AIM OF THE WORK

The objective of this study was to compare between blunt abdominal trauma in adults and children regarding the mode of trauma, organ affection, the importance of CT in diagnosis and the outcome of treatment (operative and non operative) at the Emergency Department of Alexandria Main University Hospital.

PATIENTS

This prospective study included two groups according to their age. Group 1 included children (≤16 years old) [101], while group 2 included adults (>16-60 years old) with BAT admitted to the Emergency Department of Alexandria Main University Hospital, in a 6 -months period from July 2013 through January 2014.

Exclusion criteria

Victims with the following criteria were excluded from the study:

1. Penetrating abdominal injuries.
2. Pregnancy.
3. Glasgow coma scale (GCS) ≤ 8.
4. Pathological spleen.
5. Refusal of management /discharge against medical advice (AMA).

METHODS

This is a prospective cohort study including all victims with BAT. Consent was taken from all patients to participate in the study or their care-givers.

All patients were examined and assessed by the following:

1- Neurological examination

Disability: which was evaluated in all studied patients by **AVPU score** (Alert, Voice, Pain, Unresponsive)[102], examination of pupils for equality and reactivity and checking random blood sugar.

Glasgow Coma Scale (GCS): theGCS is a widely used standardized test that evaluates the degree of nervous system or brain impairment in patients, brain injury is classified as: Severe, with GCS ≤ 8, Moderate, GCS 9 – 12, Minor, GCS ≥ 13.[103]

Response	Score
Eye opening	
Opens eyes spontaneously	4
Opens eyes in response to speech	3
Opens eyes in response to painful stimulation	2
Does not open eyes in response to any stimulation	1
Motor response	
Follows commands	6
Makes localized movement in response to painful stimulation	5
Makes non purposeful movement in response to noxious stimulation	4
Flexes upper extremities/ extends lower extremities in response to pain	3
Extends all extremities in response to pain	2
Makes no response to noxious stimuli	1
Verbal response	
Is oriented to person, place, and time	5
Converses, may be confused	4
Replies with inappropriate words	3
Makes incomprehensible sounds	2
Makes no response	1

Table (4): Shows Glasgow Coma Scale.[104,105]

2-Abdominal examination:

- A head to toe examination was done for all studied patients including spine to detect other non life threatening injuries.[31]
- In this survey full abdominal examination isdone for all studied patients either poly-traumatized patients or patients with isolated blunt abdominal trauma including:[31]

1. Inspection: for bruises, hematoma, distension, abdominal movement with inspiration.
2. Palpation: tenderness, guarding, rigidity and swelling.
3. Percussion: for dullness
4. Auscultation: for peristalsis.

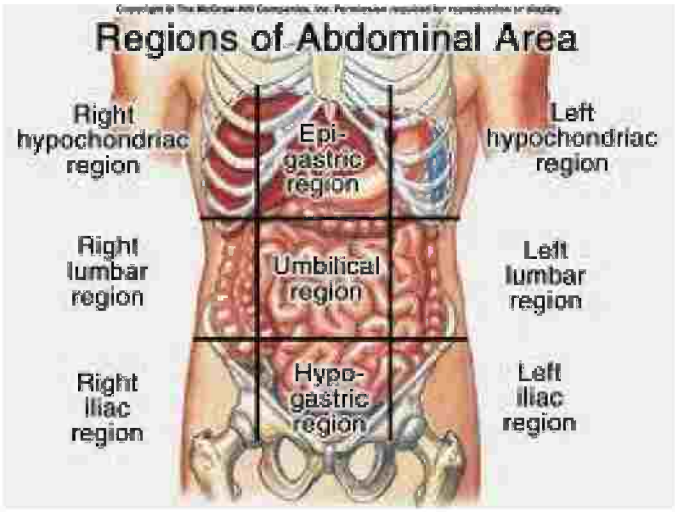

Figure 6. Regions of Abdominal Area.

