² Given the magnitude of the problem, some effective strategies have been recently proposed to prevent mortality after hip fracture.^{3,4} This Clinical Concept and Commentary summarizes these strategies and explain the future directions for research, but focuses on specific issues related to hip fracture and not to more general aspect related to anesthesia in elderly patients.⁵

Morbidity and Mortality

After hip fracture, in-hospital mortality ranges from 2.3 to 13.9%, but the risk persists beyond the immediate surgical period with 6-month mortality rates ranging from 12 to 23%.³ The mortality risk increases within 6 months and thereafter decreases, and is higher in men. When compared to elective hip replacements, patients presenting with hip fracture have a 6- to 15-fold mortality risk.⁶ This difference is explained by the high prevalence of preexisting medical conditions in this population: 75% of patients are older than 70 yr,¹ and 95% of patients present with at least one major preoperative comorbidity (fig. 1).⁷ Three in four hip fracture-associated deaths may be causally related to preexisting medical conditions rather than the fracture itself.8 This indicates that the hip fracture destabilizes a frail elderly population with a high burden of preexisting morbidities, thereby resulting in excess mortality. Some new acute conditions (stroke and cardiac events) may have also provoked falling and thus hip fracture. Frailty should be understood as a vulnerability and a decline of physiologic age-related functional capacities to confront an acute stress such as hip fracture. To summarize, it can be considered in the presence of at least one of the following conditions: (1) advanced age, the "oldest old" (i.e., >90 yr); (2) presence of several comorbidities; and (3) new acute medical conditions. Any of these conditions can weaken elderly patients with hip fracture.

Surgery Is Urgent!

A meta-analysis including 35 studies and 191,873 patients found that early surgery (cutoff, 24 to 48 h) was associated

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with significantly lower risk of death (pooled odds ratio, 0.74; 95% CI, 0.67 to 0.81).9 Although these data are impressive, possible confounders cannot be completely ruled out because observational studies failed to identify patients whose surgery is delayed for valid medical reasons and this group is obviously associated with a poorer outcome. Therefore, a large randomized study is needed, particularly when considering that the current clinical practice is not considering hip fracture as an emergency requiring early surgery. In most countries, most elderly patients are operated with a delay time more than 24 h.⁴ In 2010 in France, we estimate that 47 to 60% of patients have been operated after 48 h, a proportion close to that observed in United Kingdom (49%).¹⁰ Even in our institution where hip fracture is considered urgent surgery, the proportion of patients still operated after 48 h was 13%.³ There are many reasons that could explain this delay, including preoperative medical assessment and operating room access, but we are convinced that the main reason is how physicians considered elderly patients and the risk-benefit of early surgery. Thus, a large randomized trial is probably the only way to convince physicians of what others already consider as an evidence.

Moja *et al.*⁹ concluded that "early surgery is not intended as a race against time to operate patients in a few hours but everything possible should be done to ensure the majority of patients operated within one or two days." However, a Canadian group has demonstrated the feasibility of trial testing very early surgery (<6h) and this is probably a very good option, at least from a research point of view, because the "greatest impact of surgery may occur when hip surgery is treated much more quickly than studies have evaluated."⁴ From a clinical perspective, operating the vast majority of patients within 24 h remains a challenge.

Preoperative Assessment

Comorbidities directly influence outcome in elderly patients with hip fracture. The Cumulative Illness Rating Scale (based on four stages [moderate to mild to severe to very severe impairment] of 13 organs such as heart, vascular, head) is significantly associated with long-term mortality.³ Many other scores (Charlson Comorbidity Index and Geriatric Index of Comorbidity) have been proposed but they have been used for research, internal audit, or interhospital comparison purposes. Furthermore, none has been demonstrated to be clinically useful or underwent external validation. Most of these scores are able to predict mortality, postoperative complications, and admission into a nursing home, but all these outcomes are linked together.

A careful preoperative assessment is usually recognized as essential in these patients to stabilize coexisting medical conditions and to optimize cardiovascular and respiratory functions. However, this very general concept may be overused in elderly patients with hip fracture, leading to inappropriate consultation by specialists, last minute cancellations, and delayed surgery. The potential (and thus hypothetical) benefit of any medical intervention that may delay surgery should be weighted against the demonstrated fact that delayed surgery is associated with a poorer outcome. Moreover, the intraoperative period may represent a period of relative stability or at least a period with heavy control of cardiovascular and respiratory functions. Lastly, there is no alternative to surgery that must be finally done. Thus, although a "careful" preoperative assessment is probably required, delayed surgery should probably be the exception. For example, even if the patient has a coronary artery disease, there is no reason to perform additional investigation, except in the rare occurrence of an acute coronary syndrome with ST elevation. If the patient has cardiac failure, then there is probably no need to perform additional echocardiography. White et al.¹⁰ reported that surgery was delayed for organizational reasons in 51%, medical reasons in 44%, and anesthetic reasons in only 4% of cases. Thus, most organizational and medical reasons may not be appropriate taking into account the urgent need of surgery in these patients. The anesthesiologist should distinguish the preoperative elements that required correction (dehydration, occult hypovolemia, anemia, hypoxia, electrolyte disturbances, and arrhythmias) and those that could modify the postoperative course of the patient (cognitive disorders, chronic cardiac, respiratory, and renal failure).

