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Evaluation of Role of Laparoscopy in Diagnosis and Treatment of Non-Traumatic Acute Abdomen

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ABSTRACT

Background: abdominal pain is a common complaint seen in emergency departments in United States. Abdominal pain is the leading reason for visits to the emergency department (ED), accounting for 6.8% of all visits in 2006. **Aim of the Work*:*** this study aimed to evaluate the diagnostic role of laparoscopy in acute abdominal conditions and its therapeutic role in perforated peptic ulcer, acute cholecystits and acute appendicitis.

Patients and Methods*:* this study was conducted prospectively on 40 patients presented with acute abdomen to Al-Azhar University hospitals from March 2018 till August 2018. 24 (60%) of patients were females and 16 (40%) were males. The age ranged from 20 to 60.**Results*:*** we accomplished complete laparoscopic diagnosis in 90% of cases, and avoided negative laparotomy in 5% of cases. We converted about 10% of laparoscopically diagnosed cases to open surgery for therapeutic purposes with significant reduction in complications in laparoscopic cases and mean hospital stay 2.6 days in laparoscopic cases vs. 5.3 days in open cases. **Conclusion*:*** laparoscopy was an excellent diagnostic tool. It was a very good therapeutic tool in acute appendicitis, acute cholecystitis and perforated peptic ulcer. It was also safe and satisfactory; also it saved more hospital beds.

Keywords: laparoscopy in diagnosis, non-traumatic acute abdomen, therapeutic.

INTRODUCTION

The acute abdomen may be defined generally as an intra abdominal process causing severe pain and often requiring surgical intervention. It is a condition that requires a fairly immediate judgment or decision as to management [(1)].Nonspecific acute abdominal pain (NSAP) is defined as acute abdominal pain that lasts less than 7 days and for which the diagnosis remains uncertain after baseline examination and diagnostic tests [(1)].Different strategies to assess these patients have been used, including observation, imaging methods, and early laparoscopy (EL). In the presence of uncertainty, the watchful waiting option is also considered when the physician is able to balance the current expected benefits of immediate treatment against the risks [(2)].

The rationale for use of diagnostic laparoscopy (DL) in this setting is to prevent treatment delay, with the subsequent potential for poorer patients outcome, and to avoid unnecessary laparotomy, which is associated with relatively high morbidity rates (5-22%) [(1)].Emergency laparoscopy can be used for the diagnosis and/or management of a wide variety of diseases including acute cholecystitis, perforated duodenal ulcer, iatrogenic perforations of the colon, intestinal obstruction, the acute abdomen in surgical intensive care patients, as well as certain suspicion of mesenteric ischemia and peritonitis of all origins [(2)].

Early laparoscopic cholecystectomy in the course of acute cholecystitis decreases overall hospital stay and avoids increased complications, conversion to open procedures and mortality [(2)]. Among the many randomized studies comparing laparoscopic appendectomy and open appendectomy, only a few studies have used the findings of a diagnostic laparoscopy to guide the subsequent surgery. Most were in female patient of fertile age and documented significant reductions in the numbers of negative appendicectomies and rate of unestablished diagnosis. The diagnostic advantages in men and children are less clear due to the relative ease of diagnosis in these subgroups [(3)].

In perforated peptic ulcer, laparoscopic patient did however experience less post-operative pain in the medium to long term, which may account for the shorter hospital stay and earlier return to normal activities. Mortality may also be marginally lower in those treated laparoscopically [(4)].

The DL procedure can be performed safely in ICU patients. Few complications include bradycardia, increased peak airway pressures and perforation of a gangrenous gallbladder during laparoscopic manipulation [(5)].

Laparoscopy can be performed safely for the majority of patient of acute abdomen. The reported morbidity rate was 24% and the rate for mortality ranged from 0% to 4.6% [(3)].Generally, there are 3 major categories of complications associated with laparoscopic procedure: vascular injuries, visceral injuries and abdominal wall injuries including port -site infection, hematoma and acute herniation at trocar site [(5)].There is insufficient evidence to recommend routine use of early laparoscopy as the gold standard in patients with undifferentiated acute abdominal pain. Conversely, there is no evidence of harm. Further large clinical trials are required to determine the role of laparoscopy in this clinical situation [(6)].

