Research Article

Epidemiological profile of thoracolumbar fracture (TLF) over a period of 10 years in Tianjin, China

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Context/Objective: The objective of the research was to illustrate the epidemiology profile of thoracolumbar fracture (TLF) in Tianjin Medical University General Hospital, China, from 2006–2015.
Design: Hospital-based retrospective study.
Setting: Tianjin Medical University General Hospital.
Methods: Medical records of inpatient patients with TLF from 1 January 2006 to December 2015 were collected. Detailed information on epidemiological characters were analyzed based on the medical records suffering from TLF from T11-L2 level, including incidence, age and sex, marital, occupation, etiology and fracture type, types of injuries.
Results: Totally 132 cases were identified. The incidence rate was 2.4 patient per million population at 2015. Male-to-female ratio was 1.4:1, with a mean age of 49.1 ± 17.7 years. The cases number in 46–60 group, totally 35 and accounting for 26.5%, was the largest. There is a significant differences of cases number between 2011–2015 group and 2006–2010 group. Retiree, taken up 48.5%, was the largest group among TLF patients. The most common injury level was T12 (34) accounting for 25.7%. Falls (57, 43.2%) (low falls and high falls) were the leading causes, followed by motor vehicle collisions (MVCs) (23, 17.4%).Compression is the only type of osteoporosis and took up 55.3%.
Conclusions: The incidence ratio is increased annually in TMUGH. Male was more vulnerable than female based on different social character. The average age was older in 2011–2015, retiree accounted for the main proportion and compression took up the largest percentage, the mean age increased and osteoporosis takes more in recent years.

Keywords: Thoracolumbar, Hospital-based retrospective study, Epidemiology, Compression, Fracture

Introduction

Spinal injury is a common orthopedic trauma disease, often leads to disabilities and serious consequences. Thoracolumbar fracture (TLF) (T11-L2) is the most common vertebra fracture due to its special position between fixed thoracic spine and movable lumber spine.[1–3] High-energy injuries often occur in young people, in addition to the spinal injury, more along with the corresponding segment of spinal cord injury and other organs injury.[4–7] Low-energy injuries, often occur among the elderly population due to etiologies such as osteoporosis and low fall, result in long-term lying in bed. Either age group leaves a huge burden to the family and the society.[8]

The incidence rate of TLF are ranging from 6.4–11.7 per million population per year in the United States.[9,10] The major etiology of TLF is motor vehicle crash (MVC) and the most TLF type is blunt.[1,9–11] These studies discuss the underlining factors related to the epidemiological profile in USA. The application of seatbelt apparently reduced the incidence rate and severe

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DOI 10.1080/10790268.2018.1455018

injury of TLF. So the design of seat-belt, improved from lap belts to an advanced lap-shoulder belt, combined with airbag, contributed to the reduced incidence rate of TLF.[9,11,12] Based on the different age constituent and social development, the epidemiological profile of TLF in China is definitely different from that in United States. However, with the largest population in the world, China has little studies focus on epidemiological characters of TLF. As a devastating injury, TLF should be controlled through the cooperation among government, traffic administration bureau and hospitals so as to reduce the incidence rate of TLF.

With the fast development of economy and living quality, the epidemiological profile of TLF must have changed. To provide information on the epidemiological characters of TLF in Tianjin, China, so as to design efficient prevention studies, we collected and analyzed the medical records of TLF patients from 1 January 2006 to 31 December 2015.

Methods

Participants

The present study included the Thoracolumbar Fracture (TLF) patients admitted to Tianjin Medical University General Hospital, the biggest tertiary level medical center in Tianjin, from January 2006 to December 2015. Detailed information on epidemiological characters was analyzed based on the medical records of patients suffering from (TLF) from T11 level to L2 level, including age, sex, marital status, occupation, date of injury, cause of injury, level of injury, types of injury, ASIA score. Patients accompanied by other organs injury, vertebral fracture except for T11-L2, incomplete medical records were excluded. A total of 132 cases were taken into this study.

Study group

The patients were divided into different groups according to age (16–30, 31–45, 46–60, 61–75 and ≥76), sex (male and female), marital status (married and unmarried), occupations (peasant, worker, office clerks, students, drivers and retirees), date of injury (grouped according to year), causes of injury (high fall (>1 m), low fall (<1 m), motor vehicle collisions, other kinds of trauma and osteoporosis), levels of injury, types of injury (compression, burst, dislocation, flexion), ASIA score (A, B, C and D).

