

# Evaluation of the Laboratorial Profile of Elderlies with Proximal Femur Fracture by Low Energy Mechanism\*

## *Avaliação do perfil laboratorial de idosos com fratura de fêmur proximal por mecanismo de baixa energia*

Marcelo Baggio<sup>1</sup> Daniel Teixeira de Oliveira<sup>2</sup> Renato Locks<sup>1</sup>

<sup>1</sup>Hospital Regional de São José Dr. Homero de Miranda Gomes, São José, SC, Brazil

<sup>2</sup>Knee Surgery, Escola Paulista de Medicina, Universidade Federal de São Paulo, São Paulo, SP, Brazil

**Address for correspondence** Marcelo Baggio, Rua Adolfo Donato da Silva, Hospital Regional de São José Dr. Homero de Miranda Gomes, s/n, Praia Comprida, São José, SC, Brazil (e-mail: marcelobaggio@gmail.com).

Rev Bras Ortop 2019;54:382–386.

### Abstract

**Objective** This study aims to evaluate the laboratory results profile of elderly patients with proximal femoral fractures and to verify the relationship between these data, fracture outcome and death.

**Methods** Cross-sectional study of patients admitted to the orthopedic emergency service of a referral hospital between February and April 2017 with proximal femoral fracture by low energy mechanism and submitted to laboratorial and imaging tests. Patients with suspected or confirmed pathological fracture were excluded from the study.

**Results** Sixty-six individuals were evaluated, 44 of whom were women, all over 60 years old. Transtrochanteric fractures had the highest incidence in the study (36). Alterations of parathyroid hormone and albumin levels were significant for death ( $p \leq 0.05$ ). Length of hospital stay was not a significant factor for death.

**Conclusions** Laboratory abnormalities were not related to the outcome of death. Albumin may be related to the risk of death. No laboratory result was pointed out as a facilitator in the generation of proximal femoral fractures. More studies are needed to better understand the laboratory influence on fractures and their consequences.

### Keywords

- ▶ mortality
- ▶ hip fractures
- ▶ vitamin D
- ▶ albumins
- ▶ calcium

### Resumo

**Objetivo** Avaliar o perfil laboratorial de idosos com fratura de fêmur proximal e verificar a relação dos dados com o desfecho da própria fratura e com o desfecho do óbito.

**Métodos** Estudo transversal de pacientes admitidos na emergência ortopédica de um hospital referência, entre os meses de fevereiro e abril de 2017, com fratura de fêmur proximal, por mecanismo de baixa energia, sendo coletados exames laboratoriais e de imagem. Foram excluídos do estudo pacientes com suspeita ou confirmação de fratura patológica.

\* Work performed at Hospital Regional de São José Dr. Homero de Miranda Gomes, São José, SC, Brazil.

Marcelo Baggio's ORCID is <https://orcid.org/0000-0003-4070-7919>.

**Palavras-chave**

- ▶ mortalidade
- ▶ fraturas do quadril
- ▶ vitamina D
- ▶ albuminas
- ▶ cálcio

**Resultados** Foram avaliados 66 indivíduos, sendo 44 mulheres, todos com idade superior a 60 anos. A fratura transtrocanterica apresentou maior incidência no estudo (36). Alterações nos níveis do hormônio da paratireoide e da albumina foram significativos para óbito ( $p \leq 0,05$ ). O tempo de internação não foi fator significativo para óbito.

**Conclusões** Alterações laboratoriais não estavam relacionadas ao desfecho de óbito. A albumina pode estar relacionada ao risco de óbito. Nenhum resultado laboratorial foi apontado como facilitador na geração de fraturas de fêmur proximal. Mais estudos são necessários para poder entender melhor a influência do quadro laboratorial do paciente na ocorrência de fraturas e suas consequências.

