RESULTS

During the 27 months study period, 40 patients with blunt hepatic trauma were admitted to Accident & Emergency Departments in Benha Univeristy Hospitals, and El-Sahel Teaching Hospital during the period from October 1999 to December 2001.

Five patients out of the forty patients did not accomplish the criteria for nonoperative management and thereby required emergency laparotomy after resuscitation but without CT examination.

Thirty-two patients (80%) were males and eight patients (20%) were females (Fig. 6).

Of the forty patients, eight patients were below eleven years (20%), ten patients (25%) were in the age range of eleven to twenty years, 16 patients (40%) were between 21 and 30 years, four patients were between 31 and 40 years (10%), two patients (5%) were 44 years and 60 years old (Table 11, Fig. 7).

The most common mechanism of trauma was related to motor vehicle accident (MVA). Blunt hepatic injuries were sustained from pedestrian (20 cases, 50%), occupant of car (6 cases, 15%), falls from height (10 cases, 25%), bike accidents (2 cases, 5%) and others (2 cases, 5%) (Table 12, Fig. 8).

CT scans obtained from contrast material enhancement demonstrated one or more capsular disruptions in 9 patients, subcapsular hematomas in 6 patients, intrahepatic

hematomas or areas of perenchymal devascularization in 29 patients, intraparenchymal lacerations in 25 patiens, and suggested disruption of major intrahepatic vessels in 3 patients (Table 13, Fig. 9).

The present study reported that 75% of all lesions were situated in the right hepatic lobe and 25% were situated in the left lobe (Fig. 10). Two lesions of the left hepatic lobe were situated adjacent to the falciform ligament. Five patients with injuries of the right lobe also had extrahepatic hematomas caused ty involvement of the bare area of the liver.

On the basis of the criteria given in Table (14), injuries were classified as CT grade I in two (6%) patients, grade II in eleven (31%) patients, grade III in twelve (34%) patients, and grade IV in ten (29%) patients. There were no patients with CT grade V injuries (Fig. 11).

The relationship between the hepatic CT injury grades and the hepatic enzymes levels at admission was directly proportionate. Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) levels were significantly higher in grade III and IV injuries, than in grade I and II. The mean level of ALT was 640.95±120.98 for grade III and IV, and 288.38±92.60 for grade I and II, with significant P value (<0.01). Meanwhile, AST was 818.55±119.21 for grade III and IV and 480.00±130.51 for grade I and II and P value (<0.01) (Fig. 12)

The mean values of AST decreased 50% within 24 hours from a maximal level seen at the time admission and were nearly normal 8 days later. The ALT levels decreased more gradually (Fig. 13).

Alkaline phosphatase levels increased slightly between day 1 and day 8, but never were greater than the upper limit of normal, whereas, total bilirubin increased on day 1 and retrumed to normal on day 8.

In seven patients, initial CT scans showed no intraperitoneal fluids. In 28 patients, free intraperitoneal fluid was present and was classified as minor hemoperitoneum in eight patients (estimated to be less than 250 ml.), moderate hemoperitoneum (250-500 ml.) in ten patients, and major hemoperitoneum (more than 500 ml.) in ten patients. There were no patients with CT grade V injuries. Table (15) shows the relation between CT injury grade and hemoperitoneum (Fig. 14).

Thirty-three patients (82%) were treated successfully by nonoperative means including two patients with CT grade I hepatic injuries, eleven patients with grade II injuries, twelve patients with grade III injuries, and eight out of ten patients with grade IV injuries (Fig. 15).

Of the total forty patients in our study, seven patients (17.5%) required operative intervention; because of hemodynamic instability in two cases, peritoneal signs in one case, splenic rupture in one case, and massive hemoperitoneum in the fifth case. The other two cases required delayed intervention because they failed conservative treatment. One of them developed delayed hemorrhage and the other one had subphrenic biloma collection.

Thirty patients (75%) had one or more associated injuries, with the chest injury being the most common as shown in Table (16), and the remaining ten (25%) patients

had no associated injuries as shown in Figure (16). There were 50 associated injures, both intra- and extra- abdominal occurred among thirty of the forty patients with hepatic injury. Among those fifty associated injures, there were eleven injuries occurring abdominally and thirty-nine injuries extra-abdominally as shown in Table (16).

The indications for surgery in the five patients who required emergency surgical intervention were displayed in Table (17), two of such patients were operated on for hemodynamic instability defined as Hemodynamic Instability Scale (HIS) of grade 4 and 5. The third patient had clinical signs of peritonitis, on exploration there was perforated small bowel. One patient was operated upon for severe splenic injuries identified by ultrasound examination, and the last one was operated upon for massive hemoperitoneum identified by ultrasound examination.

The surgical procedures performed on those patients who required urgent laparotomy were packing in one case, but the patient died from uncontrolled hemorrhage due to avulsed right hepatic vein form its origin from the inferior vena cava (IVC), one case required resection debridement of segments VI and VIII of the right lobe, one case required repair of perforated small bowel, one case required splenectomy because of severe splenic injury, and the last case required omental flap and repair of gastric perforation due to deep fracture injury of the left lobe and gastric perforation as shown in Table (18).

On the other hand, nonoperative management failed in two patients. The first patient had a grade IV liver laceration and hemodynamic instability score (HIS) of 3. The patient

developed subphrenic biloma caused by bile duct injury of segment VIII, which was asymptomatic and was recognized on follow-up ultrasound examinations, after two weeks, CT scans were performed to confirm the diagnosis and was successfully treated with percutaneous drainage only. The second patient has had a grade IV liver laceration and HIS score of 3 and major hemoperitoneum. After successful initial conservative treatment, the patient developed a decrease in hematocrit (Hct) level and blood pressure on day 9, where CT scan was obtained and showed a major amount of free perihepatic and perisplenic fluids, indicating free intraperitoneal hemorrhage. At surgery, an actively bleeding parenchymal liver lesion was revealed in segment VI that necessitated placement of sutures..

