Influence of surgical delay on complications in older adults with hip fracture

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Abstract

Introduction: Hip fracture is a serious injury of increasing importance in older adults and early surgical intervention is recommended to reduce associated complications.

Aim: To evaluate the influence of surgical delay in older adults with hip fracture regarding post-surgical morbidity and mortality, treated at the "Fructuoso Rodríguez" Hospital in the period 2021 and 2022. **Material and method**: Prospective study of 720 patients who were characterized according to demographic, clinical and surgical variables. The causes of surgical delay were identified. Finally, the preoperative time and the relationship with postsurgical complications were determined. Analysis was performed with SPSS 25.0 and Epidat 3.0. The ethical aspects of this type of research were taken into account.

Results: The average age was 82 years. The female sex was 71.9% and male 28.1%. The right hip was more affected, 58.8%. The majority were extracapsular fractures 65.4%. The surgical interventions were: reduction and osteosynthesis 64.2%, arthroplasty 34.4% and external fixation 1.4%. 91.5% had preoperative time less than 48 hours and 8.5% had preoperative time equal to or more than 48 hours. The reasons for surgical delay were organizational in 56.7%, medical problems in 33.3%, and anticoagulation in 10.0%. Delayed patients generally had a long postoperative stay, increased postoperative complications ($p = 0.000$), and mortality (OR=14.059299).

Conclusion: Delaying surgical intervention leads to increased morbidity and mortality in older adults with hip fractures.

Keywords: hip fracture, surgical delay, older adult, preoperative time, complications

Glossary of Abbreviations and Acronyms

CVA, cerebrovascular accident; BC, before Christ; AO/OTA, arbeitsgemeinschaft für osteosynthesefragen /orthopedic trauma association; ASA, american society of anesthesiologists; ADL, activities of daily living

ID, identity card; COT, orthopedic and traumatology center; COVID-19, Coronavirus Disease 2019; SD, standard deviation; DHS, dynamic hip screw; EKG, electrocardiogram; COPD, chronic obstructive pulmonary disease;

FMS, osteosynthesis material failure; Fx, fracture; HC, clinical history; HODFR - "fructuoso rodríguez" orthopedic teaching hospital; HTA, arterial hypertension; CKD, chronic kidney failure; Kg, kilogram; m2, square meter

MINSAP, ministry of public health; SPSS, statistical package for the social sciences; Rx, x-rays; CT, computerized axial tomography; MRI, magnetic resonance imaging

Introduction

Hip fracture is a serious injury of increasing importance in older adults, both because of its frequent high morbidity and mortality, and because of the important social and economic costs in the Public Health systems of developed countries due to the high prevalence of osteoporosis and the progressive aging of the population. It is associated with increased mortality, reduced mobility, loss of function, increased use of health services, residential institutionalization, depression, cognitive impairment and increased risk of new fractures.[1,2] Fractures of the upper end of the femur were described for the first time in the works of Hippocrates (460 BC), but it was not until the 16th century that Ambrose Paré proposed a treatment method and, in turn, Smith Petersen, father of modern orthopedic.surgery, popularized the osteosynthesis of femoral neck fractures with his trilaminar nail. Subsequently, other researchers devised methods and devices seeking to maintain the principles of exact reduction, rigid fixation and impaction of the fracture.[3,4] Approximately 1.6 million hip fractures occur worldwide each year. The majority of this number is from developed countries. There are various studies in different parts of the world that estimate that figures will exceed 6 million in the year 2050.[5–9] In the United States, more than 300,000 elderly people are admitted each year for hip fractures.[10, 11]

In studies carried out in Latin America, the incidence of hip fracture varies from 40 to 360 patients per 100,000 inhabitants.[12] In Cuba, about 12,000 hip fractures occur annually, a figure that increases year after year and constitutes a significant challenge for the Cuban Public health system. This fracture is one of the main causes of hospital admission among older adults and presents great variability in terms of incidence, seasonality, length of hospital stay and mortality.[12,13]

Hip fracture is one of the main public health problems in developed countries due to the high prevalence of osteoporosis and the progressive aging of the population.[14] Currently, countries are facing drastic changes in their population structure, due to a process called “demographic transition”, according to which the population of a country goes from a demographic profile with certain characteristics to a different one. This brings with it the configuration of a demographic profile characterized by an elderly population. Scientific and technological advances have increased life expectancy, a factor that impacts the mortality rate.[14,15] In Latin America, the demographic transition is characterized by its speed: all countries in the region are moving towards older societies; it is a generalized process, the general population grows by 1.5%, the population over 60 years of age grows by 3.5% and 75% of the people born today in Latin America will become older adults, while that 40% will exceed 80 years of age. So in a century the percentage of older adults will quadruple.[16]

Cuba is an example of a developing country that shows a significant aging of its population, with its economic and social implications, it is estimated that it will have the oldest population in Latin America at the dawn of the year 2025. It is expected that by the year 2050 Cubans will enjoy one of the highest average ages on the planet.[16,17] In Cuba, where life expectancy exceeds 75 years on average, being somewhat higher in women and where more than 12% of the population is represented by the group of 65 years and older, this problem does not escape, however, as in other countries and regions, only isolated and very limited studies have been carried out to address this problem, which does not allow it to be characterized.[12,18]

Hip fracture is a serious clinical injury associated with population aging. It contributes significantly to mortality and loss of quality of life in older adults.[18,19] Virtually all patients require surgical intervention, which in many cases suffers a delay of several days, which has been related to an increased complications and mortality.[20,21] The mortality rate of these patients is double that of people of the same age without fracture, with respiratory and cardiovascular problems as the main causes of death within the first 30 days.[20] There are studies that show that half of these deaths are caused by the patient’s clinical situation at the time the fracture occurred, but the rest are due to postoperative complications that could be avoided.[21] Among the factors that delay treatment, some include medical nature such as decompensated systemic diseases, extra-hospital and in-hospital infections. Other factors are related to the organization of the hospital, such as delay in estimating surgical and pneumological risks, insufficient operating room. Finally, other administrative or managerial factors such as insufficient preferential planning for these patients.[22]

Regardless of the cause, when surgical intervention is delayed it leads to complications. Infections of the surgical site, urinary tract, pressure ulcers and deep vein thrombosis are the most frequent complications observed.[23] Mortality in one month after hip fractures is between 5% and 10% and of them a 2% to 2.6% of patients die before receiving indicated surgical management. One year after surgery, mortality varies between 20% and 31%.[24,25] Factors associated with increased mortality after hip fracture include: older age, male sex, poor control of systemic diseases (metastatic cancer, congestive heart failure, renal failure, liver disease, lymphoma, and/or weight loss) psychiatric illness, low albumin (<3.0 g/dL), nursing home residence, surgical treatment before stabilization of coexisting medical conditions, poor baseline functional status, and postoperative complications.[26]

To avoid complications and mortality in these elderly people, a multidisciplinary team is necessary. After making a diagnosis of hip fracture, the next step is to decide whether the patient needs surgery or not. For most patients, surgical treatment is indicated and this should be performed within the first hours after admission.[27,28] McGuire in his work “Delays until surgery after hip fracture increases mortality” established that surgical delay for 2 or more days has a 17% greater risk of complications and mortality in the first 30 postoperative days.[27] Other authors such as Zuckerman have established that a surgical delay of more than 2 days is an important predictor of mortality in one year.[28]

Justification of the study

The constant increase in life expectancy in countries where medical care is adequate, including Cuba, a global example, many studies have been carried out on aging problems and hip fractures in older adults. In most patients, surgical treatment is indicated and should be performed in the first hours after admission, but in the medical literature there is still contradictory data on the benefits of early surgery in older adults who need adequate resuscitation before the surgery. However, the causes of surgical delay do not only constitute intrinsic medical problems of the patient, they can also be extrinsic such as planning, availability of operating rooms and other related institutional causes.

In a hospital such as the "Fructuoso Rodríguez" Orthopedic Teaching Hospital where many elderly patients with hip fractures are admitted and undergo surgery, it is important that such a study be carried out to establish the causes of the surgical delay. Reducing preoperative time is of great benefit to the patient and his/her family, the hospital, and the country, since long preoperative time has been shown to be associated with complications, long hospital stays, and high resource consumption.

All of the above raises the need to obtain more information on this important topic, which will contribute to future research, the training of orthopedic surgeons and the benefit of patients in orthopedic hospitals as well as their families. This constitutes the motivation to carry out this investigation.

Scientific problem

How does preoperative time influence the incidence of complications and post-surgical mortality of hip fracture in older adults treated at the "Fructuoso Rodríguez" Orthopedic Teaching Hospital between January 2021 and December 2022?