Statistical analysis

All detailed data were entered by two independent researchers and checked by the third researchers to make results credible. SPSS 11 (IBM, Armonk, NY, USA) and Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) were used by two researchers to manage and analyze the data. The characteristics listed in Table 1 was expressed as numbers. To explore the differences in characteristics by etiology and by two periods, a descriptive study of relevant variables was carried out. Bonferroni method and the chi-square method were used for the within-group comparisons. A P value < 0.05 was defined as statistically significant.

Results

Incidence

Based on the data acquired from the National Bureau of Statistics of China, from 2006–2015, the population in Tianjin is increase steadily by average 4.16%±0.91 per year, and the patients number in 2014–2015 is sharply increased compared with that from 2006 to 2013. The average incidence rates from 2006 to 2013 were in a low level, while the incidence rate reaches a 2.4 patient per million population at 2014 (Figure 1).

Compared to 37.2% in 2006–2010 group, the Fall took up 46.9% in 2011–2015 group. The constituent ratio percentage of MVCs was decreased although the case number was increased, while the constituent ratio percentage of other trauma and osteoporosis was steady (Figure 2).

Age and sex

Age and sex distribution were showed in Table 1. For 132 cases, 58.3% (77) were male and 41.7% (55) were female. Male-to-female ratio was 1.4:1. Mean age was 49.1 ± 17.7, mean age of male was 44.13 ± 17.09, while the mean age of female was 55.96.5 ± 16.37, ranking from 16–87.

The 46–60 year group accounted for 26% followed by the 31–45 year group taking up 25%. During 2006-2010, there was 51 patients and the mean age was 47.64 ± 16.81, while there was 81 patients in 2011–2015 and the mean age was 49.95 ± 18.33. There is an obvious increasing case number during 2011–2015 section compared with that in 2006–2010, and the osteoporosis became a major factor of TLF in elderly population.

Marital

Married-to-Unmarried is 1:5.9 (19:113) and unmarried patients' average age is 25.2, while it is 53.2 in married patients. Fall is the most common cause resulting TLF in both groups, however fall take up 61% in unmarried group compared to 56.7% in married group. Interestingly the osteoporosis occurred only in married group, demonstrated age related characters of TLF.

Table 1 Characteristics of patients with TLF in Tianjin Medical University General Hospital, China from 2006 to 2015.

Variables	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	total
Frequency	13	9	12	6	11	10	13	9	24	25	132
Age											
16–30	2	2	3	3	1	2	3	1	4	5	26
31–45	2	2	6	1	1	5	3	1	8	4	33
46–60	5	2	3	2	6	1	3	3	5	5	35
61–75	4	2	0	0	2	2	4	4	5	6	29
76–	0	1	0	0	1	0	0	0	2	5	9
Average age	51.692	51.1	39.7	37.7	54.2	41.2	47.4	56	48.4	54.1	49.1 ± 17.7
Sex											
Male	7	6	11	4	6	9	7	2	15	10	77
Female	6	3	1	2	5	1	6	7	9	15	55
Marital status											
Married	12	9	10	4	10	9	11	8	21	19	113
Unmarried	1	0	2	2	1	1	2	1	3	6	19
Occupation											
Peasant	2	1	4	2	2	2	1	0	2	1	17
Workers	1	3	2	2	1	4	3	1	8	4	29
Office clerks	2	0	1	0	1	0	0	0	1	0	5
The retired	6	5	2	2	6	3	7	7	11	15	64
Students	1	0	1	0	1	1	2	1	1	4	12
Drivers	1	0	2	0	0	0	0	0	1	1	5
Etiology											
Low fall	1	2	0	1	1	1	4	1	0	6	17
High fall	4	2	5	3	0	6	4	2	7	7	40
MVCs	4	1	2	1	3	2	2	0	5	3	23
Other trauma	0	3	5	1	5	2	1	3	9	5	34
Osteoporosis	4	1	0	0	2	0	1	3	3	4	18
Level of injury											
T11	1	1	1	0	0	0	2	0	0	0	5
T12	4	2	3	0	1	3	1	2	12	6	34
L1	6	2	6	2	6	3	4	2	3	13	47
L2	2	1	0	2	0	3	3	1	7	5	24
Multiple fracture	0	3	2	2	4	1	3	4	2	1	22
AISA Scale											
A	0	1	2	2	2	0	1	1	0	0	9
B	0	0	0	1	0	0	0	0	2	0	3
C	1	0	0	0	1	0	1	0	0	0	3
D	0	0	0	0	0	1	1	1	1	1	5
E	12	8	10	3	8	9	10	7	21	24	112

ASIA, American Spinal Injury Association; MVCs, motor vehicle collisions; OTs, other traumas; SCI, spinal cord injury.

