The pattern and management outcomes of splenic injuries in the Assir region of Saudi Arabia

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Summary

Background: **In the last decade or so, the management of splenic injuries has undergone a lot of debate and changes including refinement of the indications for non-operative management (NOM). The aims of this retrospective study are: to characterize the pattern of splenic injuries in the Abha region of Saudi Arabia; to analyze the mechanisms of injury and; to review the treatment modalities employed and their outcome.**

Design: **This is a retrospective chart review.**

Setting: **Assir Central Hospital, Abha (A level II regional trauma centre). Patients: All 61 patients above the age of twelve years admitted into the hospital with splenic injuries over the nine year period from May 1994 to May 2003 formed the basis of the study.**

Outcome measures: **These included complications during management and mortality. Detailed analyses of the outcome measures were carried out using the student t test, chi-square test, and means.**

Results: **The mean age of the patients was 29.75 ± 15.13 years. M: F ratio = 29.5:1. The splenic injury was caused predominantly by motor vehicular accidents (MVA) (52 patients-87.2%).**

High speed, non-use of seat belts, major vehicular deformity, car rollover and lack of air bags in the vehicles were the major characteristics of the MVA. The main clinical presenting features in the patients were related to blood loss, associated head and chest injuries. The mean duration of hospital stay was 18.8 ± 21.31 days (Range = 1-123 days). There was no significant correlation between the haemoglobin on admission and the haemoglobin six hours after admission (Pearson correlation coefficient = 0.303, p= 0.057). The mean volume of blood transfused in the first 24 hours of admission was 1,788.75 ml ± 842.65 (range = 250 – 4,000cc). Splenectomy was performed in 58 patients (95.1%) while the remaining 3 (4.9%) were managed conservatively. The complications that had significant effect on clinical outcome, especially mortality, included bronchopneumonia (p=0.001), brain death (p=0.000), renal failure (p=0.005), cardio-respiratory arrest (p=0.000), and hypovolaemic shock (p=0.005).

Conclusions: **Splenic injuries are caused predominantly by MVA and the presentation is determined by the injuries in other organs or systems. Complications that develop during treatment do impact on mortality.**

Key words: ***Splenic injuries, Management outcomes, Splenectomy***

Résumé

Introduction: Environ dans la demière décénnie, la prise en charge des blessures spléniques a déjà subi beaucoup de débat et changement y compris Ie raffinement des indications pour la Gestion Non-Operatoire (GNO). Les buts de cet étude retrospective sont de caracteriser la tendance des blessures spléniques dans la région d' Abha de l' Arabie saoudite, d' analyser les mécanismes de la blessure et de faire Ie bilan des méthodes du traitement utilisées et leur résultats.

Plan: II s'agit d'un bilan retrospectif d'un graphique.

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Patients: La base de cet étude est fondée sur 61 patients âgés de plus de douze ans hospitalisés atteints des blessures spléniques au cours d'une période de neuf ans de mai 1994 au mai 2003.

Résultats: On remarque aussi des complications pendant la prise en charge de la mortalite. Des analyses detaillées des résultants ont été effectuées tout en utilisant l'étudiant t épreuve, examen chi-square, et moyens.

Résults: L'âge moyen des patients était 29,75+-15,13 ans. Rapport H:F = 29,5 : 1. La blessure splénique est principalement causée par l'accident d'automobile (MV A), 52 patients - 87,2%). Grande vitèsse, non utilisation de ceinture de securité, difformité des vistures graves, capoter de voiture et la penurie de sac gonflable dans la voiture étaient des caracteristiques très grands de MVA. Les traits cliniques majeurs chez des patients étaient liés avec la perte du sang, des blessures liées et associées avec la tête et la poitrine. La durée moyenne d'hospitalisation etait 18,8 + -21,31 jours (varier entre 1 -123 jours) II n'y avait aucune correletion entre l'hémoglobine pendant l'admission et l'hemoglobine six heures après l'admission. Coefficient correlation de Pearson = 0,303, P = 0,057). Le volume moyen du sang transfusé pendant la première 24 heures d'admission était 1,788,75 ml +- 842,65 (varier entre 250 -4,000 cc). La splénectomie etait opérée chez 58 patients soit 95,1 % tandis que les autres 3 gait 4,9% out été traités selon des estimations prudentes. Des complications ayant des effets importants sur Ie résultats cliniques, la mortalité en particulier, étaient les suivantes: La bronchoneumonie (P = 0,001), la mort du cerveau P = 0,000, insuffisance rénale (P = 0,005), arrêts cardiorespiratoire (P = 0,000), et choque hypovolemie (P = 0, 0005).

