International Orthopaedics (2019) 43:187–192
https://doi.org/10.1007/s00264-018-4132-3

ORIGINAL PAPER

# Functional outcomes and mortality in geriatric and fragility hip fractures—results of an integrated, multidisciplinary model experienced by the "Florence hip fracture unit"

Roberto Civinini[1] · Tommaso Paoli[1] · Luisella Cianferotti[1] · Alessandro Cartei[2] · Alberto Boccaccini[2] · Adriano Peris[2] · Maria Luisa Brandi[1] · Carlo Rostagno[3] · Massimo Innocenti[1]

Received: 29 June 2018 / Accepted: 22 August 2018 / Published online: 29 August 2018


## Abstract

**Purpose** The aim of this study was to evaluate the outcomes of an integrated multidisciplinary hip fracture unit through the following parameters: time to surgery, mortality, return to activities of daily living, adherence to re-fractures prevention programs.

**Methods** Six hundred seventy-seven consecutive patients with hip fracture were included in the study. We calculated the time to surgery as the time in hours from admission until surgery. The in-hospital mortality was calculated as the number of deaths that occurred before discharge. Each patient was then evaluated post-operatively at six weeks, three months, and one year. We studied basic activity of daily living (BADL) and the New Mobility Scale (NMS). Adherence to re-fractures prevention programs was also evaluated.

**Results** 88.9% of patients underwent surgery within two calendar days from admission. In-hospital mortality was 2.4%, and the overall mortality at one year from the intervention was 18.7%. Full mobility status or a low impairment of the mobility status was reached in 32.1% of the patients at one year and a level ≥ 3 of autonomy in BADL was reached in 62.4% (338/542) of patients. Three hundred forty-two patients were prescribed a specific therapy for secondary prevention of re-fracture.

**Conclusions** An integrated, multidisciplinary model for the treatment of hip fragility fractures was effective in reducing time to surgery and mortality, increasing the level autonomy and mobility status and promoting adherence to re-fracture therapy.

**Keywords** Basic activity of daily living (BADL) · Hip fractures (HF) · Mortality

## Introduction

Hip fractures (HF) in the elderly are currently one of the main healthcare system problems in developed countries, due to the socio-economic and welfare impact that they entail [1–4]. The one year mortality of these fractures rates from 20 to 30% [5, 6], with high rate of institutionalization (20–25%) and a decrease of 60% in the level of autonomy in activities of daily living [7–9].

Those epidemiological data support the need for a different approach to improve outcomes. In recent years, several models for the management of patients with HF have been adopted in many institutions, with the aim of reducing hospital complications, optimizing the management and treatment of the patient [10, 11]. All the proposed models focus on a multidisciplinary and multiprofessional collaboration that allows to implement the quality of care and, at the same time, reduce costs [12, 13].

The hospital is a tertiary teaching hospital treating about 700 new cases of hip fracture a year; since 2014, it is in function a multidisciplinary hip fracture as part of a project of the Italian Health Ministry [RF-2010-2316600]. The service was created to allow rapid medical stabilization and early fracture fixation and to facilitate discharge.

The aim of this study was to evaluate the outcomes of the co-management model used in our institution through the following parameters: time to surgery, mortality, return to activities of daily living, adherence to re-fractures prevention programs.

✉ Roberto Civinini
roberto.civinini@unifi.it

[1] Department of Surgery and Translational Medicine, University of Florence, C.T.O. Largo Palagi 1, 50139 Florence, Italy

[2] Azienda Ospedaliero-Universitaria Careggi, Florence, Italy

[3] Department of Experimental and Clinical Medicine, University of Florence, Florence, Italy

## Patients and method

We present a prospective cohort study of 677 consecutive patients with hip fracture aged more than 65 years old referred between October 2015 and December 2016 to our unit.

The average age of the study population was 84.5 (± 8.3) and 467 (69%) were female, while 210 (31%) were males (female-male ratio of 2.2:1). According to the AO classification [13], 327 (48.3%) patients had a 31B (femoral neck fractures), 319 (47.1%) a 31A1/31A2 (trochanteric fractures), and 31 (4.6%) had a 31A3 (intertrochanteric, subtrochanteric, and reverse obliquity fractures).

