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Utility of Ultrasound in Evaluation of Patients with Abdominal Pain

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Abstract: ***Abdominal pain is a common cause of patient's visit to healthcare facilities. Pain abdomen may be due to causes such as acid peptic disease, ureteric calculus, cholecystitis, pancreatitis and acute appendicitis. History and physical examination narrows the differential diagnoses. In some of the patients, further evaluation with imaging modalities is done. Among the different imaging modalities, ultrasound is often the first, and many times the only imaging modality needed to arrive at diagnosis. Ultrasound is widely available, cost-effective and there is no ionizing radiation. So, ultrasound is preferred over CT as initial imaging modality. In this study we studied the diagnostic yield of ultrasound of abdomen and pelvis in 104 consecutive patients with complaints of pain abdomen referred for ultrasound in the months of December 2018 and January 2019 at Vishnupriyadharshini scans, Theni. Spectrum of diagnosis in our study includes ureteric calculus (most common 12 %) followed by cholelithiasis (11%) and mesenteric lymphadenitis (6%), acute pancreatitis, acute appendicitis (3%), ileocecitis, small bowel obstruction, acute pyelonephritis, ovarian cyst, scar endometriosis, ectopic gestation, etc.***

Keywords: Abdominal pain, ultrasound, ureteric calculus, cholelithiasis, appendicitis, pancreatitis

1. Introduction

Abdominal pain may be caused by various diseases such as gastritis, cholelithiasis, ureteric calculus, appendicitis, pancreatitis and ovarian torsion. Clinical history and physical examination narrows the differential diagnoses. Common symptoms that are associated with abdominal pain are vomiting, fever, radiation of pain, burning micturition, hematuria, jaundice, altered bowel habits, etc.

Imaging modalities are useful to arrive at diagnosis early so that appropriate treatment is given promptly. Plain radiographs are of limited use. Chest X-ray erect PA view is useful to identify air under diaphragm (perforation) and abdominal X-ray AP is of use to demonstrate dilated bowel loops (in paralytic ileus and intestinal obstruction). Ultrasound is often the first imaging modality in evaluation of patient with pain abdomen. Ultrasound is operator-dependent. In peripheral areas of a state, in general, operator efficiency is probably better for ultrasound compared to higher modalities (CT and MRI) due to more experience with ultrasound (author's personal view). Spatial resolution of modern ultrasound is excellent. It is bowel gas which limits ultrasound in some of the patients in whom CT is preferred over or follows ultrasound. Even in western countries, ultrasound is preferred over CT in evaluation of right upper quadrant pain and in pediatric patients. MRI is of use in further evaluation of biliary pathology and in pelvic pathologies.

2. Materials and Methods

Ultrasonography of abdomen and pelvis was performed with Hitachi Aloka Arietta S60 (Tokyo, Japan) machine with 1-5 MHz convex probe, 3-7 MHz linear probe and 2-10 MHz Transvaginal probe. For evaluation of abdominal wall and inguinal region, 5-13 MHz high frequency linear probe was used when needed.

a) Study sample

104 consecutive patients (belonging to any age group/ sex) who were referred for ultrasound of abdomen with history of abdominal pain in the months of December-2018 and January 2019 to Vishnupriyadharshini scans, Theni.

It is a retrospective study. The radiologist was aware of patient symptoms during study. The plan to conduct such a study was conceived later than the time of study. Ultrasonography referral forms and ultrasound images were assessed retrospectively.

b) Source

Patients were referred from healthcare facilities (OP clinics, nursing homes, hospitals) in Theni District, Tamil Nadu and in nearby places.

Inclusion criteria:

Patients who are referred for ultrasound of abdomen with history of abdominal pain

Exclusion criteria:

Patients with history of trauma
Patients with prior imaging

3. Results

There were 104 patients of which 50 (48%) were female patients and 54 (52%) were male patients.