Conclusion: Des blessures spléniques sont causés d'une manière prédominante par MV A et la présentation est décidé par des blessures dans les autres organs ou systèmes. Des complications qui se produit pendant Ie traitement out des impacts sur la mortalité.

Introduction

In the last decade or so, the management of splenic injuries has undergone a lot of debate and changes[1-14]. However, several areas of controversy still exist regarding

Correspondence

the optimum management of those patients who present with haemodynamic instability[7, 12, 15, 16]. The indications for non-operative management (NOM) continue to be refined with evidence of improved outcomes[2, 3, 6, 8, 9, 11, 13, 14, 16-21] while refinements in diagnostic imaging such as contrast helical computerized tomography (HCT) and ultrasonography (US) provide improved diagnostic accuracy and play a role in follow-up of patients who have received NOM[11,12,15-18,22-26]. The mechanisms of splenic injury cover a wide spectrum including motor vehicular accidents[7, 8, 27, 28], falls from heights, rupture of diseased spleens, complication of colonoscopy[29], and chest tube insertion[30]. The fact that the most common cause of splenic trauma is MVA[27] has meant that the presentation, clinical course and choice of management modality depended to a large extent on the associated injuries which the patient has. The MVA characteristics have also been shown to have a direct relationship to specific abdominal injuries[28].

Although some past reports have shown poorer management outcomes in patients older than 55 years who received NOM following blunt splenic injuries[21], the ensuing recommendation that this group be managed exclusively by splenectomy no longer holds. Recent reports [3, 4, 13, 14, 27] have shown that failure rate of NOM in this group is identical to that observed in younger patients.

The aims of this retrospective study are: to characterize the pattern of splenic injuries in the Abha region of Saudi Arabia; to analyze the mechanisms of injury and; to review the treatment modalities employed and their outcome.

Materials and methods

All patients above the age of twelve years admitted into the hospital with splenic injuries over the 9- year period from May 1994 to May 2003 formed the basis of the study. A total of 665 items were extracted from the patients' records. These included patient demographic data, mode of injury, clinical symptoms and findings at presentation, HCCT and US findings, Interval between injury and arrival in hospital, associated injuries, quantity of haemoperitoneum, grade of splenic injury, blood transfusion requirements, modality of treatment, outcome and follow-up details. Detailed analyses of the outcome measures were carried out using the student t test, chi-square test, means, and multivariate linear regression.

Results

Sixty-one patients were admitted with splenic injury during the 9 -year period of the study. The mean age of the patients was 29.75 ± 15.13 years (Range= 14-84 years). There were 59 males (96.6%) and 2 females (3.3%). M: F ratio = 29.5:1. The splenic injury was caused predominantly by motor vehicular accidents (MVA) (52 patients-87.2%). Five patients (8.2%) fell from heights (Mean distance of fall = 3.14 ± 4.15 metres). In three patients, the splenic trauma was due to assault (1 Gunshot and 2 stab injuries). The cause of injury could not be established in one patient. The injury to the spleen was blunt in 58 patients (95.1%) and penetrating in three (4.9%) due to stabbing in 2 patients (3.3%) and gunshot in one (1.6%).

The mean interval between injury and arrival in the

Table 1. The mode of transportation to the ER in 61 patients who sustained splenic injuries

Mode of transportation to the ER	No. of patients	%
Ambulance	24	39.3
Private car	19	31.1
Not stated	16	26.3
Air ambulance	1	1.6
Walked in	1	1.6
Total	61	100

ER: Emergency room.

Table 2. MVA characteristics* in patients who sustained splenic injuries.

MVA characteristics	No. of patients	%
High speed(>100kph)	50	82.0
Major vehicular deformity	29	47.5
Car rollover	20	32.8
Steering wheel collapse	18	29.5
Prolonged extrication	13	21.3
Head on collision	11	18.0
Ejection from vehicle	10	16.4
Lateral impact	10	16.4
Seat belt restraint	3	4.0
Air bag in car	2	3.3

MVA= motor vehicle accident
KPH = kilometres per hour.
**Mean number of vehicles involved in MVA = 1.69 ± 0.82*

Table 3. Clinical signs and symptoms observed in patients with splenic rupture upon arrival in ER

