

AIM OF THE WORK

The aim of this work is to:

1. Study the incidence and the patterns of retroperitoneal injuries after blunt abdominal trauma in the emergency department.
2. Assess the outcomes of management of retroperitoneal injuries.

PATIENTS

This prospective study was conducted on all patients with blunt abdominal trauma with proven retroperitoneal injuries admitted to Alexandria Main University Hospital within 6 months from the 1st of October 2013 to the 1st of April 2014.

Exclusion criteria:

Patients with blunt abdominal trauma with proven non retroperitoneal injuries.

METHODS

This is a prospective study including all patients with blunt abdominal trauma with proven retroperitoneal injuries admitted to Alexandria Main University Hospital within 6 months from the 1st of October 2013 to the 1st of April 2014. An informed consent was taken for all patients who were included in the study.

Analytical statistics:

Data were tabulated, coded then analyzed using the computer program SPSS (Statistical package for social science).

All patients were subjected to the measures of Advanced Trauma Life Support (ATLS) protocol as follows:

Primary Survey:

The assessment was done using the "ABCDE" approach: ⁽⁸³⁾

1- Airway and cervical spine stabilization:

- Open airway was ensured by chin lift, jaw thrust, oral airway (in unconscious patients) or nasal airway. In order to protect the cervical spine, open the airway using the modified jaw thrust maneuver. ⁽⁸⁶⁾ Airway was Provided by endotracheal intubation or surgical intervention-needle cricothyroidectomy and tracheostomy. ^{(15) (87)}
- The cervical spine was protected while establishing a patent airway and was remaining protected until injury had been rolled out. Spinal precaution was removed once X-rays were free. ⁽⁸⁸⁾
- Any solid foreign bodies were removed and suction of the oral cavity to remove vomitus, secretions or blood. ⁽⁸⁹⁾

2- Breathing: ^{(15) (90)}

- Look, listen and feel; assessed ventilation and oxygenation.
- Chest was exposed and chest wall movement was observed if necessary.
- Breathing was assessed by determining the patient's respiratory rate and by subjectively quantifying the depth and effort of inspiration. A pulse oximeter was also applied to measure oxygen saturation continuously and maintained at greater than 95%. Care was taken to observe the patients as well as the pulse oximetry reading.
- Interventions for inadequate ventilation and/or oxygenation.

3- Circulation:

To assess the hemodynamic state of the patients evaluation was includes the following: ⁽⁹¹⁾

- Blood pressure was measured, heart rate was recorded.
- The presence and equality both central and peripheral pulses.
- Capillary refill.
- Skin color, moisture and temperature.
- Mental status.

The route of IV access is important, large bore peripheral IV catheters in upper extremities were resuscitation line of choice. If this was not possible, venous access was gained by venous cut down or by inserting central line into femoral, internal jugular or subclavian vein. ⁽⁹²⁾ Warm intravenous crystalloids such as Normal Saline or Ringer's Lactate was administered repeated crystalloid bolus until perfusion and peripheral pulse improved and blood administration might be required to resuscitate. ^{(90) (93)}

4- Disability (a brief neurological examination):

- This was assessed early to document neurological deficit before giving sedation or paralytics. The level of consciousness, papillary response and

motor function of the four extremities was verified by assessment of Glasgow Coma Score (GCS) or AVPU. ⁽⁹⁴⁾

- The **AVPU scale** (Alert, Voice, Pain, Unresponsive) is a system by which a first aider, ambulance crew or health care professional was measured and recorded a patient's responsiveness, indicating their level of consciousness. ⁽⁹⁵⁾

Glasgow Coma Scale or GCS a patient was assessed against the criteria of the scale, and the resulting point. Individual elements as well as the sum of the score are important. Interpretation generally, brain injury is classified as: Severe, with GCS ≤ 8 , Moderate, GCS 9 – 12, Minor, GCS ≥ 13 . ⁽⁹⁴⁾

Table (8): Shows Glasgow Coma Scale. ^(96, 97)

Response	Score
Eye opening	
Opens eyes spontaneously	4
Opens eyes in response to speech	3
Open eyes in response to painful stimulation (eg, endotracheal suctioning)	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 nonpurposeful 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

5- Exposure/Environment for complete examination:

- **Exposure:**

Patients were undressed to allow for complete visualization of all injuries present. Complete physical examination is typically done in a head to toe manner and includes ordering and collecting data from appropriate laboratory and radiological investigation, for the placement of additional lines, catheter (nasogastric, Foley's) and monitoring devices. ^{(15) (87) (90) (98)}

- **Environment:**

Loss of body temperature was occur in trauma patients due to many causes this include exposure to the element ,wet clothes ,shock and volume resuscitation fluid that have been not warm It is imperative to cover the patient with warm blankets to prevent hypothermia in the emergency department. Intravenous fluids were warmed and a warm environment maintained. Patient privacy was maintained. ^(89, 99,100)

Resuscitation:

Resuscitation was performed concomitantly and continues as the physical examination is completed by: ⁽¹⁰⁰⁾

1. Protecting the airway with assisted ventilation and oxygenation as required.
2. Monitoring patient vital signs.
3. Providing resuscitation with intravenous fluids and blood products.
4. Electro cardiogram leads, pulse oximetry, draw labs.
5. Gastric and urethral catheters.

Secondary Survey:

Three main elements to the secondary survey: ^(90,101)

1. Vital signs monitoring.
2. Top-to-toe survey.
3. Medical history (AMPLE).

- **Vital Signs**

- This involves repeating ABCDE approach, obtaining accurate figures for each component. This was done and recorded at least every 10-15 minutes on a stable patient, more frequently if there was cause for concern.
- Airway: Patent (Yes), Noise? (Quiet breathing only)
- Breathing: Rate/regularity/depth (12-18/min)
- Circulation: Pulse rate/strength (carotid/radial) (60-80/min), Capillary refill (<2s/same as first aider) and Blood Pressure (>100/60)
- Disability: AVPU or GCS, Pupils (Equal, reactive to light)

- **Identification of all injuries via a head-to-toe examination.**

1. **Head and face** ⁽¹⁰²⁾

- Skull was observed and palpated (anterior and posterior) for signs of trauma (contusions, abrasions, deformity, crepitus, or lacerations).
- Eyes checked for: equality and responsiveness of pupils, movement and size of pupils, foreign bodies, discoloration, contact lenses, and prosthetic eyes.
- Nose and ears were checked for foreign bodies, fluid, or blood.
- Mouth was rechecked for potential airway obstructions (swelling, dentures, loose or avulsed teeth, vomitus, malocclusion, absent gag reflex) and odors, altered voice or speech patterns and evidence of dehydration.

2. **Neck** ⁽¹⁰³⁾

- Injuries under the hard collar were not seen. In line immobilization while the collar is off.
- Signs of trauma were observed and palpated for, jugular venous distention, using of neck muscles for respiration, tracheal shift or deviation, cervical spine tenderness.

3. **Chest:** ^(103,104)

- Signs of trauma were observed and palpated for, implanted devices, medication patches, chest wall movement, asymmetry, retractions and accessory muscle use.
- Auscultation breath sounds bilaterally.

4. **Abdomen:** ^(105,106)

- **Inspection** for signs of trauma, scars, diaphragmatic breathing and distention. Ecchymosis involving the flanks (Grey Turner sign) or the umbilicus (Cullen sign) indicates retroperitoneal hemorrhage.
- **Palpation** was done in all four quadrants taking special note of tenderness, guarding (muscles contract as pressure is applied) rigidity (rigid abdominal wall- indicates peritoneal inflammation) rebound (release of pressure causes pain)

- **Percussion** it was common practice to start percussing in a quadrant where there is no pain/discomfort and to percuss the painful quadrant(s) last. Making sure to percuss all the 9 areas.
- **Auscultation** was sometimes done before percussion and palpation, unlike in other examinations. It was performed first because vigorously touching the abdomen may disturb the intestines, perhaps artificially altering their activity and thus the bowel sounds. Additionally, it was the least likely to be painful/invasive; if the person had peritonitis and you check for rebound tenderness and then want to auscultate you were no longer had a cooperative patient.
- **Digital rectal examination** for the estimation of the tonicity of the anal sphincter, which was useful in case of fecal incontinence or neurologic diseases, including traumatic spinal cord injuries.

