

# The Incidence of Splenic Injury Following Blunt Abdominal Trauma (BAT), Sultan Qaboos University Hospital Experience

Abdullah Al-Busaidi, Tariq Al-Shafei, Huda Al-Moqbali, Sara Al-Kindi, Mohammed Al-Saadi, Nadya Al-Busaidi, Hani Al-Qadhi

College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Sultanate of Oman

Email: khalott8@live.com

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## Abstract

The aim of the study was to review traumatic splenic injury following blunt abdominal trauma (BAT), during the period from January 2009 to January 2015 at SQUH. The data for this study was retrospectively collected. It included 768 patients admitted to SQUH general surgery department following BAT. 43 patients with splenic injury were identified (34 males, 9 females). The mean age of patients with splenic injury was 36.0 years (34.4 years for males, 42.1 years for females). The most common mechanism of injury was motor vehicle collision (90.7%). Grade I, II are the most common grades of splenic injury. Non-Omani patients accounted for (51.2%) and most of them were pedestrians at the time of trauma. Ribs fracture is the most common injury associated with splenic injury. 36 (83.7%) patients were managed conservatively and 7 (16.3%) patients were splenectomized. Angioembolization was done for 11 (30.6%) patients. Despite the small population of Oman, high incidence of motor vehicle collision (MVC) increases the incidence of splenic injury among young age group.

## Keywords

Spleen, Splenic Injury, Blunt Abdominal Trauma, Motor Vehicle Collision

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## 1. Introduction

Oman is considered one of the countries with good death registration data. The reported number of road traffic deaths is around 800 per year and the estimated road traffic death rate per 100,000 population is 30.4 [1]. Oman was ranked 4th in occurrence of motor vehicle collision (MVC) in Arabian Gulf Co-operation Council (GCC) and 57th worldwide in 2009 according to World Health Organi-

zation (WHO) [2]. The most common modalities of blunt trauma are motor vehicle collisions, falls from height, assaults, and sporting injuries. The spleen is the second most commonly injured organ following blunt abdominal trauma (BAT) after liver. Up to 45% of patients with BAT will have a splenic injury. It has been shown that the most common mechanism of splenic injury is MVC. Therefore, splenic injury can affect any age group [3] [4].

The most reliable sign of splenic injury is hemodynamic instability with a rising pulse rate and a decreasing blood pressure. The patients with splenic injury may present with either left hypochondrium pain associated with left shoulder tip pain or diffuse abdominal pain. It has been shown that left lower chest injury presents in 43% of patients with splenic injuries [4]. The mortality resulting from splenic injury increases if there are associated injuries of other organs, increased injury severity score and increased age. According to trauma centers in North America, the mortality rate after splenic injury is 6% - 10% [3].

Splenic artery pseudoaneurysm (SAPA) is one of the most dangerous complications of splenic injury; hence it should be investigated and managed appropriately. The gold standard investigation for SAPA is angiography. However, if angiography is not available, contrast CT and MRI are proved to be very useful [5] [6]. CT scan is considered the gold standard for imaging blunt abdominal trauma, and identification of splenic injuries [4].

Splenic injuries are classified by American Association for the Surgery of Trauma (AAST) according to its severity. Grade I and II splenic injuries are treated conservatively. All patients with Grade V injuries are treated by splenectomy. Grade III and IV injuries are treated by partial resection or mesh splenorrhaphy [7]. Recent evidence suggests that grades (IV and V) may also be suitable for non-operative management with the adjunct of angioembolization [4].

This study is conducted for the first time in the Sultanate of Oman and its aim is to review traumatic splenic injury following BAT during the period from 2009 to 2015 at Sultan Qaboos University Hospital (SQUH).

## 2. Methods

This is a retrospective study conducted at SQUH. The study sample included 768 patients admitted to SQUH general surgery department following BAT from January 2009 to January 2015. Medical record numbers of all patients above 12 years of age including both sexes were collected from surgical in-patient registry books.