Clinical signs/symptoms	Number of patients	%
Tachycardia	50	82.0
Restlessness	37	60.7
Loss of consciousness	34	55.7
Chest pains	33	54.1
Dyspnoea	28	45.9
Pallor	28	45.9
Arrival in ER intubated	24	39.3
Dizziness	22	36.1
Confusion	21	34.4
Shock	21	34.4
Clammy extremities	18	29.5
Sweating	14	23.0
Periorbital haematoma	12	19.7
Bleeding from the nose	9	14.8
Palpitations	9	14.8
Syncope	8	5.2
Flail chest (paradoxical respiration)	7	11.5
Bleeding from the ear	7	11.5
Cardiac arrest in the ER	6	9.8
Pupils: Dilated/reacting sluggishly	6	9.8
Pupils: Dilated and fixed	5	8.2
Open pneumothorax	4	6.6
Orthopnoea	4	6.6
Otorrhoea	3	4.9
Rhinorrhoea	3	4.9
Cyanosis	2	3.3
Pulsus paradoxus	1	1.6
Paraplegia	1	1.6
Monoparesis	1	1.6
Congested neck veins	1	1.6
Paraparesis	1	1.6

Table 4. The occupations of 61 patients admitted with splenic injuries

Occupation	No. of patients	percent
Student	29	47.5
Unemployed	9	14.8
Technician	6	9.8
Professional	5	8.2
Farmer	5	8.2
Not stated	4	6.6
Housewife	3	4.9
Total	61	100

Table 5. Abdominal findings in patients with splenic injuries.

Abdominal findings	No. of patients	Percent
Abdominal distensionn	23	37.7
Abdominal tendernesss	50	82.0
Abdominal muscle rigidity	40	65.6
Abdominal wall haematoma	5	8.2
Bowel sounds		
Equivocal	28	45.9
Normal	20	32.8
Absent	13	21.3
DPL		
Not done	51	83.6
Positive	8	13.1
Equivocal	1	1.6

DPL= Diagnostic peritoneal lavage.

Table 7. Estimated blood loss in patients with splenic injuries.

Total blood loss	Frequency	Percent
<500ml	12	19.7
501 - 1000ml	19	31.1
1001 - 1500ml	11	18.0
1501 - 2000ml	8	13.1
>2000ml	6	9.8
Not known	5	8.2
Total	61	100.0

Table 6 Findings on plain radiography, ultrasound scan and computerised tomographic scan of the abdomen

Findings	No. of patients	Percent
Plain abdominal x-ray		
Rupture of left diaphragm	3	4.9
Gas under the diaphragm	7	11.5
Fluid in the abdomen	5	8.2
Abdominal ultrasound scan		
Fluid in the abdomen	46	75.4
Splenic injury	37	60.7
Liver injury	14	23
Gut injury	3	4.9
Mesenteric injury	3	4.9
Retroperitoneal haematoma	5	8.2
Pancreatic injury	21	34.4
Injury to left kidney	6	9.8
Injury to right kidney	1	1.6
Rupture of bladder	10	16.4
Urine extravasation	1	1.6
CT scan of the abdomen		
Haemoperitoneum	11	18.0
Liver injury	7	11.5
Splenic injury	17	27.9
Retroperitoneal haematoma	4	6.6
Pancreatic injury	22	36.1
Ureteric injury + extravasation	8	13.1

patients (39.3%) arrived by ambulance while 19 (31.3%) arrived by private cars. The characteristics of the MVA are shown in Table 2. High speed, non-use of seat belts, major vehicular deformity, car rollover and lack of air bags in the vehicles were the major characteristics of the MVA. Out of the 52 patients who had MVA, 24 each (39.3%) were drivers and passengers respectively while 4 (6.6%) were pedestrians.

Table 3 shows that the main clinical presenting features in the patients were related to blood loss, associated head and chest injuries. The mean duration of hospital stay was 18.8 ± 21.31 days (Range = 1-123 days). Only 23% of our patients stayed in the hospital for 7 days or less while the majority (77%) were hospitalized for more than 7 days. Nearly half (47.5%) of the patients in our series were students (Table 4). Thirty-three of the patients (54.1%) were single, 27 were married, while one was widowed.

Table 8. Effects of various complications on management outcomes in patients with splenic injuries

Complications	No. Without complications /(deaths)	No. With complications /(deaths)	Chi square tests	
			P (Pearson chi square)	P (likelihood ratio)
Sepsis syndrome	56(13)	3(1)	0.872	0.837
Bronchopneumonia	58(14)	1(0)	0.001*	0.073
Wound infection	58(13)	1(1)	0.181	0.223
Pulmonary embolism	54(14)	1(1)	0.835	0.736
ARDS	54(11)	5(3)	0.118	0.159
Brain death	50(5)	9(9)	0.000*	0.000*
Renal failure	56(11)	3(3)	0.005*	0.009*
Liver failure	58(13)	1(1)	0.181	0.223
MOFS	58(13)	1(1)	0.181	0.223
Cardio-respiratory arrest	47(2)	12(12)	0.000*	0.000*
Hypovolaemic shock	56(11)	3(3)	0.005*	0.009*