It is reported that in nonoperatively treated patients, there were three patients with mild pleural effusions who were treated conservatively. Three patients developed repeated attacks of distension and vomiting, those patients recovered uneventfully without surgical intervention as shown in Table (19).

As regards the five patients managed surgically without CT scans, four patients (80%) had hemodynamic instability scale (HIS) scores of 4. One patient had HIS score of 5. One of the above patients developed slight postoperative wound infection. Another patients developed burst abdomen after resection debridement of injured liver, he was taken to the operating theatre, and tension sutures were performed with uneventful outcome. The patients who had HIS score of 5 died on table from uncontrolled hemorrhage due to avulsed right hepatic vein from its origin from the inferior vena cava (IVC).

In nonoperatively treated patients, there were three other patients developed nosocomial pneumonia. Minor infection-related complications included urinary tract infection and superficial thrombophlebitis. Other minor complications included one case of pneumothorax, one case of deep venous thrombosis (DVT), and one case of contrast reaction.

There was one mortality in the seven patients who were treated operatively due to uncontrolled hemorrhage, which failed perihepatic packing.

For all patients who were treated successfully nonoperatively, ultrasonographic resolution took form 1-3 months.

The transfusion requirement in the first twenty-four hours for the nonoperative patients was significantly lower than for the patients undergoing surgery with a mean of (2.76±1.28) and (5.29±2.56); respectively and significant P value (<0.01).

Periods of the stay in hospital were shorter in patients treated nonoperatively (Mean=16.09±4.91) versus patients managed operatively (Mean= 23.57±11.31) and therefore significant (P value 0.01).

The mean length of stay in the ICU was (4.30±1.72) for patients managed nonopearatively, whereas, the mean length of stay in the ICU for patients who required urgent laparotomy was (6.57±3.31) with a significant difference (P<0.05).

On admission, the hematocrit level was significantly

higher in patients managed nonoperatively than those patients who were treated surgically, with a mean of (32.64±2.98) and (28.57±3.15); respectively and P value <0.01, which is also significant.

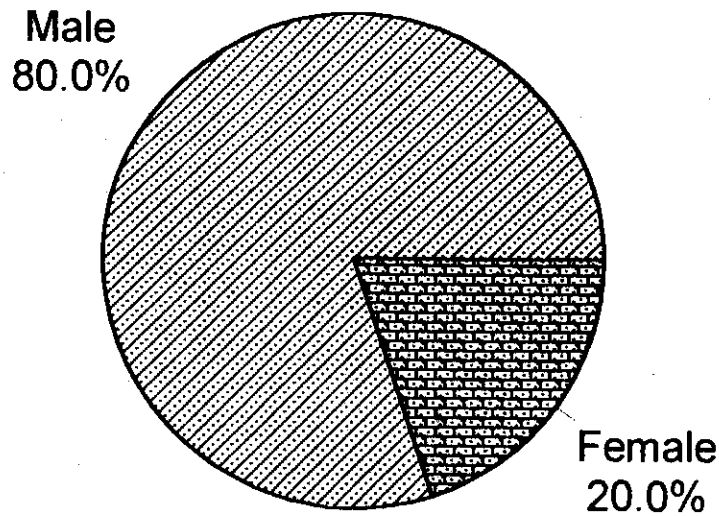


Fig. (6): Sex distribution in the 40 patients

Table (11)

Age distribution in the 40 patients with sustained blunt hepatic trauma, under study

Age Gr. (years)	No.	%
<11	8	20.0%
11 - 20	10	25.0%
21 - 30	16	40.0%
31 - 40	4	10.0%
41 +	2	5.0%
Total	40	100%

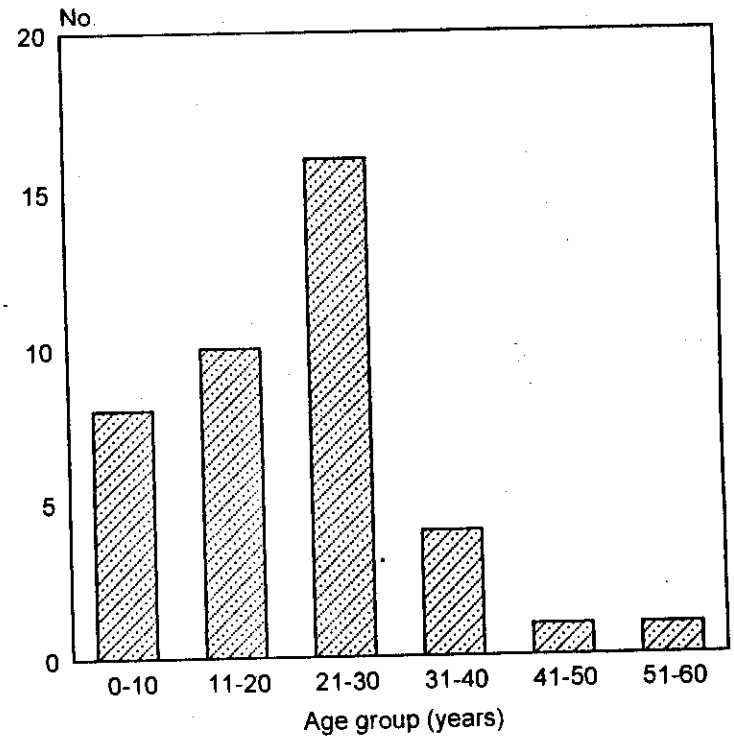


Fig. (7): Age distribution in the 40 patients sustained blunt hepatic trauma

Table (12)