The limited quality of the available literature on DL make generalizations difficult and allow

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institutional and personal biases to be introduced into the interpretation of available results; but the high baseline mortality rate for this patient population makes it difficult to draw firm conclusions about the impact of DL on clinical outcomes. Additional high-quality research is needed to evaluate the role of DL for the acute abdomen patients [3].

AIM OF THE WORK

This study aimed to evaluate the diagnostic role of laparoscopy in acute abdominal conditions and its therapeutic role in perforated peptic ulcer, acute cholecystits and acute appendicitis.

PATIENTS and METHODS

This study was conducted prospectively on 40 patients presented with acute abdomen to Al-Azhar University hospitals from March 2018 till August 2018. 24 (60%) of patients were females and 16 (40%) were males. The age was ranged from 20 to 60.

The study was approved by the Ethics Board of Al-Azhar University.

1. Management plan

A. Preoperative:

a) Rapid history and examination for exclusion of trauma and taking vital signs.
b) Venous line and taking blood sample for laboratory investigations.
c) Fluid and electrolyte replacement.
d) In cases of suspected peritonitis or intestinal obstruction, Ryle tube and Foly's catheter were inserted. In cases of suspected acute appendicitis, patient was asked to evacuate his bladder just before operation otherwise Foly's catheter is inserted.
e) Full history and clinical examination.
f) Laboratory investigations according to diagnosis.

- In cases of suspected acute appendicitis usually complete blood count (CBC) is usually enough.
- In every case of lower abdominal pain in female in child bearing period pregnancy test was done.
- In the rest of cases: routine lab (CBC, liver and kidney function tests, Random blood sugar) is done. Serum Amylase level was asked for cases of upper abdominal pain (suspecting acute pancreatitis).

g) Plain X- ray abdomen erect and supine was done for all cases.
h) Abdominal sonography was done routinely in all cases. CT was done if there was doubtful diagnosis by ultrasound, inadequate diagnosis by clinical, X-ray and US examinations or suspicion of pancreatitis, mesenteric ischemia.
i) Provisional diagnosis was put and suspected surgical cases within our criteria have undergone our study.

a) Inclusion criteria:

Acute abdomen patients:

- With acute abdominal pain more than 6 hours.
- With clinical evidence of surgical abdomen.

b) Exclusion criteria

- Patients with history of abdominal trauma since one week.
- Patients with contraindication to laparoscopy (uncontrolled hypercapnea, coagulopathies), patients with severe abdominal distention and history of repeated abdominal surgery.

B. Operative:

a) Surgeries were done in Al-Azhar University Hospitals.
b) 30° lens, 0° lens, non traumatic graspers and 20L/ m insufflators were used.
c) Sterilization of laparoscopic equipments was done by gluatraldehyde 4%.
d) Patients received preoperative prophylactic antibiotics, 3rd generation cephalosporins usually.
e) Informed consent was taken either from patient or 1st degree relative.

Operative technique

a) Patients received general anesthesia, patient was put in supine position, with ability to tilt the table on need and availability of lithotomy position.
b) With open (Hasson) technique 11mm disposable trocars or 10 mm metal trocars for the camera was inserted, usually periumblical. Then laparoscopic exploration of the abdomen was done. Additional trocars were inserted according to the pathology.
c) Non traumatic intestinal graspers were used to deal with the intestine and omentum.
d) Observation of any fluid: pus, bile, intestinal content and blood. Then aspiration and sampling.
e) Searching for the cause: beginning with the most probable according to preoperative diagnosis and intraoperative finding (nature of the fluid, aggregation of loops or omental adhesions).
f) If there was satisfactory cause, exploration was completed and diagnostic laparoscopy was considered successful.
g) Dealing with the cause laparoscopically was tried either completed laparoscopically, laparoscopic assisted via planed incision according to pathology, or total conversion to open surgery.
h) If there was doubtful or unsatisfactory cause, exploratory incision was done usually midline incision; upper or lower according to most probable diagnosis.
i) Peritoneal toilet was done by suction irrigation; 5mm laparoscopic suction canula was used. Irrigation by large amount of normal saline.
j) Drains were inserted according to pathology.

