Section: Radiodiagnosis

Original Research Article

COMPARATIVE ASSESSMENT OF EFFICACY OF CONTRAST ENHANCED COMPUTED TOMOGRAPHY AND ULTRASONOGRAPHY IN EVALUATION OF RIGHT LOWER QUADRANT ABDOMINAL PAIN

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Abstract

Background: Right lower quadrant (RLQ) abdominal pain occurs directly above the right inguinal ligament and can last for few hours to months. The most common causes of RLQ pain are conditions that affect the underlying intra-abdominal organs, such as infection, perforation, inflammation, blockage, neoplasia, vascular events, etc. Contrast enhanced computed tomography (CECT) can and ultrasonography (USG) are the most common diagnostic technique adopted to diagnose the cause of RLQ pain. Present study aims at analyzing the efficacy of CECT and USG in evaluation of right lower quadrant abdominal pain. **Materials and Methods:** Total 30 patients visited to the outpatient department with the RLQ pain who had undergone CECT and USG scan. Patients who were in need of immediate surgery and patients with abnormal renal function test were excluded from the study. **Result:** The mean age of the patients was 35.83 ± 19.27 years with majority of males (63.33%). Acute pain was observed in 23 (76.67%) patients and chronic pain in 7 (23.33%) patients. Appendicitis being the most common diagnosis observed in (46.67%) cases. The sensitivity of CECT was 100% for all cases. Compared to the CECT, the sensitivity of USG was 46.15% for appendicitis, 100% for renal or ureteric calculi, 66.66% for enteric infective etiology and retroperitoneal lesions and 75% for genitourinary lesions. **Conclusion:** Although CECT and USG were complimentary to each other, but since CECT was more sensitive than USG, therefore, it is recommended that for proper diagnosis both USG and CECT should be combined.

INTRODUCTION

Abdominal pain in the right lower quadrant (RLQ) or right iliac fossa pain, is a discomfort that originates in the lower part of the abdomen. It occurs directly above the right inguinal ligament in the region of the abdomen. RLQ pain may start acutely and last for a few hours to a few days, or it may start sub acutely and last for weeks or months. The most frequent causes of RLQ pain are conditions that affect the underlying intra-abdominal organs, such as infection, perforation, inflammation, blockage, neoplasia, vascular events, etc. Early diagnosis is crucial to reduce the morbidity, which will still be significant if complications ensue.[1]

When a clinical diagnosis cannot be determined for a patient with RLQ pain, laboratory or imaging tests are frequently done to reach to a diagnosis and direct the course of treatment.[2] For the diagnosis of appendicitis, imaging techniques including USG and CT scans with and without contrast are also often employed.[3] Imaging tests can be separately employed or can be conducted in combination. Imaging investigations are crucial for the identification of all illnesses that produce RLQ pain, including acute appendicitis.[4]

In the emergency room, USG is the imaging technique of choice for evaluating RLQ pain. Sometimes USG is used as a triage test to distinguish between individuals whose diagnoses

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can be made with just USG and those who need further imaging using CT. The effectiveness of alternative tests and their influence on clinical outcome are influenced by a variety of circumstances. Although USG is a non-invasive, affordable, and widely accessible technology, it has its own limitations that make it challenging for the radiologist (for example bowel gases). CT scans produce detailed images. Contrast agents may or may not be used during a CT scan. Contrast can be given intravenously, rectally, or orally, as well as through a combination of these methods. On the other hand, CT has the drawback of ionising radiation, but also has the advantage of conclusively ruling out or confirming appendicitis, because of greater precision.[5]

The USG and CT both have the benefit of alternative diagnosis. Therefore, adding any of the two imaging modalities, or both, would be advantageous in the treatment plan. Therefore, choosing the optimum modality with high diagnostic accuracy is crucial to be cost-effective and prevents needless surgery The current study has thus made an effort to assess how USG and CECT are used in individuals with RLQ pain.

MATERIALS AND METHODS

Study Design

Present study was a single centric, prospective, observational, hospital-based study conducted at the department of radiodiagnosis and imaging. Total 30 patients who visited to the outpatient department with the RLQ pain, underwent CECT and USG scan. Patients who were in need of immediate surgery and patients with abnormal renal function test were excluded from the study.

Ultrasonography (USG)

Ultrasonography of all the enrolled patients was carried out in the Department of Radiodiagnosis. A routine USG was done using ALPINION ECUBE8 machine for the lower abdomen using a C1-6CT Hz convex transducer to rule out alternative abnormalities related to solid organs and to rule out free fluid followed by graded compression of the RLQ giving attention to the site of maximal tenderness was performed using a linear transducer L3-12T Hz. Approximately 10-15 minutes average time was taken for each patient. The USG findings were reported as positive, negative or inconclusive. Alternative diagnoses were also reported.