5. Pelvis/Genito-urinary: ^{(103) (104)}

- Signs of trauma was observed and palpated for or asymmetry, incontinence, blood at urinary meatus, or presence of any other abnormalities. A urinary catheter was only inserted if there was no blood at the urethral meatus, no perineal bruising, and rectal examination is normal. Gently palpate lateral pelvic rims and symphysis pubis for tenderness, crepitus, or instability. Palpate bilateral femoral pulses when necessary.
- Vaginal examination in female patients with pelvic fractures or vaginal bleeding. In pregnancy this examination was deferred to an obstetric specialist.

6. Back: Inspection, palpation for trauma, asymmetry, spinal tenderness, and sacral edema. ⁽¹⁰⁴⁾

7. Extremities: ^{(103) (104)}

- Inspection and palpation of each limb for signs of trauma, asymmetry, skin color, capillary refill, edema, medical information bracelets, track marks, and equality of distal pulses, tenderness, crepitation, or abnormal movement. Pulsation, sensory and motor function were assessed as indicated.
- If the patient was cooperative, the patient was asked to move the limbs in response to command in preference to passive movement in the first instance. Adequately splint any injuries. Reassess after splints, traction or manipulation.

8. Neurological examination:

The Glasgow Coma Scale was repeated and scores was recorded. Any localizing/lateralizing signs were looked for. Signs of cord injury were looked for. ^(103,104)

- **Key elements of the patient's history include the following: AMPLE** history. ⁽¹⁰⁷⁾

A Allergies

M Medications (Anticoagulants, insulin and cardiovascular medications especially)

P Previous medical/surgical history

L Last meal (Time)

E Events /Environment surrounding the injury; i.e. exactly what happened

Imaging and diagnostic test:

A variety of tests are used to identify RPI after BAT patients including: plain radiologic studies, focused assessment with sonography for trauma (FAST), diagnostic peritoneal lavage (DPL) and computed tomography (CT).⁽²⁷⁾

- **Plain radiologic studies.**

Chest and pelvic radiography continue to be important adjuncts to the secondary survey. The results may suggest haemorrhage in adjacent cavities, but they cannot rule out intra-abdominal bleeding or visceral injury.⁽²⁸⁾ The chest x-ray can help distinguish pneumothorax, hemothorax, diaphragmatic rupture, and rib fractures and other signs of potential aortic disruption.⁽²⁶⁾ Pelvic films on the other hand are standard in evaluation processes. Patients with pelvic fractures have a high energy mechanism. This mandates rapid abdominal evaluation to avoid confusing retroperitoneal bleeding common with pelvic fracture with intra abdominal blood loss. In addition patients with thoraco-lumbar spine fracture must have abdominal evaluation.⁽²⁹⁾

- **Focused Assessment by Sonography for Trauma (FAST).⁽³⁷⁾**

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.

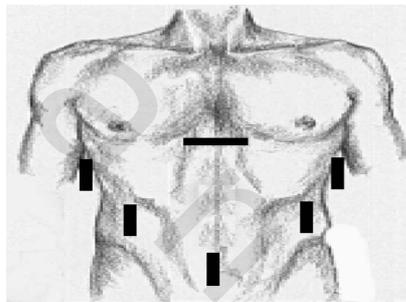


Figure (12): An illustration of the 4 scanning windows of the FAST examination.⁽³⁴⁾

- **Computed tomography (CT)** was submitted to all patient.
- **Diagnostic peritoneal lavage (DPL)** was performed with the aim to exclude gut perforation if indicated.

Laboratory Investigation:

- **Complete blood count:**

- **Hemoglobin and hematocrit:** rapid hemoglobin or hematocrit machines were quickly identified patients who had physiologically significant volume deficits and hemodilution.⁽¹⁸⁾⁽¹⁰⁸⁾⁽¹⁰⁹⁾
- **Platelet:** platelet transfusions were used to control active bleeding or to treat patients with thrombocytopenia (i.e., platelet count < 50,000/mL).⁽¹¹⁰⁾ The decision to transfuse platelet was based on the extent of surgery/trauma, ability to control bleeding with local measures, rates of bleeding, risk of bleeding, the presence of platelet dysfunction, and other coagulation abnormalities.⁽¹¹¹⁾
- **White blood cells (WBC):** White blood cells count elevation on admission is nonspecific and did not predict the presence of a hollow viscus injury, the diagnostic value of serial White blood cells counts for predicting a hollow viscus injury within the first 24 hours after trauma is very limited.⁽¹¹²⁾

- **Coagulation profile:** Partial thromboplastin time / activated partial thromboplastin time were obtained in patients who had history of blood dyscrasias (e.g., hemophilia), who had synthetic

problems (e.g., cirrhosis), or who were took anticoagulant medications (e.g., warfarin, heparin).^(18,113)

- **Blood type, screen, and cross match:**
 - **Indications:**⁽¹¹⁴⁻¹¹⁶⁾
 - a. Only was used in cases of severe life-threatening hemorrhage not expected to respond to crystalloid resuscitation; was waited until type-specific blood was available.
 - b. Obvious major bleeding during transport with subsequent impending cardiac arrest due to anemia (not hypovolemia).
 - c. Major bleeding in the trauma room resulting in hypotension requiring transfusion prior to availability of type specific blood.
- **Urine analysis:** significant trauma to the abdomen and/or flank, gross hematuria, microscopic hematuria in the setting of hypotension, and a significant deceleration mechanism.^{(109) (117)}
- **Serum chemistries:** Na⁺, Cl⁻, K⁺, and blood urea nitrogen levels do not influence the initial management of major trauma patients. In patients with severe blunt injury, hemoglobin, glucose, blood gas, and lactate measurements occasionally resulted in morbidity-reducing or resource-conserving management changes. Rapid bedside blood-glucose determination, obtained with a finger-stick measuring device, is important for patients with altered mental status.⁽¹¹⁸⁾

Definitive Care of patients with proven retroperitoneal injuries:

- Surgery: type, operative maneuver, specialty workup.
- Splinting: types, duration.
- Medications (if indicated).
- Consultation (if specialist care is required in emergency room).
- The intra hospital or inter hospital transfer of critically ill patient.
- Follow up until discharge.⁽⁹⁹⁾

Tertiary survey:

Was performed 24 hours after admission, was also recommended and included a follow-up head-to-toe examination to minimize the risk of missed injuries.^(119,120) The tertiary survey involved repetition of primary and secondary survey and revision of all laboratory and radiographic studies. Multiply-injured patient must be evaluated with serial examinations by a provider with advanced skills.^(121,122)

RESULTS

The current study was carried out on patients with blunt abdominal trauma (BAT) with proven retroperitoneal injuries (RPI) who were admitted to the Emergency Department in Alexandria Main University Hospital between 1st of October 2013 to 1st of April 2014. During this period the total numbers of BAT patients were 278. Among those, there were 81 cases who were diagnosed to have RPI (29.1%) and there were 197 cases who were diagnosed to have non retroperitoneal injury (non-RPI) (70.9%) who were excluded.

