

CASE REPORTS

A Retrospective on the Treatment of Trochanteric Fractures of the Femur in the Bucharest Clinical Emergency Hospital in 2015

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Abstract

Fractures of the trochanteric region of the femur are some of the most commonly encountered fracture types, especially in elderly patients. Our study analyses all trochanteric fractures according to the ICD-10-CM classification, treated in the Bucharest Emergency Hospital Orthopedics department during a one year period of time, in regards to the type of treatment, duration of hospitalization, related costs and other indicators. The results showed that there are slight differences in regards to costs when choosing the treatment type ($p < 0.05$), while there was no significant difference in the duration of hospitalization ($p > 0.05$). This leads to the conclusion that measures should be undertaken to maximize cost-efficiency when treating trochanteric fractures in the future.

Keywords: trochanteric fracture, Gamma nail, DHS / Dynamic Hip Screw, Emergency Hospital

Rezumat

Fracturile masivului trohanterian femural sunt unele din cele mai întâlnite tipuri de fracturi, mai ales în cazul pacienților vârstnici. Studiul nostru a analizat toate fracturile trohanteriene, conform clasificării ICD-10-CM, tratate în cadrul clinicii de Ortopedie-Traumatologie din cadrul Spitalului Clinic de Urgență București pe parcursul unui an calendaristic, în ceea ce privește tipul de tratament, durata spitalizării, costurile asociate și alți indicatori. Rezultatele relevă diferențe în ceea ce privește costurile asociate fiecărui tip de tratament ($p < 0.05$), însă nu și diferențe semnificative în ceea ce privește durata de spitalizare ($p > 0.05$). Concluziile fiind astfel orientate către necesitatea găsirii unor măsuri de creștere a cost-eficienței în tratamentul fracturilor trohanteriene pe viitor.

Cuvinte cheie: fractură trohanteriană, Spitalul de Urgență, DHS, Gamma Nail

INTRODUCTION

Fractures of the proximal femur are some of the most commonly encountered fracture types, especially when talking about elderly patients^{1,2}. Apart from the immediate impact on the patient's health, a more problematic issue is the impact on the quality of life, especially

when talking about geriatric patients³. Early surgical treatment, combined with early discharge from hospital and a well-tailored rehabilitation program are mandatory for assuring a quick recovery of the patient's autonomy. It is estimated that every person over the age of 65 has a 10% chance to fall once per year, with the possibility of contracting a proximal femur fracture.

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Figure 1A, B. AO/OTA 31-A1 and 31-A3 fracture types.

This chance is increased to 50% when talking about an age of over 85 years^{2,3}.

Thus, from a mathematical point of view, taking into account the steady increase in life expectancy, one can come to the conclusion that fractures of the proximal femur in elderly patients will steadily increase in number in the coming years⁴. When talking about numbers, one must also take into account the relative strain this kind of pathology applies to the medical system. Treating a proximal femur fracture requires hospitalization, implants and prolonged aftercare – all leading to increased healthcare costs.

Fractures of the proximal femur can be classified using the AO/OTA classification proposed by Müller et al.⁵, which divides these fractures into 3 topographical regions defining the proximal femur: 31-A Trochanteric area fractures, 31-B Femoral neck fractures and 31-C Femoral head fractures. The most commonly encountered types among those three, are those of the 31-A and 31-B type.

The purpose of this study was to analyze the treatment applied to all fractures involving the trochanteric region (AO/OTA 31-A type fractures). The reason for choosing this kind of fractures lies within the versatility of treatment options, including extra- and intramedullary osteosynthesis, rather than arthroplasty⁶⁻⁹.

MATERIALS AND METHODS

Our study is a retrospective analysis of the treatment applied to fractures of the trochanteric region in a 1 year interval (January to December 2015) in the Bucharest Clinical Emergency Hospital's Orthopedics Department. The data was obtained using the Hospital's proprietary management system including the patients' database. A total of 282 cases were selected, using the ICD-10-CM diagnostic codes S72.10 "Unspecified trochanteric fracture of femur" and S72.11 "Fracture of greater trochanter of femur", with a total of 143 cases for the former and 139 cases for the latter. The database was created using the following information: name, sex, age, department treated in (Orthopedics I,II & III), ICD-10-CM code, diagnosis, side, method of treatment, month of admission, no. of days from admission until surgery, no. of days from surgery until discharge, total no. of days in hospital, costs pertaining to hospitalization, costs pertaining to medication, costs pertaining to materials (including surgical implant) and total costs.

