Morbidity and Mortality in Intertrochanteric Hip Fractures Treated With Cephalo-medullary Nailing. Predictive Value of the Parker Mobility Score

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ABSTRACT

Introduction: Hip fracture represents an independent predictor of morbidity and mortality. The aim of this retrospective study was to assess the morbidity and mortality associated with intertrochanteric hip fractures fixed with cephalomedullary nails. **Materials and Methods:** We analyzed all patients treated between 2018 and 2021 with a cephalomedullary nail for an intertrochanteric hip fracture, with a minimum follow-up of 12 months. We evaluated the demographic data, comorbidities, functional level through the Parker Mobility Score (PMS), complications, and mortality (12 months and at the end of follow-up). Variables related to post-operative complications or death were identified by bivariate and multivariate regression analyses. **Results:** 68 patients were included. The mean follow-up was 23 (range 12-40) months. The rate of complications was 8.8% (n=6), 1 urinary tract infection, 1 pneumonia, 1 deep vein thrombosis, and 3 (4.4%) cephalic screw fixation losses. Patients who had complications presented significant differences in age at the time of fracture. Mortality at 12 months and at the end of the study was 2.9% (n=2) and 29.4% (n=20) respectively. Those patients who died presented significant differences in the incidence of kidney comorbidities, dementia, a Charlson Comorbidity Index > 4, and a PMS < 5. PMS < 5 was the only independent variable related to mortality. **Conclusions:** Cephalomedullary nailing in unstable intertrochanteric hip fractures in elderly patients represents a treatment option that offers an acceptable complication rate and a low 12-month mortality rate. The risk of death is significantly increased in patients with low functional scores (Parker < 5) pre-fracture.

Keywords: Intertrochanteric hip fracture; morbidity; mortality; cephalo-medullary nailing; Parker Mobility Score.
Level of Evidence: IV

Morbimortalidad en pacientes con fracturas intertrocantéricas de cadera tratadas con clavos cefalomedulares. Valor predictivo del Índice de Movilidad de Parker

RESUMEN

Introducción: La fractura de cadera es un factor independiente que aumenta la morbimortalidad. El objetivo de este estudio retrospectivo fue determinar la morbimortalidad en ancianos con fracturas intertrocantéricas de cadera tratadas con clavos cefalomedulares. **Materiales y Métodos:** Se analizó a pacientes tratados con clavo cefalomedular por fractura intertrocantérica de cadera, entre 2018 y 2021, y un seguimiento mínimo de 12 meses. Se registraron: datos demográficos, comorbilidades, capacidad funcional con el Índice de Movilidad de Parker, complicaciones y tasa de mortalidad a los 12 meses y al final del seguimiento. Se identificaron las variables independientes relacionadas con complicaciones o muerte. **Resultados:** Se incluyó a 68 pacientes (seguimiento medio 23 meses). La tasa de complicaciones fue del 8,8%: infección urinaria, neumonía, trombosis venosa profunda y tres pérdidas de fijación del tornillo cefálico. Al comparar pacientes con complicaciones o sin ellas, hubo diferencias significativas en la edad cuando se produjo la fractura. Las tasas de mortalidad anual y al concluir el estudio fueron del 2,9% y 29,4%, respectivamente. Las diferencias fueron significativas en la incidencia de comorbilidades renales, demencia, el Índice de Comorbilidad de Charlson >4 y el puntaje de Parker <5 en quienes fallecieron. El puntaje de Parker <5 fue la variable indepen-

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diente relacionada con muerte. **Conclusiones:** Las tasas de complicaciones y de mortalidad a los 12 meses del tratamiento de las fracturas intertrocantéricas inestables de cadera con clavos cefalomedulares es aceptable en ancianos. El riesgo de muerte aumenta significativamente si el puntaje de Parker es <5 antes de la fractura.

Palabras clave: Fractura intertrocantérica; morbilidad; mortalidad; clavo cefalomedular; índice de movilidad de Parker.
Nivel de Evidencia: IV

INTRODUCTION

Hip fractures in older adults represent a public health problem worldwide and generate a considerable impact on morbidity and mortality.[1] Up to 90% of these fractures occur in patients >65 years of age, predominantly in women, after a fall from their own height.[1-3] The mortality rate ranges between 2% and 7% during the hospital stay, while, after one year, it is 17-33%.[4,5] It is considered that the mortality rate in these patients doubles or triples that of the population of the same sex and age who did not suffer a hip fracture.[6-9]

This impact on morbidity and mortality has been related to different factors, such as age, comorbidities (analyzed individually, or using the Charlson Comorbidity Index [CCI], or the American Society of Anesthesiologists [ASA] score), type of of treatment and functional status before the fracture.[10,11] The Parker Mobility Score is an instrument to assess pre-fracture mobility that has also been related to death after surgical treatment of a hip fracture.[12]

The objective of this retrospective study was to evaluate the factors related to morbidity and mortality in patients with intertrochanteric hip fracture treated with a cephalomedullary nail.

