

VALIDITY OF CONTRAST ENHANCED CT IN THE ASSESSMENT OF ACUTE PANCREATITIS AND ITS RELATED COMPLICATIONS

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ABSTRACT

BACKGROUND

In the earlier days, ultrasonogram was considered as one of the most important investigation for pancreatitis, later the clinicians started using cholangiography in acute pancreatitis, but today CT is considered as a gold standard test in the diagnosis of acute pancreatitis. Though the sensitivity of CT in diagnosing acute pancreatitis was not studied much particularly in a mild case, but a good-quality contrast enhanced CT demonstrates distinct pancreatic and peri-pancreatic abnormalities.

AIM

To assess the importance of computed tomography in diagnosing acute pancreatitis and its related complications.

MATERIALS AND METHODS

A prospective study was conducted on 150 patients with clinically suspected pancreatitis. CT was performed on all the patients with Siemens Spiral CT scanner Sensation 16 slice. Oral contrast of was 1000 mL given one hour prior to the scan in the form of taking 250 mL every 15 mins. The CT severity index (CTSI) and the necrosis point scoring was used to assess the severity of acute pancreatitis. All the complications related to acute pancreatitis were also assessed.

RESULTS

The CT analysis in the detection of acute pancreatitis showed the sensitivity of 100% and the positive predictive value of 97.3%. The severity index of acute pancreatitis based on the CT imaging had shown that majority of the patients are with moderate (60.6%) level of acute pancreatitis. The necrosis point scoring showed that 54.6% of the patients had necrosis involving less than 30% of the pancreas. Among the various complications detected by CECT the commonest were pleural effusion and ascites.

CONCLUSION

CECT is the most important gold standard technique both for diagnosis as well as for predicting the prognosis in acute pancreatitis. The clinicians should routinely send the patient for the CT imaging whenever there is a suspicion of pancreatitis clinically.

KEYWORDS

Pancreatitis, Contrast enhanced computed tomography, CT severity index, Necrosis scoring.

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INTRODUCTION: Acute pancreatitis (AP) is defined as acute inflammation of the pancreas, which is classified as mild, moderate and severe disease.¹ Among them, mild form is more common which occurs in among 80% of the patients, whereas 15 – 20% of the acute pancreatitis usually manifests as severe form with complications.²

Worldwide the incidence of AP is increasing, which might be related to obesity, and ageing of the population along with the increase in the incidence of gallstones and alcohol abuse.³ In developing countries like India, increase in the alcohol consumption is one of the most important cause for acute pancreatitis. Although the pathophysiology of AP is not completely understood, pancreatitis occurs in a chain of events which is mainly triggered by alcohol abuse, which leads to activation and release of pancreatic enzymes into the pancreatic interstitium and peripancreatic tissues, which further leads onto autodigestion and necrosis of pancreatic tissues.^{4,5}

The most common presentation of AP is abdominal pain associated with nausea and vomiting and with the increase

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level of pancreatic enzymes in blood and urine. The mortality rate in AP is usually high in older age group population.

In the earlier days, ultrasonogram was considered as one of the most important investigation for pancreatitis. On ultrasound, the visualisation of pancreas was only achieved in 60-70% of the patients. In AP, the pancreas usually appears as hypoechoic, diffuse or focal enlargement with dilatation of duct if head is focally involved.^{4,5} Fluid collection may be seen in the lesser sac in approximately 50% of the cases. Later, the clinicians started using cholangiography in acute pancreatitis which shows a long gently tapered narrowing of the common bile duct with pre-stenotic biliary dilatation. The common bile duct may show smooth or irregular mucosal surface.⁶

Today, CT is considered as a gold standard test in the diagnosis of acute pancreatitis. The recent studies had shown that even patients serum amylase and lipase levels were supposed to be normal, but the CT features were suggestive of acute pancreatitis.⁷ Of the various imaging techniques which are available today, CT is the preferred imaging technique in the initial evaluation of AP as well as in the followup period. Though the sensitivity of CT in diagnosing acute pancreatitis was not studied much particularly in a mild case, but a good quality contrast enhanced CT demonstrates distinct pancreatic and peripancreatic abnormalities in most patients of moderate-to-severe acute pancreatitis.⁸

In CT, the radiologic grading system on a 10-point severity scale was initially developed by Balthazar and colleagues based on mild, moderate, and severe morphologic forms of AP which is considered as CT Severity Index (CTSI).⁹ It also includes the quantification of pancreatic/extrapancreatic inflammatory changes, which is graded in the scale of 0–4, and the spread of pancreatic parenchymal necrosis is measured in the point scale of 0–6 points, both these conditions are assessed by contrast enhanced CT. Besides prognostic information on patient morbidity and mortality, the CTSI will also help us to depict the order in which the morphologic manifestations occur in AP.¹⁰ So, in this context the present study was carried out to assess the validity of CT in diagnosing acute pancreatitis and its related complications.

