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Accuracy of ultrasound for the diagnosis of acute pancreatitis

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ABSTRACT

Background and Objectives: The interaction of light with materials, particularly at the nanoscale, forms the foundation of many modern optical and photonic technologies. Among these materials, silver stands out as a preferred choice due to its remarkable optical and electrical properties, including its ability to support low-loss surface plasmon resonances in the visible and near-infrared spectrum. To find the accuracy of ultrasonography in acute pancreatitis taking computed tomography as a gold standard.

METHODOLOGY: Cross-sectional analytical study conducted at the Department of Radiology, Jinnah Hospital Lahore, Pakistan. 163 patients were enrolled in our study. The inclusion criteria of our study were; all patients of both genders aged 18-65 years, presenting with severe acute abdominal pain and epigastric pain with the age group 15 -70 years included in this study. The exclusion criteria included Post-operative case, and lower abdominal pain. All patients underwent CT scan and reports were interpreted by the radiologist. Ultrasonography findings were compared with CT scan findings.

RESULTS: The sensitivity of ultrasound was recorded as 95%, Specificity was 100%. The PPV were 100% and NPV was 27.27 %. In 95% of the cases, the ultrasound was accurate identified pancreatitis. The computed tomography also confirm pancreatitis in n= 160 (98%) while three participant pancreatitis were not diagnosed.

CONCLUSION: Ultrasonography is a highly sensitive & accurate noninvasive method in diagnosing acute pancreatitis. It has not only improved ability of detection of acute pancreatitis but also better patient care by proper preoperative planning and management of acute pancreatitis patients.

KEYWORDS: Acute pancreatitis, Ultrasonography, Sensitivity, Specificity, CT scan.

INTRODUCTION

Acute pancreatitis (AP) is a dangerous condition that manifests itself as an acute abdomen. It is a pancreatic inflammatory disorder.1 It is an inflammatory complaint that triggers a complicated chain of immunological responses that disturb both the progression and outcome of the disease. Early identification and differentiation are required to distinguish edematous acute pancreatitis from necrotizing. The mainstream of people suffers from an insignificant form of the disease, through low morbidity and mortality. However, the clinical course is severe in 10–25% of cases, necessitating intensive care and, in some cases, surgical or radiological intervention. As a result, if the early treatment might reduce morbidity and death, proper diagnosis of patients with acute pancreatitis is crucial. Whatever causes the illness, it develops in three stages: local pancreas inflammation, a broad inflammatory response, and eventually multi-organ failure. An about half of patients die under the 1st week after a severe attack and progress excessive systemic syndrome of inflammatory reaction leading to syndrome and death of multiple organ dysfunctions.2-5 A total of 210,000 acute pancreatitis admissions are expected in the U.S every year. The majority of people with AP knowledge have stomach discomfort that starts in the Epigastric and radiates posterior in most cases. Pain can start quickly, reaching its peak intensity in 30 minutes or less, is frequently excruciating, and lasts for more than 24 hours without relief. Nausea and vomiting are common side effects of the pain. Physical examination reveals considerable upper abdominal discomfort when guarding is present.6

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Two of the following three characteristics must be present in order to diagnose acute pancreatitis: Pain in the abdomen that is consistent with acute pancreatitis, a sudden onset of severe, chronic epigastric pain that frequently radiates to the back. Acute pancreatitis frequently results in collections of necrotic tissue and intra-abdominal fluid. Early on in the course of acute pancreatitis, these collections form. Such a collection does not have a wall or capsule in its early stages. Lesser sac, transverse mesocolon, anterior and posterior pararenal spaces of the retroperitoneum, and small bowel mesentery are the preferred sites for fluid accumulation. The activated pancreatic enzymes that cause necrosis of the surrounding tissues also result in these collections.7

