

Analysis of the Morbidity and Mortality of Patients with Peritrochanteric Fractures Surgically Treated with Proximal Femoral Intramedullary Rod*

Análise da morbimortalidade dos pacientes com fraturas peritrocantéricas tratadas cirurgicamente com haste intramedular de fêmur proximal

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Abstract

Objective To analyze the morbidity and mortality of patients with peritrochanteric fractures treated with intramedullary rod and its relationship to the length of hospital stay, the time until surgery and the comorbidities of the patients.

Methods An observational, analytical and retrospective study was carried out through the evaluation of the medical records of 74 patients who underwent surgical treatment of peritrochanteric fractures with intramedullary proximal femoral rods from 2011 to 2014 in a hospital unit.

Results The mean age at the moment of the fracture was 79.7 years, and the mean total hospitalization time was 16.7 days, with an average of 11.3 days until surgery and 5.4 days from surgery to discharge. The incidence of complications during hospitalization in the group aged ≥ 78.5 years was of 47.6%, while in the younger group it was of 19.4% ($p = 0.013$). The incidence of hospitalization complications in the group that underwent surgery more than 6 days after the fracture was significantly higher: 42.9% ($p = 0.019$). It was also observed that the incidence of complications during hospitalization was significantly associated with a surgical risk index ≥ 3 ($p = 0.001$) and diabetes mellitus ($p = 0.001$).

Conclusion Complications related to peritrochanteric fractures are significantly related with a high surgical risk index (grades 3 and 4), diabetes mellitus, age (> 78.5 years), and prolonged preoperative hospitalization (> 6 days).


Keywords

- femoral fractures/epidemiology
- morbidity and mortality
- intramedullary fracture fixation

Resumo

Objetivo Analisar a morbimortalidade dos pacientes com fraturas peritrocantéricas tratadas com haste intramedular e sua relação com o tempo de internação, com o tempo para fazer o procedimento cirúrgico, e com as comorbidades dos pacientes.

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Palavras-chave

- fraturas do fêmur/ epidemiologia
- morbimortalidade
- fixação intramedular de fraturas

Métodos Foi feito um estudo observacional, analítico e retrospectivo por meio da avaliação dos prontuários de 74 pacientes submetidos ao tratamento cirúrgico de fraturas peritrocantéricas com haste intramedular de fêmur proximal de 2011 a 2014 em uma unidade hospitalar.

Resultados A idade média no momento da ocorrência da fratura foi de 79,7 anos, e o tempo de internação total médio foi de 16,7 dias, com média de 11,3 dias até a cirurgia, e 5,4 dias da cirurgia à alta. A incidência de complicações na internação no grupo com idade $\geq 78,5$ anos foi de 47,6%, enquanto no grupo mais novo ela foi de 19,4% ($p = 0,013$). A incidência de complicações na internação no grupo que fez a cirurgia após 6 dias foi significativamente maior (42,9%; $p = 0,019$). Observou-se também que a incidência de complicação na internação está significativamente associada ao risco cirúrgico de grau ≥ 3 ($p = 0,001$) e à diabetes mellitus ($p = 0,001$).

Conclusão As complicações relacionadas às fraturas peritrocantéricas estão significativamente associadas ao risco cirúrgico elevado (graus 3 e 4), diabetes mellitus, idade ($> 78,5$ anos) e tempo de internação pré-operatório prolongado (> 6 dias).