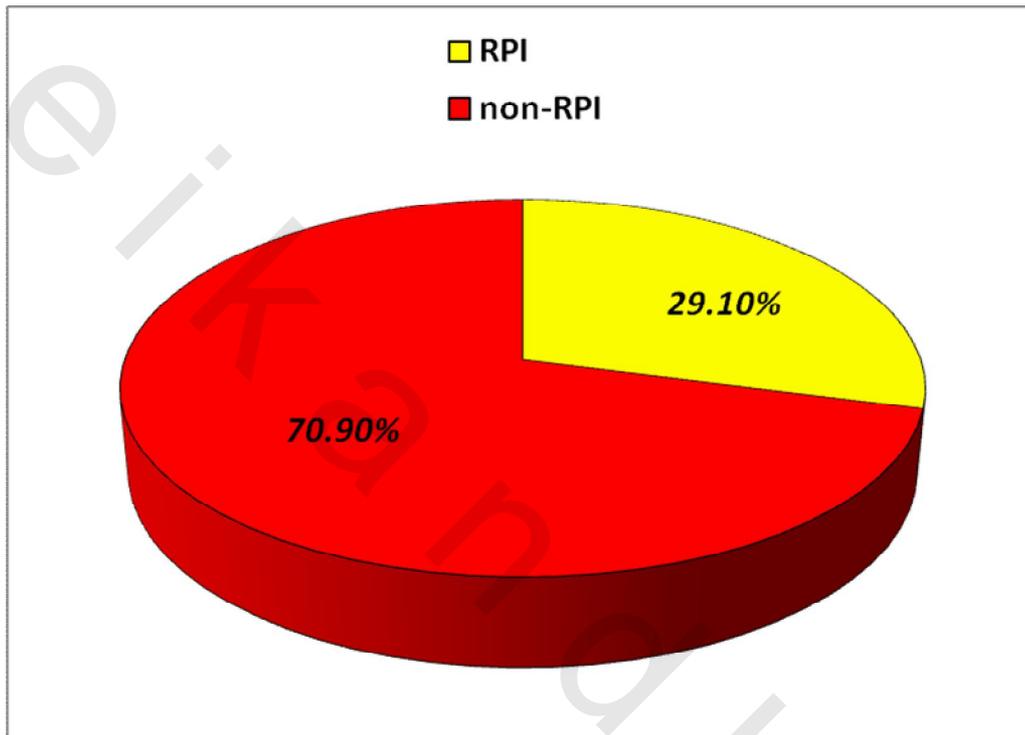


Figure (13): Percentage of patients with BAT.

As regards the ages of patients with proven RPI, table (9), figure (14) show that the majority of the patients belonged to 20-30 years age group, followed by 10-20 years age group.

Table (9): Shows age incidence in the present study

Age	No.	%
<10	12	14.8
10-20	24	29.6
20-30	30	37.0
30-40	8	9.9
40-50	4	4.9
50-60	2	2.5
≥60	1	1.2

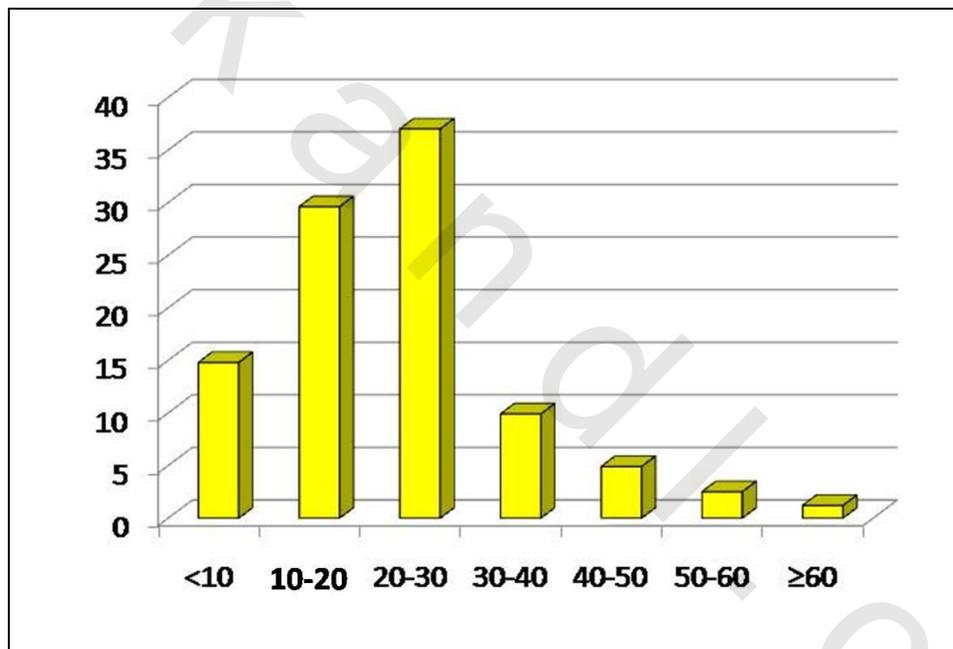


Figure (14): Shows age incidence in the present study.

As regards the gender in the RPI patient, RPI was significantly higher in male 60(74.1%) compared to female 21(25.9%). (Table (10), Figure (15))

Table (10): Shows patient's gender in the present study.

Gender	No.	%
Male	60	74.1
Female	21	25.9

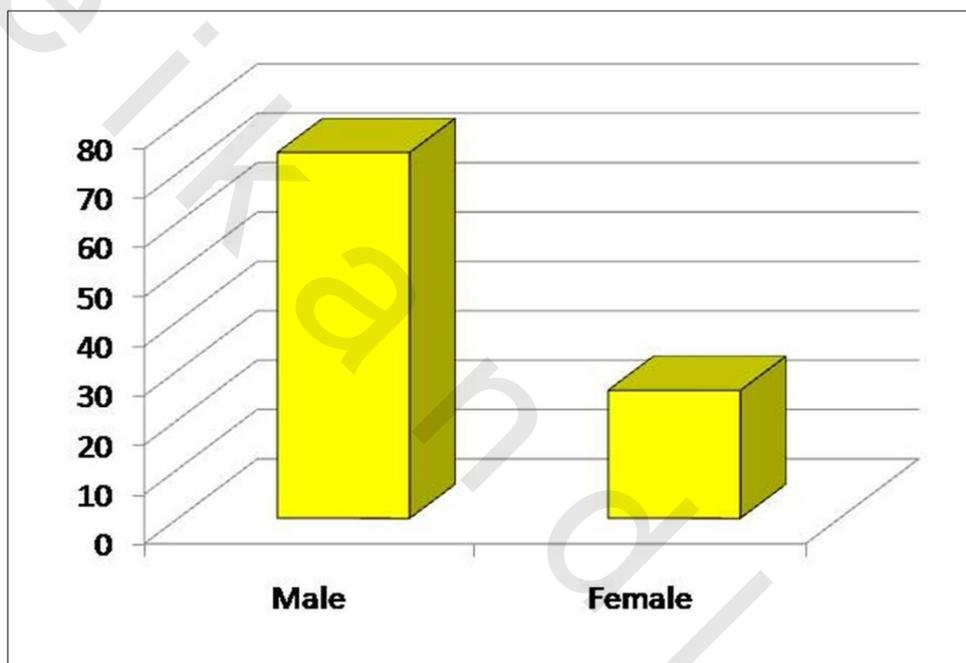


Figure (15): Shows patient's gender in the present study

As regards the mode of injury in the RPI patients, 54(66.7%) patients had road traffic accident (RTA), 18(22.2%) patients fell from height and 9(11.1%) patients had physical assault. (Table (11), Figure (16))

Table (11): Mode of injury in the present study.

