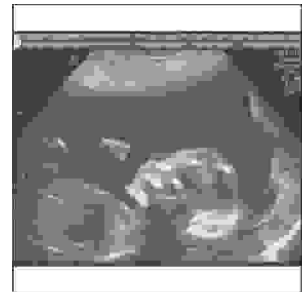


ORIGINAL

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## ULTRASONOGRAPHY; DIAGNOSTIC ROLE OF IN ACUTE ABDOMEN (NONGYNAECOLOGICAL CAUSES)

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**ABSTRACT ...** [tarimalik1443@yahoo.com](mailto:tarimalik1443@yahoo.com). **Objectives.** (1) To determine the role of ultrasonography as the primary imaging modality in patients of acute abdomen. (2) To evaluate the sensitivity, specificity, positive and negative predictive value of ultrasonography in acute abdomen. **Design:** A hospital based descriptive study. **Setting:** In Combined Military Hospital Lahore which is a tertiary care hospital. **Period:** From 1<sup>st</sup> Jan 2003 to 30 Dec 2003. **Subjects:** A total of 100 consecutive patients of acute abdomen were selected for the study. There were 61 male patients and 39 female patients. The patients' age ranged from 02 years to 70 years. Ultrasonography was done using ALOKA SSD-5500 machine with high resolution probes. **Results:** During my study of patients of acute abdomen most common conditions encountered were renal colic due to renal and ureteric stones followed by gut perforation, cholecystitis, appendicitis and cholelithiasis. My study revealed a sensitivity of 79.7% and specificity of 88.4% of ultrasonography in patients with acute abdomen. The positive predictive value was 95.1% and a negative predictive value was 60.5%. **Conclusion:** Ultrasonography helped in prompt decision making in most of the cases of acute abdomen with a high sensitivity and specificity in skilled and experienced hands, as well as high positive predictive value. Hence, in our setup it can be used as a primary imaging modality for patients presenting with acute abdomen in any age group, as it is readily available, cost effective and free of any radiation hazards. Ultrasonography not only helps in diagnosing the cause of pain but also ruling out other possibilities.

**Key words:** Ultrasonography, Abscess, Appendix, Appendicitis, Laparotomy, intussusception, cholecystitis.

### INTRODUCTION

Acute abdomen in an emergency setup has become one of the most important and routinely encountered emergency. Patients with acute abdomen can present with symptoms of varying types. Sometimes, clinical

examination alone does the job and no further investigation is required before undergoing emergency laparotomy. However, most of the times, diagnosis on clinical examination cannot be made alone and hence a rapid assessment of the patient using imaging modalities

is required. Recent technologic advances in ultrasonographic equipment such as high resolution probes, Color Doppler techniques etc have led to a very high sensitivity and specificity in diagnosing acute abdominal conditions especially in experienced and skilled hands<sup>1</sup>.

Ultrasonography is relatively a much cheaper technique as compared to other radiological imaging modalities. It has no known hazards to the human beings and does not require any contrast medium that is why it has no contraindications and can be used in all age groups.

Patients readily accept an ultrasound scan because the procedure requires only light pressure on the skin. Patient preparation is minimal: bladder filling is required for obstetric and pelvic scanning and fasting is necessary for the gall bladder, but otherwise the patient may be scanned as and when convenient, a major advantage for emergency uses. In addition, mobile ultrasound systems that can be taken to the bedside are available.

Ultrasonography in many acute abdominal conditions has proved to be very valuable, most of the times providing the clinicians with accurate diagnosis and narrowing the list of differential diagnosis. Ultrasonography can also be used in conjunction with other imaging modalities such as CT scan, MRI and contrast studies to confirm the diagnosis, hence saving precious lives by giving in time diagnosis, and sparing the patient from unnecessary surgery when ever possible<sup>2</sup>.

#### **My purpose of study includes following**

To document the role of ultrasonography in the diagnosis of acute abdominal conditions as the primary imaging modality in general Pakistani population.

To evaluate the sensitivity, specificity, positive and negative predictive value of this technique. This was achieved by correlating the findings of ultrasonography with other radiological investigations and with the surgical findings on laparotomy.