Mechanisms of injury among the 40 patients under study

Mechanism of injury	No.	%
Motor vehicle accident:		
Pedestrian	20	50.0%
Occupant of the care	6	15.0%
Falling from Height	10	25.0%
Bike accident	2	5.0%
Others	2	5.0%
Total	40	100%

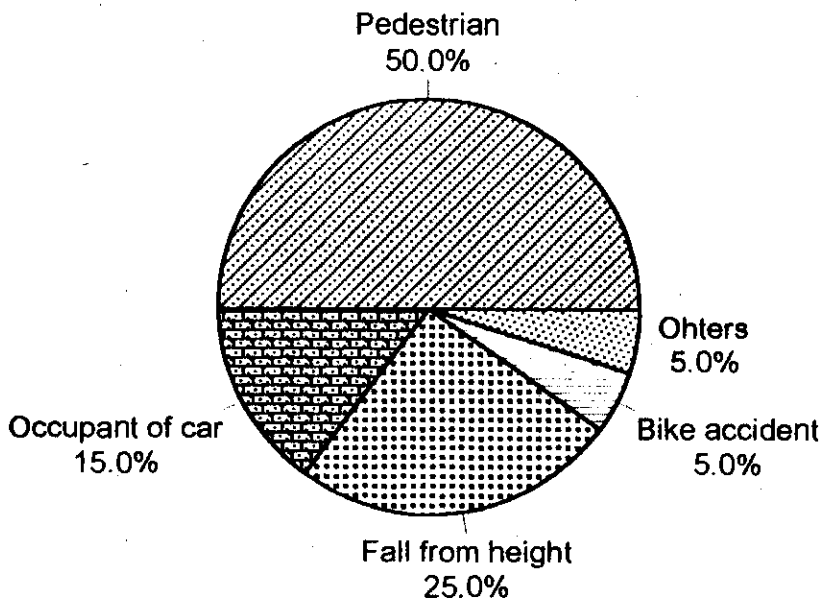


Fig. (8): Percentage of various mechanisms of blunt liver injury in the 40 patients

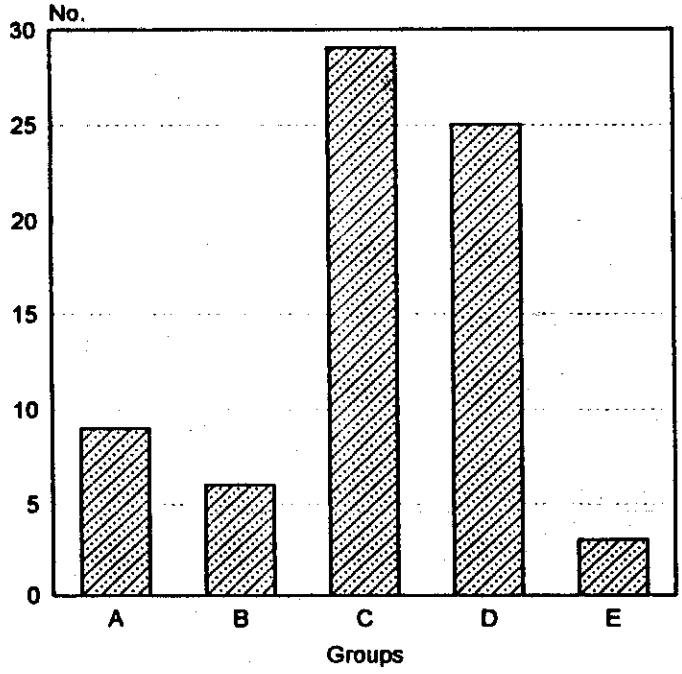
Table (13)

Summary of the initial CT scan of the 35 patients with blunt liver injuries

Liver injury in the CT	No.	%
Capsular disruptions	9	22.5%
Subcapsular hematomas	6	15.0%
Intra-hepatic hematomas or area of parenchymal devascularization	29	72.5%
Intra-parnchymal lacerations	25	62.5%
Suggested disruption of major intra-hepatic vessels	3	7.5%

Plate (7): A C.T. scan of the abdomen shows a grade I trauma with laceration, hematoma, and periportal tracking

Plate (8): A C.T. scan of the abdomen shows a grade I liver trauma with subcapsular hematoma.



A. Capsular disruptions
B.Subcapsular hematomas
C. Intra-hepatic hematomas or area of parenchymal devascularization
D. Intra-parenchymal lacerations
E. Suggested disruption of majore intra-hepatic vessels

Fig. (9): Findings on initial CT scans of the 35 patients sustained blunt hepatic trauma

Plate (9): A C.T. scan of the abdomen shows a linear grade II laceration.

Plate (10): A C.T. scan of the abdomen shows a central hematoma of grade II liver trauma.

