

# Outcome in geriatric fracture patients and how it can be improved

T. Roth · C. Kammerlander · M. Gosch · T. J. Luger ·  
M. Blauth

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**Abstract** Geriatric fractures are an increasing medical problem worldwide. This article wants to give an overview on the literature concerning the outcome to be expected in geriatric fracture patients and what can be done to improve it. In literature, excess mortality rates vary from 12% to 35% in the first year after a hip fracture, and also, other geriatric fractures seem to reduce the patient's remaining lifetime. Geriatric fractures and, in particular, hip fractures constitute a major source of disability and diminished quality of life in the elderly. Age, gender, comorbid conditions, prefracture functional abilities, and fracture type have an impact on the outcome regarding ambulation, activities of daily living, and quality of life. Comprehensive orthogeriatric comanagement might improve the outcome

of geriatric fracture patients. For the future, well designed, large prospective randomized controlled trials with clear outcome variables are needed to finally prove the effectiveness of existing concepts.

**Keywords** Geriatric fracture · Hip fracture · Morbidity and mortality · Orthogeriatric comanagement · Outcome

## Introduction

Geriatric fractures are an increasing medical problem all over the world. The lifetime risk of any osteoporotic fracture ranges between 40% and 50% in women and 13–22% in men [1]. According to the epidemiologic development, a considerable rise of these fractures is estimated worldwide during the coming decades and the related costs for the society will be increasing as well [2, 3].

All osteoporotic fractures may lead to a significant physical impairment; the fractures of the proximal femur are a major cause of morbidity and mortality and often contribute to the patient's loss of independence and of quality of life.

In 1993, Sernbo et al. reported on the unfavorable consequences of hip fractures in a study on a series of 1,429 consecutive patients treated at a hospital in Malmö, Sweden. One year after the fracture, 34% of the men and 20% of the women had died and only 70% of the patients could be discharged to their original accommodation. Six months after the fracture, twice as many patients still had to live in a nursing home, and 1 year after the fracture, fewer than 50% had reached their original walking ability and most needed additional social support [4].

This article wants to give you an overview on the literature concerning the outcome we have to expect in

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T. Roth (✉) · C. Kammerlander · M. Blauth  
Department for Trauma Surgery and Sports Medicine, Medical  
University of Innsbruck,  
Anichstrasse 35,  
6020 Innsbruck, Austria  
e-mail: Tobias.Roth@uki.at

C. Kammerlander  
e-mail: Christian.Kammerlander@uki.at

M. Blauth  
e-mail: Michael.Blauth@i-med.ac.at

M. Gosch  
Department for Geriatric Medicine, Landeskrankenhaus Hochzirl,  
Hochzirl 1,  
6170 Hochzirl, Austria  
e-mail: Markus.Gosch@tilak.at

T. J. Luger  
Department for Anesthesiology and Critical Care Medicine,  
Medical University of Innsbruck,  
Anichstrasse 35,  
6020 Innsbruck, Austria  
e-mail: Thomas.Luger@i-med.ac.at

geriatric fracture patients and on what we can do to improve it.

### Excess mortality rates

As mentioned above, Sembo described a 1-year mortality rate of 20% and 34% for women and men, respectively, after hip fracture [4].

Giverson reported a cumulative mortality of 26.5% at 1 year and 36.2% at 2 years after fracture in his register-based study of 2,674 first hip fractures over a ten-year period. Despite significantly increasing age at admission over the time, no changing time trend of mortality was observed, nor was the mortality influenced by the type of proximal femur fracture [5].

In their review of all articles published on the mortality after hip fracture over a four decade period from 1959 until 1999, Haleem and colleagues also described a consistent mortality rate of hip fracture patients over the years from 11% to 23% at 6 months and 22–29% at 12 months after fracture with some geographic variations. They further found, that the mean age at fracture increased from 73 years in the 1960s to 79 years in the 1990s, which the authors interpreted as a reflection of the longer life expectancy of a fitter and older population, who are more likely to suffer a hip fracture at an older age. The fact that the mortality rate remained constant over the years despite the increasing age (which is an independent risk factor for mortality after hip fracture) might be seen as a result of improved medical treatment and increased awareness [6].