To document the relative limitations of ultrasonography

in the evaluation of abdominal organs and abdominal cavity.

#### **PATIENTS AND METHODS**

A total number of 100 consecutive patients, presenting in the emergency department of CMH Lahore were selected for the research study. Females presenting with acute lower abdominal pain or pelvic pain were first evaluated by ultrasonography and those found to have pain due to gynecological causes were excluded from the study, both sexes were included in the study. There was no age limit. The patients were selected on the basis of a temporal sampling technique. The study was conducted in one year from 1<sup>st</sup> January 2003 till 30<sup>th</sup> December 2003. Aloka prosound SSD-5500 using high resolution biconvex probes was used in the ultrasonographic evaluation of selected patients. 100 patients of various age groups of any age and sex group, ranging from 2 to 70 years using a temporal sampling technique were selected. Patients presenting with acute abdomen were initially evaluated using ultrasound technique under the experienced guidance of senior radiologists of our department. On the basis of diagnosis patients were categorized into two main groups:

#### **Those requiring surgical intervention urgently**

Patients who did not require surgical intervention, at least in the next few weeks/months.

Ultrasonographic diagnosis was confirmed in patients requiring laparotomy post operatively. Ultrasonographic diagnosis in patients not requiring surgery was confirmed by using other radiological techniques such as CT scan and IVU.

Patients with equivocal diagnosis even after using other imaging techniques were not included in the study. Hence in my research study GOLD STANDARDS were post operative findings in patients who were operated upon and CT scan abdomen in conjunction with plain X-rays and IVU in patients not undergoing surgery.

#### **Data Collection Procedure**

After selection of the patient, a thorough Ultrasound examination was done and if required re-evaluation by a

skilled radiologist was carried out. Patients who underwent surgery after ultrasonographic study, their ultrasound findings were evaluated postoperatively and positive findings as well as missed findings were documented. Patient who did not require surgery, were further evaluated after ultrasonography by using other imaging techniques such as CT scan, IVU, MRI and plain X-rays etc.

## RESULTS

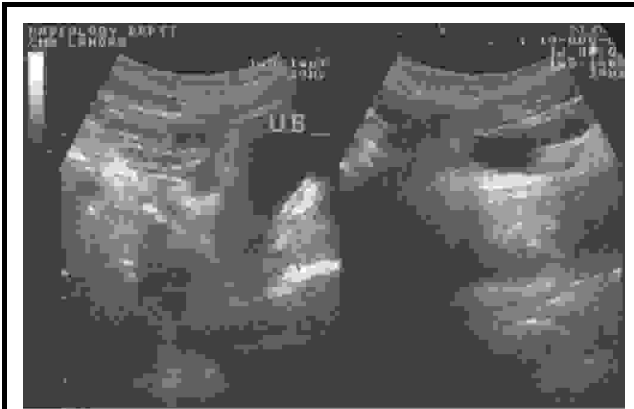
A total number of 100 consecutive patients of varying age groups were selected prospectively for the study, presenting in the emergency department of Combined Military Hospital Lahore. The patients were studied from 1<sup>st</sup> of January 2003 till 30<sup>th</sup> of December 2003.

Table-I. Breakdown of data of patients

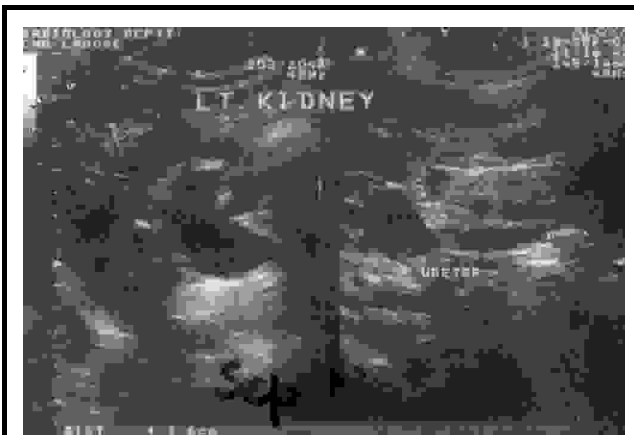
Diseases	Gold standard diagnosis	True positive cases	False negative cases	False positive cases
Cholelithiasis	05	05	00	01
Calculus cholelithiasis	04	04	00	00
Acalculous cholecystitis	03	03	00	00
Renal calculus	15	12	03	01
Ureteric calculus	14	08	06	01
Acute pancreatitis	03	02	01	00
Acute appendicitis	06	04	02	00
Intussusception	03	02	01	00
Choledocholithiasis	01	01	00	00
Gut perforation	07	05	02	00
Intestinal obstruction	03	03	00	00
Renal vein thrombosis	01	01	00	00
Liver abscess	05	05	00	00
Ruptured hydatid cyst	04	04	00	00

