

# Functional Aspects and Physiotherapy Education in Home Between Intra- and Extra-Capsular Femoral Fractures of Hospitalized Elderly

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**Abstract:** *Objective:* To verify the intra- and extra-capsular femoral fracture, the degree of dysfunction that the elderly patient presents in the postoperative period, and the care they receive at hospital discharge.

*Design/Setting:* This was a prospective cross-sectional study conducted elderly patients hospitalized for proximal femoral fractures who received clinical and surgical care in a public hospital.

*Participants:* Twenty-five elderly patients with femoral fractures: intra capsular (GFI; n=11) and extra-capsular (GFE; n=14).

*Main Outcome Measures:* Questionnaire to the postoperative clinical aspects was performed. The angle joint of the lower limbs was determined by goniometer and the foot functionality by Foot Function Index (FFI) questionnaire. The pain was evaluated using the visual analogue pain scale (VAS) and muscle strength by the force scale.

*Results:* A greater female predominance was observed for GFI group. Regarding home guidelines, both groups of fractures did not present reports by the health professionals involved. The range of motion remained reduced for hip adduction and ankle dorsiflexion in GFE group. The GFI group reduced flexion and extension knee and the functionality of the feet.

*Conclusions:* It can be concluded that proximal femoral fractures intra- and extra-capsular, differ according to gender, with a female predominance of intra-capsular fractures. As well, regarding the range of joint motion, the extra-capsular fractures resulted in reductions in hip adduction and ankle dorsiflexion compared to intra-capsular fractures, which presented reductions in knee flexion and extension. Regardless of the type of fracture, there was no home guidance after the surgical procedure.

**Keywords:** Femur fracture, Muscle strength, Motion analysis, Elderly.

## 1. INTRODUCTION

The elderly population has experienced rapid growth worldwide [1, 2]. Perspectives indicate that by the year 2025, there will be an increase from 14 to 18.8% in the incidence of older people over 60 years, generating an increase in the prevalence of chronic degenerative diseases [3, 4].

In addition to degenerative diseases of acute or chronic comorbidity in older people, occur also changes in posture with an increased lumbar curvature and reductions in joint extension [5, 6] associated with a reduced dynamic equilibrium [6], as well as decreased joint mobility and muscle strength [7]. Other important changes include high rates of osteopenia and

osteoporosis in the elderly [8]. All of these are risk factors may also be associated with increased falls in the elderly population [5-7].

The rate of falls among the elderly has reached alarming rates and usually occurs through trauma that occurs spontaneously and during travel or stumbling [9]. The main clinical consequence of falls is fractures of the femur, occurring in 90% of cases and representing the most common reason for the admission of elderly people in hospitals for orthopedic emergencies [9, 10].

Currently, femoral fractures represent an important social, economic, and public health problem, as the estimated number of femoral fractures may increase by 310% in men and 240% in women by the year 2050 [11]. Proximal femoral fractures are the most common, with two forms: intra-capsular (femoral neck with 45.3%) and extra-capsular (transtrochanteric and subtrochanteric with 54.7%) [12]. In most cases, surgery is indicated in these fractures, and conservative

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treatment is indicated only in cases of incomplete fractures without displacement or in cases when they do not have clinical conditions for surgery. The period 24-48 hours after fracture is considered ideal for the surgical procedure, considering the general health of the patient [13]. These fractures are the main cause of disability, functional impairment, and a high mortality rate [4, 8]. According to some authors, femoral fractures, in addition to the injury itself, also result in responsible to the family, as they promote some dependence due to the lessened autonomy to perform some functions after the trauma [14]. One of the explanations is that after a proximal femur fracture, the bone loses its ability to support the load, causing the elderly to remain for a long period immobilized, increasing their functional weakness and decreasing the mobility of the lower limbs and independent march [15, 16]. This is in addition to causing a series of emotional changes to the elderly [17].