Table 1: Gender distribution

Sex	Number of patients	%
Female	50	48%
Male	54	52%
Total	104	100%

Table 2: Age distribution
There were 13 children (aged 12 years or less) and 91 adults in this study

Age group	Number of patients	%
Child (≤ 12 years)	13	12%
Adult (> 12 years)	91	88%
Total	104	100%

Table 3: Age & Gender distribution

Age group	Female	Male	Total
Child (≤ 12 years)	7	6	13
Adult (> 12 years)	43	48	91
Total	50	54	104

Table 4: Ultrasound Diagnosis

Disease condition	Cases	%
Urinary tract calculus		
Ureteric calculus	12	12%
Staghorn calculus	1	1%
Pelviureteric junction calculus	1	1%
Vesicoureteric junction calculus	5	5%
Cholelithiasis	11	11%
Acute pancreatitis	2	2%
Chronic pancreatitis	1	1%
Intestinal pathology		
Acute appendicitis	3	3%
Mesenteric lymphadenitis	6	6%
Ileo-cecitis or inflammatory bowel disease	2	2%
Small bowel obstruction	1	1%
Colonic malignancy with liver secondaries	1	1%
Chronic parenchymal liver disease	4	4%
Congestive hepatomegaly	1	1%
Acute pyelonephritis	1	1%
Horse-shoe kidney	1	1%
Ectopic kidney	1	1%
Autosomal Dominant polycystic kidney disease (ADPKD)	1	1%
Space occupying lesion in kidney (angiomyolipoma)	1	1%
Bilateral chronic medical renal disease	1	1%
Deep vein thrombosis (DVT) extending to external iliac vein	1	1%
Undescended right testis in right iliac fossa	1	1%
Para-aortic lymphadenopathy with splenic lesion (TB or lymphoma)	1	1%
Cystitis	1	1%
Gynaecological diseases		
Ovarian/ adnexal cyst	4	4%
Adenomyosis	2	2%
Fibroid	2	2%
Scar endometriosis	1	1%
Ectopic pregnancy	2	2%
Hernia		
Umbilical hernia	5	5%
Inguinal hernia	2	2%
Hiatal hernia	1	1%
Inguinal abscess	1	1%
Enlarged prostate	1	1%
No sonological abnormality	36	35%

4. Discussion

Out of the 104 patients, 68 patients (65%) were found to have one or more pathologies. No sonological abnormality was found in 36 (35%) patients. Some of the patients had more than one pathology and so total number of pathologies was 81 exceeding the number of patients with pathologies which was 68. For example, among four patients with chronic parenchymal liver disease, three had cholelithiasis also. Similarly umbilical hernia was found as incidental finding with other pathologies in four patients.

Most common sonological diagnosis in patients presenting with abdominal pain in our study is ureteric calculus. Twelve patients were found to have ureteric calculus (12%). Together with PUJ calculus (1 patient) and VUJ calculus (5 patients), calculi in the urinary tract constituted 17% of total cases. Isolated cases of renal calculi without ureteric calculus were not counted as positive sonological diagnoses in our study as renal calculi are fairly common in our region which is located in south India, to the east of western ghats. In contrary to some of the past western literature emphasizing CT KUB for suspected ureteric calculus, current trend is in favor of ultrasound to minimize radiation[1] and as ultrasound is usually sufficient in most of the patients. Most of the radiologists in our region are good at detecting ureteric calculus sonologically. Ultrasound should be the preferred initial imaging study in the diagnosis of an acute stone episode [2,3].

Adjusting the gain, Reducing the sector width, reducing focal zone width, keeping the focal point at region of interest, increasing the frequency and if needed adding colour Doppler (to see twinkle artifact) are some of the technical tips to improve detection of calculi. To trace upper ureter, anterior approach using linea semilunaris window (lateral to rectus muscle) with graded compression is useful. Lateral approach using a sonological window posterior to ascending and descending colon is also useful to evaluate upper ureter. Detection rate of lower ureteric calculi is more when the urinary bladder is well distended. Well distended bladder facilitates detection of lower ureteric calculus by serving as acoustic window; backpressure distension exacerbates ureteric distension and therefore visualization of upper ureter is also facilitated by a filled bladder.[3]

One patient (a 65 years old lady) was found to have 38 mm right renal staghorn calculus (Figure 1a). But in addition to right loin pain, she had burning micturition also. With careful sonological assessment, a 3 mm calculus was found at the vesicoureteric junction (Figure 1b) which was confirmed with colour Doppler evaluation showing twinkle artifact.[4] This experience is mentioned here to emphasize that there should not be satisfaction of search. When an imaging study is performed, when we find one finding, we have to keep in our mind that there may be more important finding that is the cause for patient symptoms.