Center et al. described an increased mortality rate in all proximal femoral, vertebral, and other major fragility fractures in their prospective cohort study over 5 years of the Dubbo population aged 60 years and older. In women, age-standardized mortality ratios were 2.18 for proximal femur, 1.66 for vertebral, and 1.92 for other major fractures; in men, these rates were 3.17 for proximal femur, 2.38 for vertebral, 2.22 for other major, and even 1.45 for minor fractures, respectively [7].

Johnell and his group studied 2,847 patients with osteoporotic fractures at the spine, the proximal humerus, the hip, and the forearm. Survival after 1 year was 72% for clinical spine fracture, 78% for hip fracture, 87% for shoulder fracture, and 94% for forearm fractures and the mortality rate decreased in the subsequent years. At 5 years, survival was lowest for spine fractures at only 28%, followed by hip fractures at 41%, and proximal humerus and forearm fractures (64% and 74%, respectively). The authors concluded that patients with hip, vertebral, and shoulder, but not forearm, fractures have a higher mortality rate compared with the general population and that this is more pronounced in the year after the fracture compared with 5 years later [8].

Recently, in a long-term observational study of fracture patients of the Dubbo population, Bliuc et al. reported an increased mortality risk for all low-trauma fractures for 5–10 years in a sample of older men and women. A subsequent osteoporotic fracture was associated with an increased mortality risk for another 5 years [9].

Summarized, in the literature excess mortality rates vary from 12% to 35% in the first year after a hip fracture and also other geriatric fractures seem to reduce the patient's remaining lifetime, but the cause for these findings still remains unclear. Hip fracture mortality is higher in men than in women and increases with age, the number of comorbidities, and low prefracture functional status, but also low bone mineral density is reported to be a risk factor for mortality itself [10, 11].

### Loss of function and of quality of life

In 1990, Magaziner et al. described a severe loss of function in a prospective cohort study of 536 patients with acute hip fracture aged 65 years and older: by 1 year post-discharge only slightly above 60% of the patients regained their prefracture walking abilities, fewer than 50% had recovered physical activities of daily living and only about 30% had recovered IADL (instrumental activities of daily living) performance level while most of the recovery already occurred by 6 months after the fracture [12].

Koval and his group conducted a prospective study targeted on the ambulatory ability at a minimum follow-up of 1 year of 336 community-dwelling, previously ambulatory hip fracture patients aged 65 years and older. Forty percent of patients remained ambulatory but became more dependent on assistive devices, 12% of previous community ambulators became household ambulators, and 8% of the patients became non-functional ambulators [13].

Cooper described that after 1 year, 40% of hip fracture patients were still unable to walk independently, 60% required assistance with one essential activity of daily living (e.g., dressing, bathing, food preparation) and 80% were unable to perform at least one IADL (e.g., driving, grocery shopping, or house cleaning). Twenty-seven percent of these patients had to enter a nursing home for the first time [14].

In a smaller study conducted in the Netherlands, only 57% of surviving patients were back in their original living situation, 43% reached the same ambulatory level, and 17% achieved the same level of activities of daily living at 4 months after admission for hip fracture as before fracture. Also, quality of life at 4 months was lower compared with reference values [15].

Leibson et al. investigated 312 patients with fracture of the proximal femur and 312 pair-matched controls in a

population-based historical cohort study. One year after admission, estimated mortality was 20% for cases vs 11% for controls, only 49% had returned to their level of disability before fracture and 51% of cases vs 16% of controls had a level of disability one or more units worse than before baseline. The cumulative incidence of first nursing home admission was 64% for cases compared to 7% for controls [16].

In another study on the functional outcome after hip fracture of 275 patients, Rosell and Parker found a 20–25% decline in mobility and related functions and a reduction of 5% in tasks not related to hip function, only 66.9% survived to 1 year after fracture. The most marked decrease in function was seen in advanced ADL like shopping (39.7% decrease) and self-caring (e.g., decrease of 37.8% in independently taking a bath) [17].