MATERIALS AND METHODS

The database of our Center was retrospectively analyzed to identify all patients with an intertrochanteric hip fracture treated with a cephalomedullary nail between 2018 and 2021.

The inclusion criteria were: patients >65 years old, with an unstable intertrochanteric hip fracture treated with cephalomedullary nailing, and with a minimum follow-up of 12 months. Patients whose fractures were caused by an oncological disease or high-energy trauma, as well as those who were unable to walk, were excluded.

For pre-surgical optimization, a multidisciplinary team of clinical medicine, orthogeriatrics, cardiology, endocrinology, kinesiology, and orthopedics specialists treated all patients from hospital admission.

The surgery was performed on a traction table, under fluoroscopy. Anesthesia was general or spinal, according to the anesthesiologist's indication. Cephalomedullary nails were always used, with one or two cephalic screws and one or two static distal bolts. From the first day following surgery, postoperative therapy consisted of standing and walking with a walker, as tolerated. The use of two canes was indicated for the first four weeks, followed by three weeks with only one cane. Clinical and radiographic controls (anteroposterior radiographs of both hips and lateral radiographs of the operated hip) were done at 3, 6, and 12 months, and then annually.

Variables analyzed

Demographic data, such as sex and age, and comorbidities were recorded according to the affected system, classifying them as cardiac, pulmonary, hepatic, rheumatic, and renal. The presence of dementia, osteoporosis, diabetes, and anticoagulation was also recorded. With these data, the CCI at admission and the ASA score were calculated. The Parker Mobility Score was used to assess patients' pre-fracture walking abilities, which ranges from 0 (non-ambulatory) to 9 (independent mobility) based on gait type, ability to go shopping, need for assistance, and difficulties (Table 1).[12] In addition, the days elapsed until surgery and the total days of hospitalization were recorded.

In the radiographic analysis, the cervico-diaphyseal angle, the position of the cephalic screw according to the areas described by Cleveland,[13] the tip-apex distance and the quality of the reduction were determined using the method described by Baumgaertner.[14] Union, failure, complication and mortality rates were analyzed at one year and at the end of the study.

Table 1. Parker Mobility Score Description

Walking ability	No difficulty	Alone with an assistive device	With help from another person	Not at all
Able to walk inside house	3	2	1	0
Able to walk outside house	3	2	1	0
Able to go shopping	3	2	1	0

Bone consolidation was defined as the presence of a callus in three of the four cortices in the radiographic analysis, and failure was defined as the loss of fixation of the cephalic screw in the femoral head or the presence of nonunion (absence of bone consolidation 9 months after surgery, without radiographic progression of healing in the last three months).

Statistical Analysis

The variables are expressed as mean and range, median and standard deviation, or frequency and percentage, depending on their distribution and nature. To establish differences, the Mann-Whitney or Fisher tests were used, as necessary. With the significant results ($p < 0.05$), a multivariate analysis was performed in order to identify the risk variables. The SPSS, IBM program was used for the analysis.

RESULTS

73 patients were identified, five of them were excluded (one for fracture secondary to oncological disease, another for fracture in the context of multiple trauma, three for not complying with the minimum follow-up). The study population consisted of 68 patients with 68 fractures. The characteristics of the included patients are detailed in Table 2.

Complications

The complication rate was 8.8% (n = 6): a urinary infection, pneumonia, and deep vein thrombosis, which were cured with specific medical treatment. The remaining ones corresponded to three (4.4%) cephalic screw fixation losses that were treated by total hip arthroplasty (Figure). When comparing patients with complications and without complications, only significant differences were observed in the age when the fracture occurred (Table 3). However, this variable could not be identified as an independent risk variable (odds ratio, OR, 1.29; 95% confidence interval, 0.8-1.60).

Figure. Patient treated with intramedullary nailing for an intertrochanteric hip fracture. During the follow-up period, there was a loss of cephalic screw fixation, which was treated with total hip arthroplasty.