Fourteen female patients were dropped during the study as they were diagnosed as pain lower abdomen secondary to gynecological causes and were replaced by patients with non gynecological causes of acute abdomen. No data was lost during the study. Following conditions as mentioned in table I were confirmed after ultrasonographic diagnosis with the help of my selected gold standard technique and are given in a complete tabulated form.

Out of 100 patients in whom the study was conducted, there were 74 true positive cases. Ultrasound showed positive findings leading to a diagnosis in 59 patients while 41 patients tested negative. By applying Gold Standard as described previously sensitivity was 79.7%, specificity was 88.4%, positive predictive value of 95.1% and a negative predictive value of 60.5%.



**Fig-1. Free Fluid In The Pelvic Cavity In A Patient of Acute Pain Abdomen Secondary To Perforated Duodenal Ulcer Confirmed On Laparotomy.**

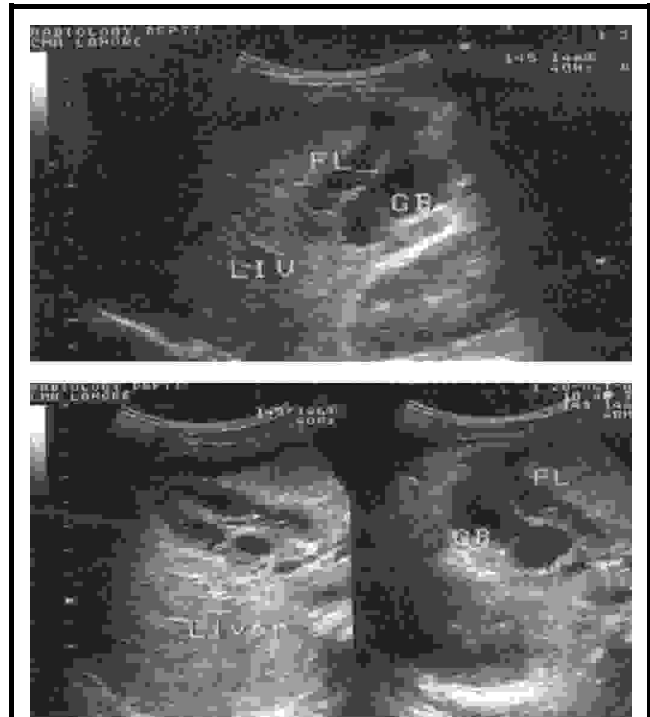


**Fig-2. Patient with severe left ureteric colic, ultrasound shows left ureteric calculus with hydronephrosis and hydroureter confirmed on ct kub.**

