INTRODUCTION

Abdominal pain is the commonest complaint requiring emergency surgical admission. The patient with acute abdominal pain requires detailed investigations but diagnosis can still remain uncertain. Moreover significant variations are noted in clinical features, laboratory and imaging studies with respect to age, sex and associated co-morbidities and added that one third of patients have non-specific abdominal pain. These difficulties notwithstanding, the surgeon must make a decision to operate or not. Once the decision for surgery has been made, the surgeon must choose the approach - laparotomy or laparoscopy

• Pain that lasts for 6 hours or longer is usually caused by diseases of surgical pathology

• Primary goals in the treatment of patients with acute abdominal pain:
  -to arrive at a differential diagnosis and plan for confirming the diagnosis through appropriate investigations
  -to determine whether surgical intervention is necessary
  -to prepare the patient for operation and to minimize the perioperative morbidity and mortality
The emergence of laparoscopy as a realistic diagnostic and therapeutic tool heralded a new surgical age. There was considerable reduction in post-operative pain, days of hospital stay, wound infections and costs. The success of laparoscopy in the field of gynaecology for sterilisation and hysterectomy led to its application in surgical cases like gall bladder disease and later in treating malignancy and trauma care. In the beginning laparoscopy was used only for elective surgery but as technology and surgical experience widened it was introduced into the emergency setting also. Laparoscopic surgery is now considered as invaluable tool in many abdominal surgeries such as acute appendicitis, trauma, perforated peptic ulcer disease and acute pancreatitis and this list seems set to expand further.

There are two different clinical scenarios for which laparoscopy can be used in emergency department for acute abdominal pain. The first is that a provisional diagnosis is reached following examination and investigations and specific procedure is planned accordingly. The second is that abdominal pain of uncertain etiology where a diagnosis is not achieved after relevant investigations and thus the role of laparoscopy in such cases will be diagnostic.
Laparoscopy helps in both the evaluation of acute abdominal pain of uncertain etiology and the treatment of the same. Laparoscopic surgery is firmly established as the procedure of choice in acute appendicitis, acute cholecystitis and gynaecological emergencies.
AIMS AND OBJECTIVES

-To assess the accuracy of diagnostic laparoscopy to identify the cause of acute abdomen not diagnosed by imaging.

-To assess the efficacy of laparoscopy in ascertaining treatment after diagnosis

-To assess the ability to avoid unnecessary non-therapeutic laparotomies.
REVIEW OF LITERATURE

HISTORY OF LAPAROSCOPIC SURGERY:

In 1805, Bozzini designed the first modern day endoscope, “LICHTLEITER” by using the light of a candle directed to the tube containing reflecting mirrors for visualisation of urethra and vagina.

In 1856, Antonie Jean Desormeaux, the French surgeon introduced a versatile endoscope that burned “gazogene”, a mixture of alcohol and turpentine for producing light.

In 1879, Maximillian Nitze developed cystoscope with series of lenses and platinum wire as a light source.

In 1901, George Kelling, the German surgeon was the first to use cystoscope in a living dog. He named the procedure as “koiloscope”. He also performed the first human laparoscopy.

After World War 1, Zollikofer of Switzerland advocated the use of CO₂ for insufflations instead of air.

In 1936, Boesh, the Swedish surgeon performed the first laparoscopic tubal ligation with electrocoagulation.

In 1938, John Veress developed a spring loaded needle for creation of pneumothorax in patients with tuberculosis.
In 1940, Raoul Palmer, the French surgeon conceived the importance of continuous intra abdominal pressure monitoring during pneumoperitoneum and the use of gravity to assist in retraction.

In 1952, the development of fiberoptic light by Foriestier and the rod lens system by the British doctor Hopkins was a major shift from the prevailing endoscopes with long air segments between them.

In 1966, Kurt Semm, a German gynaecologist invented the automatic insufflators that was capable of monitoring and maintaining adequate intraabdominal pressure.

He also performed the first laparoscopic appendicectomy during a gynaecological procedure.

In 1971, Hasson from Chicago, USA published a report on his alternative and safe access by a specially designed cannula.

In 1986, Warshow used laparoscopy to identify the stages of cancer of pancreas.

In 1986, the revolution in endoscopic technology took place when a group of Japanese engineers constructed a matrix which allowed transferring video signals to the monitors.

In 1985, Eric Muhe from Germany first performed the operation of laparoscopic cholecystectomy by using veress needle technique.
The word laparoscopy is derived from two words.

“Laparo” means Abdomen; “scopy” means to visualize

Laparoscopy is defined as endoscopic visualization of the internal abdominal organs.

**EQUIPMENTS:**

(1) **THE CAMERA:**

The camera is the vital part of imaging system. It contains a manual focus, zoom and white balance. The resolution of previously available tube cameras were low. The present day cameras use charged coupled device (CCD). The CCD contains silicon wafer which are divided into multiple tiny sensors called pixels. These light sensitive elements transform the incoming light signals into electronic signals depending on energy of light. The resolution of the camera is directly proportional to the number of pixels it contains.\(^{(1)}\) In a single chip camera colour sensors are provided in a single chip and the monitor resolution for these cameras is around 400-600lines. The currently available cameras are 3 chip ones that require a monitor resolution of 950 lines. A unified light is split into red, green and blue by a prism located in the head of camera. These signals are captured by separate CCD’s which contain multiple sensors.\(^{(2)}\) The information is broken down into binary code and after further processing like
filtering, noise reduction, data compression and resolution enhancement, the final image is sent to the monitor. The currently available cameras have capability of producing videos with resolution as high as 950 lines.\(^{(3)}\)

All these cameras need white balancing before introduction into abdomen to get a true colour image of the internal organs. During white balancing the camera is calibrated against a white light as a reference value. The manual focus should be adjusted at the beginning of every operation and should be fine tuned for the distance from the scope and the organs that have to be dissected.\(^{(4)}\)

Placement of two separate video monitors, on the either side of the operating table allows all members of the surgical team to have an unobstructed view of the operation. Additional monitors may be useful for some advanced laparoscopic procedures. Now a days three dimensional (3D) cameras are available which have incorporated stereoscopic vision into imaging technology.\(^{(5,6)}\)
(2) LAPARASCOPE:

Hopkins invented the laparoscope in 1952. They used thin lens system and the images produced by them were of inferior quality due to insufficient light and poor quality. The present day scopes have series of rod lens in the center with rim of optical fibres on the outer aspect. 10mm scopes are routinely used for most surgeries. There are various types of laparoscopes based on the size and the angle of vision like forward viewing laparoscope (0 degree), angled view scopes (30, 45 degree). The angled view scopes provide a flexible field of vision when compared to the forward viewing ones. These scopes provide an unobstructed view of the dissecting area from a distance. It allows more space for the manoeuvrability of instruments and has ability to look around the corners. The camera which is attached to the proximal end of the
laparoscope captures these images and processes it and displays it on the monitor. The rod Hopkins system provide an excellent field of vision with minimal distortion.\(^{(7)}\) The size varies from 0.8 to 14mm in diameter. The brightness of the image reduces with the reduction of size of the scope. A 5mm scope generally transmits only 10% of the light as a 10mm scope.

\[0^0\text{ and } 30^0\text{ scopes.} \]

(3) LIGHT SOURCES:

A light source helps in producing images with bright and even illumination. There are two types of light sources, halogen and xenon. The xenon 300 watts lamp produces an intense image of light that closely approximates the sun and it is the standard light source for laparoscopic surgery. Although they are cold light sources, the condensed light at tip produces considerable heat that may burn drapes or internal organs or produce thermal injury to the organs. These are costly and approximate life of these xenon bulbs are around 500 hours.
(4) LIGHT CABLES:

Light is transmitted from light source to area of dissection through light cable. They are two types fluid filled and the fibre optic cables. The entire length of the cable must be intact to obtain a brighter field of vision. The fluid filled cable transmit greater amount of light and conduct more heat than fibre optic cables. The other disadvantages are the stiffer nature that cause hindrance in manoeuvring the angled scopes, inability to autoclave and their fragile nature. The fibre optic cables are more user friendly and the individual fibres are susceptible to damage. A cable with more than 25% of the fibres should be replaced.
(5) INSUFFLATOR:

The working space can be created by either pneumoperitoneum or by abdominal lift systems. In 1966, Kurt Semm introduced the concept of automatic insufflation devices that are capable of monitoring intra abdominal pressures. The intra abdominal pressures must be maintained at 12-14mm Hg to avoid complications such as gas embolism or drop in blood pressure. The modern day insufflators are designed to deliver high volume of gas into the abdominal cavity at a predetermined flow rate. They monitor the pressure continuously and halt the flow once the set pressure is reached. The devices should be capable of delivering at least 10L/min of gas per min. The indicators on the insufflator denote all the vital information that is
needed for the surgeon like intra abdominal pressure, rate of inflow of gas and volume of gas used from the cylinder.

