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Original Research Article

Pattern and Mortality of Chest Injuries among Victims of Road Traffic Accidents in a Tertiary Hospital in North West Saudi Arabia

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Abstract

Injuries due to road traffic accidents (RTAs) and their associated morbidity and mortality constitute a major health problem in the Kingdom of Saudi Arabia (KSA) and worldwide. This study aims to investigate the frequency, pattern and mortality of chest injuries among victims of RTAs in a tertiary hospital in Tabuk City in Northwest Saudi Arabia. This is a retrospective, descriptive hospital-based study conducted at King Khalid Hospital in Tabuk City between 2010 and 2015. The records of all patients who were involved in RTAs and sustained chest injuries and who were admitted to the hospital were retrieved. The pattern of chest injuries and their associated injuries in addition to the demographic features of the patients were determined. The study involved 378 patients most of whom were males who constituted 85.4% (male: female ratio = 5.9:1). Young patients (≤ 40 years) were 274 (72.5%) while elderly patients (>40 years) were 104 (27.5%). Rib fracture was the predominant type of chest injury observed in 274 patients representing 64.6%. Limb injury was the most common associated injury (35.2%). Most of the patients were admitted to the general ward (71.1%), most of them have stayed in the hospital for a week or less (57.7%) and most of them were discharged safely (57.7%) while 18 patients have died (4.8%). Associated injuries were commonly encountered with many types of chest injuries and have affected males more significantly than females (57.1% versus 7.75 respectively, P-value=0.04). Thoracic vertebral injury, pneumothorax and lung contusion were noted more significantly in young patients than in their elderly counterparts (P-value= 0.032, 0.035, 0.047 respectively). Chest injuries among victims of RTAs is frequently encountered in Tabuk City. The pattern of these injuries and their associated extra thoracic injuries is similar to other regions in the KSA.

Keywords: Chest injuries, Road traffic accidents, Associated injuries, Kingdom of Saudi Arabia

INTRODUCTION

Road traffic accidents (RTAs) and their associated injuries and mortality are among the challenging problems that face the health sectors in the Kingdom of Saudi Arabia (KSA) and all over the globe (Mohan et al, 2015; Bendak, 2011; Al-Zahrani et al, 1994). The World Health Organization (WHO) has estimated that 1.25 million people die each year due to RTAs which is expected also to be the 7th leading cause of death in

2030 (WHO, 2016). In a large-scale study of the trauma registry at King Abdu-Aziz Medical City in Riyadh, RTAs accounted for 52% of all traumatic injuries, which was higher than the reported incidence in other developing countries like India, Iran and Oman (Alghanam et al, 2014). It has been estimated that one person is killed and four are injured every hour due to these accidents and most of those victims are in their top ages of productive life, reflecting the economic impact of this problem beside its health effects (Mansuri et al, 2015; Ainy et al, 2015; Nofal et al, 1997; Khan et al, 2014; Elshinnawey, 2008). Having said that, it should be mentioned that RTAs is still a major cause of morbidity and mortality even among the elderly population (Etehad, 2015; Jean et al, 2004). Al-Ghamdi (1996) in his comprehensive assessment of RTAs in KSA, has indicated that Saudi Arabia is ranked 25th among 40 countries regarding the fatality rate of these accidents. Ansari et al (2000) have indicated that the ratio of accident to injuries in KSA was 8:6 in comparison to the corresponding international rate of 8:1, and the ratio of accident to death is 32:1 in comparison to 283:1 in the USA. These figures obviously reflect the severity and seriousness of RTAs in Saudi Arabia. The pattern of increased frequency and mortality related to RTAs seems consistent among most of the regions in KSA (AL-Zahrani et al, 1994; Khan et al, 2010; Barrimah et al, 2012; AL-Shehri et al, 2008). The trend of rise in the frequency of RTAs observed in KSA in the last decades is attributed to the expansion in the construction of roads and increased number of vehicles, which was not paralleled by an adequate rise in the attitude and 2ehavior of vehicle drivers (Bendak et al, 2011; AL-Zahrani et al, 1994; Mansuri, 2015; Ansari et al, 2000; BaHammam et al, 2014; Ofosu, et al, 1988).