Figure 1 (a): Staghorn calculus of size 38 mm in right kidney with dilated collecting system

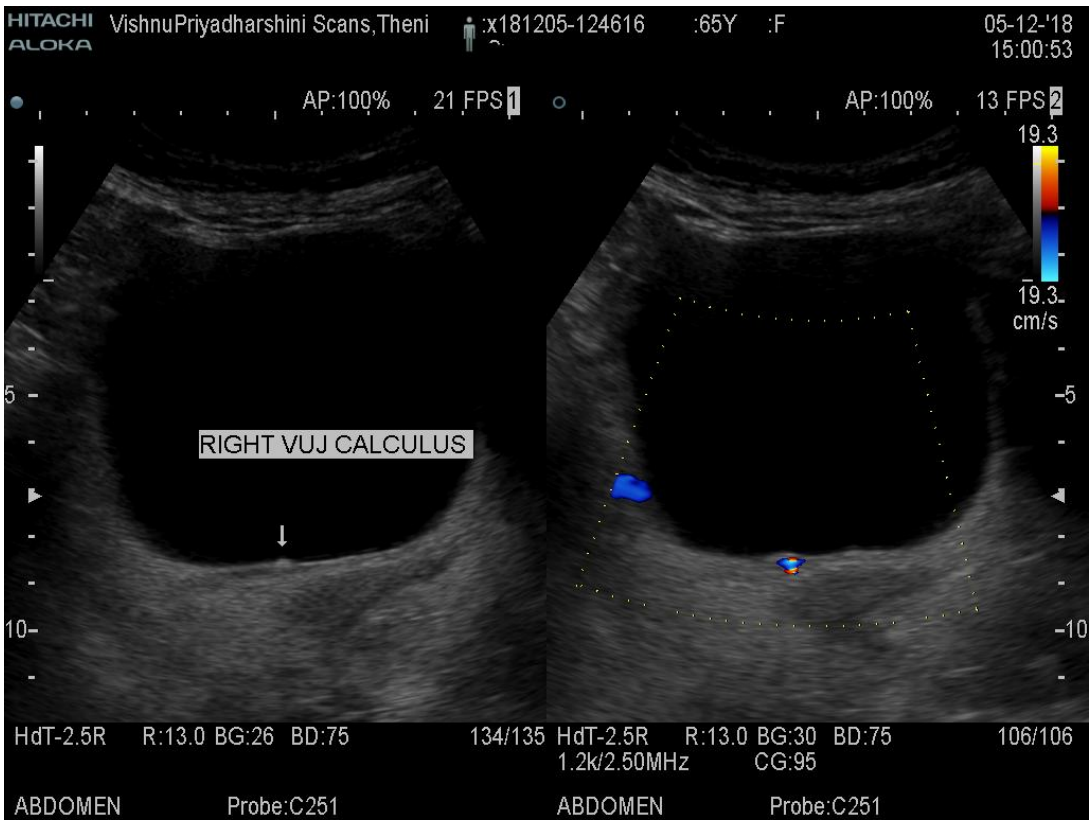

Figure 1 (b): The same patient with staghorn calculus also had right VUJ calculus of size 3 mm with colour Doppler showing twinkle artifact.