Many of the patients in question are being treated with anticoagulants, mainly vitamin K antagonists. Because of the need for urgent surgery, surgery should not be delayed until spontaneous normalization of hemostasis. In patients with an international normalized ratio more than 1.5, the administration of vitamin K (1 to 3 mg) is usually not sufficiently rapid normalization, whereas administration of prothrombin complex concentrates (20 IU/kg) allows an immediate correction of the international normalized ratio.¹¹ Aspirin should not be interrupted and its effect on perioperative bleeding and hemoglobin decrease is considered negligible.¹² Interruption of clopidogrel is more controversial but it did not significantly increase bleeding, blood transfusion, length of surgery, and length of stay.¹³ The only drugs that probably required delayed surgery are the new oral anticoagulants (dabigatran, apixaban, and rivaroxaban) because these are very powerful anticoagulants and there is still no antidote available. This remains an unresolved clinical problem that is more frequently encountered although these drugs may be contraindicated in these elderly patients with frequently altered renal function. Among the other chronically taken drugs, β -blockers, statin, and benzodiazepines should not be interrupted. Benzodiazepines withdrawal is the single, main easily preventable cause of postoperative delirium in these elderly patients.

Hip fracture may be associated with severe pain, and effective analgesia is required as soon as possible. Inappropriate pain control may favor postoperative delirium, and patients with delirium may also receive inadequate analgesia. In the emergency department as well as in the postanesthesia recovery room,¹⁴ intravenous morphine titration is a very simple and efficient method. As opioid administration is not

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Fig. 1. Frequency of main comorbidities in the elderly patients.

related to incident delirium, there is no reason to limit it.¹⁵ However, nerve blocks can also be easily performed either in the emergency department or in the postanesthesia recovery room. Analyzing 21 randomized trials including 1,422 patients, Rashiq *et al.*¹⁶ concluded that the combination of obturator and lateral femoral cutaneous nerve blockade is likely to be the most effective against postoperative pain and that fascia iliaca blockade is likely to be the most effective against delirium. Postoperative epidural analgesia induced superior analgesia, but this improvement was not able to translate into an enhanced rehabilitation.¹⁷ Nerve blockade should be provided as soon as possible, ideally upon arrival at the emergency department.

Intraoperative Management

Some observational studies have noted that regional anesthesia was associated with better outcome than general anesthesia, but other studies did not. A recent large database analysis (n = 18,158 patients) observed that regional anesthesia was associated with a lower in-hospital mortality (odds ratio, 0.71; 95% CI, 0.54 to 0.93) and a lower incidence of pulmonary complications (odds ratio, 0.75; 95% CI, 0.64 to 0.89) but confounding bias cannot be ruled.¹⁸ The coding of "regional" versus "general" anesthesia is a serious concern in these large administrative database analyses, only in-hospital mortality was assessed, whereas long-term mortality is the appropriate outcome, and timing of surgery was not even considered in this study.¹⁸ However, the lack of benefit on mortality rate has been recently confirmed in a large observational study in the United States.¹⁹ There is no reason to favor regional versus general anesthesia in these patients and the difference, if it exists, is probably small. Anyway, regional anesthesia is contraindicated in a significant proportion of patients treated with platelet antiaggregant (clopidogrel, prasugrel, ticagrelor, and ticlopidine) or anticoagulant. Contraindication is only relative with aspirin.

Intraoperative intravascular volume optimization²⁰ or goal-directed hemodynamic treatment²¹ has been proposed

to improve outcome in elderly patients with hip fracture after some encouraging results have been obtained after major surgery. The principle is to perform fluid challenge using appropriate intraoperative monitoring, either central venous pressure or esophageal Doppler. However, only a few underpowered randomized studies have been yet performed^{20,22} and they used only an intermediate (and not a surrogate) endpoint (length of stay) leading to the proposal of a costeffectiveness analysis.²¹ Although nobody could argue against the need for "hemodynamic optimization" in a frail elderly patients, this research perspective might be a dead end for the following reasons: (1) intraoperative period may represent a period of relative stability and the need for hemodynamic optimization may encompass a larger period, pre- or postoperatively to modify the outcome and (2) there are few data to indicate that intraoperative instability has a major impact on outcome as compared to other known factors such as early surgery and multidisciplinary postoperative care.^{3,4} Anyway, intraoperative monitoring using bispectral index measurement may be a useful guidance for careful titration of anesthetic drugs in these frail elderly patients although no evidence-based data are yet available to support that.