Two major comorbidities were present in 38.2% (258/677) of patients, among which the most frequent were coronary heart disease (15.7%—106/677) and heart failure (14.8%—100/677). We calculated the Charlson Comorbidity Index (CCI) and the Greenfield Index (GI) for each patient: the CCI was 4 in 35.5% (240/677) and 6 or greater in 28% (190/677) of patients, and the GI was 0 in 32.9% (223/677) and 3 in 13.6% (92/677) of patients. Clinical and demographic data are reported in Table 1.

**Table 1** Clinical characteristics of the study population

| Characteristic | Population ($n = 677$) |
|---|---|
| M/F | 210/467 |
| Age (years) | 84.5 ± 8.3 |
| Type of fracture: | |
| 31B | 327 (48.3%) |
| 31A1/31A2 | 319 (47.1%) |
| 31A3 | 31 (4.6%) |
| Delay of intervention < 48 h | 617 (91.1%) |
| ADL | |
| ≤ 4 | 129 (19%) |
| > 4 | 221 (32.6%) |
| Dementia | 215 (31.8%) |
| Parkinson | 36 (5.3%) |
| > 2 major comorbidities | 258 (38.2%) |
| Cerebrovascular disease | 27 (4%) |
| Coronary heart disease | 106 (15.7%) |
| Aortic stenosis | 27 (4%) |
| Heart failure | 100 (14.8%) |
| Atrial fibrillation | 58 (8.6%) |
| Cancer disease | 52 (7.8%) |
| Diabetes | 54 (9%) |
| Chronic kidney disease | 20 (3%) |
| Chronic obstructive pulmonary disease | 67 (9.9%) |
| Charlson Comorbidity Index (CCI): | |
| 1–3 | 18 (2.7%) |
| 4 | 240 (35.5%) |
| 5 | 229 (33.8%) |
| ≥ 6 | 190 (28.0%) |
| Greenfield Index (GI) | |
| 0 | 223 (32.9%) |
| 1 | 166 (24.5%) |
| 2 | 196 (29%) |
| 3 | 92 (13.6%) |

### Description of the hip fracture unit

Our hip fracture unit is structured as a geriatric co-managed care unit which represents the most complex model of care among those described for the management of the elderly patient with HF. The unit includes orthopaedics, anaesthesiologists, geriatricians, nurses and physiotherapists, health care and social agency staff, and endocrinologists.

The internist/geriatrician clinical staff is integrated into the orthopaedic ward where the patient is managed together from his arrival until discharge. In the emergency room, all patients underwent pre-operative orthopaedic and radiological investigation, venous line positioning, ECG, and laboratory examination including troponin I assay and chest X-ray. Deep venous thrombosis prophylaxis with low molecular heparin was started as soon as possible. In patients treated with oral anticoagulants, withdrawal and oral vitamin K administration were considered in selected cases to allow recovery of normal clotting parameters. Withdrawal of thienopyridine platelet antagonists was considered individually. After transferral to the hip fracture unit, careful clinical evaluation by the internal medicine specialists (history, physical examination, ECG and chest x-ray evaluation, bedside echocardiography when needed) allowed orthopaedics and anaesthesiologists to schedule surgery and choice anaesthesiology strategy within 48 hours from trauma. Postoperative observation for 24–48 hours in intensity care unit was planned for high-risk patients. Patients are then allocated to a physiotherapist who works closely with doctors and nurses for faster rehabilitation, preparing patients for safe and rapid discharge.

In our unit, there is, finally, a fracture liaison service (FLS), which means a service that treats all patients over the age of 65 in order to reduce the risk of further re-fracture. Tuscany Region, through the T.A.R.Ge.T. project (Appropriate Treatment of Geriatric re-fracture in Tuscany) was the first region in Italy to enable a project to reduce hip re-fractures in elderly patients. The first step of the program begins at the admission in the ward when all the patients are tested for serum 25(OH)D vitamin D levels. In case of hypovitaminosis D, optimization of both vitamin D status and calcium intake are prescribed [14, 15].

At discharge, all the fractured patients over 65 are screened for inclusion in the T.A.R.Ge.T. project and those enrolled are referred to the Unit of Bone and Mineral Diseases (BMD) of the University Hospital of Florence. In this service, patients

are given a first-level laboratory test for an evaluation of differential diagnosis of osteoporosis, a booklet about the risks and benefits of re-fracture prevention, and a supplementation of calcium plus vitamin D. Patients are then scheduled for bone mineral density assessment.