I) Acute cholecystitis:

- Classic 4 ports method, open (Hasson) technique were used.
- The critical-view-of-safety technique described by Strasberg has been increasingly used. If the identification and dissection of the Calot's triangle

structures has been made difficult by adhesions or inflammation, a laparoscopic fundus first anterograde approach used to avoid common bile duct injury.

- Modifications of the procedure are included when necessary (decompression of the gallbladder, introduction of an additional cannula, sutures to control the cystic duct).
- Subtotal cholecystectomy has been advocated in cases where the local conditions are particularly hostile due to intense inflammation and increased risk of damage to Calot`s triangle structures.
- Drains were always inserted

II) Acute appendicitis:

- 3 ports method, open (Hasson) technique were used. Exploration of abdomen was done. Appendix is removed if inflamed.
- Ports were 10 mm periumblical for camera, 5 mm in left iliac fossa or suprapubic and 10mm in right iliac fossa to achieve triangulation. In some cases 2 working ports was put in left iliac fossa and suprapubic
- Dissection of mesoappendix was done by monopolar diathermy, bipolar diathermy, extra or intracorporeal knot, ultrasonic shear (Ethicon ACE)™, Ligasure ™ and titanium clips.
- Appendicular base was secured by 1 or 2 extra or intracorporeal knot endoloops, or by absorbable polymer clips.
- Appendix was delivered inside right trocar if thin or inside retrieval bag if thick or inflamed.
- Peritoneal suction irrigation was done up to 5 liters if peritonitis was present.

III) Perforated peptic ulcer:

Patients were selected according to **Boey and Wong** [7] criteria who established a scale of surgical risk from 0 to 3 in treatment of perforated peptic ulcer, according to the presence of three parameters: state of shock on hospitalization (SAP <90 mmHg), ASA III-V (presence of severe co-morbidity) and duration of symptoms (>24 h). Laparoscopic management would be safe enough for classes 0 and 1, while it should be avoided in those of a higher degree.

- Patient in the trendelenburg position at 15-20° was generally recommended.
- The surgeon can stand between the patient's legs or at the patient's left side.
- One 5 mm trocar was positioned in the epigastric site to lift the liver and if necessary the gall bladder.
- The other two trocars were usually positioned in the left abdominal quadrant, on the mid-clavicular line above the umbilical transverse line and on the right side in a position which was diametrically opposite on the projection of the abdominal waif of the transpyloric region.
- Peritoneal toilet was done by normal saline and aspiration.
- Closure of defect via omental patch by intracorporeal sutures or Knotless with threads secured by clips holding it.
- Drains were inserted in Morrison pouch and pelvis.

Criteria of Evaluation

1. Diagnostic role:

To achieve complete operative diagnosis comparative to preoperative provisional diagnosis

Therapeutic role:

To do complete laparoscopic surgical treatment for perforated peptic ulcer, acute cholecystitis and acute appendicitis.

2. Outcome measures

Success of laparoscopic technique, postoperative mortality, laparoscopic related complications , general complications and length of hospital stay.

Statistical analysis of data

All the data were collected, correlated to each other and analyzed using statistical package of social science (SPSS), version 2014. The quantitative data were presented in the form of mean and standard deviation. The qualitative data were presented in the form of number and percentage. Sometimes some quantitative data were transformed into qualitative.