Mode of Injury	No.	%
RTA	54	66.6
Fell from height	18	22.2
Physical assault	9	11.1

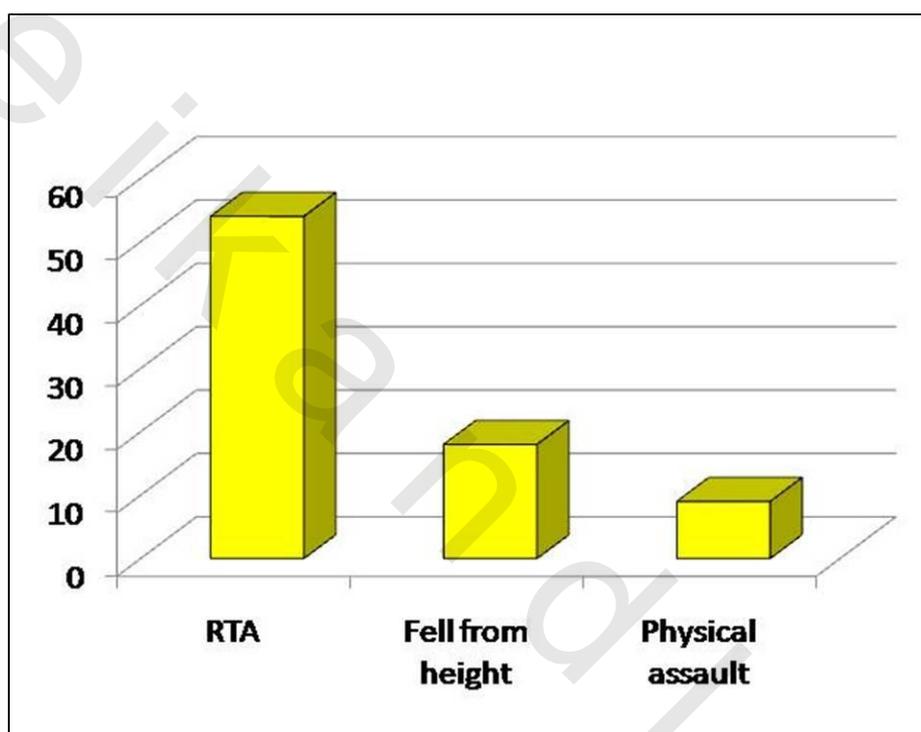


Figure (16): Mode of injury in the present study.

As regards Physical examination in the RPI patients, it is represented in table (12), figure (17).

Table (12): The physical examination in the present study.

Physical Examination	No.	%
Abdominal tenderness	69	85.2
Rebound tenderness	69	85.2
Abdominal guarding and rigidity	60	74.1
Abdominal Pain	59	72.8
Contusion of abdominal wall and back	52	64.2
Abdominal distention	52	64.2
Pallor	42	51.9
Hematuria	34	42.0
Vomiting	19	23.5

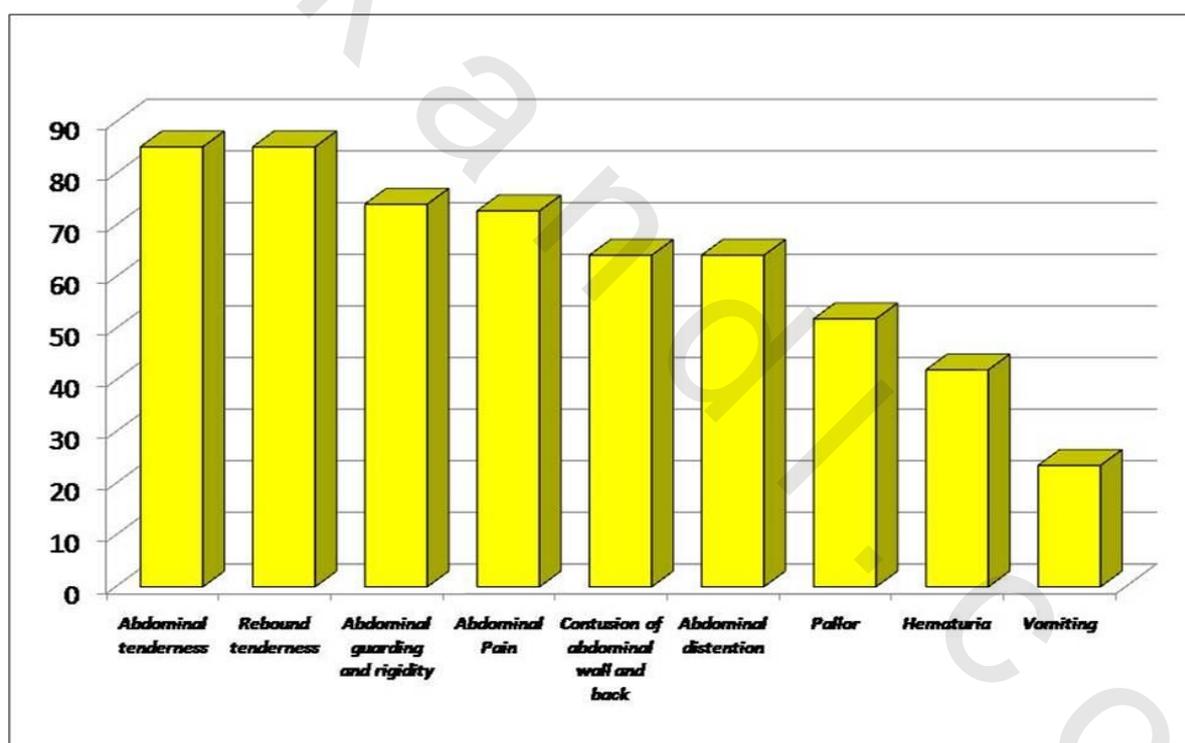


Figure (17): The physical examination in the present study.

As regards the ultrasound diagnosis of the RPI patients, 65(23.3%) patients had retroperitoneal hematoma and 35(12.6%) patients had kidney lesion. (Table (13), Figure (18))

Table (13): Ultrasound diagnosis of the RPI patients.

Ultrasound Diagnosis	No.	%
Retroperitoneal Hematoma	65	80.2
Kidney Injury	35	43.2

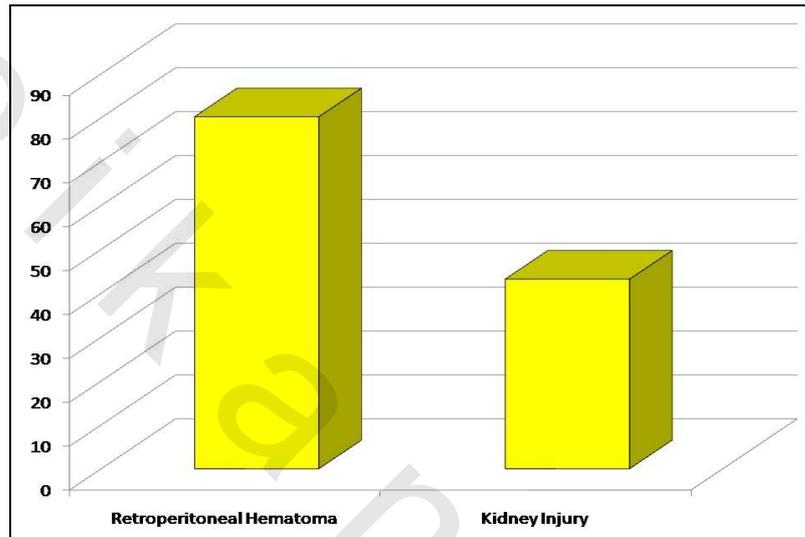


Figure (18): Ultrasound diagnosis of the RPI patients.

As regards the CT finding of patients with proven RPI, 65(80.2%) patients had retroperitoneal hematoma, 40(49.4%) patients had retroperitoneal free fluid, 35(43.2%) patients had kidney injury, 19(23.4%) patients had spinal paraspinal hematoma, 12(14.8%) patients had adrenal injury, 3(3.7%) patients had pancreatic injury, 3(3.7%) patients had retro peritoneal air and 2(2.5%) patients had vascular injury, 1(1.2%) proximal ureter. (Table (14), Figure (19))

Table (14): CT finding of patients with proven RPI.

