Femoral Shaft Fracture in Adult Victims in Semey, Kazakhstan from 2009–2011: An Epidemiological Retrospective Study

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Abstract: Background. To determine epidemiology and characteristics of adult`s femoral shaft fracture (FSF) in Semey city, Kazakhstan over a 3-years period (2009-2011); and to compare these findings with other countries data. **Methods.** Data from Department of Traumatology of Semey Emergency Hospital were used in this study and all of 101 FSF of 95 patients for the 3-years period were included. **Result.** Over the 3-years period, the portion of FSF was 26.5% of all femoral fractures with average annual incidence rate of 9.7 per 100,000 person-years. Majority of patients were males: 65.3% (n=62). The total average age of patients was 43.7 years old, and male average age was much more younger than female: 38.2 and 54.7 respectively. In the 15-49 years old group, the incident rate ration male/female was 3.69 (95% CI: 2.09; 6.55). The majority of FSF was closed (83.2%) and comminuted (51.5%). In 38.6% of fracture were in the middle thirds; 35.6% - proximal, and 25.7% - distal. The main causes of FSF were road traffic injuries (45.3%) and household injuries (38.9%). The quantity of FSF was higher in the summer season (34.8% of total patients). **Conclusion.** Male predominance, lower average age and lower proportion of middle thirds fracture, majority of type B fractures, and high portion of FSF after RTI - are specific for FSF patients in Semey, Kazakhstan. This study would be useful in health-care planning and management for patients with FSF in Semey, Kazakhstan.

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Introduction

Femoral shaft fracture (FSF) is one of the most common major injuries that an orthopedic surgeon is required to treat (Whittle AP, 2003). The shaft is defined as the middle part of the femur 5 cm below the minor trochanter at the proximal part and 9 cm above the knee joint (Torbert JT, 2008). In osteoporotic bones, the FSF can be broken after low-energy trauma, mostly in older persons (Salminen ST, 2000). But a high-energy injury is usually required to break the shaft, especially in younger patients (Court-Brown CM, 2006).

The annual incidence of FSF worldwide is about 1-1.33 fractures per 10,000 population (Fogerty SJ, 2007). FSF is more common in male above 30 years of age (Fogerty SJ, 2007), who are at an economically productive age.

Explore epidemiological findings is important step in prevention and improvement policy measures. To our knowledge, this is the first article about the epidemiological situation of FSF in Kazakhstan in an international publication.

The aim of this study was to determine the epidemiological situation of FSF in Semey, Kazakhstan during the years 2009-2011 years and to compare with other studies.

Methodology

The design of this study is a retrospective and descriptive. Semey is the second largest city in the East Kazakhstan region, with a total average population of 326,739 residents during 2009-2011 (Statistics Department of East Kazakhstan Region Government, 2011). Department of Traumatology of Semey Emergency Hospital is specializing in providing care to all adults (older than 15 years of age) of Semey and its vicinity with bone fractures.

All patients with FSF treated in Department of Traumatology during the period of January, 1st 2009 to December, 31st 2011 were included to this study. Data were retrieved from hospital`s archives.

The following parameters of patients with FSF were retrospectively analyzed: age, gender, cause and type of injury, seasonality, location and characteristics of the FSF. The total quantity of parameters such as part of shaft fractured, character and type of fracture was equal to the number of broken femoral shafts (n=101), while the total of

other parameters, such as type and cause of injury, gender and age groups, and seasonality was equal to the number of cases (n=95).

This study was reviewed and approved by the Ethical Committee of Semey State Medical University (protocol no. 2, October, 24 2012).

Incidence rate: The FSF incidence rate was calculated as a ratio of total absolute number of FSF patients over the 3-years period multiplied by 100,000 and divided by 3 (for the 3-years period) and the average number of Semey City residents.

Causes of Injuries: A road traffic injury (RTI) is defined to be an injury caused by a road traffic accident. A household injury is an injury in a house (apartment or cottage), or in the stairwell of an apartment building or in the courtyard of cottage. A job-related injury is an injury at work when exercising professional responsibilities, or on the way to and from work within one hour before and after the shift. A street injury is an injury on the street, and in circumstances different from the above injuries, usually due to slipping and falling down or criminal action.

Statistical analysis. The results are presented in absolute numbers and percentages. All statistical analysis is performed using Stata software, version 11.0.

