Evaluation of Laparoscope in Abdominal Trauma in Kerbela city
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ABSTRACT

Background: The use of laparoscope in trauma for diagnostic purposes is generally limited; we attempt to investigate the therapeutic function of laparoscopic surgery in trauma patients. Laparoscope may be effective and safe in treating patients with abdominal trauma. Aims of the Study: To identify the following:

1. Benefits of Laparoscope in Abdominal Trauma.
2. Contraindications for Laparoscope in Trauma Patients.
3. Indications for conversion (from laparoscopic to open approach).

Patient and methods: forty patients with abdominal trauma whether penetrating or blunt who were admitted to the casualty unit in Imam al-Hussein Medical City in Holy Karbala City from Jan 2016 to June 2016 and were diagnosed as a cases of acute abdomen by clinical examination base some were in shock state and unstable admitted immediately to theatre laparotomy was done to them other cases in shock but corrected undergone surgery for different causes some of them undergone purely laparoscopic interference by laparoscopic device under the name (KARL STORZ—ENDOSKOPE) other patients undergone conversion for different causes.

Results: forty were included in a prospective study who were undergone surgical intervention either in form of traditional laparotomy or diagnostic laparoscopy eight (20%) of them undergone exclusive laparoscopic interference while nine (22.5%) undergone conversion, other twenty three (57.5%) undergone open approach.

Conclusions: From the study, it was concluded that:

1. One of the most important tools that is used to manage the blunt abdominal injury (BAI) is laparoscope.
2. The laparoscope is a good preventive measure of nontherapeutic laparotomies.
3. It’s important measure in diagnosing and even treating diaphragmatic injuries.
4. Traumatic bowel injuries can be diagnosed and even treated by the laparoscope.
5. The presence of profuse hemorrhage make continue on laparoscopic approach is non judges.

Keywords: laparoscope, abdominal trauma, laparotomy, conversion

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INTRODUCTION

One of the main causes that leads to death between 1 to 44 years is trauma. Treatment and evaluation of abdominal injuries are critical components in the care of severely injured trauma patients; Lamy, who reported two instances of splenic injury, which was first used laparoscope for a trauma patient in 1956. So, Gazzaniga has stated that laparoscope is useful in determining the need for laparotomy. In 1991, Berci stated that, through the use of laparoscope in 150 patients with blunt abdominal trauma, he had reduced the number of negative laparotomies done for hemoperitoneum by 25 % [1], exploratory laparotomies in trauma patients with possible intra-abdominal injury are associated with high negative laparotomy incidence and major surgical morbidity. Laparoscope was introduced for trauma patients to prevent unnecessary exploratory laparotomies with a higher morbidity and cost linked [2]. It is controversial that urgent explorative laparotomy is essential as a standard procedure in treating the abdominal penetrating wounds. In the absence of acute casualties, compulsory clinical operation with penetrating abdominal wounds produces a high rate of adverse laparotomies. Laparoscope is an effective surgical technique that inspects the peritoneum for perforation symptoms and removes major intra-abdominal lesions. [3].

There is still controversy about the appropriate function of the laparoscope in trauma environment, although it can provide advantages over conventional exploratory laparotomy, laparoscope can be a screening, diagnostic or therapeutic device for trauma [4] In many fields of abdominal surgery laparoscopic surgery has greatly improved clinical performance. But its use in abdominal trauma has been restricted by many surgeons worried about its health. Laparoscope may be safe and effective in treating patients with abdominal trauma, and may mitigate complications.
related to laparotomy (illness, complications of the wound and lengthy hospital stay) to avoid unnecessary laparotomy
[5]. Laparoscope mainly aims at using the least invasive method in order to exclude or investigate visceral injuries and
organs and then reach a diagnosis if possible. Laparoscope may therefore be a treatment alternative for patients with
specified traumatic injuries with emerging methods and increased experience, [6] A new clarification of the Society of
American Gastrointestinal and Endoscopic Surgeons (SAGES) recommendations for diagnostic laparoscopy in April
2010 was recommended for trauma patients to avoid unnecessary exploratory laparotomies with their related higher
morbidity and expense. Laparoscope is technically feasible and can be used effectively (moderate recommendation)
in suitably chosen trauma patients. Effectively, the treatment reduced the occurrence of adverse laparotomies and
lowered patient morbidity. A high clinical risk of intra-abdominal injury (strong recommendation) should be regarded
in hemodynamically stable blunt trauma patients with potential intra-abdominal injury and equivocal results on
imaging studies or even in patients with unfavorable tests. It can be particularly useful and should be treated with
recorded or equivocal penetration of the anterior fascia (strong recommendation) in patients with penetrating
abdominal trauma. It should be used in patients with possible diaphragm damage, as there are large levels of occult
injury imaging and laparoscope provides the best precision of treatment (strong recommendation). With early
detection of serious incidents, patients should be treated closely postoperatively. Where laparoscopic experience is
accessible (strong recommendation), medical care may be given safely. The technique should be integrated into
hospital diagnosis and recovery systems for trauma patients to improve results[2].