Patients admitted for re-intervention after initial surgery, for any kind of reason, were excluded from the study.

Cases were divided into 4 different groups, according to the method of treatment used: 1. Dynamic Hip Screw (DHS) group, 2. 3-rd generation Gamma Nail (Gamma3) group and 3. Other method of treatment group, 4. Non-surgical treatment group.

The data was analyzed using Microsoft Office Excel 2016 and IBM SPSS Statistics 24 software.

RESULTS

According to the data obtained from the hospital's database, the treatment of all 282 fractures of the trochanteric region amounted to a total of 3711 days



Figure 2A, B. Treatment of trochanteric region fractures using a DHS and b-Gamma Nail.

of hospitalization with a total budgetary impact of 1.704.708,00 RON (approximately 375,878 EURO as of today). This translates into a per-case average of 13-16 days of hospitalization and a cost of 6035 RON (1331 EURO).

Patients were treated in different ways: extramedullary osteosynthesis using a Dynamic Hip Screw (n=137), intramedullary osteosynthesis using a 3rd generation Stryker™ Gamma Nail® (n=104), other methods of treatment (n=10), including the use of Dynamic Condylar Screw (DCS - 95° angulated plate, n=6), Universal Femoral Nail (n=3), cannulated 6.5 mm screws (n=1) and non-surgical treatment (n=31).

Due to the low number of cases in which alternative methods of treatment, other than DHS, Gamma3 and non-surgical, were used, these cases were excluded from further analysis. It should be noted though, that all 3 cases treated with a Universal Femoral Nail were of the AO/OTA 31-A3 variation, including subtrochanteric extension of the fracture.

The summary of the results comprising the remaining 3 groups of patients can be found in Table 1.

When analyzing the data pertaining to the duration of hospitalization, the authors noticed that, whilst the mean hospitalization (days) of both DHS and Gamma3 groups was comparable (13.45 for the DHS group and 14.47 for the Gamma3 group), the distribution of cases was broader in the Gamma3 group than in the DHS group. This is shown in Figure 3A and B.

The total costs associated with the treatment of trochanteric fractures are shown in figure 4A and B. As shown in the figure, costs associated with intramedullary treatment using a Gamma3 Nail are higher than those associated with the use of the extramedullary option of the Dynamic Hip Screw system.

Further statistics of the DHS and Gamma3 treated subgroups were analyzed using IBM SPSS Statistics 24. For more accurate results, unusual values were searched for within the variables and extreme values

Table 1. Summary of results

	DHS group (n=137)	Gamma3 group (n=104)	Nonsurgical treatment (n=31)
Mean age (years)	78.28	77.78	80.77
Sex	36 male / 101 female	34 male / 70 female	12 male / 19 female
Side	71 right / 66 left	63 right / 41 left	18 right / 13 left
Mean hospitalization (days)	13.45	14.47	6.22
Mean pre-OP days	3.06	3.38	NA
Mean post-OP days	10,39	11.08	NA
Mean hospitalization costs (RON)	3919.59	4306.62	1728.32
Mean medication costs (RON)	471.86	821.18	201.13
Mean materials costs (RON)	1360.39	2261.98	323.58