Introduction

Fractures of the proximal third of the femur cause high rates of morbidity and mortality.¹ These lesions mainly affect patients older than 50 years of age, and transtrochanteric fractures are more frequent in people older than 60 years of age.¹

Proximal femoral fractures can be divided into intracapsular and extracapsular fractures.¹ These fractures have a great association with osteoporosis in elderly patients, and mostly result from traumas of low kinetic energy, such as falls from standing height.^{1,2} The treatment of proximal femoral fractures is mainly surgical,^{1,2} except when the clinical condition of the patient precludes the procedure.¹⁻⁴ In the analysis of peritrochanteric fractures, the instability grade must be identified in order to choose the correct treatment.⁵ Aspects such as posteromedial wall comminution, reverse fracture trait and subtrochanteric extension are considered instability factors for these fractures, and they contribute to a more laborious reduction and greater risk of synthesis failure.^{1,5}

The introduction of intramedullary devices with cephalic blockade facilitated the treatment of these fracture patterns^{1,5} and gradually replaced the dynamic hip screw (DHS), which for many years was considered the gold standard for the treatment of transtrochanteric fractures, especially those deemed unstable.¹ Cephalomedullary systems are biomechanically more favorable⁶ due to flexor momentum reduction, better rotational control and greater control of the varus collapse and of the shortening that results from their more medial disposition, when compared to extramedullary devices.⁵

Proximal femoral fractures are considered an orthopedic urgency; the literature recommends their treatment within 48 to 72 hours after trauma.¹ Delayed treatment can be detrimental to the health of the patient, since long periods of bed confinement result in complications (including pressure ulcer, urinary tract infection [UTI] and deep venous

thrombosis),⁷ which amount to up to 6 billion dollars only in clinical expenses in the United States.⁸

This study aims to evaluate the morbimortality of patients with peritrochanteric fractures surgically treated with proximal femoral intramedullary rod, and its relationship with the length of hospital stay, the time until surgical procedure, and the comorbidities of the patients.

Material and Methods

The present is a retrospective, analytical and observational study that included 74 patients. Data were collected from the medical records of patients submitted to surgical treatment of peritrochanteric (transtrochanteric or subtrochanteric) fractures with intramedullary proximal femoral rod from 2011 to 2014, after approval by the Ethics in Research Committee of our institution, registered at the Brazilian Platform under number CAAE 71991417.4.0000.5256.

Patients not submitted to surgical treatment, those skeletally immature, or those who had more than one fracture requiring surgery at the same hospital stay were excluded. In addition, patients with incomplete medical records or whose postoperative follow-up lasted less than six months were excluded, except in cases of death during the aforementioned period.

A spreadsheet database was built with the collected data for analysis using the software Statistical Package for the Social Sciences (SPSS, IBM Corp., Armonk, NY, US), version 22.0, and Microsoft Excel 2007 (Microsoft, Redmond, WA, US).

An optimal cut-off point for variables associated with a higher risk of complications was identified using the receiver operating characteristic (ROC) curve. In addition, the significant association between two qualitative variables was investigated using the Chi-squared test; if the result of the Chi-squared test was inconclusive and the circumstances were deemed appropriate, the Fisher exact test was performed. All discussions considered a maximum significance level of 5% ($p \leq 0.05$).^{9,10}

Results

The sample base of the present research consisted of 74 patients; there was no gender information regarding 7 patients, and, from the remainder, 50 were female, and 17 were male. There was a significant predominance of women (74.6%) in the population of patients submitted to the surgical correction of peritrochanteric fractures ($p = 0.000$). After analyzing the collected data, the mean age at the moment of the fracture was 79.7 years, and the mean total hospitalization time was 16.7 days, with a mean period of 11.3 days until surgery, and 5.4 days from surgery to discharge.

Complications during hospitalization occurred in 27 cases (36.5%), and 11 cases evolved with some complication after the discharge (14.9%). There were 14 deaths: 2 (2.7%) in a new postoperative admission, 4 within 2 months after surgery, 1 four months after surgery, 1 ten months after surgery, 1 twelve months after surgery, and five more than 12 months after surgery. The distribution of the incidences of interest is shown in ►Figure 1.

The patients studied presented a variety of complications during hospitalization. The most prevalent complications during hospitalization were UTI in 21 (28.4%) patients, treated and uncomplicated dyspnea in 4 (5.4%) cases, pneumonia in 3 (4.1%) cases, delirium in 2 (2.7%) cases, and atrial fibrillation in 2 (2.7%) cases. All other cases were isolated, each corresponding to 1.4% of the total sample, including cardiac and respiratory decompensation, anemia, retrosternal pain and hypertensive crisis. ►Table 1 presents the incidence of in-hospital and postoperative complications in the subgroups of interest.