The psychic consequences and functional impairments resulting from femoral fractures are of great concern to the health professionals involved in the process of the recovery of the elderly, as the costs involved in the clinical and rehabilitation treatment are high, both in the hospital and at home [18].

In the hospital environment, the costs are highly targeted toward surgical procedures and materials for the reduction and stabilization of fractures, restriction in bed after surgery, pharmacological care surgery, and physiotherapy care for functional disorders of bed rest [18]. According to the World Health Organization (2005) [2], hospitalizations for femoral fractures increase every year, with generated expenses corresponding to medical care, hospitalization and rehabilitation [19, 20].

Usually in the domicile it is related to the dependence on carrying out activities of daily living (ADLs), mainly walking. The inability to walk leads to emotional changes, leading to greater dependence among the elderly, requiring greater home care [20, 21]. It is important to emphasize that, currently, the highest mortality rate is observed in the first year post-fracture [20].

All these points signify the great public health problem of femur fractures caused by falls in the elderly, generating for this population-besides increased morbidity-social and economic costs on a large scale, due to decline in social activity, loss of autonomy and independence, change of

home/environment and family rearrangement [20, 21]. Thus, the objective of this study was to verify and compare the functional aspects and orientation in home care after intra- and extra-capsular proximal femoral fractures in the hospitalized elderly. The hypotheses of the study were: (1) Differences in the functional aspects of the lower limbs between the proximal femoral fractures intra and extra-capsular of hospitalized elderly; (2) Hospitalized elderly do not receive home care guidance after femur fracture surgery.

## **2. METHODOLOGY**

### **2.1. Study Design and Sample**

A prospective cross-sectional study was carried out with 25 elderly patients hospitalized for proximal femoral fractures who received clinical and surgical care in a public hospital, called Hospital Grajaú, in the region of Santo Amaro, São Paulo, Brazil.

The elderly were allocated into two groups: a group of 11 elderly patients with femoral fractures (intra-capsular) (GFI) and a group of 14 elderly patients with sub or infra-trochanteric (extra-capsular) fractures (GFE). The allocated was performed following the inclusion criteria. All of them signed the informed consent form, approved by the ethics committee of the local institution (number: 1.414.541).

The exclusion criteria were symptomatic musculoskeletal diseases in MMII, central and peripheral nervous system diseases, diabetes mellitus, rigid lower limb deformities, lower limb steroid infiltrations in the last three months, recent fractures in other bone segments (6 months), and have a maximum leg length discrepancy of 1cm.

#### ***Initial Assessment***

As soon as the elderly reached the hospital for rehabilitative treatment after proximal femoral fracture surgery and after signing the consent form, a questionnaire contains information on anthropometric data on fractures and the related surgery, such as exclusion criteria and associate complications was distributed.

#### ***Pain Evaluation***

Pain was evaluated using a visual analogue scale of 10 cm, by which the elderly could indicate the intensity of their pain in the proximal femoral fracture region. An intensity of 0 indicates no pain and an intensity of 10 indicates unbearable pain [22].

### **Evaluation of the Angle of Motion of the Hip, Knee, Ankle, and Foot**

An analysis of the angles of the movement of the lower limbs was performed by means of the goniometer instrument to establish the fixed and movable arm according to the evaluated movement. For this, the elderly patients remained in a static position and dorsal decubitus in the hospital bed after the intervention of the hospital physiotherapy [23].

Hip flexion was evaluated with the elderly patient in dorsal decubitus with the opposite lower limb flat on the bed (sagittal plane), stabilizing the secondary movements. Hip extension was performed with the elderly patient in the lateral position supported on the opposite side of the hip surgery, which will not be tested at 90° flexion to avoid anterior pelvic rotation.

Abduction of the hip was performed in the frontal plane with the elderly in dorsal decubitus and the lower limb to be tested in the anatomical position. For adduction of the hip, the elderly patients were placed in the dorsal position with the hip and knee joints in the anatomical position.

