

Wound infection was the most common post operative complication (15.2%), and next to it was incisional hernia (7%). The mortality rate was (7%,).

The percentage of overwhelming post splenectomy sepsis (OPSS) was zero.

Introduction:

Trauma is a major health problem in the world today.⁽¹⁾ The spleen is a solid visceral organ weighing 75 to 150 g and is about ($12 \times 7 \times 4$ cm) in size, located in the left upper quadrant of the abdomen.⁽²⁾ It is one of the most vascular organs in the body. Approximately 350 L of blood pass through the adult spleen each day, It filters an estimated 10% to 15% of total blood volume every minute. It produces proteins that enhance the ability of neutrophils to destroy encapsulated bacteria during phagocytosis, and through its production of IgM antibodies, it supports the immune system.^(2,3)

The spleen is the most commonly injured organ in blunt abdominal trauma.⁽⁴⁾ And because of its uniquely open circulation, which enables it to play a vital role in the immunologic function of the body, it can bleed profusely with minimal injury, and can be fatal in just minutes if not recognized and appropriately treated.^(5,6)

Most splenic injuries manifest at the moment of injury with symptoms of acute intraperitoneal hemorrhage and shock. Advance in diagnostic techniques that have occurred since the early 1980s have led to alternative approaches to managing these injuries.⁽⁷⁾ Splenic injuries are treated nonoperatively, by splenic repair (splenorrhaphy), partial splenectomy or resection, depending on the extent of the injury and the condition of the patient.⁽⁸⁾ In all patients who are unstable, a total splenectomy should be performed. The recognition that splenectomy renders patients susceptible to lifelong risks of septic complications has led to routine attempts at splenic conservation after trauma.⁽⁹⁾ In patients who are stable, every effort should be made to preserving part or all of the splenic tissue.⁽⁶⁾ Nonoperative management (NOM) of blunt splenic injuries has replaced splenorrhaphy as the most common method of splenic conservation.⁽⁹⁾ 70% to 90% of children with splenic injury are successfully treated without operation, and 40% to 50% of adult patients with splenic injury are managed nonoperatively.⁽⁷⁾

Patients and methods:

A total of 85 patients with splenic injuries were treated in 4 hospitals (Imara military hospital, Hammad shihab military hospital, Al-Rasheed military teaching hospital, and Al-Kindy teaching hospital) between May 1992 and April 2006.

Resuscitation, with evaluation of the patients from top to toe and stabilization occurred simultaneously. Emergency care for the patients supported vital functions by maintaining breathing and circulation by initiating intravenous fluids and blood with placement of a nasogastric tube, insertion of a Foley catheter, and application of a sterile dressing to open wounds.

Diagnostic studies vary according to their availability and the patient's condition, but usually include: chest radiograph, plain abdominal film (including the pelvis). Diagnostic peritoneal lavage had been performed when indicated. Abdominal ultrasound (US) was

performed for few patients. Baseline hematocrit, electrolytes, blood urea and serum creatinine were performed for almost all patients. The majority of patients were unstable, so we depended on physical findings for diagnosis like hypotention (systolic blood pressures lower than 100 mm Hg) and tachycardia (pulse more than 100 beats per minute), presence of ecchymoses and abrasions, left upper quadrant tenderness and guarding, Kehr's sign, Balance's sign, point tenderness at the left lower six ribs. Intravenous antibiotics and anti-tetanus serum were given prophylactically. Analgesic was given for pain as indicated. Meanwhile the patient was prepared for surgery to be taken to the operating theatre for exploratory laparotomy without any delay.

Hemodynamically unstable patients and those with signs of peritonitis underwent immediate abdominal exploration. Patients selected for observation were admitted for 24-48 hours for repeated physical examinations with frequent monitoring of vital signs and hematocrit. An exploratory laparotomy performed if signs of peritonitis or bleeding occurred. We did local wound exploration for suspected stab wounds. Serious patients were admitted to the intensive care unit postoperatively for better care.

