Original Paper

Assessment of Surgical and Non-surgical Outcomes in Patients with Dementia and Hip Fractures

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ABSTRACT: Introduction: The aging population is associated with increased osteoporosis and risk of hip fractures. Cognitive decline has recorded exponential increases in the last decades, with the rise in life expectancy. Material and methods: We conducted a prospective study on 65 patients over 65 years old associated with dementia and hip fractures. We used pre-and post-treatment variables such as age, type of fracture, type of treatment, Charlson Comorbidity Index (CCI), EQ-5D-5L score, and the Harris hip score (HHS) to assess pain, mobility, and mortality. We performed follow-ups at 6 months, 1 year, 2 years, and 3 years. Results: Patients with dementia typically arrive at the hospital without any previous analgesic treatment and receive lower doses due to poor pain recognition. The 6-month mortality rate was 48.22% and increased to 78.46% at 3 years. The best survival rates were in patients with bipolar prosthesis and Gamma nails, with a 3-year survival rate of 40% and 50%, respectively. Conclusions: Patients with dementia have a higher mortality rate compared to cognitively intact patients and the treatment decisions require a multidisciplinary team and individualized recommendations for each patient, due to high surgical risk in the elderly.

KEYWORDS: *Austin Moore prosthesis, DHS, dementia, Gamma nail, hip fracture, hip arthroplasty, joint replacement, mortality, pain management.*

Introduction

Globally, 8.5% of people are over 65, according to data from 2015. It is expected for the elderly to rise at an unprecedented rate over the next 15 years, accounting for 12% of the world's population [1].

Worldwide dementia prevalence is expected to double every 20 years, with an estimated 81 million cases by 2040, rising from 3.0% among people aged 65 to 74, to 18.7% at 75-84 years and 47.2% in people over 85 years old [2,3].

The number of patients with dementia exponentially increased in Romania from 1990 to 2015 by about 82.82% per 100,000 people, moving this pathology from 26th place to 12th in the ranking of the country's most frequent diseases [4].

Reducing the risk factors associated with depression, decreased cognitive function, and stroke is the first step in preventing dementia from early developing. Increased cortisol levels generated by stress and accompanying trauma may explain the brain damage to the cognitive areas of the brain linked to particular alterations in memory and executive function. Post-traumatic stress disorder (PTSD), a severe clinical disease that may develop during a life-threatening event and subsequently result in dementia, is twice as common in veterans of war.

Chronic stress, associated with elevated cortisol, may lead to hippocampal atrophy. Acute illness and hospitalization, delirium, and pain are potential sources of trauma that may increase vulnerability to PTSD in older adults. Trauma to the brain is one risk factor that raises the likelihood of dementia. Other risk factors that can cause mental illnesses include low IQ, a lack of education, cardiovascular diseases, and drug use [5-7].

Hip fractures increase over time with aging, osteoporosis, comorbidities and trivial trauma

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and are associated with increased morbidity and mortality risks [8-10].

These are classified into intertrochanteric fractures and neck fractures, each requiring distinct treatment approaches.

Contradictory findings have been found in several studies that have examined the decrease of ambulatory function in relation to pre-fracture level. Some found higher loss in individuals with greater independence before the fracture, whereas others reported a more noticeable loss in those with less previous autonomy. Most of these researches involve various fracture types and their corresponding therapies [11,12].

Fractures may lead to reduced mobility, making it difficult for older adults to perform daily activities independently. This decreased mobility can also result in a loss of independence and potentially contribute to social isolation. This loss of function may be temporary or permanent depending on the fracture's severity and the effectiveness of rehabilitation. The elderly is more prone to developing complications after hip arthroplasty such as delirium, infections, blood clots, bedsores, and pneumonia.

Hip fractures are associated with an increased risk of mortality, especially in males with a probability of 7.95%, while in females it is found in a proportion of 5.75% [13-15].

Selecting the appropriate surgical procedure for a hip fracture in an elderly patient's femur neck might be simple at times. The most challenging situations occur between these two extremes, where the patient's life expectancy becomes a crucial factor. People who live long enough to benefit from total hip arthroplasty will only experience its advantages [9].

