COMPARATIVE ROLE OF ULTRASOUND AND COMPUTED TOMOGRAPHY IN DIAGNOSIS OF NONTRAUMATIC RIGHT ILIAC FOSSA PAIN IN PATIENTS ABOVE 50 YEARS OF AGE ADMITTED IN A TERTIARY-CARE HOSPITAL

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ABSTRACT

Objectives: The objective of the study was to evaluate and compare the role of ultrasonography (USG) and computed tomography (CT) in diagnosing non-traumatic right iliac fossa (RIF) pain in the geriatric population. More specifically, to evaluate the diagnostic accuracy parameters of both imaging modalities after enumerating the relevant etiologies. The ultimate aim is to assess the diagnostic accuracy variables of USG in diagnosing non-traumatic RIF pain in the elderly, taking computed tomography as the gold standard of investigation.

Methods: Fifty patients in the elderly age group with non-traumatic RIF pain were evaluated consecutively by USG, followed by a CT scan.

Results: Overall, in detecting non-traumatic RIF pain in our study, sonography was found to have sensitivity, specificity, positive predictive value, and negative predictive value of 35.14%, 23.07%, 56.52%, and 11.1% with respect to a CT scan. It also reveals that in diagnosing the different etiologies of RIF pain, the findings of the USG have a weakly positive correlation with the findings of the CT scan. It also reveals that, on comparison between CT and USG, we found a statistically significant difference in diagnosing RIF pain in this study population.

Conclusions: We therefore conclude that ultrasound may be used as an initial imaging investigation as the majority of cases of non-traumatic RIF pain come in the acute stage and emergency ultrasound comes into play due to its easy use and more availability. However, we must do a CT scan after that to narrow down the differential diagnoses in this age group.

Keywords: Right iliac fossa, Computed tomography, Ultrasonography, Elderly.

INTRODUCTION

The most common cases in acute general surgical facilities are non-traumatic right iliac fossa (RIF) pain [1]. If a patient in this age group has acute RIF or lower abdominal pain but has acute colonic diverticulitis or colorectal neoplasm, the emergency laparoscopy may be inappropriate and may possibly do more damage than good. RIF encompasses the appendix, cecum, ileocecal junction, right ureter, right ovary, and fallopian tube, all protected by anterior abdominal wall muscles. Any form of infection, inflammation, development, or vascular abnormality will irritate the nerves that supply the region. For the purpose of diagnosing pain in the RIF, all international guidelines encourage the use of complementary examinations, especially imaging [2]. Prompt diagnosis and timely imaging tests can have a significant effect on the morbidity and mortality of the patient. Ultrasound offers additional details as it helps in real-time visualization of abdominal organs, bowel caliber, wall thickness, identifiable alteration of the intestinal signature and blood flow can also be assessed by Doppler. On the other side, computed tomography plays a leading role in defining an almost pin-point range of RIF pathologies. It helps to reduce both the negative appendicectomy incidence and the cost of treatment.
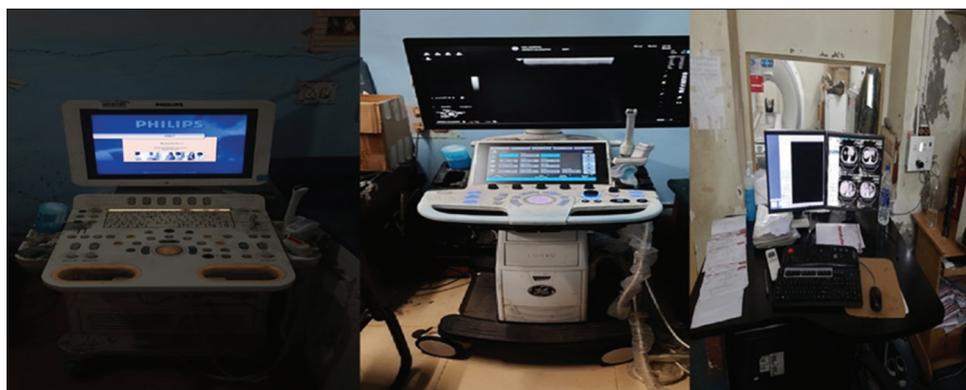
Aims and objectives

The general objective is to evaluate and compare the role of ultrasound and computed tomography in the diagnosis of non-traumatic RIF pain in an over-50-year-old patient admitted to a tertiary care hospital. The specific objectives are twofold: One is to evaluate the sensitivity and specificity of ultrasound with respect to computed tomography in non-traumatic RIF pain in patients over 50 years old, and another is

to enumerate the etiologies of non-traumatic RIF pain in patients over 50 years old admitted to a tertiary care hospital.