Objectives

General: To evaluate the influence of surgical delay in older adults with hip fracture regarding post-surgical morbidity and mortality, treated at the "Fructuoso Rodríguez" Orthopedic Teaching Hospital in the period January 2021 to December 2022.
Specific

1. Characterize demographic, clinical and surgical variables according to preoperative time.
2. Identify the causes of delay in surgical intervention.
3. Determine the possible relationship between preoperative time and postsurgical complications.

Theoretical framework

Anatomy of the hip joint

The coxofemoral or hip joint is a spherical synovial union in which the femur and coxal bone participate. It joins the free portion of the lower limb to the pelvic girdle and is classified by the number of articular surfaces as simple. The articular surfaces are, on the one hand, the head of the femur, and on the other the acetabulum of the coxal bone, enlarged by an articular fibrocartilage called the labrum acetabula.[29]

The femoral head is a smooth, rounded ridge, approximately two-thirds of a sphere with a radius of 20-25 mm. It is supported by an anatomical neck, which generally guides the head forward with an arc of between 15 and 30 degrees. Since the neck is not on the axis of the shaft, it has an average tilt angle of 130 degrees. There is a greater trochanter on the outside of the neck and a lesser trochanter on the bottom and back. These ridges are connected to the summit and together form the trochanteric mass raised by the juxta articular muscles.[12,29]

The femoral head is connected inferolaterally to the shaft through the femoral neck, which is located between the greater and lesser trochanters. The angle formed by the femoral neck and the medial aspect of the femoral shaft is approximately 127° with a range of 120° to 140°.[29–31] The femoral version is formed by the angle of the axis between the femoral neck and the transcondylar femoral axis. An important structure, known as the femoral calcar, is a dense spongy strut that extends from the posterior aspects of the femoral neck to the posteromedial proximal femoral shaft.[30] Within the femoral neck are the compression and tension trabeculae, which form the triangle of Ward that is delimited superiorly by traction trabeculae and inferomedially by compression trabeculae and represents a region of low bone density.[30,32,33] Recent studies have shown that degeneration of the trabeculae was closely related to the occurrence of femoral neck fractures and the enlargement of Ward's triangle was related to the appearance of intertrochanteric fractures.[30,34]

The gluteus minimus and gluteus medius insert into the anterolateral and lateral aspects of the greater trochanter, respectively, and together act as the primary abductors of the hip. The iliopsoas tendon inserts into the lesser trochanter and serves as the main hip flexor. The external rotators of the hip are formed by the piriformis, the superior and inferior gastrocnemius, the quadratus femoris and the obturator externus, which insert on the medial aspect of the greater trochanter, except the piriformis and the obturator internus, which insert on the superomedial surfaces of the greater trochanter and the intertrochanteric crest, respectively.[30,35]

The main vascular supply to the femoral head and neck is the medial femoral circumflex[36] and, more recently, the inferior gluteal artery has been highlighted.[30,37] The medial femoral circumflex artery originates from the deep femoral artery and the common femoral artery and runs between the piriformis and iliopsoas muscles.[30] It then divides into the deep and descending branches.[30] The deep branch runs towards the femoral head between the quadratus femoris and the obturator externus and enters the posterior aspect of the hip. Once intra-articular, the artery divides into the posterosuperior nutrient arteries, which represent the major blood supply to the femoral head and neck.[30]

The obturator nerve and femoral nerve transverse along the anteromedial hip capsule. The superior gluteal nerve is adjacent to the posterior aspects of the hip capsule. The sciatic nerve runs beneath the piriformis muscle and is located posterior to the external rotators of the hip.[30,38]

Definition of hip fracture

The term hip fracture describes fractures that occur in the proximal end of the femur.[12] They can be differentiated depending on whether the fracture line is inside or outside the joint capsule, distinguishing intracapsular fractures that affect the femoral neck and the extracapsular ones, which affect the trochanteric region.[30]

Hip fracture is defined as an interruption of bone continuity in the upper region of the femur between the subcapital region and 5 cm below the lesser trochanter.[12,39] It is associated with serious complications when treatment is delayed.[40,41]

Classification of hip fractures

Hip fractures can be classified according to their relationship to the hip capsule. Therefore, fractures can be intracapsular, such as femoral neck fractures, or extracapsular, such as intertrochanteric and subtrochanteric fractures (Figure 1).[12,30]

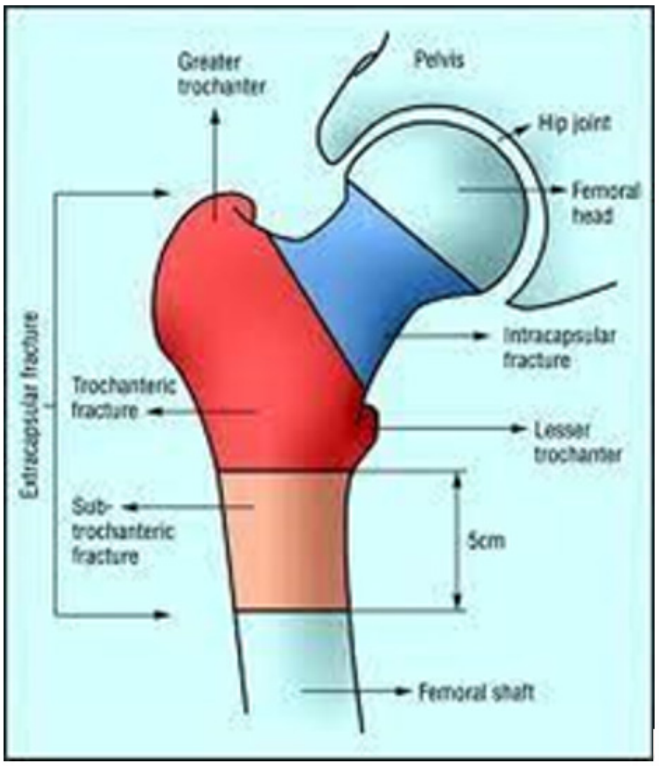

Figure 1 Location of fractures of the proximal third of the femur.

Source: adapted from Physiopedia [Internet] - Femoral neck fractures biomechanics

Intracapsular fractures: There are multiple classifications available for intracapsular fracture.[28,42] The most common classification systems include anatomical, Garden, Pauwel, and AO/OTA classification.

The anatomical classification is determined by the level of the fracture line.[2] This classifies the fractures into:

- Subcapital fractures: located at the base of the cephalic nucleus, at the junction between the head and the neck (Figure 2 A).
- Transcervical fractures: located in the central area of the femoral neck (Figure 2B)
- Basicervical fractures: at the junction of the neck and the trochanteric mass (figure 2C)

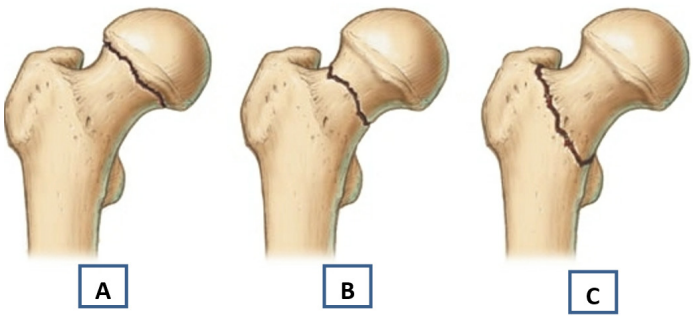

Figure 2 Delbet classification for intracapsular fracture.

Source: Adapted from Qsota medical.[43]

Pauwel's classification[36] divides fractures into three groups according to the angle of the fracture from the horizontal plane:[44]

- Type 1: <30 degrees
- Type 2: 31-50 degrees
- Type 3: >50 degrees

An increased angle is associated with increasing shear forces and is therefore a more unstable fracture with reduced healing potential.[44] This classification demonstrates marked variation between observers, particularly in displaced fractures.[45]

The complication rate is about 14-17% of avascular necrosis of the femoral head in displaced fractures.[46]

The Garden classification is a most commonly recognized classification system for intracapsular hip fractures.[36] It describes four fracture patterns and defines them based on fracture integrity and displacement.[45]

- Type 1: incomplete fracture without displacement. The femoral head appears slightly impacted in valgus.
- Type 2: complete fracture without displacement.
- Type 3: complete fracture and partial displacement; posteriorly and in varus of the cephalic nucleus. Continuity is maintained between the proximal and distal fragment.
- Type 4: complete fracture and complete displacement. There is no continuity between the proximal and distal fragments.