CT Finding of patients with proven RPI.	No.	%
retroperitoneal Hematoma	65	80.2
retroperitoneal free fluid	40	49.4
Kidney Injury	35	43.2
Spinal Paraspinal Hematoma	19	23.4
Adrenal Injury	12	14.8
Pancreatic Injury	3	3.7
Retro Peritoneal air = Pneumoretroperitonum	3	3.7
Vascular Injury	2	2.5
Proximal Ureter	1	1.2

N.B.: More than one lesion was present in the same patient

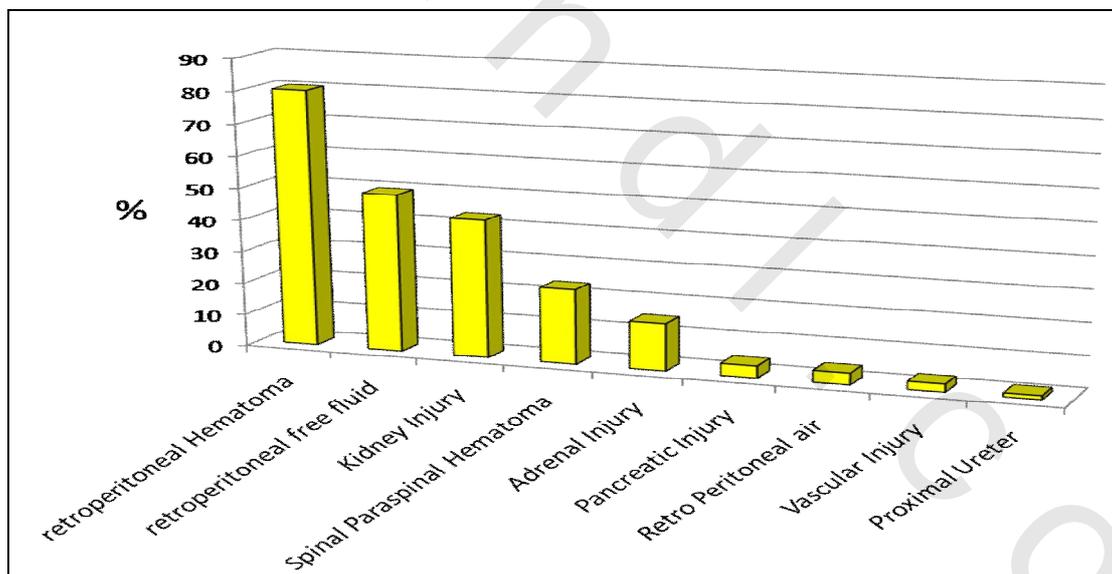


Figure (19): CT finding of patients with proven RPI.

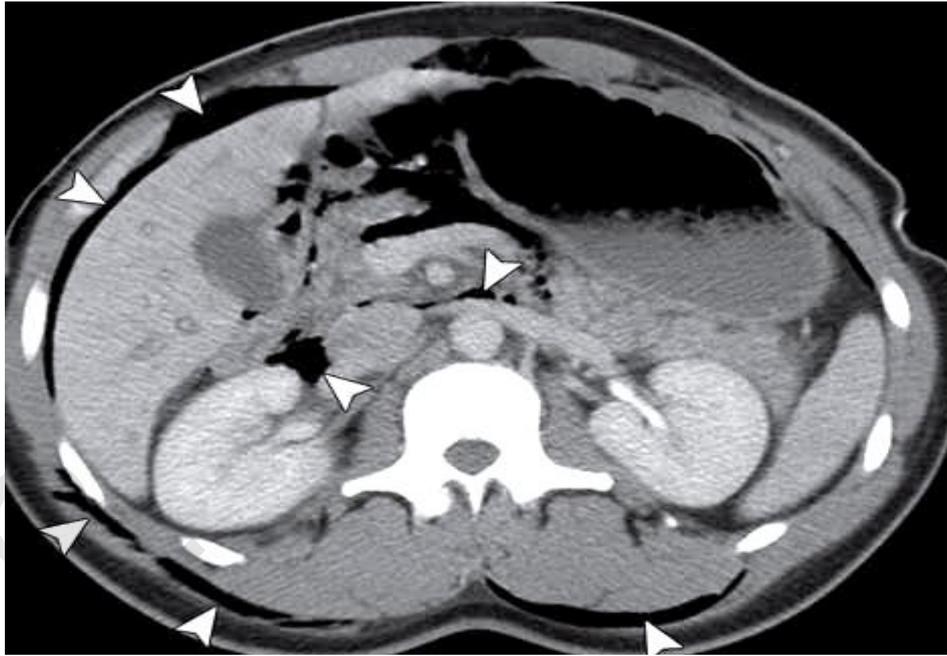


Figure (20): Abdominal CT scan with IV contrast (Retroperitoneal air) shows extra luminal air (arrowheads) in the right perirenal space, in the anterior pararenal space, and along the fascial planes of the abdominal musculature.

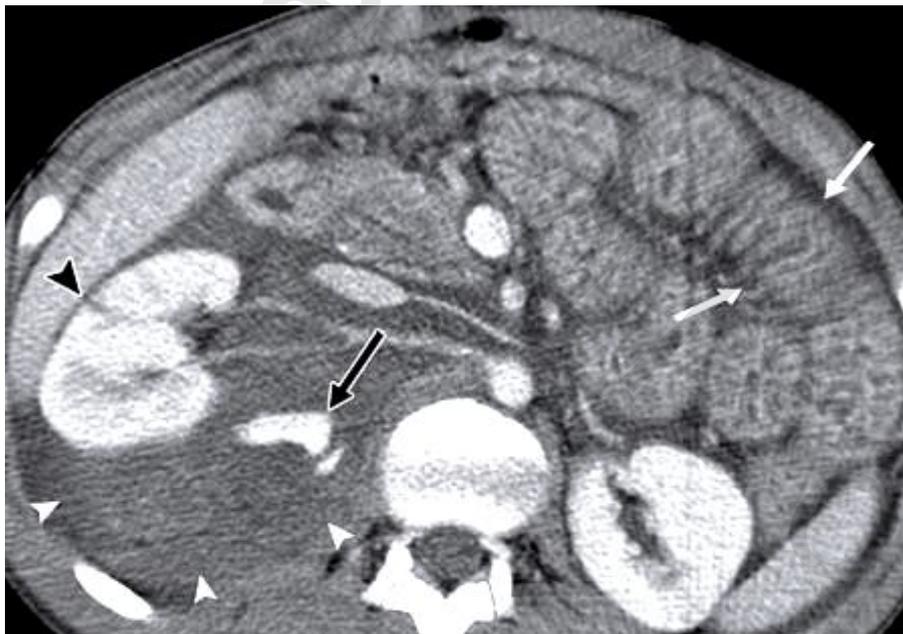


Figure (21): Contrast-enhanced CT scan shows right-sided perirenal and posterior pararenal retroperitoneal hematoma (white arrowheads) from a right renal laceration, with active extravasation of intravascular contrast material (black arrow) from a renal parenchymal injury. A laceration of the right kidney is also visible (black arrowhead). Hyperenhancing, thickened small bowel (white arrows) due to shock.

As regards the associated non retroperitoneal lesions with patients with proven RPI detected by CT, 73(90.1%) patients had intra peritoneal free fluid, 19(23.4%) patients had splenic injury, 15(18.5%) patients had liver injury and 3(3.7%) patients had bladder injury. (Table (15), Figure (22))

Table (15): Associated non retroperitoneal lesions with patients with proven RPI detected by CT.