When all the diagnostic procedures are completed and secondary causes of osteoporosis have been excluded, a proper pharmacologic treatment is initiated. As first choice, oral or i.v. bisphosphonates, such as alendronate, risedronate, or zoledronic acid, respectively, are taken into account. If contraindications, intolerance, or side effects to bisphosphonate therapy are present, second choice antiresorptive drugs, such as the subcutaneous denosumab, are considered. In more complex cases, therapy with the anabolic agent teriparatide (PTH1-34) could be initiated and maintained for up to two years, then followed by an antiresorptive.

### Evaluation of patients

We obtained information about the autonomy in basic activity of daily living (BADL) and the pre-fracture mobility status according to the New Mobility Score (NMS) [16] giving a total score ranging between 0 (no walking ability at all) and 9 (fully independent).

We calculated the time to surgery as the time in hours from admission until arrival in operating room and the number of patients who underwent surgery within two calendar days after ward admission.

The in-hospital mortality was calculated as the number of deaths that occurred before discharge. Each patient was then evaluated post-operatively at six weeks, three months, and one year.

To evaluate adherence to the program of secondary prevention of re-fracture, the following indicators were considered: how many patients had BMD testing, the percentage of patients who start treatment at three months, the percentage of patients who retained the treatment after 12 months.

### Statistical analysis

Collected data were registered as mean and standard deviation. Categorical variables were compared through the chi-square test or the Fisher exact test. Continuous variables were compared using the Student *t* test. The statistical meaning of the results obtained was assessed considering a significant value of $p < 0.05$.

## Results

Multidisciplinary clinical evaluation was performed within 24 hours from admission in 90% of patients (609/677), associated with echocardiographic examination in 41.9% of cases (284/677).

### Time to surgery

Within two calendar days from admission, 88.9% (602/677) of patients underwent surgery. The average time from admission to intervention was 30 hours (± 20.4). Before the intervention, four patients (0.6%) died into the ward and 12 patients (1.8%) were treated conservatively due to the presence of important comorbidities combined with low functional needs such as to contraindicate the intervention. Surgery was delayed to optimize patient's medical condition in 48.6% of cases. The main clinical cause of delayed surgery was the use of anticoagulant therapy at the time of fracture (9.3%—62/667).

The delay was caused by organizational reasons in the 51.4%; regarding this, we highlighted as the average time to surgery increased as the week progresses, peaking on Friday at 2.70 days ($p < 0.05$), this is because we do not have hip surgery on Sunday.

### Mortality

#### In-hospital mortality

In-hospital mortality was 2.4% (16/677) with an average age of 85.4 years ± 7.4 that resulted not significantly different from that of the patients discharged alive (84.4 years ± 8.4).

The number of BADLs in patients who died during hospital stay was significantly lower compared to the control group ($p < 0.05$). The value of the pre-operative mobility status was also significantly correlated with the in-hospital mortality ($p < 0.05$).

Patients who died during the recovery were more frequently affected by heart failure (11/16, 68%), had more than two major comorbidities (13/16, 81.2% of cases), and had a GI ≥ 3 in 10/16 (62.5%) as well as a CCI ≥ 6 in 14/16 (87.5%).

The multivariate analysis showed that only the presence of more than two major comorbidities was found to be an independent variable related to in-hospital mortality.

#### One-year mortality

Excluding ten patients lost during follow-up, the overall mortality at one year from fracture was 18.7% (125/667). The mean age in the deceased patients group was significantly higher (88 years ± 6.7) than the survival (83 years ± 8.4) ($p < 0.05$).

No statistically significant correlation was observed between the type of fracture and survival at one year ($p > 0.05$).

The degree of autonomy prior to the intervention, expressed as the number of BADL, was significantly lower in patients who died compared to the survivors ($p < 0.05$). Similarly, the value of the pre-operative mobility status was significantly correlated with the one year mortality ($p < 0.05$).