(6) IRRIGATION DEVICE:

They are important particularly for maintenance of clear visual field and hemostasis. Even small quantity of blood will absorb a great deal of light and cause insufficient illumination. Most manufacturers incorporate irrigation and aspiration into a single dual control unit. Heparin can be used in the irrigation fluid to prevent pooled blood from clotting and facilitate its removal during suctioning.
(7) ELECTROCAUTERY:

In laparoscopic surgery, electrosurgery is one of the most commonly used energy systems. The laparoscopic electrosurgical injuries are more common when compared to conventional surgery. Stray electrical energy can escape from monopolar instruments causing serious burns and tissue damage, including bowel perforation. They often go unnoticed and present with extremely difficult patient management challenges. Stray currents occur as a result of various mechanisms such as insulation failure, direct coupling or capacitance coupling. These devices are used for securing hemostasis. They must be used with utmost care to prevent injury to bowel or other organs. They can be mono-polar or bipolar. The mechanisms of injury are
1. Direct application
2. Insulation failure
3. Direct coupling
4. Capacitive coupling injuries
5. Alternate ground pad burns.

**INSTRUMENTS:**

The main difference between conventional and laparoscopic instruments is the presence of long shafts and the attached handgrip. The effectors retain the same basic design as the conventional instruments. They are usually 33cms long for its effective reach in the abdominal cavity. They are either disposable or reusable.

(1) **Veress needle:**

Veress needle is commonly used to induce pneumoperitoneum. It has a spring loaded blunt tip that retracts into a sharp sheath which penetrates the fascia and the peritoneum. The central sheath has a connector for the insufflation tube.\(^{(8)}\) The needles are available in various diameters and lengths. The diameter of the needle is 2mm and length is usually 12-15cms.\(^{(9)}\) It does not
allow more than 2.5 L of CO₂ and serves as protection against vagal shock and arrhythmias.

(2) Cannula and Trocars:

They serve as the pathway to the abdominal cavity through which the various instruments are introduced. They can cause major vascular injury which is the important cause of death in laparoscopic surgery. \(^{(10)}\) The sizes are 10 mm, 5 mm and 3 mm. They may be disposable or reusable. The trocar has a pyramidal or conical tip. The optical view trocar has a clear shaft and conical tip. The laparoscope can be inserted into the trocar and the trocar can be pushed under visual guidance. \(^{(11)}\)
(3) **Grasper:**

They can be non toothed or toothed used for retraction and extraction of gall bladder.
(4) Dissectors:

The Maryland dissector is used in calot’s dissection, isolation of vascular pedicles and hernia surgery. The right angled is used in difficult areas. They are basic instruments for dissection, either single action or double action jaws are used. Others are Kellys dissector, Dolphin nose dissector.

(5) Scissors:

Scissors can be curved or straight one. They are used in dissection, division of vascular pedicles after ligation and sutures.

(6) Convertors or reducers:

They are tubes that are placed in 10mm to reduce the diameter of the trocar to prevent the escape of pneumoperitoneum.
PNEUMOPERITONEUM:

(1) CLOSED TECHNIQUE BY VERESS NEEDLE:

The patency of the needle is first checked by flushing saline through the needle. A transverse or vertical stab is made with a knife till rectus is reached. The abdominal wall is lifted with left hand midway between pubis symphysis and umbilicus while the Veress needle is inserted at 45° toward the pelvis so as to prevent injury to aorta and IVC. There is initial resistance followed by give way. There is a click once the needle enters the peritoneal cavity. The confirmation of needle position is by

**Drop test:** A drop of saline is placed on the top of the veress needle and fluid is sucked into the peritoneal cavity by the negative pressure created inside.

- Blood, bile or faeces should not be aspirated
- Free flow of fluid into the abdominal cavity.
- Zero or negative pressure on insufflator display.

The insufflator tube is connected to the veress needle which delivers the CO₂ at a rate of 1l/min. The pressure is maintained at 10-12mm of Hg. 2-3 litres of gas is usually required for an average adult to create pneumoperitoneum.
abdomen becomes tympanic to percussion and there is obliteration of liver dullness.

(2) OPEN HASSON’S TECHNIQUE:

This method is employed to decrease the incidence of injuries associated with blind veress needle technique. An infra or suprumbilical incision (1-3cm) is made and subcutaneous tissue is bluntly dissected. Two clamps are used to lift the linea alba. A vertical defect of size 1.5cms is made. The peritoneum is held with a haemostat and incised. Two absorbable sutures
are placed on either side of the fascial defect. Then the Hasson cannula with its blunt obturator is advanced into the peritoneal cavity and the obturator removed and the sutures are firmly attached to create a seal with the fascia. Then the laparoscope is introduced.

In small children and infants the umbilicus must be avoided because umbilical abnormalities may be expected in a large percentage of cases. Veress needle and trocar are placed in the suprapubic area lateral to the rectus muscle on the left side. This point is called “point of Munro”.

The open technique for trocar insertion is recommended if a patient presents with severe abdominal distention.
**Choice of insufflating gas:**

Many gases such as air, CO₂, nitrous oxide, helium and argon are available. The following characteristics constitute an ideal insufflating agent:

- should be colourless, inert and non-explosive
- agent’s solubility should be low in the peritoneal cavity
- solubility in the blood should be high
- should be readily available, non-expensive and non-toxic.

**Air:**

Air was the first gas used to produce pneumoperitoneum. The main disadvantage is air embolism. As little as 300ml in the venous circulation and 1ml of air in the coronary circulation may lead to death.

**Carbondioxide:**

CO₂ is an odourless, colourless gas. It is most commonly used gas for insufflations during laparoscopic procedures. It dissolves rapidly in the bloodstream and has a greater safety margin. It is associated with relatively low risk of venous gas embolism and does not support combustion in the presence of electrocautery. The main disadvantages are acidosis and hypercarbia. CO₂ diffuses across the peritoneum into the blood stream, which is carried away by the blood and eliminated by the lungs. It takes several hours to be eliminated after a long laparoscopic procedure. The direct effect of CO₂ and acidosis can
lead to decrease in cardiac contractility, pulmonary hypertension and systemic vasodilatation.

**Nitrous oxide:**

Nitrogen is a biologically important, colourless, gaseous element found freely in the air. It is much more soluble in blood and body fluids. This gas is associated with insignificant changes in acid base balance and decreases pain. It can support combustion.\(^{(12)}\)

**Helium:**

It is a colourless, tasteless gas that is obtained from natural gas. It is neither combustible nor supports combustion. It has minimal effect on acid base balance and the absence of association with hypercarbia and acidosis.

**Argon:**

It is a colourless, odourless, non-combustible, chemically non reactive. It is a good alternative to CO\(_2\) in patients with decreased respiratory reserve.
**COMPLICATIONS:**

The overall morbidity and mortality related to laparoscopic access are low. It is difficult to define which technique is better. Surgeons must make decisions regarding the most appropriate access technique based on their own skills and training.

