

Early Hip Fracture Surgery and Rehabilitation. How to Improve Functional Quality Outcomes. A Retrospective Study

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Abstract

Introduction: Hip fractures are one of the major disability causes associated with a high morbidity and mortality rate. Early surgery and stable fixation could be associated with better pain control, possibly lower mortality rates, and early recovery of autonomy.

Aim: The aim of this study was to analyze a population affected by hip fractures exploring the effects of an early surgery and rehabilitation approach in relation to functional outcomes.

Materials and methods: This study included 140 adult patients (mean age 79.35±11.71, range 66-94 years) with hip fractures admitted to the orthopedic unit of the University Hospital of Messina who underwent surgery and a rehabilitation program while hospitalized. Exclusion criteria were patients not surgically treated or discharged with no rehabilitation sessions. Clinical outcomes were evaluated post-surgery and before discharge as follows: pain quantification using the visual analogue scale and functional evaluation using the Barthel Index. A rehabilitation protocol was started within 48 hours after surgery.

Results: The study sample resulted in 140 patients. Eighty-seven of them (63.14%) underwent hip replacement surgery, and 53 patients (37.86%) underwent internal fixation surgery. The greater part of the sample (68.42%) had surgery within 48 hours. Patients with more comorbidities had worse clinical outcomes, as shown by the Barthel Index, timing of verticalization and walking, and pain control. Between admission and discharge, the Barthel Index score improved, as did the pain complained of by most patients.

Conclusions: A direct connection between orthopedics and the rehabilitation team, even after discharge, should be established and promptly organized to gain the best clinical outcomes. Indeed, we propose the triad early verticalization, pain control, and Barthel Index as a possible tool to define functional quality outcomes in post hip fracture surgery.

Keywords

early rehabilitation, functional outcomes, hip fracture, orthopedic surgery

INTRODUCTION

Hip fractures are one of the leading causes of disability, with high morbidity and mortality rates (14%-36%), despite the fact that fatalities are frequently caused by comorbidities rather than the hip fracture itself.^[1] It has been shown that early surgery and stable fixation could be associated with many advantages: a recovery improvement, better pain control, reduced hospitalization time and, therefore, a lower risk of pressure injury, possibly lower mortality rates, fewer overall postoperative complications, and early recovery of autonomy in the activities of daily living.^[2] Unfortunately, providing an early surgery is not always possible due to patient-dependent factors (clinical stabilization, comorbidities, additional medical evaluation) or patient-independent factors (availability of the operating room, management delays).^[3,4]

Currently, most hip fractures are treated surgically using internal fixation techniques through various implants (intramedullary nail or extramedullary sliding hip screw) retaining the femoral head or replacing it with a prosthesis, depending on patient's condition or surgeon's decision on fracture type.^[5] More than half of hip fractures occur in the intracapsular femoral neck and are frequently treated with total hip replacement, whereas trochanteric fractures are best treated with internal fixation.^[6] Although some authors demonstrated that replacement arthroplasty is more appropriate in femur neck fracture surgery^[7], others reported that internal fixation is a good solution to stable fracture fixation^[8].

There is currently no unambiguous surgery option because many parameters, including iatrogenic complications, technical features, surgeon skill, fracture morphology, and patient characteristics, play a role in defining functional outcomes.^[9,10] Among the various surgical options, hip replacement has been shown to result in a lower need for surgical revision, whereas internal fixation, while the only way to restore the physiological anatomy, may require surgical revision in one-third of cases, compromising self-autonomy.^[5,11] Although hip fracture surgery is generally successful, few people fully recover.^[2] However, hip surgery is usually preferred over conservative treatment, improving recovery and shortening hospital stay.^[12] The most important reported risk factor associated with hip fractures is age, since such fractures are more likely to be found in older individuals.^[13,14] The mortality rate after hip fracture surgery is about 9% within 30 days, 19% at 90 days and up to 30% at 12 months.^[15] Among surviving patients, approximately up to 30% over 65-year-old patients become permanently disable in self-care, 40% lose mobility functions and the ability to walk independently, and 80% are incapable to perform daily life activities (ADL) independently after the fracture.^[2,16,17] After surgery, some factors could lead to mobility, balance, and gait impairment such as pain, decreased joint range of movement (ROM), and muscle weakness.^[18] Thus, even though surgery can shorten the length of hospital stay (LOS) and improve hip

function in the elderly, long-term rehabilitation is required to restore functional independence.^[19] Moreover, several complications, i.e., refracture possibility, especially in the elderly, usually affect the choice of granting partial or full load on the injured hip during physical rehabilitation.^[20] To this aim, post-operative care programs have been employed, including, in the early stages, bed resting and restricted weight bearing^[21], followed by early mobilization, standing, weight bearing, and walking^[14]. After hospital discharge, the rehabilitation setting (e.g., outpatients or home-based; group-based or individualized), duration and frequency have also to be encountered.^[22]