RESULTS

1) Demographic data

A) Gender:

Table 1: gender distribution

Males	Females
16 (40%)	24(60%)

As present in this table 30 of our cases (about 77.5%) aged from 20 to 50 years. It is explained by the fact that most of our patients were diagnosed as acute appendicitis occurring mainly in this age group

Table 2: age stratification of our patients

Age group (years)	No (%)
18-20	4 (10%)
21-30	12 (30%)
31-40	10 (25%)
41-50	9 (22.5%)
51-60	4 (10%)
61-67	1 (2.5%)

2) Diagnostic role

A) Overall laparoscopic diagnostic ability:

As shown in table (3) laparoscopy was capable of achieving complete diagnosis in 36 case (90%) of cases as regard positive or negative for surgery and definite pathology in positive cases. While in about 2 cases (5%) showed that there is something abnormal as free fluid or exaudate of nature suggestive of certain pathology (saponification in one cases of pancreatitis

and one case of perforated duodenal ulcer). In 2 cases (5%) diagnosis couldn't be achieved via laparoscopy and complete exploratory laparotomy was accomplished.

Table 3: percent of cases diagnosed by laparoscopy or open surgery

Level of diagnosis	No (%)
Cases of complete laparoscopic diagnosis	36 (90%)
Cases of incomplete diagnosis	2 (5%)
Cases of failed diagnosis (converted to open)	2 (5%)

B) **Diagnostic ability compared to preoperative diagnosis:**

From table (4) preoperative diagnosis was not able to judge completely on about 20% of cases, Non Specific Abdominal Pain (NSAP), to be or not to be surgical, most of them was cases of acute appendicitis. Decision was to do diagnostic laparoscopy which was able to decide in about 50% of cases of NSAP to be surgically positive or negative while 50% of cases needed an open surgery to be diagnosed.

Table 4: diagnostic ability; preoperative, laparoscopy and open surgery

Method	Positive for surgery	Query diagnosis	Negative for surgery
Preoperative	32 (80%)	8 (20%)(NSAP)	-
Diagnostic Laparoscopy	34 (85%)	4 (10%)	2 (5%)
Diagnostic laparotomy	4 (10%)	-	-
Total	38 (95%)	-	2 (5%)

From table (5) even from the cases thought to be positive for surgery by preoperative diagnosis (32 cases 80%), 2 cases turned out to be negative by laparoscopy. And 2 cases which was considered NSAP was found negative for surgery by laparoscopy. This means that diagnostic laparoscopy helped us to avoid unnecessary laparotomy in 2 cases.

Table 5: diagnostic laparoscopy compared to preoperative diagnosis

Preoperative diagnosis	Laparoscopy +ve	Laparoscopy –ve
Positive for surgery 32 cases	32 (100%)	-
Query diagnosis (NSAP) 8 cases	2 (25%)	2 (25%)

In table (6) laparoscopic diagnosis changed our preoperative diagnosis. Preoperative diagnosis can judge completely on 32 case (80%) to be surgically positive. But, the laparoscope change the diagnosis even if they still surgically positive. The other 8 cases (20%), the preoperative diagnosisgive an idea about the diagnosis but it canot confirm it.

Table 6: how diagnostic laparoscopy changed the provisional diagnosis

Diagnosis	Provisional	Lap confirmation	Percent of diagnosis change
Acute appendicitis	15	14	6.6% (1/15) '
Complicated appendicitis	5	5	0%
Acute cholecystitis	11	10	9% (1/11)
Perforated peptic ulcer	2	1	50% (1/2)
Mesenteric vascular ischemia	2	2	0%
Pancreatitis	2	1	50% (1/2)
Diverticulitis	2	2	0%
Internal herniation	1	1	0%

C) **Diagnostic accuracy of laparoscopy in different cases:**

As we see in table (7), clinical diagnosis, the cornerstone of preoperative diagnosis of non complicated acute appendicitis, can miss more than 10% of these cases and can't be sure about more than one third of these cases, compared to post operative pathology, overall diagnostic accuracy was 86.5%. Abdominal US adds nothing to our clinical diagnosis. CT is not routinely used in these cases.

Laparoscopy makes a remarkable difference in sensitivity and specificity. It can be diagnosed about 90% of cases.

While clinical diagnosis can miss more than one third of complicated cases and can't be diagnosed more than half of these cases, with overall diagnostic accuracy 77.8 %. Abdominal US elevate diagnostic accuracy to 81%.