**Introduction**

Populational aging is a reality that has been observed recently. Over the last 20 years, there was a 5% increase in people aged  $\geq 60$  years, reaching approximately 12% of the total live individuals. This statistic leads to the greater attention required in this age group, which includes higher risk of proximal femoral fractures, referred to as hip fracture.<sup>1-3</sup>

Proximal femoral fractures in elderly patients result in high morbidity and mortality. In an observational study carried out in 2015 by Daniachi et al,<sup>4</sup> from 113 patients, 92.9% suffered fractures associated with low energy traumas, mostly occurring at home from fall from own height. In a literature review regarding the main associated risk factors, the variables most associated with fracture and/or death after fracture were advanced age, and changes in calcium, albumin and vitamin D metabolism.<sup>3-7</sup>

A Chinese study by Li et al showed that patients with proximal femoral fractures had serum calcium levels lower than reference values.<sup>8</sup> Similarly, Ramason et al<sup>9</sup> reported that these patients had vitamin D deficiency or insufficiency, and some fractures resulted in death. Another study showed that calcium and vitamin D alterations may influence parathyroid hormone (PTH) levels, which was also related to death.<sup>10</sup> Koval et al<sup>11</sup> believe that the nutritional status of the patient may influence mortality and that hypoalbuminemia may be a marker.

Although the relationship of laboratorial and radiological parameters of patients with proximal femoral fracture have been investigated, few studies have addressed this issue. This study aims to outline the bone metabolic profile of elderly patients with hip fracture and to evaluate possible causes that may facilitate its outcome.

**Material and Methods**

A cross-sectional study was conducted with 66 patients. These patients met the following inclusion criteria: proximal femoral fracture, aged 60 years old or more and visited the orthopedics and traumatology service of a reference hospital between February 02 and April 02, 2017.

The work was approved by the ethics committee of the institution.

Patients whose laboratory tests were not performed or registered at the hospital system, and those with history, suspicion, or confirmation of pathological fracture caused by tumors were excluded.

The information from these patients was collected from the electronic medical record of the hospital as authorized by the institution's medical records guardian. The variables analyzed included gender, age, fracture type, serum calcium level, serum PTH level, serum 25-hydroxy-vitamin D level and serum albumin level.

The material for laboratory tests was collected at the patient's arrival in the hospital and sent to a single laboratory, which analyzed all the samples from this study.

The collected data was entered into Excel (Microsoft Corp., Redmond, WA, USA) spreadsheets and then exported to SPSS Statistics for Windows, Version 15.0 (SPSS Inc., Chicago, IL, USA) for analysis. The data were presented using descriptive statistics; qualitative variables were expressed as absolute numbers and frequencies, whereas quantitative variables were expressed as mean and standard deviation. Categorical variables were tested by chi-squared test or Fisher exact test, when appropriate, while numerical variables were tested by Student *t*-test. The significance level was set as  $p \leq 0.05$ .

**Results**

The present study evaluated 66 individuals 60 years old. As shown in ▶ **Table 1**, 66.7% ( $n = 44$ ) of the patients were female; their average age was 78.8 years old ( $n = 66$ ), with a standard deviation (SD) of 9.2. Of the individuals studied, 15.2% ( $n = 10$ ) died at admission, and the others were discharged after hospital treatment of the fracture.

Supplementary tests requested at the patient's admission are listed in ▶ **Table 2**, whereas their association with death outcome is presented in ▶ **Table 3**.

When comparing the means of laboratory test results with death or non-death outcome, it was observed that PTH and albumin values were statistically significant ( $p \leq 0.05$ ), with PTH showing a mean difference from 58.0 pg/mL, among those who did not die, to 93.1 pg/mL, among those who died; regarding albumin, those who died had a mean level of 2.7 pg/mL, and those that did not die, 3.3 pg/mL.

**Table 1** Sociodemographic and clinical characteristics of the patients seen during the study

		N	%
Gender	Female	44	66.7
	Male	22	33.3
Age	Mean	78.89	
	SD	9.206	
	Minimum	61	
	Maximum	97	
Fracture type	Femoral neck	24	36.4
	Transtrochanteric	36	54.5
	Subtrochanteric	6	9.1
Death	No	56	84.8
	Yes	10	15.2

Abbreviation: SD, standard deviation.