METHODS

This is a hospital-based prospective comparative study based on 50 patients who were admitted in the indoor-patient-department (IPD) of general surgery of NRS Medical College and Hospital from January 2020 to June 2021. These patients were selected after applying inclusion and exclusion criteria. Age crossing 50 year, encompassing both genders and only admitted patients were the inclusion criteria. Any history of trauma, patients having unstable vitals requiring urgent management, discharged patients from outpatient department (OPD)/emergency, history of previous abdominal surgery within 90 days, patient's unwillingness and technical factors hindering the imaging procedures remained the exclusion criteria for this study. Institutional review board approval for conducting this study was obtained, and informed consent of all 50 patients was obtained. The sonography machine used was a Philips HD7 with a 3.5–5 MHz curvilinear probe, a 3–12 MHz linear probe, and a sector probe whenever needed. The study was started on the Philips HD seven machines, but due to the non-functioning of the machine in mid-session, the rest of the study was carried out on the GE Logiq P9. The computed tomography (CT) scan machine used was a 16-slice multi-detector computed tomography (MDCT) machine (GE Brivo CT385) (Fig. 1). In cases where more than one diagnosis is offered on clinical assessment, if any of the first two diagnoses matches the MDCT diagnosis, it will be taken as agreement. A pro forma will be drafted to record the basic clinical information and laboratory findings. Then they will undergo an ultrasound and computed tomography imaging investigation. The imaging findings will be statistically analyzed with the aim of finding out the results of

Fig. 1: Utilized ultrasound and computed tomography scan machine with work_station

the study. Statistical analysis was done in Microsoft Excel 2019 and the Statistical Packages for the Social Sciences. Descriptive statistics were calculated as frequencies. Descriptive data were represented using various tables, graphs, and diagrams. A statistical analysis of agreement was performed using Cohen's Kappa and the intraclass correlation coefficient to find out the nature of the agreement between the two methods of observation. A $p<0.05$ was considered significant throughout all statistical tests in the analysis.

RESULTS AND DISCUSSION

Our study showed 50–60-year-olds (44%) to be the major age group, with male predominance (66%) noted. On imaging, it showed that the bowel is predominantly involved (46%), followed by the retroperitoneum (30%). Fever (52%), followed by nausea and vomiting (50%), is the most frequently encountered symptom. Table 1 shows the distribution of the frequency of diseases related to non-traumatic RIF pain in this study population, revealing cases of right ureteric calculi as the most prevalent in our study (10 out of 50), followed by appendicular abscess and right adnexal space occupying lesion (SOL) (6 out of 50, respectively). The gender-wise distribution table (Table 2) shows that 13 out of 14 cases of appendicitis and its complications were present in male patients. Eight out of 10 cases of ureteric calculi were found in male patients. Table 3 shows the distribution of the duration of symptoms in diseases diagnosed in this study, revealing that 46% of all diagnoses are being presented with <1-month duration. (Acute) It shows that ultrasound reveals underlying bowel pathology in only nine out of 23 cases, whereas CT detects 19 out of 23. It shows that ultrasound detects seven out of 15 cases related to retroperitoneal pathology, whereas CT detects nine out of 15 cases. Fig. 2 shows that in the case of detecting omental pathology, ultrasonography (USG) correctly detects only three out of six cases, whereas CT picks up in five out of six cases. Fig. 3 shows that in the case of detecting an adnexal lesion, USG picks five out of six cases (Fig. 4), whereas CT picks only two cases. In our study, with respect to CT, sonography has 54.54% sensitivity and 33.33% specificity in detecting appendicitis and its complications (Fig. 5). The positive predictive value (PPV) and negative predictive value (NPV) were found to be 75% and 16.67%, respectively. In our study, sonography had a 25% sensitivity and a 50% specificity for detecting RT ureteric calculi (Fig. 6) when compared to a CT scan. Overall, in detecting non-traumatic RIF pain in our study, sonography was found to have sensitivity, specificity, PPV, and NPV of 35.14%, 23.07%, 56.52%, and 11.1% with respect to a CT scan. It also reveals that in diagnosing the different etiologies of RIF pain, the findings of the USG have a weakly positive correlation with the findings of the CT scan. It also reveals that, on comparison between CT and USG, we found a statistically significant difference in diagnosing RIF pain in this study population.