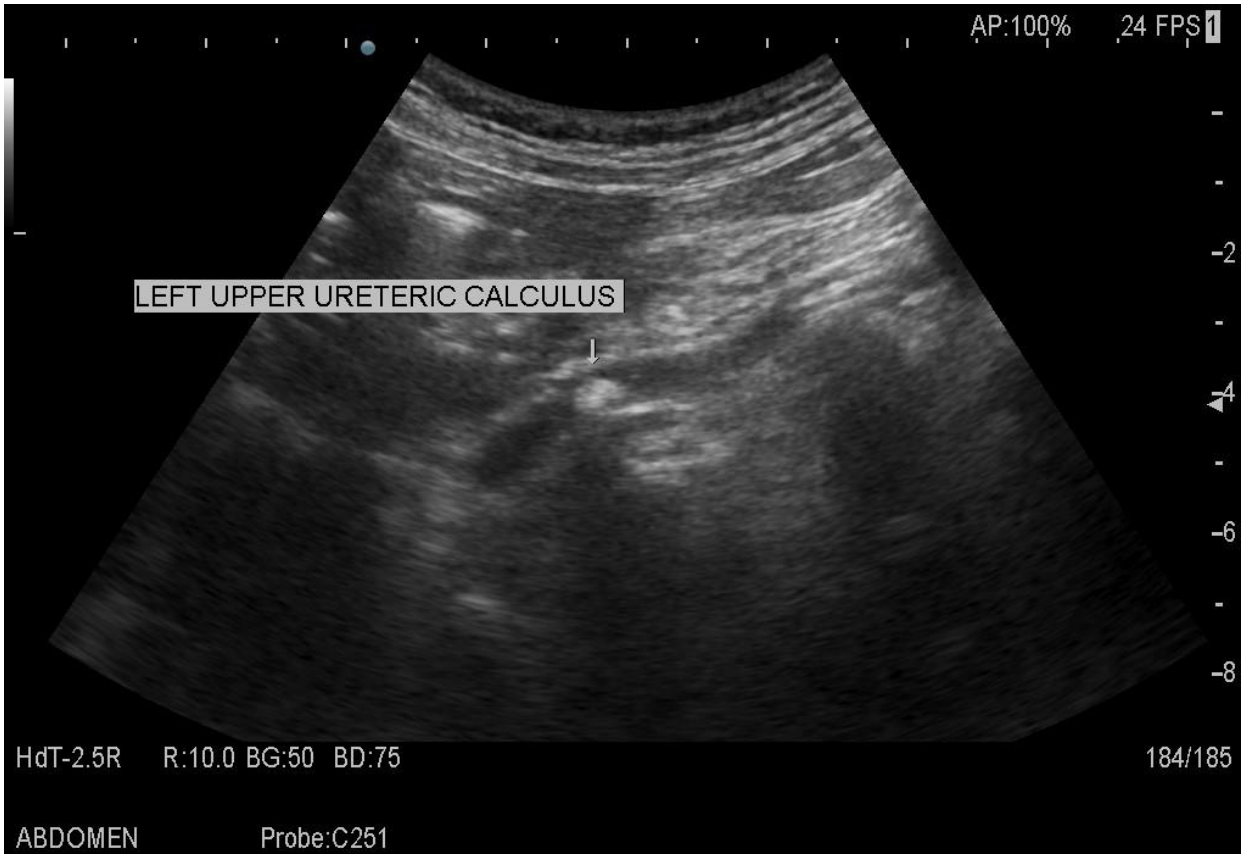

Figure 2: Another patient with left upper ureteric calculus

Cholelithiasis is the second most common disease entity in this study with 11% cases. Interestingly 4:7 (female: male) ratio in our study is surprising, but the sample size needs to be large enough to study gender distribution. Three patients with chronic parenchymal liver disease had cholelithiasis also. Association of chronic parenchymal liver disease and cholelithiasis is a known one.[5]

Mesenteric lymphadenitis is the third common disease entity with 6% of cases (Four children and two adults). Among the 13 children with abdominal pain, four (31% of children with pain abdomen referred for ultrasound) had mesenteric adenitis. Normal mesenteric lymph nodes are commonly visualized in children. Mesenteric lymphadenitis is diagnosed if a cluster of three or more lymph nodes, each measuring 5 mm or greater is detected in the right lower quadrant mesentery.[6] Care must be taken to visualize appendix, as mesenteric adenitis may be seen in association with appendicitis or with inflammatory or infective enteritis or colitis.