The optimal surgical treatment remains a matter of debate. Early postoperative mobilization, requiring early weight bearing, is one of the main objectives, but long-term surgical outcome is also important. Although new osteosynthetic techniques provide encouraging results in young patients, arthroplasty is usually recommended in the geriatric population because it enables an early weight-bearing and provide better surgical results.²³ In patients with cognitive disorders, most authors recommend arthroplasty, particularly cemented arthroplasty. In a large cohort (n = 4,335), the 1-yr incidence of repeat surgery was 23% after osteosynthesis versus 3% after arthroplasty, and pain was greater and patient satisfaction was lower in the osteosynthesis group.²³ Nevertheless, arthroplasty may induce cement-related complications and fat/fibrinocruoric embolism. The use of intrafemoral device (vacuum drainage placed in the proximal femur) to decrease the intramedullary pressure during the prosthesis insertion can markedly decrease the incidence of fat embolism (from 93 to 13%).²⁴ In young patients, noncemented arthroplasty is now widely recommended. But in elderly patients, cemented arthroplasty is preferred because of the lower proportion of mechanical complications and repeat surgery, and a lower incidence of chronic postoperative pain. It is of note that using a large database (n = 25,174), there was no significant differences in immediate and 1-yr mortality between cemented and noncemented arthroplasty.²⁵

Postoperative Care: The Orthogeriatric Concept

Various approaches have been proposed to integrate orthopedic and geriatric care for elderly patients with hip fracture, an initiative also known as orthogeriatrics (fig. 2), but few studies have reported an improvement in long-term

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Fig. 2. The orthogeriatric concept. (*A*) Increasing risk related to anesthesia/surgery *versus* comorbidities in young patients, elderly healthy patients (*i.e.*, elderly patients with harmonious aging process without significant comorbidities), and "geriatric patients (*i.e.*, elderly patients with several comorbidities). (*B*) Four designs of orthogeriatric cooperation have been proposed in the literature with increasing participation of the geriatrician and decreasing participation of the surgeon (from 1 to 4). The Unit for PostOperative Geriatric (UPOG) care belongs to the last one.

clinical outcome.^{3,26} Some of these measures have included an orthopedic ward with geriatric consultation or an orthopedic ward with daily geriatric management. A more interesting approach has included admission into a geriatric ward under the specialist care of an orthopedic consultant. To our knowledge, this is the only approach that has shown sustained mortality reduction, together with improved walking ability and less morbidity (fig. 3).³

In our institution, we created a geriatric unit devoted to the postoperative care of elderly patients with hip fracture. The medical staff from the emergency, anesthesiology and critical care, geriatric, orthopedic surgery, and rehabilitation departments define priorities for these patients. Four key factors were identified and management strategy was focused on specific points (table 1). A marked reduction (risk ratio,



Fig. 3. Survival curves for mortality for patients in the orthopedic (*solid line*) and geriatric (*dotted line*) cohorts. The orthopedic cohort (n = 131) was treated in an orthopedic department without geriatric cooperation. The geriatric cohort (n = 203) was treated in a dedicated Unit for PostOperative Geriatric care. Survival is adjusted for age, sex, and Cumulative Illness Rating Scale calculated with a Cox regression analysis. *P* values refer to log-rank test. Reproduced, with permission, from Boddaert *et al.* PLoS One 2014; 9:e83795.3.

0.43; 95% CI, 0.25 to 0.73) was observed in the risk of death at 6 months, a treatment effect is twice that observed with early surgery (fig. 3) as well as reductions in pressure ulcer, admission to intensive care unit, and re-hospitalization within 30 days.³ Early sitting and walking, prevention of pressure ulcer, early identification of urinary retention and delirium may be the most important management factors associated with survival improvement.³ One of the key aims is to create a dedicated unit where some team skills can be more easily developed. Rehabilitation facilities as well as the cooperation between acute care and rehabilitation facilities play a crucial role in the care of these elderly patients.

Postoperative delirium may affect one third of elderly patients,³ be already present at admission and is frequently

 Table 1.
 Multidisciplinary and Team Approaches in the Elderly

 Patients with Hip Fracture

Four Key Factors

- 1. Early alert from the emergency department.
- 2. Consider hip fracture as an emergency surgical case.
- 3. Rapid transfer to a dedicated geriatric unit after surgery (<48 h).
- 4. Rapid transfer of stable patients to a dedicated rehabilitation unit.