The complications at admission were not associated with the patient's gender ($p = 0.842$), or the side ($p = 0.753$) or type of fracture ($p = 0.516$). The postoperative complications were not associated with any of the analyzed comorbidities or with the type of fracture ($p = 1.000$). However, the incidence of in-hospital complications was significantly associated with a surgical risk (SR) ≥ 3 ($p = 0.001$) and with diabetes mellitus (DM) ($p = 0.001$).

The incidence of complications among patients with SR grade 1 or 2 was of 15.2%, while among patients with SR 3 or 4, it

was significantly higher: 52.5%. It is estimated that the chance of a patient with a peritrochanteric fracture with SR 3 or 4 having a complication during hospitalization is 6.2 times higher than that of a patient with SR 1 or 2. The incidence of complications among patients without DM was of 24.0%; among those with DM, it was significantly higher: 62.5%. It is estimated that the chance of a patient with a peritrochanteric fracture with DM having a complication during hospitalization is 5.3 times higher than that of a patient who is not diabetic.

►Table 2 shows the main statistics regarding age, total length of stay, hospitalization until surgery, and time from surgery to discharge of patients with or without complications at admission. The p -values are all lower than 0.05, showing that the occurrence of complications during hospitalization was significantly associated with the patient's age and length of hospital stay. There was a significant difference between the distributions of the total length of stay of the patients who had and did not have postoperative complications, as well as regarding the time between admission and surgery and the time from surgery to discharge. The postoperative complications were not significantly associated with the patient's age or to the length of hospital stay.

A ROC curve analysis was performed to determine a cut-off point for age; it identified a value of 78.5 as the cut-off point that maximizes the complication risk during admission.

►Table 3 presents the analysis of the incidence of complications in patients younger or older than 78.5 years of age. The incidence of in-hospital complications in the group younger than 78.5 years of age was of 19.4%, whereas the incidence in the group older than 78.5 years of age was significantly higher: 47.6% ($p = 0.013$).

A ROC curve analysis was performed to determine a cut-off point for the length of hospital stay until surgery; it identified a value of 6.5 as the cut-off point that maximizes the complication risk.

►Table 4 compares the incidence of complications in patients whose time between admission and surgery was lower or higher than 6.5 days. The incidence of in-hospital complications in the group that underwent surgery after 6 days of hospitalization was significantly higher ($p = 0.019$). It is estimated that the chance of a patient hospitalized for more

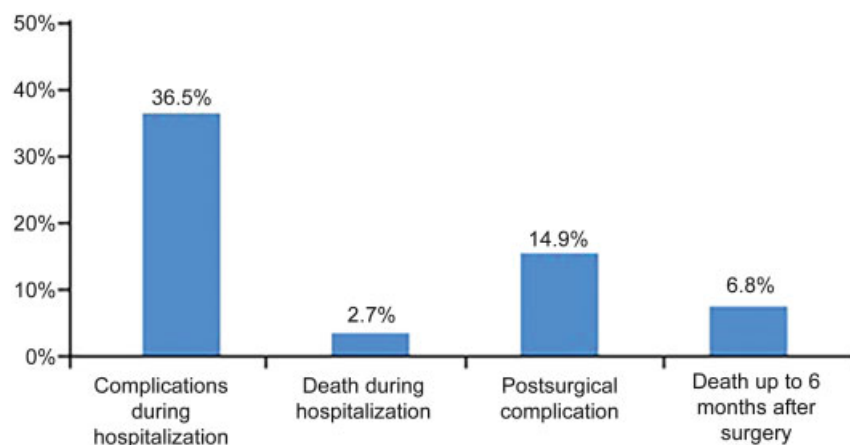


Fig. 1 Incidence of complications and deaths in patients submitted to surgery for peritrochanteric fracture correction.