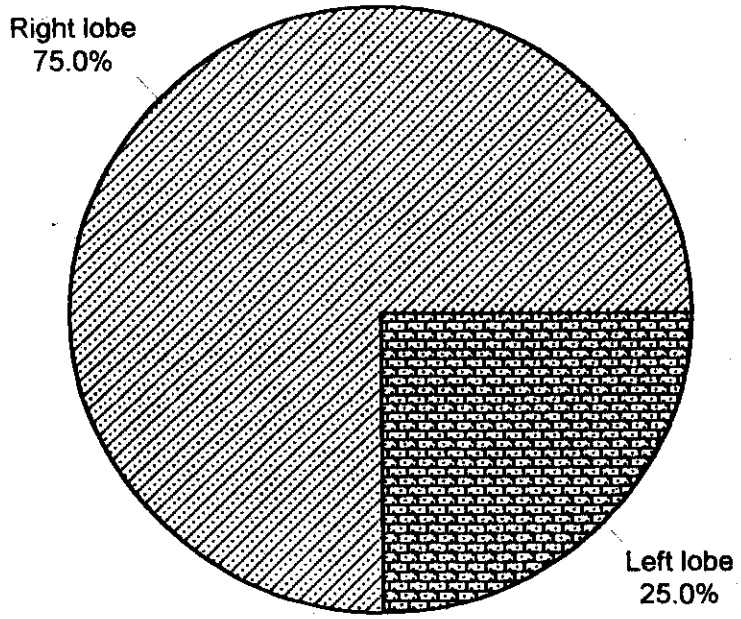


Fig. (10): Incidence of hepatic lobes affected by blunt trauma in the 40 patients

Table (14)

CT grades of 35 patients treated non-surgically, under study

Grade of injury	No.	%
Grade I	2	6%
Grade II	11	31%
Grade III	12	34%
Grade IV	10	29%

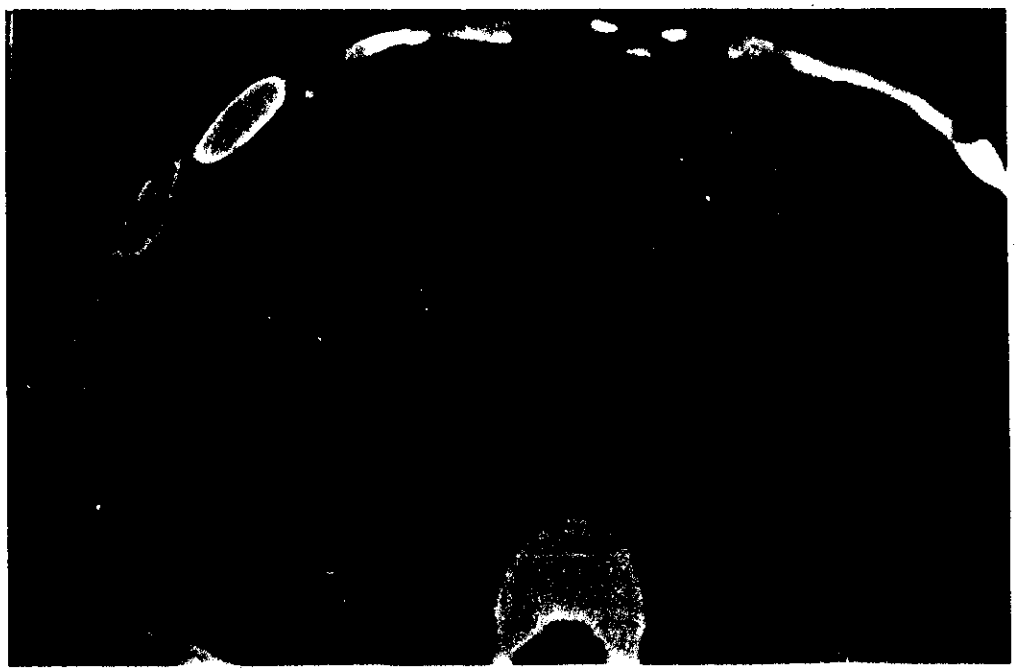


Plate (11) A C.T. scan of the abdomen shows subcapsular hematoma of grade III liver trauma.

Plate (12): A C.T. scan of the abdomen shows linear laceration of grade III and free intraperitoneal blood.

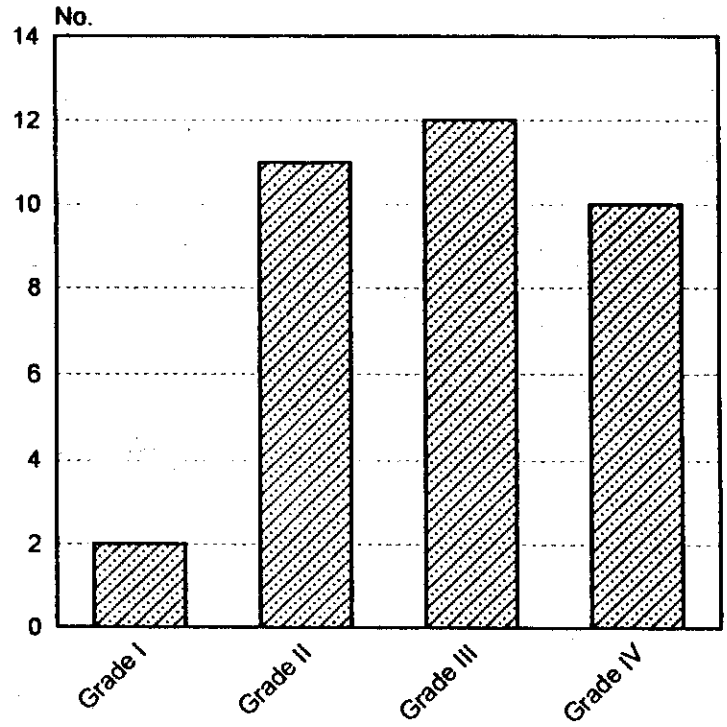


Fig. (11): Distribution of CT grades in 35 patients treated nonsurgically

Plate (13): A C.T. scan of the abdomen shows intraparenchymal hematoma of grade IV liver trauma.