There were two cases of acute pancreatitis (2%) and one case of chronic pancreatitis. Enlargement of pancreas, peripancreatic edema[7] edema just caudal to left lobe of liver in the omentum, perinephric edema and edema around splenic hilum are useful tips to diagnose acute pancreatitis. Perinephric edema may also be seen with ureteric calculus obstruction and with volume overload and so careful assessment of associated findings should be made and put together to make final imaging diagnosis.

There were three (3%) cases of acute appendicitis of which one had periappendiceal abscess also which correlated correctly with operative findings. In one of these three patients, extraluminal air was found with ultrasound, but there was no perforation or abscess found during surgery. Though diagnosis of inflamed appendix was correct, diagnosis of perforation in that case was false positive diagnosis. The reason could probably be a static loop of bowel with intraluminal air mistaken for free air. It was retrospective study. All patients were not followed-up and so we do not know how many false negatives (ie, cases of acute appendicitis missed in ultrasound) were there. In many of the patients, we could visualize normal appendix. However, to exclude acute appendicitis, entire appendix should be visualized and should be of normal caliber (less than or equal to 6 mm in diameter).

Figure 3: A 13 years old boy with acute appendicitis with periappendiceal abscess

One case of ileocecitis and another case of inflammatory thickening of sigmoid colon was found in our study (Figure 4). Evaluation with convex and linear probes and compression techniques are useful in sonological evaluation of bowel. A case of malignancy of ascending colon (Figure 5) with liver secondaries was diagnosed with ultrasound in our study. A case of small bowel obstruction was diagnosed sonologically. Surgery confirmed small bowel obstruction; it was due to adhesions.

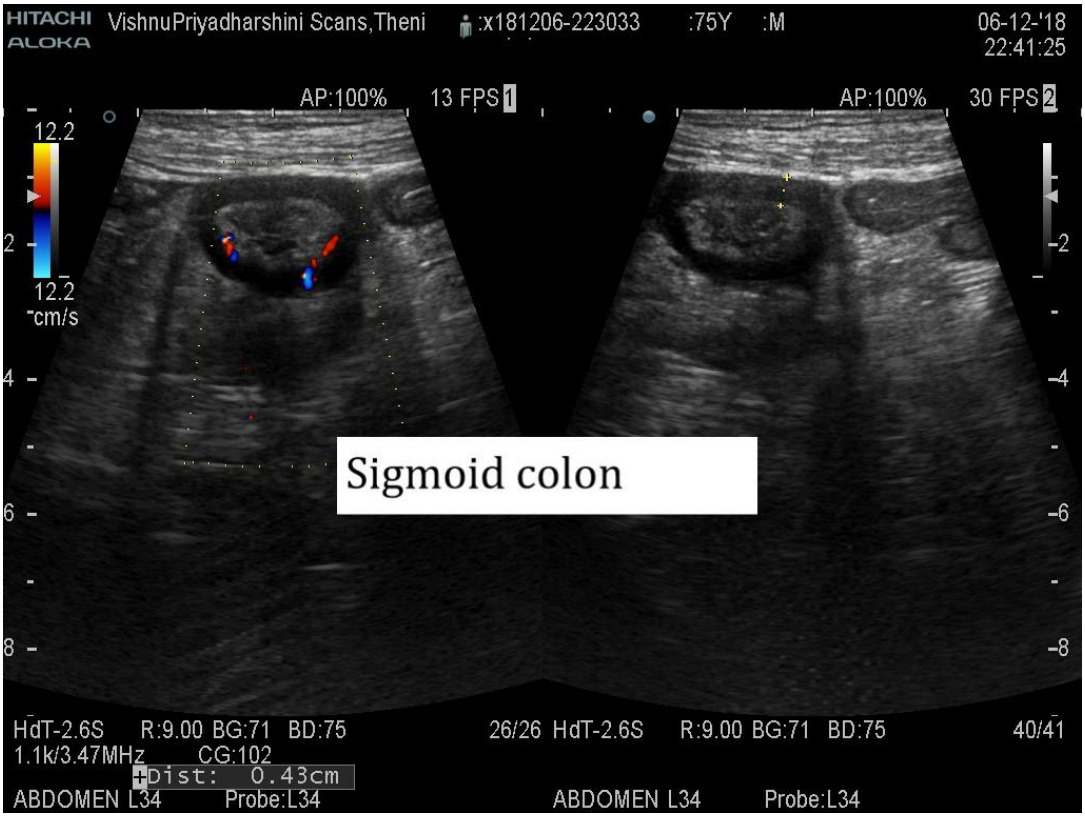

Figure 4: A 75 years old man with circumferential wall thickening of sigmoid colon with hyperemia