This classification system allows establishing a prognosis regarding consolidation, and correlates the degree of fracture displacement with the probability of vascular injury and, therefore, avascular necrosis (Figure 3).[46, 47]

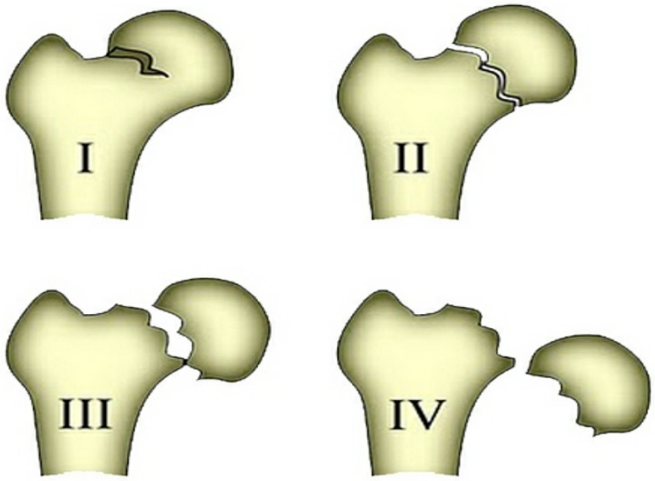

Figure 3 Garden (1964) classification for intracapsular fracture.

Source: Adapted from Qsota medical.[43]

The OA/OTA system classification is also a widely accepted classification. The proximal femur receives the number 31 and the femoral neck the letter B according to classification.[48] Fractures in the neck are classified simply as 31B and are subdivided into:

i. 31B1: Subcapital
ii. 31B2: Transcervical
iii. 31B3: Basicervical[48]

Extracapsular fractures: Extracapsular fractures can be divided into trochanteric and subtrochanteric fractures.[39,48,134] Trochanteric fractures are fractures that occur between the greater and lesser trochanters. These fractures are historically classified with the

Evans classification that evaluates the stability of the fracture.[28] There are other classifications such as Tronzo[49] but in modern practice, extracapsular fractures are generally described using the AO/OTA classification (Figure 4). The AO/OTA classification of intertrochanteric fractures is designated as 31-A. It is further divided based on stability and fracture pattern.[48]

A1: stable fracture in two parts

A2: comminuted unstable fracture

A3: unstable inverted or transverse fracture[48]

Subtrochanteric fractures are fractures that occur between the lesser trochanter and 5 cm distal to the lesser trochanter.[12,39,50]These were historically classified using the Russell-Taylor classification,[50] but now have a modernized AO classification system. Both classification methods are usually academic and rarely influence management.

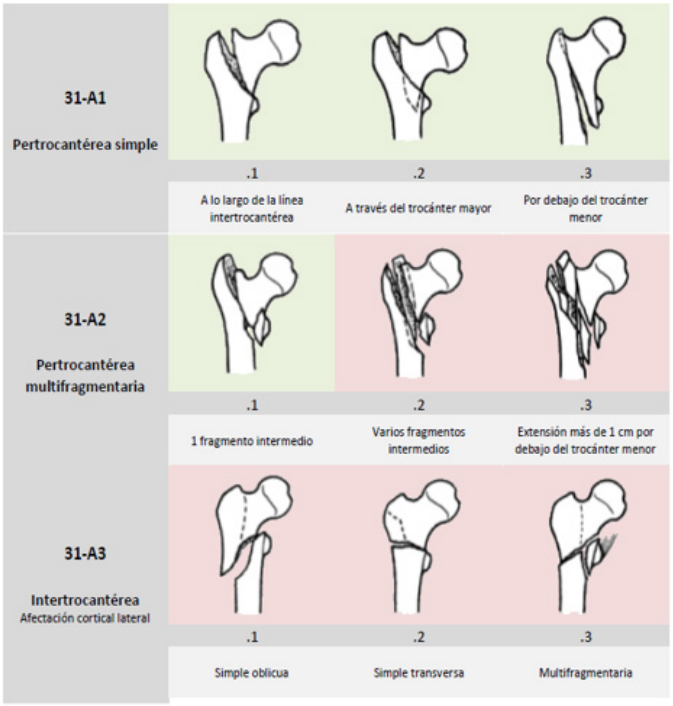

Figure 4 AO/OTA classification of extracapsular hip fractures.

Source: Adapted from traumatology teaching [48,51]

Epidemiology of hip fracture

Hip fractures are currently considered the new orthopedic epidemic. According to the World Health Organization, the incidence in Latin America is becoming increasingly high as it is the most common cause of hospitalization in traumatology and orthopedics services worldwide.[3,4,52]

Hip fractures have been recognized as one of the growing epidemics of the 21st century.[12,53] and it is estimated that around 6.3 million patients will suffer from it in 2050.[12,54] In Europe, it is estimated approximately between 500,000 and 600,000 people suffer from hip fractures every year.[2,12] In the United States, more than 300,000 older adults are admitted to hospital each year for hip fractures.[10,11]

Studies carried out in Latin America indicate the incidence of hip fracture varies from 40 to 360 patients per 100,000 inhabitants.[12] In Argentina the incidence, both in men and women over 50 years of age, ranges between 78 to 64, that is, 167 to 362 per 100,000 inhabitants, respectively, with an average between the two of 488 per 100,000 inhabitants.[12,55]

In Cuba, about 12,000 hip fractures occur annually, a figure that increases year after year and constitutes a significant challenge for the health system.[12] Various national studies indicate increasing trends in hip fractures in all provinces of Cuba.[12,14,16] This is not surprising given the high life expectancy in Cuba which is currently 79.18 years, an increase of 0.12% from 2022. This increase has been constant for the last three years recorded as 78.89, 78, 98 and 79.08 for the years 2020, 2021 and 2022 respectively.[56]

Risk factors and etiology of hip fracture

More than 90% of hip fractures are caused by a fall,[57] and two-thirds of hip fracture patients have osteoporosis.[58,59] Therefore, established risk factors generally function by influencing the risk of fall and bone quality or both.[59] Age and female sex are strongly associated with fracture risk.[59] Other established factors are previous fractures,[60] low muscle strength,[29] low weight and smoking,[61] Some diseases are strongly associated with the risk of fracture. Examples include Cushing's disease,[62] hyperthyroidism, and type 1 diabetes mellitus.[63,64] Medications, such as glucocorticoids and aromatase inhibitors, may also influence bone mass and bone quality or increase the risk of falls, such as benzodiazepines, antidepressants or antipsychotics.[65,66]

In people over 65 years of age, fracture frequently occurs due to the coincidence of a less intense mechanism such as a fall and a predisposing factor: osteoporosis.[2,12,59]

Falls: Falls are a global health problem, the incidence of which increases significantly with age.[67,68] Falls account for approximately 88% of emergency visits and hospital admissions for patients aged 65 years and older.[11] The majority of these falls occur at home as a result of loss of balance while walking.[69]

Falls are facilitated by "extrinsic factors",[70,71] such as architectural barriers, poor lighting, obstacles, etc., and by "intrinsic factors"[70,71] that are due to the patient's own conditions such as advanced age, female sex, low body mass index (<19 kg/m2), history of previous fall in the last year, confusional states (cognitive impairment or dementia), use of drugs that reduce alertness (especially sedative psychotropic drugs and cardiovascular drugs), visual and hearing defects, neuromuscular disorders, and neurological diseases that cause alterations in the musculoskeletal system (Parkinson's disease, cerebrovascular diseases) and alcoholism.[70–74]

A third of those over 65 years of age suffer an annual fall, which rises to half in patients over 80 years of age and even 25% of these have more than one fall.[72,75] These falls are mainly from feet to ground level and produce low-energy trauma but are enough to cause fractures in the elderly due to the fragility of their bones. In younger patients who suffer a hip fracture, the cause is usually secondary to high-energy trauma, such as considerable height or motor vehicle accidents.[70, 71, 74]

Osteoporosis

Osteoporosis is a systemic bone disease characterized by a decreased bone mass depending on the age and sex of the individual, with alteration of the microarchitecture of the bones,

which implies bone fragility and greater ease in producing fractures.[76] It is estimated that in the world, 200 million people suffer from this disease.[77] Older adults with osteoporosis have a high lifetime cumulative prevalence of fragility fractures.[78] Among fragility fractures, hip fractures carry high morbidity and mortality.[78,79]