Data was first collected from surgical in-patient registry books and then detailed information was obtained using Trakcare system of SQUH. The obtained data included demographic data, mechanism of injury, wearing of seat belt during MVC, grade of splenic injury, associated injuries and type of management for each splenic injury. We have found that out of 768 patients with BAT, there were 43 patients with splenic injury.

All patients with splenic injury had abdominal CT scan with intra-venous

contrast following BAT. These CT scans were reviewed and discussed with a radiological consultant to obtain the grades of splenic injury for each patient according to new grading system incorporating splenic vascular injury; American Association for the Surgery of Trauma (AAST): Organ Injury Scale (1994 version) (**Table 1**).

Statistical analysis was done on coded data using Statistical Package for the Social Sciences (SPSS) software version 21. Data were categorized and analyzed using frequency tables, pie charts and bar charts.

This study was conducted after approval by Sultan Qaboos University ethical committee.

### 3. Results

The total number of patients admitted with BAT was 768. Out of them, there were 43 patients who showed CT evidence of splenic injury. There were 34 (79%) males and 9 (21%) females. The mean age within the entire study sample was 36.0 years (median 35; range 20 - 68). Within male patients, the mean age was 34.4 years (median 33; range 20 - 58) and within the female patients, the mean age was 42.1 years (median 43; range 20 - 68). The mechanisms of splenic injury included motor vehicle collision (90.7%) and falls (9.3%).

Eleven patients (25.6%) had Grade I blunt splenic injury, 12 patients (27.6%) had Grade II, 7 patients (16.3%) had Grade III, 10 patients (23.3%) had Grade IV, and 3 patients (7.0%) had Grade V (**Figure 1**).

The patients who were involved in MVC had different grades of splenic injury, but those who had falls had only Grade I or Grade IV in equal proportions (**Figure 2**).

The position of the patients during the trauma was as follow: 11 were drivers, 2 were positioned in second seat in the vehicle, 3 were back seat passengers, 13

**Table 1.** AAST spleen injury scale.

Grade	Type of injury	Description of injury
I	Hematoma	Subcapsular, <10%
	Laceration	Capsular tear, <1 cm in depth
II	Hematoma	Subcapsular, 10% - 50%; intraparenchymal, <5 cm in diameter
	Laceration	Capsular tear, 1 - 3 cm in parenchymal depth, not involving trabecular vessel
III	Hematoma	Subcapsular, >50% surface area or expanding, ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma, ≥5 cm or expanding
	Laceration	>3 cm in parenchymal depth or involving trabecular vessel
IV	Laceration	Segmental or hilar vessels, major devascularization (>25%)
V	Laceration	Completely shattered spleen
	Vascular	Hilar vascular injury that devascularizes the spleen

\*Advance one grade for multiple injuries, up to Grade III.

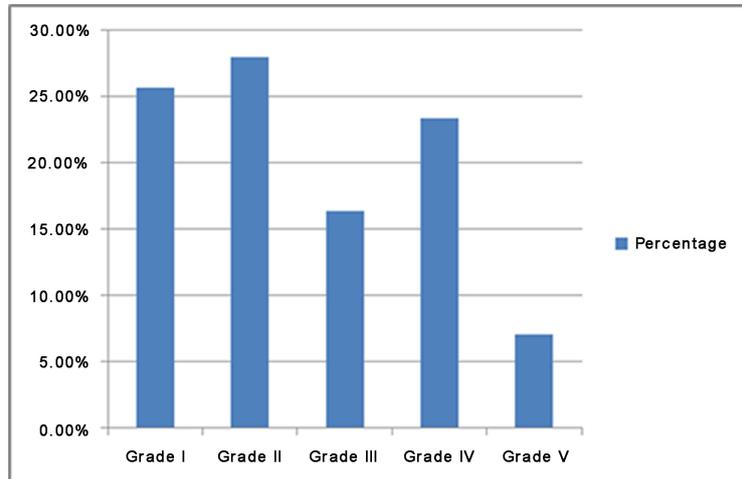


Figure 1. Grades of splenic injury.