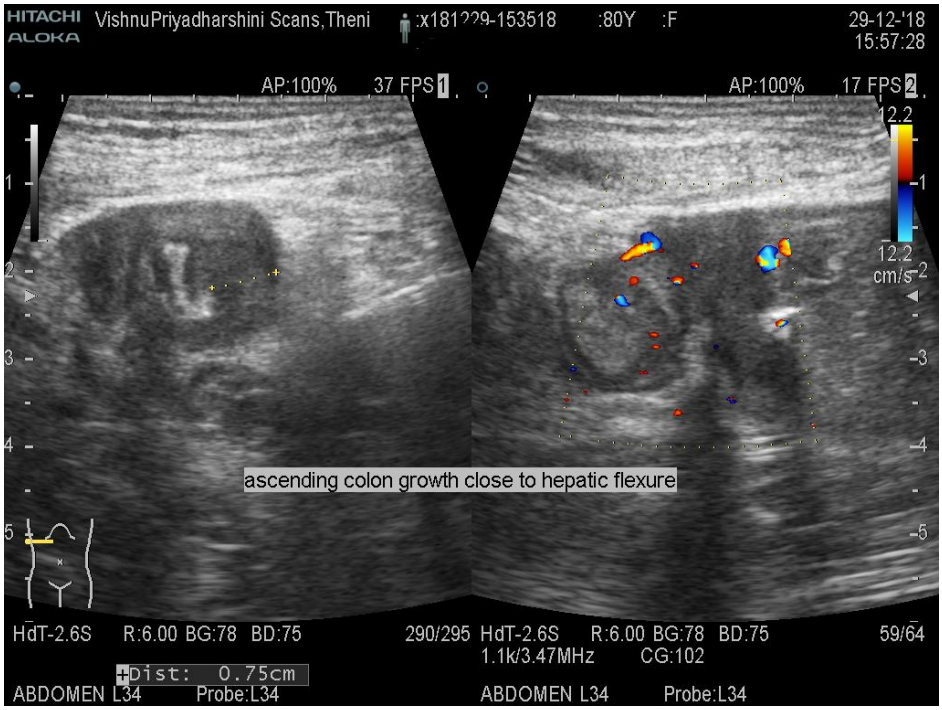

Figure 5: 80 years old lady with irregular wall thickening of ascending colon (malignancy). She had liver metastases also

One patient had acute pyelonephritis. Right kidney was bulky with altered cortical echo and loss of cortico-medullary differentiation with perinephric edema. Incidental finding of one case of ectopic kidney and another horse-shoe kidney were noted. One patient had autosomal dominant polycystic kidney disease in whom both kidneys were enlarged with multiple cortical and medullary cysts. One patient was incidentally found to have a hyperechoic space occupying lesion of size 2.4 x 2.3 cm in right kidney and probable diagnosis of angiomyolipoma was made. To differentiate from malignancy, CT was suggested; CT confirmed angiomyolipoma (by demonstrating fat density).

A 70 years old lady was sonologically found to have bilateral chronic medical renal disease (small kidneys with increased cortical echo). She had DVT also which was picked up in routine screening of left iliac fossa as a part of abdominal USG (Figure 6a). Her left external iliac vein and common femoral vein were filled with acute/ subacute thrombus (Figure 6a and 6b). Again this finding reinforces that search satisfaction should not be there when we find one pathology.