A major reason why some surgeons often avoid laparoscope in trauma today is the high rate of missing occult small
bowel accidents connected with laparoscope in a trauma. No systematic laparoscopic test for peritoneal cavity
assessment is defined for trauma [7] the opportunity to exclude non-operative internal organ damage removes
potential complications of excessive laparotomy from occurring. Development of new ideas and advanced
technologies has contributed to an advancement of intra-abdominal and diaphragm injury diagnosis and operating
procedures in recent decades [8].

While laparoscope is the gold standard for diaphragm examination in patients with penetrating left thoracoabdominal
stab wounds, multislice computed tomography is also useful for diaphragm injury detection [9]. Laparoscope may be
used in treating a diaphragm wound as a secure and feasible treatment. The diagnosis and treatment of these patients
may be an alternative method. Evidence of prevalence in most establishments includes a laparotomy to determine
organ damage, since laparoscopic removal of all intra-abdominal accidents is challenging. [8]. Laparoscope is not a
replacement for open laparotomy, in particular when haemoperitoneum is present or polluted[9].

Aims of the Study: To identify the following:

2. Contraindications for the Laparoscope in Trauma Patients.
3. Indications for conversion (from laparoscopic to open approach).

PATIENTS AND METHODS

Inclusion criteria; all patients subjected to abdominal trauma and diagnosed as acute abdomen proposed for surgery
were included.

Exclusion criteria; any abdominal trauma patient not proposed for surgery was excluded from the study.

This is a prospective study conducted at Imam al-Hussien Medical City in Karbalaa Governorate during the period
from January 2016 to June 2016. Forty patients included in the study were admitted to the casualty unit as a trauma
patient, these forty patients who were exposed to abdominal trauma some of them associated with extra-abdominal
trauma (head and neck, chest, and limbs) others only abdominal trauma, all of these patients undergone intervention
for different causes , these forty patients divided to blunt trauma (either road traffic accident or falling from height) ,
and penetrating injury (either stab injuries or bullet injuries).

Data collected from patients admitted to casualty after resuscitation, some of them were vitally unstable so deep
intravenous lines, fluids administration, and some patients examined by Focused Abdominal Sonography for Trauma
(FAST) which revealed intra-abdominal free fluid, were admitted immediately to the theatre, others after resuscitation
and stabilization, abdominal U/S and abdominal spiral computed tomography (CT) scan were done which revealed
visceral injuries or presence of haemoperitoneum.

A questionnaire built up for them and vital signs with clinical examination and related important blood test in form of
complete blood count, blood group, Rh, and other important relevant investigations like abdominal U/S or abdominal

spiral computed tomography (CT) scan whether native or with intravenous contrast media study were done according to the patient’s status and a copy of the report were kept for this study analysis.

Exploration was done in the casualty theatre by laparoscopic approach or open approach according to the situation at that time. In our Imam al-Hussein Medical City casualty theatre, we used laparoscopic device (KARL STORZ—ENDOSKOPE) serial # (07-101446), model # (SC-X15-A1203), part # (90X0374-C).

**Laparoscopic Technique:**

Under general anaesthesia with endo-tracheal tube supine position after full abdominal exposure, draping of the abdomen and after preparation of the whole laparoscopic instruments in addition to laparotomy set as at any time conversion might be decided, 1 cm infraumbilical slit incision were done, entrance to abdominal cavity done by 10-mm port by open method to avoid blind entrance, then introduce pneumoperitoneum directly (without veress needle), check the abdominal cavity for presence of hemoperitoneum [Fig 1], bile or intestinal contents, then two additional 5 mm laparoscopic ports were also placed under direct vision at right iliac fossa and at right upper quadrant then other two 5-mm ports can be used on the left side as needed as shown in [Fig. 2], upper part of the abdominal cavity is explored mainly spleen and liver, diaphragm, stomach and then small and large bowel and mesentery examined and then pelvic cavity were examined, and finally the retroperitoneum was assessed for any hematoma or visible renal or pancreatic injuries.