3-Radiological work up

I- Chest and Pelvis X-ray

II- Focused Assessment by Sonography for Trauma (FAST) [95]

Ultrasonographic assessement of the abdomen done by Toshiba nemio ultrasound by using linear probe (7.2-14 MHZ) and convex probe (1.9-6 MHZ).

This is a four quadrant ultrasonographic assessment of the abdomen:

1- Hepatorenal pouch (of Morrison).

2- Subphrenic/Splenic Recess.

3- Suprapubic Region.

4- Sub-Xiphisternal/ pericardial View.

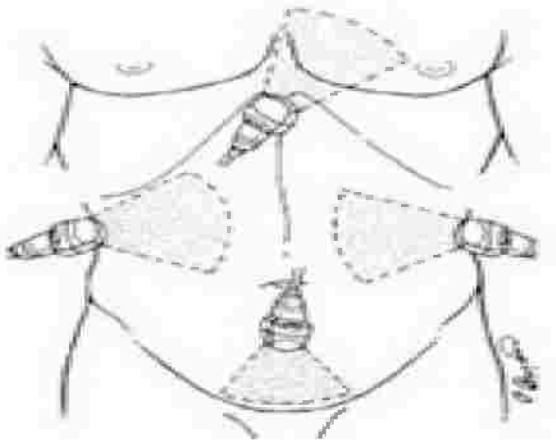

Figure 7. The 4 scanning windows of the FAST examination – clockwise from top = pericardial, perisplenic, pelvic and perihepatic.[106]

III- Computed tomography (CT) was performed to indicated Patients[107,108]

Computed tomography was performed by PhilipsCT scanner.

1. Hemodynamically stable patients with equivocal findings on physical examination.
2. Associated neurological injury.
3. Multiple extra-abdominal injuries (chest and pelvic).
4. Accurate assessment of solid organ injury for grading and detection of ongoing bleeding.
5. Hemodynamically unstable patients with negative FAST constitute a diagnostic challenge; CT scan can be performed after aggressive resuscitation.
6. Suspicion of retroperitoneal collection (pancreas, duodenum, and genitourinary system).
7. All cases with evidence of collection in ultrasound.

4- Management

Non operative management inclusion criteria are:[99]

1. Victims who are hemodynamically stable and have no coagulation disorders.
2. The victim is to be examined repeatedly.
3. Higher level of care with round-the-clock availability of laboratory and radiology.
4. Continous monitoring by obtaining serial hemoglobin levels every six hours in the first 24 hours.

Patient shifted to exploration when there is:

1. Deterioration of vital signs.
2. Development of manifestation of peritonitis .
3. Continued need for blood transfusion.
4. Falling hemotocrit or progressing haematoma.

Operative management (OM):

Accordingg to the operative findings (splenic injury, liver injury, retroperitoneal injury or genitourinary injury) operative procedure(s) was (were) done (splenectomy, intestinal repair, repair of liver laceration,.....etc.)

5- Outcome

- Morbidity and mortality in adults and children regarding NOM and OM.
- Percentage of success of NOM regarding adults and children.

6- Statistical analysis

All data were entered and coded using Microsoft Excel and analyzed with Statistical Package for Social Sciences (SPSS) version 16.0 Chi-square test were used to compare categorical variables, we relied on a *P* value of <0.05.

RESULTS

This study included 164 subjects attending the Main Alexandria University Hospital with BAT over a period of six months from July 2013 through January 2014.

They were divided into two groups according to their age. Group 1 (n=59, 36%) included children (≤16 years) , while group 2 (n=105, 64%) included adults (>16-60 years), (Figure 8).