The relationship between the different comorbidities and the prognosis of the patient operated can be assessed by

considering each factor individually or using score such as the CCI and the GI. Among the cardiological comorbidities, no statistically significant difference was found in the two groups with regard to atrial fibrillation that was present in 8.6% (11/125) of patients who died and in 26.3% (143/542) of live patients. A history of ischaemic heart disease was present in 20.1% (25/125) of the deceased patients and in 14.4% (78/542) of those living after one year from surgery. Severe aortic stenosis was associated with a mortality of 56.8% at one year, corresponding to 71/125 vs 113/542 ($p < 0.05$). Similarly, the presence of heart failure was associated with an increased risk of one year mortality (48.8%—61/125 vs 110/542) ($p < 0.05$). If we consider the simultaneous presence of more than two major comorbidities in the same patient, we observed this condition in 83.3% (104/125) of deceased patients, while in non-deceased patients, this percentage drops drastically to 26.3% (143/542). The results of the multivariate statistical analysis indicate that the presence of more than two major comorbidities in the same patient is the main independent risk factor of one year mortality in the elderly patient with HF.

Considering the more complex comorbidity indexes such as the CCI and the GI, we observed a correlation between the increase of the score and the one year mortality ($p < 0.05$).

Age is the only other independent risk factor for mortality. None of the other factors considered had an independent effect on one year mortality.

## Return to activities of daily living and quality of life

Full pre-fracture mobility status (NMS score 9/9) was present in 19.4% (131/677) of patients, while 5.2% (35/677) were enticed and unable to move before the trauma (NMS score 0/9). Complete autonomy in BADL (6/6) before fracture was present in 58.4% of the entire population, while 16.4% had a serious impairment of autonomy (only 2 or less BADL preserved).

Mobility status and level of autonomy in the BADL were analyzed after one year from the intervention. Full mobility status (score 9/9) was achieved in 12.5% (51/542) of patients; 19.6% (106/542) had a low impairment of the mobility status (score 7–8/9); 45.7% (248/542) a mildly compromised level of mobility (score 4–6/9); 13.5% (73/242) a significant impairment of the mobility status (score 1–3/9); and 9.4% were enticed or unable to walk (score 0/9).

After one year, a level ≥ 3 of autonomy in BADL was reached in 62.4% (338/542) of patients; while 37.6% (204/542) of patients showed an important impairment of autonomy (BADL < 3) (Table 2).

## Adherence to re-fractures prevention programs

Of the 661 patients with hip fracture who were discharged from the hospital, 434 (66%) were evaluated and considered eligible to be enrolled in the prevention of re-fracture program.

Within three months from discharge 278 (64%) patients received bone mineral density testing BMD and evaluation of fall and fracture. In 342 (78.8%) patients, they were prescribed specific drug treatment and calcium ± vitamin D supplementation. Bisphosphonates were the most commonly prescribed drugs for secondary fracture prevention at discharge.

Adherence at one year among those who had prescribed anti-fracture drugs was 62.3% (213 patients).

# Discussion

This study was designed to evaluate the outcomes of a group of elderly patients with hip fracture managed in an integrated multidisciplinary hip unit. This dedicated hip fracture unit is believed to be the first of its kind in Italy and one of a few worldwide; it was designed to implement various clinical practice pathways to allow pre-operative assessment, rapid

**Table 2** Activities of daily living and mobility status evaluation

| Before fracture | | 1 year of follow-up | |
|---|---|---|---|
| Autonomy in base activity of daily living (BADL) | $n = 677$ | Autonomy in base activity of daily living (BADL) | $n = 542$ |
| 1–2 | 111 (16.4%) | 1–2 | 204 (37.6%) |
| 3–4 | 123 (18.2%) | 3–4 | 98 (18.1%) |
| 5 | 48 (7%) | 5 | 58 (10.7%) |
| 6 | 395 (58.4%) | 6 | 182 (33.6%) |
| Pre-fracture mobility status (New Mobility Scale) | $n = 677$ | Pre-fracture mobility status (New Mobility Scale) | $n = 542$ |
| 0 (no walking ability) | 35 (5.2%) | 0 (no walking ability) | 51 (9.4%) |
| 1–3 | 106 (15.7%) | 1–3 | 73 (13.5%) |
| 4–6 | 232 (34.3%) | 4–6 | 248 (45.7%) |
| 7–8 | 172 (25.4%) | 7–8 | 106 (19.6%) |
| 9 (fully independent) | 131 (19.4%) | 9 (fully independent) | 68 (12.5%) |

optimization for surgery, prompt mobilization and ambulation, and rapid discharge [17].

Several experiences with different characteristics of co-managed care and with a variety of results have been published [10, 11, 18] with the common denominator being a significant reduction in mortality and improved functional outcomes.