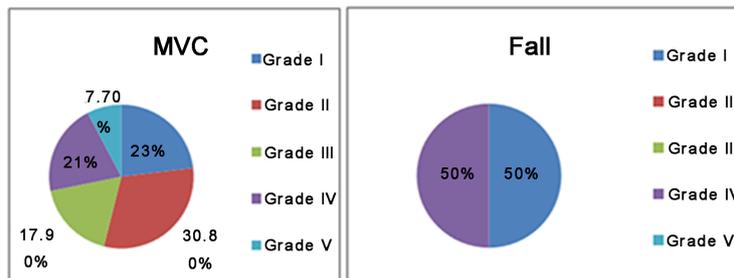


Figure 2. Grades of splenic injury and mechanism of BAT.

were pedestrians and 2 were motorcyclist while 8 patients did not have their position documented. Out of these, only 4 drivers were reported wearing seat belt at the time of trauma and they had Grade I, Grade II and Grade III of splenic injury (Table 2).

Twenty one Omani patients (48.8%) had splenic injury while 22 (51.2%) where from other countries. The majority of foreigners were equally from India; 6 patients (14%) and Pakistan; 6 (14%). Most of the foreign victims were pedestrians which can be explained by the high number of foreign laborer in Oman.

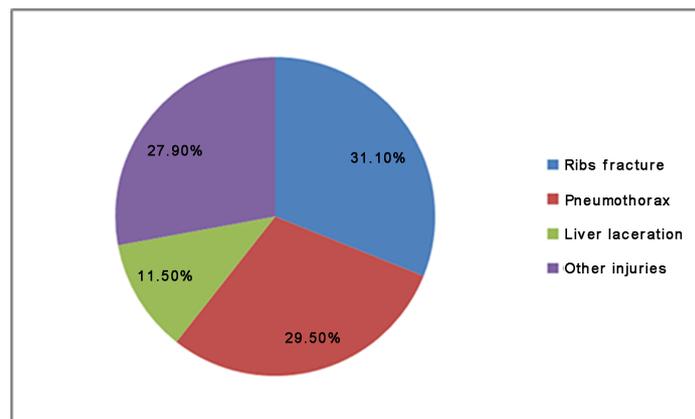
Ribs fracture was the most common injury associated with splenic injury. Ribs fracture accounted for (31.3%) of all associated injuries, followed by pneumothorax (29.5%), liver laceration (11.5%) and other injuries (27.9%) (Figure 3).

Distribution of the patients with splenic injury by age and sex is shown in Figure 4. The majority are within the age group of 20 - 30 years.

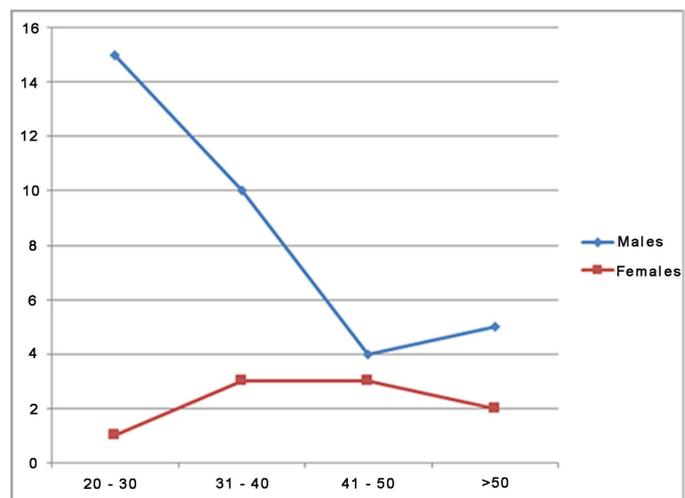
The treatment of splenic injuries in these patients was splenectomy or non-operative management. There were 36 (83.7%) patients who were managed conservatively and 7 (16.3%) patients were splenectomized. All the patients with Grade I and Grade II had conservative management. 5 (71%) patients with Grade III and 8 (80%) patients with Grade IV had also conservative management. Whereas 2 (29%) patients with Grade III and 2 (20%) patients with Grade IV had splenectomy, all patients with Grade V had splenectomy.