**Table 2** Characteristics of supplementary test samples at patient's admission

	N	Minimum–Maximum	Average	Standard deviation
Dorr Index	50	0.44–1.20	0.77	0.13
Calcium	65	4.7–10.3	8.61	1.02
Parathyroid hormone	64	11.9–311.0	63.50	52.35
25-hydroxi-vitamin D	65	6.3–72.4	20.57	11.53
Albumin	55	1.7–4.5	3.25	0.64

**Table 3** Comparison of average laboratorial test results regarding outcome variable (death and non-death)

		Calcium	p	Parathyroid hormone	p	25-hydroxi-vitamin D	p	Albumin	p
Non-death	Average	8.689	0.17	58.015	0.05	21.184	0.32	3.324	0.01
	Standard deviation	0.850		43.970		12.134		0.601	
Death	Average	8.210	0.17	93.140	0.05	17.22	0.32	2.683	0.01
	Standard deviation	1.716		81.516		6.88		0.722	

**Table 4** Comparison of average laboratorial test results regarding fracture classification

Fracture topography		Calcium	p	Parathyroid hormone	p	25-hydroxi-vitamin D	p	Albumin	p
Femoral neck	Average	8.742	0.43	62.313	0.91	23.829	0.12	3.415	0.36
	Standard deviation	1.0176		41.018		14.2542		0.6961	
Transtrochanteric	Average	8.471	0.43	65.644	0.91	17.852	0.12	3.176	0.36
	Standard deviation	1.0701		62.3672		9.3766		0.6092	
Subtrochanteric	Average	8.95	0.43	56.133	0.91	23.433	0.12	3.100	0.36
	Standard deviation	0.7765		31.9787		7.5617		0.5865	

The length of hospital stay was not a determining cause for death in this sample.

The laboratorial values of vitamin D did not present variations when compared between genders.

There were no statistically significant differences ( $p > 0.05$ ) when comparing the mean values of laboratory test results with fracture types, as shown in **Table 4**.

There was no association between classification variables of the Dorr Index and the fracture type ( $p = 0.828$ ). Similarly, the type of fracture showed no association with death ( $p = 0.555$ ) or gender ( $p = 0.191$ ).

## Discussion

Studies researching the association between hip fractures and the results of laboratory tests are studied to try to estimate possible causes and thus avoid the consequences of this association.<sup>9,10,12</sup> In the 66 individuals evaluated, mostly female, this work pointed out that transtrochanteric fractures are the most frequent in the studied age group (individuals 60 years old). There was no relationship between fracture type and death outcome. Regarding laboratory tests, it was observed that the patients who died had high levels of PTH and reduced albumin levels when compared to the patients who did not die. The length of stay was not related to mortality during hospitalization.

In a study conducted in Guangzhou, China, Li et al<sup>8</sup> observed that in patients hospitalized with proximal femoral fracture (196), those with intertrochanteric fractures presented serum calcium levels lower than the reference standard. Larrosa et al,<sup>13</sup> in their sample of 128 patients with femoral neck fractures and 196 patients with intertrochanteric fractures, did not observe any evidence of laboratory abnormality in calcium levels at hospital admission. In the aforementioned studies, the mortality outcome was not cited. Our study noted

that the laboratory calcium profile was not statistically significant in proximal femoral fractures and that the death outcome was not relevant either.

Regarding vitamin D, the present study did not reveal significant relationships in the death and non-death outcomes, nor in relation to the several fracture types or gender. This laboratory profile has been studied and attributed as altered in patients with hip fracture. Ramason et al,<sup>9</sup> in a sample of 412 patients with fractures, found out that 57.5% of the hospitalized patients had vitamin D deficiency, 34.5% showed vitamin D insufficiency, and 8% died. Another evidence of this study was that patients who live in nursing homes have lower vitamin D levels at admission. In another controlled study, Guerra et al<sup>14</sup> evaluated 110 patients with hip fracture, 54.5% of whom presented vitamin D deficiency, and 18.2% with vitamin D insufficiency. The authors show that there was a statistically significant difference between the fracture and the control groups for patients older than 70 years, which did not occur in patients aged 60 to 65 years. Gumieiro et al,<sup>15</sup> in an analysis with 88 patients with hip fracture, found no difference between vitamin D values when fracture types and deambulation capacity were compared.

