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Diagnostic Value of Computed Tomography and Ultrasound in Patients with Acute Cholecystitis

Dr. Nani Gopal Tripura[1*], Dr. Shankhadip Mula[2], Dr. Shamsh Tabrez Alam[3]

[1*]Assistant Professor, Dept. of Radiodiagnosis, ICARE Institute of Medical Sciences and Research and Dr. Bidhan Chandra Roy Hospital, Haldia
[2]Assistant Professor, Dept. of Radiodiagnosis, ICARE Institute of Medical Sciences and Research and Dr. Bidhan Chandra Roy Hospital, Haldia
[3]Assistant Professor, Dept. of Radiodiagnosis, ICARE Institute of Medical Sciences and Research and Dr. Bidhan Chandra Roy Hospital, Haldia

***Corresponding Author**: Dr. Nani Gopal Tripura
*Assistant Professor, Dept. of Radiodiagnosis, ICARE Institute of Medical Sciences and Research and Dr. Bidhan Chandra Roy Hospital, Haldia

ABSTRACT

Background: Gallstones are frequently linked to the inflammatory gallbladder illness known as acute cholecystitis (AC). In addition to occurring in surgical procedures, it can be the cause of up to 5% of ED visits. The majority of patients arrive with fever and pain in the right upper quadrant (RUQ). Furthermore, complex intra-abdominal infection is regarded as the second most common cause of AC, accounting for 18.5% of cases. Female sex, obesity, pregnancy, and being in one's forties are risk factors for AC.

Materials and Methods: The electronic medical records of the hospital were examined in order to obtain information about every patient who was diagnosed with AC. The information retrieved included the patient's height (cm), weight (kg), type of shift if they were admitted through the ED, fever, pain radiating to the shoulder or back, nausea, vomiting, and first clinical presentation, which included RUQ pain, epigastric pain, and unexplained abdominal pain. There were also other concurrent morbidities observed. The investigation encompassed the following laboratory values: total white blood cell count (WBC count), gamma-glutamyl transferase (GGT), aspartate transaminase (AST), alanine transaminase (ALT), total and direct bilirubin.

Results: In the present retrospective study a total of 140 patients were enrolled based on inclusion and exclusion criteria. The mean age in years was 44.62±12.56 years, out of 140 patients 44 (31.42%) were males and 96 were females (68.5%). The clinical presentation showed that 62.8%, 37.14%, 22.85%, 15.71%, 34.28% and 52.85% patients presented with pain in RUQ, unspecified abdominal pain, epigastric pain, fever, nausea, and vomiting. Biochemical parameters and WBC counts were assessed, it is seen that 72.8%, 62.8%, 65.71%, 61.4%, 55.71% and 45.71% had elevated bilirubin, direct bilirubin, WBC counts, ALT, AST and GGT levels. Ultrasound examination was performed in 140 patients, the diagnostic accuracy showed 35.71% sensitivity, 76.19% specificity, 50% positive predictive value and 64% negative predictive value. Similarly CT abdomen assessment was done in 24 patients who have been identified with acute cholecystitis, which showed 82.3% sensitivity, 60% specificity, 58.33% positive predictive value and 83.33% negative predictive value.

Conclusion: The major objective of the current investigation was to ascertain the sensitivity and specificity of US and CT in respect to histopathological reports in order to predict AC. We discovered that although US is more specific in diagnosing AC, CT is more sensitive than US. Thus, we came to the conclusion that, in cases where imaging is required to establish the diagnosis of AC, US is the recommended primary modality for patients with typical indications of AC, whereas CT is the preferable option for patients with atypical clinical signs and symptoms or unclear US findings.

Key-words: acute cholecystitis, gall stones, computed tomography and ultrasonography.