Patients with dementia and hip fractures represent a considerable challenge and require an integrated approach that takes into account the patient's medical and cognitive needs. Pain is a frequent symptom in the old population, experienced in up to 80%, of whom over half of them are diagnosed with a form of cognitive impairment [16].

Pain is frequently undertreated in patients with severe dementia, due to poor capability of verbally expressing the pain. These patients typically receive lower doses of analgesics; some studies reported up to 3 times lower doses of analgesics in patients with advanced dementia, compared to the general population [17], which will increase the risk for delirium. Anxiety and depression are key items to follow and evaluate because they are related to dementia outcomes and might worsen dementia patients' symptoms [18].

This study aims to highlight the importance of surgical intervention and pain control in patients with dementia and hip fractures.

Materials and Methods

We conducted a prospective cohort study between January and December 2020 at the Emergency County Clinical Hospital Saint Apostol Andrew, Galati, Romania. There were 84,017 presentations in the emergency unit (EU), of which 2,167 (2.57%) were patients with fractures that required hospitalization and surgical intervention. 520 (23.99%) of hospitalized patients had a hip fracture type as shown in Figure 1.

In the first quarter of the year, there were 119 patients (22.88%), 122 patients (23.46%) between April and June, 162 patients (31.15%) between July and September, while in the last quarter of the year was observed a decreasing number of patients with 117 cases (22.50%). We selected 65 (12.50%) patients who associated dementia, detected in various stages.

We included in our study all the patients aged over 65 years old, with acute hip fractures. These patients were treated either conservatively or surgically and had either previously been diagnosed dementia or were diagnosed during the current hospital presentation. The exclusion criteria were age under 65 years old, patients with hip fractures who did not associate dementia or chronic fractures/diseases, and coxarthrosis.

We used preoperative variables such as age, sex, comorbidities, Charlson Comorbidity Index (CCI) to appreciate the stratified risk before surgery and the mortality risks at 1-year, Mini Metal State Examination (MMSE), Mini-Cog, Moca. After admission to the orthopedic clinical department, the patients were classified according to the Reisberg scale in one of the 7 stages of dementia.

Postoperative variables included hospitalization days, mobilization after surgery, and complications such as infections, cut-outs, and mechanical failure. We used EQ-5D-5L score before and after treatment for both surgically and non-surgically treated patients, to assess the health state, the quality of life of the patients with dementia, and the mortality rate. The Harris hip score (HHS) was used to evaluate pain, patient mobility, walked distance, physical activities, thigh flexion capacity, abduction capacity, external rotation and the need for help.

Surgical fixation was performed with Dynamic hip screws (DHS) (Synthes), Gamma nail 2 (Stryker), Austin Moore prosthesis (AMP)

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(Valdomedica), and bipolar prosthesis (Biotechnic).

Data were assessed using IBM SPSS Statistics software version 25 and Python (version 3.7.9).

We applied descriptive statistics to summarize the demographic and clinical characteristics of the patients. For group comparisons, we employed t-tests for continuous variables and chi-square tests for categorical variables. Kaplan-Meier survival analysis was conducted to evaluate the survival rates, and the log-rank test was used to compare survival curves. Multivariate Cox proportional hazards regression analysis was performed to identify independent predictors of mortality. An ANOVA test was used to analyze differences between multiple groups. When the ANOVA indicated significant differences, post hoc analyses using the Tukey test were performed to identify specific differences between pairs of categories.

A p-value of <0.05 was considered statistically significant.

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Clinical Emergency Hospital, Galati, Romania. The ethics committee of the hospital approved the study, and we obtained informed consent from each patient.