Adult women are the population group most susceptible to suffering from osteoporosis[80] mainly in the years close to and after menopause with an incidence rate of 3:1 compared to men.[2,76,80] Age over 65 years increases the risk of hip fracture 13 times between 60 and 80 years and a sedentary lifestyle represents between 20-40% higher risk.[2] Low physical activity, tobacco and excessive alcohol use is also directly related to osteoporosis and therefore the risk of fracture.[76,80]

Diagnosis of hip fracture

Most fractures are diagnosed clinically by a history of a fall associated with hip pain and inability to ambulate, with or without the lower extremity in external rotation.[81,134] Simple radiography (X-ray) of the hip with anteroposterior and axial views of both hips confirms the diagnosis.[82] Around 15% of hip fractures do not present any displacement, and in 1% the fracture is not visible on the X-ray. , the use of CT or MRI is necessary to confirm the diagnosis.[82–84]

Treatment of hip fracture

Hip fracture is treated as an emergency and surgery which is indicated in most cases, must be performed within 48 hours.[85] The fundamental objectives for treating an elderly person with a hip fracture are to relieve pain, preserve life and recover the functional state prior to the fracture. These objectives must be achieved in the shortest time and at the lowest possible cost.[86]

The main clinical practice guidelines on hip fracture recommend surgical intervention as the treatment of choice.[40,87] Conservative treatment is indicated only in bedridden patients, with a very short life expectancy, and with severe neurological deterioration.[2,88]

Preoperative assessment

It is necessary to stabilize the patient's medical conditions before performing the intervention under acceptable safe conditions. The patient must be evaluated in a multidisciplinary manner.[89]

After confirming the diagnosis; chest X-ray and EKG are done. Blood extraction for cross-matching and other tests, analgesia, thromboembolic prophylaxis regimen (with or without withdrawal of antiplatelet and anticoagulant agents and, if necessary, adding vitamin K), as well as adjustment of home medication are necessary.

Thromboembolic prophylaxis is carried out with low molecular weight heparins (LMWH), due to their effectiveness in preventing thrombotic events. Treatment is started upon admission, suspended 12 hours before surgery and resumed 6 hours after surgery up to 35 days.[90]

Hydroelectrolyte alterations, fluid balance, assessment of anemia and possible malnutrition must be identified and treated to avoid increased morbidity and mortality.[91] During anesthetic induction, antibiotic prophylaxis is performed with 2 g cefazolin EV in a single dose, since it reduces the surgical wound infection rate from 5% to 1%. Vancomycin is the alternative in patients with allergies to beta-lactams and carriers of methicillin-resistant Staphylococcus aureus (MRSA).[2,92]

Anesthetic techniques: Spinal and general anesthesia are the most commonly used anesthetic techniques for the surgical treatment of hip fractures. General anesthesia has been associated with increased bleeding, thromboembolic complications, and postoperative confusion.[90,93]

On the contrary, regional anesthesia has shown better functional recovery and a lower rate of systemic complications: less bleeding, decreased incidence of thromboembolic events as well as lower risk of respiratory depression and therefore, respiratory infections.[94] It has the disadvantage of the risk of producing spinal hematoma in patients with coagulation disorders. Regarding mortality, no significant differences have been demonstrated between the two,[95] so there is not enough scientific evidence to indicate one type of anesthesia as the standard in hip fracture surgery. Therefore, the most appropriate technique must be individualized in each case.[90,93,95]

Surgical treatment

Intracapsular fractures: Intracapsular fractures of the upper femur require individualized surgical treatment.[96] It must be determined whether it is a displaced fracture (Garden types III and IV) or non-displaced (Garden types I and II). There are two fundamental types of treatment: osteosynthesis and arthroplasty. To decide which technique to use, each patient must be individualized, according to their age, ability to ambulate before the fracture, cognitive function and comorbidities.[97]

Treatment of Garden types I and II fractures is usually performed by osteosynthesis (regardless of age), with multiple cannulated compression screws in parallel along the cortex of the femoral neck (Figure 5A) or with angular plates such as DHS (Figure 5B).

In displaced fractures (Garden III and IV) and in young patients (usually under 60 years of age), we always try to perform closed or open reduction and fixation with parallel compression screws despite the risk of necrosis of the femoral head due to secondary damage to the cephalic vascularization. In the elderly patient with a displaced fracture, the treatment of choice is arthroplasty or prosthetic replacement, whether partial or total. It is the most recommended method, since it avoids the possibility of secondary surgery due to avascular necrosis, pseudoarthrosis secondary to treatment with osteosynthesis and the lack of consolidation, allowing the patient rapid mobilization and sitting, reducing the number of complications.[98] The indication for hemiarthroplasty (in which only the femoral head is replaced, preserving the patient's acetabulum), are displaced femoral neck fractures in patients older than 70-75 years with limited functional activity (figure 6c). Hemiarthroplasties can be unipolar or bipolar (with independent movement of the prosthetic head), with no significant clinical differences between the two. Hip hemiarthroplasty offers a period of four or five years of good function and little pain.[96]

Total arthroplasty (where both the femoral head and the acetabulum are replaced) is indicated in patients under 70-75 years of age with displaced femoral neck fractures, ambulant, collaborators, and in patients over 75 years of age with

degenerative hip joint disease such as coxarthrosis. , rheumatoid arthritis, tumors or failure of previous osteosyntheses (Figure 6D).[97,98]

Extracapsular fractures: The most common surgical treatment for extracapsular fractures is osteosynthesis.[39] There are a variety of internal fixation implants, including extramedullary and intramedullary types.[99] External fixation, where external rods pass through the fracture and are attached to the bones using threaded pins, has also been applied.[39,100] Although less common, arthroplasty is an option in the management of these fractures.[39]

In general, most fractures must be reduced before fixation. Typically, fragility fractures are reduced and closed, under x-ray guidance using an image intensifier. However, if a fracture is irreducible using closed means, the fracture can be openly reduced (surgically exposed to aid reduction).[39,101]

The reduced fracture is supported with an implant that is passed through the fracture or fixed with an external fixator.[39]

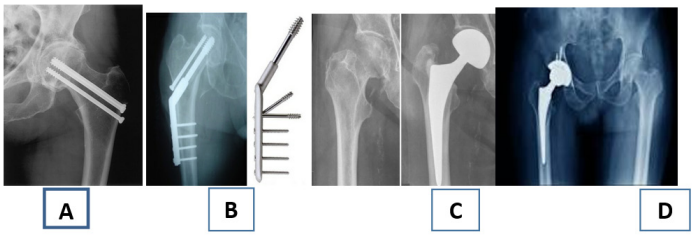

Figure 5 Surgical treatment of hip fracture (A) Osteosynthesis with cannulated screws (B) Osteosynthesis with DHS (C) Hemiarthroplasty (D) Total arthroplasty.Source: Adapted from Internet Orthopedic Images.

Morbidity and mortality of hip fracture

In-hospital mortality is estimated between 2-7%,[101] 6-12% during the first month after the fracture, reaching 17-33% of patients 12 months after the fracture 103-109. On the other hand, the appearance of medical complications during hospital admission is very high.[110–113]

This type of fracture is associated with chronic pain, reduced mobility, disability, an increasing degree of dependency, as well as functional impairment. Patients who survive the episode suffer a significant functional deterioration, so that only 40-50% recover their functional situation prior to the fracture and up to 60% will require assistance a year later.[114,115]

There are multiple variables involved such as demographic variables (age and sex), clinical variables (comorbidities, type of fracture and post-surgical complications), biological variables (previous comorbidities), mental variables (dementia, depression, post-fracture confusion) and care variables (multidisciplinary team in the acute phase, type of anesthesia, surgical delay, delay in rehabilitation, hospital stay, discharge destination), which will influence the morbidity and mortality of hip fracture.[116, 117]

Methodological design

Type of study

A prospective, longitudinal, descriptive study was carried out in older adults with a diagnosis of hip fracture, who were treated surgically at the "Fructuoso Rodríguez" Orthopedic Teaching Hospital in the period January 2021 to December 2022.

Unit of analysis

Older adults with a hip fracture diagnosed at the "Fructuoso Rodríguez" Orthopedic Teaching Hospital through physical examination along with simple radiological studies, and who met the inclusion criteria in the aforementioned time period.

Study universe

The study universe consisted of 1,105 patients.

Inclusion criteria

i. Patients of both sexes, aged 65 years and over.
ii. Patient with a diagnosis of hip fracture produced by a low energy mechanism.
iii. Acceptance by patients of surgical treatment. Signing of the informed consent form.

Exclusion criteria

i. Pathological fractures.
ii. Periprosthetic fractures.
iii. Patients with functional classification of the American Society of Anesthesiology stage four or five (ASA IV or V).