Knee flexion was measured with the elderly patient in dorsal decubitus with hip and knee flexion. For extension, the elderly patients were placed in dorsal decubitus with the hip and knee extended on the bed. For dorsiflexion and extension ankle the elderly was positioned in dorsal decubitus with the hips and knees extended and the ankle in a neutral position.

### **Assessment of Lower Limb Muscle Strength**

The muscle strength analyses were performed by means of manual resistance tests established by Kendall *et al.* (2005) [24]. The strength rating was evaluated from 0 (no force) to 4 (maximum force). The elderly patients were encouraged to perform a maximal isometric contraction of the hip muscles: flexors/extensors; medial/lateral abductors and rotators; of the knee: flexors/extensors; and of the ankle/foot: flexors/extensors and inversion/eversion. It is worth mentioning that each evaluation was performed in a careful manner while respecting the surgical procedure involved to reduce and stabilize the femur fracture. The classification of force, according to Kendall *et al.* (2005) [24] was:

- Normal: Full mobility against sharp resistance and against the action of gravity;
- Good: Integral mobility against the action of gravity and a certain degree of resistance;

- Regular: Normal amplitude movement against the action of gravity;
- Weak: Mobility in all normal directions with the elimination of gravity;
- Minimum: Signs of discreet contractibility without joint movement; Absent:

No signs of muscle contraction.

### **Feet Function Assessment**

Feet functionality was evaluated using the Foot Function Index (FFI) [25], a validated Portuguese-language instrument containing 23 items related to the impact of disability on feet. They are subdivided into three domains: foot pain (nine items), difficulty (nine items), and functional limitations (five items). Each item is measured using a visual analogue scale from zero to 10. The variation in the score is from 0 to 10, indicating the greater or the worse the impact of a disability on the feet [25].

### **Questionnaire on Care Orientation Received by Patients**

A questionnaire was completed by the elderly patients with proximal femoral fractures, both intra- and extra-capsular, on the care guidelines to be followed in the home environment, according to the health professionals involved in the hospital clinical treatment. It is important to note that the questionnaire was distributed only upon hospital discharge.

### **Statistical Analyses**

The sample size calculation of the 25 elderly patients hospitalized was based upon the pain variable, was carried out using G-Power 3.0 software, and considered a moderate effect size ( $F = 0.25$ ), a power of 80%, and a significance level of 5%. For the comparison between the groups were performed parametric test (t Student independent) followed by no parametric test (Mann-Whitney test). We adopted a significance level of 5%.

## **3. RESULTS**

The anthropometric characteristics of the elderly with intra- and extra-capsular femoral fractures were not differentiated between groups in terms of age, but in terms of sex, there were significant differences, with intra-capsular femoral fractures being more prevalent in women (Table 1).

Table 2 shows that the groups of elderly individuals with intra- and extra-capsular fractures did not present significant statistical differences in terms of any of the clinical aspects of the operated lower limb, showing that both groups did not differ in relation to pain of the lower limb and guidance on surgery.

Table 3 shows that both groups had an average of two physiotherapy sessions in a hospital environment and without home guidelines after discharge, which is independent of the groups of femoral fractures: intra- or extra-capsular.

Table 4 shows that the hip adduction and ankle dorsiflexion movements were decrease in the elderly group with extra-capsular femoral fractures compared to the elderly with intra-capsular fractures of the femur. On the other hand, knee flexion and extension movements remained with lower amplitudes of

movement for the elderly group with intra-capsular femoral fractures compared to extra-capsular fractures. In Table 5, no significant statistical difference was found between the groups of elderly with intra- and extra-capsular fractures for all degrees of muscle strength of the hip, knee, and ankle segments of the operated lower limb.

Table 6 found a statistically significant difference between the groups of elderly individuals with intra- and extra-capsular fractures only for the difficulty index in each situation.