1. **Bleeding:**

   Usually inferior epigastric artery is vulnerable to injury, which may be controlled by direct compression by the trocar or suture ligation or Foley’s catheter tamponade.

2. **Visceral injury:**

   If only needle puncture alone is present which is shown by leakage of turbid yellow fluid, the needle may be removed and reintroduced at a different place. In case of trocar laceration, it is better to suture the bowel either laparoscopically or by a minilaparotomy.

3. **Major vascular injury:**

   Vessels like aorta, inferior vena cava, iliac vessels may be injured. If central or retroperitoneal expanding hematoma occurs, the surgery should be immediately converted to open surgery. Mesentric hematoma may be left as such.
PORT LOCATION:

A three-port approach can be used

10mm: umbilical

5mm or 10mm: suprapubic or left iliac fossa

5mm: right hypochondrium

The secondary ports are inserted under laparoscopic vision. The usual site for insertion of the trocar for diagnostic laparoscopy is above the umbilicus. This position may be changed in the presence of previous surgical scars. Once the abdomen is entered the first thing to be done is to check for damage caused by trocar insertion.
PAIN PATHOPHYSIOLOGY:

When categorized, pain may be considered *visceral* or *somatic* depending on the type of afferent nerve fibres involved. Additionally, pain may be described by the neurophysiologic steps that produce it and can be defined as *inflammatory* or *neuropathic* (13). Both categorizations are helpful in diagnosing the underlying sources of pain and selecting effective treatment.

The gate control theory, promulgated by Melzack and Wall in 1965, allowed integration of physical and psychologic parameters, and explained how chronic pain can be quite different from acute pain.

The model also suggests that information regarding pain flows in two directions: (i) nociceptive signals from peripheral tissue travel through the spinal cord to higher centers and (ii) central centers can modulate, via descending signals altering spinal cord neurotransmitter and interneuron activity, the transmission of these nociceptive signals from the periphery.
FIGURE . The gate control theory of pain perception.

FIG. Viscerosomatic convergence. Nociceptive impulses originating from a viscera may impact dorsal horn neurons that synapse concurrently with
peripheral somatic nerves. These impulses may then be perceived by the brain as coming from a peripheral somatic source rather than the viscera.

Acute pain indicates ongoing tissue damage and resolve as the tissues heal. In chronic pain, additional factors are also involved and pain may persist for long time after the tissue injury or continue even in the absence of such stimuli. Major changes are seen in both afferent and efferent nerve pathways in the central and peripheral nervous systems. Local hormones or factors like tumour necrosis factor alpha (TNF-α) and inflammatory cytokines may induce changes in peripheral nerve function or stimulate normally inert fibres, resulting in pain sensation over a larger area than originally affected. A persistent flow of pain may lead to changes in the central nervous system, which amplify the original signal.\(^{(14)}\) Descending information from the central nervous system, possibly influenced by previous experiences and current circumstances, may modify pain perception and visceral function. Alteration in visceral sensation and function, provoked by a variety of neurological factors, has been termed ‘visceral hyperalgesia’. Nerve damage caused by surgery, trauma, inflammation, fibrosis or infection may play a part in this process.\(^{(15,16)}\) Pain as a result of changes in the nerve itself is termed ‘neuropathic pain’ and is characteristically burning, aching or shooting in nature.\(^{(17)}\)
**Somatic Pain**

Somatic pain is carried by A delta fibres stems from nerve afferents of the somatic nervous system, which innervates the parietal peritoneum, skin, muscles, and subcutaneous tissues. This pain is typically sharp, localized, and found on either the right or left within dermatomes that correspond to the innervation of involved tissues.

**Visceral Pain**

Visceral pain is carried by C nerve fibres found in muscle, periosteum, mesentry, peritoneum and viscera and stems from afferent fibres of the autonomic nervous system, which transmit information from the viscera and visceral peritoneum. Noxious stimuli typically involve stretching, distension, ischemia, or spasm of abdominal organs. The visceral afferent fibres that transfer these stimuli are sparse, and the resulting diffuse sensory input leads to pain that is often described as a generalized, dull aching type and poorly localised. Visceral pain often localizes to the midline because visceral innervations of abdominal organs is typically bilateral \(^{18}\). Visceral afferents follow a segmental distribution, and is typically localized by the brain's sensory cortex to an approximate spinal cord level. That level is determined by the
embryologic origin of the organ involved. For example, midgut organs, such as the small bowel, appendix, and caecum, cause periumbilical pain. Hindgut organs, such as the colon and intraperitoneal portions of the genital and urinary tract, cause pain in the suprapubic or hypogastric area (19).

Visceral afferent fibres are poorly myelinated and action potentials may easily spread from them to impact adjacent somatic nerves. As a result, visceral pain may at times be referred to dermatomes that correspond to the impacted somatic nerve fibres (20). In addition, both peripheral somatic and visceral nerves often synapse in the spinal cord at the same dorsal horn neurons. These neurons, in turn, relay sensory information to the brain. The cortex recognizes the signal as coming from the same dermatome regardless of its visceral or somatic nerve origin. This phenomenon, termed viscerosomatic convergence, leads to difficulty in a patient distinguishing internal organ pain from abdominal wall (21).
REFERRED PAIN:

Referred pain is the pain experienced at a site distant from the original organ involved. It is due to the convergence of visceral afferent fibres with parietal afferent fibres from different anatomical regions on second order neurons in the spinal cord at the same spinal segment.

*Figure 1.* Pathways of visceral sensory innervation. Afferent fibers that mediate pain travel with autonomic nerve system to communicate with the central nervous system. In the abdomen, these nerves include both vagal and pelvic parasympathetic nerves and thoracolumbar sympathetic nerves. Sympathetic nerve fibers (red line); parasympathetic nerve fibers (blue lines).
Table 1. Location and causes of referred pain

<table>
<thead>
<tr>
<th>Location</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Shoulder</td>
<td>- Liver</td>
</tr>
<tr>
<td></td>
<td>- Bile duct</td>
</tr>
<tr>
<td></td>
<td>- Right hemidiaphragm</td>
</tr>
<tr>
<td>Left Shoulder</td>
<td>- Heart</td>
</tr>
<tr>
<td></td>
<td>- Caudal pancreas</td>
</tr>
<tr>
<td></td>
<td>- Spleen</td>
</tr>
<tr>
<td></td>
<td>- Left hemidiaphragm</td>
</tr>
<tr>
<td>Scrotum and Testis</td>
<td>- Ureter</td>
</tr>
</tbody>
</table>

Fig: Areas of referred pain in certain surgical conditions like acute cholecystitis, acute appendicitis, perforated duodenal ulcer, pyelonephritis and renal calculi.
**Fig:** Neuroanatomic basis of referred pain

**NON-SPECIFIC ABDOMINAL PAIN:** acute abdominal pain of less than 7 days duration without fever, leucocytosis or peritoneal signs and no definitive diagnosis is arrived after clinical examination and baseline investigations.
Abdominal pain can be characterized by the region it affects.
Table 2. Comparison of common causes of abdominal pain

