



Comparative Study of Ultrasonography and Computed Tomography in Diagnosis of Acute Pancreatitis

¹Dr. Biraj Roy, ²Dr. Amarendra Nath Sarkar and ³Dr. Debasish Dey

¹Department of Radiodiagnosis, North Bengal Medical College and Hospital, Sushrutanagar, Darjeeling-734012, West Bengal, India

²Department of General Surgery, North Bengal Medical College and Hospital, Sushrutanagar, Darjeeling-734012, West Bengal, India

³Department of Radiodiagnosis, IPGME and R And SSKM Hospital, Kolkata, West Bengal, India 700020

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Corresponding Author

Dr. Debasish Dey,
Department of Radiodiagnosis,
Ipgme and R And Sskm Hospital,
Kolkata, West Bengal, India 700020
drdebasishdey@gmail.com

Author Designation

¹Third Year Junior Resident

^{2,3}Associate Professor

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ABSTRACT

The pancreas, a complex organ with endocrine and exocrine functions, is challenging to evaluate clinically. It functions as an exocrine gland for digestion and an endocrine gland for hormone production. Acute pancreatitis is an inflammatory process. Ultrasonography and computed tomography offer rapid, accurate and non-invasive evaluations, but ultrasonography has limitations in obese patients and those with large bowel gas. To assess the role of ultrasonography and CT whole abdomen in the evaluation of acute pancreatitis. This cross-sectional institution-based observational study will be conducted for one-year duration at the Dept. of Radiodiagnosis on 50 patients of all age groups referred from the Dept. of General Surgery NBMCH, Sushrutanagar, Darjeeling and West Bengal. In our study, 21 (42%) patients had peripancreatic Fluid Collection Detected by USG and 41 (82%) patients had peripancreatic Fluid Collection Detected by CT. Association between peripancreatic Fluid Collection with USG and CT was statistically significant ($p=0.00003$). In our study, 5 (10.0%) patients had Mild Modified CTSI, 32 (64.0%) patients had Moderate Modified CTSI and 13(26.0%) patients had severe Modified CTSI. The value of z is 5.5923. The value of p is $<.00001$. The result is significant at $p<.05$. Ultrasonography is a cost-effective, non-invasive method for early pancreatic screening, detecting fluid collections and pancreatic necrosis. CT detection increases pancreatic fluid collection. The choice between US and CT depends on patient features, clinical situation and resources. A multi modal approach may be necessary for comprehensive examination.

INTRODUCTION

Pancreas is a gland having both endocrine and exocrine function, difficult to evaluate clinically. It is a retro peritoneal glandular organ in the upper abdomen, but in reality serves two purposes-an exocrine gland aiding in digestion and an endocrine gland producing hormones hence the evaluation of pancreas is complicated as well. An inflammatory pathology involving the pancreas will form part of the differential diagnosis of other conditions presenting with acute abdominal pain. Earlier studies of conventional radiographs were non-specific for pancreatic pathologies. Imaging with ultrasound and computed tomography has afforded rapid, accurate and non-invasive evaluation of pancreas. Pancreas is a soft, lobulated and elongated organ. It lays transversely over the posterior abdominal wall, at the level of vertebrae L1 and L2. The entire organ lies posterior to the stomach, separated from it by the lesser sac. It lies anterior to the inferior vena cava, aorta, splenic vein and left adrenal gland^[1,2]. Pancreas is in anterior pararenal space of the retro peritoneum, just anterior to peri renal (Gerota fascia) and posterior to parietal peritoneum^[3]. Acute pancreatitis is defined by the International Symposium on Acute Pancreatitis (Atlanta, 1992) as "an acute inflammatory process of the pancreas with variable involvement of other regional tissues or remote organ systems associated with raised pancreatic enzyme levels in blood and/or urine^[4]." Acute pancreatitis was initially classified into mild acute (interstitial edematous) and severe acute (necrotizing) types^[5,6]. The classification was recently revised and updated, distinguishing between two phases of acute pancreatitis: an early phase (within the first week) and a late phase (after the first week)^[7]. Ultrasonic devices for medical purposes were used in the year 1957. Ultrasonography provided the first reliable, reproducible, inexpensive, non-invasive, cross-sectional view of pancreatic anatomy and radiation free imaging. However, it has limitation in obese patients and in those with large amounts of bowel gas. Computed tomography invented in the year 1973, incorporates several unique features which facilitate pancreatic imaging in finer detail. Earlier investigators used to evaluate the role of Computed Tomography in the assessment of pancreatic and Peripancreatic abnormalities were pioneers including Haaga and Alfidi (1976). The improved spatial resolution and contrast sensitivity available with the present generation of CT scanners has further enhanced our capability for evaluating pancreatic lesions unlike angiography and ERCP which are difficult to perform as well as interpret. Although Ultrasound and Percutaneous transhepatic cholangiography (PTC) have a definite role in the evaluation of pancreatic lesions, Computed tomography with its higher sensitivity emerges as the imaging technique of choice for evaluating the nature and extent of pancreatic