Typical results of contrast-enhanced CT (CECT) and, less frequently, ultrasonography for acute pancreatitis. For the diagnosis and staging of acute pancreatitis and associated consequences, computed tomography (CT) is the preferred imaging modality. An early CT scan is only advised when the diagnosis of acute pancreatitis is unclear or in cases where early complications such intestinal perforation or ischemia are suspected. This is because the diagnosis of acute pancreatitis is typically based on clinical and laboratory findings. Because an early CT scan may underestimate the existence and extent of necrosis, it may be deceptive in terms of the morphologic severity of the pancreatitis. Sometimes it is impossible to tell whether a collection contains fluid exclusively or a combination of fluid and necrotic tissue based merely on CT scans.8

Abdominal ultrasounds may occasionally reveal properties consistent with acute pancreas diagnoses. A CECT scan is the greatest imaging method for the exclusion of conditions which pretend to be AP, diagnosis of the severity and identification of pancreatitis complications and in specific a CECT scan and detecting choledocholithiasis.9-10 Ultrasound is the first imaging tool used to examine and detect choledocholithiasis in patients with acute pancreatitis.11-12It is highly recommended because its qualities are non-invasive, non-expansive, and without radiation

METHODOLOGY

This Cross-sectional and analytical study conducted from September 2020 to February 2022 at the Department of Radiology, Jinnah Hospital Lahore, Pakistan. Informed consent was obtained from all participates. 163 patients were enrolled in our study. The inclusion criteria of our study were; all patients of both genders aged 18-65 years, presenting with severe acute abdominal pain and epigastric pain included in this study. The exclusion criteria included Post-operative case, and lower abdominal pain. Ultrasound, Toshiba Applio 200, Mindray DC 70, with frequency range 2.5 – 3.5 MHz convex probe and Computed Tomography, Philips DX 16-slice single source were used.

The following parameters were studied in each case:

- Focal thickening and AP diameter was conducted on grey scale imaging.
- Fluid collections peripancreatic or pararenal was conducted on grey scale imaging.
- The echogenicity of pancreas was conducted on grey scale imaging.
- Position, size and echo pattern of the pancreas was observing on grey scale and all above-mentioned information was recorded /noted on data collection sheet.

Statistical Analysis

Data was analyzed using Statistical Software for Social Sciences (SPSS version 24.0). Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value was calculated.

RESULTS

The table 1 shows that the total participants participated in the study were comprised of 163 out of which 47 (28.8%) were female and 116 (71.2%) were male. The mean age of the participant were recorded in our study was 34.40 ± 9. According to table 1 when ultrasound was performed in such patient the majority of participants have acute pancreatitis n=152 (93.3%) which in n=11 (6.7%) was due to some other cause. In addition, they have no pancreatitis. Table 2 shows that when computed tomography was done in-patient who have pancreatitis on ultrasound. In n=46 (28%) Ct scan showed a fluid collection with necrotizing lesion in pancreas while in n=114(70%) have no necrotizing lesion and only fluid collection was noted. No changes were recorded in n=3 participants. According to table 2, total patients enrolled in our study that had acute pancreatitis are 163, out of which 152 patients were detected on ultrasound and CT scan. Table shows the sensitivity of ultrasound was recorded as 95%, sensitivity was 100%. The PPV were 100% and NPV was 27.27 %. In 95% of the cases, the ultrasound was accurate identified pancreatitis.

Table 1: Comparison of acute pancreatitis on ultrasound and computed tomography.

		Acute pancreatitis on CT		Total
		Yes	No	
Acute pancreatitis on USG	Yes	152	0	152
	No	8	3	11
Total		160	3	163

Table 2: Accuracy of ultrasound for the diagnosis of acute pancreatitis.