**Table 2.** Position at time of trauma.

Position	Frequency	Percent
Driver	11	28.2
2nd seat	2	5.1
Back seat	3	7.7
Motorcyclist	2	5.1
Pedestrian	13	33.3
Not documented	8	20.5
<b>Total</b>	<b>39</b>	<b>100.0</b>



**Figure 3.** Associated injuries.



**Figure 4.** Distribution of patients with splenic injury by age and sex.

#### 4. Discussion

Our results are consistent with the trauma studies that are available in the literature. Our study resembles them in revealing variety of splenic injuries. In a complex trauma there are several factors which make it hard to establish the outcome following blunt abdominal trauma. However, we managed to identify certain variables that were related to mortality.

Motor vehicle collisions are the main cause of morbidities and mortalities in ministry of health (MOH) institutions in Oman. Most of the patients are in the age group (20 - 34) years according to MOH annual health report, 2014 [8]. This indicates that splenic trauma occurs more commonly secondary to blunt abdominal trauma and not penetrating injuries. In our research at SQUH the most common mechanism of splenic injury was found to be motor vehicle collision. Most injuries occurred in the male group aged 20 - 30 years. This can be attributed to the Omani population being considered as a young population (60% of the population is in the productivity age group of 25 - 64 years) and the males represent 65% of the total population. Male expatriates represent 83% of the total expatriate population according to the population statistics bulletin in Mid-Year 2015. This explains the high incidence of males expatriate compared to female expatriates involvement in MVCs. These results also agree with the results provided by the national center for statistics and information where it was found that in 2015 the males accounted for 77% of road traffic accidents injuries whereas the females accounted for 23% of road traffic accidents injuries.

Those who had splenic injury due to falls had either Grade I or Grade IV in equal proportions. This can be explained by the small sample size where only 4 patients had splenic injury due to fall from height. The group of patients who were involved in MVC had high incidence of Grade I and II splenic injury. The chance of getting high grade of splenic injury following blunt trauma is high among pedestrians. Two out of three who had Grade V splenic injury were pedestrian. Motor vehicle drivers were the second most commonly affected by splenic injuries.

The drivers who were reported to wear a seat belt at the time of trauma had Grade I, Grade II and Grade III of splenic injury. This supports the evidence that established seat belts can be a protective factor against high grades of splenic injury.

Fifty-one percent of splenic injury victims were expatriates which can be explained by the high number of expatriates in Oman where they account for (43.6%) of total population and high number of those expertise work in basic labor jobs so they cannot afford a car, hence they were mostly pedestrians hit by a car. In addition, all patients who had splenic injury due to falls from height were expatriates because almost all construction builders in Oman are foreign laborers.

As it would be expected, rib fractures was the most common injury associated with splenic injury, followed by pneumothorax because the spleen is located in the left hypochondrium of the abdomen close to the 9th, 10th and 11th ribs which gives the spleen protection against different types of injuries.

The trend of splenic injury management has been re-oriented toward non-operative management due to serious complications of splenectomy such as; overwhelming sepsis and thrombocytosis. The patient selected for non-operative management in any case must be hemodynamically normal. In our study 36 (83.7%) patients were managed conservatively and 7 (16.3%) patients were splenectomized.

There were some limitations in our study where it was a retrospective study

conducted in one center which is SQUH. Other limitation is that not all the CTs were reviewed by the same consultant, due to radiology electronic system and shifting of data prior to 2010 to another system; hence, 6 CT scans were not read by the consultant involved in our study. In addition 8 patients who were involved in MVC their position at the time of trauma was not documented. Moreover, we could not estimate from the information available why young age group (20 - 30) lacked Grade V splenic injury but most of them had Grade I and II splenic injury.

Because of the above limitations further study will be required. The study should be prospective study over a longer period of time. The study should be nationwide and involve all the centers in the country. By this way we can get a better picture and better understanding of this injury.

## 5. Conclusion

In conclusion, despite the small population in Oman, we have high MVC incidence compared to other countries in the world which increase the morbidity and mortality among young age group and cost the government a lot of money in many aspects including health care. Certainly, there must be collaboration with all concerned bodies in Oman for the prevention of this problem.

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