Contrast enhanced computed tomography (CECT): CECT of lower abdomen and pelvis using Siemens Somatom Scope 16 slice CT machine, was performed in Department of Radiodiagnosis and imaging. All CT scans were obtained with helical CT scanner. A single breath-hold scan was obtained from diaphragm to below the symphysis pubis using a collimation of 5-7 mm and a pitch of 1.0 -1.5. The data was reconstructed at intervals of 3-7 mm, depending on the clinical indication. Contrast enhanced helical CT using non-ionic iodinated contrast (iohexol) oral / iv was done, whenever required. All CECT scan were reviewed by single radiologist to avoid intra observer variability.

Statistical analysis

The statistical analysis was carried out using SPSS 27.0. For quantitative variables, mean and standard deviation was used as measures of central tendency and variability respectively. For qualitative variable, fraction of total and percentages was calculated.

RESULTS

The mean age of the patients was 35.83 ± 19.27 years. Out of 30 patients, 19 (63.33%) patients were male and 11 (36.67%) patients were female. Acute pain was observed in 23 (76.67%) patients and chronic pain was observed in 7 (23.33%) patients. Clinical diagnosis was appendicitis in 14 (46.67%) patients, lump in right iliac fossa in 4 (13.33%), renal calculi in 3 (10%) and infective/ inflammatory bowel disease in 3 (10%) each, renal mass/ calculi in 2 (6.67%) and ovarian etiology in 2 (6.67%) patients each, abdominal lump in 1 (3.33%), and appendicitis/ gastritis in 1 (3.33%) patient each [Table 1].

Table 1: Sociodemographic and clinical determinants of patients.

Variable	Subdomain	N	Percent
Gender	Male	19	63.33
	Female	11	36.67
Pain	Acute Pain	23	76.67
	Chronic Pain	7	23.33
Clinical Diagnosis	Appendicitis	14	46.67
	Lump In Right Iliac Fossa	4	13.33
	Renal Calculi	3	10
	Infective/ Inflammatory Bowel Disease	3	10
	Renal Mass/ Calculi	2	6.67
	Ovarian Etiology	2	6.67
	Abdominal Lump	1	3.33
	Appendicitis/ Gastritis	1	3.33

There were 13 total cases of appendicitis, out of which 6 cases were diagnosed correctly on USG. Therefore, the sensitivity of USG for the diagnosis of appendicitis was 46%. There were 4 cases of genitourinary lesions, out of which 3 were diagnosed on USG, which showed the USG sensitivity of 75%. There were 3 cases of renal /

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ureteric calculus and all of them were diagnosed using USG, which showed the USG sensitivity of 100%. There were 3 cases of enteric infective etiology, out of which 2 were diagnosed on USG, which showed USG sensitivity of 66%. Similarly, there were 3 cases of retroperitoneal lesions, out of which 2 were diagnosed on USG, which showed the USG sensitivity of 66%.

Table 2: Table showing sensitivity of USG compared with the sensitivity of CECT.

Disease	Total Cases	Diagnosed on CECT	Diagnosed on USG	Sensitivity of CECT	Sensitivity of USG
Appendicitis	13	13	6	100.00	46.15
Genitourinary Lesion	4	4	3	100.00	75.00
Normal	4	4	4	100.00	100.00
Renal / ureteric calculus	3	3	3	100.00	100.00
Enteric Infective Etiology	3	3	2	100.00	66.66
Retroperitoneal Lesion	3	3	2	100.00	66.66

DISCUSSION

The most frequent acute abdominal disease requiring surgery is acute appendicitis. Imaging may not be required in the majority of individuals with acute appendicitis, since the clinical manifestations are adequately diagnostic to permit surgery. Patients with appendicitis have been identified using clinical prediction scores, such as the Alvarado score. However, compared to imaging evaluation, these clinically based evaluations are less accurate.[6]

The selection criteria for imaging are not frequently indicated in published research for appendicitis, although in the majority of patients, participants with conclusive clinical examination results of appendicitis, undergo surgery without imaging. In a reported study of imaging investigations, although 36 percent of the examined participants experienced nonspecific abdominal pain, but on an average, 45 to 50 percent of the imaged subjects had appendicitis. There is conflicting information on the overall impact of imaging on the success of appendix surgery and patient outcomes.[7]

Acute appendicitis may seldom be diagnosed by radiographic means until an appendicolith or other ancillary abnormalities are seen. Although historically a barium enema has been used to diagnose appendicitis, this method is dependent on the absence of appendix visibility and can be painful for people with acute appendicitis. Nonetheless, barium small-bowel follow through or barium enema may be effective following cross-sectional imaging investigations for additional causes of RLQ pain including suspected small-bowel blockage, infectious ileitis, and inflammatory bowel disease.[7]

In this study, it was observed that CT had a considerably greater sensitivity than ultrasound in identifying appendicitis, intestinal infectious etiology, retroperitoneal lesions and genitourinary lesions. No case was missed by CT, although the USG had missed many cases (38.46%). USG had a sensitivity of 46 % for appendicitis, 66 % for intestinal infective etiology, 66 % for retroperitoneal lesions and 75 % for genitourinary lesions. However, there was no appreciable difference between USG and CT in terms of sensitivity for renal/ureteric calculi.