Table 2. Description of the patients in the series

Variable	
Male sex, n (%)	16 (23.5)
Age, median SD	76.1 ± 10.8
Heart disease, n (%)	18 (26.5)
Lung disease, n (%)	6 (8.8)
Renal disease, n (%)	6 (8.8)
Dementia, n (%)	14 (20.6)
Osteoporosis, n (%)	6 (8.8)
Diabetes, n (%)	6 (8.8)
Anticoagulation, n (%)	6 (8.8)
CCI, median SD	4.6 ± 1.7
ASA score, median SD	2.7 ± 0.5
Parker score, median SD	7.2 ± -2.7
Days until surgery, median SD	3.8 ± 1.8
Total days of hospitalization, median SD	9.9 ± 3.3
CDA, median SD	132 ± 7.0
Position of the cephalic screw, n (%) Anteroposterior 1 2 3 Lateral 1 2 3	 9 (13.2) 51 (75) 8 (11.8) 6 (8.8) 53 (78) 9 (13.2)
TAD, median SD	12 ± 2.4
Reduction quality, n (%) Good Acceptable Poor	 52 (76.4) 12 (17.6) 4 (5.8)
Consolidation, n (%)	65 (95.6)

SD = standard deviation; CCI = Charlson Comorbidity Index; ASA = American Society of Anesthesiologists; CDA = cervico-diaphyseal angle; TAD = tip-apex distance.

Table 3. Comparative analysis between patients with complications and without complications

Variable	Complications (n = 62)	With complications (n = 6)	p
Male sex, n (%)	15 (24.2)	1 (16.7)	0.68
Age, median SD	75.2 ± 10.9	84.2 ± 4.6	0.04
Comorbidity, n (%)			
Heart disease	17 (27)	1 (17)	0.9
Renal disease	6 (9.6)	0	1
Anticoagulation	5 (8)	1 (17)	0.48
Hypertension	9 (14.5)	1 (17)	0.9
Dementia	14 (22.5)	0	0.3
Lung disease	5 (8)	1 (17)	0.48
Osteoporosis	4 (6.4)	2 (33.3)	0.08
Diabetes	5 (8)	1 (17)	0.48
ASA score, n (%)			
I-II	22 (35.5)	0	0.16
III-IV	40 (64.5)	6 (100)	
CCI >4, n (%)	32 (51.6)	1 (16.7)	0.31
Parker score, n (%)			
<5	16 (25.8)	2 (33.3)	0.93
>5	46 (74.2)	4 (66.7)	
Reduction, n (%)			
Good	50 (80.6)	2 (33.3)	0.09
Acceptable	9 (14.5)	3 (50)	0.29
Poor	3 (4.9)	1 (16.7)	0.24
CDA <130°, n (%)	10 (16.1)	0	0.58
Position of the cephalic screw, n (%)			
Anteroposterior			
1	7 (11.3)	2 (3.3)	0.13
2	48 (77.4)	3 (50)	0.14
3	7 (11.3)	1 (16.7)	0.69
Lateral			
1	6 (9.7)	0	0.99
2	47 (75.8)	6 (100)	0.32
3	9 (14.5)	0	0.99
TAD >2 5 mm, n (%)	14 (22.6)	3 (50)	0.14
Waiting days, median SD	3.7 ± 1.8	4.5 ± 1.4	0.32
Hospitalization days, median SD	9.7 ± 3.3	11.5 ± 3.1	0.21
Death, n (%)	18 (29)	2 (33.3)	0.82

SD = standard deviation; CCI = Charlson Comorbidity Index; ASA = American Society of Anesthesiologists; CDA = cervico-diaphyseal angle; TAD = tip-apex distance.

Mortality

The mortality rate 12 months after the fracture was 2.9% (n = 2) and 29.4% (n = 20) at the end of the study. When comparing patients who died and those who did not, significant differences were observed in the incidence of renal comorbidities, dementia, CCI >4, and Parker score <5 (Table 4).

Table 4. Comparative analysis between patients who died and those who did not, at the end of the study

	Deceased (n = 20)	Alive (n = 48)	p
Male sex, n (%)	4 (20)	11 (22.9)	0.79
Age, median SD	75.8 ±11.8	76.6 ± 10.7	0.78
Comorbidity, n (%)			
Heart disease	10 (50)	8 (16.6)	0.13
Renal disease	6 (30)	0	0.0004
Anticoagulation	0	6 (12.5)	0.17
Hypertension	10 (50)	11 (23)	0.06
Dementia	8 (40)	6 (12.5)	0.02
Lung disease	2 (10)	4 (8.33)	0.9
Osteoporosis	0	6 (12.5)	0.17
Diabetes	0	6 (12.5)	0.17
ASA score, n (%)			
I-II	4 (20)	18 (37.5)	0.16
III-IV	16 (80)	30 (62.5)	
CCI, n (%)			
>4	14 (70)	31 (64.6)	0.002
Parker score, n (%)			
>5	8 (40)	46 (95.8)	<0.00001
<5	12 (60)	2 (4.2)	
Complication, n (%)	2 (10)	4 (8.3)	0.91

SD = standard deviation; ASA = American Society of Anesthesiologists; CCI = Charlson Comorbidity Index.