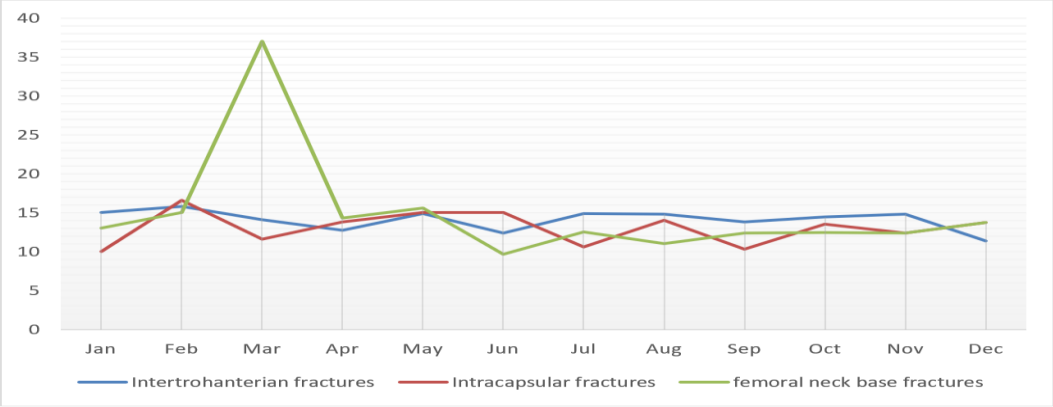

Figure 1. Distribution of cases according to the type of fractures and admission month.

Results

Pain level assessment

In our study group, we noted a high incidence of dementia reaching 12.69%.

It was found that the pain level ranged from medium to severe pre- and postoperatively, with an average pain level of 4.

Extremely severe preoperative pain was noted in 53.85% of the patients, while 29.2% had severe pain, and the rest of 7.15% had moderate pain. At admission, the mean anxiety or depression level was moderate. To reduce the patient's pain level, they were administered drugs such as anti-inflammatory drugs, pain relievers, and opioids.

We typically used paracetamol (acetaminophen) as first-line analgesia, known for its effects in reducing both pain and agitation in patients with dementia and noticed 25% lower doses in the first 48 hours, compared to the regular doses used in cognitively intact patients.

The impairment of patients with dementia to relate the pain may explain this. Patients with severe dementia have the brain areas involved in coding perception and language damage, which may mislead the observational evaluation by the medical staff.

Treatment management and mortality rate associated

Treatment management of patients with dementia and hip fractures is complex and sometimes requires delicate decisions that involve uncertain risks and benefits. The multidisciplinary team comprising an orthopedic surgeon, anesthetist, geriatrician and internist, must plan the treatment, tailoring it to each patient. This team should consider the patient's coexisting comorbidities, life expectancy, prognosis, and care preferences, while ensuring the patient's physical and mental health of the patient throughout their remaining life.

Of the group of 65 patients with dementia and hip fracture, 41 patients were operated and 24 patients were functionally treated. Thirty (46.15%) cases had femoral neck fractures, while 32 (49.22%) cases had pertrochanteric fractures and 3 cases subtrochanteric region fractures (4.62%) We classified our study group into 4 subgroups operated/ non-operated patients who deceased during hospitalization and operated/non-operated patients discharged alive (see Figure 2 and Table 1).

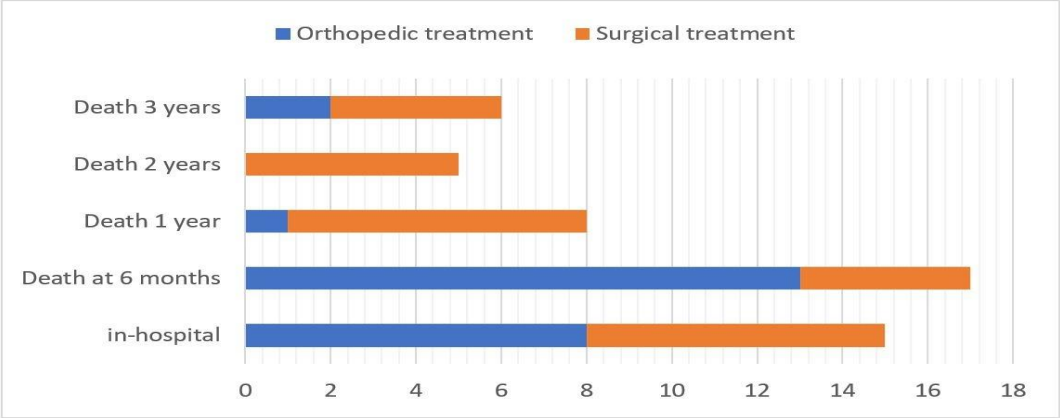

Figure 2. Distribution of overall mortality rate based on the type of treatment.

Table 1. Mortality rate depending on treatment type.