Herein, we report a 12-month retrospective analysis of orthopedic inpatients that had hip fracture surgery and rehabilitation during their hospital stay, underlying the difficulty of keeping in the follow-up most of the patients, especially the elderly ones, because of transfer difficulties, death, and the COVID pandemics.

AIM

The aim of this study was to analyze a population affected by hip fractures, exploring the effects of an early surgery and rehabilitation approach in relation to functional outcomes.

MATERIALS AND METHODS

A retrospective study was conducted on a group of 140 adult patients (mean age 79.3511.71, range 66-94 years) admitted to the orthopedic unit of Gaetano Martino University Hospital of Messina in 2021. Inclusion criteria were hip fracture patients who underwent surgery and a rehabilitation program during hospitalization and age >65 years. Exclusion criteria were patients not surgically treated or discharged with no rehabilitation sessions, pathological fractures, or other bone diseases.

Patients diagnosed with hip fractures by X-ray were admitted to the Orthopedic Department, and they mostly underwent surgery within 48 hours of admission. A complete psychiatric assessment, including clinical evaluation, pain quantification using the visual analogue scale (VAS), and functional evaluation applying the Barthel Index (BI), was performed on admission and at discharge. A rehabilitation protocol was started within 48 hours after surgery, twice a day for 45 minutes, lasting for the entire hospitalization. The rehabilitation treatment was performed only if the clinical conditions were stable (no fever, no anemia needing hemotransfusion, cooperative patients). After the physiatric evaluation, a team of physiotherapists was responsible for the rehabilitation treatment, including mobilization, physical exercises, walking, and instruction to a self-training program during hospitalization.

The detrimental effect of late surgical intervention was assessed with a linear mixed model in which the improve-

ment of the Barthel Index, at the discharge with respect to the admission, was linearly related to the time since the intervention, modeled as a dummy variable which defined the occurrence of the intervention within 48 hours from hospitalization, and the age of the patient, both modeled as fixed effects, as well as the patients, modeled as a random effect. *P*-values lower than the threshold, set to 0.05, identified a significant effect on the improvement of the Barthel Index.

RESULTS

Retrospective data collection disclosed a total of 185 patients who underwent hip fracture surgery treatment in 2021. Among them, 45 did not start the rehabilitation protocol during hospital stay because of different reasons, i.e., transfer to rehabilitation clinics, clinical instability, non-cooperative patients, and early home discharge. Therefore, the study sample resulted in 140 patients (mean age 79.35±11.71, range 66-94 years). The demographic features are shown in **Table 1**. In our cohort, 87 patients underwent hip replacement surgery (63.14%) and 53 patients underwent internal fixation surgery (37.86%). The greater part of the sample had surgery within 48 hours (68.42%). Various reasons led to a delayed (>48 h) surgical treatment: i) clinical instability, ii) low benefit/risk ratio, iii) other surgical emergencies. The mean time between surgery and rehabilitation treatment start was 2.6 days. The mean length of hospital stay was 8.6 days. Time between surgery and discharge was 6.54 days. Forty-three percent of patients were able to walk with aids support before discharge. The most represented preoperative comorbidities were high blood pressure (58%), diabetes mellitus (42%), and dyslipidemia (33%), respiratory diseases (15%), neurological disorders (20%), and dementia (16%). Twenty-four patients (18%) had surgery during COVID infection. Patients with more comorbidities had worse clinical

outcomes, as shown by BI, timing of verticalization and walking, and pain control. The BI score improved between admission and discharge, as did the pain experienced by the majority of patients. A linear mixed model identified a significant negative effect (*p*<0.001) of the patients' age on the BI improvement. Moreover, the linear mixed model demonstrated a detrimental effect of the late surgical intervention on the BI improvement (*p*=0.049) (**Fig. 1**), which also resulted in a lower fraction of patients who restarted walking during the hospitalization (20%), with respect to those who got the intervention within 48 hours (30%).