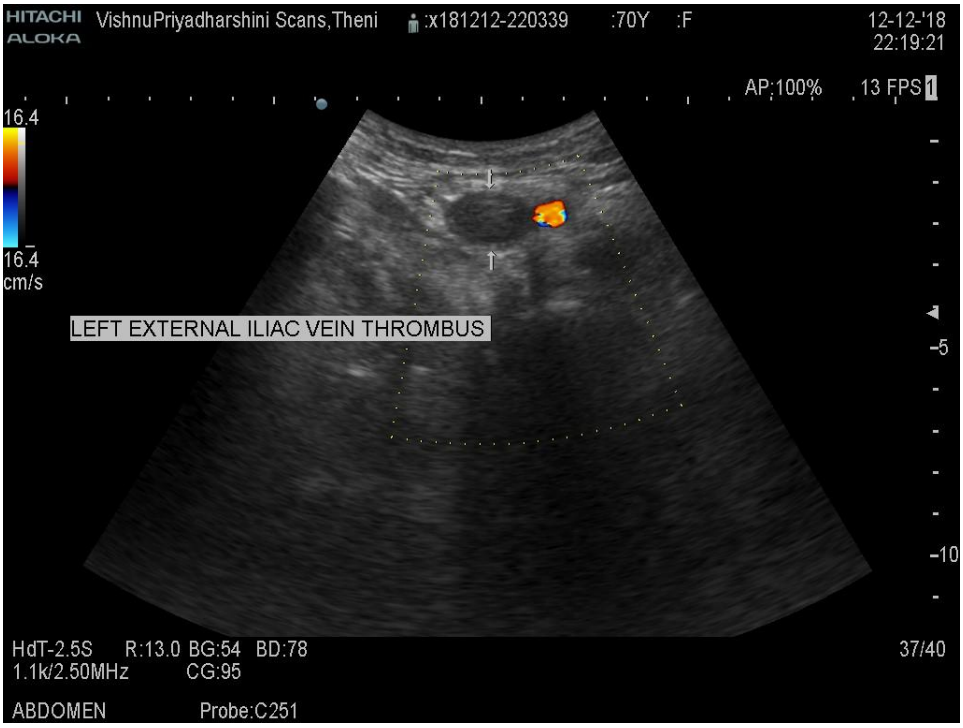

Figure 6 a: 70 years old lady with bilateral medical renal disease, screening of left iliac fossa showing thrombosis of left external iliac vein

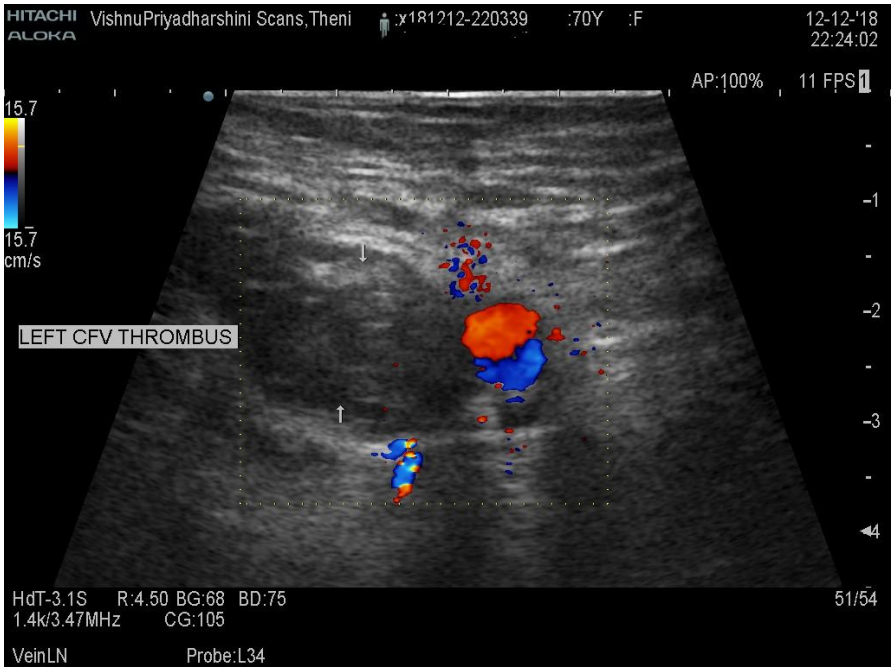

Figure 6 b: Image shows that lumen of left common femoral is expanded and filled with thrombus (DVT)

One patient had para-aortic lymphadenopathy with hypoechoic lesions in spleen for which common differentials are TB or lymphoma. Another adult patient who was referred for pain abdomen was found to have undescended right testis in right iliac fossa.