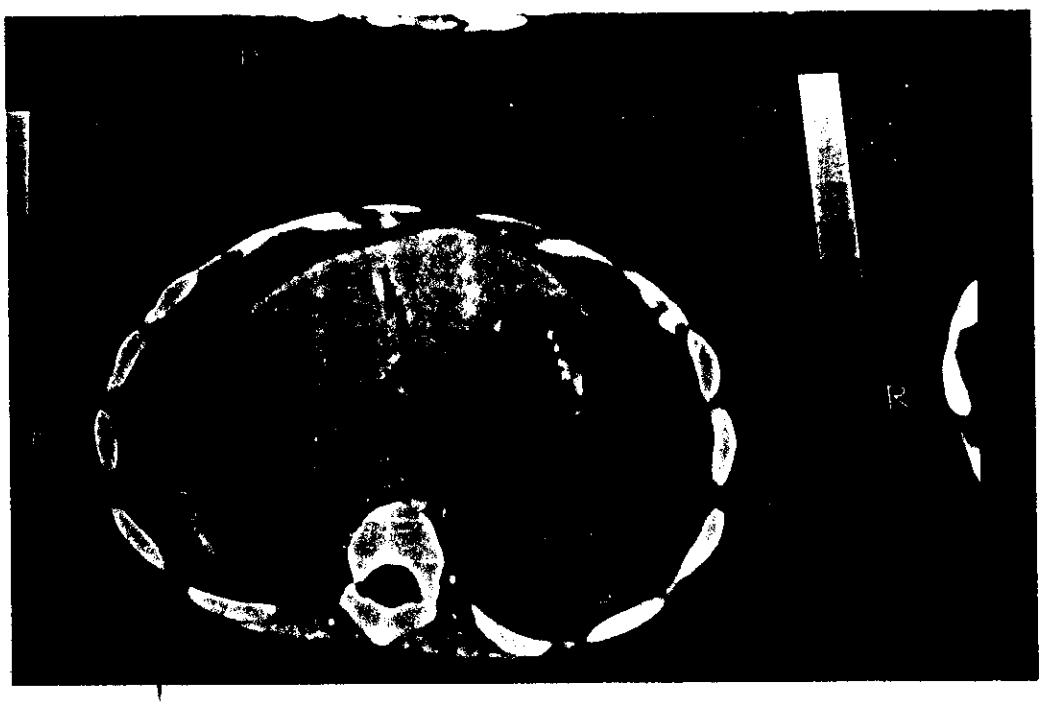


Plate (14): A C.T. scan of the abdomen shows linear laceration and massive subcapsular hematoma of grade IV.