The majority of splenic injuries were treated by splenectomy. 3 patients with minor injuries were selected for splenorrhaphy by suturing the injured site with aid of gelfoam to prevent the thread cutting the splenic tissue and the omentum was sutured to the spleen as a tamponade.

For children with splenectomies we warned their parents about the risks of postoperative infections and should be treated aggressively for any infections.

Results:

The total number of patients with splenic injuries was 85. The average age was 34.5 years (range, 8 to 72 years); 68 patients (80%) were male, and 17 (20%) were female, with F: M was 1: 4 (Figure-1).

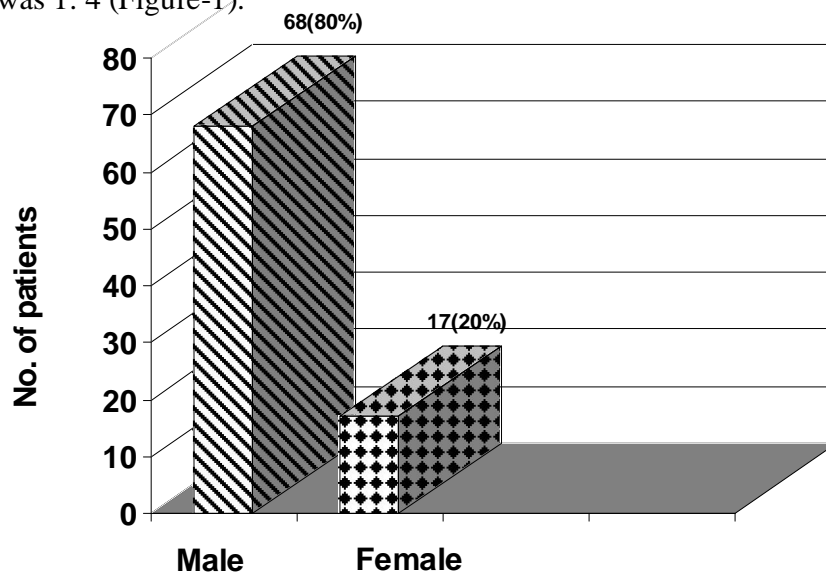


Figure (1): Sex incidence

10 (11.8%) patients were haemodynamically stable, while 75 (88.2%) were unstable (Figure-2).

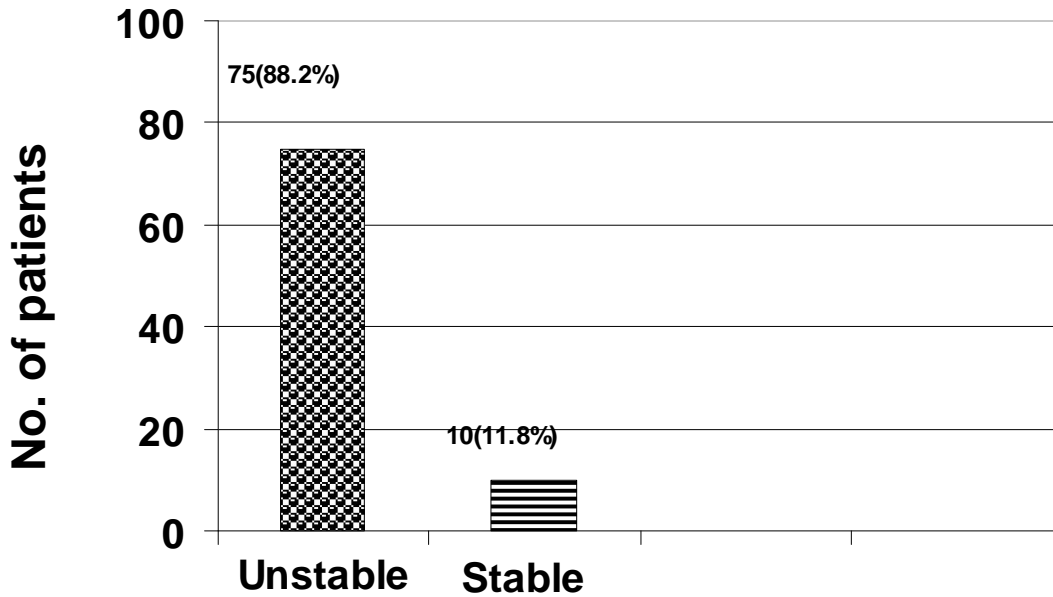


Figure (2): Prevalence of patients in relation to haemodynamic status.