lesions. The inflammatory process may be limited to the pancreas, spread to surrounding tissues or even involve the remote organs, resulting in multi organ failure and occasional death. Imaging of acute pancreatitis requires not only an understanding of the disease subtypes and associated complications but also familiarity with the appropriate radiologic nomenclature as defined by the Atlanta symposium in^[8] and, more recently, modified by the Acute Pancreatitis Classification Working Group in 2008. Correct use of the terms describing the radiological findings is crucial for management decision-making in patients with acute pancreatitis. In patients with acute pancreatitis, imaging is recommended to confirm the clinical diagnosis, investigate the etiology and grade the extent and severity of the disease. Ultrasound (US) is the first-line imaging modality in most centers for the confirmation of the diagnosis of the disease and the ruling out of other causes of acute abdomen, but it has limitations in the acute clinical setting. Contrast-enhanced computed tomography (CT) plays a significant role in evaluating the extent and evolution of the disease and its complications. Magnetic resonance imaging (MRI) has earned an ever more important role in the diagnosis of acute pancreatitis. It is especially useful for imaging of patients with iodine allergies, characterizing collections and assessment of an abnormal or disconnected pancreatic duct. The study evaluates the use of ultrasonography and CT scans in assessing acute pancreatitis, comparing their role in diagnosing the condition, highlighting cases where USG was inconclusive and comparing the effectiveness of CT scans in determining the diagnosis of the condition.

MATERIALS AND METHODS

Study Type: Institution based observational study.

Study Design: Cross sectional study.

Study Setting: This study will be conducted in Dept. of Radiodiagnosis on patients referred from Dept. of General Surgery NBMCH, Sushrutanagar, Darjeeling, West Bengal.

Study Period: One year after approval of title of the thesis.

Sample Technique: Purposive as per inclusion and exclusion criteria.

Sample Size: 50(purposive).

Study Population: 50 patients of all age groups who will be referred from the department of general surgery with suspecting of acute pancreatitis undergo USG and CECT.

Inclusion Criteria: Patients of all age groups referred for ultrasound abdomen in whom pancreatic pathology was detected on routine protocol.

Exclusion Criteria: Patients who were pregnant or expecting a pregnancy. Patient who were not willing to undergo the study. Other exclusion criteria for CT including Previous history of hypersensitivity reaction, Impaired renal functions (serum creatinine >1.5mg/dl) to undergo contrast examination.

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spread sheet and then analyzed using SPSS (version 27.0., SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests, which compare the means of independent or unpaired samples, were used to assess differences between groups. Paired t-tests, which account for the correlation between paired observations, offer greater power than unpaired tests. Chi-square tests (χ^2 tests) were employed to evaluate hypotheses where the sampling distribution of the test statistic follows a chi-squared distribution under the null hypothesis., Pearson's chi-squared test is often referred to simply as the chi-squared test. For comparisons of unpaired proportions, either the chi-square test or Fisher's exact test was used, depending on the context. To perform t-tests, the relevant formulae for test statistics, which either exactly follow or closely approximate a t-distribution under the null hypothesis, were applied, with specific degrees of freedom indicated for each test. P-values were determined from Student's t-distribution tables. A p-value ≤ 0.05 was considered statistically significant, leading to the rejection of the null hypothesis in favour of the alternative hypothesis.