Associated non-RPI Detected by CT	No.	%
Intra Peritoneal free fluid	73	90.1
Splenic Injury	19	23.4
Liver Injury	15	18.5
Bladder Injury	3	3.7

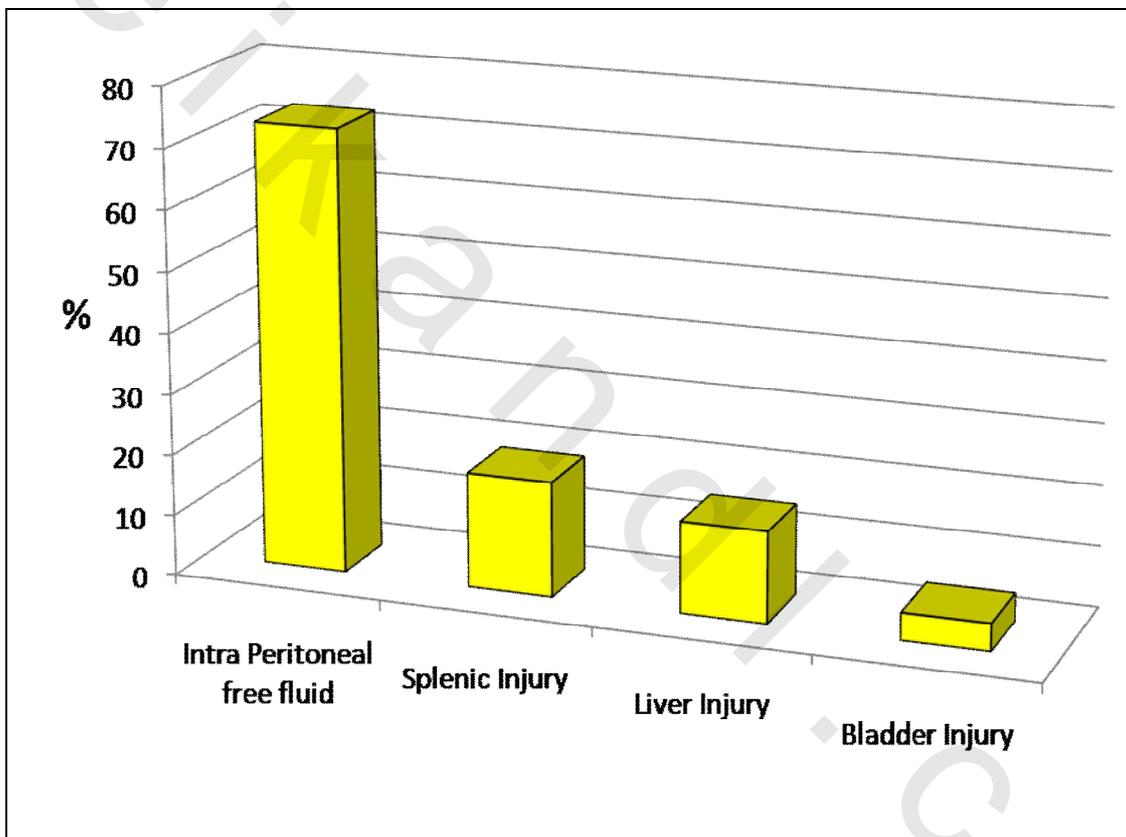


Figure (22): Associated non retroperitoneal lesions with patients with proven RPI detected by CT.

As regards the associated injury with patients with proven RPI, 49(60.5%) patients had head injury, 37(45.7%) patients had chest injury, 33(40.7%) patients had pelvic injury and 46(56.8%) patients had extremity injury. (Table (16), Figure (23))

Table (16): Associated injury with patients with proven RPI.

Associated Injury	No.	%
Head Injury	49	60.5
Chest Injury	37	45.7
Pelvic Injury	33	40.7
Extremity Injury	46	56.8

N.B.: More than one lesion was present in the same patient.

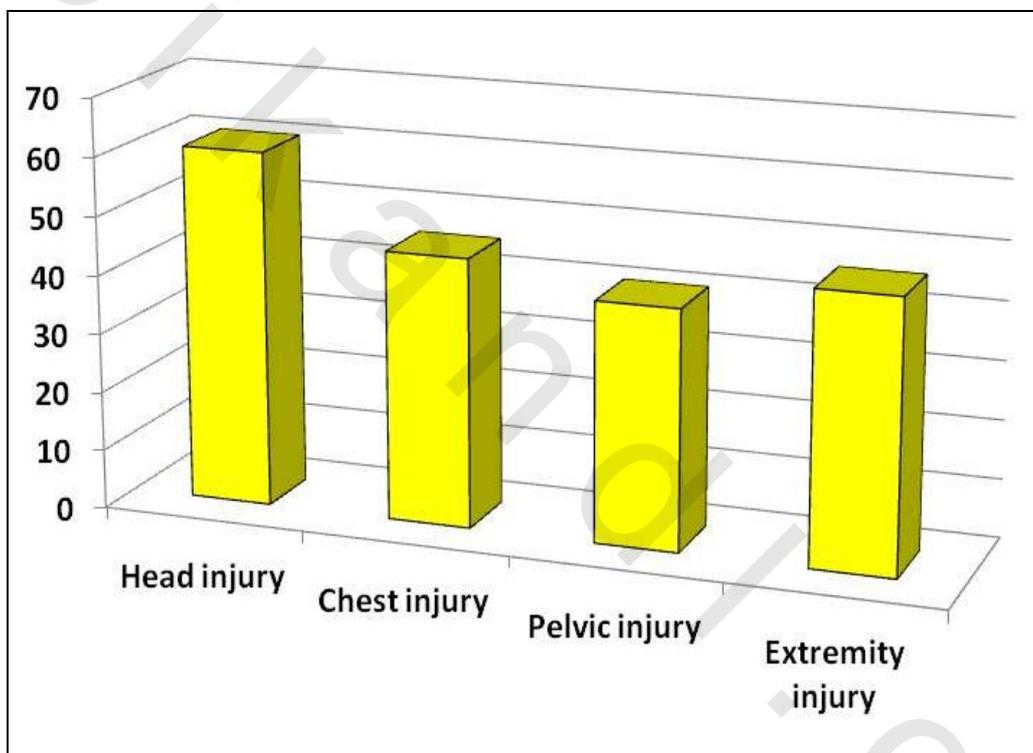


Figure (23): Associated injury with patients with proven RPI.

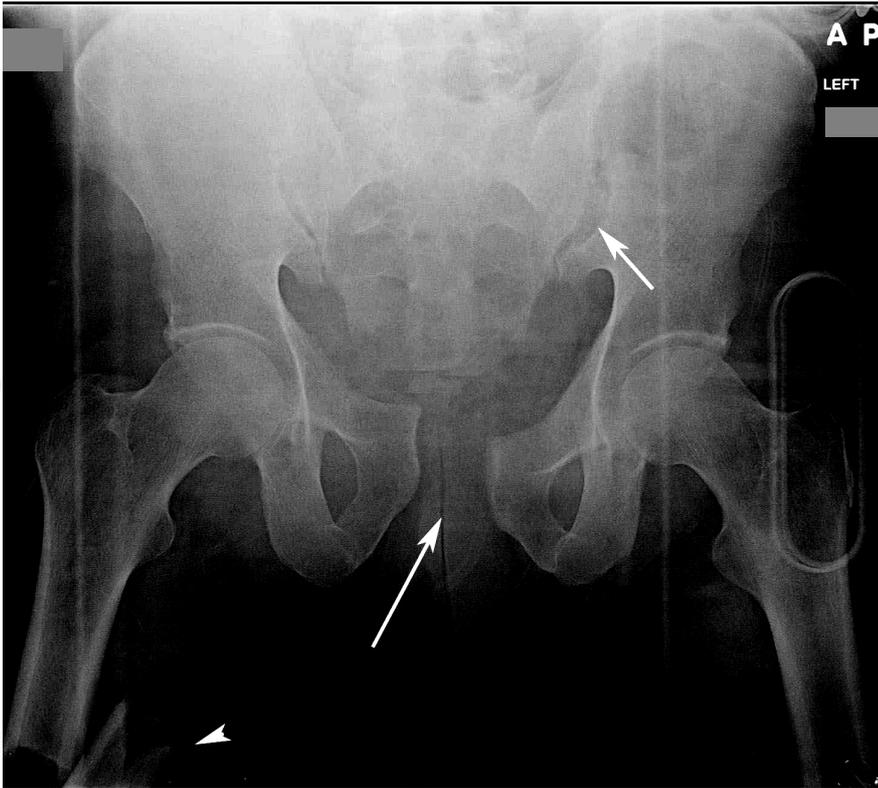


Figure (24): pelvic radiograph shows widening of symphysis pubis (long arrow), widening of left sacroiliac joint (short arrow) and a displaced fracture of the right femoral shaft (arrowhead).