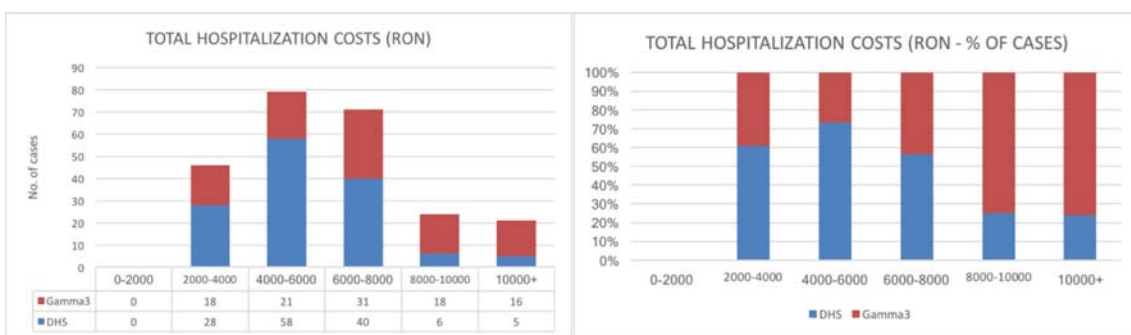
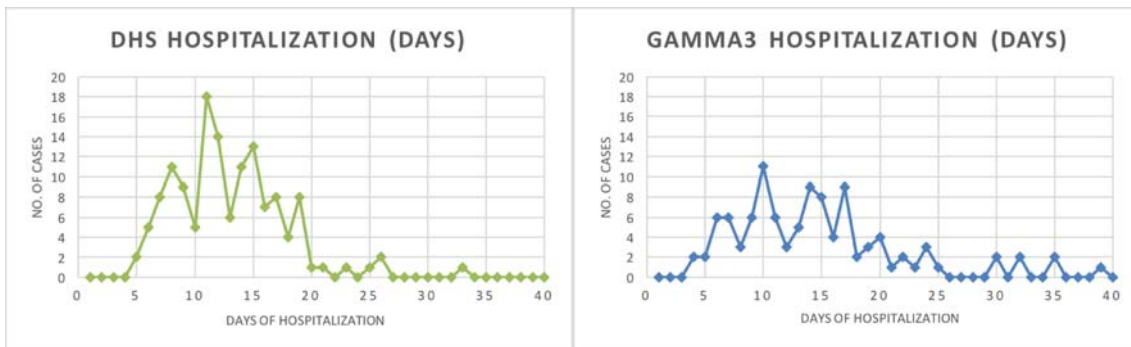


Figure 4A. Comparison of hospitalization costs – DHS (blue) and Gamma3 (red) – number of cases.

Figure 4B. Comparison of hospitalization costs – DHS (blue) and Gamma3 (red) – percentage of cases.

Table 2. Summary of descriptive statistics

Case Summaries			
Implant used		Days	Cost
DHS	N	136	136
	Mean	12.8971	5513.5294
	Median	12.0000	5387.5000
	Minimum	5.00	2246.00
	Maximum	33.00	13374.00
	Range	28.00	11128.00
	Geometric Mean	12.1003	5225.6292
Gamma3	N	99	99
	Mean	13.7576	6720.8182
	Median	14.0000	6659.0000
	Minimum	4.00	2168.00
	Maximum	35.00	15248.00
	Range	31.00	13080.00
	Geometric Mean	12.4740	6106.3991
Total	N	235	235
	Mean	13.2596	6022.1319
	Median	13.0000	5809.0000
	Minimum	4.00	2168.00
	Maximum	35.00	15248.00
	Range	31.00	13080.00
Geometric Mean	12.2564	5580.0297	

were excluded from the statistical analysis (5 from the Gamma3 group and 2 from the DHS group, hospitalization days <37, costs <16500).

The summary of descriptive statistics of the two groups can be found in Table 2.

Analyzing the data pertaining to the duration of hospitalization in the 2 subgroups using the Independent-Samples T-Test, whilst a difference in the mean value of the duration of hospitalization was observed, Levene’s Test for Equality of Variances returned different variances for the Gamma3 and DHS groups ($p < 0.05$). However, comparing the means using the t-test, the hypothesis that the means of both groups are similar was not rejected ($p > 0.05$).

In the case of hospitalization costs, however, applying the same tests underlined the difference in variances (Levene’s $p < 0.05$) and rejected the null hypothesis that the mean treatment costs of both groups are similar (t -test $p < 0.05$).

Using the nonparametric Mann-Whitney U Test for independent samples, the distribution of duration and costs within the groups of implants was analyzed.