AIM: To assess the importance of computed tomography in diagnosing acute pancreatitis and its related complications.

METHODOLOGY: A prospective study was conducted over a period of two years from December 2013 – November 2015 in the Department of Radiology in our hospital. The patients in the age group of 11–70 years, of both the sexes, who were clinically suspected for acute pancreatitis with elevated levels of serum amylase levels were included in our study. A total of 150 patients were our study subjects. Patients for whom CT could not be performed due to ionisation hazard, in conditions like pregnancy and in patients who have contraindications in using contrast were excluded from the study.

CT was performed with Siemens Spiral CT scanner Sensation 16 slice. Dual phase protocol using thinner collimation (3 mm) for examining pancreas was used, on which later on a reconstruction protocol for slice thickness of 1.5 mm was performed for better spatial resolution. The entire protocol of how the CT film was taken for the patients is tabulated below.

Sl. No	Protocol	Non Contrast	Arterial phase	Portal phase
1	KV	130	130	130
2	MA	120	140	140
3	Collimation	5 mm	3 mm	3 mm
4	Rotation time	0.8 sec	0.8 sec	0.8 sec
5	Direction	Cranial to caudal	Cranial to caudal	Cranial to caudal
6	Scan delay	None	10-15 sec	45-55 sec

Contrast medium 60-70 cc of non-ionic low osmolar contrast medium (Iohexol) injected intravenously with a flow rate of 3 mL/sec.

Oral contrast of 1000 mL given one hour prior to the scan in the form of taking 250 mL every 15 mins. This is done for better delineation of bowels loops in order to visualise the pancreas and peripancreatic tissue changes better.

In our study, we used the CTSI (CT severity index) scoring which was devised by Balthazar et al⁹ in assessing the acute pancreatitis. In grading system, patients with grades A-E of acute pancreatitis have been assigned zero to four points. Grade A is normal pancreas with 0 point, Grade B is pancreatic enlargement alone with 1 point, Grade C is inflammation confined to the pancreas and peripancreatic fat with 2 points, Grade D is one pancreatic fluid collection with 3 points and Grade E is two or more fluid collections with 4 points. Patients with 0–3 points were classified as mild pancreatitis, 4–6 as moderate pancreatitis and more than 6 as severe pancreatitis. In degree system, zero point for no necrosis, two points for 30%, four points for 50% and six points for more than 50% of pancreatic necrosis.

RESULTS: The age and sex wise distribution of the study population shows that majority of them were in the age group of 30–50 years, the mean age was 42.5±3.4. Male patients were comparatively more than the female patients in all the age group and this difference was found to be statistically significant (table 1). The validity of serum amylase levels of more than 3 times the normal, which is considered as one of the important diagnostic feature for acute pancreatitis had shown the sensitivity and specificity as 100%, whereas the positive predictive value was only 52% for the detection of acute pancreatitis. In CT analysis the positive predictive value was much higher (97.3%), so it can be inferred that prediction of acute pancreatitis based on the clinical manifestations is much more significant with CT imaging than with the serum amylase levels (table 2).

Age group	Gender		Total	P value
	Male	Female		
21-30	8(6.7%)	0	8(5.3%)	<.0001
31-40	47(39.8%)	13(40.6%)	60(40%)	
41-50	50(42.3%)	16(50%)	66(44%)	
51-60	7(5.9%)	3(9.3%)	10(6.6%)	
>60	6(5%)	0	6(4%)	
Total	118(100%)	32(100%)	150(100%)	

Table 1: Age and sex wise distribution of the study population

P value derived by applying chi-square test.

Validity measures	Serum amylase (More than 3 times of normal)	CT analysis	P value
Sensitivity	100%	100%	1.000
Specificity	100%	100%	1.000
Positive predictive value	52%	97.3%	<.0001
Negative predictive value	0%	0%	1.000

Table 2: Validity of serum amylase (more than 3 times of normal) and CT in comparison with clinical findings

P value derived by applying chi-square test.