Boonen et al. found in a prospective case control study of 159 women with hip fracture, that despite a significant recovery, patients still suffer from substantial functional impairment and loss of quality of life at 1 year after fracture (24% functional decline attributable to the fracture); poor functional status upon hospital discharge was the strongest predictor of poor function at the 1-year follow-up [18]. Most publications concentrate on hip fractures and there is little evidence concerning the effect of other fragility fractures on the functional abilities of the patients. Einsiedel et al. investigated the outcome of geriatric distal radius fractures (DRF) and proximal humerus fractures (PHF; each with 52 cases) after a 4-month period. They found no significant changes in the ability of daily living management according to the IADL-score by Lawton and Brody, even though 6% of DRF and 17% of PHF patients had to give up their own housekeeping. Interestingly, both groups showed a high incidence in fear of falling and a significant decline in the ability to walk after the incident [19].

Altogether, geriatric fractures and, in particular, hip fractures constitute a major source of disability and diminished quality of life in the elderly. Age, gender, comorbid conditions, prefracture functional abilities, and fracture type have an impact on the outcome regarding ambulation, activities of daily living, and quality of life. Of course, the quality of the surgical management, the fracture type, and dislocation also play an important role on the outcome of these patients [20].

### How can the outcome be improved?

State-of-the-art surgical treatment of geriatric fractures according to evidence-based international guidelines is fundamental, but in these frail and often comorbid elderly patients, whose sensitive equilibrium is easily disturbed, the management of the perioperative phase becomes more

important. With the implicit understanding that correct antibiotic prophylaxis, prevention of thromboembolism, and adequate and age-adjusted pain medication are basic, also other items have to come to the center of attention.

A detailed preoperative geriatric-internistic evaluation of comorbidities and such the early detection of potential complications are important, but it should not delay surgery. Patients, who do not need preoperative medical optimization, should be operated on within 24–48 h.

Concerning the type of anesthesia used, there is currently no clear consensus, whether regional anesthetic techniques have an advantage over general anesthesia. Whereas regional anesthesia may be associated with a slightly lower short-time mortality and lower incidence of deep venous thrombosis, long-time outcomes seem to be the same.

Postoperatively, physical therapy several times a day adapted to the limited capability of frail people with breathing therapy to prevent pulmonary complications, early mobilization, and weight bearing as tolerated is essential. Furthermore, attentive nursing care, frequent turning, and the routine use of special mattresses can reduce the incidence of pressure ulcers, which are a frequent complication after hip fracture surgery.

Delirium prevention and management, correction of polypharmacy, treatment of malnutrition, detection of fall tendencies, and osteoporosis care in terms of secondary prevention are further important items in the postoperative phase, which best could be covered by an experienced geriatrician in a multidisciplinary setting. Moreover, a comprehensive geriatric assessment would help to identify the patients at risk for complications and those who profit from special rehabilitation care.

Early discharge and rehabilitation planning should optimally start right at the time of admission. The patients, their relatives, as well as engaged social workers should be integrated in the decision making with the main focus of attention being put on the patient's personal and medical needs and functional possibilities. Overall goal should be to recover the status the patient had before fracture.

Some of these principles have already been proposed years ago (British Orthopaedic Association "Blue book") [21] and also in recent literature comprehensive reviews can be found [20, 22–24], but the summary above is far away from being complete.

But how can we implement all those single important items in the busy daily routine of a trauma department? How can acceptance of the required prioritization of a group of patients, previously nobody was especially interested in, be achieved?

A possible solution might be to integrate the above-mentioned principles in orthogeriatric comanagement settings with constant multidisciplinary care based on coownership of the geriatric fracture patients between

orthopedic surgeons and geriatricians from admission until completion of rehabilitation. Protocol-driven approaches might help to achieve the required prioritization of those patients. The first models of orthogeriatric comanagement of elderly hip fracture patients have already been developed in the 1950s in Great Britain [25].

In 1983, Boyd et al. presented the success of an orthogeriatric unit in Nottingham, Great Britain in reducing the average length of stay (to 48 days in those times) at a low in-hospital mortality rate of 5% [26].