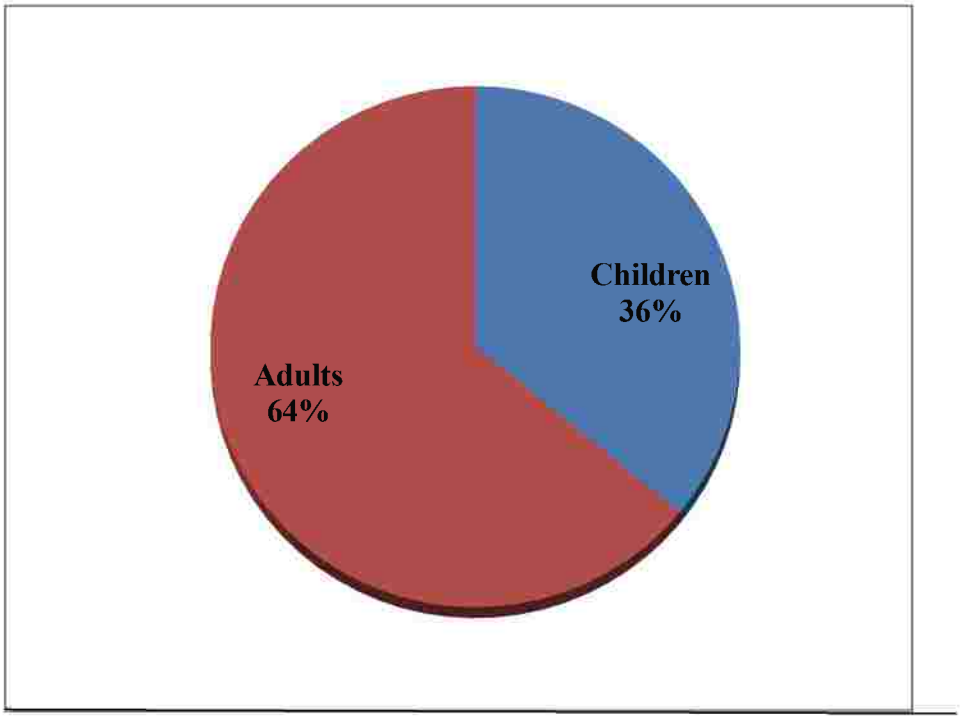

Figure 8. Distribution of patients according to age.

Males were significantly more affected than females among children and adults as seen in Table 5.

Table 5. Gender distribution of studied cases included in this study.

Gender	Children (n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
Male	48	81.4	82	78.1	$\chi^2 = 8.892$ P= 0.003*
Female	11	18.6	23	21.9	$\chi^2 = 4.235$ P= 0.040*

P<0.05 is significant

Table 6 shows that road traffic accidents (RTA) were the most common mechanism of trauma (MOT) among both groups, children and adults (52.5% and 64.8%, respectively), followed by falling from height (FFH) (22% and 16.2%, respectively). Figure 9 shows that RTAs were more among adults (64.8%) than children (52.5%) (P=0.062).

Table 6: Distribution of the studied cases according to mechanism of trauma.

MOT	Children (n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
RTA	31	52.5	68	64.8	χ^2=2.358 P=0.062
FFH	13	22.0	17	16.2	χ^2= 0.863 P=0.177
Local trauma to abdomen	11	18.7	12	11.4	χ^2=1.631 P=0.100
Others (assault by blunt objects, falling down, pedestrians)	4	6.8	8	7.6	χ^2= 0.039 P=0.422