Laparoscopy can be sure about diagnosis in 100% of cases and with overall accuracy about 96%.

Table 7: diagnostic accuracy of different modalities in acute appendicitis. *(com: complicated, non: non complicated, PPV: positive predictive value, NPV: negative predictive value)

Method of Diagnosis	Sensitivity%		Specificity %		PPV%		NPV%		Diagnostic accuracy%	
	Com	Non	Com	Non	Com	Non	Com	Non	Com	Non
Clinical diagnosis	63.6	89.6	92	83.3	43.8	61.9	96.3	96.3	77.8	86.5
Us	72.7	89.6	92	83.3	47.1	61.9	97.2	96.3	81.8	86.5
Laparoscopic Diagnosis	90.9	97.7	100	96.6	100	90.6	99	99	95.5	97.1

In table (8), clinical diagnosis can miss more than one third of these cases of acute cholecystitis and can't diagnosed about more than 20% of these cases, with overall diagnostic accuracy 71 %. Abdominal US elevate diagnostic accuracy to 81% with signs of impacted gall bladder neck stone, wall oedema and precholecystic fluid. Laparoscopy was perfect in sensitivity and specificity with overall accuracy 100%.

Table 8: diagnostic accuracy of different modalities in acute cholecystitis

Method of Diagnosis	Sensitivity	Specificity	PPV	NPV	Diagnostic
Clinical	62.50%	79.40%	33.30%	92.80%	71%
Us	75%	87.60%	50%	95.50%	79.30%
Laparoscopy	100%	100%	100%	100%	100%

As we see in table(9), as regards perforated peptic ulcer; clinical diagnosis with routine plain x-ray erect position can detect only half of the cases but can diagnosed about 94% of cases if there is air under diaphragm, overall diagnostic accuracy was 72 %. Abdominal US adds nothing to diagnosis. CT is more sensitive about pneumoperitoneum and one case revealed extravasation of the dye. Laparoscopy added much more to sensitivity and specificity. It could detect 90 % of cases, could be diagnosed 100% of cases and can deny the diagnosis in 99% of our cases with overall accuracy about 95%.

Table 9: diagnostic accuracy of different modalities in perforated peptic ulcer diagnosis

Method of Diagnosis	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Clinical diagnosis + plain xray	50%	94.10%	45.50%	95.1%	72%
Us	50%	94.1%	45.5	95.1%	72%
Laparoscopic Diagnosis	90%	100%	100%	99%	95%

3) Therapeutic Role:

Table (10) explains feasibility of laparoscopic treatment of each pathology. The treatment was either completely laparoscopic, meaning that diagnosis and treatment were done laparoscopieally; it was feasible in the most of cases. Or diagnosis and steps in treatment were done laparoscopieally but conversion to open surgery was done inevitably due to various indications (failure of progress, Inability to do complete drainage, uncontrolled bleeding, visceral injury or anesthetic indications). Planned surgery means that diagnosis is made laparoscopieally and planned incision is done to do the treatment partially or completely. Complete open surgery means that open surgery was necessary for diagnosis and treatment.

For non complicated acute appendicitis (14 case), laparoscopy was completely successful in all cases & no need for conversion.

But for complicated acute appendicitis(5 cases), Laparoscopy was enough to treat 4 (80%)of cases. But in conversion, grid iron incision was made instead of exploratory incision in one case (20%)

For acute cholecystitis (10 cases) Laparoscopic cholecystectomy was excellent for treatment of all cases of acute cholecystitis and no need for conversion.

For perforated peptic ulcer (2 cases), complete diagnosis and treatment was done laparoscopically in one case (perforation was about 1 cm), while in the other case the diagnosis is done laparoscopically and treatment was done by open surgery. In more grave cases, laparoscopy was much less successful. Complete laparoscopic treatment was not feasible in diverticulitis (1 case). Peritoneal toilet was done laparoscopically and planed surgery for exploration and transverse colostomy completed the work.