Timing and clinical outcomes are described in **Table 2**. Functional outcome and pain were better in younger pa-

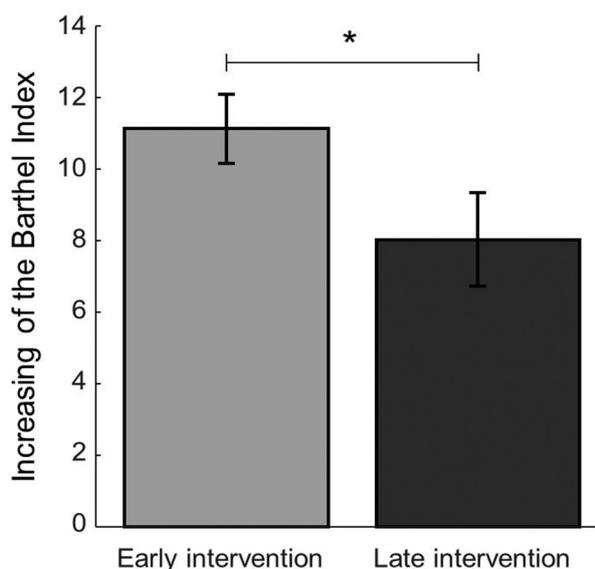


Figure 1. The increase of the Barthel Index (BI) at discharge with respect to the admission of patients who underwent the intervention within 48 hours (early intervention) or after 48 hours (late intervention). Bars indicate the mean value across patients ± the standard error. A statistical difference (*p*<0.05) was identified between the two populations.

Table 1. Demographic features of patients with hip fracture surgery

Number of patients	140
Age (years)	79.35±11.71
Women	82 (58.57%)
Type of surgery (%)	
Internal fixation	53 (37.86%)
Hip replacement	87 (63.14%)
Comorbidities	
High blood pressure (%)	58%
Diabetes mellitus (%)	42%
Dyslipidemia (%)	33%
Respiratory diseases (%)	15%
Neurological diseases (%)	20%
Dementia (%)	16%
Surgery during COVID infection	24 (18%)

Table 2. Clinical outcomes and ability to walk before discharge

Mean time between admission and surgery (days)	2.24
Surgery within 48 hours from admission	95 (68.42%)
Mean time from surgery to rehabilitation protocol start (days)	2.54
Mean length of stay (days)	6.54
After-surgery / Discharge Barthel Index (X/100)	26.21 / 36.72
After-surgery / Discharge VAS (X/10)	5.49 / 3.76
Died during hospitalization	5 (3.57%)
Patient able to walk before discharge from the Orthopedic Department	60 (43%)

tients, who gained an early verticalization and had less comorbidities prior to surgery.

DISCUSSION

In our cohort, we considered the best orthopedic outcomes deriving from an improvement of pain control, range of movements, balance, gait, leg strength, which reflects on BI score improvement. However, after hip-fracture surgery, only few patients regained their previous physical function^[10,23,24], whereas the majority became dependent, needing assistance from caregivers or institutions.^[25] Thus, hip fractures represent a burden for the health care services.^[1,26] In fact, although surgery is generally successful, few people fully recover from hip fracture surgery^[14] because severe pain, reduced joint ROM, and weak muscles strength result in reduced balance and walking speed, which affect mobility, together with previous comorbidities^[27]. However, the best rehabilitation approach and timing after hip fracture to restore physical function and to improve quality of life has not yet been fully established.^[28] To date, there is no clear and structured protocol to improve mobility after surgery for hip fracture.^[14] Numerous international guidelines recommend that mobilization should start on the day of the operation or the day after.^[29,30]

In our experience, we can assume that the best clinical outcome may be influenced by an early multidisciplinary orthopedic and rehabilitative approach, i.e., early surgery and mobilization, to help accelerating recovery, when possible.^[31-33] Conversely, delaying verticalization and walking restart after surgery is a negative prognostic factor.^[34] Our results confirm that early recovery of ambulation depends, apart from surgery (time and type), on hospital protocols for rehabilitation, as previously reported.^[10,22,35] Early surgery and early rehabilitation represent the milestones to better restore and enhance hip fracture outcomes.^[14] In our cases, the rate of ambulant patients at discharge, even with aids support, was probably due to high mean age and/or low self-autonomy and comorbidities prior to admission. In addition, the short LOS in the orthopedic department before transfer to other rehabilitation settings (i.e., home-based, inpatient, or outpatient settings) and the COVID era have negatively influenced our cohort of post-surgery ambulant patient's rates. Even though the hospital stay and the acute/subacute phase, our data confirm that early surgery combined with early rehabilitation seems to be the proper clinical approach that needs to be standardized.