<table>
<thead>
<tr>
<th>Causes</th>
<th>Onset</th>
<th>Location</th>
<th>Characteristics</th>
<th>Description</th>
<th>Radiation</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendicitis</td>
<td>Gradual</td>
<td>Periumbilical early; RLQ late</td>
<td>Diffuse early, localized late</td>
<td>Ache</td>
<td>None</td>
<td>++</td>
</tr>
<tr>
<td>Cholecystitis</td>
<td>Acute</td>
<td>RUQ</td>
<td>Localized</td>
<td>Constricting</td>
<td>Scapula</td>
<td>++</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>Acute</td>
<td>Epigastric, back</td>
<td>Localized</td>
<td>Blunt</td>
<td>Back</td>
<td>++ to +++</td>
</tr>
<tr>
<td>Diverticulitis</td>
<td>Gradual</td>
<td>LLQ</td>
<td>Localized</td>
<td>Ache</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Perforated peptic ulcer</td>
<td>Sudden</td>
<td>Epigastric</td>
<td>Localized early, diffuse late</td>
<td>Burning sensation</td>
<td>None</td>
<td>+++</td>
</tr>
<tr>
<td>Small bowel obstruction</td>
<td>Gradual</td>
<td>Periumbilical</td>
<td>Diffuse</td>
<td>Cramping</td>
<td>None</td>
<td>++</td>
</tr>
<tr>
<td>Ruptured abdominal aortic aneurysm</td>
<td>Sudden</td>
<td>Abdominal, back, flank</td>
<td>Diffuse</td>
<td>Tearing</td>
<td>None</td>
<td>+++</td>
</tr>
<tr>
<td>Mesenteric ischemia/infarction</td>
<td>Sudden</td>
<td>Periumbilical</td>
<td>Diffuse</td>
<td>Sharp</td>
<td>None</td>
<td>+++</td>
</tr>
<tr>
<td>Gastroenteritis</td>
<td>Gradual</td>
<td>Periumbilical</td>
<td>Diffuse</td>
<td>Spasmodic</td>
<td>None</td>
<td>+ to ++</td>
</tr>
<tr>
<td>Pelvic inflammation</td>
<td>Gradual</td>
<td>LQ, pelvic</td>
<td>Localized</td>
<td>Blunt</td>
<td>Upper thigh</td>
<td>++</td>
</tr>
<tr>
<td>Ruptured ectopic pregnancy</td>
<td>Sudden</td>
<td>LQ, pelvic</td>
<td>Localized</td>
<td>Sharp</td>
<td>None</td>
<td>++</td>
</tr>
</tbody>
</table>

+ = mild; ++ = moderate; +++ = severe; LLQ = left lower quadrant; RLQ = right lower quadrant; RUQ = right upper quadrant
Figure 4. Summary of differential diagnosis for abdominal pain based on its location. IBD=inflammatory bowel
Location

- **Upper middle abdominal pain**
  - Stomach (gastritis, stomach ulcer, stomach cancer)
  - Pancreas pain (pancreatitis or pancreatic cancer, can radiate to the left side of the waist, back, and even shoulder)
  - Duodenal ulcer, diverticulitis
  - Appendicitis (starts here, after several times moves to lower right abdomen)

- **Upper right abdominal pain**
  - Liver (caused by hepatomegaly due to fatty liver, hepatitis, or caused by liver cancer, abscess)
  - Gallbladder and biliary tract (gallstones, inflammation, roundworms)
  - Colon pain (below the area of liver - bowel obstruction, functional disorders, gas accumulation, spasm, inflammation, colon cancer)

- **Upper left abdominal pain**
  - Spleen pain (splenomegaly)
  - Pancreas
  - Colon pain (below the area of spleen - bowel obstruction, functional disorders, gas accumulation, spasm, inflammation, colon cancer)

- **Middle abdominal pain (pain in the area around belly button)**
  - Appendicitis (starts here)
  - Small intestine pain (inflammation, intestinal spasm, functional disorders)

- **Lower abdominal pain (diarrhea and dysentery)**

- **Lower right abdominal pain**
  - Cecum (intussusception, bowel obstruction)
  - Appendix point (Appendicitis location)

- **Lower left abdominal pain**
  - Sigmoid colon (polyp), sigmoid volvulus, obstruction or gas accumulation
• Pelvic pain
  • bladder (cystitis, may secondary to diverticulum and bladder stone, bladder cancer)
  • pain in women (uterus, ovaries, fallopian tubes)
• Right lumbago and back pain
  • liver pain (hepatomegaly)
  • right kidney pain (its location below the area of liver pain)
• Left lumbago and back pain
  • less in spleen pain
  • left kidney pain
• Low back pain
DIFFERENTIAL DIAGNOSIS OF ACUTE RIGHT LOWER QUADRANT ABDOMINAL PAIN

GI CAUSES:

1. appendicitis
2. mesenteric adenitis
3. terminal ileitis
4. meckel’s diverticulitis

GYNAECOLOGICAL CAUSES:

1. Acute salpingitis
2. pelvic inflammatory disease
3. Ruptured ovarian cyst
4. tubo ovarian mass
5. infarcted uterine myoma
6. Adnexal torsion
7. ectopic pregnancy
ACUTE APPENDICITIS:

HISTORY:

The human appendix was not noted until 1492. Leonardo da Vinci depicted the appendix in his anatomic drawings, but these were not published until the eighteenth century. In 1521, Berengario Da Capri and in 1543, Andreas Vesalius published drawings recognizing the appendix. Credit is given to Jean Fernel for first describing appendiceal disease in a paper published in 1544. Lorenz Heister provided the first description of classic appendicitis in 1711.

The first known appendectomy was performed in 1736 by Claudius Amyand in London. He operated on an 11-year-old boy with a scrotal hernia and a fecal fistula. Within the hernia sac, Amyand found a perforated appendix surrounded by omentum. The appendix and omentum were amputated. The patient was discharged a month later in good condition.
EMBRYOLOGY:

The appendix first appears during second month of gestation as a diverticulum from the terminal portion of the caecum. The growth rate of the caecum is faster than the appendix, and so the appendix is displaced medially towards the ileocaecal junction. The base of the appendix remains constant to the position of caecum, while the tip can be found in a retrocaecal, pelvic, subcaecal, preileal, or postileal.
The appendix can vary in size and the average length is 6 to 9 cm. Anomalies of the appendix like absence, doubling have been described in the literature.\textsuperscript{22–25}

**BLOOD SUPPLY:**

The appendix is supplied by the appendicular branch of the ileocolic artery, which emerges posterior to terminal ileum and enters the mesoappendix near the base.
Reginald Fitz, a professor of anatomy at Harvard, first coined the term *appendicitis*. He identified that appendix is the common cause of right lower quadrant inflammation.26

**PHYSIOLOGY:**

For many years, the appendix was erroneously believed to be a vestigial organ with no known function. It is now well recognized that the appendix is an immunologic organ that actively participates in the secretion of immunoglobulins, particularly immunoglobulin A. Although there is no clear role for the appendix in the development of human disease, an inverse association between appendectomy and the development of ulcerative colitis has been reported, suggesting a protecting effect of the appendectomy. However, this association is only seen in patients treated with appendectomy for appendicitis before age 20.
MICROBIOLOGY:

Appendicitis is a polymicrobial infection. The most common organisms are *Escherichia coli* and *Bacteroides fragilis* \(^{46-50}\)

Elderly patients with appendicitis present with difficulty in diagnosis because of the atypical presentation and many differential diagnosis. So there is high chances of perforation in the elderly. Fusobacterium nucleatum/necrophorum, which is not present in the normal caecal flora, has been identified in 62% of inflamed appendices. In addition to the other usual species (Peptostreptococcus, Pseudomonas, Bacteroides splanchnicus, Bacteroides intermedius, Lactobacillus), previously unreported fastidious gram-negative anaerobic bacilli have been encountered. Patients with gangrene or perforated appendicitis appear to have more tissue invasion by Bacteroides.

Obstruction of the lumen is the most common cause of acute appendicitis. Faecoliths are the most common cause of luminal obstruction followed by hypertrophy of lymphoid tissue. The frequency of obstruction rises with the increasing severity of the inflammatory process. Faecoliths can be found in acute simple appendicitis, gangrenous appendicitis with or without perforation and normal subjects.
Despite the use of ultrasonography (USG), computed tomography (CT), the rate of misdiagnosis of appendicitis (15.3%), and also the rate of appendiceal rupture has remained constant. The percentage of misdiagnosed cases of appendicitis is significantly higher among women than men (22 vs. 9%). The negative appendicectomy rate for women of reproductive age group is 23%. (27,28)
CLINICAL FEATURES:

The primary symptom of acute appendicitis is abdominal pain. First pain starts in the umbilical area, which is moderately severe and crampy. After a period of 12 to 24 hours, pain localizes to the right lower quadrant which is called as migratory pain, classical of appendicitis.