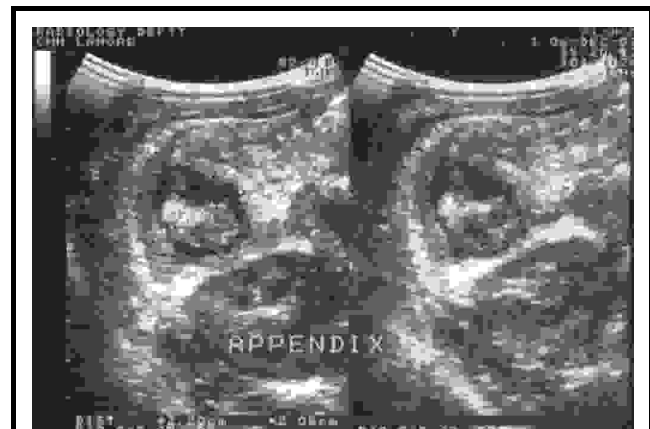
## DISCUSSION

My study was aimed at determining the importance of ultrasonography in acute abdominal conditions. In third world countries, imaging techniques such as CT scan, MRI etc are still sparingly available and costly and hence ultrasonography will be considered to be an imaging technique readily available, cost effective and less time consuming for a long time to come. Acute abdomen is one of the most common emergencies seen in our emergency setups and most of the times an accurate and early diagnosis can save many precious lives. In many hospitals especially in remote areas, ultrasonography and plain X-rays are sometimes the only

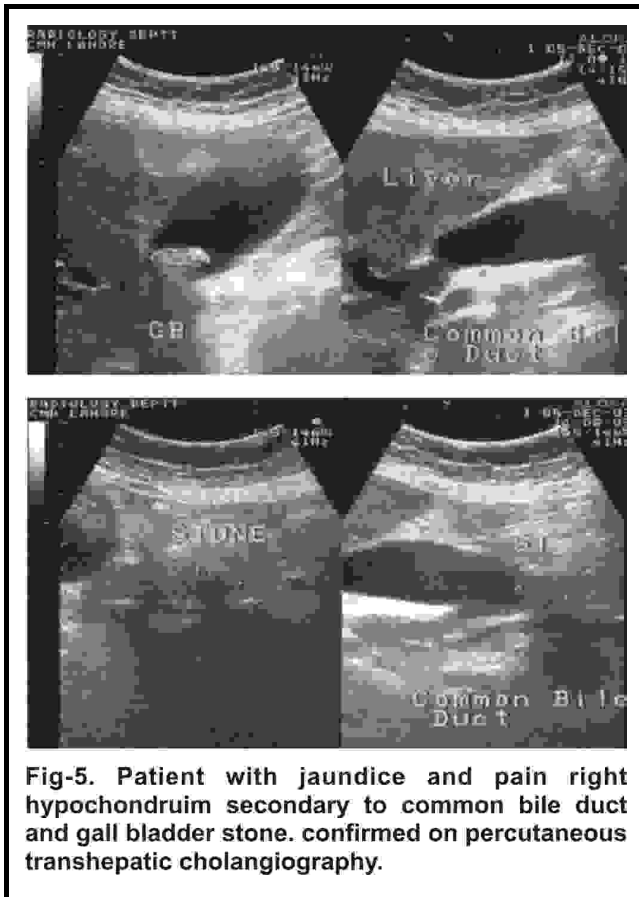
imaging facility available to access the patients of acute abdominal pain<sup>3</sup>.



**Fig-3. Patient with severe pain right hypochondrium showing features of acute acalculous cholecystitis.**



**Fig-4. Patient with pain right iliac fossa showing dilated non compressible loop of appendix secondary to acute appendicitis.**



My study included 100 consecutive patients of abdominal pain of varying age groups and included both sexes. Ultrasonography was used as the initial imaging modality in our emergency setup. Most commonly encountered cause of abdominal pain was renal colic secondary to renal and ureteric stones, followed by abdominal pain due to gut perforation. Other common conditions were acute appendicitis, cholecystitis and cholelithiasis<sup>4</sup>

Results compiled have shown that ultrasound has a high sensitivity and specificity as well as a high positive predictive value for delineating the cause of acute abdomen. However, certain retroperitoneal pathologies such as acute pancreatitis and ureteric calculi can at times be difficult to diagnose mainly due to overlying gut loops. Recent advances in ultrasound equipment such as Color Doppler technique and high resolution probes coupled with skilled and experienced sonologists can increase the diagnostic value in these conditions.

Some common limitations observed during ultrasonography were dilated overlying gut loops, which at times severely restricted the evaluation. In obese patients ultrasonographic interpretation was sometimes difficult, as fat hinders greatly the transmission of ultrasonographic waves. That is why; very obese patients with pain abdomen were not included in my study.