P<0.05 is significant

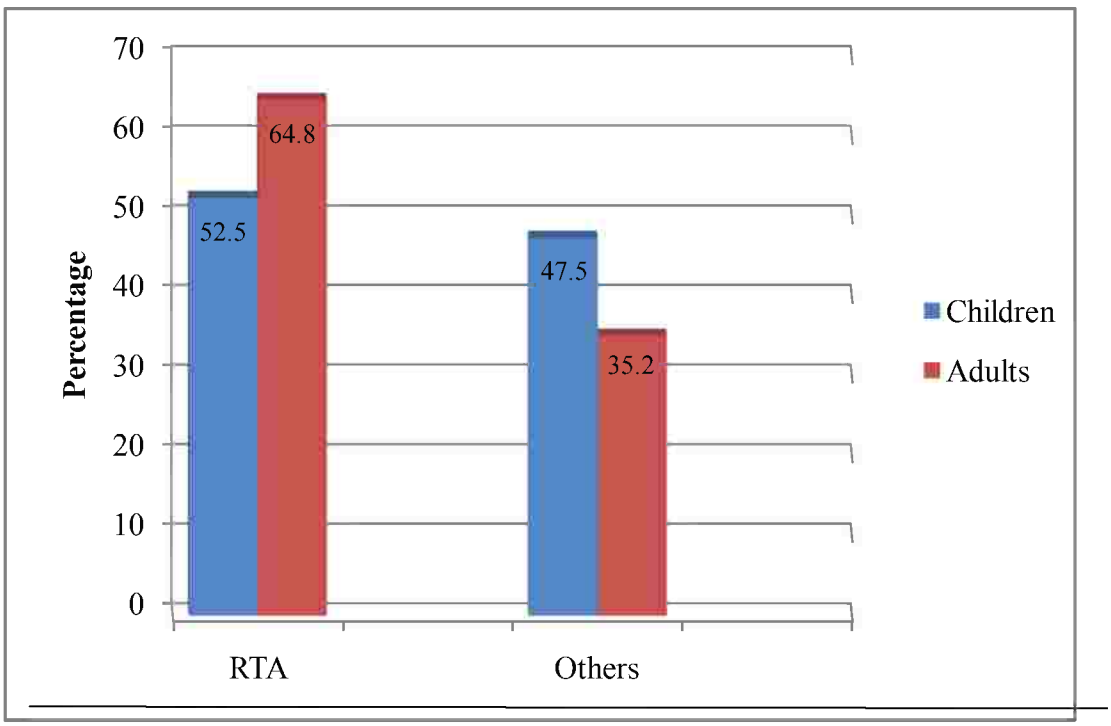

Figure 9. Distribution of the cases in both groups according to RTA.

As seen in Table 7, BAT with associated injuries were significantly more common than isolated BAT in both children and adults. In addition, BAT with associated injuries were significantly (P=0.047) more common among adults (74.3%) than children (59.3%).

Table 7. Distribution of the studied cases according to associated injuries.

	Children(n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
BAT with associated injuries	35	59.3	78	74.3	$\chi^2 = 3.95$ P=0.047*
Isolated BAT	24	40.7	27	25.7	$\chi^2 = 3.95$ P=0.047*

* P <0.05 is significant

Cardiothoracic injuries and pelvic fractures were significantly (P=0.000 and 0.003, respectively) more among adults than children as seen in Table 8.

Figure 10 shows that cardiothoracic injuries were the most common injuries among both groups.

Table 8 . Distribution of the studied cases according to other associated injuries:

	Children(n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
Cardiothoracic injuries	23	39.0	70	66.7	$\chi^2 = 23.75$ P=0.000*
CNS injuries	18	30.5	31	29.5	$\chi^2 = 0.018$ P=0.895
Pelvic fractures	14	23.7	50	47.6	$\chi^2 = 9.060$ P=0.0026*

