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Acute Pancreatitis: Role of Imaging Modalities

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Abstract

The combination of appropriate clinical findings and laboratory tests permit an accurate diagnosis of acute pancreatitis in most patients. Cross-sectional imaging with ultrasound and CT has afforded rapid, accurate and noninvasive evaluation of the pancreas. Ultrasound provided the first reliable, reproducible, cross-sectional view of pancreatic anatomy. However, it has limitations in obese patients and in those with large amounts of bowel gas. CT offers a diagnostic method that does not have these limitations. But CT is expensive, exposes patients to ionizing radiation, and has difficulty in defining tissue planes in lean patients. A prospective observational study was carried out at Department of Surgery of NIMS Medical College and Hospital, Jaipur from October 2012 to Septembet 2014. The objective of the study was to assess the severity of acute pancreatitis based on findings of ultrasound and CT scan. A cconvenience type of non-probability sampling was used for the selection of study subjects. All the subjects with acute pancreatitis fulfilling the inclusion and exclusion criteria were included in the study after taking prior informed consent. Wherever required sonographic study was done using Philips Envisor Doppler machine by a linear 3 – 12 MHz probe and a curvilinear 3 – 5 MHz probe. The CT study was done within 3 to 4 days of admission using a Toshiba AestionT 10mm sections throughout the abdomen and 5 mm section throughout the pancreas. USG was carried out in 27 patients out of 30 (90%) and pancreas was visualised in 20 of them (74%) of which 55% showed bulky pancreas while contracted pancreas was observed in 1 patient. Half of these patients showed hypoechocity while calcification, ductal dilatation and focal lesions were observed in 1 patient each. MRI was carried out in 18 patients out of 30 (60%) and pancreas was visualised in all of them. Bulky pancreas was observed in 88.9% patients (16/18 patients) while calcification, ductal dilatation and focal lesions were observed in 1, 2 and 2 patients respectively. Most of the patients (28/30) were managed by conservative methods while surgery was required in 1 case each of biliary pancreatitis and trauma **.** It was concluded that ultrasonography should be the initial investigation supplemented by CT wherever required, which is confirmative investigation in diagnosing and staging of acute pancreatitis.

Keywords: Acute Pancreatitis, Computed Tomography Scan, Ultrasonography, Visualisation of pancreas

Introduction

The pancreas is a difficult organ to evaluate by both clinical and routine radiological methods. An inflammatory pathology involving the pancreas will form part of the differential diagnosis of other conditions presenting with abdominal pain. The combination of appropriate clinical findings and laboratory tests permit an accurate diagnosis of acute pancreatitis in most patients. Chronic pancreatitis, on the other hand, forms a much more difficult entity to evaluate clinically or biochemically.

The clinical and biochemical parameters form a key factor in the diagnosis of Acute Pancreatitis. But the history and clinical presentation may be misleading and the biochemical parameters (particularly serum amylase values) can be normal, particularly when the test is performed a few days after the initial attack. To exclude other abdominal catastrophes and support the clinical suspicion of acute pancreatitis, conventional radiographs have been used [1].

Radiographic studies are of limited value in patients suspected of having acute pancreatitis, both to support and exclude its diagnosis. Supine, lateral decubitus and erect films of the abdomen help exclude other diagnosis such as a perforated viscus. Nonspecific finding are found in radiographs in patients with acute pancreatitis, including adynamic ileus or a sentinel loop. In addition, pancreatic calcifications may be found in patients with chronic pancreatitis, and peripancreatic gas is seen uncommonly in patients with pancreatic abscess. These tests are rather insensitive and nonspecific [2].

Cross-sectional imaging with ultrasound and CT has afforded rapid, accurate and noninvasive evaluation of the pancreas. Ultrasound provided the first reliable, reproducible, cross-sectional view of pancreatic anatomy. However, it has limitations in obese patients and in those with large amounts of bowel gas. CT offers a diagnostic method that does not have these limitations. But CT is expensive, exposes patients to ionizing radiation, and has difficulty in defining tissue planes in lean patients. Modern ultrasound machines allow quick and comprehensive evaluation of the abdomen and the pancreas with its ductal system. Because the examination is inexpensive, non-invasive, and well accepted by the patient, it is currently one of the first imaging techniques performed for the evaluation of suspected chronic pancreatitis [3]. In present study we focus on role of these two imaging modalities in the management of acute pancreatitis.

Materials and Methods

Study Type and Area: The present Prospective Observational study was being carried out in Department of Surgery of NIMS Medical College and Hospital, Jaipur from October 2012 to Septembet 2014.