P = asymptotic significance (2-sided).
ARDS= adult respiratory distress syndrome.
MOFS= multiple organ dysfunction syndrome.
**= Statistically significant*

Emergency Room (ER) was 59.80 ± 38.79 minutes (range= 20-240 minutes). Patients who arrived in the ER within one hour of their injuries constituted 78.5%. The mode of transportation of the patients to the ER is shown in Table 1. Twenty-four

On admission, the mean systolic blood pressure was 106.25 ± 22.47. Only 19.3% of the patients had a systolic BP less than 90mm Hg. In 18.6% of cases, the systolic BP was

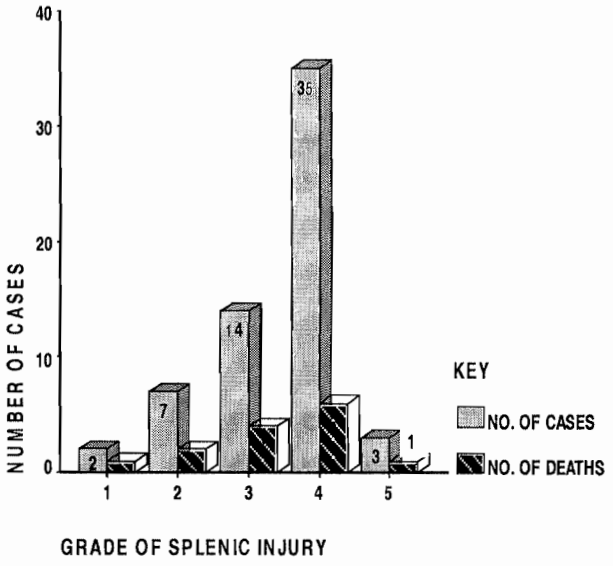

Fig. 1 *Bar chart showing the relationship between the grades of splenic injury and mortality.*

above 120 mmHg. The left hemi-diaphragm was ruptured in 3 patients (4.9%).

Associated rib fractures occurred on the left side in 12 patients (19.7%) and in 8 cases (13.1%) on the right side.

The mean haemoglobin level and white blood count (WBC) on admission were 11.825 ± 2.68 gm/dl (Range = 2.8 - 16.3 gm/dl) and 13.46 ± 7.014 x 10^9 (range = 3.2 - 37.0 x 10^9) respectively. The haemoglobin was less than 10 gm/dl in only 12.1% of the patients. Six hours after arrival in the ER the mean haemoglobin was 11.373 ±1.846 gm/dl (range = 7.5 – 15.5 gm/dl). There was no significant correlation between the Haemoglobin on admission and the haemoglobin six hours after admission (Pearson correlation coefficient = 0.303, p= 0.057). The total estimated blood loss in the patients is shown in Table 7. In 50.8% of the patients, blood loss did not exceed 1 litre. The mean volume of blood transfused in the first 24 hours of admission was 1,788.75 ml ± 842.65 (range = 250 – 4,000cc).

The grading of the splenic injuries were: Grade I-2(3.3%), II-7(4.3%), III-14(8.6%), IV-35(21.4%), V-3(4.9%).

Sepsis syndrome was diagnosed in 2 patients (3.3%) while multiple organ failure syndrome (MOFS) was seen in 3 patients (4.9%). Two patients (3.3%) developed heart failure while pulmonary failure, renal failure and liver failure occurred in 2 patients each (3.3%) respectively. Four patients (6.6%) developed coagulopathies.

Mechanical ventilation was instituted in 31 cases (50.8%) for a mean duration of 7.2 ± 6.78 days (range = 1-30). Inotropic agents were administered to 11 patients (18%) within 24 hours of admission. Splenectomy was performed in 58 cases (95.1%) while the splenic injuries were managed non-operatively in 3 cases (4.9%) all of whom survived. Fourteen (23%) of the patients died while two patients (3.3%) were evacuated to higher centres for management of associated injuries. The relationship between the grade of splenic injury and mortality is shown in Figure 1. Mortality was significantly related to the grade of splenic injury (p= 0.007).The complications observed during the management and their effects on the clinical outcome are shown in Table 8. The complications that had significant effect on clinical outcome, especially mortality, included bronchopneumonia (p=0.001), brain death (p=0.000), renal failure (p=0.005), cardio-respiratory arrest (p=0.000), and hypovolaemic shock (p=0.005).