In the present study, there were 13 cases of appendicitis, out of which 6 cases were diagnosed correctly on USG, which shows 46% sensitivity of USG for the diagnosis of appendicitis. According to Debnath et al,[8] the USG alone demonstrated sensitivity rate of 81% for the diagnosis of appendicitis. The sensitivity of combined USG and CT scan was 96 %. Repplinger et al,[9] evaluated the diagnostic sensitivity of MRI and CT for appendicitis. For MRI imaging, the sensitivity was 96.4 percent, while that of CT scan it was 98.4 percent.

Some of the ultrasonography accuracy estimations in this study were less accurate than those that have been published elsewhere in the literature. According to Puylaert et al,[10] the reported appendicitis detection sensitivity of ultrasonography in skilled hands had been as high as 90%. Ultrasound sensitivity in prior meta-analyses of diagnostic imaging in acute appendicitis ranged from 78-86%,[11] which is in consistency with the values in the current research which indicate a sensitivity of 46%.

One of the earlier investigations by Augustin et al,[12] also showed that female patients with suspected appendicitis had much lower ultrasonography sensitivity compared with male patients. The inability of ultrasonography to penetrate fat is a well-known drawback. Not all fatty people are unsuited for ultrasound evaluation, because it is a real-time test. Ultrasound pictures can more frequently be properly interpreted in patients with a high percentage of extra-mesenteric fat.

In a meta-analysis of six studies in adolescents and adults, CT demonstrated superior sensitivity (91%) and specificity (90%) compared with ultrasound (78% sensitivity and 83% specificity). While ultrasound examinations revealed heterogeneity, indicating a larger dependency on operator competence, the results of CT investigations showed consistent results across all studies and institutions.[13] According to several studies thinner slices and multiplanar reformats may boost confidence in recognising the appendix.[14]

In our study, there were 3 cases of renal / ureteric calculus, 2 out of 3 were diagnosed using X-RAY KUB area which shows the sensitivity of (0.66) and all of them were diagnosed using USG, which

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shows the USG sensitivity of 100%. In an earlier study, Patlas et al,[15] evaluated the diagnostic accuracy of USG and CT scan for the detection of ureteric stones in patients with renal colic. For the diagnosis of ureterolithiasis, the USG demonstrated 93% sensitivity and 95% specificity, whereas the CT demonstrated the sensitivity and specificity of 91% and 95%, respectively.

In current study, there were 3 cases of enteric infective etiology, out of which 2 were diagnosed on USG, which shows the USG sensitivity of 66%. In most cases of infectious enteritis in our study, the bowel wall appeared normal or mildly thickened. This is similar to which has been reported by the Macari et al.[16]

Similarly, there were 3 cases of retroperitoneal lesions out of which 2 were diagnosed on USG, which shows the USG sensitivity of 66%. Charan et al,[17] reported that USG can very well characterise retroperitoneal masses. In comparison to MDCT, USG has been shown to have a sensitivity of 77% and an accuracy of 78% in identifying and characterising retroperitoneal masses. When assessing retroperitoneal masses, USG and CT had corresponding sensitivity rates of 77% and 100%.

In present study, there were 4 cases of genitourinary lesion, out of which 3 were diagnosed on USG, which shows the USG sensitivity of 75%. According to research that was previously published by Heidenreich et al., the comparison of unenhanced CT scans with enhanced corticomedullary and nephrographic phases indicated 100% sensitivity on CECT, advocating that this approach may be a good one.[18]

Totaro et al. highlighted that the diagnostic accuracy of the USG could 95% for tumors >0.5 cm situated on the posterior or lateral walls of the bladder whereas CT imaging could be more sensitive with sensitivity between 79 to 89.7% and specificity between 91–94.7%.[19] Liu et al., analyzed the sensitivity and specificity of USG, CECT and MRI for the diagnosis of ovarian lesions. The sensitivity and specificity for USG was 89% and 84% respectively, for CECT it was 85% and 86% respectively, and for MRI it was 89% and 86.[20] All these studies highlighted the high diagnostic accuracy of CECT over the USG, which has also been observed in the current study.

The major limitation of the study is the sample size. Due to small sample size, the results of present study cannot be generalized to whole population. Apart from this, all the patients were from a single institute, therefore, a multicentric study is required to validate the finding of this study.

CONCLUSION

Present study was a single centric, hospital-based, prospective, and observational study conducted in a health care facility. This study was conducted to establish the role of USG and CECT in evaluation of patients having right lower quadrant pain and to see the sensitivity and specificity of the USG and CECT in diagnosis of right lower quadrant pain. The sensitivity of ultrasound is less in cases of appendicitis, genitourinary lesion, retroperitoneal lesion, and bowel lesion in comparison to CECT scan, which is 100% sensitive, so if had this study been done only by doing USG, it would have missed many lesions. Due to the wide spread availability of CT scanner now a days, the correlation of USG and CECT is very much beneficial for detecting lesions which cannot be detected every time on USG alone. So, the correlation between USG and CECT is therefore necessary and complementary to each other in detecting abdomino-pelvic lesions.

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