From a prognostic point of view, the possible risk of further falls and fractures after discharge, the age, and a potential functional decline in the elderly could play a negative role. Thus, even though early surgery increases the probability of walking again after hip fracture, it is not the only factor influencing the time between surgery and first walking day. Moreover, non-medical issues largely influenced the time from surgery to physiotherapy start and from surgery to first walking day, i.e., sex^[36], socio-economic

differences^[37], seasonal variation and fall risk^[38], as well as medical issues^[39], i.e., pneumonia, peptic ulcer, thrombosis, and osteoporosis^[8]. Unfortunately, COVID pandemic era negatively influenced the orthopedic surgery and rehabilitation, since most patients refused to be admitted in rehabilitation centers or to come back to the follow-up check-ups.^[40] Independent factors must be considered as well, i.e., the availability of operative rooms and related personnel and of the rehabilitative settings after discharge.

However, our results are hampered by several limitations: I) the retrospective design which did not allow the authors to have long-term follow data on revision surgeries and mortality rate; II) time of the study considered (the pandemic era), which limited admissions and follow-up in rehabilitation centers, thus data on walking ability recovery after discharge are lacking; iii) patients dropout, especially the oldest ones, because of fear of getting COVID.

CONCLUSIONS

We think that a direct connection between orthopedics and the rehabilitation team, even after discharge, should be established and promptly organized to gain the best clinical outcomes after hip fractures. Moreover, being able to quantify the clinical and functional improvement after early surgery and rehabilitation, choosing fast and easy administrable tools, is mandatory.

Indeed, based on our findings, we propose the triad of early verticalization, pain control, and BI as a tool for defining functional quality outcomes in post-hip fracture surgery. More research is needed to validate this easily administered triadic tool before it can be used on a large scale.

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Competing interests

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Authors contribution

A.A.: research design; G.L. and I.S.: study design, data acquisition; S.P. and R.S.C.: data acquisition, manuscript preparation; D.M. and D.B.: statistical analysis of data; D.L., A.T., and D.E.: revision of the manuscript. All authors have read and approved the final manuscript.

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Ранняя хирургия перелома бедра и реабилитация. Как улучшить результаты функционального качества. Ретроспективное исследование

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Резюме

Введение: Переломы бедра являются одной из основных причин инвалидности, связанной с высоким уровнем заболеваемости и смертности. Раннее хирургическое вмешательство и стабильная фиксация могут быть связаны с лучшим контролем боли, возможно, более низким уровнем смертности и ранним восстановлением автономии.

Цель: Целью данного исследования было проанализировать популяцию, пострадавшую от переломов бедра, и изучить влияние раннего хирургического вмешательства и подхода к реабилитации в отношении функциональных исходов.

Материалы и методы: В исследование были включены 140 взрослых пациентов (средний возраст 79.35±11.71, диапазон 66-94 лет) с переломами бедра, поступивших в ортопедическое отделение Университетской больницы Мессины, которые перенесли операцию и программу реабилитации во время госпитализации. Критериями исключения были пациенты, не прошедшие хирургическое лечение или выписанные без проведения реабилитационных курсов. Клинические результаты оценивались после операции и перед выпиской следующим образом: количественная оценка боли с использованием визуальной аналоговой шкалы и функциональная оценка с использованием индекса Barthel. Протокол реабилитации был начат через 48 часов после операции.

Результаты: В выборку исследования вошли 140 пациентов. Восемьдесят семь из них (63.14%) перенесли операцию по эндопротезированию тазобедренного сустава, а 53 пациента (37.86%) – операцию внутренней фиксации. Большая часть выборки (68.42%) перенесла операцию в течение 48 часов. Пациенты с большим количеством сопутствующих заболеваний имели худшие клинические результаты, о чём свидетельствуют индекс Barthel время вертикализации и ходьбы, а также контроль боли. Между поступлением и выпиской индекс Barthel улучшился, как и боль, на которую жаловались большинство пациентов.

Заключение: Для достижения наилучших клинических результатов необходимо установить и оперативно организовать прямую связь между ортопедами и реабилитологами даже после выписки. Действительно, мы предлагаем триаду ранней вертикализации, контроля боли и индекса Barthel в качестве возможного инструмента для определения результатов функционального качества в хирургии после перелома бедра.

Ключевые слова

ранняя реабилитация, функциональные исходы, перелом бедра, ортопедическая хирургия