## 5. DISCUSSION

The main results this study showed that intra-capsular femoral fractures remained more prevalent in women, whereas for extra-capsular fractures, the prevalence was equal between men and women, with a

**Table 1: Mean, Standard Deviation, Percentage, and p-Value of the Comparison of Anthropometric Variables among the Elderly Groups with Intra-Capsular and Extra-Capsular Fractures in a Hospital Environment**

Variables	Intra-Capsular Fracture (Femoral Neck) n=11	Extra-Capsular Fracture (Transtrochanteric) n=14	P
Sex	80% (F);20% (M)	50% (F);50% (M)	0.034*
Age	77.0±6.1	73.6±7.5	0.346

Tests: \*Mann-Whitney; *t Student independent*. Significant difference  $p < 0.05$ .

**Table 2: Median and p Value of the Comparison of Clinical Aspects of the Lower Limb between the Groups of Elderly with Intra-Capsular and Extra-Capsular Fractures in a Hospital Environment after the Surgical procedure**

Clinical Aspects of the Lower Limb	Intra-Capsular Fracture (Femoral Neck) n = 11	Extra-Capsular Fracture (Transtrochanteric) n = 14	p
Muscular Dysfunction	1.0	1.0	0.500
Decrease of muscle strength	1.0	1.0	0.500
Presence of pain	1.0	1.0	0.500
I walked home before the fracture	1.0	1.0	0.848
Daily activity before fracture	1.0	1.0	0.869
Had orientation on surgery	2.0	2.0	0.224
Orientation after surgery	2.0	2.0	0.371

Tests: \*Mann-Whitney. Significant difference  $p < 0.05$ .

**Table 3: Median, Mean, and p-Value of the Comparison of the Orientation on Lower Limb Movements to the Home after Hospital Discharge among the Elderly Groups with Intra-Capsular and Extra-Capsular Fractures**

Orientation by Home	Intra-Capsular Fracture (Femoral Neck) n = 11	Extra-Capsular Fracture (Transtrochanteric) n = 14	P
You had orientation about fracture care	2.0	2.0	0.415
You had physiotherapy care	2.4 ± 1.1	2.5±1.0	0.630

Tests: \*Mann-Whitney; *t Student independent*. Significant difference  $p < 0.05$ .

**Table 4: Mean, Standard Deviation, and p Value of the Comparison of Pain and Range of Motion of the Lower Limb between the Groups of Elderly with Intra-Capsular and Extra-Capsular Fractures in a Hospital Environment 24 Hours of the Surgical Procedure**

Lower Limb Movement angle with Surgery	Intra-Capsular Fracture (Femoral Neck) n=11	Extra-Capsular Fracture (Transtrochanteric) n=14	p
Pain	5.0 ± 2.6	4.3 ± 1.5	0.121
Hip flexion	12.5 ± 1.9	12.3 ± 1.5	0.060
Hip extension	1.5 ± 1.9	2.7 ± 1.0	0.319
Hip abduction	23.5 ± 3.8	23.0 ± 1.1	0.080
Hip adduction	4.0 ± 0.1	5.3 ± 1.0	0.020*
Knee flexion	38.5 ± 7.7	38.3 ± 2.3	0.044*
Knee extension	4.0 ± 0.1	2.3 ± 0.8	0.004*
Ankle flexion	12.5 ± 2.5	14.7 ± 1.0	0.045*
Ankle extension	32.5 ± 10.0	37.7 ± 1.5	0.379

Tests *t Student independent*. Significant difference  $p < 0.05$ .