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Fig. 1 Hemoperitoneum in Abdominal Trauma Patient undergone Laparoscopic Surgery

Fig. 2 Ports Sites during the Laparoscopic Surgery
RESULTS:

Totally forty cases who exposed to abdominal trauma and undergone surgical intervention were grouped into those who exposed to blunt abdominal trauma who were twenty five (62.5%), while other group was penetrating abdominal trauma were fifteen (37.5%), there were nine cases (60%) of this group exposed to bullet injury, which regarded by some authors as a contraindication for laparoscopic interference, while the remaining six cases (40%) were stab injuries we considered it as an indication for laparoscopic interference unless the victim was vitally unstable and this is what we found in our study that from these six patients four of them were approached laparoscopically unfortunately two of them were converted to open laparotomy for causes that we going to discuss it later in the discussion, while the remaining two were approached laparoscopically, the remaining two cases were treated through opened laparotomy from the start. In the blunt trauma group nineteen patients (76%) are road traffic accident victims and six patients (24%) falling from height.

<table>
<thead>
<tr>
<th>Mechanism of Abdominal Trauma</th>
<th>LaparoscopicallyTreated</th>
<th>Open surgery</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt trauma</td>
<td>13(76.4%)</td>
<td>12(52.1%)</td>
<td>25(62.5%)</td>
</tr>
<tr>
<td>RTA</td>
<td>7(41.1%)</td>
<td>12(52.1%)</td>
<td>19(76%)</td>
</tr>
<tr>
<td>FFH</td>
<td>6(35.2%)</td>
<td>- (0.0%)</td>
<td>6(24%)</td>
</tr>
<tr>
<td>Penetrating</td>
<td>4(23.5%)</td>
<td>11(47.8%)</td>
<td>15(37.5%)</td>
</tr>
<tr>
<td>Stab</td>
<td>4(23.5%)</td>
<td>2(8.6%)</td>
<td>6(40%)</td>
</tr>
<tr>
<td>Bullet</td>
<td>-(0.0%)</td>
<td>9(39.1%)</td>
<td>9(60%)</td>
</tr>
<tr>
<td>Total</td>
<td>17(42.5%)</td>
<td>23(57.5%)</td>
<td>40</td>
</tr>
</tbody>
</table>

Regarding gender distribution our study revealed that ten (25%) of them were females eight of them (80%) approached laparoscopically whether exclusively or converted while only two (20%) were approached by open while male gender were thirty (75%) from them nine (30%) approached by laparoscopy and twenty one (70%) were open. the male to female ratio was 3:1 with (pvalue<0.001) which is statistically significant.
Regarding age group we found that in (18-30) age group we had five cases (12.5%) were females while the male in this age group were twelve (30%) this is followed by pediatric age group below eighteen years old was nine (22.5%)

<table>
<thead>
<tr>
<th>Age(years)</th>
<th>&lt;18</th>
<th>18-30</th>
<th>31-40</th>
<th>41-50</th>
<th>51-60</th>
<th>&gt;60</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>6(15%)</td>
<td>12(30%)</td>
<td>7(17.5%)</td>
<td>2(5%)</td>
<td>1(2.5%)</td>
<td>2(5%)</td>
<td>30(75%)</td>
</tr>
<tr>
<td>Females</td>
<td>3(7.5%)</td>
<td>5(12.5%)</td>
<td>&lt;(0.0%)</td>
<td>1(2.5%)</td>
<td>1(2.5%)</td>
<td>-(0.0%)</td>
<td>10(25%)</td>
</tr>
<tr>
<td>Total</td>
<td>922.5%</td>
<td>1742.5%</td>
<td>7(17.5%)</td>
<td>3(7.5%)</td>
<td>2(5%)</td>
<td>2(5%)</td>
<td>40(100%)</td>
</tr>
</tbody>
</table>

Regarding cases that are started with laparoscope then converted to open approach in our study we got nine cases (22.5%) were converted to open laparotomy, from these cases we had six cases (66.6%) where profuse haemoperitoneum from which four of them were mesenteric injuries while other two, one of them liver injury and other was splenic injury, the other two bowel injuries one of them was small bowel injury and other was large bowel injury, only one (11.1%) was urinary bladder injury