In pancreatitis (3 cases), the diagnosis and treatment was done by laparoscopic by drainage of lesser sac.

From 2 cases of mesenteric ischemia, 1 case was successfully diagnosed by laparoscope to be ischemic but still viable loops; and was treated by drain insertion and 2nd look.

One case of intestinal gangrene was successfully diagnosed by laparoscope and treated by planed incision to do resection and illeostomy.

Table 10: feasibility of laparoscopic treatment

Pathology (Total no)	Total laparoscopic treatment	Laparoscopic assisted (conversion)	Laparoscopic assisted (planned)
Uncomplicated appendicitis (14)	14 (100%)	-	-
Complicated appendicitis (5)	4 (80%)	1(20%)	-
Acute cholecystitis (10)	10 (100%)	-	-
Perforated peptic ulcer (2)	1 (50%)	1(50%)	-
Mesenteric ischemia (2)	1 (50%) (2^{nd} look)	1 (50%)	-
Pancreatitis (3)	3 (100%)	-	-
Diverticulitis (1)	-	-	1(100%)
Internal hernia (1) Total (38)	1 (100%) 34 (89.4%)	- 3 (7.9%)	- 1(2.6%)

4) Outcome Measures;

In Table (11), as regard perioperative complications; collectively it was accepted.

Table 11: overall periopertive complications of laparoscopic and open cases

Complications	Laparoscopic cases (40 cases)
Intestinal injury	1 (2.5%)
1ry hemorrhage	-
Anasthetic complications	-
Wound infection	-
Burst abdomen	-
Perioperative mortality	-
Postoperative collection	1(2.5%)
Reactionary hemorrhage	-
Total	2 (5%)

In table (12) complications of the main therapeutic laparoscopy operations is viewed as explained before.

Table 12: periopertive complications of therapeutic laparoscopy

Complications	Uncomplicated appendicitis	Complicated appendicitis	Acute cholecystitis	Perforated peptic ulcer
Intestinal injury	1 (2.5%)	-	-	-
1ry hemorrhage	-	-	-	-
Anasthetic complication	-	-	-	-
Wound infection	-	-	-	-
Burst abdomen	-	-	-	-
Mortality	-	-	-	-
Postoperative collection	-	-	-	1 (2.5%)
CBD injuries	-	-	-	-
Reactionary hemorrhage	-	-	-	-

Table (13) reveals mean length of hospital stay (LOH) for laparoscopic and open cases, totally 2.6 vs 5.3 days respectively. In all laparoscopic cases it was less than open cases. The less complications and shorter hospital stay means saving money and working hours.

Table 13: mean hospital stay ± standard deviation

	Laparoseopic cases	Open cases
Uncomplicated appendicitis	1 day ±0.3	1.7 days ± 0.5
Complicated appendicitis	4 days ± 0.7	5.7 days ± 0.9
Acute cholecystitis	1.5 days± 0.4	4.7 days ± 0.3
Perforated peptic ulcer	4 days ±0.6	6.5days ± 0.5
Total cases	2.6days±0.5	5.3days± 0.7

DISCUSSION

Acute abdomen cases often represent diagnostic challenge to the general surgeon. The diagnosis is important due to the different pathologic conditions that might be responsible for the acute situation and therefore important for planning the correct abdominal incision or avoiding an unnecessary laparotomy.

We discussed our results in comparison with recent corresponding results.

