

## Femoral fractures in road traffic accidents

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**Abstract:** The purpose of this study is to describe and analyze the severity of road traffic accidents in which a femoral fracture was identified, comparatively, in ante and post-mortem cases. For this purpose we have conducted a retrospective study, using the archives of the National Institute of Legal Medicine from which were selected 82 consecutive cases of clinical medical-legal expertises and 100 cases of autopsy (AR) reports for road traffic accidents. Femoral fractures were identified in 34 cases, of which 12 were in clinical cases and 22 in necropsy cases. Femoral shaft fractures were significantly associated with a lethal outcome, whilst fractures of the proximal extremity were significantly associated with a non-fatal outcome. Femoral fractures have a tendency to occur at younger ages compared with the cases in which such a lesion was not identified. Conclusions. Femoral shaft fractures were more frequent in younger males and fractures of the proximal extremity in older female patients. The presence of a femoral fracture (especially if it is involved the femoral shaft) is associated with an increased risk for an unfavorable outcome.

**Key Words:** femoral fractures, road traffic accidents, prevalence, mortality, Romania, legal medicine.

According to the WHO's report "World Report on road traffic injury prevention" 1.2 million people die annually in road traffic accidents (RTAs) worldwide, with millions more sustaining severe, debilitating injuries[1], being the tenth leading cause of death and the ninth leading cause of morbidity[2]. In Romania road traffic accidents caused almost 2800 deaths in 2011 according to the official reports from the Medical Legal Network[3], representing more than 25% of all violent deaths. Most victims of the RTAs in Romania are young adult males, with associated cranial cerebral lesions, lower limb fractures, and various upper limb lesions[4].

Even though the characteristics of RTA related trauma in Romania were previously published[4-7], studies dealing specifically with lower limb fractures associated with RTAs in Romania were not identified in recent scientific literature. The purpose of this study

is to describe and analyze the severity of road traffic accidents in which a femoral fracture was identified, comparatively, in ante and post-mortem cases.

### MATERIALS AND METHODS

The study was retrospective, using the archives of the National Institute of Legal Medicine from which were selected 82 consecutive cases of clinical expertises (CE) and 100 cases of autopsy (AR) reports for road traffic accidents. The femoral fractures were divided into fractures of the femoral shaft and of the proximal extremity (fractures of the distal extremity were not identified in the study group). The severity of the initial trauma and the in-hospital evolution were quantified as described in [8], by using two parameters: (1) sev\_in (initial severity), which was obtained by quantifying the severity of the initial lesions and (2) Sev\_Tot,

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which measures the severity of the lesions depending upon to the number of days of hospitalization and the type of medical legal expertise (clinical or necropsy).

**RESULTS**

Femoral fractures were identified in 34 cases, of which 12 (14.63%) were in clinical cases and 22 (22%) in necropsy cases. Femoral shaft fractures were significantly associated with necropsy cases (21 cases, and only 4 in the clinical group), whilst fractures of the proximal extremity were significantly associated (Pearson  $\chi^2=15.811$ , significant at a  $p<0.001$ ) with clinical cases (8, and only one in the necropsy group). In the male patients group femoral fractures are more frequent (23 cases out of 104) whilst in the female group were identified only eleven cases out of 78. While femoral shaft fractures are relatively homogenous distributed amongst sex groups (15 cases in male and 10 in female patients), fractures of the proximal extremity are more often found in female patients (eight cases, with only one in male patients). The mean age for the cases with femoral shaft fractures was 40.44 whilst for fractures of the proximal extremity the mean age was 52.78 (62 years for the necropsy case and 51.63 for clinical cases).

Femoral fractures have a tendency to occur at younger ages compared with the cases in which such a lesion was not identified (see Table 1). The difference however is not statistically significant. Femoral shaft fractures were associated with a mean of  $1\pm 1.97$  days of hospitalization in the necropsy group and  $9.25\pm 2.21$  days in the clinical group. Fractures of the proximal extremity had a mean number of days of hospitalization equal to  $13.37\pm 9.4$ . In the subgroup without femoral fractures, the clinical cases had a mean hospitalization of  $8.68\pm 9.1$ , and the necropsy group had a mean of 10.42 with a standard deviation of 15.56 days. The differences between subgroups are statistically significant ( $F=4.745$ ,  $p<0.001$ ).