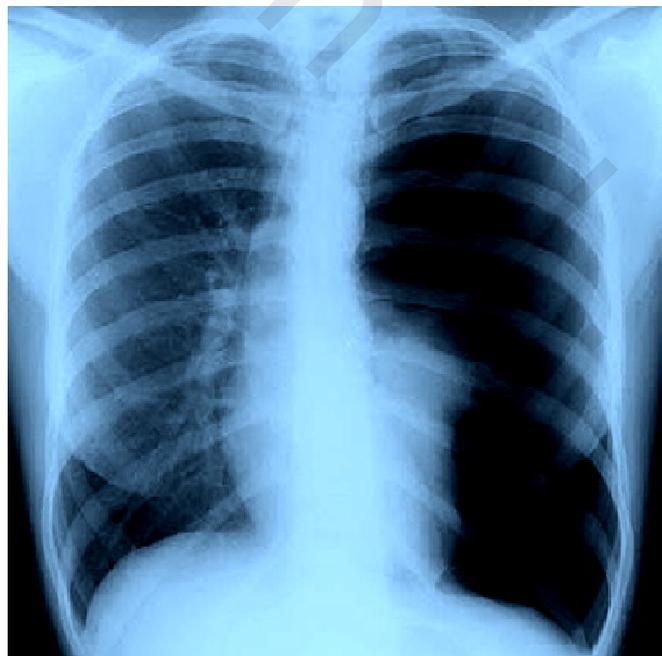


Figure (25): Chest radiograph with pneumothorax on the left side with left lung collapse.

As regards management patients with proven RPI, 76(93.8%) patients were non operative and 5(6.2%) patients were operative. two out of the five patients were operable due to RPI (vascular injury and pancreatic laceration) and three operable due to associated non RPI (liver laceration, splenic laceration and gut rupture) (Table (17), Figure (26))

Table (17): Management of patients with proven RPI.

Management (n=81)	No.	%
Operative	5	6.2
Non-Operative	76	93.8

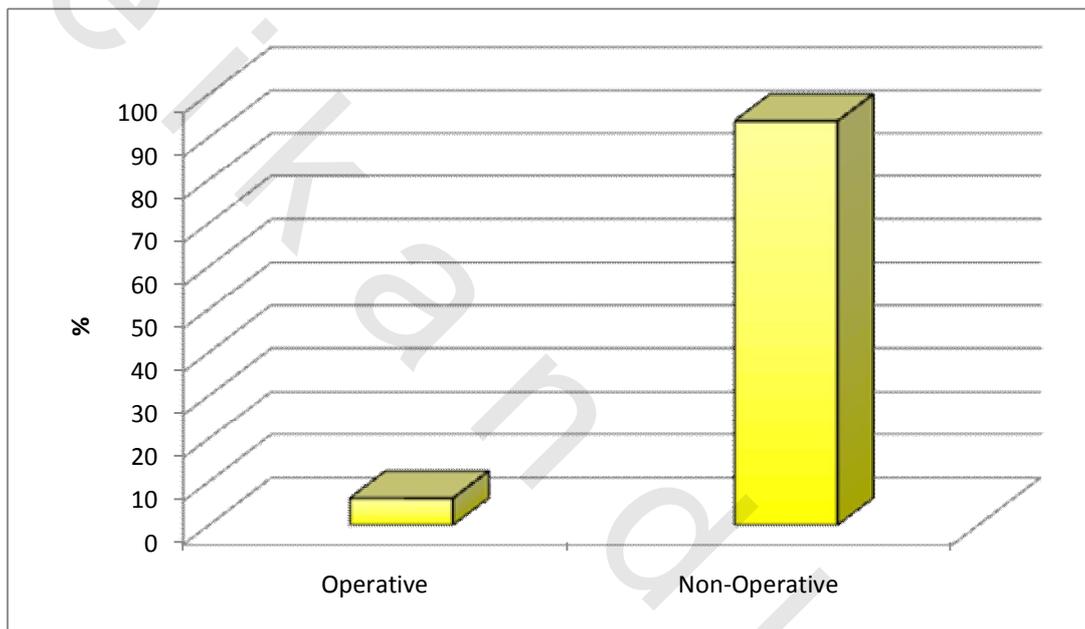


Figure (26): Management of patients with proven RPI.

As regards the blood transfusion of patients with proven RPI, 59(72.8%) patients need blood transfusion and 22(27.2%) patients no need to blood transfusion. (Figure (27))

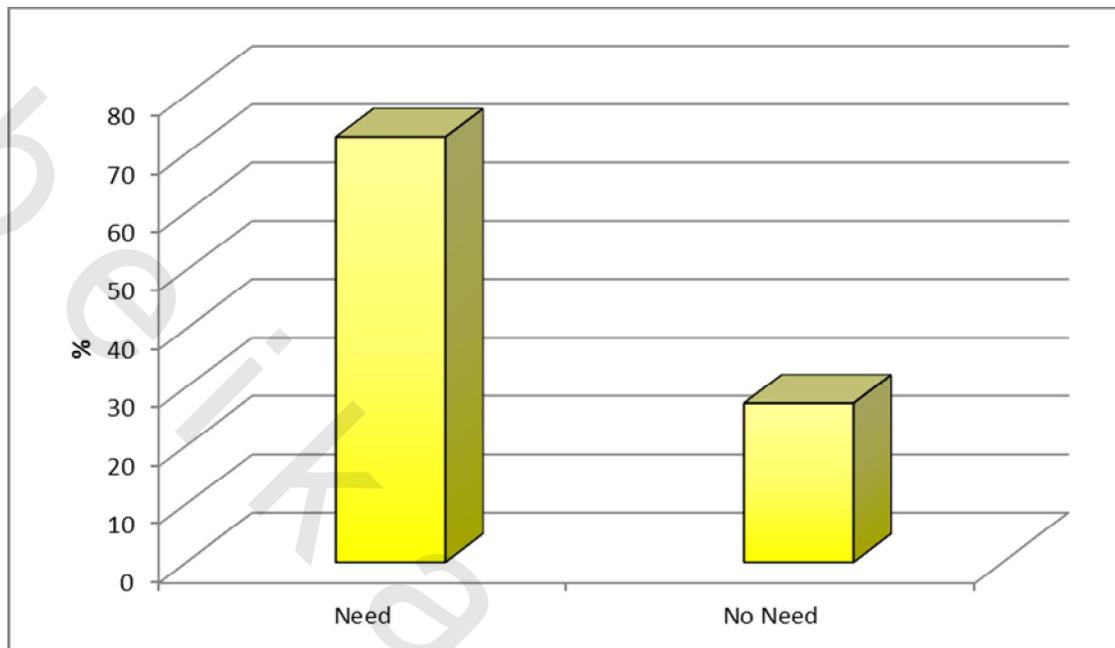


Figure (27): Blood transfusion of patients with proven RPI.

As regards the duration of hospital stay of patients with proven RPI, The ranging hospital stay of patients was from 7-9 days this presented 43.2%. That was due to the conservative treatment was a safe and very effective method in the management of RPI patient in our series this translated to a reduction in hospital stay. (Table (18), Figure (28))

Table (18): Duration of hospital stay of patients with proven RPI.