Penetrating injuries constituted 50 (58.8%) patients, Blunt trauma constituted 8 (9.4%) patients, while 27 (31.8%) of splenic trauma was due to penetrating and blunt trauma caused by explosive injury (Figure-3).

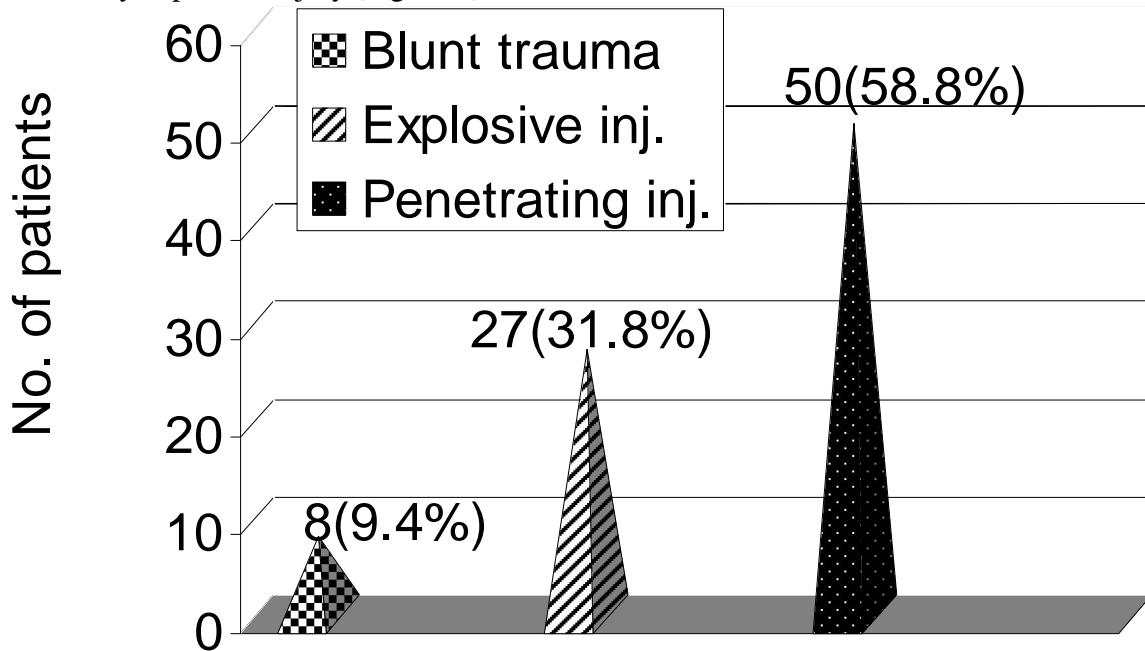


Figure (3): Types of splenic injuries.

Table-2 illustrates that bullet injury (gunshot) was the most common cause of splenic injuries.

Table (2): Causes of splenic injuries.

Cause	No.	%
Bullet injury (gunshot)	30	35.3
Shell fragments injury	16	18.8
Stab wound	4	4.7
Explosive injury	27	31.8
Car sccident	6	7
Motorcycle accident	1	1.2
Sports mishaps	1	1.2

Of the 85 patients entered into the study, 12 (14.1%) patients had isolated splenic injury. 67 (78.8%) patients had associated abdominal injuries, while extraabdominal injuries were found in 37 (43.5%) cases (Figure- 4).