Results

Epidemiology. Altogether, the number of femoral fractures treated at the Department of Traumatology of Semey Emergency Hospital during the period of 2009-2011 was 381. Totally, 95 patients (cases) with 101 femoral shaft fractures (or 26.5% of all femoral fractures), including six patients with fractures of both femurs, were identified.

The incidence rate of FSF was 9.7 per 100,000 person-years during research period.

Characteristics of Fractures. The most frequent diaphysis fracture localizations were in the middle (n=39 or 38.6% of the total) and proximal (n=36 or 35.6%) thirds, followed by the distal third (25.7%) (table 1). Closed fractures occurred in 83.2% of patients, and open in 16.8% of patients.

The majority of fractures, 52 (51.5%), were comminuted (Group B in the AO/ASIF classification) (table 1). Transverse and oblique fracture lines were seen in 19.8% and 13.9% of patients, respectively. The remaining types of fractures were less than 8% for each type.

Characteristics and Causes of Injuries. FSF as an isolated injury occurred in 47 cases (49.5% of total), and as a polytrauma in 48 cases (50.5% of cases) (table 1). Associated injury (n=34, 35.8%) with damage of the central nervous system was the dominant type of polytrauma, mostly in the form of closed cranio-cerebral injury (81%). Combined and multiple trauma were seen in 1.1% and 13.7% of patients, respectively.

Table 1. The characteristics of the femoral shaft fractures and their cases, 2009-2011 years.

Parameter	2009	2010	2011	**Total**	**% of total**
Part of the shaft:					
Proximal 1/3	14	15	7	**36**	**35,6**
Middle 1/3	15	18	6	**39**	**38,6**
Distal 1/3	9	7	10	**26**	**25,8**
Total	38	40	23	**101**	**100**
Character of FSFs:					
Closed	32	34	18	**84**	**83,2**
Open	6	6	5	**17**	**16,8**
Type by AO/ASIF classification:					
A1 (spiral)	5	3	0	**8**	**7,9**
A2 (oblique)	6	3	5	**14**	**13,9**
A3 (transverse)	9	9	2	**20**	**19,8**
B (comminuted)	17	21	14	**52**	**51,5**
C (double)	1	4	2	**7**	**6,9**
Type of injury:					
Isolated	18	18	11	**47**	**49,5**
Associated	10	16	8	**34**	**35,8**
Multiple	6	5	2	**13**	**13,7**
Combined	1	0	0	**1**	**1,1**
Cause of injury:					
Road traffic injury	14	20	9	**43**	**45,3**
Household injury	14	13	10	**37**	**38,9**
Job-related injury	2	3	1	**6**	**6,3**
Street injury	5	3	1	**9**	**9,5**
Gender:					
Male	26	24	12	**62**	**65,3**
Female	9	15	9	**33**	**34,7**
Mean age:					
Male	36,5	40,8	37,3	**38,2**	
Female	56,3	50,3	57,5	**54,7**	

The major causes of femoral shaft fracture (table 1) were road traffic injury (45.3%) and household injury (38.9%). Job-related injury was at 6.3% and street injury at 9.5% of patients as the cause of trauma.

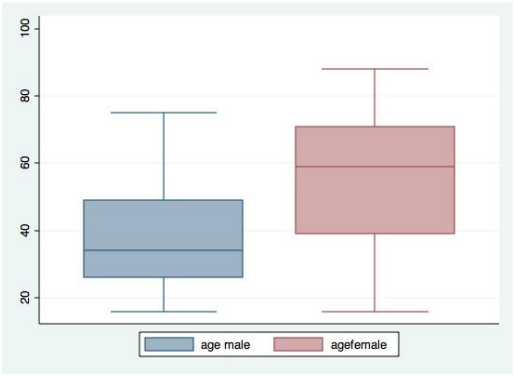

Figure 1. Age of patients with FSFs

Table 2. Age groups of cases stratified by gender.

Age group	Male		Female		Incidence rate ratio male / female	95 % CI	
	Abs. number	%	Abs. number	%			
15-49	48	77,4	13	39,4	3.69	2.09	6.55
> 50	14	22,6	20	60,6	0.98	0.49	1.95
Total	62	100	33	100			

Demographic characteristics. In our study, 62 of the patients were males (65.3% of total cases) and 33 (34.7%) were females (table 2). Gender ratio was 1.9:1. The mean age of patients was 43.7 years, while the males average age was 38.2 years and females - 54.7 years (table 1, figure 1).