Sample size

The sample consisted of a total of 720 patients selected at random.

Data collection

Definition of variables

i. Hospital stay: Period between entry and exit.
ii. Day of the week of admission: Monday / Tuesday / Wednesday / Thursday / Friday / Saturday / Sunday
iii. Preoperative stay: Period between time of diagnosis until time of start of operation

<48 hours = on time or early surgery

≥48 hours = delay or delayed surgery

iv. Postoperative stay: Period between the time of completion of the operation and the time of medical discharge.

Causes of surgical delay

Doctor factors
i. Absence
ii. Sickness
iii. Others

Patient factors
i. Clinical problems: glycemia, hypertension, coagulation, anemia, etc.
ii. Medications: anticoagulants

Organizational causes
i. Lack of prosthesis and implants
ii. Lack of theatre gowns
iii. lack of blood
iv. Weekend/holiday
v. other

Operationalization of variables

Variable	Type	Scale	Description	Indicator
Age	Continuous quantitative	65-69 70-74 75-79 80-84 85-89 90-94 95 and more	According to years completed	number and percentage Mean SD Minimum Maximum
Sex	Dichotomous nominal qualitative	Male Female	According to biological sex	number and percentage
Comorbidities	Nominal qualitative polytomous	HTA Mellitus diabetes Ischemic heart disease stroke IRC COPD Psychiatric disorders others	According to personal pathological history	number and percentage
laterality of affected hip	Qualitative nominal dichotomous	Right Left	According to anatomical location of the coxarthrosis	number and percentage
Location	Qualitative nominal dichotomous	Intracapsular Extracapsular	According to anatomical location of the fracture	number and percentage
Fracture type	Nominal qualitative polytomous	Subcapital Transcervical Basicervical Intertrochanteric Subtrochanteric	According to anatomical location of the fracture	number and percentage
Osteosynthesis material	Nominal qualitative polytomous	DHS Intramedullary nails Cannulated screws Angle plates External fixation Hemiarthroplsty Total arthroplsty	Depending on the material used to perform the osteosynthesis	number and percentage
Complications general	Nominal qualitative polytomous	Pneumonia Anemia Thromboembolic Bedsores Heart failure Delirium Others	According to morbidity caused by the disease or treatment	number and percentage
Complications local	Nominal qualitative polytomous	Surgical site infection Osteosynthesis material failure Periprosthetic fracture Delayed union Pseudarthrosis Others	According to morbidity caused by the disease or treatment	number and percentage
Preoperative stay	Continuous quantitative	< 48 hours ≥48 hours	According to time elapsed, in hours, between the date of admission and the date of surgery	number and Percentage Median Interquantile range Minimum Maximum
Postoperative stay	Continuous quantitative	0 – 23 24 -47 48 – 73 74 – 97 98 – 121 122 – 145 146 and more	According to time elapsed, in hours between the surgery date and the discharge date.	number and Percentage Median Interquantile range Minimum Maximum
Status upon discharge, 30 days, 6 months and a year	Nominal qualitative dichotomous	Alive Deceased	Depending on the patient's condition	number and percentage

Techniques and procedures

Techniques for obtaining data

The sources of information were the medical record of each patient included in the research, whose information was entered into a data collection form in which all general information related to the study was filed:

i. Informed consent form for participation (Annex 1).
ii. Data collection form for the included patients (Annex 2).

All the information was reviewed and classified to be later subjected to the different stages of statistical analysis.

Data processing and analysis techniques

With the information collected, a database was created in excel format of Microsoft Office version Windows 10, which was subsequently exported to the SPSS version 25.0 and Epidat version 3.0 system for analysis.

Statistical analysis

No intermediate statistical analyzes were carried out, only the one corresponding to the end of treatment.

To summarize the information of the study sample, descriptive statistics were used such as the arithmetic mean, standard deviation, minimum and maximum for all continuous and discrete quantitative variables that were analyzed.

For all qualitative variables, the absolute and relative frequencies of each group were calculated, p and OR value at the 95.0% confidence level.

The results were presented in the form of a table and/or graphs for better understanding.

Discussion and synthesis techniques

The results were presented and compared with the existing literature: clinical trials or descriptive or other published studies. The findings were discussed based on the stated objectives. Finally, the coincidences and contradictions between the present study and others reviewed were verified and conclusions were reached.

Procedures

Surgical technique

It is a procedure that was carried out under anesthesia with regional block (spinal) or general anesthesia. Once anesthetized, the patient is placed in the supine or lateral decubitus position depending on the type of fracture, on the orthopedic table. If it is an extracapsular fracture, reduction was performed through the use of an orthopedic traction table and confirmed with fluoroscope in the anterior-posterior positions and the lateral positions of the fracture.

The surgical field was prepared in the asepsis and antisepsis manner. Antibiotic prophylaxis was administered 30 minutes before the skin incision.

The approach was selected based on the type of fracture and the surgeon's preference. The most common type of fracture in the study was intertrochanteric and most surgeons used a fixed angle plate and the choice was a lateral approach. This procedure is described below:

i. A lateral longitudinal incision of 5 to 7 cm, depending on the length of the implant stem, was made from 3 to 5 cm below the greater trochanter.
ii. The incision was deepened to the subcutaneous tissue and the fascia was splitted.
iii. The vastus lateralis muscle was separated from its posterior intermuscular septum and retracted anteriorly with a Bennett retractor.
iv. Perforating branches of the lateral femoral circumflex artery were found and cauterized using diathermy.
v. The muscle fibers attached to the bone were separated using a deperiostizer.
vi. With the help of floroscopy, the entry point of the plate was determined and a Steinmann pin was passed as a guide.
vii. Holes were drilled through the cortex of the bone around the guide pin entrance and the entrance was widened with a 'rongeur'.
viii. The guide pin was removed and the 130-degree angle plate was slid through the middle and lower femoral neck toward the femoral head until the distance between the tip of the plate and the surface of the femoral head was approximately 25 mm using fluoroscope in AP and lateral views.
ix. The plate was then impacted against the bone surface and bicortical screws were secured in holes drilled in the stem of the fixed angle plate implant.
x. Finally, floroscopy was used to confirm the correct positioning of the distal and proximal part of the implant and iatrogenic fractures were also ruled out.
xi. The surgical wound was then closed in stages using absorbable sutures for muscle, fascia, and subcuticular tissues and nonabsorbable sutures for the skin.

Postoperative treatment

Immediate postoperative period until hospital discharge:

Control x-rays were performed.

Patients received adequate analgesia, antithrombolic prophylaxis, and were hydrated for 24 to 48 hours. Postoperative hemoglobins were performed within 24 hours.

Patients were encouraged to perform ankle plantarflexion activities and exercises, active back stretching, and isotonic quadriceps contraction. These activities helped eliminate swelling, promote venous reflux, and prevent deep vein thrombosis. Patients were reviewed daily by a multidisciplinary team until they were clinically stable for hospital discharge.

From hospital discharge until the last clinic visit

Patients continued oral analgesics and prophylactic antithrombolic medications at home. The wounds were dressed every 48 hours by family doctors. The patients continued to perform ankle plantar flexion activities and exercises, active back stretching, and isotonic quadriceps contraction. The first postoperative consultation was 15 days after surgery. The surgical wounds were inspected and the skin stitches were removed. Control radiographs were re-examined. The next consultation was 30 days later. The surgical sites were examined and radiographs were taken and examined. After 6 to 8 weeks, partial weight-bearing activity was initiated for the affected limb, and after 12 weeks, patients were able to walk completely on the affected limb with weight-bearing. Follow-ups continued at 6 months and 12 months before patients were discharged from the clinic.

Ethical considerations

The study was carried out in accordance with the provisions of the Declaration of Helsinki, amendment of Fortaleza, Brazil on research in human beings. Informed consent was requested from each participating patient. The objectives of the study were explained in detail to them, they were informed that entry into the study was completely voluntary and that if they did not accept they would have every guarantee of receiving adequate medical care with the conventional methods available, without this affecting their relations with the doctor or with the institution. The patients gave their approval in a document signed by themselves and by the author of the research (Annex 1).

This study was examined by the Scientific Council and the Ethics Committee of the "Fructuoso Rodríguez" Orthopedic Teaching Hospital and was approved.

The oral presentation or publication, in public or scientific written press, and/or in scientific or other events, of the partial or complete results of this study was carried out after mutual agreement by the main researchers at the time. They considered and guaranteed necessary ethical and the confidentiality of the individual data of the participating subjects.

Limitations of the study

The limitation of this study was the lack of resources during the COVID-19 pandemic.