Table 1 Incidence of in-hospital and postoperative complications in the subgroups of interest

Subgroup	In-hospital complication rate		p-value	Postsurgical complication rate		p-value
	n	%		n	%	
<i>Gender</i>						
Female	19	38.0%	0.842	6	12.0%	1.000
Male	2	11.8%		2	11.8%	
<i>Surgical risk (grade)</i>						
1 or 2	5	15.2%	0.001	5	15.2%	1.000
3 or 4	21	52.5%		6	15.0%	
<i>SAH</i>						
Without SAH	4	23.5%	0.206	4	23.5%	0.263
With SAH	23	40.4%		7	12.3%	
<i>DM</i>						
Without DM	12	24.0%	0.001	6	12.0%	0.321
With DM	15	62.5%		5	20.8%	
<i>Type of fracture</i>						
Subtrochanteric	3	27.3%	0.516	2	18.2%	1.000
Transtrochanteric	20	39.2%		8	15.7%	

Abbreviations: DM, Diabetes mellitus; SAH, systemic arterial hypertension.

Table 2 Main statistical data regarding age, total length of stay, length of stay until surgery and time from surgery to discharge of patients with and without in-hospital complications

Statistical data	Age		Total length of stay		Length of stay until surgery		Time from surgery to hospital discharge	
	Without complication	With complication	Without complication	With complication	Without complication	With complication	Without complication	With complication
Minimum	42	68	6	9	3	4	2	2
Maximum	96	97	30	64	20	54	13	31
Average	77.4	83.2	13.7	22.7	9.6	14.9	4.0	7.7
Median	78	83	13	18	9	12	4	5
Standard deviation	10.2	6.6	5.4	14.0	4.4	10.7	1.7	7.5
Coefficient of variation	0.13	0.08	0.39	0.62	0.45	0.72	0.42	0.97
p-value, Mann-Whitney test	0.001		0.010		0.003		0.010	

Table 3 Incidence of complications in patients submitted to surgery for peritrochanteric fracture correction

Complication rate	Age < 78.5 years (n = 31) (%)		Age > 78.5 years (n = 42) (%)		p-value, Chi-squared test	OR	95%CI from OR
In-hospital	6	(19.4%)	20	(47.6%)	0.013	3.8	1.3–11.1
Postsurgical	5	(16.1%)	6	(14.3%)	1.000	0.87	0.2–3.2

Abbreviations: 95%CI, 95% confidence interval; OR, odds ratio.

than 6 days before surgery to have any complication is 5.6 times higher than that of a patient operated on within 6 days.

Discussion

Peritrochanteric fractures are related to high rates of morbidity and mortality.^{1–4} According to the current literature,

the general incidence of mortality after the surgical correction of trochanteric fractures ranges from 6 to 11% within the first month, and from 14 to 36% within the first year.¹¹ In the present study, a mortality rate of 18.9% was found; 6.8% of deaths occurred within the first 6 postoperative months.

Some papers did not consider the relationship between type of fracture, age and number of comorbidities with the

Table 4 Incidence of complications in patients submitted to surgery for peritrochanteric fracture correction

Complication rate	Surgery performed within 6 days (n = 17) (%)	Surgery performed after 6 days (n = 56) (%)	p-value	OR	95%CI from OR
In-hospital	2 (11.8%)	24 (42.9%)	0.019	5.6	1.2–27.0
Postsurgical	1 (5.9%)	10 (17.9%)	0.439	3.5	0.4–29.4

Abbreviations: 95%CI, 95% confidence interval; OR, odds ratio.

risk of mortality,¹² whereas other authors made a statistically significant survey and narrowed the relationship between age (> 80 years old) and number of comorbidities (greater than 2) with a higher mortality rate.^{3,4} The literature also has conflicting rates regarding mortality and time until surgery, ranging from an close relationship between lower mortality in patients treated up to 72 hours after fracture^{1,2,13} and no difference in mortality, even when the surgical procedure is delayed.^{8,14,15}