RESULTS AND DISCUSSIONS

Table 1: Distribution of Per Pancreatic Size, Peripancreatic Inflammation, Peri Pancreatic Fluid Collection, Extra Pancreatic Manifestation by USG and CT

		USG	CT
Size	Bulky	32(64%)	40(80%)
	Normal	18(36%)	10(20%)
Peri pancreatic inflammation	Yes	34(68%)	40(80%)
	No	16(32%)	10(20%)
Peri pancreatic Fluid Collection	Yes	21(42%)	41(82%)
	No	29(58%)	9(18%)
pancreatic duct dilatation	Yes	4(8%)	8(16%)
	No	46(92%)	42(84%)
Extra pancreatic Manifestation	Ascites	12(24%)	16(32%)
	Pleural Effusion	24(48%)	32(64%)
	Fatty Liver	22(44%)	25(50%)
	Pseudo aneurysm	1(2%)	3(6%)
	Gall Bladder Stone	10(20%)	6(12%)

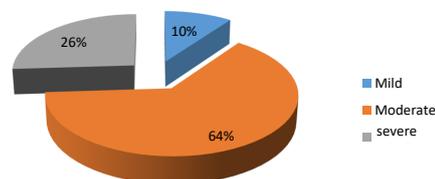


Fig. 1: Distribution of Modified CTSI

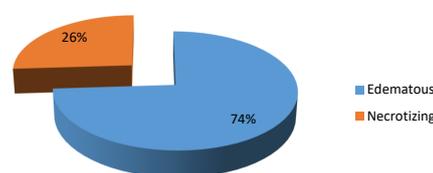


Fig. 2: Distribution of Edematous or Necrotizing on CECT

In our study, 32 (64%) patients pancreas were bulky on USG and 18 (36%) patients pancreas were normal on USG, 40 (80%) patients pancreas were bulky on CT and 10(20%) patients pancreas were normal on CT. Association between size of pancreas with USG and CT was statistically not significant (p=0.0747) .In our study, 34 (68%) patients had peripancreatic inflammation by USG and 40 (80%) patients had peripancreatic inflammation by CT. Association between peripancreatic inflammation with USG and CT was statistically not significant (p=0.1713).In our study, 4 (8%) patients had pancreatic duct dilatation Detected by USG and 8 (16%) patients had pancreatic duct dilatation Detected by CT. Association between pancreatic duct dilatation with USG and CT was not statistically significant (p=0.2183) .In our study, 12 (24%) patients had Ascites on USG and 16 (32%) patients had Ascites on CT .In our study, 24 (48%) patients had Pleural Effusion on USG and 32 (64%) patients had Pleural Effusion on CT. In our study, 22 (44%) patients had Fatty Liver on USG and 25(50%) patients had Fatty Liver on CT. In our study, 1 (2%) patient had Pseudo aneurysm on USG and 3(6%) patients had Pseudo aneurysm on CT. In our study, 10 (20%) patients had Gall Bladder Stone on USG and 6(12%) patients had Gall Bladder Stone on CT.

Association between Extra pancreatic Manifestation with USG and CT was not statistically significant ($p=0.8548$). In our study, 5 (10.0%) patients had Mild Modified CTSI, 32 (64.0%) patients had Moderate Modified CTSI and 13(26.0%) patients had severe Modified CTSI. The value of z is 5.5923. The value of p is $<.00001$. The result is significant at $p<.05$. In our study, 37 (74.0%) patients had Edematous on CECT and 13(26.0%) patients had necrotizing on CECT. The value of z is 4.8. The value of p is $<.00001$. The result is significant at $p<.05$.