In 1992, Zuckerman et al. reported the positive results of a comprehensive interdisciplinary care program on 431 geriatric hip fracture patients. The program patients had fewer postoperative complications and less intensive care unit transfers, significantly improved walking ability at discharge and less discharges to nursing homes compared to a matched group with normal care [27].

Koval and colleagues in 2004 were able to verify the positive results of the same program, which is primarily based on the implementation of clinical pathways for hip fracture patients. Presenting the data of 747 patients compared to 318 standard care controls, the authors showed significant decreases in the acute hospital length of stay, in-hospital mortality, and 1-year mortality, but could not find statistically significant differences in the rate of surgical revision, discharge status, or recovery of ambulatory ability [28].

In the “Sheba” model of comprehensive orthogeriatric care in Israel elderly hip fracture patients are treated in a specialized comanaged unit, which is based upon the concept, that a hip fracture represents a geriatric, rather than an orthopedic disease. This center has also proven to successfully having increased the patient’s functional outcome at low rates of morbidity and mortality and relatively short length of hospital stay [29, 30].

In Spain, Vidán and his team conducted one of the few randomized controlled trials with 157 hip fracture patients receiving daily comprehensive geriatric intervention during the acute phase compared to 164 patients receiving standard orthopedic care in the same unit. Their program significantly reduced in-hospital mortality and major medical complications, but showed only modest benefits concerning the length of hospital stay and long-term functional outcomes [31].

Recently, Friedman et al. published data of the Geriatric Fracture Center at Highland Hospital in Rochester, New York based on orthogeriatric comanagement, total quality management, protocol-driven care, and early discharge planning. In a first descriptive publication the authors reported lower than predicted length of stay (mean 4.6 days) and lower readmission rates with short time to surgery and low complication and in-house mortality rates compared to the expected outcomes determined from a large healthcare database [32]. Compared to a center with conventional orthopedic care of hip fracture patients, the patients treated in the Geriatric Fracture Center

had shorter times to surgery, shorter length of stay, fewer cardiac complications, and fewer cases of thromboembolism, delirium, and infection at equal rates of in-hospital mortality and readmission [33].

However, in a Cochrane review of the few available randomized controlled studies on multidisciplinary rehabilitation for older people with hip fractures up to April 2009 conducted by Handoll et al., the authors could not find a conclusive evidence of the effectiveness of multidisciplinary inpatient rehabilitation after geriatric hip fracture also because of the broad heterogeneity and some methodical shortcomings of the analyzed trials. But they at least found a trend towards an effectiveness of those interventions in all main outcomes and concluded that better structured and larger randomized controlled studies were needed in the future first concentrating on the overall effectiveness of multidisciplinary rehabilitation care [34].

## Discussion

This overview cannot cover the whole immense amount of existing literature on the outcome after geriatric fractures. Furthermore, it is often difficult to compare the individual results due to different outcome variables, inclusion criteria (type of fracture, age, gender, exclusion of pathological fractures, and cognitively impaired patients and others), follow-up intervals, methodical features, and differences in the social systems concerning the structures of medical care and social nursing facilities. Most of the existing studies concentrate on hip fractures and there are only a few publications, which also investigated other typical geriatric fractures concerning their morbidity and mortality.

But all in all it is obvious, that geriatric fractures have excess mortality rates and a severe impact on the patient’s quality of life. Also in consideration of the expected epidemiologic development and the socioeconomic consequences, improvements on this field are urgently needed.

There are some very promising concepts of orthogeriatric comanagement of elderly fracture patients, most of which have shown to improve the patient’s outcome in different areas of interest. Due to the heterogeneity of the existing concepts it seems difficult to assess which elements really make the difference. It might be that the sole increased awareness of the proverbial fragility of these patients is essential; the further structure of an orthogeriatric intervention must be tailored to the individual local needs.

## Conclusion

Fragility fractures are a main contributor to mortality, morbidity, and diminished quality of life in elderly people.

Comprehensive orthogeriatric comanagement might improve the outcome of these patients. For the future well-designed, large prospective randomized controlled trials with clear outcome variables are needed to finally prove the effectiveness of existing concepts.

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