My study showed a sensitivity of about 66.6% in diagnosing pain abdomen secondary to acute appendicitis<sup>5</sup>. Sonographic pitfalls usually observed in diagnosing acute appendicitis are related mainly to retrocaecal location of the appendix, gas filled appendix or due to a perforated appendix<sup>6</sup>.

In general, the test is less useful than other modalities for diagnosing ureteric calculi. My study revealed a sensitivity of about 53% and specificity of about 98% for the detection of ureteric stones. Similarly in detection of renal stones ultrasound has shown a sensitivity of 80% and a specificity of around 98%.

The success of diagnostic ultrasound is very dependent on operator skill and experience. In Renal colic secondary to calculi, whether the stones are radiolucent or opaque does not matter because an ultrasound picture is based strictly on density, not on calcium content<sup>7</sup>. Ultrasound is a good way to monitor known stones after medical or surgical therapy if the stones are large enough to be detected by this modality and in a suitable position. Ultrasound can also be used to check the abdomen for a possible abdominal aortic aneurysm or cholelithiasis, which can sometimes be mistaken for acute renal colic. It is also useful in differentiating filling defects observed on contrast studies because stones are much more echogenic than tumors, clots, or tissue<sup>8</sup>. Ultrasound is the initial imaging modality of choice for patients with acute renal colic who are pregnant because it avoids all potentially hazardous ionizing radiation.

My study has concluded on the fact that in case of ureteric calculi, CT KUB and sagittal reconstruction technique are much more reliable in detection of ureteric stones.

Despite these benefits, ultrasound has some specific limitations in patients with urolithiasis. Studies are both operator dependent and equipment dependent and some small stones do not exhibit acoustic shadowing.

Ultrasonography using high resolution techniques is of high sensitivity and specificity in patients with acute abdominal pain secondary to gut related pathologies such as intestinal obstruction, perforation and intussusception

Two cases of acute abdomen presenting in the emergency department were finally diagnosed as Pneumonitis with pleurisy. One case of acute epigastric pain was secondary to Acute MI radiating to epigastric region. Hence in patients of upper abdominal pain if no cause could be determined on ultrasound or other investigations, plain Chest X-ray should also be carried out to rule out chest pathologies.

My study has yet again enlightened the importance of ultrasonography as the primary imaging modality in the diagnosis of acute abdomen. The results of my study show a relatively high sensitivity as well as specificity of ultrasonographic technique in the hands of experienced sonologists. The latest techniques such as high resolution probes and use of Color Doppler techniques have helped the sonologists a lot in making the diagnosis of acute abdominal conditions and in ruling out other causes of pain. Ultrasound has virtually no contraindications and is free of any biological hazards and can be used freely in both sexes and importantly in any age group. The patients are able to tolerate this technique much easily. Also ultrasound can safely be used in pregnant women where exposure to X-rays is undesirable and dangerous to the foetus.

## CONCLUSION

Ultrasonography is a radiological technique which is readily available, cost effective and has no known biological hazards. In patients of acute abdomen where early prompt diagnosis can save precious lives, ultrasonography has shown its importance as a primary imaging modality and hence has helped the treating physicians and surgeons a lot. It has a high sensitivity

and specificity in experienced and skilled hands.

Ultrasonography has certain limitations such as presence of dilated gut loops obscures the underlying deep structures and fatty patients. In equivocal cases help of other radiological investigations such as CT scan, MRI, IVU and plain radiography should be sought and final diagnosis should be made after correlating ultrasound findings with other radiological techniques and above all correlation with clinical findings cannot be overemphasized.

Ultrasound has proved to have very low sensitivity in patients of acute abdomen secondary to gut related pathologies and ureteric obstructions. In such cases Plain radiography and CT scan have a much higher sensitivity and in equivocal cases where no diagnosis has been reached after ultrasonography above mentioned investigations should be advised.

Hence on the basis of my study, I would safely conclude by saying that ultrasonography in our set up should be the initial radiological investigation in patients presenting with acute abdomen and other investigations should be advised when no definite diagnosis could be reached.

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