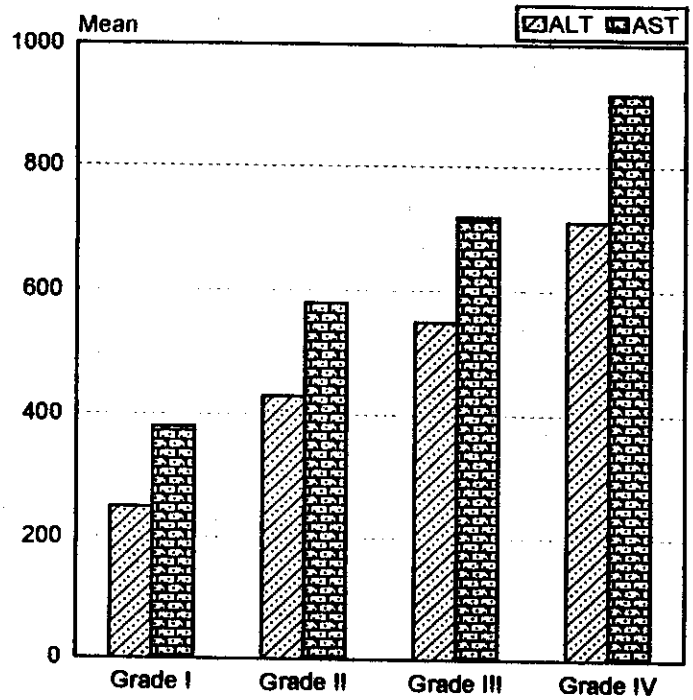


Fig. (12): Mean ALT and AST according to CT grades in the 35 patients

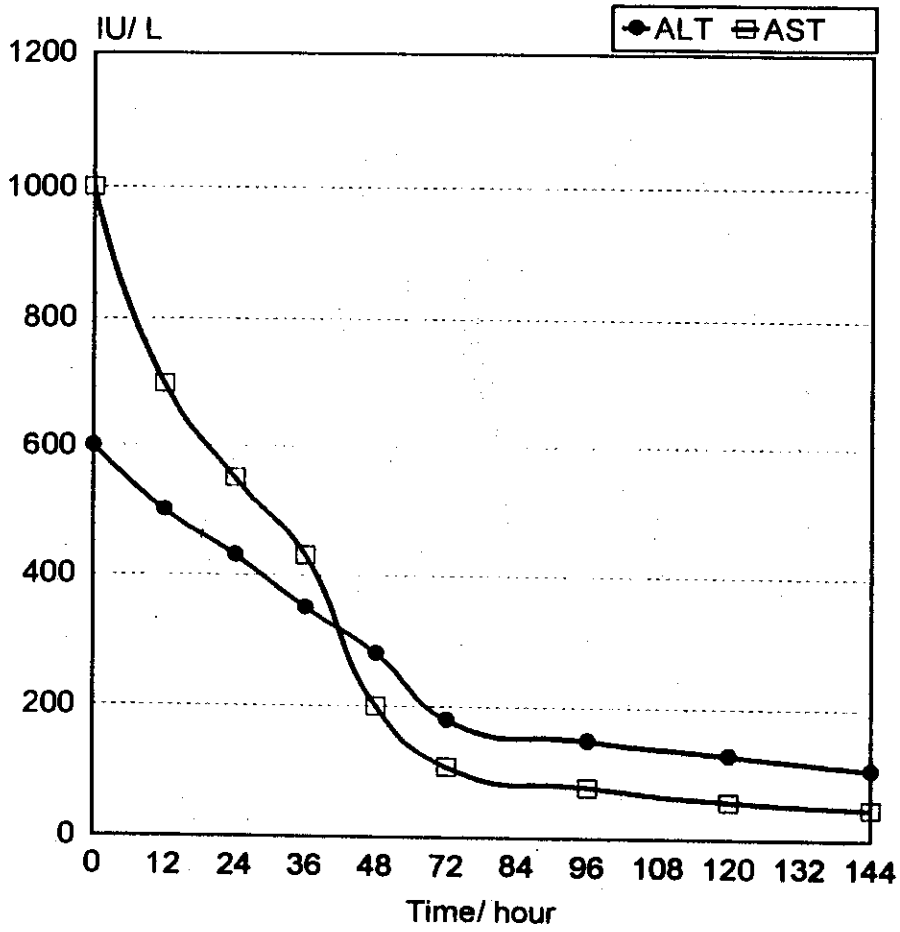


Fig. (13): Mean values of ALT and AST in patients with hepatic injury. 0 time, time blood drawn for measurement of transaminase level at the time of admission to the Emergency Department (All within 2 hours of injury)

Table (15)

Relation between CT injury grade and hemoperitoneum

Hemoperitoneum	CT injury grade				
	I	II	III	IV	Total
None	1	3	2	1	7
Minor (<250ml)	0	3	3	2	8
Moderate (250-500ml)	1	4	3	2	10
Majore (>500ml)	0	1	4	5	10
Total	2	11	12	10	35

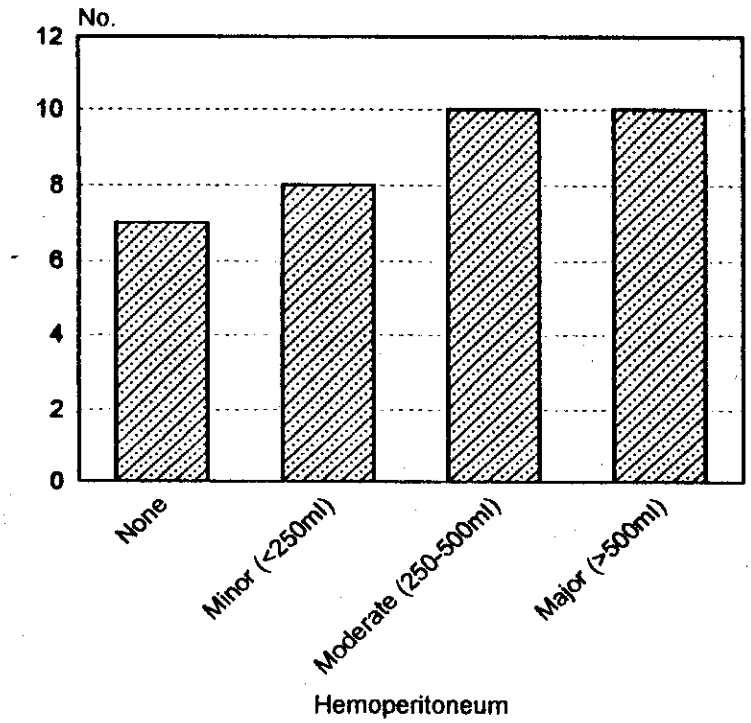


Fig. (14): Amount of hemoperitoneum detected by CT in 35 patients

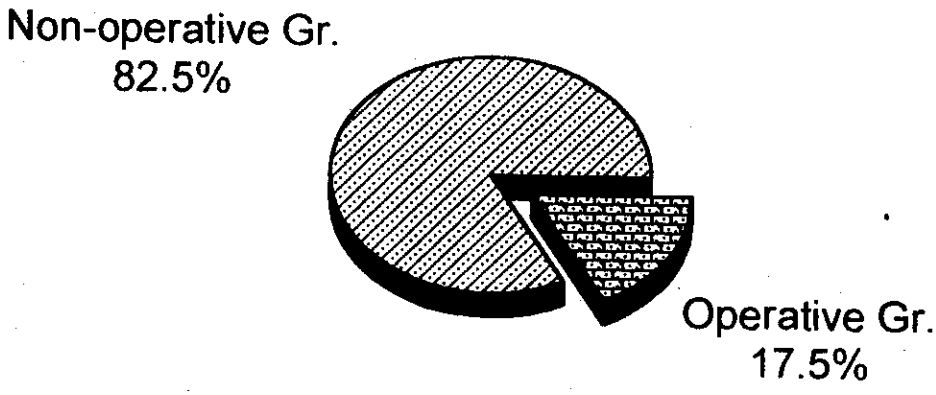


Fig. (15): Pie Chart showing number of patients managed operatively and non-operatively in 40 patients

Table (16)

Distribution of injury in the different parts of the body associated with blunt hepatic trauma

Associated injury	Site of inury	No.	%
Abdominal injuries:	Spleen	2	18%
	Kidney	2	18%
	Small bowel	1	9%
	Stomach	1	9%
	Urinary bladder	2	18%
	Retroperitoneal hematoma	3	27%
	Total abdominal injuries	11	100%
Chest injuries:	Right hemothorax	4	25%
	Left hemothorax	1	6%
	Bilateral hemothorax	4	25%
	Fracture ribs	7	44%
	Total chest injuries	16	70%
Head injuries		5	22%
Facial injuries		3	13%
Fracture spine		2	9%
Fracture pelvis		4	17%
Extremity injury	Uypper limb	3	13%
	Lower limb	6	26%
	Sub-total	23	100%
Total abdominal and extra-abdominal injuries		50	100%