Results

Of the 720 patients included in the analysis, 518 (71.9%) were female; 155 fall in the age group between 80 and 84 years (21.5%), 120 in the group between 85 and 89 years (16.7%) and 116 in the age group between 75 and 79 years (16.1%). (Table 1). Age ranged between 65 and 99 years, and the mean was 82 years (SD=8.5); in males, the mean was 84 years (SD=8.9) and in females it was 81 years (SD=8.2), with no statistically significant differences between both sexes (p=0.5605) (Table 2).

Table 1 Distribution of patients according to age and preoperative time.

Age	Less than 48 hours.		48 hrs. and more		Total		P Value	OR
	#	%	#	%	#	%		
65-69	3. 4	5.2	5	8.2	39	5.4	0.4795	1.641282
70-74	81	12.3	7	11.5	88	12.2	0.9855	0.925011
75-79	143	21.7	10	16.4	153	21.3	0.4205	0.707528
80-84	199	30.2	16	26.2	215	29.8	0.6159	0.821887
85-89	150	22.8	13	21.3	163	22.7	0.9211	0.919028
90-94	47	7.1	8	13.1	55	7.6	0.1524	1.965476
95-99	5	0.7	2	3.3	7	1.0	0.2161	4.433898
TOTAL	659	100.0	61	100.0	720	100.0		

Source: Data collection form

Table 2 Distribution of patients according to sex and preoperative time.

Sex	Less than 48 hours.		48 hrs. and more		Total		P Value	OR
	#	%	#	%	#	%		
Male	182	27.6	20	32.8	202	28.1	0.4772	1.278478
Female	477	72.4	41	67.2	518	71.9	0.4772	0.782180
TOTAL	659	100.0	61	100.0	720	100.0		

Source: Data collection form

With regards to the laterality of the fractures, 68.8% occurred in the right hip with 423 patients and 41.2% in the left hip with 297 patients (Table 3).

Table 3 Distribution according to fracture laterality and preoperative time.

Lateralide	Less than 48 hrs.		48 hrs. and more		Total		P Value	OR
	#	%	#	%	#	%		
Left	273	41.4	24	39.3	297	41.2	0.8571	0.917137
Right	386	58.6	37	60.7	423	58.8	0.8571	1.090350
Total	659	100.0	61	100.0	720	100.0		

Source: Data collection form

The type of fracture that predominates is the extracapsular with 471 patients representing 65.4%. 249 patients representing 35.0% had intracapsular fracture. Among the extracapsular, 61.0% are intertrochanteric with 442 patients and only 4.0% are subtrochanteric. In intracapsular fractures, subcapital fractures predominate with 229 patients representing 32.0% (Table 4).

Table 4 Distribution according to type of fracture and preoperative time.

Fracture type / Preoperative time				<48hrs		≥48 hours		P Value	OR
Fracture type	#	%	Subtype	#	%	#	%		
Extracapsular	471	65.4	Intertrochanteric	408	61.9	34	55.7	0.4178	0.774691
			Subtrochanteric	26	3.9	3	5.0	0.9766	1.259284
			Subcapital	208	31.6	21	34.4	0.7522	1.138341
Intracapsular	249	34.6	Transcervical	11	1.7	2	3.3	0.6887	1.996918
			Basicervical	6	0.9	1	1.6	0.8990	1.813889
Total	720	100.0		659	100.0	61	100.0		

Source: Data collection form

Reduction and osteosynthesis is the most used surgical technique with 462 cases representing 64.2%, followed by hemiarthroplasty with 244 cases representing 33.8% and external fixation with 10 cases representing 1.4% (Table 5). Within the reduction and osteosynthesis, the use of the angular blade predominates with 89.7% follow by DHS with 7.8% (Annex 3).

Table 5 Distribution according to type of surgical intervention and preoperative time.

Type of surgical intervention	<48 hours		≥48 hours		Total		P Value	OR
	#	%	#	%	#	%		
Reduction and Osteosynthesis	424	64.3	38	62.3	462	64.2	0.8579	0.915710
Hemiarthroplasty	223	33.8	21	34.5	244	33.8	0.9612	1.026457
Total arthroplasty	3	0.5	1	1.6	4	0.6	0.7717	3.644444
External fixation	9	1.4	1	1.6	10	1.4	0.6913	1.203704
Total	659	100.0	61	100.0	720	100.0		

Source: Data collection form

The highest number of cases were admitted on Tuesday, Wednesday and Monday with 19.0%, 18.8% and 17.9% respectively. 91.5% of patients were operated in less than 48 hours. Among the 8.5% patients operated at 48 hours or later, the majority, 44.3% patients were admitted on Friday and with statistically significant differences between the two groups (p=0.0000) (Table 6).

Table 6 Distribution according to the day of the week of admission and preoperative time.

Pre-op Stay and Day of week of admission	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total	%
< 48 hours	126	133	130	124	12	53	81	659	91.5
≥ 48 hours	3	4	5	4	27	eleven	7	61	8.5
Total	129	137	135	128	39	64	88	720	100.0
%	17.9	19.0	18.8	17.8	5.4	8.9	12.2	100.00	
P value	0.0095	0.0154	0.0418	0.0264	0.0000	0.0169	0.9858		
OR	0.218801	0.277536	0.363324	0.302773	42.816176	2.515472	0.925011		

Source: Data collection form

In those operated early, the majority (45.8%) had a postoperative stay of up to 2 days, but of those operated late, the majority (41.0%) had a postoperative stay equal to or more than 5 days, with statistically significant differences between the two groups. (p=0.0000) (Table 8).

Table 7 Distribution according to postoperative stay and preoperative time.

Postoperative stay	Early surgery (<48 hrs)		Delayed surgery (≥48 hrs)		P Value	OR
	#	%	#	%		
1 day	21	3.2	1	1.6	0.0801	0.506349
2 days	302	45.8	3	5.0	0.0000	0.061144
3 days	248	37.6	11	18.0	0.0036	0.364597
4 days	54	8.2	21	34.4	0.0000	5.881944
5 days and more	34	5.2	25	41.0	0.0000	12.765523
Total	659	100.0	61	100.0%		

Source: Data collection form

In 56.7% of the cases the reason for the delay was organizational, in 33.3% it was due to patient medical problems and in 10% it was due to coagulation (Figure 6).

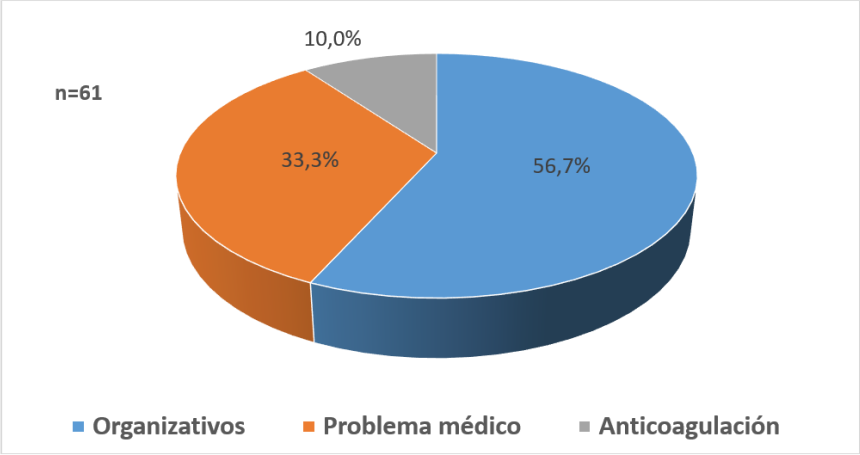

Figure 6 Main reasons for surgical delay.

Source: Data collection form

Anemia occupies first place among complications in both patients operated before and after 48 hours with p value (p=0.0000) between the two groups statistically significant and odd ratio of 7.5703, followed by surgical site infection with statistically significant p of 0.0000 between the two groups and an odd ratio of 6.8683. The other common complication encountered are pneumonia, implant or osteosynthesis material failure, urinary tract infection, periprosthetic fracture and bedsores (Table 8).

Table 8 Preoperative time and postoperative complications.

Complications	<48 hours (n = 659)		≥48 hours (n = 61)		p value	OR
	#	%	#	%		
Anemia	32	4.9	17	27.9	0.0000	7.570313
Surgical site infection	25	3.8	13	21.3	0.0000	6.868333
Pneumonia	8	1.2	5	8.2	0.0006	7.265625
Osteosynthesis material failure	7	1.1	5	8.2	0.0003	8.316327
Urinary tract infection	5	0.8	4	6.6	0.0010	9.178947
Periprosthetic fracture	4	0.6	2	3.3	0.1443	5.550847
Bedsores	4	0.6	4	6.6	0.0003	11.491228

88.3% of patients operated in less than 48 hours did not present any complications. The majority of complications were in the group operated at or after 48 hours; 26.2% with only one complication; 21.3% with two complications and 11.5% with three or more complications (Table 9).