**Table 1.** Days of hospitalization and mean age for patients with femoral fractures

Femoral fractures		Age	Days of hospitalization
No	Mean	50.77	10.4231
	No	78	78
	Std Deviation	25.047	15.56263
Yes	Mean	41.73	1.6364
	No	22	22
	Std Deviation	21.837	3.55294
Total	Mean	48.78	8.4900
	No	100	100
	Std Deviation	24.562	14.29805

The severity of the cases in which a femoral shaft fracture is present is higher for both Sev\_In and Sev\_Tot parameters compared with the cases in which no femoral fracture was identified. Proximal fractures are associated with a higher Sev\_Tot and a lower Sev\_In value compared with the cases with associated femoral shaft fractures in the clinical groups whilst in the necropsy group the scores are lower in both instances (see Table 2 for details).

**DISCUSSIONS**

Lower limb fractures are amongst the most frequent trauma lesions caused by road traffic accidents. For example Hou found lower limb fractures to be the most frequent, followed by fractures of the upper extremity, skull, and maxillo-facial region[9]. Chalya found traumatic lesions in the extremities to be the most frequent lesions secondary to RTAs with a prevalence of 65%[10]. Jean identified lower limb lesion in 40.4% of all RTAs, this location being the most frequent. In Romania, lower limb fractures are the third most common type of lesion in RTAs after cranial and facial trauma (32.4%), and thoracic lesions (19.1%), being identified in 16.7% of all cases[5]. Admassie, analyzing only lower limb fractures, proved femoral fractures to be the most frequent, accounting for 15.8 of all lesions at this level[11]. In our study the overall prevalence of femoral fractures was 18.6%, much higher in necropsy cases (22%) compared to the clinical group (14.63%),

Femoral fractures have two main etiologies - falls in elderly, case in which is most often affected the proximal extremity [12 13] and road traffic accidents, in which femoral shaft fractures are most frequent[14-16]. For example, a study conducted by Salminen et al found 75% of all femoral shaft fractures to be associated with road traffic accidents, most of them in the middle third (79%), with a transversal line of fracture in 77%[17]. In our study group femoral shaft fractures were more frequent in younger males and fractures of the proximal extremity in older female patients, results similar to other studies[11-17].

The number of days of hospitalization is significantly lower if the patient had a femoral fracture compared with the cases in which such a lesion is not present( $F$  test = 6.865, significant at  $p = 0.01$ ). The main cause of this apparently paradoxical result is the fact that most femoral shaft fractures were associated with an extremely short survival (a mean of  $1\pm 1.97$  days). The presence of a femoral fracture (especially if it is involved the femoral shaft) is associated with an increased kinetic

**Table 1.** Severity associated with femoral fractures

Group	Femoral Fracture	N	Sev_Tot	Std.Dev Sev_Tot	Sev_In	Std.Dev. Sev_In
Clinical	No Fracture	70	8.6857	9.10891	11.4143	9.29156
	Femoral Shaft	4	9.2500	2.21736	13.0000	5.35413
	Proximal Extremity	8	13.3750	9.42546	11.3750	3.88909
	<b>Total</b>	82	9.1707	8.97157	11.4878	8.71956
Necroptic	No Fracture	78	89.5769	15.56263	52.3846	30.28961
	Femoral Shaft	21	99.0000	1.97484	61.7143	34.08686
	Proximal Extremity	1	85.0000	.	35.0000	.
	<b>Total</b>	100	91.5100	14.29805	54.1700	31.09031

energy developed during the accident, therefore leading to an increased probability of supplemental organ involvement, and subsequently increasing the risk for an unfavorable outcome.

As an exception, the presence of femoral fractures located in the proximal extremity is often associated with elder persons and an overall decreased severity. However, due to the presence of adjacent pathologies, this decreased severity of the initial traumatic lesions is not associated with a proportionate decrease in the fatality rate. This conclusion is confirmed by the fact that proximal fractures in the clinical group have a higher Sev\_Tot value and a lower

Sev\_In value (see Table 2).

## CONCLUSIONS

Our study confirms the increased prevalence of femoral fractures in higher severity road traffic accidents and the association between such a lesion and an unfavorable outcome. Fractures of the proximal extremity, even if have a lower initial severity index, due to the fact that they are associated with an increased age and subsequent comorbidities, is associated with an increased fatality risk.

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