INTRODUCTION

Gallstones are frequently linked to the inflammatory gallbladder illness known as acute cholecystitis (AC) [1]. In addition to occurring in surgical procedures, it can be the cause of up to 5% of ED visits [2-4]. The majority of patients arrive with fever and pain in the right upper quadrant (RUQ) [5]. Furthermore, complex intra-abdominal infection is regarded as the second most common cause of AC, accounting for 18.5% of cases [6]. Female sex, obesity, pregnancy, and being in one's forties are risk factors for AC [1]. Additionally, almost one-third of people with cholelithiasis are affected. 1-4% percent of cholelithiasis patients exhibit symptoms annually, and of these, thirty percent go on to develop AC [8–10]. Ultrasound (US) is the preferred initial imaging test for the diagnosis of AC, with scintigraphy being a better alternative. One secondary imaging test that can identify extra biliary diseases and problems related to AC is computed tomography (CT) [11]. The US procedure, which typically takes ten to fifteen minutes to perform, uses high-frequency sound waves to create images of interior organs without exposing the patient to radiation. On the other hand, CT uses revolving X-ray equipment in conjunction with computers to create a cross-sectional image of the body. CT scans usually take ten to thirty minutes. It is not advised for pregnant women or children since the radiation exposure ranges from 2 to 10 mSv [12]. The preset study was conducted to assess the diagnostic accuracy of ultrasound versus computed sonography in acute cholecystitis.

MATERIALS AND METHODS

Study site

This study was conducted at the Department of Imaging, at our tertiary care hospital.

Study population

We included the patients diagnosed with acute cholecystitis who has undergone laparoscopic cholecystectomy whose CT and ultrasound reports are available.

Study design

Retrospective review study.

Inclusion Criteria

We included the diagnosed and confirmed cases of acute cholecystitis who has undergone laparoscopic cholecystectomy for the past 2 years at our tertiary care hospital in the age group 18-60 years.

Exclusion Criteria

Patients with no radiological investigation, pregnant women, patients who were refereed from other hospitals were excluded.

Clinical Data collection: The electronic medical records of the hospital were examined in order to obtain information about every patient who was diagnosed with AC. The information retrieved included the patient's height (cm), weight (kg), type of shift if they were admitted through the ED, fever, pain radiating to the shoulder or back, nausea, vomiting, and first clinical presentation, which included RUQ pain, epigastric pain, and unexplained abdominal pain. There were also other concurrent morbidities observed. The investigation encompassed the following laboratory values: total white blood cell count (WBC count), gamma-glutamyl transferase (GGT), aspartate transaminase (AST), alanine transaminase (ALT), total and direct bilirubin.

Radiological findings: The US findings included a sonographic Murphy's sign, gallstones, gallbladder sludge, enlarged/distended gallbladder, common bile duct dilatation (>6 mm), gallbladder wall thickening (defined as a gallbladder wall >3 mm), pericholecystic fluid, and air within the gallbladder lumen or wall (dirty shadowing). These findings were based on the final attending radiologist's interpretation. If a patient had any of the aforementioned symptoms, they were deemed positive for AC. Gallstones, pericholecystic fluid, pericholecystic inflammation, common bile duct dilatation (defined as >6 mm), increased enhancement of the adjacent liver, gallbladder wall thickening (defined as >3 mm), indistinct gallbladder wall, choledocholithiasis, air within the gallbladder lumen or wall, increased gallbladder wall attenuation, and poor gallbladder wall were all recorded for each CT study.

Pathological findings: The specimens that were classified as AC had certain characteristics, such as bleeding, fibrin deposition, neutrophilic infiltration, edema, and mucosal ulcers. Specimens of chronic cholecystitis included lipid-laden macrophages in the lamina propria, Rokitansky-Aschoff sinuses in the wall, mucin-secreting cells lining the papillary mucosa, and mononuclear infiltration.

Statistical Analysis

Statistical evaluation was performed by statistical package for the social sciences (SPSS) version 17. Data was presented as tables, bar diagrams and pie charts. Sensitivity, specificity, negative predictive value (NPV), and positive predictive value (PPV) for US and CT were calculated for assessing the diagnostic value of CT and USG. A p value <0.05 was considered statistically significant.