We classified all FSF patients into two age groups: 15-49 years old, and older than 50 years, because persons under 50 years old are the most active and economically productive. Data from table 3 shows that in our cases in the 15-49 years old group, the males were predominant (95% CI: 2.09; 6.55). In the group more than 50 years old, the rate of FSF in female was higher than in male (95% CI: 0.49; 1.95).

Seasonal Changes. With the aim of determination of seasonal changes in a year for FSF we summarized all cases in the 3 years period by month, and calculated the percentage of cases occurring in each month from total (table 3).

Table 3. Absolute number and percentage of femoral shaft fractures in Semey per month/year.

Parameter	2009	2010	2011	**Total (%)**
Jan	2	7	2	**11 (11,6%)**
Feb	3	2	1	**6 (6,3%)**
Mar	1	1	0	**2 (2,1%)**
Apr	4	2	1	**7 (7,4%)**
May	5	4	1	**10 (10,5%)**
Jun	3	5	1	**9 (9,5%)**
Jul	5	4	2	**11 (11,6%)**
Aug	3	3	7	**13 (13,7%)**
Sep	2	3	0	**5 (5,3%)**
Oct	3	2	3	**8 (8,4%)**
Nov	2	5	3	**10 (10,5%)**
Dec	2	1	0	**3 (3,2%)**

We observed an increase of cases during summer months with peak in July (summer seasonality of FSF) in Semey (table 3, figure 2).

Discussion

The main problem of FSF is the long treatment and reconvalescence time (about 4-6 months) for patients. In patients with polytrauma, open or double fracture, the reconvalescence period may be even longer (Femur Shaft Fractures, 2011). This could lead not only to financial constraints of the patients themself, as they are unable to attend their working place but also for the Health Institutions, as prolong in-patient care is very costly (Wong MK, 2002; Sahota O, 2012; Hepgüler S, 2011). Understandably, the prevention of FSF is more cost-effective than treatment (Galbraith JG, 2011; Heinrich S, 2011; Huang PJ, 2012). And in many cases FSF could be prevented if appropriate prophylactic measures are applied (Becker C., 2011).

In our study we aimed to explore epidemiology and characteristics of FSF in Semey, which could be a stepping stone for FSF prevention policy.

By comparing with worldwide data we found similarity in following parameters:

Firstly, the annual incidence rate of FSF, which was 9.7 per 100,000 person-years in Semey. For comparison, FSF incidence rate per 100,000 person-years was 9.9 in Finland (Salminen ST, 2000); 10.3 in UK (Court-Brown CM, 2006); 10 in Sweden (Weiss RJ, 2009); and 10–13.3 – worldwide (Fogerty SJ, 2007), which are slightly higher but mostly the similar to our data.

Secondly, in our data, closed fractures were prevalent (83.2%), which is similar to the results of studies in Finland (Salminen ST, 2000) and Sweden (Weiss RJ, 2009), where proportion of FSF were 87.5% and – 82% respectively.

Finally, we obtained unimodal age distribution in male and female as in other studies (Court-Brown CM, 2006; Weiss RJ, 2009; Wong PCN, 1966; Bengner U., 1990). In our study males were predominant in the 15-49 years old group (Table 3) (77.4%) but rate of female was higher in the >50 years old group (60.6%). Although, other studies have used different age span grouping, main characteristic pattern could be cleary seen, that in younger age males are predominant and on older group females are more affected. For example, Fogerty et. al. (2007) noted that among the FSF patients that males less than 30 years old were the majority. Salminen S.T. et al. (2000) identified that the “highest age and gender specific incidences were seen in males from 15 to 24 years of age and in females 75 years of age or older”. Hedlund R. et. al. (1986) wrote that in the 20-29 years old group the incidence of FSF in male was two times higher than in female of the same age, but in the group more than 70 years old the rate of FSF in female was higher than in male.

Despite above mentioned similarities to the worldwide data, we found differences in gender ratio and average age, location and type of FSF, main cause of FSF.

In our study, male patients were much more predominant, with male to female ratio (1.9:1). But oppositely, in UK (Court-Brown CM, 2006) and Sweden (Weiss RJ, 2009), female predominated among FSF patients: 1:1.8 and 1:1.2, respectively. This difference might be the result of higher proportion of young and middle age patients (see below), where males are prone to more risky behavior.