Chest trauma is among the serious injuries in victims of road traffic accidents. Batouk and his colleagues (1998) have studied 574 patients who arrived dead to Asir central hospital of whom 52.8% was related to RTAs. Most of them were young males (mean age: 21-39 years, male to female ratio: 14:1) and head and neck, and chest injuries were the most frequently reported ones. Similar results were also reported by studies in the UK and India (Murkey et al, 2012; Ankarath et al, 2002). Al-Saigh et al (1999) have found that 62% of chest injuries among children presented to King Fahad Hospital in Al-Madinah were due to RTAs. They have also concluded that rib fractures were the most common thoracic injury while head and neck injuries were the most common associated injuries. Al-Shammariet al (2009) have indicated that 3.7% of pedestrians, who were involved in collision with motor vehicles in Riyadh, have sustained chest injuries. A similar study in China on pedestrian collisions with cars has pointed that thoracic injuries were the second most common cause of death (Zhao et al, 2014). Chest trauma due to RTAs accounted for 20% of all trauma cases admission in the state of Qatar according to El-Menyar and his colleagues (2016), and 67.7% and 12.2% of all RTA injuries in two studies in Singapore (Jean et al, 2004; Wong et al, 2002). Pulmonary contusion was the most common type of chest injury identified in their series followed by rib fractures. They have also asserted that head injury was the commonest associated injury and tends to increase the mortality significantly among their patients (Al-Menyar et al, 2016; Jean et al, 2004). In a study in Damascus, Syria, RTAs were responsible for 33% of all chest trauma and rib fracture was the commonest form of injury identified (34%). Associated injuries were present in 35% of those patients, which have mainly involved the head and extremities (Al-Koudmani et al, 2012). Similar results were also reported from India (Choudhary et al, 2015). Chest injuries were also among the commonest injuries reported in the elderly population (Etehad et al, 2015; Nagata et al, 2010; Abou-Raya et al, 2009).

This study aims to investigate the frequency and mortality rate of chest injuries among victims of road traffic accidents in a tertiary hospital in Tabuk City in Northwest Saudi Arabia. There are no published results of chest injuries among RTA patients in this part of the kingdom, which is observed to have a relatively high rate of RTAs. Most of the data regarding RTAs come from police records where usually there is no indication to the resultant injuries. Provision of data regarding the pattern, frequency and consequences of this kind of injuries would bring it to the awareness of the public and authorities and set the stage for the implementation of suitable strategies to improve its outcome.

Patients and Methods:

This is a retrospective, descriptive hospital-based study conducted at King Khalid Hospital in the city of Tabuk in North West Saudi Arabia. All patients who were involved in major RTAs and admitted to the hospital with chest injury between 2010 and 2015 were included. Those who sustained minor injuries and/or arrived dead to the hospital were not included in the study. Type and frequency of chest injuries, their associated injuries and length of hospital stay, treatment applied, mortality and the demographic features of the patients were retrieved and transferred to the study questionnaire. Data was analyzed using the SPSS computer software (SPSS Inc. Chicago, Illinois) version 16. Descriptive and correlation studies were done to highlight the results and significance of the relevant results was tested using the T-test. The ethical committee at King Salman Armed Forces Hospital in the North West region of Saudi Arabia has issued an ethical approval for the conduction of the study.

RESULTS

The study involved 378 patients, 323 of them were males (85.4%) while females were 55 (14.6%). Male to female ratio is 5.9:1. Patients who were 40 years of age or

Table 1. Type and frequency of chest injuries and their associated injuries (N=378)

No.	Injury	Frequency	Percentage
1.	**Chest injuries:**		
1.	Rib fracture	244	64.6%
2.	Thoracic vertebrae	157	41.5%
3.	hemothorax	100	26.5%
4.	Simple pneumothorax	86	22.8%
5.	Lung contusion	76	20.1%
6.	Sternal fracture	13	3.4%
7.	Flail segment	10	2.6%
8.	Cardiac tamponade	2	0.5%
2.	**Associated injuries:**		
1.	Limbs	133	35.2%
2.	Head	121	32.0%
3.	Spine	48	12.7%
4.	Pelvis	27	7.1%
5.	Abdomen	26	6.9%
6.	Neck	12	3.2%
7.	Others	2	0.5%

Table2. Operative treatment, hospital stay and fate of the patients (N=378):