Anorexia always accompanies appendicitis. Vomiting occurs nearly in two-thirds of the patients. Vomiting is caused by both central stimulation and paralytic ileus due to inflammation.

Some patients give a history of constipation beginning. Diarrhea can occur particularly in children, due to irritation of the bowel by inflamed appendix. Frequency of micturicition is caused by pelvic appendix.

INVESTIGATION:

X-RAY:

Plain x-rays of the abdomen taken as part of the general evaluation of a patient with acute abdominal pain, are of little help in the differential diagnosis of acute appendicitis. The exceptions are when a faecolith is demonstrated and
when other diagnoses such as acute cholecystitis, perforating duodenal ulcer, perforating colon cancer, acute diverticulitis, and pyelonephritis are being excluded. The presence of faecolith is highly indicative of the diagnosis. A chest x-ray is advised to rule out pain referred from a right lower lobe pneumonia.

**USG:**

ultrasonography is an accurate method used to diagnose cases of appendicitis. The technique is not expensive, can be rapidly performed even bedside by the surgeon himself, does not require a contrast material, and safe in pregnant patients. The diameter of the appendix is measured in the anteroposterior dimension with compression. Features suggestive of appendicitis if a noncompressible appendix greater than 6 mm in the anteroposterior direction is identified. The presence of an faecolith highly favours the diagnosis. Thickening of the appendix wall and the presence of periappendiceal fluid is a sign of early mass formation or perforation. Features of a normal appendix are easily compressible, blind-ending tubular structure measuring less than 5 mm in diameter. USG is inconclusive if the appendix could not be traced. When the diagnosis of acute appendicitis is excluded by sonography, other parts of the abdomen must be examined carefully to identify the etiology of acute
abdominal pain. In females, particularly in childbearing age, the pelvic organs must be thoroughly examined either by transabdominal or transvaginal ultrasonography to exclude gynaecological pathology as a cause of acute abdominal pain. USG has sensitivity of 55 to 96% and a specificity of 85 to 98%. (29–31)

A false-positive scan result are found in periappendicitis due to inflammation in the surrounding organs, a dilated fallopian tube or small bowel can be mistaken for an inflamed appendix and the appendix is not compressible because of overlying excess fat in obese persons. False-negative results can occur if appendicitis is confined to the tip as in early appendicitis, appendix not adequately visualised due to retrocecal location, or the appendix is compressible due to tip perforation. 32
USG of a 10-year-old girl with appendicitis. The anteroposterior diameter measured 10.0 mm in both noncompression (A) and compression (B) views.
COMPUTERISED TOMOGRAM:

Although CT is a potentially useful tool, disadvantages are expensive, patient exposure to radiation, cannot be used during pregnancy, allergy to intravenous contrast agents and intolerance to oral ingestion of water soluble contrast when patient has nausea and vomiting. Finally, CT scanning is not useful in all patients with right lower quadrant pain. (33)
**LAPAROSCOPY:**

Laparoscopy can be used both as diagnostic and therapeutic tool for patients with acute abdominal pain with suspicion of acute appendicitis. Diagnostic Laparoscopy has been in the armamentarium of gynaecological surgeons for many years for evaluation of females with lower abdominal complaints. Laparoscopy helps in differentiating acute gynaecologic pathology from acute appendicitis.
Appendicectomy should be immediately performed for acute appendicitis because of the risk of perforation. The rate of appendiceal perforation is 25%.

In some cases, as the disease process progresses, it may be possible to palpate a tender mass in the right lower quadrant. This is called a “phlegmon”, results from adherence of the omentum and loops of intestine to an inflamed appendix. Patients who present with a mass have symptoms for at least 5 to 7 days. Differentiating acute simple appendicitis from acute perforated appendicitis clinically is often difficult. When appendicitis becomes advanced enough that there is a large, inflamed mass and the anterior abdominal wall is involved, the patient often avoids sudden movements that can cause pain.

The rate of false-negative appendectomies is highest in young adult females. A normal appendix is found in 32 to 45% of appendectomies performed in women 15 to 45 years of age.\(^{(34)}\)

Diagnostic laparoscopy has been employed as a potential tool to decrease the number of negative appendectomies performed.\(^{(35)}\) Women in the reproductive age group with suspected appendicitis are the group of patients most likely to benefit from diagnostic laparoscopy. Most of these patients do not have appendicitis at exploration and a gynaecological pathology is identified.\(^{(36)}\) Diagnostic laparoscopy reduced the number of unnecessary appendicectomies
in these group of patients.\textsuperscript{(37)} So normal appearing appendix in women with identifiable gynecologic pathology can be left all alone.\textsuperscript{(38)}

In one study, 11 (26\%) out of 43 appendectomy specimens described as normal by the surgeon showed acute appendicitis on pathological examination.\textsuperscript{(39,40)} As a result, removal of a grossly normal appendix at the time of appendectomy is recommended.

**TECHNIQUE OF LAPAROSCOPIC APPENDICECTOMY:**

Port positions in laparoscopic appendicectomy
Position of surgeon and monitor in laparoscopic appendicectomy.
Steps of laparoscopic appendicectomy.
LAPAROSCOPIC APPENDICECTOMY:

After creating pneumoperitoneum by veress needle method, ports are inserted as depicted above. First, thorough laparoscopic examination of whole abdomen particularly pelvic organs should be done to rule out other pathology. Appendix is then held with a grasper and mesoappendix dissected and cauterised using electrocautery. The mesoappendix is stripped up to the base. Then 3 knots are applied using endoloop, two near the base and one above. Then the appendix is cut between the above two knots and appendix delivered out through 10mm port. Base of the appendix should be inspected for any bleeding and tightness of the knots should be ensured.

Alternatively, clips can be applied to the base of the appendix by creating a rent in the mesoappendix and appendix removed after ligating or cauterising mesoappendix. The appendix specimen is then placed in an endobag and retrieved out through the 10mm port. In females, a colpotomy can be done and specimen can be retrieved through the pouch of douglas.
GYNAECOLOGICAL DISORDERS:

Diseases of the female reproductive organs that mimic appendicitis are pelvic inflammatory disease, ruptured graafian follicle, twisted ovarian cyst, endometriosis, and ruptured ectopic pregnancy.

PELVIC INFLAMMATORY DISEASE:

The infection is usually bilateral but, if restricted to the right side, it may imitate acute appendicitis. Nausea and vomiting are present in half of those with pelvic inflammatory disease. There is lower abdominal pain and tenderness and movements of the cervix is extremely painful. Intracellular diplococci may be demonstrable on smear of the purulent vaginal discharge. A careful history and clinical examination can differentiate both these conditions.
RUPTURED GRAAFIAN FOLLICLE:

A corpus luteum cyst is the most common cyst to rupture and causes hemoperitoneum. Clinical features are similar to ruptured ectopic pregnancy. Ovulation commonly results in the spillage of blood and follicular fluid into the peritoneal cavity to cause lower abdominal pain. When the amount of fluid spilled is profuse and if it is from the right ovary, it simulates appendicitis. There is diffuse pain and tenderness in the lower abdomen. Leukocytosis and fever are absent. Pain that occurs at the midpoint of the menstrual cycle, is called “mittelschmerz”.

Transvaginal sonogram of a haemorrhagic corpus luteum cyst.
TWISTED OVARIAN CYST:

Simple cysts of the ovary are not uncommon and are asymptomatic. Rupture or torsion of the right-sided cysts mimicks appendicitis. Patients may present with lower quadrant pain, tenderness, fever, and leukocytosis which produces picture of peritonitis. Transvaginal ultrasonography and CT scanning can help in the diagnosis.