Discussion

The mean age of the patients (29.75 ± 15.13 years) in this study reflects the segment of the society that is very actively mobile. The preponderance of males (M: F ratio = 29.5:1) reflects the fact that in the Kingdom of Saudi Arabia, only men are allowed to drive vehicles and also most of the patients ruptured their spleens during MVAs. Similarly high M: F ratios have also been reported from Israel[23], whereas Cocanour[20] reported a 2:1 M:F ratio for a series from Texas, USA.The splenic injury was caused predominantly by motor vehicular accidents (MVA) (52 patients-87.2%). Five patients (8.2%) fell from heights (Mean distance of fall = 3.14 ± 4.15 metres). The injury to the spleen was blunt in 58 patients (95.1%) and penetrating in three (4.9%) due to stabbing in 2 patients (3.3%) and gunshot in one (1.6%).

The mean interval between injury and arrival in the Emergency Room (ER) was 59.80 ± 38.79 minutes (range= 20-240 minutes). Patients who arrived in the ER within one hour of their injuries constituted 78.5%. There was no statistically significant difference in the clinical outcome vis a vis the interval between injury and arrival in the ER. Transportation to the ER by ambulance is a reflection of the well organized healthcare delivery system in Saudi Arabia, a developing country.

The significant characteristics of the MVA in our series included high speed, non-use of seat belts, major vehicular deformity, car rollover and lack of air bags in the vehicles. Reifff, et al.,[28] have reported a technique of predicting possible intraabdominal injuries based on vehicle occupant identity, vehicle collision characteristics, and the speed at impact (Delta V).

The main clinical presenting features in the patients were related to blood loss, associated head and chest injuries. The implication is that in this subpopulation of patients with multiple organ injuries including the spleen, other injuries may mask the presentation of the splenic injury as well as predispose to a more adverse outcome[27, 28].

The haemoglobin level was less than 10 gm/dl in only 12.1% of the patients. This may be related to the comparatively early retrieval from the scene of the MVA and transportation to the hospital. Our results showed no significant correlation between the haemoglobin on admission and the haemoglobin six hours after admission (Pearson correlation coefficient = 0.303, p= 0.057). In 50.8% of the patients, total estimated blood loss did not exceed 1 litre. The mean volume of blood transfused in the first 24 hours of admission was 1,788.75 ml ± 842.65 (range = 250 – 4,000cc). The transfusion requirements in this series are similar to those reported by Ravera, et al.,[6] from Uganda.

The three patients who had NOM were haemodynamically stable and satisfied the criteria enumerated by Goffette[17], Laterre Ochsner [19], and Cocanour [20]. Although NOM has become an accepted management option in patients with splenic injuries who are haemodynamically sta-

ble, several criteria need to be satisfied[19]. These include: (1) haemodynamic stability, with or without minimal fluid resuscitation; (2) no demonstrable peritoneal signs on abdominal examination; (3) The absence on CT scan of any intraperitoneal or retroperitoneal injuries that require operative intervention. Other exclusion criteria include: injury of grade IV or higher, large associated haemoperitoneum, and contrast blush on CT scan. NOM in splenic injuries has evolved from the experience gained in its adoption in paediatric patients. Some possible complications reported in patients treated by NOM[17, 20] include: (a) abnormal or insufficient injury healing process; (b) retention of necrotic tissue; (c) secondary infection of initially sterile collections; (d) underestimation of injury severity; (e) delayed splenic rupture; (f) overt bleeding occurring 4 to 8 days following injury and requiring splenectomy, (g) splenic artery pseudoaneurysm; and (h) splenic abscess occurring up to one month after splenic injury. None of these complications were seen in this study. However, with the current swing to increasing management of blunt splenic injuries by NOM[2, 5, 19, 20, 24, 27], many of the patients managed by splenectomy could have been selected for NOM.

The high mortality rate of 23% observed in the splenectomy group is similar to the mortality of 21% reported from Serbia by Sijacki, et al.,[27].

The mean duration of hospital stay was 18.8 ± 21.31 days (Range = 1-123 days). Only 23% of our patients stayed in the hospital for 7 days or less while the majority (77%) were hospitalized for more than 7 days. Cocanour and others [20] have shown no significant differences in hospital and ICU stays in patients managed by splenectomy or NOM. Prolonged hospital stay was not on account of injuries to other organs or systems.

Conclusions

In Saudi Arabia, the most common cause of splenic injuries in adults is MVA. The MVA characteristics, associated injuries, and complications observed during the management directly impact on the mortality.

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