No.	Parameter	Frequency	Percentage
1.	**Operative treatment:**		
1.	Tube thoracostomy	112	74.7%
2.	Fixation of thoracic vertebrae	37	24.7%
3.	Thoracotomy	1	0.6%
4.	Total	150	100%
2.	**Hospital stay:**		
1.	One week or less	218	57.7%
2.	Two to three weeks	94	24.9%
3.	More than one month	66	17.5%
4.	Total	378	100%
3.	**Fate of the patients:**		
1.	Discharged	266	70.4%
2.	Referred	55	14.6
3.	Died	18	4.8
4.	Discharged against medical advice	38	10.1%
5.	Total	378	100%

younger than that were 274 (72.5%) while those older than 40 years were 104 (27.5%). Rib fracture(s) was the most common type of chest injury occurred in 244 patients representing 64.6% and limb injury/fracture was the most common recognized associated injury (35.2%) as shown in table (1). 271 patients (71.1%) were admitted to the general ward while 107 patients (28.3%) were admitted to the intensive care unit. Operative treatment for the chest injuries was underwent in 150 patients (39.7%), most of the patients (57.7%) have stayed in the hospital for a week or less and most of them were discharged safely from the hospital (70.4%), while 18 patients have died giving rise to a mortality rate of 4.8% as shown in table (2). Table (3) shows the correlation between the type of chest injury and gender on one hand and with the age group on the other hand. No statistically significant difference was observed regarding the distribution of the type of chest injury in males and females. On the other hand, thoracic vertebral injury, pneumothorax and lung contusion tend to affect younger patients significantly more than their elderly counterparts (P-value= 0.032, 0.035, 0.047 respectively) as shown in table (3). Correlation between the tendency of associated injuries to occur with the different types of chest injuries is shown in table (4). Most of the chest injuries identified tend to be associated with injuries in

Table 3. Correlation between the type of chest injuries and the age and gender of patients (N=378)

No.	Chest Injury	Males		Females		*P-value*
		Frequency	Percentage	Frequency	Percentage	
1.	Rib fracture	212	56.1%	32	8.5%	0.285
2.	Thoracic vertebrae	129	34.1%	28	7.4%	0.127
3.	Flail segment	10	2.6%	0	0	0.186
4.	Hemothorax	88	23.3%	12	3.2	0.399
5.	Pneumothorax	77	20.4%	9	2.4%	0.222
6.	Lung contusion	67	17.7%	9	2.4%	0.454
7.	Sternal fracture	11	2.9%	2	0.5%	0.931
8.	Cardiac tamponade	2	0.5%	0	0	0.558
No.	**Chest injury**	**≤ 40 years**		**> 40 years**		***P-value***
		Frequency	**Percentage**	**Frequency**	**Percentage**	
1.	Rib fracture	166	43.9%	78	20.6%	0.09
2.	Thoracic vertebrae	123	32.5%	34	9.0%	0.032
3.	Hemothorax	75	19.8%	25	6.6%	0.512
4.	Pneumothorax	70	18.5%	16	4.2%	0.035
5.	Lung contusion	62	16.4%	14	3.7%	0.047
6.	Sternal fracture	10	2.6%	3	0.8%	0.715
7.	Flail segment	5	1.3%	5	1.3%	0.107
8.	Cardiac tamponade	2	0.5%	0	0	0.385

Table 4. Correlation between the associated injuries and the different types of chest injury (N=378):

No.	Injury	Associated injury		*P-value*
		Yes	No	
1.	Rib fracture	173 (45.8%)	71 (18.8%)	0.001
2.	Thoracic vertebrae	85 (22.5%)	72 (19.0%)	0.000
3.	Hemothorax	79 (20.9%)	21 (5.6%)	0.001
4.	Pneumothorax	68 (18.0%)	18 (4.8%)	0.002
5.	Lung contusion	58 (15.3%)	18 (4.8%)	0.019
6.	Sternal fracture	6 (1.6%)	7 (1.9%)	0.152
7.	Flail segment	5 (1.3%)	5 (1.3%)	0.320
8.	Cardiac tamponade	1 (0.3%)	1 (0.3%)	0.656

other parts of the body. It was also found that associated injuries inflict males (57.1%) more significantly than females (7.7%) (P=0.04) while no difference was found in their frequency between young and elderly patients (P=0.192). The maximum number of accidents have occurred in Ramadan (14%) followed by Shawwal (11.1%) Sha`ban (10.1%) and Thulhijja (9.8%).