Torsion requires emergency operative management. If the torsion of the ovary and tube become gangrenous it requires excision. (41-45)

RUPTURED ECTOPIC PREGNANCY:

An ectopic pregnancy is defined as implantation of the blastocyst in a site other than the uterine cavity. If tubal rupture occurs, initially there is localised pelvic pain which is temporarily relieved and generalized abdominal pain sets in as hemoperitoneum develops. Rupture of right tubal or ovarian ectopic can simulate appendicitis. Patients may give a history of amenorrheoa or vaginal bleeding. Many patients are ignorant of their pregnancy. The first symptom may be the development of right lower abdominal or pelvic pain. The levels of human chorionic gonadotropin are elevated and the pregnancy test is usually
positive. There is leukocytosis, and the hematocrit level falls because of hemorrhage. Per vaginal examination reveals cervical tenderness, and culdocentesis reveals bloody tap. The presence of blood is pathognomonic. The treatment of ruptured ectopic pregnancy is emergency laparotomy, peritoneal lavage and salpingectomy.
MECKEL'S DIVERTICULITIS:

Meckel's diverticulum is the most common congenital anomaly of the small intestine. It results from the patent vitellointestinal duct.

“Rule of 2”:

- It occurs in about 2% of the population

- 2 inches long

- 2:1 female predominance

- Only half of those who are symptomatic are under 2 years of age.

It is located on the antimesenteric border of the ileum 2 feet proximal to the ileocaecal valve.

The incidence is equal among men and women. It may harbour heterotrophic tissue like gastric mucosa. Pancreatic mucosa and colonic mucosa are encountered in about 5% of diverticula.

It is called as ‘true’ diverticula as it contains all the layers of the small bowel.
Figure 67-7  Meckel's diverticulum and other remnants of the yolk stalk.  A, Section of the ileum and Meckel's diverticulum with an ulcer.  B, Meckel's diverticulum connected to the umbilicus by a fibrous cord.  C, Umbilico-ileal fistula resulting from persistence of the entire intra-abdominal portion of the yolk stalk.  D, Vitelline cysts at the umbilicus and in a fibrous remnant of the yolk stalk.  E, Umbilical sinus resulting from persistence of the yolk stalk near the umbilicus. The sinus is not always connected to the ileum by a fibrous cord as illustrated.  F, The yolk stalk has persisted as a fibrous cord connecting the ileum with the umbilicus. A persistent vitelline artery extends along the fibrous cord to the umbilicus.
Most Meckel's diverticula are incidentally discovered during autopsy or laparotomy. The most common presentation of Meckel's diverticulum is gastrointestinal bleeding, which occurs in 25% to 50% of patients. Other common presenting symptom is intestinal obstruction.

Meckel's diverticulitis cannot be differentiated clinically from appendicitis and should be included in the differential diagnosis of a patient with right lower quadrant pain. It may lead to perforation and cause peritonitis. If the appendix is found to be normal during appendicectomy, the terminal 60cms of the ileum should be examined carefully for the presence of an inflamed Meckel's diverticulum.
Treatment

The treatment of a symptomatic Meckel's diverticulum is surgical resection of the diverticulum or resection of the segment of ileum bearing the diverticulum. The treatment of Meckel's diverticulum found incidentally remains ambiguous. It is generally recommended that asymptomatic diverticula found in children during laparotomy should be resected.

![Figure 65.11 Steps in the performance of Meckelian diverticulectomy.](image-url)
TUBERCULOSIS OF THE ABDOMEN:

In 1882, Robert Koch discovered Mycobacterium tuberculosis as the causative agent. It is a potentially fatal contagious disease that can affect any organ in the body. Today, it continues to be a major health problem in many developing countries. Abdominal tuberculosis comprises of infection of gastrointestinal tract, mesenteric lymph nodes, peritoneum, omentum and solid organs. Abdominal tuberculosis is the commonest form of extrapulmonary tuberculosis.

INCIDENCE AND MODE OF SPREAD:

The overall incidence of the disease is increasing along with AIDS. It is more common in old age and poor economic groups. Primary abdominal TB is hyperplastic type and secondary disease is mostly ulcerative. It spreads by different routes to abdomen. If it is by ingestion of contaminated food it is called primary type and secondary is caused by swallowing infected sputum. It can also spread through blood, lymph and bile. In females, a common route is through the genital organs.
CLASSIFICATION:

1. Peritoneal tuberculosis:
   - Ascitic type
   - Fibrous type
   - Peritoneal type - mesenteric adenitis, cysts, abscess, adhesion, omental.

2. Gastrointestinal type:
   - Ulcerative
   - Hyperplastic
   - Fibrotic

3. SOLID ORGAN TUBERCULOSIS:
   - Liver, spleen, gall bladder, common bile duct and pancreas

INTESTINAL TUBERCULOSIS:

   The terminal ileum and ileocaecal junction are commonly involved. This is due to abundant lymphoid tissue, slower rate of absorption and prolonged stasis which provides longer contact time. A mass be palpable in the right iliac fossa.
**Clinical features:**

Abdominal pain, diarrhoea, weight loss, fever, anorexia, vomiting, abdominal distension, borborgymi and abdominal mass.

Complications are intestinal obstruction, malabsorption, perforation and bleeding.

**Investigations:**

- ESR
- Chest X-ray
- sputum AFB
- USG
- colonoscopy
- diagnostic laparoscopy

**Treatment:**

- ATT
- Limited resection of stricturous segment and ileocolic anastamosis.
ADHESIVE COLIC:

Intra abdominal adhesions are common and mostly results from injury to peritoneum after surgery or infection. 95% of patients develop adhesions after laparotomy. They are the most common cause of small bowel obstruction. It is a common cause of infertility in females. Appendicectomy is a common cause of adhesions and in females it is due to previous LSCS or hysterectomy.

Peritoneal injury leads to peritoneal inflammation and production of plasminogen activator inhibitors. This results in loss of peritoneal fibrinolytic activity and organisation of fibrinous adhesions into permanent fibrous adhesions.

Treatment:

Surgical treatment of intestinal adhesions is adhesiolysis. Laparoscopy is replacing laparotomy as the method of choice for adhesiolysis since it is associated with less de novo adhesion formation.

Technique of safe adhesiolysis:

- Adhesions must be stretched and opened up to visualise the local anatomy
- They are least vascular at the point of attachment to anterior abdominal wall rather at the center. So, it must be divided at the point of attachment
- They are best divided using scissors.
Prevention of intra abdominal adhesions:

1. Good surgical technique:
   - gentle handling of tissues
   - starch free gloves
   - minimal use of electrocautery
   - avoiding closure of peritoneum
   - minimising bacterial contamination
   - careful hemostasis
   - use of omentum around the site of surgery

2. Barrier agents:

   These are absorbable or non absorbable membranes or liquids that cover traumatised peritoneal surfaces and prevent adhesion formation. Complete hemostasis should be ensured before its application.

   0.4% Sodium hyaluronate in phosphate buffered saline
   4% Icodextrin
   Oxidised regenerated cellulose
   Expanded polytetrafluoroethylene
   0.5% ferric hyaluronate gel
MATERIALS AND METHODS

STUDY DESIGN:  Prospective study

STUDY SETTING:
Department of General Surgery, Government Stanley Medical College Hospital, Chennai.

SAMPLE SIZE:  50 cases

STUDY PERIOD:  June 2013-June 2014

STUDY POPULATION:
Women attending to Medical College Hospital Surgery outpatient and emergency department with abdominal pain and who fulfill the selection criteria.
INCLUSION CRITERIA:

• first episode of acute pain of >6 hours and <7 days duration.

• associated with tachycardia, nausea, vomiting, fever and loss of appetite.