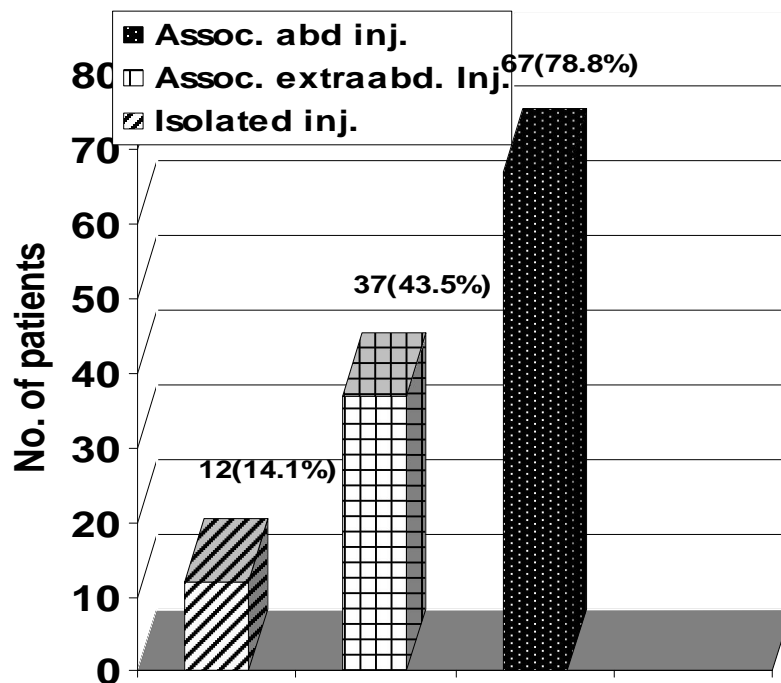


Figure (4): Incidence of isolated splenic injuries, associated abdominal and extra abdominal injuries.

Table (3): summarizes the organs that injured in association with splenic injuries.

Table (3): The organs that injured in association with splenic injuries.

Organ	No.	%
Liver	30	35.3
Gall bladder & bile ducts	6	7
Stomach	32	37.6
Diaphragm	26	30.5
Pancreas	16	18.8
Duodenum	14	16.5
Mesentery	33	38.8
Small bowel	31	36.5
Large bowel	23	27
Lung & pleura	26	30.5
Kidney & adrenal gland	12	14.1
Ureter	3	3.5
Urinary bladder	10	11.7
Vessels	8	9.4
Head & neck	16	18.8
Spine	6	7
Upper & lower limbs	20	23.5
Pelvis	4	4.7

Of the 50 patients with penetrating injuries 40 (80%) patients had associated abdominal injuries. Blunt splenic trauma was associated with other serious abdominal injuries in 3 (37.5%) cases. Explosive injuries of the spleen were associated with other serious abdominal injuries in 24 (88.9%) patients (Figure-5)