**Table 5: Mean, Standard Deviation, and p Value of the Comparison of Lower Limb Muscle Strength between the Elderly Groups with Intra-Capsular and Extra-Capsular Fractures in a Hospital Environment 24 Hours of the Surgical Procedure**

Lower Limb Muscle Strength with Surgery	Intra-Capsular Fracture (Femoral Neck) n = 11	Extra-Capsular Fracture (Transtrochanteric) n = 14	p
Pain	1.5 ± 0.6	2.0 ± 0.1	0.181
Hip flexion	2.0 ± 0.8	2.0 ± 0.1	0.500
Hip extension	1.8 ± 0.5	1.7 ± 0.5	0.806
Hip abduction	1.5 ± 0.6	1.3 ± 0.5	0.645
Hip adduction	1.5 ± 0.6	1.5 ± 0.5	0.500
Knee flexion	1.5 ± 0.6	1.5 ± 0.5	0.500
Knee extension	3.2 ± 0.5	3.0 ± 0.6	0.527
Ankle flexion	3.2 ± 0.5	3.0 ± 0.7	0.527

\* Tests *t Student independent*. Significant difference  $p < 0.05$ .

**Table 6: Mean, Standard Deviation, and p Value of the Comparison of Feet Function Index -IFP among the Elderly Groups with Intra-Capsular and Extra-Capsular Fractures in a Hospital Setting after 24 Hours of the Surgical Procedure**

Feet Function Index – IFP	Intra-Capsular Fracture (Femoral Neck) n = 11	Extra-Capsular Fracture (Transtrochanteric) n = 14	p
Frequency of activity due to foot limitations	0.20 ± 0.22	0.20 ± 0.22	0.291
Level of difficulty in feet	3.84 ± 2.61	2.64 ± 1.25	0.082
Difficulty in every situation	4.04 ± 1.75	2.98 ± 1.07	0.002*

\* Tests *t Student independent*. Significant difference  $p < 0.05$ .

mean age above 70 years for both groups of proximal femur fractures.

Proximal femoral fractures in the elderly represent a serious problem within the context of public health due

to the high economic costs for their treatment, especially in the hospital environment, and its consequences, as well as the high morbidity and mortality rates [19-21]. There is an association with proximal femoral fractures between age and mortality

rate, that is, individuals aged above 80 years present a higher probability of death compared that of individuals aged between 60 and 79 years [26].

According to the literature on the elderly over 80 years in age, the incidence rate of fractures can reach as high as four times that of the lower age group (70–79 years), with a higher mortality risk [2, 4, 20]. In the present study, it can be observed that the mean age in both groups of femoral fractures was between 73 and 77 years, suggesting an age group with a lower risk of mortality [21].

Regarding the fracture index by sex, it was observed in this study that intra-capsular fractures were more prevalent in the elderly women. Several studies in the literature [26-29] also observed the female predominance of proximal femoral fractures. The higher prevalence among women may be explained by the fact that and are more exposed to some risk factors, such as osteoporosis, greater susceptibility to falls, and a longer life expectancy than males [29]. Haentjens *et al.* (2007) [29] reveal a greater predominance of intertrochanteric femoral fracture (51%) among elderly women compared a femoral neck fracture (49%).

A possible explanation for this contradiction in the results may be due to the socioeconomic characteristic of the region, with a greater tendency of falls among the elderly, as verified in this study. As well, the similarity between the sexes in terms of extra-capsular fractures and the greater predominance of intra-capsular fractures among women may suggest a greater susceptibility from them, due to the risk factors involved, especially the decrease of hormones [30]. According to a recent study, in 2016, among the elderly hospitalized in a single-center regional hospital for women, there were more incidents of proximal femoral fractures among patients averaging 78 years old, corroborating with Franco *et al.* (2016) [31].

Another important finding observed in this study was that intra and extra-capsular femoral fractures do not differ in relation to pain, the function of the lower limb segment and guidance on surgery. This shows proximal femoral fractures, intra- and extra-capsular, present similarities in pain and functional changes, as well as no guidance by the multi-professional team before and after the surgical procedure. Much of the literature reveals that after a postoperative year, less than 50% of surviving elderly patients can walk without assistance, and only 40% can perform the ADLs independently [20, 21, 29]. Perhaps these disabilities can be explained by

the lack of home guidance after discharge, as verified in this study [20].