Occupation

The occupations of TLF patients were divided into peasants (12.8%), workers (21.9%), retired (48.4%), drivers (3.8%), office clerks (3.7%), and students (9%) (Figure 3). The number of retiree and workers accounted for 48.4% and 21.9%, respectively. The etiology constituent ratio of each occupation is showed in Figure 3.

Etiology and fracture type

The etiology of TLF is showed in Figure 4. Fall takes up 43.2% followed by other trauma 25.7%. Compression is the only type of osteoporosis and took up 55.3% of all TLF patients, while burst accounted for 37.1%. Totally 20 cases suffered from spinal cord injury (SCI), the etiology of the SCI patients were showed in Figure 4 and the injured level distribution were also presented. The L1 (35.6%) and T12 (25.7%) were the most vulnerable vertebra followed by L2, and the T11 is tolerant to injury.

Types of spinal cord injuries

The proportions of ASIA A, B, C and D injuries were 6.8% (9:132), 2.3% (3:132), 2.3% (3:132) and 3.8% (5:132), respectively, and the distribution of ASIA

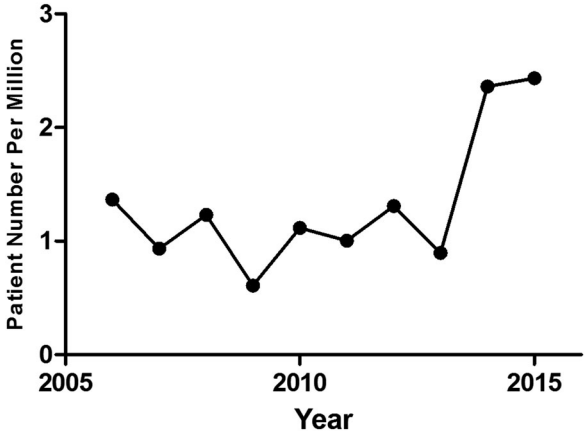

Figure 1 Annual incidence rate of TLF in Tianjin Medical University General Hospital was showed depended on the data from National Bureau of Statistics of China.

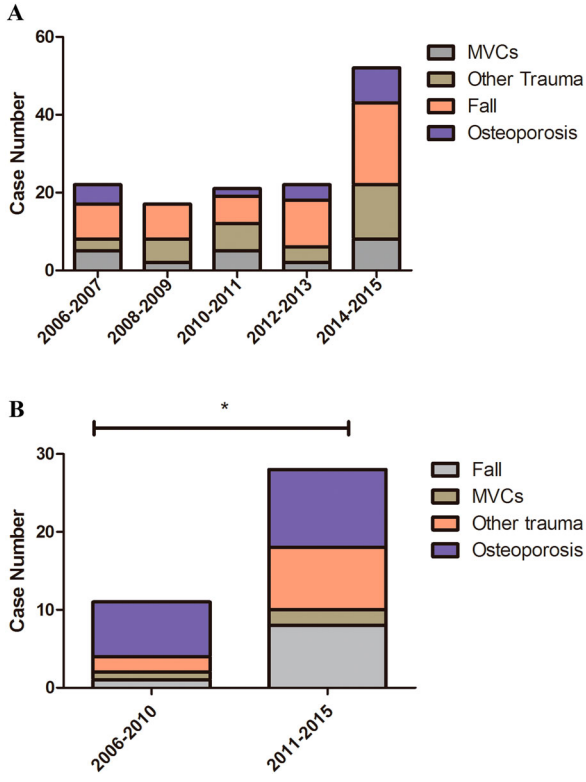

Figure 2 The etiology constitution every two years (A) and etiology constituent every 5 years (B) were shown. The occupation constituent is different between 2006–2010 and 2011–2015 (*P<0.0347, Chi-square test).

grade was shown in Table 1. As for the severity of injury, 9 patients (6.8%) had complete injury with no motor or sensory function was preserved in the sacral segments S4-S5 while 11 (8.3%) had incomplete injury with the degree of function depended on the extent of the injuries.