	In hospital	6 months	1 year	2 years	3 years	Cumulative total
Surgical treatment (n=41)	7(10.77%)* 17.07%**	4(6.15%)* 9.75%**	7(10.77%)* 17.07%**	5(7.70%)* 12.20%**	4(6.15%)* 9.75%**	27(41.54%)* 65.84%**
Bipolar prosthesis	1	2	1	1	-	5
Moore prosthesis	1	-	2	2	1	6
DHS	3	1	4	1	1	10
Gamma nail	1	1	-	1	-	3
Screws	1	-	-	-	-	1
Blade plate	-	-	-	-	2	2
Functional treatment (n=24)	8(12.30%)* 33.33%**	13(20%)* 54.17%**	1 (1.54%)* 4.17%**	0%	2(3.08%)* 8.33%**	24 (36.92%)* 100%**
TOTAL (n=65)	15(23.07%)*	17(26.15%)*	8 (12.31%)*	5 (7.70%)*	6 (9.23%)*	51 (78.46%)*

**reported to the whole study group*

*****reported to the matched subgroup (surgical or functional treatment)***

The ANOVA test revealed significant differences in the survival rates among different treatment types ($F(6, 58)=5.31$, $p<0.001$). The posthoc analysis using Turkey test indicated that:

- Patients treated with Gamma nails had significantly higher survival rates compared to those treated with Functional treatment ($p=0.0157$).

- Patients treated with Bipolar prosthesis had significantly higher survival rates compared to those treated with Functional treatment ($p=0.0124$).

- Patients treated with DHS had significantly higher survival rates compared to those treated with Functional treatment ($p=0.0141$).

We also performed chi-square tests to compare categorical variables. For instance, the comparison of complication rates between different treatment types showed significant differences ($chi^2=11.99$, $df=6$, $p=0.062$).

These results are illustrated in Figure 3.

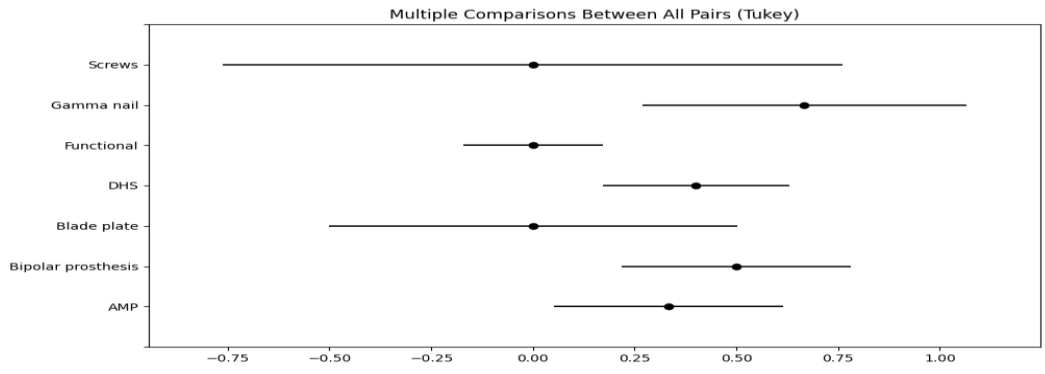

Figure 3. Estimated survival according to the type of treatment using the CCI score. Significant differences between groups were determined using ANOVA followed by the Tukey post-hoc test (p<0.05).

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The average days from admission to surgery were 2.76 days, ranging from 2 to 4 days. The average number of hospitalization days for intertrochanteric fractures was 14.1 days, 13.05 days for intracapsular ones, and 14.9 days for femoral neck base fractures.

The overall mortality was 23.07% during hospitalization, which increased to 48.22% at 6 months, 61.53% at 1 year, 69.23% at 2 years, and reached 78.46% at 3 years. Fifteen patients died during hospitalization, of which only 13 (86.67%) were admitted to the traumatology department, while 3 patients (13.37%) were admitted directly into the intensive care unit (ICU); 7 (46.67%) of them underwent surgical treatment and the other 8 (53.34%) were functionally treated. The 7 surgically treated patients from the subgroup of patients that died during hospitalization were performed surgical intervention as follows - 5 (71.43%) patients had pertrochanteric fractures where osteosynthesis was performed with Dynamic Hip Screw (DHS) systems in 3 cases, Gamma nail and screws in one case, and 2 patients (28.57%) had fractures of the base of the femoral neck that were operated with bipolar prosthesis and AMP, respectively. Three (20%) out of the 15 in-hospital deceased patients had previous hospitalizations and history of other surgeries as follows: one patient had previous femoral neck fracture surgery on the contralateral side, the second had a humerus fracture treated with Kuntscher rod, and the last of them suffered various abdominal wounds.