• diagnosis not established with imaging studies or operative finding is different from pre-op diagnosis.
EXCLUSION CRITERIA:

1. Chronic pain,
2. Acute exacerbation of chronic pain,
3. Proven malignancy,
4. H/o trauma,
5. Diagnosis established with imaging,
6. Pregnancy
7. Contraindications to create pneumoperitoneum
8. Uncontrolled coagulopathy
9. Hemodynamically unstable patients
10. Patient refusing invasive technique [diagnostic laparoscopy]
• **DATA COLLECTION METHOD:**

  Interview, clinical examination and relevant investigation.

• **METHOD OF STUDY:**

  All female patients attending surgical outpatient and emergency service during the study period will be screened to identify the cases of acute abdominal pain. The investigator will apply the inclusion & exclusion criteria. Those meeting the study criteria will be invited to take part in the study and those who give consent will be recruited. Relevant sociodemographic and clinical details will be collected. All subjects will be evaluated as per the flow chart to identify the cause of abdominal pain.
Patient with acute abdominal pain

History & physical examination

History & physical exam suggestive of specific diagnosis

NO

Investigations

YES

treat specific condition

Normal

abnormal

evaluate and treat specific cause

Inadequate relief with analgesics

Diagnostic laparoscopy

Treated based on laparoscopic findings
## FINDINGS:

<table>
<thead>
<tr>
<th>DIAGNOSIS</th>
<th>NO. OF PATIENTS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACUTE APPENDICITIS</td>
<td>25</td>
<td>LAP APPENDICECTOMY</td>
</tr>
<tr>
<td>ACUTE APPENDICITIS</td>
<td>1</td>
<td>PRE OP DIAGNOSIS: RIGHT OVARIAN CYST</td>
</tr>
<tr>
<td>EARLY APPENDICULAR MASS</td>
<td>3</td>
<td>OPEN APPENDICECTOMY</td>
</tr>
<tr>
<td>APPENDICULAR ABSCESS</td>
<td>1</td>
<td>CONVERTED TO LAPARATOMY</td>
</tr>
<tr>
<td>GAIIGRENOUS APPENDICITIS</td>
<td>1</td>
<td>PRE OP DIAGNOSIS: CHOLELITHIASIS</td>
</tr>
<tr>
<td>ADHESIVE COLIC</td>
<td>7</td>
<td>LAP ADHESIOLYSIS</td>
</tr>
<tr>
<td>TB ABDOMEN</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>MECKEL'S DIVERTICULUM</td>
<td>1</td>
<td>OPEN RESECTION</td>
</tr>
<tr>
<td>TUBO OVARIAN MASS RIGHT</td>
<td>1</td>
<td>LAP SALPINGO OD PHORECTOMY</td>
</tr>
<tr>
<td>Ruptured Right</td>
<td>1</td>
<td>LAPARATOMY</td>
</tr>
<tr>
<td>Haemorrhagic Ovarian Cyst</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POD With Right Hydro Salpinx</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ruptured Liver Abscess</td>
<td>1</td>
<td>LAPARATOMY</td>
</tr>
<tr>
<td>NON DIAGNOSTIC</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
DISTRIBUTION OF DIAGNOSIS:

- acute appendicitis
- gangrenous appendicitis
- early appendicular mass
- appendicular abscess
- adhesive colic
- TB abdomen
- meckel's diverticulum
- tubo ovarian mass
- ruptured hemorrhagic ovarian cyst
- PID with hydrosalphinx
- ruptured liver abscess
- non-specific
Out of 50 female patients studied, 35 patients had appendicular pathology. Of which, 30 patients had acute simple appendicitis, 3 had early appendicular mass formation. 1 case of acute appendicular abscess was found. In one patient where the pre-op diagnosis was gall bladder stones, diagnostic laparoscopy revealed acute gangrenous appendicitis as the cause of right sided abdominal pain. Even appendix which appeared normal by macroscopic appearance were removed and histopathological examination confirmed presence of inflammation in it. In other patient were the pre-op USG concluded as right ovarian cyst as the cause of acute abdominal pain, inflamed appendix was found during diagnostic laparoscopy. 7 patients had adhesions of omentum and bowel to their previous scars and anterior abdominal wall which caused the acute pain. 2 patients was diagnosed as TB abdomen who had had multiple tubercles over their bowel, omentum. No surgical intervention was offered to these patients, but they had their omentum biopsied for the confirmation of diagnosis and were started on ATT. One patient was found to have inflamed Meckel’s diverticulum for which laparatomy was done and resected.

Tubo ovarian mass was noticed in a patient for which laparoscopic salpingo oophorectomy was done. The other female had ruptured right haemorrhagic ovarian cyst for which laparotomy and peritoneal lavage and ovarian cystectomy done. Free fluid with inflamed right fallopian
tube was the finding in different female suggesting pelvic inflammatory disease and right hydrosalphinx. In a 45 year old female patient who presented with diffuse right sided abdominal pain, to our surprise we had a small ruptured liver abscess with pus in the peritoneal cavity for which laparotomy and peritoneal lavage was done. In one patient HPE analysis of appendix did not reveal any inflammation and was concluded as non-diagnostic.
INTRA-OP IMAGES:

Fig – laparoscopic view of inflamed appendix.

Fig – specimen of gangrenous appendix excised.
Fig a & b showing small ruptured liver abscess in the right lobe of liver. This was not identified with imaging and diagnostic laparoscopy could make the diagnosis.
Fig (c)

Fig (d)

Fig c & d – laparoscopic and open view on Meckel’s diverticulum.
Fig – omental and small bowel adhesions to anterior abdominal wall in a patient with previous LSCS scar.

Fig – multiple tubercles over anterior abdominal wall and omentum in a patient with abdominal TB.
Fig – ruptured right haemorrhagic ovarian cyst of size 2x2 cms.

Fig – right tubo ovarian mass.
DISTRIBUTION ACCORDING TO AGE GROUP:

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>NO. OF PATIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-25</td>
<td>23</td>
</tr>
<tr>
<td>25-35</td>
<td>14</td>
</tr>
<tr>
<td>35-45</td>
<td>13</td>
</tr>
</tbody>
</table>

(no. of patients)
Out of 50 female patients, 23 patients are in the age group 15-25 years, 14 patients are in the age group 25-35 years and 13 patients are in the age group 35-45 years.
DISTRIBUTION ACCORDING TO SIGNS AND SYMPTOMS:

<table>
<thead>
<tr>
<th>SYMPTOMS/SIGNS</th>
<th>NO. OF PATIENTS</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>nausea</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>vomiting</td>
<td>33</td>
<td>66</td>
</tr>
<tr>
<td>fever</td>
<td>21</td>
<td>42</td>
</tr>
<tr>
<td>tachycardia</td>
<td>46</td>
<td>92</td>
</tr>
</tbody>
</table>

![Bar chart showing the number of symptoms]
Out of 50 patients, tachycardia was present in highest number in 46 patients, followed by vomiting in 33 patients, nausea in 24 and fever in 21 patients.
The table and bar chart provide the following information:

### No. of Patients and Percentage

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. of Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic</td>
<td>49</td>
<td>98%</td>
</tr>
<tr>
<td>Therapeutic</td>
<td>38</td>
<td>76%</td>
</tr>
<tr>
<td>Open surgery (laparotomy and open appendicectomy)</td>
<td>8</td>
<td>16%</td>
</tr>
<tr>
<td>Conservative (TB abdomen and PID)</td>
<td>3</td>
<td>6%</td>
</tr>
</tbody>
</table>

### Procedure Results Chart

- **Diagnostic**: 49 patients
- **Therapeutic**: 38 patients
- **Open**: 8 patients
- **Conservative**: 3 patients
Among 50 patients, diagnostic laparoscopy was conclusive in 49 patients. 38 patients were offered surgical treatment by means of laparoscopy. 8 patients required laparotomy for the treatment of the surgical condition and 3 patients were managed conservatively.
**SURGICAL PROCEDURE:**