Sampling Technique and Sample Size: Convenience type of non-probability sampling was followed for the selection of study subjects. All the subjects with acute pancreatitis coming to the department of surgery, NIMS Hospital and fulfilling the inclusion and exclusion criteria were included in the study after taking prior informed consent. Final sample size came out as 30 patients.

Inclusion criteria: Patients who were confirmed to have acute pancreatitis based on imaging findings (USG/ CT) on either of the two modalities along with a combination of clinical features and biochemical values suggestive of pancreatitis.

Exclusion criteria: Patients in whom the diagnosis of pancreatitis was made purely on clinical grounds without any imaging (ultrasound or CT) being done and; patients in whom no imaging was done prior to surgery where a diagnosis of pancreatitis was made.

Method of Data Collection

Informed consent was obtained in all patients. After admission to the hospital, a detailed clinical history and examination of the patient was done. Relevant investigations were undertaken to make the diagnosis. Four sequential steps have been followed for all patients.

1. Establishing the diagnosis of pancreatitis, excluding other abdominal conditions that have similar clinical features,
2. Identify the presence of biliary tract disease, excluding other possible etiologies of the acute pancreatitis,
3. Assess the severity of the disease: The patients were classified as having,

a. *Mild acute pancreatitis*: If it is associated with transient organ failure (<48 hours), no local complications and an uneventful recovery.

b. *Severe acute pancreatitis:* If it is associated with organ failure (>48 hours) and/or local complications, such as necrosis, abscess, or pseudocyst.

4. Detect any complications.

Routine investigations like complete hemogram, Blood urea, Serum calcium and Serum amylase were performed. The sonographic study was done using Philips Envisor Doppler machine by a linear 3 – 12 MHz probe and a curvilinear 3 – 5 MHz probe. The CT study was done within 3 to 4 days of admission using a Toshiba AestionT 10mm sections throughout the abdomen and 5 mm section throughout the pancreas. The treatment plan was focused on adequate initial resuscitation and supportive care, early detection of complications and definitive treatment of the associated biliary disease. Data like clinical symptoms and signs, results of investigations, complications, surgical procedures if any, duration of hospital stay, recurrence if any were carefully recorded. All the data was collected and entered in Microsoft excel sheet and then transferred to SPSS software ver. 17.0 for analysis. Data was analysed using appropriate statistical measures.

Results

Over half of the subjects (56.7%) were between 31-50 years of age (mean age – 38.1 ± 4.4 years) with 73.3% male population. Most common symptoms was pain in abdomen (100%) followed by nausea (83.3%) and abdominal distension (33.3%). Alcoholic pancreatitis was the most common etiologic cause (80%) followed by idiopathic. S. amylases levels were raised in 53.3% patients while hypocalcemia was observed in 23.3% patients (table 1).

USG was carried out in 27 patients out of 30 (90%) and pancreas was visualised in 20 of them (74%) of which 55% showed bulky pancreas while contracted pancreas was observed in 1 patient. Half of these patients showed hypoechocity while calcification, ductal dilatation and focal lesions were observed in 1 patient each (table 2).

MRI was carried out in 18 patients out of 30 (60%) and pancreas was visualised in all of them. Bulky pancreas was observed in 88.9% patients (16/18 patients) while calcification, ductal dilatation and focal lesions were observed in 1, 2 and 2 patients respectively (table 3).

Pancreatic Necrosis was the most common complication (23.3%) followed by Ascitis (20%), Organ failure (10%), Fluid collection and Pleural effusion (6.7%each). Pseudocyst and GI bleeding was observed in 1 patient each. Most of the patients (28/30) were managed by conservative methods while surgery was required in 1 case each of biliary pancreatitis and trauma (table 4).

Discussion

Acute pancreatitis is a common cause of acute abdomen in patients presenting to the surgical emergency department. Alcohol being the most common cause of acute pancreatitis in this part of the country, it has a male preponderance and most commonly presents in the 4^{th} decade of life [4]. While diagnosing a case of acute pancreatitis, a through history, a complete physical examination and biochemical tests are necessary. Radiological confirmation is also required in some cases. The management is mainly conservative, with surgery reserved for patients with biliary pancreatitis and those developing complications secondary to acute disease [5].

The overall visualization of the pancreas was far better by CT than by ultrasound. In a study done between 1979-1980 on 102 patients, good to excellent visualization of the pancreas was present in 64% of CT scans as compared to 20% of sonographic studies [6]. With improvements in technology, visualization of the pancreas is better on both modalities [7-9]. This study showed that the pancreas is visualized in as many as 74.1% of patients on ultrasonography and in 100% of patients on CT in acute pancreatitis.