A meta-analysis to determine whether the ortho-geriatric collaboration was associated with improved outcomes; the overall results found that co-managed collaboration was associated with a significant 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) compared to the traditional models of care [19]. Recently, another meta-analysis has also shown for the first time how the co-managed model seems to give the best results in terms of mortality [20].

We found that our integrated, multidisciplinary model of care was also associated with a very low rate of in-hospital mortality and one year mortality (in-hospital mortality 2.4% and 1-year mortality 18.8%).

Advanced age and high ASA scores are two of the major risk factors associated with worst functional outcome, increased readmission, and post-operative mortality [21–23]. Forni et al. [24] reported an increase of 30-day mortality risk of 8.4% for each year above 65 years. Accordingly, we found that age and the presence of more than two major comorbidities were independent risk factors for mortality.

These results are similar to the best results reported in other studies concerning the same co-management model; however, our study group of patients was older (84.5 mean age) compared to other series [10, 25–28].

Although, the pre-operative period does not appear to be an independent risk factor for intra-hospital and one-year mortality; it has been reported that a preoperative period greater than 72 hours is associated with increased complications and worse functional outcomes [22]. Overall, 88.9% of our patients underwent surgery within the recommended two calendar days, with being admitted on Friday as the single most important factor associated with prolonged time to surgery.

Full mobility status or a low impairment of the mobility status was reached in 32.1% of the patients at one year and a level ≥ 3 of autonomy in BADL was reached in 62.4% (338/542) of patients.

We believe that our integrated team (internal medicine, geriatric and orthopaedic specialists, and anaesthesiologists) may contribute to shorten time from hospital admission to surgery. The main difference from previous models of care is the availability of a rapid (within the first 12 hours from admission) accurate internist/geriatrician clinical evaluation, including bedside echocardiography and pre-operative systematic troponin assay.

This approach allowed detection of severe clinical comorbidities, assessment of cardiovascular conditions, volemic status, and therefore, an accurate risk stratification. Most of the decompensated clinical conditions at admission were stabilized by the medical team in order to schedule surgical intervention within the first two days from trauma. Furthermore, continuous post-operative clinical monitoring by the internal medicine specialists and geriatricians had permitted early detection and treatment of in-hospital complications, thus allowing a decrease in early mortality.

Finally, we could demonstrate that the activation of a multidisciplinary integrated model of care for secondary prevention of fragility fractures is an effective strategy to increase the probability for patients to receive BMD testing and, above all, to increase the proportion of patients receiving a specific anti-fracture drug prescription after hip fracture. One-year adherence to treatment tends to decline, but that could be considered physiological in such an older population.

## Compliance with ethical standards

**Conflict of interest** The authors declare that there is no conflict of interest.

## References


1. Treml J, Kroker PB (2000) Hip fracture audit: time for standards to be evidence-based. Int Orthop 24:181–183
2. Innocenti M, Civinini R, Carulli C, Matassi F (2009) Proximal femural fractures: epidemiology. Clin Cases Miner Bone Metab 6:117–119
3. Gullberg B, Johnell O, Kanis J a (1997) World-wide projections for hip fracture. Osteoporos Int 7:407–413. https://doi.org/10.1007/PL00004148
4. Cooper C, Cole ZA, Holroyd CR et al (2011) Secular trends in the incidence of hip and other osteoporotic fractures. Osteoporos Int 22:1277–1288. https://doi.org/10.1007/s00198-011-1601-6
5. Keene GS, Parker MJ, Pryor GA (1993) Mortality and morbidity after hip fractures. BMJ 307:1248–1250
6. Leibson CL, Tosteson ANA, Gabriel SE et al (2002) Mortality, disability, and nursing home use for persons with and without hip fracture: a population-based study. J Am Geriatr Soc 50:1644–1650
7. Cooper C (1997) The crippling consequences of fractures and their impact on quality of life. Am J Med 103:12S–17S discussion 17S–19S
8. Magaziner J, Hawkes W, Hebel JR et al (2000) Recovery from hip fracture in eight areas of function. J Gerontol A Biol Sci Med Sci 55:M498–M507
9. Suhm N, Kaelin R, Studer P et al (2014) Orthogeriatric care pathway: a prospective survey of impact on length of stay, mortality and institutionalisation. Arch Orthop Trauma Surg 134:1261–1269. https://doi.org/10.1007/s00402-014-2057-x
10. Kammerlander C, Roth T, Friedman SM et al (2010) Ortho-geriatric service–a literature review comparing different models. Osteoporos Int 21:S637–S646. https://doi.org/10.1007/s00198-010-1396-x
11. Giusti A, Barone A (2011) Optimal setting and care organization in the management of older adults with hip fracture. Eur J Phys Rehabil Med 47:281–290
12. British Orthopaedic Association (2007) The care of patients with fragility fractures. (Guideline ref ID: BOA2007). https://doi.org/10.1136/bmj.2.5211.1518