Table 9 Preoperative time and number of complications

Number of complications	Early surgery (<48 hrs.) N = 659		Delayed surgery (≥48 hrs.) N = 61		p value	OR
	#	%	#	%		
None	582	88.3	25	41	0.0000	0.091877
1 complication	33	5	16	26.2	0.0000	6.744781
2 complications	25	3.8	13	21.3	0.0000	6.868333
≥3 complications	19	2.9	7	11.5	0.0021	4.366472

Source: Data collection form

The total mortality among the 720 patients was 15 (2.1%); 8 (13.1%) were among those delayed and 7 (1.1%) were among those early. Mortality was higher at one month in those operated on from 48 hours and more with 4.9% followed by 3.3% at 6 months and with those who were in the hospital at the time of death and with statistically significant differences between those operated early (Table 10).

Table 10 Postoperative mortality and preoperative time

	Early surgery (<48 hrs.) N = 659		Delayed surgery (≥48 hrs.) N = 61		Value of p	OR
Mortality	#	%	#	%		
In-hospital	1	0.2	2	3.3	0.0096	22.30509
At 1 month	1	0.2	3	4.9	0.0001	34.03448
At 6 months	2	0.3	2	3.3	0.0366	11.13559
At 12 months	3	0.4	1	1.6	0.7717	3.644444
Total deaths	7	1.1	8	13.1	0.0000	14.0593

Source: Data collection form

Discussion

The present work addressed hip fracture as a health, economic and social problem where aging of the population plays a determining role. The results showed that the incidence of hip fractures increases with age in both sexes, but women tend to have a higher incidence than men, with the right hip being the most frequently affected. Extracapsular type fractures were the most common and of them the intertrochanteric fracture predominated. In most of these cases, reduction and osteosynthesis with fixed angle blade was surgical treatment applied. The largest number of patients were operated in less than 48 hours, experiencing a short preoperative and postoperative stay and less complications. The main reasons for the delay were organizational reasons and patients' underlying medical problems, and the main complications were anemia and surgical site infection with a high mortality in those operated at 48 hours or more. These results are similar to the findings of similar studies carried out in Cuba and some regions of the world.

There are numerous studies examining the relationship between age, sex and hip fractures. In the research there is a predominance of the female sex (71.9%). The age group with higher number of cases was 80 to 84 years representing 29.8% of the total, and it is assumed by the structure of the demographic pyramid of the province where the relationship of female/male is higher. In addition, the data from the 2020 book of annual health statistical confirm the predominance of the female sex in the Cuban population.[119] This can be attributed to several factors, including: osteoporosis and differences in the risk of falls, even its incidence may vary in function of other individual and population risk factors.

In a study conducted by Lin KB in Taiwan, the incidence of hip fractures in the elderly was approximately twice as high in women as in men. Age-specific incidence rates for hip fractures increased significantly in both sexes. The average annual increase rates were 9.5% and 7.6% in men and women respectively. These trends in hip fracture incidence increase monotonically over time.[120]

Sánchez Delgado's studies recognize that the epidemiological behavior of hip fracture was conditioned by the predominance of ages over 70 years, at the expense of the female sex.[121] Kebaetse in Botswana, relate the predominance of fractures in people over 50 years of age but in that case, the male sex predominated[122] in contrast to the finding in this research.

Regarding the laterality, right hip fractures predominated in our study, this finding corresponds to what was described by Cuenca in his research on the evolution of hemoglobin and hematocrit according to the type of hip fracture, where there was a predominance of the right limb in the patients studied.[123] Rodríguez González in a study carried out in Spain on the influence of the delay in hip fracture surgery in the elderly on post-surgical medical complications also found this result where the largest number of the cases studied presented the fracture in the right limb.[2]

There are two types of hip fractures that predominate in the general population and are managed in different contexts: intracapsular fractures and extracapsular fractures. In this research there is a predominance of extracapsular fractures with the most frequent being the intertrochanteric subtype. Extracapsular fractures occur outside the capsule of the hip joint; these fractures are more common in older adults and are often the result of a fall. In studies by Sánchez Delgado in Cuba, the same predominance was found and it was demonstrated that intracapsular fractures have a low risk of occurrence, a situation determined by the anatomy of the hip and the factors that cause the fracture; and the

epidemiological study by Kebaetse in Botswana also recognized this phenomenon. Correoso Castellans in a study carried out in Spain on the delay in hip fracture surgeries and its influence on morbidity and mortality found the same result.[121,122,124] Several international publications on sites echo this phenomenon, also reporting that fractures of the neck of the femur, also known as femoral neck fractures, are common injuries suffered by older patients who are more likely to have gait instability and bones with reduced mineral density, which predisposes to fracture. Older women with osteoporosis are at higher risk.[125,126]

Studies by Tanner and Kloseck suggest that in women the proportion of hip fractures that occurred at the intertrochanteric site increases significantly with age in all four age groups ($p < 0.001$), while the proportion of intertrochanteric hip fractures among men decreases with age ($p = 0.025$). The mean age of women with intertrochanteric fractures is significantly more than that of those with subcapital fractures, while men with intertrochanteric fractures are younger than men with subcapital fractures.[127]

As for treatment, surgery is often necessary to repair a hip fracture. Choosing the type of surgery depends on several factors, including the location and severity of the fracture, the patient's age, general health, and personal preferences. Reduction and osteosynthesis was the most used surgical technique in the study of the cases, being used in more than 64% of the patients. It is striking to note that fixed angle blade, instead of DHS is still the implant much used in Cuba with considerably good outcome.

Several authors of international studies issue certain criteria. Palm in his study found that nondisplaced femoral neck fractures appear to be adequately treated with parallel screws/pins or a sliding hip screw, whereas displaced femoral neck fractures should receive a prosthesis in elderly patients. Stable intertrochanteric fractures are well treated with a sliding hip screw, while intramedullary nails seem better for unstable intertrochanteric and subtrochanteric fractures[128] and, Sharon Babcock in her study found that failed internal fixation of intracapsular hip fractures is usually treated with arthroplasty, while extracapsular proximal femoral nonunions may be amenable to revision of internal fixation or arthroplasty. Although not a classic hip fracture, bisphosphate-associated subtrochanteric femur fractures affect a similar patient population and are historically difficult to treat.[129]

Franka S. Würdemann in the Netherlands and different surgical specialists treat different types of hip fractures and have different preferences regarding implants for hip fracture surgery in comparable patients.[130] In the study carried out by Lin KB in Taiwan, most intertrochanteric fractures received the same treatment, which is open reduction fracture surgery, in those techniques they show that different surgical treatment approaches were used in young and elderly adults when their fracture types were the same. There was an obvious difference in the treatment used in different age strata for different types of fractures: there were fewer joint replacements for those under 60 years of age than for those over 60 years of age.[120]

Waiting time for surgery after a hip fracture provides a measure of access to care. Waiting time may be influenced by comorbid conditions, hospital transfers, and practice differences or related to certain types of medications, such as anticoagulants. However, longer waits may indicate lack of resources, physician unavailability, and/or other issues related to access to care.

Regarding the preoperative length of stay in our study, the cases that were operated on in less than 48 hours predominated (91.5%), the highest percentage (46.3%) was operated before 24 hours and the weekdays with most admissions were Tuesday with 19% of the patients followed by Wednesday and Monday respectively. Among the patients operated on before 24 hours, the majority (33.6%) were admitted on a Thursday and among those operated on at 48 hours or more, the majority (44.3%) were admitted on a Friday. The main causes of delayed in performing surgery were organizational such us lack of functioning operating rooms on weekends and holidays; unavailability of implants, sterile gowns, blood and others. This was followed by the decompensation of the patients underlying medical conditions such as hypertension, heart failure and diabetes mellitus. Problems with coagulation was another factor that caused delayed. Several studies correspond to these results.