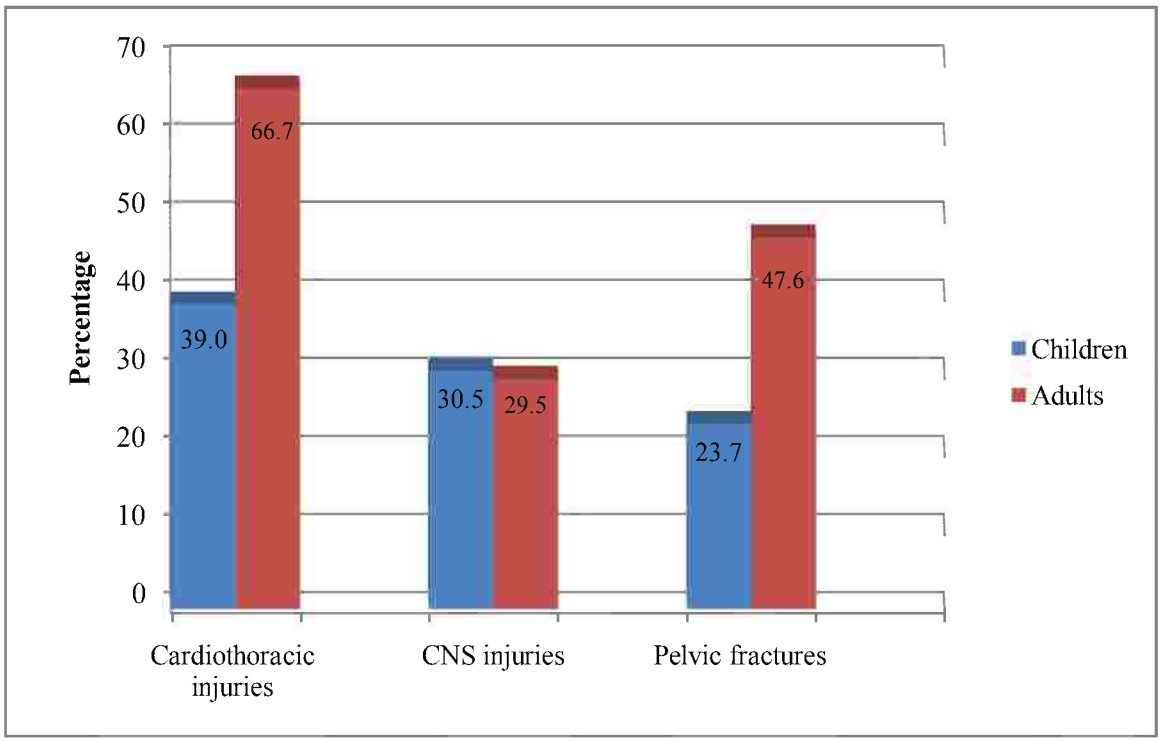

Figure 10. Distribution of the studied cases according to associated injuries

At presentation, most cases in both children and adults (69.5% and 70.5%, respectively) had a GCS of 15 as seen in Table 9.

Table 9. Distribution of the studied cases according to GCS.

GCS	Children (n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
15	41	69.5	74	70.5	χ^2= 0.0175 P= 0.895
9-12	15	25.4	19	18.1	χ^2= 1.235 P= 0.267
13-14	3	5.1	12	11.4	χ^2= 5.40 P= 0.020*

*P <0.05 is significant

On admission, there were no statistically significant differences between both groups regarding BP (P= 0.662) as 40.7% of children and 34.3% of adults were hypotensive with a systolic BP < 90 mmHg, while 44.1% of children and 47.6% of adults were tachycardic with a pulse > 100 b/min as shown in Table 10.

Table 10. Distribution of the studied cases according to blood pressure, and Pulse.

Vitals	Children(n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
SBP (<90 mmHg)	24	40.7	36	34.3	$\chi^2 = 0.192$ P= 0.662
HR (>100 b/min)	26	44.1	50	47.6	$\chi^2 = 665$ P= 0.414

P <0.05 is significant

Table 11 shows that there were no significant differences in the patients who needed blood transfusion among children and adults (55.9% and 53.3%, respectively).

Table 11. Percentage of patients who needed blood transfusion in the studied group.

Blood Transfusion	Children(n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
Needed	33	55.9	56	53.3	$\chi^2 = 0.103$ P= 0.748
Not needed	26	44.1	49	46.7	$\chi^2 = 0.103$ P= 0.748

P <0.05 is significant

Regarding clinical examination of patients with BAT, there were no statistically significant differences between both groups in inspection (external wounds and bruises), (P=0.229), while there were statistical differences between them in palpation (rigidity), percussion (shifting dullness) and auscultation (peristalsis) (P=0.042, 0.032 and 0.038, respectively).

As shown in Table 12, 59.3% of children and 53.3% of adults had external wounds or bruises on inspection, 93.2% of children and 83.8% of adults had rigid abdomen on palpation, and 93.2% of children and 83.8% of adults had dullness on percussion. Regarding auscultation, 74.6% of children and 85.7% of adults had heard peristalsis.