13. Academy A, Board OS, September D (2014) Clinical practice guideline on the treatment of hip fracture in the elderly adopted by the American Academy of Orthopaedic Surgeons Board of Directors. Aaos
14. Cianferotti L, Parri S, Gronchi G et al (2017) The use of cholecalciferol in patients with hip fracture. Clin Cases Miner Bone Metab 14:48–53. https://doi.org/10.11138/ccmbm/2017.14.1.048
15. Maier GS, Horas K, Seeger JB et al (2015) Vitamin D insufficiency in the elderly orthopaedic patient: an epidemic phenomenon. Int Orthop 39:787–792. https://doi.org/10.1007/s00264-014-2519-3
16. Parker MJ, Palmer CR (1993) A new mobility score for predicting mortality after hip fracture. J Bone Joint Surg (Br) 75:797–798
17. Rostagno C, Cartei A, Civinini R, Prisco D (2018) Hip fracture unit: beyond orthogeriatrics. Intern Emerg Med 13:637–639. https://doi.org/10.1007/s11739-018-1818-x
18. Hughson J, Newman J, Pendleton RC (2011) Hip fracture management for the hospital-based clinician: a review of the evidence and best practices. Hosp Pract 39:52–61. https://doi.org/10.3810/hp.2011.02.374
19. Grigoryan KV, Javedan H, Rudolph JL (2014) Orthogeriatric care models and outcomes in hip fracture patients: a systematic review and meta-analysis. J Orthop Trauma 28:e49–e55. https://doi.org/10.1097/BOT.0b013e3182a5a045
20. Moyet J, Deschasse G, Marquant B et al (2018) Which is the optimal orthogeriatric care model to prevent mortality of elderly subjects post hip fractures? A systematic review and meta-analysis based on current clinical practice. Int Orthop:1–6. https://doi.org/10.1007/s00264-018-3928-5
21. Carow J, Carow JB, Coburn M et al (2017) Mortality and cardiorespiratory complications in trochanteric femoral fractures: a ten year retrospective analysis. Int Orthop 41:2371–2380. https://doi.org/10.1007/s00264-017-3639-3
22. Stone AV, Jinnah A, Wells BJ et al (2018) Nutritional markers may identify patients with greater risk of re-admission after geriatric hip fractures. Int Orthop 42:231–238. https://doi.org/10.1007/s00264-017-3663-3
23. Bliemel C, Buecking B, Oberkircher L et al (2017) The impact of pre-existing conditions on functional outcome and mortality in geriatric hip fracture patients. Int Orthop 41:1995–2000. https://doi.org/10.1007/s00264-017-3591-2
24. Forni C, Gazineo D, D'Alessandro F et al (2018) Predictive factors for thirty day mortality in geriatric patients with hip fractures: a prospective study. Int Orthop. https://doi.org/10.1007/s00264-018-4057-x
25. Shyu Y-IL, Liang J, Wu C-C et al (2005) A pilot investigation of the short-term effects of an interdisciplinary intervention program on elderly patients with hip fracture in Taiwan. J Am Geriatr Soc 53:811–818. https://doi.org/10.1111/j.1532-5415.2005.53253.x
26. Shyu Y-IL, Liang J, Wu C-C et al (2008) Interdisciplinary intervention for hip fracture in older Taiwanese: benefits last for 1 year. J Gerontol A Biol Sci Med Sci 63:92–97
27. Vidán M, Serra JA, Moreno C et al (2005) Efficacy of a comprehensive geriatric intervention in older patients hospitalized for hip fracture: a randomized, controlled trial. J Am Geriatr Soc 53:1476–1482. https://doi.org/10.1111/j.1532-5415.2005.53466.x
28. Friedman SM, Mendelson DA, Bingham KW, Kates SL (2009) Impact of a comanaged geriatric fracture center on short-term hip fracture outcomes. Arch Intern Med 169:1712–1717. https://doi.org/10.1001/archinternmed.2009.321