After evaluating serum PTH levels in a sample with 562 hip fractures, Madsen et al<sup>10</sup> believe that death is related to the sum of laboratory changes in vitamin D and calcium levels. These authors do not state that the single PTH alteration indicates a risk of death, but that this may be an indicator of poor health, generating an instability factor that results in death. Di Monaco et al<sup>16</sup> and Fischer et al<sup>17</sup> corroborate the analysis that PTH alteration may be a risk factor for death, but their small sample is a limiting factor. In the present study, PTH alteration shows significant values for death; however, as in Monaco et al<sup>16</sup> and Fischer et al,<sup>17</sup> the sample size may be a limitation.

Koval et al<sup>11</sup> correlated hypoalbuminemia with late mortality and state that these low levels are directly caused by an inadequate nutritional status. Grimes et al<sup>18</sup> did not relate hospitalization time to death in their analysis with 8,383 patients. Parker et al,<sup>19</sup> in a meta-analysis with 428 patients, demonstrated that surgical treatment does not decrease the risk of death when compared to the conservative treatment. Sakaki et al,<sup>1</sup> in a literature review, concluded that there are four major influential factors in mortality, that is, advanced age, association of diverse comorbidities, male gender, and cognitive deficits. In our analysis, it was observed that albumin and PTH levels alterations are significantly related to death, while the hospitalization time did not have any significance.

It is important to note that, without vitamin D, only 10 to 15% of dietary calcium will be absorbed at the intestinal level, resulting in a forced elevation of PTH levels and a rebound effect at the renal tubular level, generating calcium reabsorption. The increased PTH level causes bone resorption due to osteoclasts stimulation, leading to osteopenia and osteoporosis, which increases the risk of fractures.<sup>20</sup> One study showed that 3,270 elderly individuals who received 800 IU of vitamin D and 1,200 mg of calcium in a daily replacement dose for 3 years had a 43% reduction in hip fractures incidence.<sup>21</sup> In a meta-analysis comparing the daily replacement with 400 IU or 700 to

800 IU of vitamin D, it was observed that low doses did not alter fracture outcomes, but that high doses (700–800 IU) reduced the relative risk of hip fracture by 26%.<sup>22</sup> This shows that there is an intimate bone metabolic relationship; therefore, the isolated analysis of PTH, vitamin D, and calcium can generate a false negative result and a misinterpretation of laboratorial findings. The dietary relationship with hypoalbuminemia agrees with the aforementioned alterations, corroborating the malnutrition picture and reduced calcium ingestion.

These profile parameters were analyzed because they are the most studied variables describe in the literature as death-related complications. The literature also associates such parameters with cognitive diseases and multiple clinical comorbidities, but this correlation was not studied because of the difficulty in performing a multidisciplinary follow-up in our service due to scientific reasons. The present study may be confined to limited outcomes because of the small number of patients studied and the lack of long-term follow-up. Blood collection for laboratory analysis was performed in a similar way for all patients, and, therefore, it is not a limiting source in their results. Data analysis was performed by a single trained professional, with no bias. The average time of hospitalization may present divergent results from the literature, and, in our service, the reservation of intensive care beds, when necessary, is difficult due to the large number of polytrauma patients admitted.

## Conclusions

The death outcome indicates that albumin level changes, possibly related to malnutrition, may increase the risk. In the present study, the increased PTH level showed a tendency to death, but the low number of patients studied may limit this result. Hip fracture-related bone metabolic analyses need further studies to complement the results already described in the literature for a better understanding of the relationship of laboratory results with fractures and their consequences.

## Conflicts of interest

The authors declare that there is no conflict of interest.

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