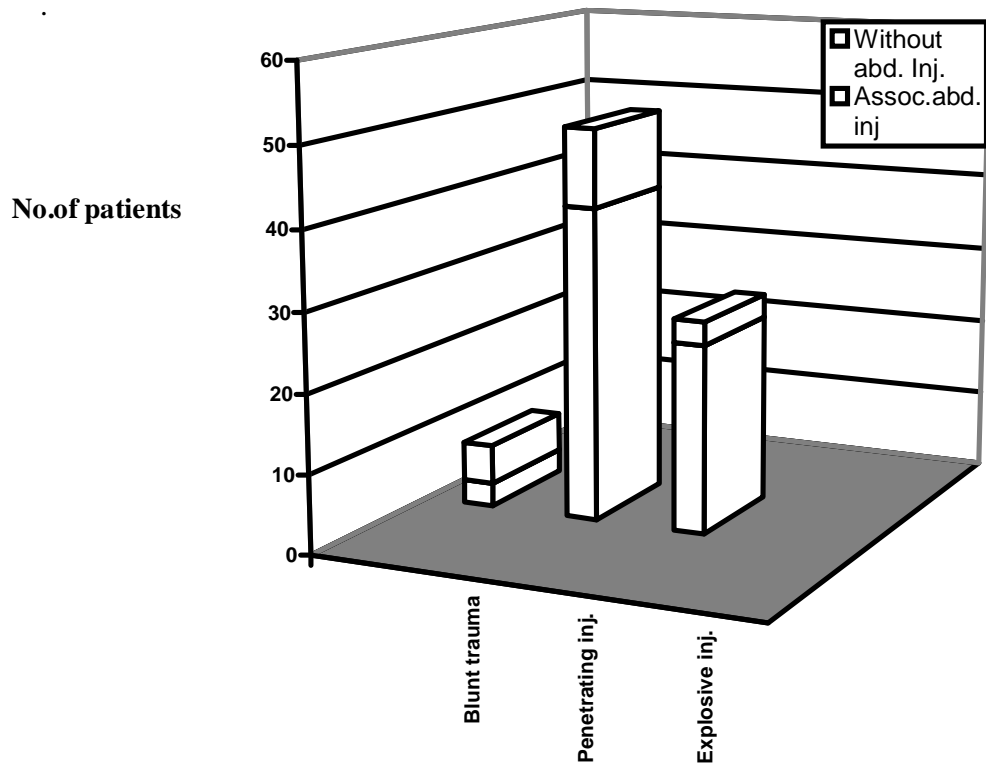


Figure (5): Incidence of associated abdominal injuries in relation to types of splenic trauma.

82 (96.5%) patients underwent splenectomy and 3 (3.5%) splenorrhaphy (Figure-6).

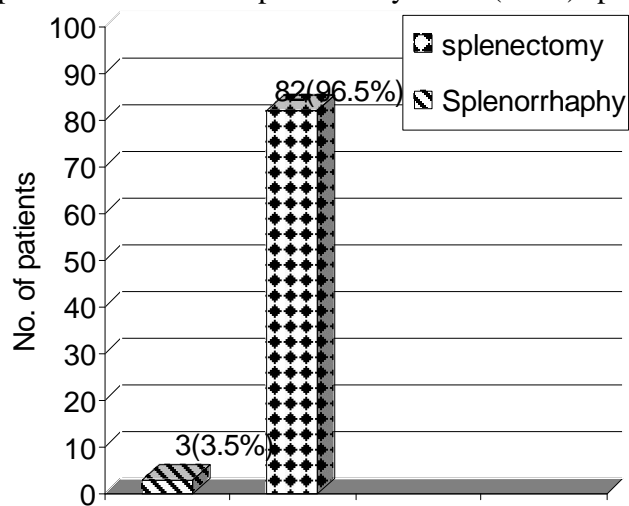


Figure (6): Incidence of splenectomy and splenorrhaphy.

Table-4 demonstrates the post operative complications, which shows wound infection was the most common post operative complication (15.2%), and next to it was incisional hernia (7%). There were 6 (7%) deaths. In 2 of the 6 deaths the cause was a severe associated intraperitoneal vascular and hepatic injuries. 4 patients died as a result of severe associated extraperitoneal injuries (severe head, chest and pelvic injuries).

Table (4): Post operative complications.

Complication	No.	%
Bleeding	4	4.7
Subphrenic abscess	2	2.3
Pneumonia	3	3.5
Deep vein thrombosis	2	2.3
Pulmonary embolism	1	1.2
Wound infection	13	15.2
Incisional hernia	6	7
Death	6	7

Discussion:

Male predominance is a feature of most traumatic injuries⁽¹⁰⁾, and this was proved in the present study which showed F:M was 1: 4. This may be due to the fact that males spend most of their times outside their homes and because of the nature of their careers that exposed them more to accidents and injuries.

Contrary to Andrew J A Holland *et al* who mentioned splenic trauma is more common in children than in adults⁽¹¹⁾, the present study showed splenic trauma is more common in adults than in children, and the most commonly affected age group was 21-30 years.

It is mentioned that the associated intraabdominal injuries occur in approximately 40 to 50 percent of patients with splenic rupture.⁽¹²⁾ The present study showed much higher percentage (78.8%). This high percentage was because most of splenic trauma (85.9%) was due to bullet (gunshot), shell fragments and explosive injuries.

It is documented that automobile accidents are the most common cause of blunt trauma to spleen.⁽¹³⁾ A similar finding was also found by our study.