Alterations in size were better appreciated on CT. On CT, 23 patients with acute pancreatitis (88.9%) were seen to have a bulky pancreas. Of the remainder, one had a contracted pancreas due to underlying chronic pancreatitis; and in one case, the pancreas was normal. This patient had clinical features and laboratory findings suggestive of acute pancreatitis and was managed conservatively. He was asymptomatic at the time of discharge. Incidentally, the ultrasound study of this patient was also normal. Duct dilation and calcification were picked up in three patients on CT and in 2 patients in USG.

The sensitivity of ultrasongraphy in detecting acute pancreatitis was 60% in those patients in whom the pancreas was visualized. However if all the sonographic studies were considered, sonography diagnosed acute pancreatitis in only 17 of 41 cases representing 44.4% of cases. CT had a sensitivity of 94.4% mainly due to better visualization (100%) and better assessment of size. As all the patients had pancreatitis, the specificity could not be estimated. However, the positive predictive value of both ultrasound and CT was 100%. This means that all patients with a bulky, hypoechoic pancreas on ultrasound have acute pancreatitis. It must be pointed out that 2 patients were taken up for surgery and of these 1 had a normal pancreas on ultrasound. Hence, as mentioned in the study by SJ Hessel et al, a negative ultrasound study does not exclude significant and, at times, life-threatening pancreatic disease [8].

Conclusion

Ultrasonography is non-invasive, quick, inexpensive widely available and a safe tool in the imaging and diagnosis of pancreatitis though it has certain limitations. Due to bowel gas the pancreas may not be visualized. Extra pancreatic spread of inflammation and vascular complications may not be picked up by Ultrasonography. These limitations are overcome with the use of CT which yields more diagnostic information in the evaluation of acute pancreatitis. Enlargement, altered echogenecity, surrounding edema are findings suggestive of acute pancreatitis on CT. Thus ultrasonography should be the initial investigation supplemented by CT, which is confirmative investigation in diagnosing and staging of acute pancreatitis.

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TABLES

Table 1. Baseline characteristics of Patients

Variables		N	%
Age Groups (years)	< 30	9	30.0%
	31-50	17	56.7%
	> 50	4	13.3%
Gender	Male	22	73.3%
	Female	8	26.7%
Symptoms	Pain in Abdomen	30	100.0%
	Nausea/ Vomiting	25	83.3%
	Abd. Distension	10	33.3%
	Fever	5	16.7%
	Ictreus	2	6.7%
Etiology	Alcoholism	24	80.0%
	Billiary	1	3.3%
	Trauma	1	3.3%
	Idiopathic	4	13.3%
Investigation	S. Amylase (> 240IU/L)	16	53.3%
	S. Calcium (< 8 mg%)	7	23.3%
	WBC (> 15,000/cumm)	2	6.7%
	AST (> 200 IU/L)	0	0.0%
Radiological Modality Used	CT Scan	18	60.0%
	USG	27	90.0%

Table 2. Distribution of patients based on USG Findings

Pancreas on USG (n-27)	N	%
Visualised*	20	74.10%
Non-Visualised	7	25.90%
Size on USG* (n-20)		
Bulky	11	55.00%
Normal	8	40.00%
Contracted	1	5.00%
Ecogenicity on USG* (n-20)		
Hypoechoic	10	50.00%
Heterogenous	2	10.00%
Normal	8	40.00%
Other Findings on USG* (n-20)		
Calcification	1	5.00%
Focal Lesion	1	5.00%
Duct Dilatation	1	5.00%

Table 3. Distribution of patients based on USG Findings

Pancreas on CT (n-18)	N	%
Visualised*	18	100.00%
Non-Visualised	0	0.00%
Size on CT* (n-18)		
Bulky	16	88.90%
Normal	1	5.60%
Contracted	1	5.60%
Other Findings on CT* (n-18)		
Calcification	1	5.60%
Focal Lesion	2	11.10%
Duct Dilatation	2	11.10%

Table 4. Distribution of patients based on complications & management strategies

Variables		**N**	**%**
Complications	Fluid Collection	2	6.7%
	Pseudocyst	1	3.3%
	Ascitis	6	20.0%
	Pleural Effusion	2	6.7%
	GI Bleed	1	3.3%
	Necrosis	7	23.3%
	Organ Failure	3	10.0%
Management	Conservative	28	93.3%
	Surgical	2	6.7%