DISCUSSION

Chest injuries among victims of RTAs have reported frequently to the institute in which the study was conducted. Although the data is emerging from a single hospital, it has some reflection on the high incidence and seriousness of RTAs that is documented in other studies

(Alghnam et al, 2014; Jha et al, 2003). Batouk et al (1996) and Al-Saigh et al (1999)have already proved the commonality of chest injuries among the patients in their series. In consistency with results in Tabuk, other regions of the Kingdom, regionally and worldwide, chest injuries have inflicted males much more than females most of whom were forty years of age or younger (AL-Zahrani et al, 1994;Alghnamet al, 2014; Mansuri et al, 2015; Khan et al, 2010; Etehad et al, 2015; Barrimah et al, 2012; El-Menyar et al, 2016; Choudhary et al, 2015; Jha et al, 2003; Issa, 2016; Singh et al, 2014; Hamadeh et al, 2013; Pikoulis et al, 2006; Parreira et al, 2012). Moreover, injuries tend to be more severe in males than in females, particularly the young, which agree with the findings of some studies in the kingdom and other countries (Ansari et al, 2012; Batouk et al, 1996; AL-Shammari et al, 2009; Slesak et al, 2015). This is explained by two findings; first, some serious chest injuries (vertebral fractures, lung contusion and pneumothorax) tend to affect mainly young males, which could also clue the high magnitude of force incurred in these accidents. Exceeding speed limits is a major cause of RTAs in Saudi Arabia and it could subject victims to violent force that could result into serious injuries (Al-Ghamdi, 1996; AL-Shammari et al, 2009). Second, associated injuries, which can cause significant morbidity and mortality (Batouk et al, 1996; El-Menyar et al, 2016), affect males more significantly than females, who tend also to be young (Mayou et al, 2003). Despite its importance, the severity of injuries among the patients in this study was not assessed using standardized injury scores, for example the Injury Severity Score (ISS) and the Abbreviated Injury Scale (AIS) (Nagata et al, 2010; Parkinson et al, 2014) and this need to be considered in future studies in the area. Al-Koudmani et al (2012) have pointed to a link between extra-thoracic injuries in chest trauma and the severity of RTAs implied by the number of ribs fractured. Legislations that prohibit car driving by females and the frequent involvement of young males in outdoor activities may explain these results as has been highlighted by Issa (2016) in his study in Tabuk city, and others (Murkey et al, 2012). Nevertheless, these findings should furtherly raise vigilance to the tendency of these injuries to affect people at the ages of their maximum productive life and the implication of that on the economic growth and prosperity of the country.