This cross-sectional observational study was conducted within an institution. This research carried out on patients referred from the General Surgery Department of NBMCH, Sushrutanagar, Darjeeling, and at the Department of Radiodiagnosis ,NBMCH a year after the thesis's title was approved. Fifty individuals across all age groups who are suspected of having acute pancreatitis and are referred from the general surgery department received USG and CECT scans. In our study, out of 50 patients, higher number of patients were 21-30 Years of old in male group (10) compared to Female group (6) but which was statistically not significant ($p=0.9202$) and the mean Age of patients was 37.04 ± 11.42 which is similar to the study found by Banday^[9] that the age of the patients in the study group was in the range of 17-80 years. Maximum patients were in the age group 40-50 years (42.0%). The mean age was 42.32 years and in our study, out of 50 cases, 33 (66%) were male and 17 (34%) were females with a male to female ratio of 1.9:1. Rehan^[10] found that mean age of the patients was 39.03 ± 8.71 years and most of the patients were females 73 (60.8%). Another nearest study observed by Manu^[11] that the age group of patients was 15-66 years with maximum patients (36%) between 26 and 30 years and 86% of patients were male, male to female ratio was 8.6: 1.4 with male preponderance also. We showed that, female population were lower [17 (34.0%)] than male population [33 (66.0%)]. Male: Female ratio was=1.9:1 and it was statistically significant ($p=.00138$) and also 44 (88%) patients were Visualised by USG and 50 (100.0%) patients were Visualised by CT. Shetty^[12] examined that out of 47 patients, pancreas was normal in 2% cases in CT scan and Grasedonio^[13] found that acute pancreatitis (AP) represents a pancreas inflammation of sudden onset that can present different degrees of severity but In our present study, higher number of patients were bulky size of pancreas in CT [40 (80%)] compared to USG [32 (64%)] which was statistically not significant ($p=0.0747$) which corresponding study found by Bellamkonda^[14] that acute pancreatitis is a severe

inflammatory process involving pancreas which may remain localized within the pancreas or spread to regional tissues, involving adjacent or remote organs and may run a highly unpredictable clinical course with variable outcome alike SAXENA^[15] found that acute pancreatitis is a process of acute inflammation of pancreas usually caused by biliary stone, alcohol ingestion, metabolic factors and drugs. Rehan^[10] found that a total of 120 patients of either gender aged 20-60 years with epigastric pain radiating to back and having monographic findings (decreased or 64 heterogeneous pancreatic echogenicity, pancreatic enlargement, peripancreatic fluid collection), supportive of acute pancreatitis were taken except we observed that, most of the patients had heterogeneous parenchyma in Detected by CT [38 (76%)] compared to Detected by USG [33 (66%)] but it was statistically not significant ($p=0.2705$). Banday^[9] observed that acute Pancreatitis is a very common condition leading to the emergency visits in both developed and developing countries. Computed Tomography plays a pivotal role in the diagnosis and subsequent management of pancreatitis. The modified CT severity index includes a simplified assessment of pancreatic inflammation and necrosis as well as an assessment of extra pancreatic complications. In our study, more number of the patients had peripancreatic inflammation in CT [40 (80%)] compared to USG [34 (68%)] which was statistically not significant ($p=0.1713$) but Grasedonio^[13] found that acute pancreatitis (AP) represents a pancreas inflammation of sudden onset that can present different degrees of severity and also Manu^[11] found that Pancreatic inflammation was seen in 100% of patients. 30% patients had no evidence of pancreatic necrosis on CT scan. Another comparable study observed by Bellamkonda^[14] that acute pancreatitis is a severe inflammatory process involving pancreas which may remain localized within the pancreas or spread to regional tissues, involving adjacent or remote organs and may run a highly unpredictable clinical course with variable outcome. Contrast enhanced Computed Tomography (CT) scan is the gold standard technique for accurate depiction of pathology and complications of pancreatitis. Modified CT Severity Index (MCTSI) helps in evaluating the pancreatic inflammation and necrosis and it is also used for assessment of extra pancreatic complications of acute pancreatitis. Ulla^[16] showed that the CT features of acute pancreatitis were focal or diffuse enlargement of pancreas, areas of necrosis, peripancreatic fat standings, extra pancreatic fluid collections, perinephric fat stranding, perirhinal fascial thickening, ascites, pleural effusion, pseudocyst