We found (9.4%) of the splenic trauma caused by blunt trauma, which is much less than that of Wilson RH *et al* who stated that blunt trauma accounts for 66-75% of all splenic trauma in adults and up to 97% in children.⁽⁴⁾

This study showed the penetrating and explosive injuries were the most common cause of splenic trauma at all ages. A finding is dissimilar to that of McAnena OJ *et al* and Thal ER *et al* who have found in adults, 50-75% of splenic trauma caused by motor vehicle accidents while in children and adolescents, contact sports is a more common mechanism.^(14,15) This can be explained by the effect of warfare, civilian bombing, and the terrorist explosions in our country.

The present work showed penetrating injury was associated with other serious abdominal injuries in (80%) of cases, which is less than that of Shackford SR, Molin M. who mentioned penetrating injury is associated with other serious abdominal injuries in over 90% of cases.⁽¹⁶⁾

We have found the most commonly associated organ injuries were the mesentery (38.8%), stomach (37.6%), small bowel (36.5%), and liver (35.3%). This differs from that of Shackford SR *et al* who have found the most commonly associated organ injuries were the stomach, left kidney, and pancreas.⁽¹⁶⁾

The high rate of splenectomy (96.5%) and absence of partial splenectomy and NOM in this study in comparison to that mentioned in the literatures^(4,5,15,16), were because monitoring the patient in a critical care environment with follow-up CT scan and US were not available 24 hours a day in our hospitals. Moreover the majority of our victims (88.2%) were haemodynamically unstable. In addition to that we need more experience in splenorrhaphy, partial splenectomy and NOM.

Regarding the morbidity and mortality, wound infection was the most common complication, it was developed in 13 (15.2%) patients. Associated injuries, patient age, and hemodynamic stability are important factors that will affect morbidity and mortality.⁽⁴⁾ In our series 6 (7%) patients died because of multiple severe injuries to other organs with multiple organs failure. Our mortality rate (7%) lies within the range that mentioned by Wilson RH *et al* (3-23%)⁽⁴⁾, but higher than that stated by Pachter *et al* (5.2%)⁽⁹⁾, and lower than that documented by T V Clancy *et al* which was (13%)⁽¹⁷⁾ (Table- 5).

Table (5): Comparison between other studies and our study regarding the mortality rate.

Author	Mortality rate
Wilson RH <i>et al</i>	3-23%
Pachter <i>et al</i>	5.2%
T V Clancy <i>et al</i>	13%
Our study	7%

In respect to OPSS, no patient died during the study period as a consequence of OPSS. Our percentage of OPSS represents the lower limit mentioned by Wilson RH *et al* (0 - 2.2%)⁽⁵⁾ and less than that reported by Shackford SR *et al* (0.28 to 1%)⁽¹⁶⁾. This may be due to intraperitoneal implantation of splenic material seeded during the traumatic event (splenosis).⁽⁵⁾

Conclusion:

From our study we concluded that:

1. Male predominated, with F: M was 1: 4.
2. The most common affected age group was 21-30 years.
3. Bullet injury was the most common cause of splenic injury, and the automobile accident was the most common cause of blunt splenic trauma.
4. About 80% of patients with splenic trauma had associated abdominal injuries. The mesentery, stomach, small bowel and liver were the most common injured abdominal organs.
5. The percentage of OPSS was zero.

Proposals and recommendations:

Trauma care is a serious and expensive healthy problem. It needs establishing of trauma centres with all necessary equipments and specialized teams committed to the work. US, CT scan, and other investigations should be available 24 hours a day.

The hospitals should be ready at any moment to receive major traumas. Facilities should be immediately available; including intensive care unit, emergency operating room with experienced trauma team members for monitoring the patient in a critical care environment with follow-up CT scans or US.

The trend in management of splenic injury continues to favor nonoperative or conservative management. NOM needs to get more attention, we need more experience. Surgeons must feel comfortable in managing such patients, and considered the risks carefully before this difficult decision is made.

No patient died during the study period as a consequence of OPSS, this needs other coherent studies.

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