The main aim of our study was to illustrate the importance of USG and computed tomography in obtaining a specific diagnosis in patients with

Table 1: Distribution of diagnosed diseases related to non-traumatic right iliac fossa pain

Diagnosis	Frequency (%)
Appendicitis	4 (8)
Appendicular abscess	6 (12)
Appendicular mass	4 (8)
Right-sided diverticulitis	3 (6)
Complicated inguinal hernia	4 (8)
RT adnexal SOL	6 (12)
RT ureteric calculi	10 (20)
Pseudomembranous colitis	1 (2)
RT psoas abscess	3 (6)
RT pyelonephritis	2 (4)
Inflammatory bowel disease	2 (4)
Epiploic appendagitis	1 (2)
Omental infarction	1 (2)
Colon carcinoma	3 (6)
Total	50 (100)

SOL: Space occupying lesion

Table 2: Gender distribution in diseases related to non-traumatic right iliac fossa pain

Diagnosed disease	Number of male patients (%)	Number of female patients (%)
Appendicitis	4 (8)	0
Appendicular abscess	5 (10)	1 (2)
Appendicular mass	4 (8)	0
RT diverticulitis	2 (4)	1 (2)
Complicated inguinal hernia	0	4 (8)
RT adnexal SOL	0	6 (12)
RT ureteric calculi	8 (16)	2 (4)
RT sided pyelonephritis	1 (2)	1 (2)
Pseudomembranous colitis	1 (2)	0
RT psoas abscess	2 (4)	1 (2)
Inflammatory bowel disease	2 (4)	0
Epiploic appendagitis	1 (2)	0
Omental infarction	1 (2)	0
Colon cancer	2 (4)	1 (2)
Total	33 (66)	17 (34)

SOL: Space occupying lesion

non-traumatic fractures. RIF pain is non-traumatic. Initially, ultrasound was performed for these patients, and then computed tomography was performed when ultrasound was inconclusive or when the clinician wanted additional information. In our study, we found that the major age group who presented with non-traumatic RIF pain was 50–60 years (44%). In the study done by Gammeri *et al.* [3], the mean age group was 65 years old. The male-female ratio in our study was approximately 1.9:1, whereas the male-female ratio was 1:1 in a study by Bourcier *et al.* [4]. In our study, the bowel is the predominant organ involved in

Table 3: Duration of symptoms in diseases diagnosed in this study

Serial number	Diagnosis	Number of cases	<1 month	1–3 months	3–6 months	>6 months
1	Appendicitis	4	4	0	0	0
2	Appendicular abscess	6	5	1	0	0
3	Appendicular mass	4	3	1	0	0
4	RT diverticulitis	3	1	1	1	0
5	RT ureteric calculi	10	6	2	2	0
6	Complicated inguinal hernia	4	1	1	1	1
7	RT adnexal SOL	6	0	0	0	6
8	Colon carcinoma	3	0	0	0	3
9	Epiploic appendagitis	1	1	0	0	0
10	Omental infarction	1	1	0	0	0
11	RT Psoas abscess	3	0	2	1	0
12	Pseudomembranous colitis	1	0	0	1	0
13	RT pyelonephritis	2	1	1	0	0
14	Inflammatory bowel disease	2	0	0	1	1
	Total (%)	100	46	18	14	22

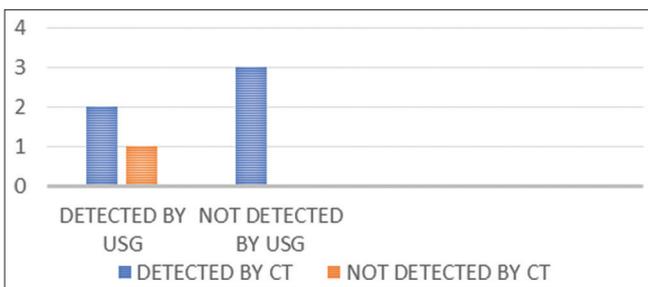SOL: Space occupying lesion

Fig. 2: Comparison of findings of use in respect to ct in diagnosing omental pathology

Fig. 3: Comparison of findings of use in respect to ct in diagnosing adnexal pathology in this study