formation etc and Rehan^[10] found that a total of 120 patients of either gender aged 20-60 years with epigastric pain radiating to back and having monographic findings (decreased or heterogeneous pancreatic echogenicity, pancreatic enlargement, peripancreatic fluid collection), supportive of acute pancreatitis were taken but we found that, higher number of patients had peripancreatic Fluid Collection in Detected by CT [41 (82%)] compared to Detected by USG [21 (42%)] and it was statistically significant ($p=0.00003$) which related study found by Grassedonio^[13] that among the localized complications, they can identify: acute peripancreatic fluid collections (APFC), pseudocysts, acute necrotic collections (ANC), walled off pancreatic necrosis (WOPN), venous thrombosis, pseudoaneurysms and haemorrhage. Multiple organ failure syndrome (MOFS) and sepsis are possible generalized complications of AP. Ullal^[16] showed that the CT features of chronic pancreatitis were focal or diffuse atrophy of the gland, duct dilatation, pancreatic calcifications, ductal calculi etc. Various complications encountered were acute fluid collections, pseudocyst formation, necrosis, pseudoaneurysm, portal vein thrombosis, abscess formation etc but we showed in our study that, less number of patients had pancreatic duct dilatation in Detected by USG [4 (8%)] compared to Detected by CT [8 (16%)] which was not statistically significant ($p=0.2183$). We found that, higher number of patients had Pleural Effusion in CT [32 (64%)] compared to USG [24 (48%)] but it was not statistically significant ($p=0.8548$). Pleural effusion was the most common extra-pancreatic complication, 28 patients (56%), followed by ascites. Raghuwanshi^[17] showed that Pleural effusion was the most common extra-pancreatic complication seen in 46% cases. Another study Alberti^[18] observed that the most common extra pancreatic finding was pleural effusion in 76 (51.0%) patients. Melkundi^[19] found that 100 cases of acute pancreatitis patients were studied to evaluate the complications using MCTSI. The MCTSI grades are classified into mild (0-2), moderate (4-6) and severe (8-10) and also Raghuwanshi^[17] showed that the clinical outcome was compared with the currently accepted CTSI and Modified CTSI. Related study found by Sahu^[20] that according to MCTSI, mild, moderate and severe cases were 24 (40%), 10 (16.7%), 26 (43.3%), respectively. MCTSI was concordant with the RAC grading in 54 (90.0%). Area under the receiver-operating characteristic (ROC) curves (AUROC) was compared by the Hanley and McNeil method. MCTSI were significantly associated with outcome parameters ($P<0.001$), except duration of ICU stay. Sensitivity,

specificity, positive predictive value (PPV) and accuracy of MCTSI for detecting moderate/severe disease were 100%, 92.3%, 94.4% and 96.7%. MCTSI showed significant correlation with clinical outcome parameters and good concordance with RAC grading of severity. MCTSI showed a higher sensitivity but lower specificity than CTSI in differentiating mild from moderate/severe AP. But in our study, most of the patients had Moderate Modified 66 CTSI [32 (64.0%)] which was statistically significant ($p<0.00001$) and also the mean modified CTSI of patients was 5.6000 ± 2.2131 . We showed that, more number of patients had Edematous pancreatitis on CECT [37 (74.0%)] and it's also statistically significant ($p<0.00001$) which comparable study examined by Banday^[9] that CECT was found to be an excellent imaging modality for diagnosis, establishing the extent of disease process and in grading its severity.

CONCLUSION

We come to the conclusion that ultrasonography is unique in that it is non-invasive, emits no ionizing radiation and is reasonably priced. It is very helpful for early screening and assessment, especially in cases when patients cannot get CT scans or in settings with limited resources. Furthermore, US can offer real-time imaging to help assess problems such fluid collections or pancreatic necrosis. We discovered that there was a statistically significant increase in the number of patients with pancreatic fluid collection when detected by CT as opposed to USG. The majority of patients in our study had statistically significant Moderate Modified CTSI. We demonstrated that a statistically significant proportion of individuals had edematous pancreas after receiving CECT. In the end, the decision between US and CT is based on a number of variables, such as the patient's features, the clinical situation and the resources that are available. For a thorough examination and therapy of acute pancreatitis, a multi modal approach combining both imaging modalities may frequently be required, with US acting as an initial screening tool and CT offering a confirmatory and in-depth assessment when appropriate.

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