

A COMPARATIVE ANALYSIS OF THE TREATMENT OF HUMERAL DIAPHYSEAL FRACTURES

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Abstract: Fractures of the humeral diaphysis are around 1% of all the fractures, but with important socioeconomic impact due to its complex treatment including also rehabilitation, affecting both young and elderly patients and generating important functional disabilities. This is a retrospective observational cohort analyze study that includes 1098 consecutive patients with diagnostic of calcanean fracture treated between 20120 and 2014. The purpose of this study is to analyze the variables associated with these fractures that influence the decision making in their treatment. We found significant difference in patients over 50 years vs. under 50 regarding the incidence of this fracture and the presence of comorbidities. The most important early complication is represented by the lesion of the radial nerve. The preferred treatment is surgical, but with a large variability of technique with a preference for closed reduction and fixation with intramedullary devices.

INTRODUCTION

Fractures of the humeral diaphysis are around 1% of all the fractures, most of them being caused by blunt trauma.(1) One major complication is the radial nerve palsy that occurs in 6-17% of these fractures.(2,3) It is also noticeable the association of these fracture with other type of fractures in complex trauma patients. There is also an important rate of nonunion of up to 20% of these fractures.(4) There are still many questions to answer regarding the appropriate treatment of these fractures.(5) Even if the rate of nonunion seems to be lower with orthopaedic treatment, there are important complications related to this type of treatment like shoulder and elbow stiffness due to immobilization.(6,7) On the other hand, the surgical treatment seems to offer many advantages related to quality of reduction, duration and costs of overall treatment, despite the higher rate of nonunions.(8)

This pathology has an important socioeconomic impact due to its complex treatment including also rehabilitation, affecting both young and elderly patients and generating important functional disabilities.

PURPOSE

The purpose of this work is to analyze the variables associated with these fractures that influence the decision making in their treatment with final impact on the outcome or the cost of the treatment.

MATERIALS AND METHODS

This study includes 109 consecutive patients with the diagnosis of humeral shaft fracture treated in the Department of Orthopaedic and Trauma Surgery of the County Clinical Emergency Hospital of Sibiu. Data were collected from patients' observational sheets and hospital archives. This is a retrospective observational cohort analysis for a period of 3 years, from January the 1st, 2012 to December 31th, 2014.

The data we have collected and analyzed includes: age, gender, type of treatment, comorbidities and associated lesions, complications, hospitalization. The patients were

divided considering groups of age, type of the fracture, orthopaedic treatment with cast immobilization or surgical treatment with different techniques of open reduction and internal fixation. Choosing the best treatment for these fractures is a decision based not only on the type of fracture, but also the functional status of the patient. The data we have collected were inserted in a table and then analyzed with Graph Pad, statistical analysis. For p value and comparison between variables we have used Chi square Test and Pearson Test. Some of the important correlations we found are detailed in the next section.

RESULTS AND DISCUSSIONS

In the three analysed years in the Department of Orthopaedic and Trauma Surgery, there were treated 4217 patients. There were 109 cases with patients with diaphyseal fractures of the humerus, meaning 2.58% of all cases.

There were 55 male patients and 54 female patients, suggesting that the incidence of this type of fracture is related more to causal trauma than to associated factors. Analyzing data for each year, we found different gender-related incidence, with no significant statistical difference, except for year 2013 when there were 13 female patients and 25 male patients of a total of 38 patients.

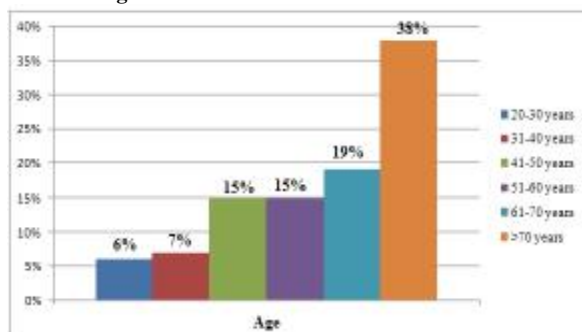
Figure no. 1 shows the incidence of humeral shaft fractures related to age. There are 3 patients under 20 years of age. We can see that the incidence is increasing with age, 38% of all are patients over 70 years old, this representing a significant statistical difference calculated with Pearson Test: ($p < 0,0001$, $p = 0,05$ reference value; $r = 0,5486$). The data for gender and age-related incidence shows that for patients < 50 years old, there are more males for each group (26 males compared with 4 females) with statistical significance difference. For patients 51 to 60 years old the number is equal between genders, and for patients >50 years this report is reversed in favour of females: 42 versus 19. These results can be the result of activity for younger patients and due to domestic accidents for elderly people. A role for the increased incidence of fractures in elderly women might be also the presence of