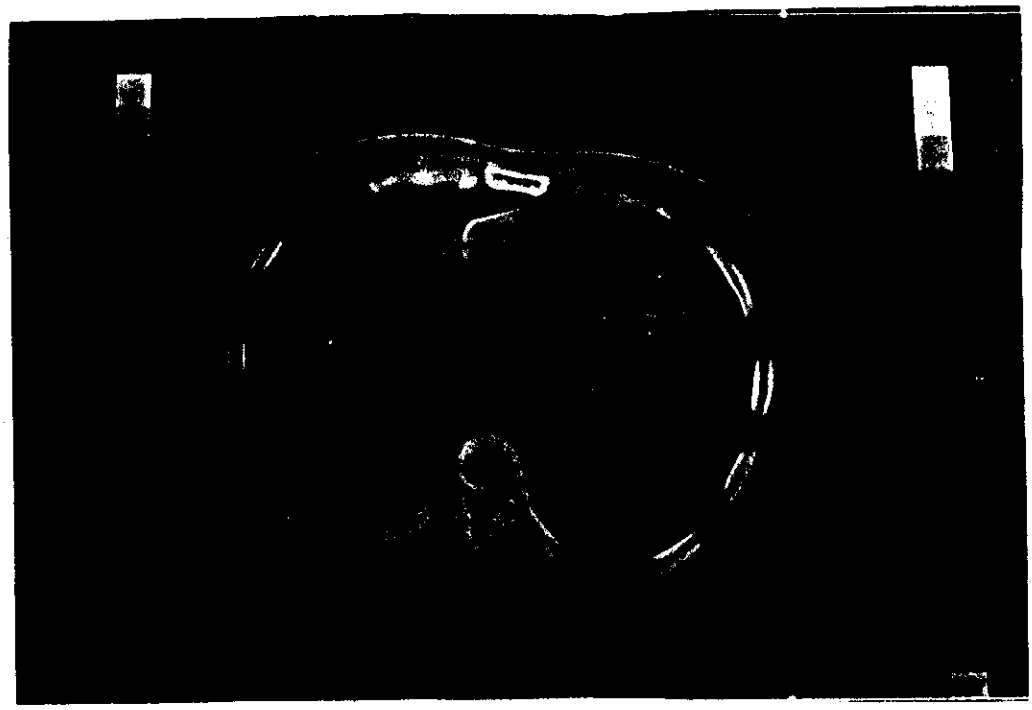


Plate (15): A C.T. scan of the lower chest depicts right hemothorax associated with traumatic liver.

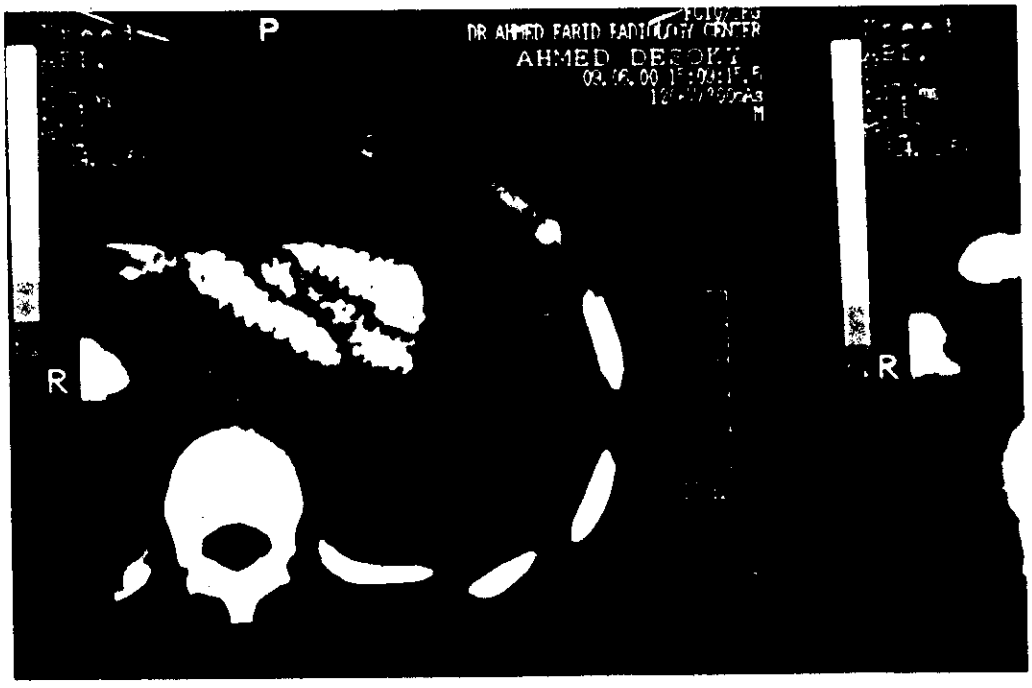


Plate (16): A C.T. scan of the abdomen depicts laceration of the lower pole of the spleen.