Statistic	Value	95% CI
Sensitivity	95.00%	90.39% to 97.82%
Specificity	100.00%	29.24% to 100.00%
Disease prevalence (*)	98.16%	94.72% to 99.62%
Positive Predictive Value (*)	100.00%	
Negative Predictive Value (*)	27.27%	16.03% to 42.42%
Accuracy (*)	95.09%	90.56% to 97.86%

DISCUSSION

In pancreatitis, an inflammatory disease, pancreatic enzymes auto digest the gland. The condition known as acute pancreatitis refers to the recovery of the gland without any morphologic changes or impairment of function. Pancreatitis can also recur on a regular basis, leading to the gland's functional and morphologic loss; this is referred to as chronic pancreatitis. The pancreas produces 13 times as much protein as the liver and reticuloendothelial system combined, which together make up 4% of the total body weight, despite making up only 0.1 percent of the body weight.14 Abdominal USG is the primary method of imaging used in the first stages of acute pancreatitis to evaluate the biliary tract and determine whether biliary stones are the cause of the disease.15

In current study, total participants that participated in our study were comprised of 163 out of which 47 were female and 116 were male. The mean age of the participant were recorded in our study was 34.40± 9. The lower age that was recorded as 18 years and maximum age was 60 years.

A modified CT severity index was developed by Bollen et al. to evaluate the severity of acute pancreatitis. The modified CT severity score has a 71% sensitivity and a 93% specificity, with a 69% positive predictive value and a 94% negative predictive value, according to the study's findings. They concluded that the modified CT severity score had a better correlation with pancreatic infection and could diagnose clinically severe disease with accuracy16. The modified CT severity index's sensitivity and specificity were reported to be 78% and 81%, respectively, in a different study by Bollen et al.20 Jauregui-Arrieta et al. studied how well the modified CT severity index worked to determine how severe acute pancreatitis was. According to their research, the modified CT severity score had an 81% positive predictive value, 66% specificity, and 61% sensitivity. They concluded that individuals with severe acute pancreatitis benefit more from screening using the modified CT severity score17. In order to evaluate various radiological grading systems for determining the severity of acute pancreatitis, Sharma et al. conducted a study. They discovered that the modified CT severity index has a 98.6% sensitivity, a 26.5% specificity, a 73.7% positive predictive value, and a 90% negative predictive value. They verified that the currently recognized modified CT severity index is, in fact, a potent instrument for predicting severe acute pancreatitis and that it associated favorably with APACHE ll, the most dependable clinical grading system now in use for predicting pancreatitis sequelae.18

In a study by Tenner et al., a total 110 consecutive patients with acute pancreatitis were included. In a patient with clinically serious acute pancreatitis, the probability of a positive ultrasound result was 89.60% (sensitivity). Ultrasound had a sensitivity of 77.80% in assessing moderate and extreme types of acute pancreatitis as defined at laparotomy. The low specificity of ultrasound was 44.00% in comparison with modified prognostic criteria, but high in comparison with CT (87.50%) & staging at laparotomy (85.69%). According to the author, the early ultrasound in acute pancreatitis is helpful in diagnosing the severity of the disease and affects the decision-making. Using computed tomography as the gold standard, the sensitivity, specificity, positive and negative predictive value, and diagnostic accuracy of ultrasonography for diagnosing acute pancreatitis were 90.77%, 86.81%, 83.10%, 92.94%, and 88.46%, respectively, in comparison to our findings.19 As compared to our study the sensitivity of ultrasound was recorded as 95%, sensitivity was 100%. The PPV was 100% and NPV was 27.27 %. In 95% of the cases, the ultrasound was accurate identified pancreatitis. Another study showed 92.0% sensitivity & 84.0% specificity of ultrasonography in 16 diagnoses of patients with acute pancreatitis.20

Because of the small size and retroperitoneal location with overlaying structures, the pancreas presents a challenge for ultrasonography. Early research conducted in the country describes the structural alterations in the pancreas that are seen on trans-abdominal ultrasound in about two-thirds of patients with chronic pancreatitis that have been detected.

CONCLUSION

Ultrasonography is a highly sensitive and accurate noninvasive method in diagnosing acute pancreatitis. It has not only improved ability of detection of acute

pancreatitis but also better patient care by proper preoperative planning and management of acute pancreatitis patients.

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Authors Contributions:

Zafar Iqbal and Zain ul Abidin: Substantial contributions to the conception and design of the work. Design of the work and the acquisition.

Rana Sohaib and Talha Khalid : Drafting the work. Final approval of the version to be published.

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