Table 12. Distribution of the studied cases according to clinical examination

Abdominal examination	Children(n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
Inspection (External wounds)					
Yes	35	59.3	56	53.3	χ^2=0.549 P=0.229
Palpation (Rigidity)					
Yes	55	93.2	88	83.8	χ^2=2.996 P=0.042*
Percussion (Shifting dullness)					
Yes	24	40.7	28	26.7	χ^2=3.425 P=0.032*
Auscultation (Peristalsis)					
Yes	44	74.6	90	85.7	χ^2=3.135 P=0.038*

*P <0.05 is significant

Table 13 shows that the spleen was the most commonly involved organ by both FAST and CT scan among children and adults followed by liver then kidney. Also it demonstrated that CT scan could detect specific injuries that were not detected by FAST particularly active extravasation. However, there were no statistically significant differences in the presence of active extravasation among children and adults (P=0.449).

Table 13 . Organ injury detected by US and CT in the present series.

Organ injury	FAST				CT			
	Children (n=59)		Adults (n=105)		Children (n=59)		Adults (n=105)	
	N	%	N	%	N	%	N	%
Spleen	30	50.9	81	77.1	43	72.9	62	59.0
Liver	20	33.9	35	33.3	33	55.9	56	53.3
Kidney	15	25.4	12	11.4	27	45.8	47	44.8
Free fluid without solid organ injury	19	32.2	47	44.8	0	0.0	0	0.0
Retroperitoneal hematoma	6	10.2	26	24.8	23	39.0	55	52.4
Traumatic lumbar hernia	0	0.0	0	0.0	1	1.7	0	0.0
Intestinal tear	0	0.0	0	0.0	2	3.4	2	1.9
Diaphragmatic tear	0	0.0	0	0.0	2	3.4	0	0.0
Extravasation	0	0.0	0	0.0	8	13.6	15	14.3

Table 14 shows that there were statistically significant differences in detection of organ injuries by US and CT in both age groups.

Figure 10-14 shows multiple organ injuries detected by CT scan with intravenous contrast .

Table 14 . Test of significance of organ injury detected by US and CT in the present series.

Test of significance	Children(n=59)	Adults (n=105)
Spleen	χ^2=6.071 P=0.014*	χ^2=7.912 P=0.005*
Liver	χ^2=5.789 P=0.016*	χ^2=8.552 P=0.0035*
Kidney	χ^2=5.323 P=0.021*	χ^2=28.88 P=0.000*
Retroperitoneal hematoma	χ^2=13.213 P=0.0003*	χ^2=16.902 P=0.00*

*P <0.05 is significant

Figure 11. CT scan of the abdomen with intravenous contrast showing multiple lacerations of the spleen with no extravasation

Figure 12. CT scan of the abdomen with intravenous contrast showing multiple lacerations of the spleen and the liver with no active extravasation.

Figure 13. CT scan of the abdomen with intravenous contrast showing mild extra-peritoneal collection with extra peritoneal rupture of urinary bladder.

Figure 14. CT scan of the abdomen with intravenous contrast showing renal contusion with active extravasation from left lower lobe.

Figure 15. CT scan of the abdomen with intravenous contrast showing splenic laceration with no active extravasation.

Regarding the management of BAT, there were no statistically significant differences among both age groups (P=0.321) as 84.7% of children and 81.9% of adults were managed conservatively, while 15.3% of children and 18.1% of adults were managed surgically either from the beginning or due to failed conservative treatment as shown in Table 14 .

Among those who were treated surgically, 77.8% and 78.9% of both children and adults were managed surgically from the start, while 22.2% of children and 21.1% of adults, respectively were managed surgically after failed conservative management (Figures 11 and 12).

Table 15. Distribution of studied cases according to management of abdominal trauma.