Rib fracture (single or multiple) was the commonest type of chest injury identified in this study as was also shown by Al-Saigh et al (1999) in KSA and Al-Koudmani et al (2012) in Syria and Mezue et al (2012) in Nigeria. However, El-Menyar et al (2016) have found that lung contusion was the commonest thoracic injury, and have concluded a higher frequency of intrathoracic injuries than chest wall injuries among RTA victims in Qatar. Ankarath and his colleagues (2002) have also declared that lung contusion was the predominant type of chest injury in their series in the UK. These differences in the dominance of intrathoracic and chest wall injuries were attributed to the severity of injury and the position of the victim during the accident (driver, passenger, cyclist or pedestrian) as has been proved by studies in the UK (Ankarath et al, 2002; Mayou et al, 2003). In this study, almost two thirds of the patients have sustained an associated injury in another part of their bodies in addition to the chest. That was mainly in the limbs and the head, which could be explained in view of the results of similar studies in other regions of KSA and worldwide which have found that the extremities and the head and neck were the most frequently injured parts of the body (Mansuri et al, 2015; Khan et al, 2010; Batouk et al, 1996; Ankarath et al, 2002; Al-Saigh et al, 1999; Al-Koudmani et al, 2012; Choudhary et al, 2015; Jha et al, 2003; Singh et al, 2014; Pikoulis et al, 2006; Garg et al, 2006; Wong et al, 2002). The high frequency of spinal injuries noted in this study may be related to the high rate of disabilities recognized among victims of RTAs in Al-Taif city in Saudi Arabia by AL-Shehri and his colleagues (2008) where chest injuries were also common. In addition, the mortality rate of 4.8% in this study could be linked to the findings of Alghnam et al (2015) (32.8%) and Barrimah et al (2012) who have pointed to an increased mortality due to RTA injuries in general among Saudi population. Altogether, these findings reflect the seriousness of injuries sustained by victims of RTAs in Tabuk, in line with what has already been affirmed by previous studies in KSA (Al-Ghamdi, 1996; Ansari et al, 2000). Unfortunately, data regarding the nature of the accidents (vehicle crashes and turnover, vehicle to pedestrian, drivers or front- or back-seat passengers, restrained or unrestrained vehicle occupants) were not available in the patients records. Provision of such data would delineate the circumstances that have resulted into these injuries and allow solid conclusion to be made out (Al-Ghamdi, 1996; Barrimah et al, 2012; El-Menyar et al, 2016). The relevant authorities and public organizations can in turn use these results to enlighten the community about the problem and set suitable strategies to prevent it or at least alleviate its consequences (Mohanet al, 2015; Issa, 2016; Parreira et al, 2012). In this regard, we advocate the constitution of an RTA registry that combines data from hospital and police records to provide a detailed description of the accident in relation to the findings documented by health care givers (Hamadeh et al, 2013; Slesak et al, 2015).

Finally, it was noted that the maximum number of accidents in this study has occurred in the holy month of Ramadan followed by Shawwal. A similar finding was indicated by the records of the trauma registry at King Abdu-Aziz Medical City in Riyadh (Alghnam et al, 2014). Seasonal variations in the incidence of car accidents have been recognized by some studies in Saudi Arabia and worldwide (Nofal et al, 1997; Khan et al, 2010; Singh et al, 2014; Pikoulis et al, 2006; Slesak et al, 2015). These are attributed to the increased traffic

movement observed in some seasons like Haj, Omrah, holidays and festivals; probably Ramadan witnesses such an increased traffic movement similarly. However, other studies did not find any relation between RTAs and a particular month of the year (AL-Zahrani et al, 1994; Etehad et al, 2015; Alnasser et al, 2012). In any way, the authorities should endeavor to spend some extra effort in monitoring streets during times of the year in which people use roads excessively.

Limitations

The study is limited by lack of some essential information regarding the nature of the accidents and the circumstances of the passengers during it that could have provided more insight on the problem and help formulate plans to combat it. Patients with chest injuries who arrived dead to the hospital, died in the emergency room or have minor chest trauma and were not admitted to the hospital were not included in the study because we could not retrieve their data from the Emergency Department. Therefore, the actual number of RTA victims with chest injuries could be higher than what is reported. Another limitation is that the data is coming from a single hospital and that will not produce a wide picture of the problem that is representative of the whole region. Therefore, we recommend involving the districts as well as the main referral hospitals in Tabuk region in future studies.

CONCLUSION

Chest injuries among victims of RTAs and their related morbidity and mortality is common in Tabuk City. The pattern of these injuries and their associated extra thoracic injuries is similar to other regions in KSA. Young males are the mainly affected group of population in which sustained injuries tend to be severe too. Seasonal variations in the frequency of RTAs exist in this area like other regions in the kingdom and needs to be considered by the responsible authorities working to fight the problem. There is a need to improve the reporting system of RTAs, and we suggest establishing a trauma registry that combines data from hospitals and police records to provide detailed information that would help to devise appropriate strategies and actions to alleviate the problem and its consequences.

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Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

Abou-Raya S, Abd ElMeguid L. (2009). Road traffic accidents and the elderly. Geriatr Gerontol Int,9: 290–297.

Ainy E, Soori H, Ganjali M, Baghfalaki T. (2015). Eliciting road traffic injuries cost among Iranian drivers' public vehicles using willingness to pay method. International Journal of Critical Illness and Injury Science, 5(2): 108-113.

Al-Ghamdi A. (1996). Road accidents in Saudi Arabia: a comparative and analytical study. WIT Transactions on the Built Environment, 26: 231-253.