1) Diagnostic role

As regard diagnostic ability of laparoscopy, **Dominguez *et al.*** [8] stated that diagnostic accuracy reached 96.9%. **Golash and Willson** [9] found that the definitive diagnosis was made in 90% of patients after diagnostic laparoscopy. Laparoscopy changed the clinical diagnosis in 30% of cases. In our study, we reached definitive diagnosis in 90%. Incomplete diagnosis was reached in about 5% and open surgery was needed for diagnosis in about 5% of cases. As regard preoperative diagnosis, **Lockwood *et al.*** [10] concluded that diagnostic laparoscopy for acute RIF pain in females was safe and associated with improved diagnostic rates over ultrasound. **Agresta *et al.*** [11] stated that NSAP represented from 22 - 40% of acute abdomen cases. In our study, NSAP reached 20% of all cases. **Garbarino and Shimi** [12] noticed that, routine laparoscopy reduced the negative appendicectomy rate to 5%. Also **Shahzad** [13] found that 31.3% of suspected acute appendicitis has another pathology. **Majweski** [14]; stated that diagnostic laparoscopy changed the treatment in 14% of cases.In our study, we avoided unnecessary laparotomy in 2 cases so we avoided unnecessary appendictomy in about 12.5% of these cases. As regard diagnosis of specific pathologies **Luke *et al.*** [15] found that ultrasound does not help in patients with suspected appendicitis. Similar results were observed by **Ekere *et al.*** [16]**.** Also, **Markar *et al.*** [17] claimed that CT did not appear to improve the diagnostic accuracy of appendicitis. **Garbarino and Shimi** [12] noticed elevation of diagnostic accuracy of routine diagnostic laparoscopy in acute appendicitis to more than 95%. **Mirabella *et al.*** [18] claimed that, clinical diagnosis plus plain radiography have sensitivity (50-70%) for the confirmation of pneumo-peritoneum in cases of perforated peptic ulcer. **Chen *et al.*** [19] in a retrospective study of 14 patients with PPU reported a 100% reliability of a CT scan to determine a pneumoperitoneum, but only 36% in determining the perforation site. **Hainaux *et al.*** [20] showed an 86% accuracy of CT in specifying the site of the lesion that increase to 90%by using. In our results, diagnostic accuracy of clinical diagnosis plus plain X- ray were 72% with sensitivity 50%, specificity 94%. US added nothing for diagnosis [21]. According to **Smith *et al.*** [22] ultrasound (US) is the preferred initial modality in the investigation of right upper quadrant pain. It is more sensitive than computed tomography (CT) in the diagnosis of acute cholecystitis.

Also, **Agresta *et al.*** [11] recommended laparoscopy for treatment of established acute cholecystitis not for diagnosis. In our results, clinical examination plus US accomplished more sensitivity 75%, but less specificity 88% and accuracy 79.3%. Already diagnostic laparoscopy was perfect in these cases by 100 % sensitivity, specificity and accuracy. **Agresta *et al.*** [11] noted that diagnostic laparoscopy is effective in diagnosis and treatment of Hinchey class II b and III acute diverticulitis with abscess not amenable to drainage (IIb) or purulent diffuse peritonitis (III)) while, conversion may be needed in class IV. They also stated that there was no advantage of diagnostic laparoscopy (DL) over CT in diagnosis of acute mesenteric ischemia. In our study, laparoscopic diagnosis of diverticulitis was difficult. In contrast we had a very good experience with DL as regard mesenteric ischemia.

2) Therapeutic Role

Laparoscopy has become a routine procedure in the management of acute abdominal disease and can be considered both an excellent therapeutic and additional diagnostic tool in selected cases[23,24]**.** **Golash and Wittson** [9] converted 7% of their laparoscopically diagnosed cases to open surgery for sake of treatment. In our study 90% of surgically positive cases were done laparoscopically. 5% was done completely open for diagnosis and treatment. 2 cases was tried laparoscopically and converted to open.

Kucuk [25] claimed that from 75 cases of laparoscopic appendectomy; the rate of conversion to open surgery was 1.3% and they were complicated. ***Swedler et al.*** [26] found that there were 6.2% rate of conversions. ***Agresta et al.*** [11] stated that conversion rate after LA for total procedures (3.6%) and after LA in complicated appendicitis (4.6%). As regard treatment of acute appendicitis, all cases were done laparoscopically while 20% of complicated appendicitis converted to open surgery.