Fig. 4: Right adnexal sol

Fig. 5: Inflamed appendix with appendicolith

Fig. 6: Right ureteric calculus

elderly non-traumatic RIF pain (46%). In the study done by Gammeri *et al.* [3], the bowel was also the most common organ affected (62%). However, in the Indian study done by Samraj *et al.* [5], the bowel was involved almost in all cases (96.66%). In our study, when we arrange the diagnosis related to non-t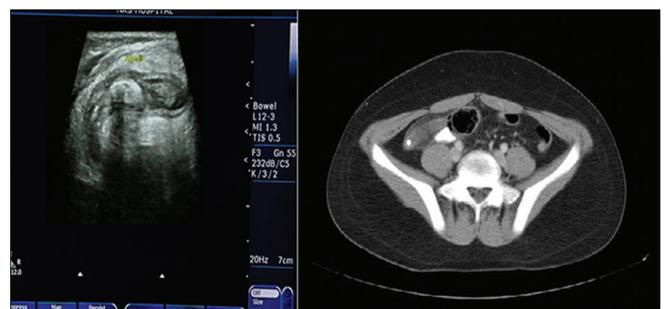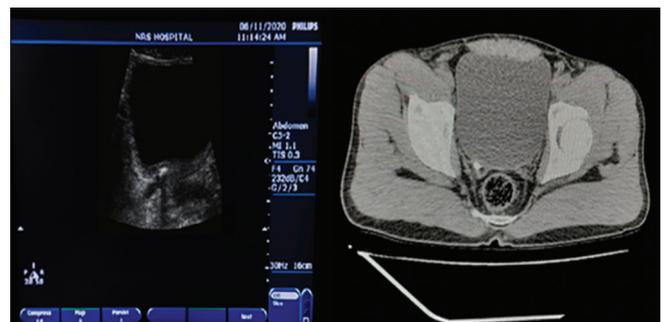raumatic RIF pain, appendicitis and its complications together stand 1st in frequency (28%), followed by right ureteric calculi (20%). However in individual scenarios, right ureteric calculi were most common, followed by appendicular abscess (12%) and right adnexal SOL (12%). The study done by Burai *et al.* [6] revealed that ovarian cysts were the second cause of non-traumatic RIF pain. Although appendicitis was more frequent than ovarian cysts, the difference is 2% (19% vs. 17%, respectively).The most common complication of appendicitis is abscess formation, followed by an appendicular lump or mass. In our study, the majority of appendicular abscesses were found in the age group of 50–60 years. Furthermore, we found that out of 14 cases related to appendicitis, 10 cases developed complications (71%). These results are corroborated by the study done by Shchatsko *et al.* [7] where they found that elderly patients were significantly more likely than other age groups to have complicated appendicitis with perforation or abscess. The complicated appendicitis rate ranges from 18% to 70%. The next most common diagnosis is adnexal SOL. We found that in this diagnosis, all age groups of the elderly were absolutely similarly affected. Age is the most significant risk factor for ovarian cancer, with a lifetime risk for ovarian cancer of 1 in 70. Malignant ovarian neoplasms manifest after age 65. In our

study, male elderly patients were mostly affected by appendicitis and its complications, and ureteric calculi made up the major bulk of the different diagnoses in non-traumatic RIF pain of the elderly (92.8% male in appendicular pathology, 80% in rt ureteric calculi). In our study, 46% of all diagnoses are presented with duration of 1 month (acute). About 85.7% (12 out of 14) of the cases of appendicitis with its complications presented as acute manifestations. About 100% of cases of rt adnexal SOL have symptoms that last longer than 6 months. In our study, ultrasound was able to detect only nine cases out of 23 (39.513%), whereas CT detected 82.61% of the cases of bowel pathology. Visualization of the gut in the pelvis and lower quadrants is frequently limited by the deep position of the bowel, which is often obscured by intraluminal gas from more superficial loops of gut. In our study, ultrasound detects only seven cases of retroperitoneal pathology out of 15 cases and three out of six cases in omental pathology. Conventionally, CT has been the imaging modality of choice for the evaluation of omental lesions. In our study, ultrasound detects only seven cases of retroperitoneal pathology out of 15 cases and three out of six cases in omental pathology. Conventionally, CT has been the imaging modality of choice for the evaluation of omental lesions. In our study, USG detected five cases out of six adnexal SOL cases. In respect to CT, the sensitivity and specificity of USG are found to be 50% and 0%, respectively. The PPV and NPV are found to be 20% and 0%. In the study done by Bhimani *et al.* [8], in the evaluation of ovarian lesions, CT scan (97.8%) was more sensitive than USG (85.1%), but sonography (94.5%) was more specific than CT scan (92.1%) in the diagnosis of malignant lesions. USG (95.2%) has a high PPV as compared to CT scanning (93.7%) for diagnosing malignant lesions. However, CT scan had a higher NPV (97.2%) than USG (83.3%) in ruling out malignant lesions. In our study, with respect to CT sonography, it has 54.54% sensitivity and 33.33% specificity in detecting appendicitis and its complications. The PPV and NPV were found to be 75% and 16.67%, respectively. In a retrospective study by Ross *et al.* [9] on 968 children, the efficacy of USG in determining acute appendicitis in patients with non-visible appendix was studied. In 526 cases, the appendix was not found in sonography, of which 15.6% had a positive pathology for acute appendicitis. The sensitivity and specificity of ultrasound in the group where the appendix was fully visible were reported at 99.5% and 81.3%, respectively. The study eventually found that children with no reassuring clinical examinations following incompletely visualized appendices in the US may benefit from further imaging modalities to reduce the rate of negative appendectomy. In our study, sonography had a 25% sensitivity and a 50% specificity in detecting rt ureteric calculi when compared to a CT scan. In the study done by Ahmed *et al.* [10], in 184 patients, National Council for Cooperative Training detected 276 (97.2%) stones, while the US could identify 213 (75.5%) stones. The overall sensitivity and specificity of the US were 75.4% and 16.7%, respectively. Overall, in detecting non-traumatic RIF pain in our study, sonography was found to have sensitivity, specificity, PPV, and NPV of 35.14%, 23.07%, 56.52%, and 11.1% in respect to CT scan. Our study is a very unique one. We took a CT scan as the gold standard investigation for evaluation of non-traumatic RIF pain, and then we used sonography to pick up the diagnoses and compare the findings in respect to the CT scan. Normally when we compare two modalities in studying one pathology, the gold standard one was normally histopathology or else. However in our study, as we did not get histopathology reports in all cases, we focused this study on the comparison of imaging investigations only. We found that USG is not as good as a CT scan in detecting various pathologies of non-traumatic RIF pain. Another uniqueness of our study is that we focus only on patients aged over 50 years which is very rarely studied in respect to non-traumatic RIF pain before. Geriatric radiology is almost neglected all over the world despite the burden of aged people throughout the world and specifically in India is huge. In developing countries like India, elderly patients face many obstacles in reaching and taking healthcare facilities in India until date. Moreover, a huge amount of hospitals run by government do not have ultrasound and CT scan machine. In Nil Ratan Sircar Medical College and Hospital, where the study is being done,has fortunately both ultrasound and CT scan machines. Furthermore due to its easy accessibility, many elderly