Multivariate analysis

With the variables of interest related to mortality, a multivariate analysis was performed. The final adjusted model showed a Parker score <5 as an independent variable related to mortality (Table 5).

Table 5. Multivariate analysis

	Odds ratio	95% confidence interval	p
Renal disease	0.77	0.11-5.04	0.78
Dementia	1.91	0.57-9.37	0.38
CCI >4	1.20	0.91-1.99	0.05
Parker score <5	1.31	1.02-1.98	0.02

CCI = Charlson Comorbidity Index.

DISCUSSION

One of the main findings of our study was that cephalomedullary nail treatment was associated with a complication rate of 8.8%, resulting from three medical complications and three mechanical failures.

When analyzing preoperative comorbidities, significant differences were only found in age between patients who suffered complications and those who did not. Patients who had complications were almost 10 years older than those who did not. We understand that this could be due to the fact that, at an older age, patients may suffer more comorbidities.

The three complications were: urinary infection, pneumonia, and deep vein thrombosis, conditions that have been widely reported as frequent complications after a hip fracture.[15] The incidence of postoperative complications has been shown to be a variable that affects mortality after surgery for a hip fracture.[16-18] In our analysis, this variable was not identified as significant, possibly due to the low number and the relatively low impact on mortality with respect to urinary tract infections and deep vein thrombosis.[15-18]

Regarding mechanical complications, there were three losses of cephalic screw fixation in the femoral head, resulting in a failure rate of 4.4%. This rate was similar to that published by Kashigar et al. in 2014[19] and Ibrahim et al. in 2019.[20] When analyzing the variables related to these failures, neither the quality of the reduction nor the position of the implant were correlated with the failures. We understand that these are more frequent in patients with poor reduction, a cephalic screw in the upper area in the anteroposterior radiograph, and anterior in the lateral radiograph, and a tip-apex distance >25 mm as reported by Garabano et al. in 2022.[21] Perhaps the lack of statistical significance in our analysis is related to the low number of failures evaluated.

The other relevant finding was that the mortality rate one year after the fracture was 2.9%, a figure lower than the 10-33% published.[5,12,16,20,22] This could be a consequence of the interdisciplinary management of patients and correct preoperative optimization.

When variables related to death were analyzed, it was observed that patients who died had significant differences in the incidence of comorbidities, such as dementia, kidney disease, a CCI >4, and a Parker score <5. Dementia and kidney disease have been associated with death after a hip fracture.[22,23] In 2015, Pérez-Sáez et al.[22] found that hip fracture and mortality rates increase in patients with chronic kidney disease. Likewise, according to a 2021 meta-analysis, patients with dementia have worse functional outcomes and higher rates of infection, dislocations, respiratory complications, and mortality after a hip fracture.[23]

The CCI has been shown to be a useful tool for assessing preoperative comorbidities.[11] Regarding mortality, its predictive value after a hip fracture has been proven in several studies.[15,16,24] Although we found significant differences in this score between patients who died and those who did not, it was not possible to identify it as an independent risk variable related to death.

Parker et al.[12] reported that the Parker score was directly correlated with death, that the risk of death after a hip fracture increases if the Parker score is <5, a finding similar to that obtained in our study.

The relationship between pre-fracture functional activity and death after hip fracture surgery has been widely studied. Multiple types of scales and scores have been developed that have highlighted this relationship;[12,25,26] In addition to the Parker Mobility Score, we can mention the Koval score[25] and the score that evaluates the performance of daily activities,[26] among others. Regarding functional activity, it has been published that only 40-50% of elderly people who suffer a hip fracture will recover the level of activity they had before.[15] This demonstrates another aspect of the impact of the fracture in these patients. In this study, it was observed that those patients with lower Parker scores, in other words, those with lower functional capacity, were those who had an increased risk of death.

The limitations of this study are those of a retrospective study that included a small number of patients. The latter could have generated a lack of statistical significance in some of the variables related to mortality, generating type 2 or beta errors.

CONCLUSIONS

The treatment of unstable intertrochanteric hip fractures with cephalomedullary nails in the elderly represents an option that offers a relatively low number of complications. The associated annual mortality rate was 2.9%, and close to 30% at the end of follow-up. This rate was associated with the level of functional activity before the fracture, represented by a Parker score <5.

Conflict of interest: The authors declare no conflicts of interest.

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