Alghnam S, Alkelya M, Al-Bedah K, Al-Enazi S. (2014). Burden of traumatic injuries in Saudi Arabia: lessons from a major trauma registry in Riyadh, Saudi Arabia. Ann Saudi Med, 2014; July-August; 291-296.

Al-Koudmani I, Darwish B, Al-Kateb K, Taifour Y. (2012). Chest trauma experience over eleven-year period at al-mouassat university teaching hospital- Damascus: a retrospective review of 888 cases. Journal of Cardiothoracic Surgery, 7:35.

Alnasser M, AlSelaim N, Aldhukair S, Elbedah K, Tamim H, Alazzam S, AlTokhais T, Alenazi S, Zamakhshary M. (2012). Patterns of pediatric trauma in Ramadan: an observational study. Annals of Pediatric Surgery, 8(1): 9-11.

Al-Saigh A, Fazili F, Allam A. (1999). Chest trauma in children: A local experience. Annals of Saudi Medicine,19(2): 106-109.

AL-Shammari N, Bendak S, AL-Gadhii S. (2009). In-Depth Analysis of Pedestrian Crashes in Riyadh. Traffic Injury Prevention, 10: 552–559.

AL-Shehri A, Farahat F, Hassani M, Abdel-Fattah M. (2008). Pattern of disability among patients attending Taif Rehabilitation Center, Saudi Arabia. Disability and Rehabilitation, 30(11): 884–890.

AL-Zahrani A, Jamjoom M, AL-Bar H. (1994). Traffic Accident Characteristics in Jeddah, Saudi Arabia. JKAU: Eng. Sci., 6: 69-80.

Ankarath S, GiannoudisP.V, Barlow I, Bellamy M.C, Matthews S.J, Smith R.M. (2002). Injury patterns associated with mortality following motorcycle crashes. Injury, Int. J. Care Injured, 33: 473–477.

Ansari S, Akhdar F, Mandoorah M, Moutaery K. (2000). Causes and effects of road traffic accidents in Saudi Arabia. Public Health, 2000; 114: 37-39.

BaHammam A, Alkhunizan M, Lesloum R, Alshanqiti A, Aldakhil A, Pandi-Perumal S, Sharif M. Prevalence of sleep-related accidents among drivers in Saudi Arabia. Annals of Thoracic Medicine, 2014; 9(4): 236-241.

Barrimah I, Midhet F, Sharaf F. (2012). Epidemiology of road traffic injuries in Qassim region, Saudi Arabia: consistency of police and health data. Int J Health Sci (Qassim), 6(1); 31-41.

Batouk, A, Abu-Eisheh N, bu-Eshy S, Al-Shehri M, Al-Naami M, Jastaniah S. (1996). Analysis of 303 Road Traffic Accident Victims Seen Dead on Arrival at Emergency Room-Assir Central Hospital. J. Family and Community Medicine, 3(1): 29-34.

Bendak S. An in-depth analysis of red light crossing problem in Saudi Arabia. (2011). Advances in Transportation Studies an international Journal, Section B 25: 67-74.

Choudhary A, Prasad K, Sreeramulu P. N. (2015). A Clinico - Epidemiological Study of Traumatic Chest Injuries in a Rural Tertiary Care Centre in India: Our Experience. IJBAR, 6(02): 110-114.

El-Menyar A, Abdelrahman H, Al-Hassani A, Ellabib M, Asim M, Zarour A, Al-Thani H. (2016). Clinical presentation and time-based mortality in patients with chest injuries associated with road traffic accidents. Arch Trauma Res.,5(1): e31888.

Elshinnawey M, Fiala, L, Abbas, M, Othman N. (2008). Road Traffic Injuries in Saudi Arabia, and Its Impact on the Working Population. J Egypt Public Health Assoc, 38(1): 2-14.

Etehad H, Yousef-Zadeh, Chabok Sh, Davoudi-Kiakalaye A, Dehnadi M, Hemati H, Mohtasham-Amiri Z. (2015). Impact of road traffic accidents on the elderly. Archives of Gerontology and Geriatrics, 61:489-493.

Garg N, Hyder A. (2006). Road traffic injuries in India: A review of the literature. Scandinavian Journal of Public Health, 34: 100–109.