Management of BAT	Children (n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
Conservative management	50	84.7	86	81.9	$\chi^2 = 0.215$ P= 0.321
Surgical management	9	15.3	19	18.1	
Surgical from start	7	77.8	15	78.9	$\chi^2 = 0.005$ P= 0.944
Failed conservative	2	22.2	4	21.1	

*P <0.05 is significant

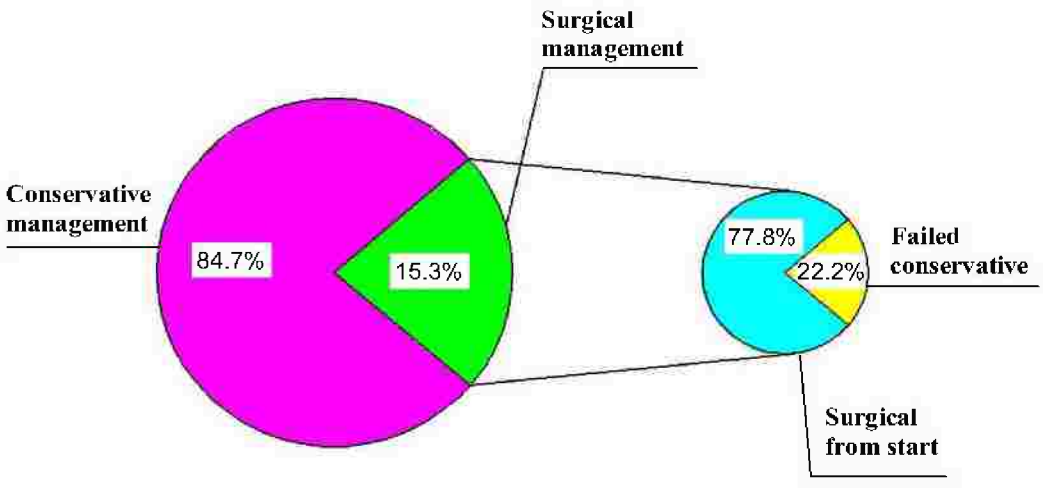

Figure 16. Distribution of studied cases according to management of BAT in children.

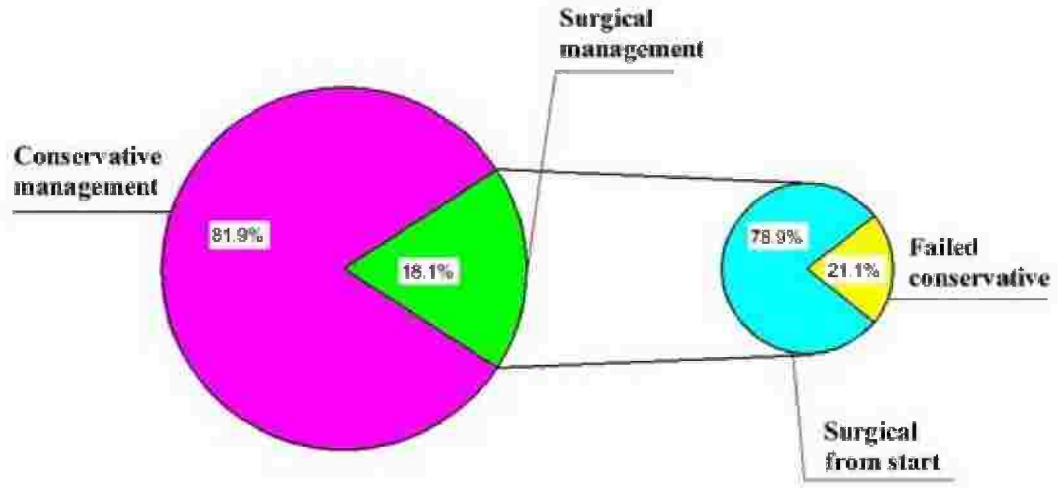

Figure 17. Distribution of studied cases according to management of BAT in adults.

Most surgical interventions were splenectomy in both groups while repair of liver laceration were more common in adults than children (26.3% and 22.2%, respectively) this was summarized in Table 15.