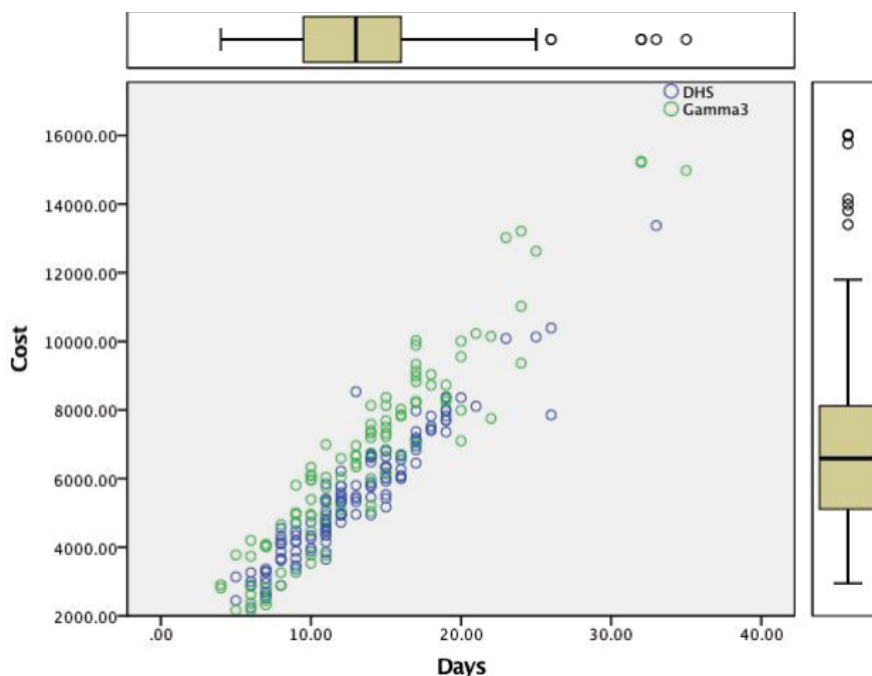


Figure 5. Correlation of hospitalization cost and duration using a scatter plot and additional boxplots highlighting means of variables.

The results showed that the distribution of days spent in hospital was the same in both DHS and Gamma3 groups ($p > 0.05$), whilst the distribution of costs within the groups was different ($p < 0.05$).

Correlations between the age of the treated patients and the costs and days of hospitalization were searched for using bivariate correlations using the Pearson Correlation Coefficient, but both tests resulted in no correlations between the tested variables.

Furthermore, as theoretically expected, a strong correlation between the duration and costs of hospitalization was observed – a bivariate correlation of the two variables returned a Pearson Correlation Coefficient of 928 ($p < 0.05$). This linear correlation in both subgroups can be visualized in Figure 5, using a scatter plot with additional boxplots to highlight the means of both variables.

CONCLUSIONS

Fractures of the trochanteric region of the femur remain in some of the most common conditions treated in the orthopedic department of Bucharest’s Clinical Emergency Hospital.

While different methods of treatment exist, intramedullary nailing with a Gamma3 Nail and extramedullary osteosynthesis using a Dynamic Hip Screw remain the preferred methods of our clinic.

While a non-surgical treatment was opted for in a quite significant number of cases (over 10%), it should be noted that the majority of these cases were not fit to undergo surgery, as the operative treatment remains the golden standard.

In regards to the choice of implant, it should be noted that the preferred treatment still seems to be the surgeon’s personal preference. While intramedullary osteosynthesis is generally considered more modern and less invasive, there were still more cases treated using the DHS than the Gamma Nail. However, implant availability might also play a role in this regard.

While the main goal of surgical treatment should be considered being early mobilization and reduced hospitalization, reality shows that the mean duration of hospitalization is still very high at about 2 weeks. Whilst the costs for treating trochanteric fractures are generally lower than those associated with the treatment of other conditions, the total budgetary impact is still high, due to the abundance of cases.

The slightly higher costs associated with the use of the Gamma Nail versus the costs using a Dynamic Hip Screw when treating fractures of the trochanteric region cannot be associated with a net benefit in regards to a decrease in the duration of hospitalization. While costs remain slightly higher in the Gamma3 group, curiously so does the amount of days spent in hospital. However, since total costs also include the cost of the

implant, higher costs in the Gamma3 group can partially be explained by the difference in acquisition price for the two implants – 1455 RON for a Gamma3 Nail versus 473 RON for a Dynamic Hip Screw.

The relatively long duration of hospitalization in the Gamma3 group can also be explained by the preferred use of the less invasive technique in more complicated cases, for example in more complex fractures or with patients presenting additional medical conditions.

Long hospitalization can also be partially explained by the influence of a variety of factors, starting from the lack of specialized rehabilitation centers for transfer, the familial conditions of the patient and the asso-

ciation of other age-related conditions which require prolonged treatment, just to name a few.

In the authors' opinion, whilst the method of treatment should still be the surgeon's preference according to his skills with each implant and the particularity of the case, measures should be taken to assure early mobilization and rehabilitation after surgery in order to decrease the time a patient spends in hospital. This will not only benefit the healthcare provider with a decrease in costs and occupancy, but also the patient due to a faster integration into society and the possibility to quickly resume day to day activities.

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