Navez et al. [24] concluded that, although laparoscopic cholecystectomy is currently considered as the standard treatment for acute cholecystitis, an open approach is still a valid option in more advanced disease. Conversion rate was 11.3%. ***Campanile et al.*** [27] stated that the incidence of conversion is 9.5% if surgery is performed within 2 days from the onset of symptoms, and rises to 16.1% if surgery is done within 4 days. **Our results** revealed all our operations were done laparoscopically and within 2 days of admission. Conversion rate was 0%.

As regard treatment of perforated peptic ulcer, ***Agresta et al.*** [11] stated that Laparoscopy is a useful diagnostic tool, especially if a laparoscopic treatment is likely (GoR. ***Bertleff and Lange*** [28] found that conversion rate was about 12.5%. ***Saverio et al.*** [21], recommend laparoscopic approach for diagnostic purposes.also suggested laparoscopic repair of PPU in stable patients with PPU <5 mm in size. **Our results** in perforated peptic ulcer (2 cases), Conversion was done in one case due to technical difficulties. The other case was done laparoscopically in which the perforation was 1 cm.

Although ***Mbadiwe et al.*** [29] concluded that the laparoscopic approach is associated with lower complication rates compared with the open approach for the surgical treatment of diverticulitis with a primary anastomosis. **In our results** complete laparoscopic treatment was not feasible in complicated diverticulitis.

About treatment of severe acute pancreatitis ***Van Santvoort et al.*** [30] stated that the first step should be percutaneous drainage, followed, whenever needed, by minimally invasive retroperitoneal debridernent. While open surgery should be the last step. **About our results**, the 3 cases of pancreatitis was treated by laparoscopic drainage of lesser sac.

Agreeing with ***Agresta et al.*** [11] and ***Gonenc et al.*** [23] laparoscopic role in acute mesenteric ischemia was diagnostic mainly with no attempt of resection or doing a stoma.

3) Outcome Measures

For cases of acute abdomen as a whole, ***Agresta et al.*** [31] have done 1,272 patients admitted with acute abdomen have been approached laparoscopically. In comparison with open surgery, there were significant reduction of total complication in laparoscopic treatment than open surgery (1.9% vs 13%) the percent of redo surgery was 1.3% mean hospital stay was 4.5 vs 6.5 days. **Our results show** as regard perioperative complications; collectively it was 5% in laparoscopic cases. In laparoscopic group there were no mortality, no anesthetic complications, one case (2.5%) of abdominal collection, one case of intestinal injury (2.5%). Mean length of hospital stay (LOH) for laparoscopic and open cases, totally 2.6 vs 5.3 days respectively.

As regard laparoscopic appendectomy (LA) ***Thereaux et al.*** [32] found that 7.1 % of patients experienced intra-abdominal abscess (IAA); seven of these cases were treated conservatively. The mean length of hospital stay was 6.9 ± 5. **Our outcome** in LA for non complicated appendicitis shows, no mortality, no anesthetic complications, one case (2.5%) of iatrogenic intestinal injury. Mean LOS was 1 day versus 1.7 days in open cases. But **for complicated appendicitis revealed** no mortality, no anesthetic complications, no cases of wound infection. Mean LOS was 4 days versus 5.7 days in open cases.

For acute cholecystitis, ***Navez et al.*** [24] found 3.5% presented biliary complications in early laparoscopy group and 4.5% had other local complications. **Our result shows** no mortality, no anesthetic complications, no cases of intraoperative bleeding, no cases of port site infection. Mean LOS was 1.5 days versus 4.7 days in open cases.

As regard perforated peptic ulcer, ***Bertleff and Lange*** [28] found total mortality for laparoscopic treatment (2.5% vs 5.8% in open surgery), total morbidity (22% vs 36% in open surgery) and LOS (6 % vs 6.5%). **Our result** showed no mortality, no anesthetic complications, only one case of post operative intra abdominal collection (2.5%) which treated by ultrasound guided drainage and covering antibiotics. Mean LOS was 6.5 days.

CONCLUSION

Laparoscopy was an excellent diagnostic tool. It was a very good therapeutic tool in acute appendicitis, acute cholecystitis, and perforated peptic ulcer. It was also safe and satisfactory; also it saved more hospital beds.

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