<table>
<thead>
<tr>
<th>Reasons for Conversion</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profuse Haemoperitoneum</td>
<td>6 (66.6%)</td>
</tr>
<tr>
<td>Bowel Injuries</td>
<td>2 (22.2%)</td>
</tr>
<tr>
<td>Urinary Bladder Injury</td>
<td>1 (11.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>9 (22.5%)</td>
</tr>
</tbody>
</table>

Regarding the period of hospitalization, the eight cases managed laparoscopically, six of them (15%) kept in hospital from one-three days postoperatively while the other two cases which approached by laparoscope were hospitalized more than seven days because they had extra-abdominal injuries one of them extremity injury who required two orthopedic surgeries, the other case had head injury and required close monitoring in the intensive care unit (ICU), while regarding open approach only six (15%) were one-three days and the other were 12(30%) for four-seven and more than seven days
About the duration of the operation we found that duration of the laparoscopic procedures (diagnostic or therapeutic) were shorter and we found that the duration of operation were significantly short when compare open and conversion groups [table 5].

<table>
<thead>
<tr>
<th>Days</th>
<th>No. of patients</th>
<th>Lap.</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>6(15%)</td>
<td>6(15%)</td>
<td></td>
</tr>
<tr>
<td>4-7</td>
<td>-</td>
<td>12(30%)</td>
<td></td>
</tr>
<tr>
<td>&gt;7</td>
<td>2(5%)</td>
<td>12(30%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 died in ICU</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

Regarding open operative procedures there were eighteen cases bleeding control, which involve liver and splenic injuries, mesenteric injuries, while nine cases were bowel injuries with resection and anastomosis while in laparoscopic procedure we had one case of liver injury with bleeding controlled with cauterization and tube drain placed, one case with intra-abdominal ruptured hydatid cyst which treated by excision (deroofing), we had one case stomach injury which was sutured laparoscopically, two cases no findings identified and two cases simple haemoperitoneum found but no interference needed and one case splenic subcapsular hematoma identified kept in place [table 6].

<table>
<thead>
<tr>
<th>Operative Procedure</th>
<th>No. of Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusively Laparoscope</td>
<td></td>
</tr>
<tr>
<td>Liver injury suturing</td>
<td>1</td>
</tr>
<tr>
<td>No positive finding</td>
<td>2</td>
</tr>
<tr>
<td>Ruptured hydatid cyst</td>
<td>1</td>
</tr>
<tr>
<td>Stomach injury suturing</td>
<td>1</td>
</tr>
<tr>
<td>Small bowel inj. suturing</td>
<td>1</td>
</tr>
<tr>
<td>Positive Finding Without Interference</td>
<td>2</td>
</tr>
<tr>
<td>Open Laparotomy</td>
<td></td>
</tr>
<tr>
<td>Bleeding control</td>
<td>18</td>
</tr>
<tr>
<td>Segmental Resection of Small Bowel</td>
<td>9</td>
</tr>
<tr>
<td>Loop Colostomy</td>
<td>3</td>
</tr>
<tr>
<td>Diaphragm Injury Repair</td>
<td>4</td>
</tr>
<tr>
<td>Stomach Injury Suturing</td>
<td>2</td>
</tr>
</tbody>
</table>

Eight patients with extra-abdominal injuries who managed laparoscopically we found four cases had head and neck injuries, one with chest injury and five with limbs injuries [table 7].

Trauma is still one of the main causes of death and injury and is the most significant cause of mortality for young people under 40[3]. Immediate management of abdominal injuries consists of resuscitation and evaluation. Patients in shock require resuscitations with crystalloid solutions and blood products, as well as a rapid assessment for the sources of bleeding, according to ATLS protocol [13].