Management Focused on following things

- 1. Early mobilization (chair sitting 24h and walking 48h)
- 2. Pain management (acetaminophen and morphine).
- 3. Provision of air-filled mattresses in high-risk patients (Braden Scale).
- 4. Swallowing disorders detection.
- 5. Detection of stool impaction.
- 6. Detection of urinary retention (bedside ultrasound).
- 7. Anemia detection and correction.
- Detection of delirium (Confusion Assessment Method); avoid any chronic benzodiazepine treatment withdrawal.
- 9. Malnutrition detection (nutritionist).

underdiagnosed. Risk factors include advanced age, preoperative cognitive impairment, depression, psychotropic medication use, fluid and electrolyte disturbances, and vision or hearing impairment.²⁷ Pain, urinary retention, inappropriate antiemetic drugs such as haloperidol (anticholinergic effects), and benzodiazepine withdrawal are also recognized as precipitating factors. Delirium is associated with a slower recovery and a poorer outcome and a vicious circle may be initiated (delirium, physical restraint and medication to treat delirium, postoperative complications, then more delirium). A systematic daily detection procedure is required but, from a prevention and therapeutic point of view, there is no unique target. A multifactorial intervention program based on an early started and supporting treatment (including early supplemental oxygen, intravenous fluid and nutrition supplementations, increased monitoring of vital physiologic variables, adequate pain relief, avoidance of delay in transfer, screening for delirium, and avoiding polypharmacy) reduced the incidence of delirium (from 34 to 22%) in these patients.²⁸

Swallowing disorders represent a strong risk factor of aspiration pneumonia, and its detection may lead to modification of food consistencies and careful survey. Stool impaction frequently occurs and represents a source of discomfort, a risk factor of bladder retention, and may induced delayed rehabilitation and life-threatening complications. Perioperative urinary retention is observed in 25% of cases.³ Despite this high incidence, physicians should try to remove as soon as possible indwelling urethral catheters implying that a careful and systematic survey using bedside echography is mandatory.³

Anemia is very frequent $(50\%)^3$ and is associated with transfusion, an increase in hospital length of stay, rate of postoperative infection, and long-term mortality but a severity bias is very likely. Carson *et al.*²⁹ have shown the absence of clinical benefit of a restrictive regimen of transfusion as compared to a liberal one in elderly patients. Malnutrition detection and management may be an important part of the healing and rehabilitation process. Myint *et al.*³⁰ recently observed that nutritional supplement induced some clinical benefits (less weight loss, reduced rate of infections, and length of stay) but without significant rehabilitation improvement. The precise nutrition strategy required remains to be determined.

Pending appropriate prevention, the rate of symptomatic venous thromboembolism (1.3%) and pulmonary embolism (0.25%) at 3 months is very low.³¹ In the ESCORTE study (n = 6,860 patients), 98% of patients received low-molecular-weight heparin, 69% of patients for at least 4 weeks,³⁰ although they are contraindicated above 75 yr.

Conclusion and Perspectives

In elderly patients, hip fracture remains a frequent and devastating process with a high long-term mortality and a deleterious effect on daily life activities and quality of life in survivors. An alignment of multidisciplinary hospital teams (physicians and nurses) and hospital care paths (from emergency department admission to rehabilitation care) toward optimal care as well as an early surgery are key factors that may improve morbidity and mortality. Further studies are required to both validate the "orthogeriatric concept" in various healthcare systems³ and definitely demonstrate that early surgery can save life.⁴ Although a multidisciplinary approach is required, the anesthesiologists should also promote their own research perspectives. Hemodynamic optimization of the very short intraoperative period may not be the most important question. Several important clinical issues probably deserve more attention namely: (1) Is a new anesthetic agent such as Xenon (NCT01199276*) or a low sedative drug regimen during anesthesia (NCT00590707) able to reduce the incidence of postoperative delirium? (2) Does dexmedetomidine play a role in the postoperative care of these patients? (3) What is the optimal analgesic regimen, particularly focusing on the role of nerve block (NCT01593319; NCT 1547468; and NCT01638845*); (4) Which perioperative nutrition management is able to improve rehabilitation? (5) How can we speed or improve recovery and rehabilitation in these patients? Anesthesiologists may also need a clinically useful score to predict the outcome replacing the obsolete American Society of Anesthesiology score.

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Competing Interests

Dr. Riou has received consultant fees and lecture honoraria from LFB (Les Ulis, France) and was an investigator in studies conducted by LFB and Octopharma (Boulogne, France). The other authors declare no competing interests.

Correspondence

Address correspondence to Dr. Boddaert: Department of Geriatrics, Groupe hospitalier Pitié-Salpêtrière, 47–83 Boulevard de l'Hôpital, 75651 Paris Cedex 13, France. jacques. boddaert@psl.aphp.fr. This article may be accessed for personal use at no charge through the Journal Web site, www. anesthesiology.org.

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