Thirty-four (68%) patients of the 50 patients discharged alive underwent surgical treatment. The mortality rate was 11.76%, at 6 months, 32.35% at 1 year, 47.05% at 2 years follow-up, and 58.82% at 3 years. Reported to the subgroup of surgically treated patients the mortality rate was 17.07%, 26.82%, 43.89%, 56.09%, and 65.84% at 6 months, 1, 2 and 3 years follow-up, respectively with a survival rate of 34.16% at the end of the follow-up). The surgically treated patients showed a lower mortality rate of 65.84% (reported to surgically treated subgroup of patients) at 3 years, while the functionally treated patients had no survivals at the end of the follow-up. Twenty (58.82%) of those surgically treated and discharged alive patients had fractures at the level of the trochanteric region, and 14 (41.18%) had fractures at the level of the femoral neck.

Most of the patients with fractures at the trochanteric level had been operated with DHS systems (70%), but with a lower survival rate of 47.05% and 41.17% at 2 and 3 years, respectively, compared to Gamma nails treated patients with a survival rate of 50%. Six patients with femoral neck fractures who underwent AMP had lower survival rates with 1 (16.67%) survivor at 2 years and none at 3 years, compared to the patients who underwent surgery with bipolar type prosthesis, with a survival rate of 40% at both 2 and 3 years follow-up. Therefore, the survival rates in trochanteric region fractures were higher than femoral neck fractures, 48% and 36% at 2 and 3 years follow-up, and 31.25% and 25% respectively, results that correlated with CCI scores.

The mean CCI score was 7.70% in patients that were operated with bipolar prosthesis and nearly two times higher in patients with AMP-13.80%.

In patients with trochanteric region fractures, the CCI score was 8.61% (DHS), 11.7% (Gamma nail), 15.5% (blade plate) and 17.20% (screws).

The highest survival rate was in patients operated with Gamma nails in trochanteric region fractures, and bipolar prosthesis in the femoral neck fractures (Table 1, 2).

Table 2. The survival rate in surgically treated patients.

Surgically treated patients	*DHS (n=17)*	*Blade plate (n=2)*	*Gamma nail (n=5)*	*Screws (n=1)*	*Moore Prosthesis (n=6)*	*Bipolar prosthesis (n=10)*
Deceased in hospital N=7	3	-	1	1	1	1
Discharged alive N=34	14	2	4	-	5	9
Survival at 2 years N(%)	8 (47.05%)	2 (100%)	2 (50%)	0	1 (16.67%)	4 (40%)
Survival at 3 years N(%)	7 (41.17%)	0	2 (50%)	0	0	4 (40%)

From the group of the 50 patients discharged alive, 16 (32%) patients were functionally treated due to the patient's status, multiple comorbidities with poor prognosis based on CCI, anesthetic contraindications, or the family's refusal to undergo surgical treatment. The mortality was high, with only 2 (12.50%) patients alive at 2 years, and none at the 3 years follow-up.

The in-hospital mortality rate was two times higher in non-operated patients compared to operated ones, 3 times higher at 6 months (29.2% vs. 87.50%) and remained increased up to 2 times higher at the annual follow-ups (43.89% vs. 91.67%, 56.09% vs. 91.67% and 65.84% vs. 100% at 1, 2 and 3 years, respectively).

In our study, the average survival rate of surgically treated patients was about 1.5 years, while for the non-surgically treatment was about 7 months.

The surgically treated patients who died during hospitalization had an average comorbidity risk at 1 year of 17.22% (ranging from 10.30% to 27.7%). Both operated and non-operated patients (due to family refusal) discharged alive had an average mortality risk at 1 year of 9.48%, ranging between 3% and 24.10%, based on CCI scores. The mortality rate was high and correlated with mobility and daily life activities prior to fracture in 69.54% of cases.