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osteoporosis, but we have no data for this. The associated pathology may also contribute to this increased incidence.

Figure no. 1. Incidence of humeral diaphyseal fractures related to age



Another parameter that we have analyzed was the cause of the fracture. The data collected reveal that traffic accidents are involved in 18% of cases (20 patients). Accidents of daily living, especially falling down on the same level causes 59% (64 patients), representing the large majority of the patients. Another important cause is falling from a higher level (work accidents, falling from trees etc.), for 12 patients (11%). More than half (14 out of 25) of the patients between 30 and 50 years were involved in traffic accidents. In contrast, 64 out of 75 patients over 50 years old declared as cause of the trauma, accidents of daily living, falls at the same level. There is a prevalence of traffic accidents for young males and domestic accident for elderly females as cause for these types of fractures. These results are in concordance with the type of activity these two categories of patients are doing.

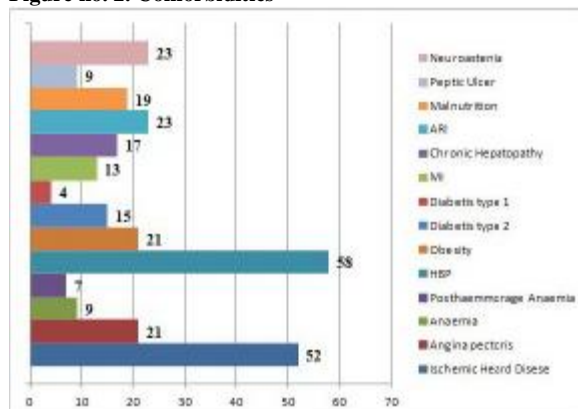
From all 109 patients, there were 25 patients with complex trauma (multiple injured patients), one from train accident, 16 traffic accidents, 3 falls from another level (more than 3 meters high), 2 falls at the same level, one aggression. 14,6% patients were victims of traffic accidents, including car drivers, car passengers, pedestrians. Only 36% of multiple injured trauma patients were females. There are no statistical significant correlations with the age of the patients, with preponderance in the 30-50 years old group.

There is an important number of patients presenting another fracture concomitant with the humeral shaft fracture. Most frequent concomitant fractures are at the same upper limb: forearm 12 patients (11%), clavicle 4 patients. There are also 9 patients with facial and head fractures, 9 patients with rib fractures, 8 patients with pelvic fractures 7 patients with spinal fractures and 11 patients with lower limb fractures. 12 patients presented more than one fracture associated, in multiple injured patients.

The next data we have analyzed are the comorbidities, excluding osteoporosis due to missing of objective data and superficial skin and soft tissue lesions presented mainly in multiple injured patients and which has no relevance for the treatment or outcome of these fractures. The most important comorbidities are related to the age group over 50 years old: 58 patients with high blood pressure (53%), 52 patients (47%) presented with chronic ischemic heart disease, 21 obese patients. 27% of the patients presented anemia and 15%, chronic liver disease, as shown in figure no. 2. We found no statistical significant correlations between comorbidities, type of trauma, gender, treatment, and age except for particular diseases with prevalence in specific group of age. It is probable that some chronic conditions may contribute to certain domestic trauma involved in these fractures.

The most important early complication is represented by the lesion of the radial nerve. This pathology is presented in 11 patients (10%) out of 109.