Our analysis of the postoperative mortality was not statistically significant because small, isolated values could not be directly related to surgery; however, the morbidity (complications) rate during hospitalization in patients operated more than 6 days after the occurrence of the fracture was significantly higher (42.9%) compared to those operated within 6 days (11.8%) ($p = 0.019$). The postoperative complication rate was also higher in patients operated after more than 6 days of hospitalization (17.9%) compared to those who were operated within 6 days (5.9%), but with a smaller difference ($p = 0.439$). We observed that patients operated after 6 days of hospitalization were 5.6 times more likely to have a complication during hospitalization than those operated within 6 days.

The female gender was significantly more affected (74.6%) by peritrochanteric fractures in our sample, which is in line with the literature findings (74–80%).^{1–4,12} In addition, women presented more complications during hospitalization than men ($p = 0.842$). Although the values found in the present analysis show a similar index of postoperative complications in both genders ($p = 1.000$), there is evidence in the literature that males are not only expressively more susceptible to postoperative complications, but also present higher mortality rates up to 1 year postoperatively.^{16,17} In the present paper, the patients' gender was not statistically relevant for complications ($p = 0.842$).

Several authors have analyzed postoperative mortality and morbidity rates in relation to the length of hospital stay, age and comorbidities,^{1,2,8,11–14,17–19} but there are insufficient studies regarding complications during hospitalization. A study evaluating the effects of delayed treatment of proximal femoral fractures found that in-hospital complications are more frequent (56.1%) in patients operated 7 days after trauma; in addition, these patients presented prolonged immediate postoperative hospitalization periods and more postoperative complications.⁷ The complication rate of the group operated within 48 hours was of 16.5%.⁷ This result is very similar to the one found in the present study, in which more than 6 days of hospitalization until surgery significantly increased the risk of complications.

The most frequent in-hospital complications found in the literature are pressure ulcers (17.4%), UTI (17%) and deep vein thrombosis (9.4%).⁷ The most frequent complications in the present study were UTI (28.4%), dyspnea (5.4%) and pneumonia (4.1%). Other factors, such as SR grade 3 or 4, age > 78 years, and the presence of DM as a comorbidity also have a great effect on the risk of complications during hospitalization.

Age > 78.5 years was an increased and significant risk factor for in-hospital complications ($p = 0.013$), but not for postoperative complications after hospital discharge. The literature cites the age group of 70 to 80 years old as an important factor for postoperative complications, but it does not specify whether those are in-hospital or presurgical complications.^{13–17,19,20}

The literature also presents evidence compatible with the present findings when analyzing the correlation between SR and comorbidities as complication-predisposing factors. The most serious in-hospital complications cited were pulmonary infection and cardiac arrest (unspecified), which were directly related to the number of comorbidities (three or more) and a higher surgical risk. The direct correlation of DM with intra- and extra-hospital complications is not clear in the literature, whereas the number of comorbidities is the main reported factor.^{14,15,17,19}

We believe that our limited sample may have reduced the statistical significance of some of the factors studied. However, our study ratifies the importance of greater attention and agility in the assistance to peritrochanteric fractures with surgical treatment indication with implants such as intramedullary rods. Although we did not observe a large number of complications during the postoperative period, they are directly related to excessive costs with clinical pathologies and increased morbidity in patients with prolonged preoperative hospitalization. In addition, in elderly and osteoporotic patients, who present a higher risk of peritrochanteric femoral fractures, adequate control of comorbidities, especially DM, is important because of the higher rate of complications.

Conclusion

Peritrochanteric fractures treated with proximal intramedullary femoral rods presented a mortality rate of 12.6% within the first postoperative year, and a morbidity rate of 51.4%. In-hospital complications are significantly associated with the patient's age, length of hospital stay, SR grade 3 or 4, and the presence of DM as an associated comorbidity. However, the complications after hospital discharge did

not present a significant correlation with the time between admission and surgery and the patient's age.

Conflicts of Interest

The authors have none to declare.

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