In our study, the average Harris Hip Score after one year in surgically treated patients was 69 in trochanteric fractures and 66 in neck fractures. The conservatively treated patients scored 16 and 18 in trochanteric fractures and neck fractures respectively (including immobilized patient in bed).

After treatment mobility evolution

The mobility ranged between 1 (the of the surgery) and 66 days, with a mean distance of 3.2 meters, with a range between 1 and 9 meters. The walk time ranged between 25-32 seconds for trochanteric fractures and 21-29 seconds for neck femoral fractures, without significant differences between the two groups. The average days until walking in operated patients were 5.61 days with a mean walked distance of 3.75 meters, while the non-operated patients had a mean of 51 days with a mean of 1.27 meters walked.

We used the EQ-5D-5L scale on the 50 patients discharged alive (34 operated and 16 non-operated) at 6, 12 and 24 weeks to evaluate mobility, self-care capacity, the performance of usual activities, pain and discomfort level, anxiety and depression using a 5 levels scale from no problems to, slight, moderate, severe and extreme problems/inability.

At the first follow-up, conservative-treated patients had an average of extremely severe mobility problems, severe to extremely severe problems in self-care and daily activities and persisting severe pain and depression or anxiety levels. The surgically treated patients declared severe problems in terms of mobility and self-care, severe to extremely severe problems in usual activities, moderate to severe pain levels and depression, except one who accused persisting severe problems throughout all analyzed areas.

At the second follow-up at 12 weeks, 3 (18.75%) of the conservatively treated patients were already deceased, while the rest of the patients had little improvement in mobility, with severe to extremely severe problems in mobility, pain and depression/anxiety levels and severe difficulties in self-care and usual activities.

Meanwhile, surgically treated patients associated a mean of moderate to severe mobility problems, as well as in self-care and usual activities and moderate pain levels and depression/anxiety levels.

At the third follow-up at 24 weeks, 7 (43.75%) more patients of the conservatively treated patients were already deceased. The 3 left patients reported severe to extremely severe problems in mobility, self-care and usual activities, moderate to severe pain and discomfort levels and slight to moderate depression/anxiety levels. In the surgically treated group, 2 (5.88%) patients were deceased. The average mobility was moderate, the self-care and usual activities problems ranged between moderate to severe, the pain and discomfort level was moderate and depression and anxiety ranged between no to severe levels, with an overall level of slight problems.

Thereby, conservatively treated patients had severe persisting problems, without significant improvement in mobility, self-care and ability in usual activities during the analyzed period and a slight improvement in pain levels and depression/anxiety levels. Operated patients had a reduced mobilization compared to the general population, with a direct effect on self-care and daily activity, but with improved results compared to the first group.

Also, better results were observed in the case of perceived pain and discomfort and the level of anxiety/depression, compared to non-operated patients, with persisting of moderate, respectively mild levels at the end of the last follow-up.

In our study group, 6 (9.23%) patients presented had readmissions in the Orthopedic-Traumatology department for dislocation of the prosthesis. Most of them moved with a walking frame, and their daily activity was limited to household activities. The production mechanism was in most cases falling from standing height as a result of the loss of consciousness and less often due to hyperflexion movements associated with internal or external rotation. Thus, 40%

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(6 patients) of the 14 patients who underwent hip arthroplasty were readmissioned for prosthesis dislocation in the following 12 months.

Discussion

Dementia has an increasingly high incidence, as reported in a previous study carried out between 1988 and 2015, on over 49,000 patients aged over 65, where 8,6% people associated dementia, reaching up to 97% in the 8th-9th decades of life [19].

Patients with advanced dementia are more numerous in hospitals than in the community and observational pain tools and pain self-reporting have limited applicability that may lead to pain undertreatment [20].

Poor pain control may lead to behavioral and psychological changes such as agitation, aggression, or verbal abuse, that might be mistaken as "part of the disease" and as not pain indication [16].

Some studies [21,22] suggested that administered opioids trigger the onset of delirium, while other ones [23,24] demonstrated that severe pain triggers the onset of delirium, but this needs further validation on larger heterogeneous groups. A few studies reported the use of nerve blocks before hip surgery as a promising alternative for opioid administrations, as it is already known that is difficult to adjust and side effects are not neglectable (associated with sedation and mental function impairment) [25-30]. Peripheral nerve block (PNB) prior surgery may be an alternative to opioid analgesics, which were associated with significant side effects. Intravenous paracetamol administration was recommended as an alternative to PNB with similar outcomes, but lower costs and reduced opioid analgesia [26,31,32]. Paracetamol was negatively correlated with agitation and delirium [33-35]. Despite the considerable benefits of paracetamol administration, a previous study reported prescriptions in only 66.5% of patients with hip fractures [33].