Nowadays the surgical practice is directed toward the minimal invasive intervention, for hemodynamically stable patients, laparoscopy can play an important role in the diagnosis and treatment of blunt and penetrating trauma[3,11]. It’s considered as an additional tool that has been used more recently, mainly to establish or exclude the presence of peritoneal penetration, but others mentioned that diagnostic laparoscopy remains fairly well accepted that it’s in most hands not sufficient to explore the entire abdomen (there will be missed injury) but it can be used to identify violation of the parietal peritoneum, which can then prompt laparotomy to address injuries [13,15] we found that in trauma patient whether blunt or penetrating (except in case of bullet injury) laparoscopy is highly beneficial in evaluation of intra-abdominal organs injuries and this will reduce the negative laparotomy (supposing that patient is vitally stable) and this is agreed by Heng-Fu Lin, et al., reporting a research and finding that Laparoscope is feasible and healthy for patients with hemodynamically stable blunt hollow viscus and mesenteric injuries and also this proved by Selman Uranus et al., who claimed that laparoscopy can be used effectively and safely in healthy trauma patients and this greatly reduced negative laparotomy, cost-effectiveness, morbidity and hospital stay [14,15]. In addition to these conclusions there is wider uses of laparoscopy in trauma patients like a study by Sosa who confirmed 121 consecutive gunshot abdominal wounds was treated with laparoscope. 79 (65%) had adverse laparoscopy and these patients were diagnosed without laparotomy, about 7.2% refused non-interventional laparotomy[1]. So most of authors and in our practice in hemodynamically unstable trauma patient whether blunt or penetrating injury there is no role to start with laparoscopy but can be assessed by other examinations like FAST or depend on clinical findings and shift patient to laparotomy.

Diaphragmatic injuries if not diagnosed and treated promptly then it will end with diaphragmatic hernia and will be difficult to be repaired later on. On the other hand, presence of diaphragmatic injury can be risky to patient to undergo laparoscopic interference as it may lead to tension pneumothorax unless it treated promptly by chest tube at side of diaphragmatic tear [10]. Laparoscopy may then be used for medical as well as therapeutic uses. In our study we had nine cases converted from laparoscopic approach to open laparotomy mainly because of profuse haemoperitoneum resulted from splenic or liver injuries which obscured the visualization that necessitate conversion and this matter can be avoided (avoidable causes of conversion) by improving the level of skills for the surgeon and for the assistant staff, and by improving the advanced instrumentations like suction system, monitor HD and so on.

On the other hand, other cause of the conversion we faced was the presence of small bowel injuries, again this is another avoidable cause of conversion and this is by improve skills and provision of laparoscopic staplers which encourage the therapeutic laparoscopy. This is proved by study done by Matsevych OY et al., where he had small bowel repair, resection and anastomosis of the most cases in his study, rate of therapeutic laparoscopy was 73% [17].

Improvement of laparoscopic interference in the casualty will improve skills and be beneficial to trauma patient to reduce conversion rate as we had one case in our study with urinary bladder injury which is can be dealt laparoscopically with the availability of skilled well-trained personnel.

We found that therapeutic laparoscopy beneficial even with unordinary emergency cases in trauma that we had cases of post trauma intra-abdominal ruptured hydatid cyst which treated laparoscopically by suction of the contents and excision of the cyst and wash of the abdominal cavity with normal saline and surgery outcome was encouraging.

About the period of hospitalization it’s much shorter with laparoscopy even it was therapeutic laparoscopy and this agreed with what Zafar SN et al. reported in his retrospective study that patient undergone laparoscopic approach had significantly lower hospital stay as compared with those undergone open approach [18].

**DISCUSSION:**

**Table 7 Extra-Abdominal Associated Injuries**

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>No. of Patient</th>
<th>Lap.</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head and Neck</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Chest</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Limbs</td>
<td>5</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>

Regarding complications of laparoscopic surgery

- First of all were complications of general anesthesia and this matter is specifically important in our study because we were dealing with trauma patient who had significant insult to the normal physiology of the body although some reported cases done under spinal anesthesia and even under local anesthesia, and there is report about bed side laparoscope.[19].
- Second one is missed injuries in laparoscopy that include bowel, vascular, bladder injuries and so on. That’s we didn’t record any case of missed injury but Tammy Kindelet al. in his study recorded significant missed injuries [20].
- Other less common events is trauma induced by laparoscopy these trauma occurs even in most skilled surgeons one of it is off-screen injuries, heat transmission by using electro cautereization and else.

**CONCLUSIONS:**

From our study we concluded that:

1. One of the most important tools that is used to manage the blunt abdominal injury (BAI) is laparoscope.
2. Laparoscope is a good preventive measure of negative laparotomies.
3. It’s important measure in diagnosing and even treating diaphragmatic injuries.
4. Traumatic bowel injuries can be diagnosed and even treated by laparoscopic approach.
5. The presence of profuse hemorrhage make continue on laparoscopic approach is nonjudges.

**RECOMMENDATIONS:**

a. We highly recommend use of laparoscope as tools in order to treatment the trauma patients.
b. Encouragement and improvement of emergency theatre teams with proper instrumentations and advanced skills of laparoscopic procedures to increase the percent of laparoscopic therapeutic interventions.

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