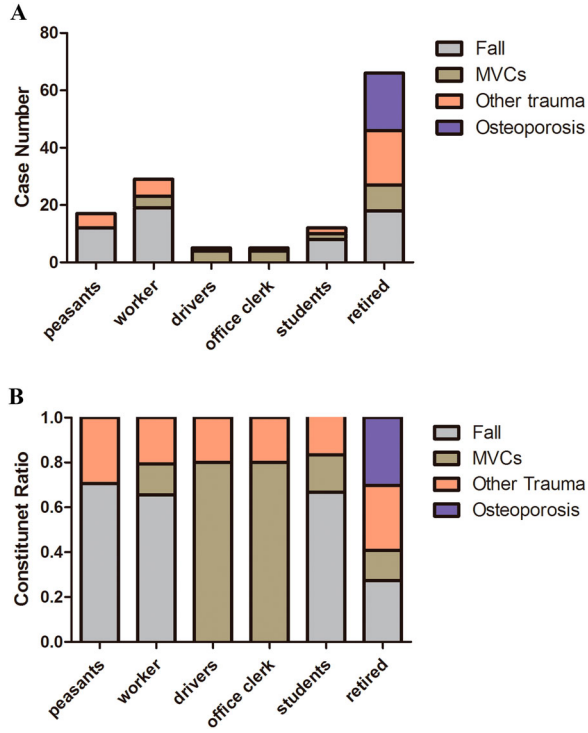

Figure 3 Etiology constitution and etiology constituent ratio were presented. (A) The etiology percentage constituent of different occupations. (B) The etiology constituent of different occupations.

Discussion

Spinal fractures are mostly caused by high-energy trauma, like motor vehicle collision, falls, fall objects or sports.[13] In our retrospective study osteoporosis associated with no obvious trauma became a major cause of TLF among elderly population. A thorough knowledge of epidemiology of TLF will facilitate the prevention, management and then reduce the incidence rate and improve the social health. To our knowledge, this is the first epidemiology study of TLF that tried to describe the epidemiology profile in Tianjin China.

The incidence rate of MVCs related injuries was decreased because of widely application of seat-belt, behavior modification and improved automobile safety design.[14] Wang *et al.* reported that the incidence rate is increased from 1998 to 2011 in the USA, but the injury severe fracture did not increase.[15] On the contrary, Doud *et al.* showed the incidence rate of TLF injury was increased during 1998–2011 period.[11] In our study, the incidence rate from 2011–2015 is increased compared with that from 2006–2010. The improved safety of cars and widely application of set-belt indeed decreased the sever spinal fracture, providing study-based evidence for the transport agency and the