Nurses are the first line of medical personnel who interact with these patients and their ability to assess the pain level is typically based on observation, prior experience, and facial/behavioral changes [29]. Currently, there is a lack of specific guidelines and pain undertreatment of patients with dementia remains the main concern, therefore special training of medical staff, and routine use of pain assessment tools may improve the confidence in evaluating patients with dementia, and consequently, the pain assessment and treatment, even though it may require multiple tests in advanced dementia [36].

Hip fractures are common and comprise around 24% of the cases in our Orthopedic clinic. In our study, most cases of dementia patients with traumatic hip fractures were in the first quarter of the year, influenced by local climatic factors (glazed frost, ice, snow) [37].

One of the oldest orthopedics' problems is femoral neck fractures. Despite several advancements in osteosynthesis some complications are still relatively common, such as avascular necrosis in 10%, 5%, of displaced and undisplaced fractures respectively and nonunion in 33% of cases of displaced fracture, 30% in undisplaced ones [8].

The surgical intervention done in the first 72 hours was correlated with a lower risk of morbidity and mortality [38].

Even historically in many developed countries, unipolar prosthesis is used in many developing countries. AMP has an increased risk of degenerative changes of the acetabulum, osteoarthritis, protrusion-acetabuli and experiencing persistent pain [39]. Still, it has some advantages, essential in elderly patients, such as reduced operative time, reduced bleeding, and early mobilization that may reduce the complications associated with prolonged immobilization [8,39,40].

Several previous studies reported good results of AMP use in elder patients [8,39], with similar [41] or improved [42] outcomes after AMP compared to bipolar prosthesis. In our study, the best survival rate was in patients with bipolar prosthesis, but it was correlated with lower age and improved CCI scores.

Patients who underwent hip arthroplasty have higher risks of readmission for dislocation of the prosthesis in the following 12 months. In our study, 40% of patients were read missioned in the first year, similar to previous studies results that reported readmissions in 42.85% of cases, significantly more frequently compared to the general population, where it ranges from 0.5% to 3% [43]. The anterolateral approach may prevent the recurrence of dislocation of the hip prosthesis. Patients with dementia have a 7 times higher risk of redislocation after closed reduction, compared to the general population, making it debatable whether patients with dementia should have a Girdlestone procedure or a closed reduction of a dislocated prosthesis [44]. In Herman et al. study, the redislocation risk after hip arthroplasty ranges from 0.5% to 3% in the general population, but dementia represents a significantly higher risk of

reintervention [43]. Due to the larger and increased jump distance in the bipolar prosthesis, dislocation rates are much reduced in the first postoperative year compared to total hip arthroplasty (THA), but has a higher risk of periprosthetic fracture [45]. However, in our study there were no cases of periprosthetic fractures.

High CCI scores (over 6 points) were also positively correlated with 90-day readmissions and poorer prognosis [46].

Most of the time, the fractures are caused by low-energy trauma such as fall from standing height or less or due to failure to comply with medical recommendations. The treatment of patients with dementia and hip fractures can be a challenge in terms of choosing the best form of treatment. Even though surgical treatment has better outcomes, improved functionality and life expectancy, functional treatment might be the right choice in patients with high CCI, with a life expectancy of weeks, which would assure pain control and a decent end-of-life [47].

According to our results, the follow-up of surgically treated patients at 6, 12 and 24 weeks showed improvement in the quality of life in dementia patients, with improved mobility and decreased pain and state of mind, while the functionally treated ones had poorer outcomes, with higher levels of pain that worsened the mental state and higher mortality rate, therefore the conservative treatment should be reserved for particular cases, in patients with high CCI scores, for end-of-life in dignity and no/low pain levels or where osteosynthesis is unavailable, which will decrease the risks associated with surgery, but rehabilitation is likely to be delayed [48].