Barnea in a study conducted in Israel obtained the similar results and was able to demonstrate a significant decrease in mortality for hip fracture patients who underwent hip fracture repair within 48 hours of admission and demonstrated that the day of the week a patient is admitted may influence the length of preoperative stay, finding that patients admitted on the weekend were 15% more likely to experience delays in surgery, which may be related to the reduced availability of surgical staff and resources during weekends.[131] Klestil in a meta-analysis conducted in Canada found similar results and showed that for elderly patients suffering from hip fracture, early surgery is associated with a reduction in mortality and perioperative complications, in addition patients operated on within 48 hours had 20% less mortality at 1 year and associated that the Operative delay in older patients with hip fracture is associated with an increased risk of postoperative complications and mortality.[132]

In our study, the predominant postoperative stay is 24 to 47 hours (49.9%). In the meta-analysis carried out by Klestil it showed that the average length of preoperative stay varied from 24 to 72 hours, while postoperative stay ranged from 3 to 15 days. Several factors contributed to these ranges, including the need for medical stabilization, the availability of operating rooms, and the presence of comorbidities that required additional management.[132] A crucial finding of the analysis was the clear correlation between a prolonged preoperative stay and an increase in postoperative stay, suggesting that preoperative delays may prolong patient recovery. The study of Klestil suggested that early surgery is associated with a reduction in mortality and perioperative complications and patients operated on within 48 hours had 20% less mortality at one year.[132] The Canadian Institute for health reported that operative delay in older patients with hip fracture is associated with an increased risk of postoperative complications and mortality.[133]

Among the main causes responsible for these delays we find first the organizational ones with a high percentage (56.7%) followed by medical problems and coagulation, these results correspond with other international studies. Thomas in a study carried out on the impact of surgeries in patients with fractures finds this similar result and suggests that the timing of surgery for patients with hip fractures remains a challenge, as it requires multidisciplinary coordination between different occupational groups and the availability of adequate surgical capacity with competent personnel and appropriate equipment.[132]

Emmerson B.R, in his study finds that waiting time has been influenced by comorbid conditions, transfers to the hospital and practice differences related to certain types of medications such as anticoagulants and established that the most common reasons for delay found in the study were: need for additional medical stabilization (30%), lack of availability of operating rooms (25%) and the need for additional preoperative tests (20%) and in some cases he stated that delays were due to the need to obtain consent for surgery.[133]

The main complications that occurred in patients with hip fracture where there was a delay were, firstly, anemia in 27.8%, followed by surgical site infection in 21.3%, pneumonia 8.2% and others. These results are similar to results in several studies. In some cases, surgical site infections occupy the first place, as in the study by Emmerson BR, where infection rates after surgical treatment of a fractured hip range between 0.6 and 3.6%, but vary depending on the type of operation, in which case the study describes other generic surgical complications including postoperative pain, bleeding, neurovascular injury, and wound problems, and explains that specific complications of arthroplasty include dislocation, loosening, wear, leg length discrepancy, and periprosthetic fractures. For fixation devices, recognized complications are failure of fixation or metal work, vascular necrosis, and nonunion.[134]

In the study carried out by Lin KB demonstrate the appearance of a set of complications that correspond to what was found in our study.[120] The study of Klestil established that early surgery is associated with reduced mortality and perioperative complications. Patients operated on within 48 hours had 20% less mortality at one year; these early hip surgeries within 48 hours are associated with a lower risk of mortality and fewer perioperative complications.[132]

The predominant mortality in our study was that of patients operated on at 48 hours or more with a mortality rate at 1 year of 13.1% and 4.9% within one month of post-surgery; result that corresponds to studies that suggest that delay can cause complications and death in some patients. De Luca, in his research on mortality in these type of patients, suggests that advanced age, male sex, number of comorbidities, preoperative state of activities of daily living (ADL), general anesthesia, hospitalization time and transfer to other services were significantly related with mortality rate.[135]

Barnea in his study was able to demonstrate a significant decrease in mortality for patients with hip fracture who underwent fracture repair within 48 hours of admission,[131] just as Thomas stated in his research that the absolute risk of dying within 12 months was 21% in patients who had surgery after 48 hours and 17% in patients who had surgery within 48 hours, resulting in a 20% lower long-term mortality risk in patients operated on within 48 hours.[133]

The results of this research are not far from what is described in the national and international literature and we hope that the information presented here serves to focus attention on this critical problem and to stimulate new research and improve the treatment of hip fractures. In the rapid and timely care of hip fractures every second counts, and every second we can gain through better research and medical practice is a win for both patients and our healthcare system as a whole.

Conclusions

Hip fracture predominated in patients in the eighth decade of life, mainly females. The most frequently observed varieties of fractures were intertrochanteric fractures. Reduction and osteosynthesis with a 130º fixed angle blade was the most commonly used surgical treatment.

i. The main causes of surgical delay were organizational and medical problems of the patients.

ii. The surgical intervention was performed in the first 47 hours after admission, and in those who were not operated on within this period, high rates of complications and mortality occurred.

Recommendations

i. Socialize the results of this research through scientific events and publications.

ii. Carry out comparative studies in the post-Covid-19 stage.

Declaration

I, Philip Kwadwo Krah Baabiineh, hereby declare that this study is my own original research and has not been submitted or published anywhere else, whether in whole or in part, for other academic fulfillment and all references cited have been duly recognized.

Dedication

This research is dedicated to my family and all my teachers who taught me.

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First of all, I thank God for the strength to do this work.

I also want to thank my family and the government of Ghana for their support in various ways for my studies in Cuba.

I would like to thank my tutor and all the professors at the “Fructuoso Rodríguez” Orthopedic Teaching Hospital (HODFR) for their help in various ways. Thank you so much everyone.

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Without forgetting the patients and their families who voluntarily participated in this research, I am eternally grateful for your participation.

May God bless each and everyone for their contribution that led to the completion of this thesis.

APPENDIX

Appendix 1: Informed Consent

I,…… …… I agree to participate in the research titled: **Influence of surgical delay on complications in older adults with hip fracture**

It has been explained to me that this study aims to evaluate

the influence of surgical delay in older adults with hip fracture regarding post-surgical morbidity and mortality, treated at the "Fructuoso Rodríguez" Orthopedic Teaching Hospital in the period January 2021 to December 2022.

My participation is voluntary, for which I sign this informed consent along with the doctor who gave me the explanations.

In Havana on the……day of the month……of the year 20……

…… ……

Patient's signature. Physician's Signature

Appendix 2. Data collection form.

First and Last Name: _____ _ HC: _____ID:_____

Age:_____ Sex: Male: ____ Female: ____

Entry day:_____ Date:_____ Time:_____ am__ / pm__

Injury mechanism: Direct: ____ Indirect: ____

Affected hip: Right __ Left: ____

Fracture type:

Intracapsular: ___ (Subcapital: ____ Transcervical: ____ Basicervical: ____)

Extracapsular: ____ (Intertrochanteric: ____ Subtrochanteric: ____)

Comorbidities

None: ____ HTN: ____ Diabetes mellitus: ____ Ischemic heart disease: ____ Stroke: ____ CRF: ____ COPD: ____ Psychiatric disorders: ____ other:_____

Pharmacotherapy: antiaggregation:____ anticoagulation: ____ antibiotics:_____

ASA surgical risk : I___, II____, III____ IV____.

Operative date:_____Time:____am/pm Preoperative stay: _____ hours

Surgical delay (≥48 hours): Yes: ___ NO: ____

If delay, reason for surgical delay:

Organizational: __ Antiplatelet: __ Anticoagulation: __ Medical problems: ___ COT study:__ Other: _____ Briefly describe the cause of delay _____

Type of anesthesia: Spinal__ Spinal + catheter__ General___

Type of surgical treatment:

(to) Reduction and osteosynthesis: _____

(Osteosynthesis material: DHS: ____ Cannulated screws: ___ Angle blade: ____ External fixation: _____)

(b) Arthroplasty: ____(Hemiarthroplasty: ____ Total arthroplasty: ____)

Post-surgical complications

Surgical site infection: ____ Anemia___ (Transfusion: Yes: ____ No: _____)

Pneumonia: ____ Heart failure: ____ Delirium: ____

Thromboembolic events: ____ Bedsores: ____ Failure of implant:__ Periprosthetic Fx:___ Pseudoarthrosis__ Malunion__ Nonunion___ Other: ____ None: _____

Date of discharge from hosp: _____Time: _____ am__ / pm___

Total stay:_____ days. Preoperative stay: _____hours

Status upon discharge: Alive: ____ Deceased: ____

Status at 30 days: Alive: ____ Deceased: ____ (date: _____)

Status at 6 months: Alive: ____ Deceased: ____ (date: _____)

Status at 12 months: Alive: ____ Deceased: ____ (date: _____)

Annex 3 Distribution according to reduction and osteosynthesis technique.

Lamina angulares = fixed angle blades

DHS = Dynamic hip screw

Tornillos canulados = Canulated screws

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