patients came to us referred from various OPDs for routine ultrasound and CT scan. During the time of COVID-19 epidemics due to lockdown, we have very less patients to come in our department, but we managed to get 50 patients as our sample size for our study.

CONCLUSIONS

RIF pain is a common presentation and the underlying cause can be difficult to ascertain. The casualty officer or GP may be puzzled as to which speciality to refer such patients, being torn between the surgeon, the gynecologist, the urologist or even the medical team on call. We studied on 50 patients from the geriatric population (above 50 year of age) admitted in general surgery IPD with non-traumatic RIF pain. We took USG and CT scans of all those patients consecutively to detect the underlying pathology. We took a CT scan as gold standard investigation and compare the USG finding with it. We found that ultrasound is not as good as a CT scan in correctly identifying pathology. We therefore conclude that ultrasound may be used as an initial imaging investigation as the majority cases of non-traumatic RIF pain comes in the acute stage and emergency ultrasound comes to play a role due to its easy use and more availability. However, we must do a CT scan after that to narrow down the differential diagnoses. We as a radiologist should follow-up the patients afterward by discussing with the surgeons, pathologists and may even have to do follow-up ultrasound or any other imaging investigation.

Limitation

This prospective study explores the use of MDCT technology in medical imaging, addressing concerns about healthcare costs and radiation exposure. The study aims to evaluate the effectiveness of imaging in patient management and reduce negative surgical rates and unnecessary hospital admissions. However, the study is based on radiology and has a low sample size, making its statistical importance low. In addition, the study population is not representative of the geriatric population, as patients with RIF pain may be admitted to other medical fields, such as orthopedics, urosurgery, gynecology, and emergency wards. Future prospective studies could evaluate these findings in other community hospital settings.

Summary and recommendation

The study reveals that USG alone cannot diagnose non-traumatic RIF pain, requiring confirmation through computed tomography and biopsy/histopathology. Despite radiation risk, CT scans are recommended to narrow down the diagnostic domain.

AUTHORS' CONTRIBUTION

Research concept: Dr Prasun Das; Supervision: Dr. Sudipta Basu, Dr. Malay Karmakar; Data Collection: Dr Prasun Das, Dr. Srijak Bhattacharyya; Data analysis and interpretation: Dr. Srijak Bhattacharyya, Dr.Malay Karmakar; Literature search: Dr Prasun Das, Dr Malay Karmakar; Writing article: Dr Prasun Das; Critical review: Dr Malay Karmakar, Dr Sudipta Basu; Article editing: Dr Srijak Bhattacharyya; Final approval: Dr Prasun Das, Dr Sudipta Basu, Dr Malay Karmakar, Dr Srijak Bhattacharyya.

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