RESULTS

Table 1: Shows demographic and clinical presentation of study subjects

Variables	Number of Patients 140
Age (years)	44.62±12.56
Males	44 (31.42%)
Females	96 (68.5%)
Clinical presentation	
Abdominal pain (RUQ)	88 (62.8%)
Unspecified abdominal pain	52 (37.14%)
Epigastric pain	32 (22.85%)
Fever	22 (15.71%)
Nausea	48 (34.28%)
Vomiting	74 (52.85%)

Table 2: Laboratory findings of Acute Cholecystitis Patients

Variables	Number of Patients
Elevated Bilirubin	102 (72.8%)
Direct Bilirubin	88 (62.8%)
Elevated WBC counts (>11,000/micro L)	92 (65.71%)
Elevated ALT (>45 IU/L)	86 (61.4%)
Elevated AST (>50 IU/L)	78 (55.71%)
Elevated GGT (60 IU/L)	64 (45.71%)

Table 3: Imaging studies in Acute Cholecystitis Patients

USG diagnosis of lesions		CT diagnosis of lesions	
Diagnosis by USG		Diagnosis by CT	
Diagnosed as AC	40 (28.57%)	Diagnosed as AC	24 (60%)
True positive	20	True positive	14
False negative	36	False negative	3
True negative	64	True negative	15
False positive	20	False positive	10

Table 4: Diagnostic Value of CT and USG in Acute Cholecystitis

USG diagnosis of lesions		CT diagnosis of lesions	
Diagnosis by USG		Diagnosis by CT	
Sensitivity	35.71%	Sensitivity	82.3%
Specificity	76.19%	Specificity	60%
PPV	50%	PPV	58.33%
NPV	64%	NPV	83.33%

DISCUSSION

In the present retrospective study a total of 140 patients were enrolled based on inclusion and exclusion criteria. The mean age in years was 44.62±12.56 years, out of 140 patients 44 (31.42%) were males and 96 were females (68.5%). The clinical presentation showed that 62.8%, 37.14%, 22.85%, 15.71%, 34.28% and 52.85% patients presented with pain in RUQ, unspecified abdominal pain, epigastric pain, fever, nausea, and vomiting. Biochemical parameters and WBC counts were assessed, it is seen that 72.8%, 62.8%, 65.71%, 61.4%, 55.71% and 45.71% had elevated bilirubin, direct bilirubin, WBC counts, ALT, AST and GGT levels. Ultrasound examination was performed in 140 patients, the diagnostic accuracy showed 35.71% sensitivity, 76.19% specificity, 50% positive predictive value and 64% negative predictive value. Similarly CT abdomen assessment was done in 24 patients who have been identified with acute cholecystitis, which showed 82.3% sensitivity, 60% specificity, 58.33% positive predictive value and 83.33% negative predictive value. The results of the present study showed computed tomography has better diagnostic accuracy as compared to ultrasound.

If clinical suspicion of AC exists, US should be used as the first imaging modality. Its broad availability, low cost, quick image acquisition time, and absence of ionizing radiation are among its benefits. The capacity of US to diagnose AC based only on the Murphy sign's existence is another benefit. With a 92% PPV for AC, the Murphy sign is a valuable tool when used in conjunction with cholelithiasis [13]. It has been demonstrated that cholescintigraphy is more sensitive and specific for AC than CT and US [14]. CT is also easily accessible and can be completed rapidly, although its drawbacks include ionizing radiation and high cost. CT is often used to evaluate patients with an unclear clinical presentation, wide differential diagnosis, and pain not solely localized to the right upper quadrant [15].

Limitations of the study

The present study has some limitations pertaining to sample size and single centric study. Further research is required to confirm the findings with larger sample size and multi centric study.

CONCLUSION

The major objective of the current investigation was to ascertain the sensitivity and specificity of US and CT in respect to histopathological reports in order to predict AC. We discovered that although US is more specific in diagnosing AC, CT is more sensitive than US. Thus, we came to the conclusion that, in cases where imaging is required to establish the diagnosis of AC, US is the recommended primary modality for patients with typical indications of AC, whereas CT is the preferable option for patients with atypical clinical signs and symptoms or unclear US findings.

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