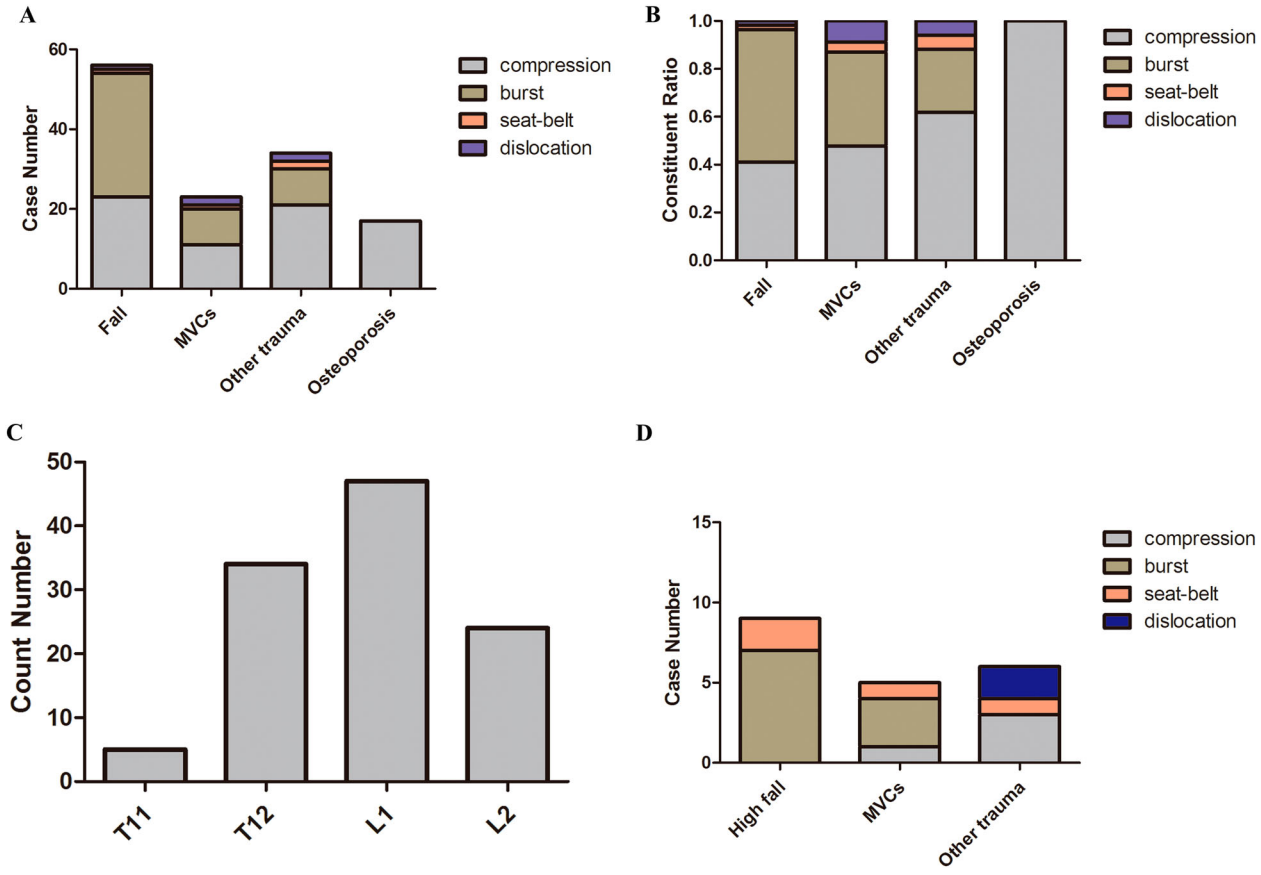

Figure 4 Fracture type constitution and constituent ratio was showed in (A) and (B). The injury level were presented in (C). The etiology constituent ratio of TLF associated with SCI was shown in (D).

government to emphasize the importance of the use of seat-belt to reduce the TLF.[3] The incidence rate differences among studies might be results of different screen method and more patients suffering from fatal injuries dead before reaching emergency room.

The studies in Jordan and Nigeria showed MVCs and fall were the most common etiolog.[16–18] Bullet injuries and industrial trauma were additional causes.[16,19] Different from previous studies in the United States and similar to India.[10,20] the most common mechanism was fall, accounting by 43.2%, followed by other trauma (25.7%). The most common TLF type was compression fracture (55.3%), which was similar to that in India.[20] Corresponding to previously study, the most vulnerable vertebra in this study was L1 (35.6%).[8,20] The differences of most common mechanism and fracture type between our study and previous reports might be the result of different economic development, age constituent and social characters. Compared with The United States, China is a fast developing country, which has the largest population in the world and the increasing construction may result in high rate of fall among workers, what's more, because of the aging society in Tianjin, China, the elder population contributes to the high rate of fall and compression. As a transition position (T11-L2) from the fixed thoracic spine to movable lumber spine, thoracolumbar vertebras are biomechanically vulnerable to injury.

The neurological damage is a devastating associated injury following TLF, in this study 20 patients suffered from spinal cord injury, which resulted in lower limb paralysis. High-energy trauma like high fall, MVC and other trauma were more prone to cause spinal cord injury while osteoporosis was a relative mild etiology without neurological damage. On the contrary, Khurjekar *et al.* reported a high rate of neurological injury and the differences was the results of inclusion criteria that restricted to severe spine injury.[20]

Some limitations exist in this study which should be noticed. (1) Although Tianjin Medical University General Hospital is the largest hospital in Tianjin, as a single-center-based retrospective study on the epidemiology profile, could not represent the exactly profile

in Tianjin, China. (2) Patients' records from outpatient department were miss. (3) Patients younger than 15 were excluded. (4) The classification of occupation needs to be detailed further to obtain valuable information.

Conclusion

In summary, this study described the epidemiological profile of TLF in Tianjin, China, from 2006-2015. The incidence ratio was increased annually in TMUGH. Male were more vulnerable than female based on different social character. The average age was older in 2011–2015, retiree accounted for the main proportion and compression took up the largest percentage, the mean age was increased and osteoporosis took more in recent years. These data might be useful for the government, the Centers for Disease Control and transport agency to set efficiency regulations and actions to prevent the incidence rate.

Acknowledgments

This work was supported by the National Natural Science Foundation of China(81672171, 81330042), Sino-Russian Joint Research Sponsored by the Ministry of Science and Technology, China (2014DFR31210), International Cooperation Program of National Natural Science Foundation of China (81620108018), Tianjin Science and Technology Committee, China (13RCGFSY19000, 14ZCZDSY00044), Tianjin Medical University General Hospital Youth incubation Foundation (ZYYFY2015008).

Disclaimer statements

Conflicts of interest The authors declare no conflict of interests.

Funding This work was supported by the National Natural Science Foundation of China (81672171, 81330042), Sino-Russian Joint Research Sponsored by the Ministry of Science and Technology, China (2014DFR31210), International Cooperation Program of National Natural Science Foundation of China (81620108018), Tianjin Science and Technology Committee, China (13RCGFSY19000, 14ZCZDSY00044), Tianjin Medical University General Hospital Youth incubation Foundation (ZYYFY2015008).

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