Patient's average age in Semey was 43.7 years. This is about 25 years younger than patients with femoral diaphysial fractures in Edinburgh, where the average age was 68 years (Court-Brown CM, 2006). This might be due to difference in age pyramid in both countries. As UK belongs to aging society, which is opposite to Kazakhstan (Population Pyramids of the World from 1950 to 2100, 2010).

In our study, type A and type B fractures were 41.6% and 51.5% respectively. However, in Finland (Salminen ST, 2000) type A was higher - 48%, and type B much more lower - 39%. Moreover, in our study, middle thirds FSF were the most frequent (38.6%) which is about 2 times lower than in Finland, where 79% of FSF were in the middle thirds. As middle thirds FSF are mainly results of high energy injures, much higher RTI in Finland may explain this difference.

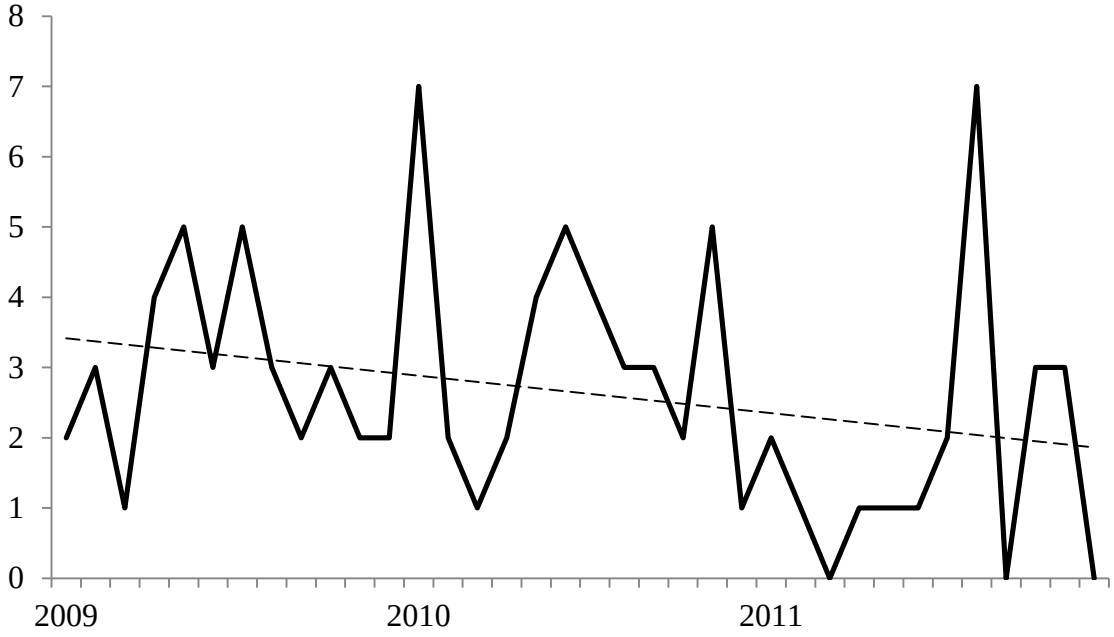

Figure 2. Seasonality and trend of the femoral shaft fracture in Semey (abs. number per month/year).

In our study, the main cause of FSFs was RTI (45.3%) which reflects serious problem of Kazakhstan`s road traffic accidents (World Health Organization, 2009). Although, in Finland the major cause of FSF was RTI 68.2% (Salminen ST, 2000), however, Sweden has much lower FSFs in young adults (17%) (Weiss RJ, 2009) comparing to Semey. It worth to notice that England have had similar high number of RTI FSF in 1970s-1980, but managed to decrease it by implementation of road safety program (Court-Brown CM, 2006).

The highest incidence of FSF in Semey was during the summer (34.8% of the total); followed by autumn (24.2%), winter (21.1%) and spring (20%). Unfortunately, we couldn't find data from other countries to compare with. We attribute the high summer incidence in our region to the increasing of number of road accidents during summer season. In dynamic the rate of FSF in Semey decreased from 35 (2009) to 23 (2011) cases per year. We suppose this reduction could be as a result of the reduced number of road traffic accidents, which are related to a new road safety policy in Kazakhstan (Batpenov ND, 2011).

Conclusion

Male predominance, lower average age and lower proportion of middle thirds fracture, majority of type B fractures, and high portion of FSF after RTI - are specific for FSF patients in Semey, Kazakhstan. This study would be useful in health-care planning and management for patients with FSF in Semey, Kazakhstan.

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Conflict of interests

The authors declare that they have no conflict of interests.

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