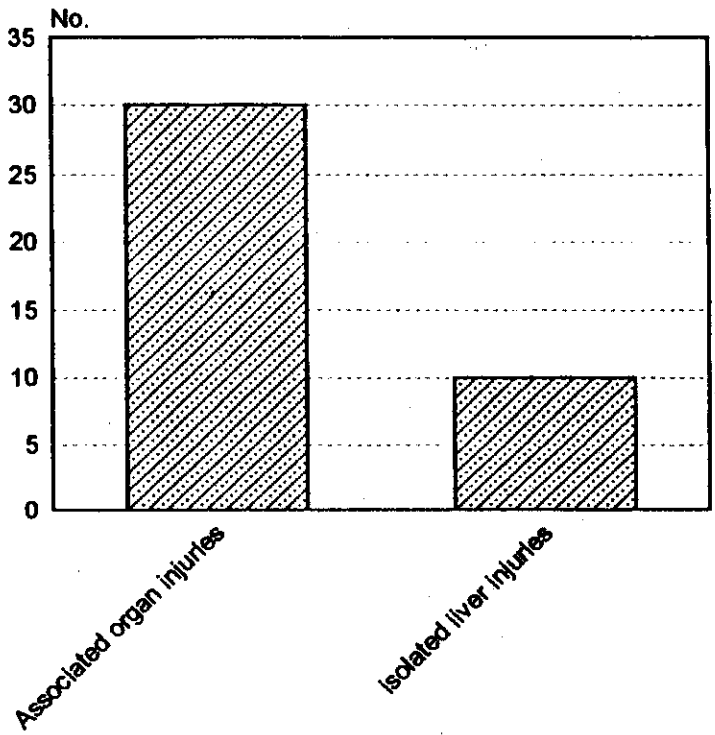


Fig. (16): Incidence of associated injuries in the 40 patients

Table (17)

Indications for surgical intervention

Indication for surgery	No.	%
Hemodynamic instability	2	5.0%
Massive hemoperitonium	1	2.5%
Splenic injury	1	2.5%
Peritoneal signs	1	2.5%
Failed non-surgical treatment	2	5.0%
Total	7	17.5%

Table (18)

Gurgical procedures performed on patients that required urgent laparotomy from the beginning

Indication of surgery	No.	Surgical procedure
Hemodynamic instability with HIS scores of grade 5 and active bleeding from right hepatic vein	1	Packing which failed and the patient died
Hemodynamic instability with HIS scores of grade 4	1	Resectional debridment of segment Vi and VII
Massive hemoperitoneum due to deep fraqcture injury of the left lobe and gastric perforation	1	Omental flap to the liver and repair of the gastric perforation
Severe splenic injury	1	Splenectomy and repair of the liver by mattress sutures
Peritoneal signs of small bowel perforation	1	Repair of both liver and small intestine
Total	5	

Table (19)

Incidence of complications in patients under study (Treated with non-operative and surgical)

Complications	No.	%
Subhepatic biloma collection	1	2.5%
Delayed hepatic hemorrhage	1	2.5%
Mild pleural effusion	3	7.5%
Repeated attacks of distrension	3	7.5%
Wound infection	1	2.5%
Burst abdomen	1	2.5%
Total	10	25.0%

Plate (17): A C.T. scan of the abdomen was obtained on day-9 shows a major amount of hemoperitoneum.

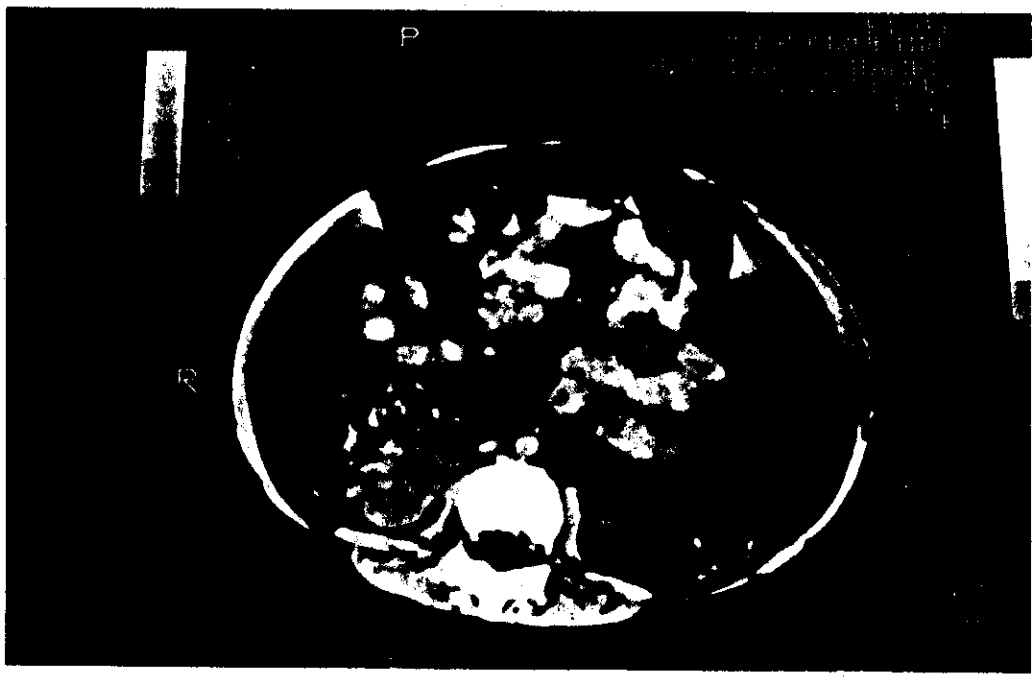


Plate (18): A C.T. scan of the abdomen shows subhepatic and perisplenic bile collection.

Table (20)

Outcomes of nonoperative management of published studies

Author	No.	Nonoperative management (%)	Success (%)	ICU length of stay (days)	Hospital stay (days)	Blood transfusion (units)
Meredith (1994)	72	55%	97%	8	18.5	5.4
Sherman (1994)	30	50%	97%	7.1	15.7	6.7
Groce (1995)	136	82%	89%	8.5	18.1	2.4
Boone (1995)	46	36%	91%	5.2	16.6	8.3
Brasel (1997)	82	61%	96%	3.7	10.2	6.1
Malhotra (2000)	661	85%	92.5%	7.2	12.7	4.4
Present study	40	87.5%	94.0%	4	16±4	3