<table>
<thead>
<tr>
<th>LAP PROCEDURE</th>
<th>NO. OF PATIENTS</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAP APPENDICECTOMY</td>
<td>30</td>
<td>60%</td>
</tr>
<tr>
<td>LAP ADHESIOLYSIS</td>
<td>7</td>
<td>14%</td>
</tr>
<tr>
<td>LAP SALPINGO OOPHORECTOMY</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>38</td>
<td>76%</td>
</tr>
</tbody>
</table>

![Bar chart showing the number of patients and their percentages for different procedures.](chart.png)
Among 38 patients offered surgical treatment 30 underwent laparoscopic appendicectomy, 7 underwent laparoscopic adhesiolysis and laparoscopic salpingo oophorectomy in one patient.
COMPLICATIONS:

<table>
<thead>
<tr>
<th>Complications</th>
<th>No. of Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound Infection</td>
<td>1</td>
<td>2.5%</td>
</tr>
<tr>
<td>Paralytic Ileus</td>
<td>1</td>
<td>2.5%</td>
</tr>
<tr>
<td>UTI</td>
<td>1</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

**Complications**

- **Wound Infection**: 1 case, 2.5%
- **Paralytic Ileus**: 1 case, 2.5%
- **UTI**: 1 case, 2.5%
Post laparoscopic complications were urinary tract infection, paralytic ileus and wound infection which occurred in 1 patient each.
Intra op Finding

- Appendicular abscess
- Ruptured haemorrhage
- Ruptured liver abscess
- Hydrosalphinx with P
- Gangrenous appendix
- Right Tubo ovarian m
- McKel’s diverticulum
- Adhesive colic
- Appendicitis
- Appendicular m
- TB Abdomen

Frequency
Since this study is a qualitative one which indicates whether there is a positive finding with diagnostic laparoscopy and specific intervention could be accomplished we apply Chi square test.

On applying Chi square test for this study, p value is <0.001 which is statistically significant.

Therefore, this study is significant one and diagnostic laparoscopy can be a handful tool in evaluation of acute abdominal pain.
DISCUSSION:

In our study nearly 35 out 50 patients had appendicular pathology as their cause of acute right lower quadrant pain. 7 patients had adhesive colic, 1 had Meckel’s diverticulum and 2 female patients had TB abdomen, ruptured liver abscess was the cause in one patient and non–diagnostic or non specific in a single patient. 3 patients had gynaecological pathology like right tubo ovarian mass, pelvic inflammatory disease with right hydrosalphinx and ruptured right haemorrhagic ovarian cyst.

According various literature reviews there is a high rate of negative appendicectomy in females particularly higher in the reproductive age group(15-45 years). This is due to the fact that acute gynaecological pathologies like PID, torsion ovarian cyst, ruptured ectopic pregnancy were similar in their presentation to acute appendicitis. Also, patient cannot be put on observation owing to high rate of appendicular perforation. USG cannot be conclusive in many circumstances. CT has disadvantages like expensive, exposure to radiation, allergy to dyes and still can be non-diagnostic. CT is not found to be useful in all studies. But in this study appendicular pathology holds
most of the share in contributing to the atypical presentation of female with acute right lower quadrant pain that was inconclusive by USG.

So it is justifiable to subject the patient to diagnostic laparoscopy. Also, laparoscopy could accomplish treatment in significant number of patients and avoid unnecessary laparotomy in many patients.

In one study by Haller group, by following strict observation policy for atypical cases they could raise the rate of accurate diagnosis of appendicitis to 90% compared to previous 80%, but rate of appendicular perforation remained the same increasing the complications and morbidity.
RESULTS:

Out of the 50 cases studied, all 50(100%) were female patients, the average age being 27.5 years. Abdominal pain was the universal complaint present in all 50 patients (100%), nausea was present in 24(48%), vomiting was present in 33 (66%), fever in 21 (42%) and tachycardia in 46(92%). In our study, 8 (16%) patients had undergone previous surgery. Laparoscopy was diagnostic in 49 patients (98%). Laparoscopy could accomplish treatment in 38 patients (76%). Unnecessary and non-therapeutic laparotomies were avoided in 10 patients (20%). Only 8 patients (16%) had to be subjected to laparotomy and open method for appropriate management. Average hospital stay was 6.8 days. Morbidity rate for laparoscopic surgery was 7.7%. There was no mortality in our study.
CONCLUSION:

Thus laparoscopy is of greater significance in evaluation of acute abdominal pain in women of reproductive age group where the diagnosis is ambiguous after clinical examination and investigations. It also helps in avoiding unnecessary further radiological investigations and exposure to radiation. It also helps in identifying other gynaecological causes of acute right lower quadrant pain which mimicks appendicitis and helps in avoiding unnecessary negative appendicectomy. Finally it could accomplish therapeutic intervention in significant number of patients.
BIBLIOGRAPHY:


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CLINICAL PROFORMA

1. Name- Age - IP no.-
2. DOA- DOS- DOD-
3. addresses-

4. Onset of pain
5. Location
6. Duration-
7. Character – cramp □ aching □ stabbing □ burning □ tingling □ itching □
8. Aggravating Factors-Y/N if yes mention
9. Alleviating factors-Y/N if yes mention
10. Associated symptoms - fever □ vomiting □ nausea □ loss of appetite □ constipation □ diarrhea □ dyspepsia □ loss of weight □ burning micturition □ bleeding PR □ jaundice □
12. Radiation-Y/N
14. severity-mild □ moderate □ severe □ very severe □ unbearable □
15. Menstrual history-regular □ irregular □

Dysmenorrhea □ menorrhagia □
   LCB-

17. Marital history- married since
   History of infertility-Y/N

18. Chronic medical illness-Y/N if yes mention

19. Previous surgery-Y/N if yes no.

21. History of trauma-Y/N

23. Family history- insignificant / significant (mention if significant)

**EXAMINATION**

- General condition-good □ poor□
- CVS-
- RS-
- Abdomen- tenderness - Y/N
  - Guarding/rigidity-
  - Bowel sounds-

- LE-external genitalia

- Per rectal examination-
INVESTIGATION

- Complete blood count-Hb- Tc- Dc- plt-
- RBS-
- ESR-
- RFT-
- LFT-
- CXR, ABDOMEN X-RAY-
- ECG-
- Urine routine-sugar puscells
- Urine culture & sensitivity-
- Screening test STI-HIV VDRL HbsAg
- USG abdomen & pelvis-

OPERATIVE NOTES

Laparoscopic procedure-
Finding-
Post-operative period-

Condition on discharge-

Follow up: pain relieved □ increased □
no significant change □
நூறு பரப்பு

என்னுடைய நவாக்தர்களின் நாள்காலியுடன் சேர்ந்தே

நூறு பரப்பு

என்னுடைய நவாக்தர்களின் நாள்காலியுடன் சேர்ந்தே மற்றும் நவாக்தர்களின் நாள்காலியுடன் சேர்ந்தே என்னுடைய நவாக்தர்களின் நாள்காலியுடன் சேர்ந்தே

இந்த என்னுடைய நவாக்தர்கள் மற்றும் நவாக்தர்களின் நாள்காலியுடன் சேர்ந்தே என்னுடைய நவாக்தர்களின் நாள்காலியுடன் சேர்ந்தே என்னுடைய நவாக்தர்களின் நாள்காலியுடன் சேர்ந்தே


அம்மனை பந்துவை போக்கு கூட்டு லிருங்கமைக்கவே போக்கு

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INSTITUTIONAL ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : Role of laparascopy in pain abdomen in women of reproductive age group

Principal Investigator : Dr. R.R. Rajkamal

Designation : PG in MS (Gen Surg)

Department : Department of General Surgery
Government Stanley Medical College,
Chennai-10

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 10.01.2014 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM.

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

[Signature]
MEMBER SECRETARY,
IEC, SMC, CHENNAI