The immobilization can lead to complications in the musculoskeletal and respiratory systems, patients should be submitted to treatment continuously, but poor orientation during treatment may aggravate the situations of the elderly patients [20]. This lack of information for patients is common, making visible the need for guidance on how to continue the rehabilitation of the elderly patient. In this context, health professionals need to insert care, considering the needs, culture, schooling, and knowledge of the elderly patient. Professionals can use health education to enable the families of elderly patients to assist in functional exercises [32].

Health professionals who assist elderly patients must provide not only specialized services within the hospital, but also guidance and assistance to family members who are responsible for the care of the elderly patient up for discharge, as these relatives are responsible for the continuity of the treatment given to the elderly patient when at home [32, 33]. Confirmation of the importance of orientation for movement maintenance can be verified by changes in the range of motion of hip adduction and ankle dorsiflexion, which remained reduced in extra-capsular fractures when compared to intra-capsular fractures. Intra-capsular fractures led to reductions in knee range of motion, both for flexion and for extension. Considering the importance of the rehabilitation of elderly patients after proximal femur fractures, multi-professional involvement is considered necessary for clinical care and adequate follow-up. Physiotherapy holds a great prominence in this process, because during the hospital period, its aim is to promote postoperative guidance and stimulate the return to ADLs, thus improving the quality of life of the elderly. The rehabilitation performed during hospitalization vary according to the needs of the elderly, with emphasis on passive mobilizations, resistance exercises, metabolic exercises, respiratory re-expansion and weight-bearing exercises and the prescription of crutches [34].

The rehabilitation process after a femoral fracture is directed toward preventing joint stiffness as a result of capsular retractions of the lower limbs [34, 35]. Through this research, we can observe a certain articular stiffness of the lower limbs, considering the reduction of knee flexion and extension movements for intra-capsular fractures and the reduction of hip adduction and ankle dorsiflexion movements for extra-capsular fractures among the elderly.

In relation to reduced muscle strength, both groups of fractures were similar, but the reduced strength among the elderly tends to lead to a lower capacity for postoperative ambulation, making them more vulnerable to further falls and suffering new fractures [36], as well as greater susceptibility to mortality [20]. The difference in muscular strength between the different types of proximal femoral fractures is due to the hospital period, as all the elderly patients were only in hospital an average of two days after the surgical procedure. Patients with femoral fractures who underwent repair surgery and who received physiotherapeutic treatments were discharged faster [37], a fact that may explain the average two-day post-operative hospitalization observed in the present study. In addition to the muscular strength and functionality of the feet, it has also been altered, with a greater impact being a functional limitation for intra-capsular femoral fractures, which can be expected due to the lower ankle dorsiflexion found in these elderly individuals.

Aging leads to a reduction in range of motion in general, and it has also been reported that aging generates limitations in the range of motion of ankle dorsiflexion, as well as a decrease in strength and increase in ankle flexor muscles stiffness, which would lead to gait limitations and a greater susceptibility to falls. Reports suggest the weakening of the ankle dorsiflexors during the aging process can be an important factor to elucidate falls among the elderly [38]. We also observed decreased functionality of the feet in the elderly patients with intra-capsular femoral fractures.

## CONCLUSION

It can be concluded that proximal femoral fractures intra and extra-capsular differ according to gender, with a female predominance of intra-capsular fractures. As well, regarding the range of joint motion, the extra-capsular fractures resulted in reductions in hip adduction and ankle dorsiflexion compared to intra-capsular fractures, which presented reductions in knee flexion and extension. Regardless of the type of fracture, there was no home guidance after the surgical procedure.

## ABBREVIATIONS

**GFI:** intra-capsular femoral fractures; **GFE:** extra-capsular femoral fractures; **FFI:** Foot Function Index; **VAS:** visual analogue pain scale.

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