Figure no. 2. Comorbidities

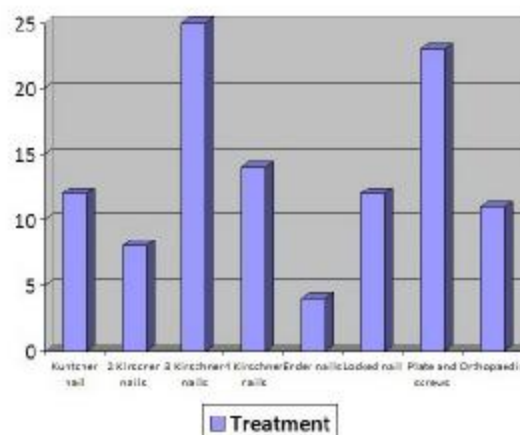


From the 109 patients included in this study, 38 (35%) declared at the admission in the hospital, that they are consuming alcohol: 13 (12%) daily, and 25 (23%) only on special occasions. We found no statistical significance using Chi Square Test related to alcohol consumption.

We arbitrarily classified the siege of the fracture dividing the humeral diaphysis in three thirds. The medium third include 75 patients (68%), the proximal third 30 patients (27%) and the distal third only 4% of all patients.

98 patients (90%) were treated with internal fixation of the fracture, 75 patients with closed reduction and fixation with intramedullary devices, 23 patients with open reduction and internal fixation with plate and screws. Only 11 patients (10%) were treated orthopaedically with plaster and/or Dessault immobilization. In Figure no. 3, it is represented the distribution of treatment in correlation with the number of patients. Using the Chi squared test we found significantly statistically differences between surgical or orthopaedic treatment: $p: 0.0051$ ($p < 0,05$ reference value); OR: 1,313 (< 1 there is no association between the two variables); 92% confidence interval. The preferred surgical technique in this group is represented by closed reduction and fixation with intramedullary devices used for 75 patients (69%). As we can see, there is no consensus regarding the surgical technique.

Figure no. 3. Treatment for humeral shaft fractures



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The reason for this is partially the preference of the surgeon for a certain technique, but also the lack of consensus in literature. There are different techniques available with satisfactory results but also with a significant rate of complications.(9,10,11) In all but three patients with surgical treatment were immobilized postoperative with casts, bandages or scarves.

There is a total of 622 days of hospitalization for all 109 patients, meaning an average of 5.7 days/patient, between 2 days and 64 days for a multiple injured patients. Because there are reasons independently to the treatment of humeral fracture that have prolonged the hospitalization period, we have considered that we cannot obtain correct and relevant statistical data for this parameter.

The early complication rate in our group of patients is: 11 patients presented radial nerve palsy upon admission, there are 2 early postoperative deep infections, 12 wound complications (hematoma and seroma), and one necrotic wound. We have collected no data about the late complication rate, and even if there are 5 patients with prolonged hospitalization due to associated pathology or infection, there are no data for a valid statistical analysis. For this reason, we have not included in this study complications like stiffness, ankylosis or muscular atrophy, although these were present in patients during prolonged hospitalization.

We have not detailed the types of immobilization used for these patients because the variety of techniques (Dessault bandage with or without cast, plasters, Caldwell, scarves, Sarmiento) used alone or sequential generated data unusable for a statistical analysis. The small number of cases also generated improper data for a detailed analysis of surgical techniques. However, it is clear that the treatment of choice for the majority of patients was surgical.

CONCLUSIONS

The humeral shaft fracture is rare, representing 2.58% of all fractures.

There is no difference in prevalence of these fractures relative to gender of the patients.

There is a significant statistical difference in patients over 50 years old vs. under 50 years regarding the incidence of this type of fracture.

The main causes for producing these fractures are domestic accidents in elderly patients, followed by traffic accident related with young active patients.

The most important early complication is represented by the lesion of the radial nerve (10%).

There is an important association with cardiovascular diseases as comorbidities, for sure due to the age of the patients, and with possible implications in the causality of these fractures.

The most frequent localisation is in the middle third of the diaphysis.

There is an important preference for the surgical treatment, but with no consensus regarding the technique, with a preference for closed reduction and fixation with intramedullary devices.

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