Table 16. Management of each individual organ injury.

Surgical management	Children (n=9)		Adults (n=19)		Test of significance
	N	%	N	%	
Splenectomy	3	33.3	8	42.1	$\chi^2 = 0.197$ P= 0.657
Repair of liver laceration	2	22.2	5	26.3	$\chi^2 = 0.055$ P= 0.815
Nephrectomy	1	11.1	3	15.8	$\chi^2 = 0.109$ P= 0.741
Intestinal repair	1	11.1	2	10.5	$\chi^2 = 0.002$ P= 0.963
Traumatic lumbar hernia repair	1	11.1	0	0	$\chi^2 = 2.189$ P= 0.139
Diaphragmatic tear repair	1	11.1	0	0	$\chi^2 = 2.189$ P= 0.139
Bladder repair	0	0	1	5.2	$\chi^2 = 0.491$ P= 0.483

Figure 13 shows that the percentage of the cases that were alive was more common than dead cases (89% and 11%, respectively).

Regarding the mortality rate it was higher among children than adults (11.9% and 10.5%, respectively) with no statistically significant difference (P= 0.392) as seen in Table 16.

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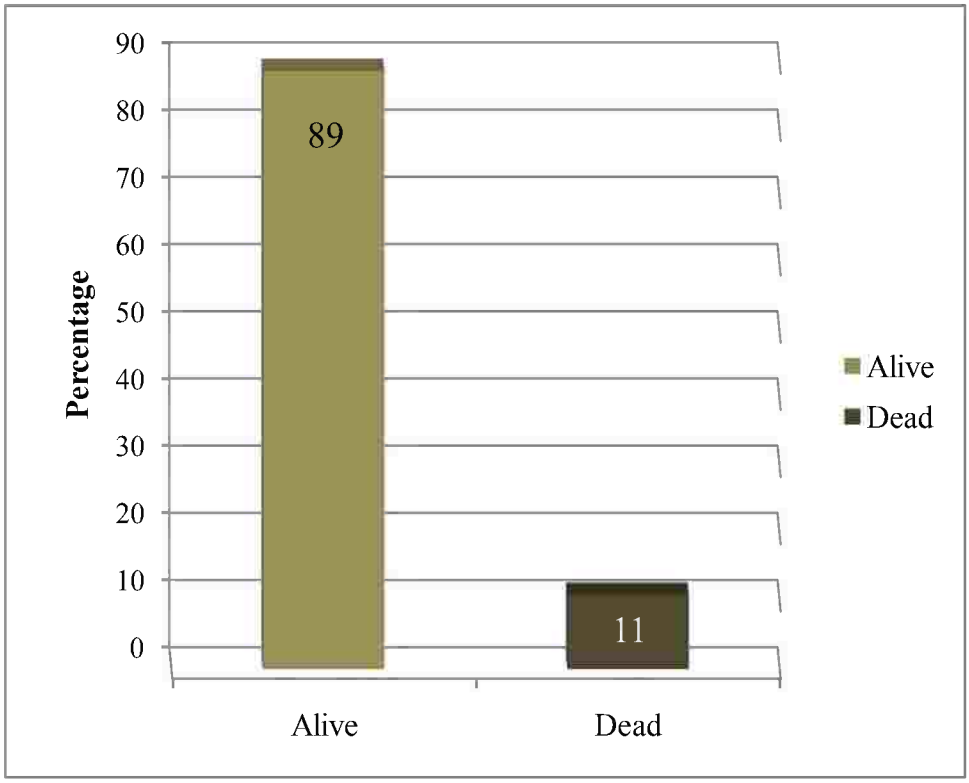

Figure 18. Distribution of studied cases according to mortality.

Table 17. Distribution of studied cases according to mortality

Mortality	Children (n=59)		Adults (n=105)		Test of significance
	N	%	N	%	
Dead	7	11.9	11	10.5	$\chi^2 = 0.075$ P= 0.392

*P <0.05 is significant