Five cases of umbilical hernia were found, four of them as incidental findings and one patient had pain due to umbilical hernia (with free fluid in addition to omentum within hernia sac). Two cases of inguinal hernia were seen. By assessing relationship of inferior epigastric vessels with neck of hernia sac, we could confidently differentiate direct and indirect inguinal hernias. Content of hernia and reducibility could be assessed. Another case was diagnosed as hiatal hernia by demonstrating widened oesophageal hiatus measuring 18 mm.

Four cases of ovarian/ adnexal cysts (4%) were found. Two cases of adenomyosis were found. Two cases of uterine fibroids were found incidentally. One case of scar endometriosis was found in anterior abdominal wall.

There were two cases of ectopic pregnancy. Abdominal pain, irregular menstrual cycle and bleeding PV were the symptoms. Urine pregnancy test was positive in both of them. But there was no intrauterine gestational sac. Adnexal lesion separate from ovary [8] was found (Figure 7). Free fluid was seen in cul-de-sac.

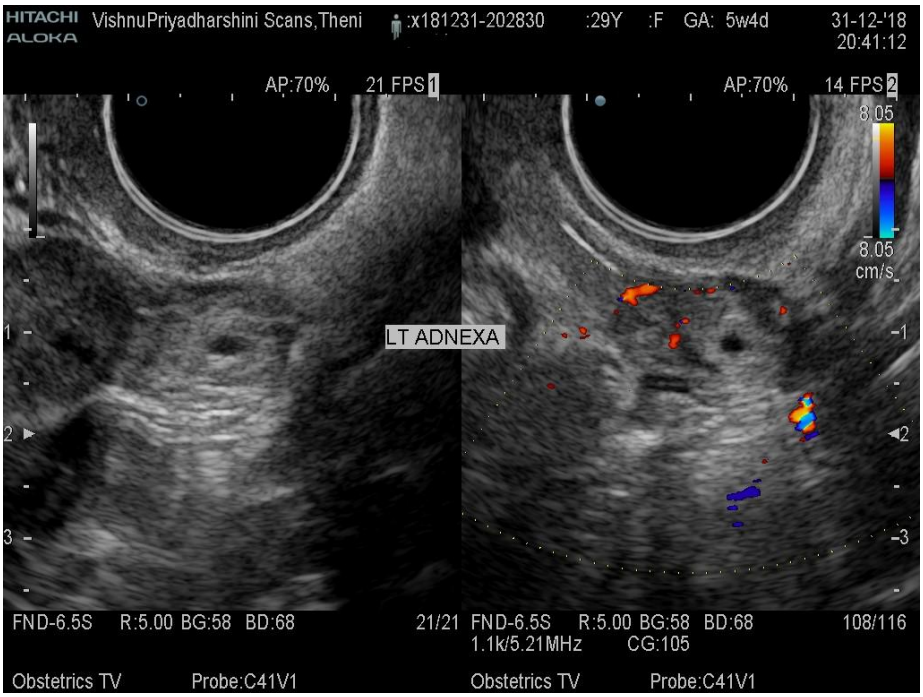

Figure 7: Heterogeneous left adnexal lesion with vascularity. Left ovary was seen separately. Urine pregnancy test was positive. There was no intrauterine gestation. Features are suggestive of left tubal ectopic gestation.

No sonological abnormality was found in 36 patients (35% of patients) with pain abdomen. This is probably from causes such as gastritis which are not usually diagnosed with ultrasound.

Among 104 patients, 68 patients (65% of patients) were found to have one or more pathology.

5. Conclusion

Ultrasound is useful imaging modality in evaluation of patients with abdominal pain. This retrospective study shows that ureteric calculus and cholelithiasis are the two most common diseases in our region in patients referred for ultrasound with pain abdomen. Higher prevalence of renal and ureteric calculi in our region needs further studies to assess the cause.

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