Hamadeh R, Ali N. (2013). Fatalities from road traffic accidents among the young in Bahrain. EMHJ, 19(10): 854-860.

Issa Y. (2016). Effect of driver's personal characteristics on traffic accidents in Tabuk city in Saudi Arabia. Journal of Transport Literature,10(3): 25-29.

Jean LM, Han S, Ananthraman V, Allen Y. (2004). Patterns of injuries sustained by pedestrians in road traffic accidents at the Singapore general hospital. Annals of emergency medicine, 44(4): S129.

Jha N, Srinivasa D.K, Roy G, Jagdish S. (2003). Injury pattern among road traffic accident cases: a study from south India. Indian Journal of Community Medicine, 28(2): 85-90.

Khan Z, Asiri K, Iqbal J. (2010). Injury patterns from road traffic accidents. Pak J Med Sci, 26(2): 394-398.

Mansuri F, Al-Zalabani A, Zalat M, Qabshawi R. (2015). Road safety and road traffic accidents in Saudi Arabia. A systematic review of existing evidence. Saudi Med J, 36(4): 418-424.

Mayou R, Bryant B. (2003). Consequences of road traffic accidents for different types of road user. Injury, Int. J. Care Injured, 34: 197–202.

Mezue W, Ndubuisi C, Erechukwu U, Ohaegbulam S. (2012). Chest Injuries Associated with Head Injury. Niger J Surg., 18(1): 8–12.

Mohan V, Sarkar R, Abraham V, Balraj V, Naumova E. (2015). Differential patterns, trends and hotspots of road traffic injuries on different road networks in Vellore district, southern India. Tropical Medicine and International Health, 20(3): 293–303.

Murkey P, Nagrale N, Tirpude B, Wankhade P, Patond S. (2012). Pattern of chest injuries in fatal vehicular accidents in central India. J. Forensic Med. Sci. and Law, 21(2):??.

Nagata T, Uno H, Perry M. (2010). Clinical consequences of road traffic injuries among the elderly in Japan. BMC Public Health,10:375.

Nofal FH, Saeed AAW. (1997). Seasonal variation and weather effects on road traffic accidents in Riyadh City. Public Health, 111: 51-55.

Ofosu JB, Abouammoh AM, Bener A. (1988). A study of road traffic accidents in Saudi Arabia. Accid Anal Prev, 20(2): 95-101.

Parkinson F, Knet S.W.J, Aldous C, Oosthuizen G, Clarke D. (2014). The hospital cost of road traffic accidents at a South African regional trauma center: A micro-costing study. Injury, Int. J. Care Injured, 45: 342–345.

Parreira J, Gregorut F, Perlingeiro J, Solda S, Assef J. (2012). Comparative analysis of injuries observed in motorcycle riders involved in traffic accidents and victims of other blunt trauma mechanisms. Rev Assoc Med Bras,58(1):76-81.

Pikoulis E, Filias V, Pikoulis N, Daskalakis P, AvgerinoS E, Tavernarakis G, Belechri M, Pappa P, Theos C, Geranios A, Gougoudi E, Leppaniemix A, Tsatsoulis P. (2006). Patterns of injuries and motor-vehicle traffic accidents in Athens. International Journal of Injury Control and Safety Promotion,13(3): 190–193.

Singh R, Singh H, Gupta S, Kumar Y. (2014).Pattern, severity and circumstances of injuries sustained in road traffic accidents: A tertiary care hospital-based study.Indian Journal of Community Medicine,39(1): 30.

Slesak G, Inthalath S, Wilder-Smith A, Barennes H. (2015). Road traffic injuries in northern Laos: trends and risk factors of an underreported public health problem. Tropical Medicine and International Health, 20 (11): 1578–1587.

WHO media centre (2016). Road traffic injuries. http://www.who.int/mediacentre/factsheets/fs358/en/

Wong E, Leong M, Anantharaman V, Raman L, Wee K, Choas T. (2002). Road traffic accident mortality in Singapore. The Journal of Emergency Medicine, 22(2): 139–146.

Zhao H. Yin Z, Yang G, Che X, Xie J, Huang W, Wang Z. (2014). Analysis of 121 fatal passenger car-adult pedestrian accidents in china. Journal of Forensic and Legal Medicine, 27: 76-81.