Duration of Hospital stay (n=81)	No.	%
1-3	12	14.8
4-6	21	25.9
7-9	35	43.2
10-12	6	7.4
13-15	7	8.6

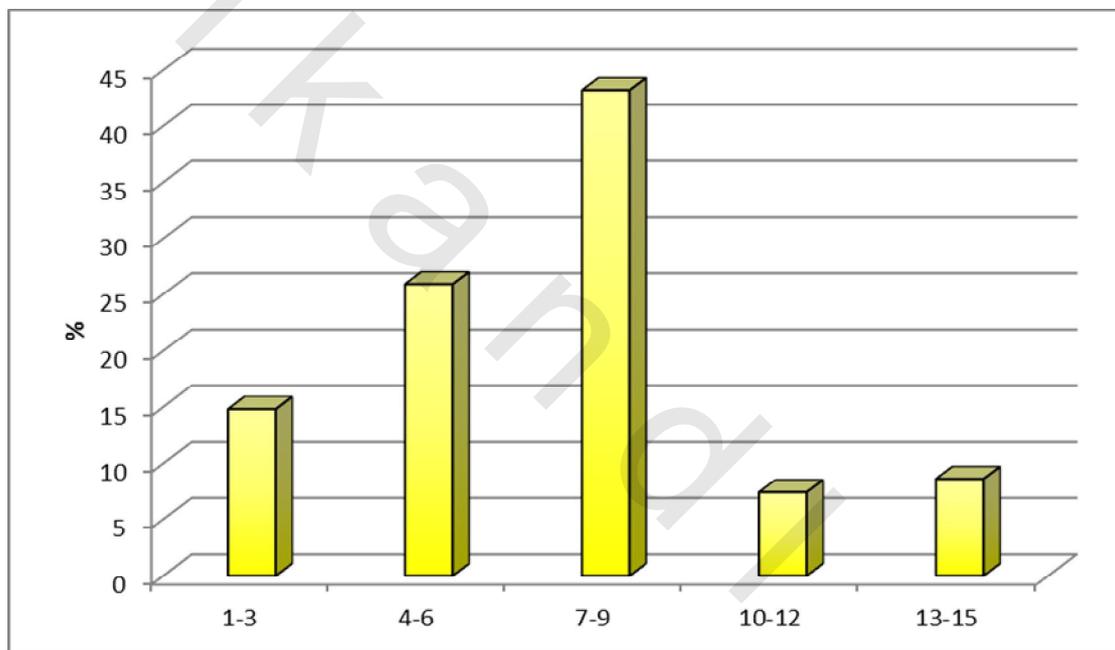


Figure (28): Duration of hospital stay of patients with proven RPI.

As regards the morbidity during follow up and tertiary survey of patients with proven RPI, 16(19.8%) patients had chest infection, 12(14.8%) patients had wound infection, 3(3.7%) patients had superficial thrombophlebitis, 2(2.5%) patients had post operative complication and 1(1.2%) patients had a missed injury (pancreatic injury). (Table (19), Figure (29))

Table (19): Morbidity of patients with proven RPI.

Morbidity (n=81)	No.	%
Chest infection	16	19.8
Wound Infection	12	14.8
Superficial Thrombophlebitis	3	3.7
Post operative complication	2	2.5
Missed injuries (pancreatic injury)	1	1.2

N.B.: More than one lesion was present in the same patient.

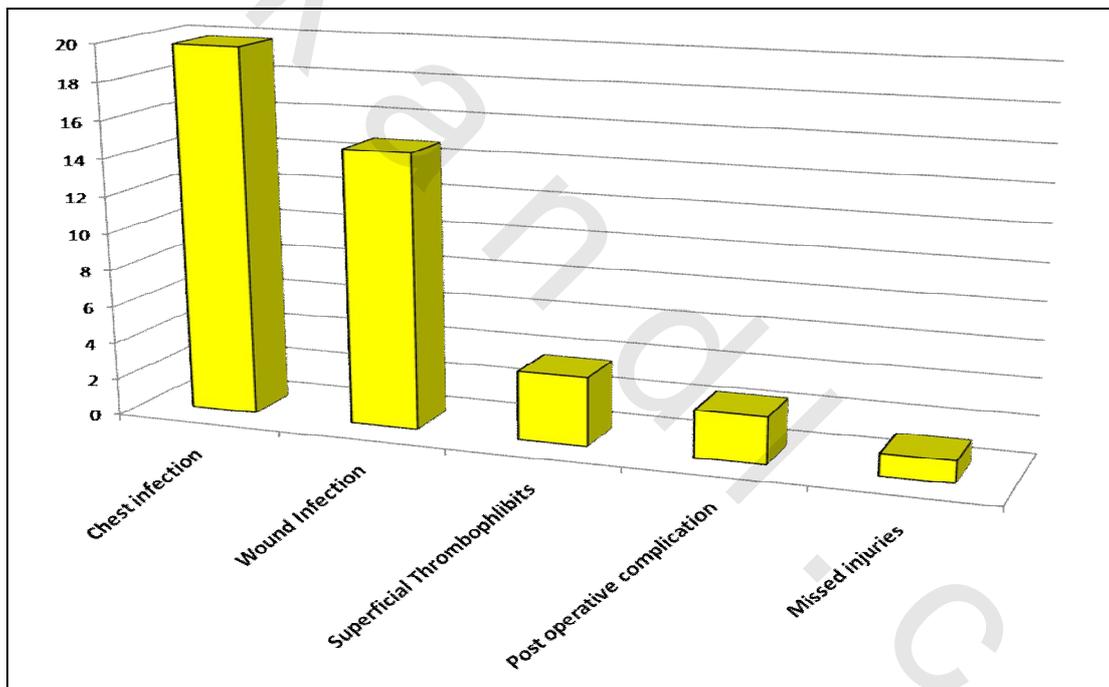


Figure (29): Morbidity of patients with proven RPI.

As regards the mortality of patients with proven RPI, There were 12 patients who died, this presents 14.8%, 3(25%) of the patients who died due to RPI (one due to vascular injury and two due to pancreatic lesion) and 9 (75%) out of the patients who died due to associated injury to RPI (3 due to head injury, 3 due to liver injury, 1 due to splenic injury, 1 due to gut rupture, 1 due to chest injury). (Table (20), Figure (30))

Table (20): Mortality of patients with proven RPI.

Mortality (n=12)	No.	%
Patients who died due to RPI	3	25
Patients who died due to associated injury to RPI	9	75

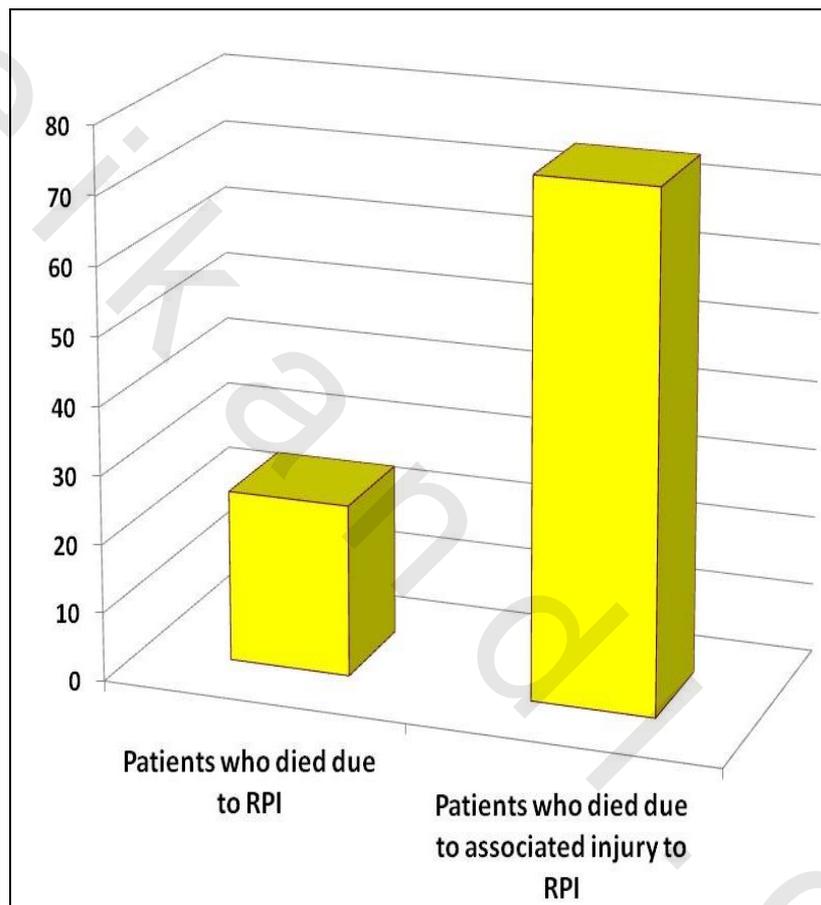


Figure (30): Mortality of patients with proven RPI.