A significant decrease in life expectancy in patients with dementia and hip fracture, was reported, decreasing from 18 to 2.3 years (depending on the patient's age) in a previous study [49], to 1.4 years in the current study. Early mobilization was positively correlated with survival rate and recovery time after hip fractures, consistent with previous articles [50-53].

The overall mortality was high, reaching 61.53% in the first year and increasing by 7-9% every year. Still, our results uphold the results of some previous studies, with increased mortality rates compared to patients without dementia [51,54], which reported 77.9% one-year mortality rate and 87.6% at 2 years, three times higher than patients without dementia. Wolters et al. reported a life expectancy of up to 18 years in patients with dementia alone aged 65, with a significant decrease up to 2.3 years in those aged over 95 years old [49].

Other studies reported improved mortality rates, ranging between 15.8% and 32% at 6 months, 15% and 39% at 1 year, 34.5% and 45% at 2 years [50,54-57].

On the other hand, patients who received functional treatment, regardless of the stage of dementia, had poorer quality of life and higher mortality rates, 3 times higher than the operated patients at 6 months and 2 times higher at the annual follow-ups at 1, 2 and 3 years, similar to previous studies [55], while other studies reported improved survival rates, ranging from 45 to 55% at 6 months, but dropping to 38% at 2 years follow-up [58-60].

Some studies have demonstrated that joint salvage techniques for the undisplaced neck of femur fractures have a significant risk of poor function, non-union, comorbidities, and revision, with failure rates as high as 40% [61].

Conversely, a recent systematic review on 1971 patients concluded that arthroplasty surgery as an acceptable alternative in older patients with undisplaced femoral neck fractures, which intensifies the debate over whether internal fixation is still appropriate for these patients [62].

Our results are consistent with previous studies [52], while, we had conflicting results compared to some studies [63-65] in terms of mortality and intracapsular fractures of the femoral neck. Previous studies reported a 4-5 times higher risk of mortality, than in patients without femoral neck fractures, while in this study the intracapsular mortality rate was similar to trochanteric region fracture mortality. Another study reported better outcomes in femoral neck fractures compared to intertrochanteric fractures[11].

At the same time, some studies reported that in-hospital mortality was about 15%, while the probability of death in one year was 30% due to complications. In another report on 1023 patients, there are no major differences regarding the death rate in one year, but at the same time, patients with bipolar prosthesis have faster recovery and weight loading on the limb, meanwhile, hip dislocation remains a much more common complication in these patients [66].

The mortality rate was significantly high, probably due to the overcrowding of the clinic and the delayed surgical intervention, limited available total hip prostheses, the increased risk in particular in these patients and last but not least, due to the higher median age, with an

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average of ~84 years. CCI scores was correlated with short and long-term prognosis.

Elderly patients undergoing a large-scale surgical intervention have great risks of complications such as delirium, infections, dislocation of the prosthesis, pulmonary thromboembolism, and anemia, however, the surgical decision should be based on type of fracture, previous mobility, comorbidities such as diabetes mellitus, hypertension, stroke, lipid profile [48,67,68] that are correlated with poorer prognosis.

In our study, we aimed to enhance the existing therapeutic treatment and the necessity of pain management in patients with dementia and hip fractures. Our study question was to determine the risk variables associated with elevated rates of problems various types of treatments.

Limitations of the study

This is a single-center study, on small group of patients and the data may vary from one region of the country to another.

Our study was limited by the decision of the patients and the relatives in choosing the functional-orthopedic treatment, despite the surgical recommendation, underdiagnosis of dementia, the limited budget of the hospital and also the limited performance of some tests to establish the progress in patient's rehabilitation.

The COVID-19 pandemic also contributed to the physical limits of human interaction between medical personnel, staff and patients.

Conclusions

The exponential growth of the two pathologies will generate higher and higher costs for hospitals and increase the need for specialized medical staff, caregivers and rehabilitation programs.

This study aims to enhance the understanding of dementia patients' management, raising awareness and the necessity in prioritizing of surgical time in these patients.

Functional treatment should be applied in a very limited group of patients, with anesthetic contraindications.

Otherwise, AMP, bipolar prosthesis or Gamma nail should be considered in femoral neck fractures and trochanteric fractures, respectively, which will ensure a lower level of pain, and a lower subsequent risk in dementia decompensation.

Data Availability Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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