Age group	Necrosis scoring				Total
	0 points	2 points	4 points	6 points	
21-30	5(22.7%)	2(3.3%)	1(1.7%)	0	8(5.3%)
31-40	4(18.1%)	24(40%)	28(49.1%)	4(36.3%)	60(40%)
41-50	9(40.9%)	28(46.6%)	23(40.3%)	6(54.5%)	66(44%)
51-60	2(9%)	4(6.6%)	3(5.2%)	1(9%)	10(6.6%)
>60	2(9%)	2(3.3%)	2(3.5%)	0	6(4%)
Total	22(100%)	60(100%)	57(100%)	11(100%)	150(100%)

Table 4: Distribution of the study subjects based on the necrosis scoring of the pancreas

Complications detected	Frequency (n=150)	Percentage
Pleural effusion	64	42.6%
Ascites	58	38.6%
Abscess	8	5.3%
Pseudocyst	6	4%
Total	136	90.6%

Table 5: Complications detected by CECT among the patients with acute pancreatitis

The complications detected by using CECT among the patients were shown in table 5. It is inferred from the table that pleural effusion (42.6%) was found to be the most common complication followed by ascites (38.6%). Most of the pleural effusions tend to be bilateral except in 4 cases where it was unilateral. The other less common

The severity index of acute pancreatitis based on the CT imaging had shown that majority of the patients are with moderate (60.6%) level of acute pancreatitis, followed by mild and only 16% of the patients had severe acute pancreatitis. Age had not been a factor in deciding the severity, as there was almost equal distribution of mild, moderate and severe cases in all the age groups (table 3).

Age group	CTSI score			Total
	(0-3) Mild	(4-6) moderate	(>6) Severe	
21-30	4(11.4%)	4(4.3%)	0	8(5.3%)
31-40	12(34.2%)	35(38.4%)	13(54.1%)	60(40%)
41-50	16(45.7%)	42(46.1%)	8(33.3%)	66(44%)
51-60	2(5.7%)	6(6.5%)	2(8.3%)	10(6.6%)
>60	1(2.8%)	4(4.3%)	1(4.1%)	6(4%)
Total	35(100%)	91(100%)	24(100%)	150(100%)

Table 3: Distribution of the study subjects based on the CTSI score in the assessment of acute pancreatitis

Table 4 shows the necrosis scoring of the pancreas among the patients. It is depicted from the table that majority (54.6%) of them had the score of 0 and 2, which shows that the necrosis was only less than 30% involvement of the pancreas, whereas the necrosis of more than 30% but less than 50% in 38% of the patients and it was more than 50% in only 7% of the patients of acute pancreatitis.

complications which were detected are abscess (5.3%) and pseudocyst (4%) of pancreas.

DISCUSSIONS: Acute pancreatitis is a life threatening condition which might lead on to a stage of severe morbidity or mortality if not identified earlier and treated.¹¹ The treatment mainly depends on the accurate assessment of the disease severity.¹² The early detection of pancreatic necrosis is the most important aspect in the treatment of acute pancreatitis. Mortality rate of <1% is associated with the interstitial pancreatitis and it rises to >20% in patients resenting with the necrosis of the pancreatic gland.¹³

The major complication occurring in necrotising pancreatitis which leads to mortality is secondary bacterial infection followed by multi-organ failure.¹⁴ The recent report says that secondary bacterial infection can cause mortality up to the rate of 67% in patients with infectious necrosis of

>50% of pancreas.^{15,16} So, these patients are usually monitored in the intensive care unit and followup laboratory and imaging studies are performed on a regular basis.

Imaging techniques plays a crucial role in the management of pancreatitis. It enables diagnosis as well as classifying them based on the type of severity.¹⁷ It also plays an important role in deciding the prognosis of the disease and identification of the various complications like abscess and pseudopancreatic cyst at an earlier stage and helps in the image-guided drainage and aspiration.¹⁸ Though ultrasound is the first investigation usually performed during the time of admission it rarely helps in diagnosing neither pancreatitis nor its complications, but it helps in identification of gallstones and biliary dilatation, which are the major precursors for acute pancreatitis.¹⁹ Early identification and treatment of these calculi may have a significant positive impact on outcome. When imaging pancreatitis, contrast-enhanced CT is the most clinically useful investigation for grading the disease severity and in the detection of the necrosis.²⁰

The present study indicates that acute pancreatitis is more common among the middle age adults and men are more vulnerable to develop this condition than the females, as alcohol consumption being one of the major risk factor for acute pancreatitis and the results are almost in par with Lankisch PG et al,²¹ Garg PK²² and Morinville VD et al.²³ In the present study among the 150 clinically suspected patients with increased levels of serum amylase, 146 of them were diagnosed as acute pancreatitis by using CT imaging, whereas only 78 of them have been confirmed by using the criteria of 3 times the serum amylase levels. A study done by Ishtiaq Ahmed Chishty suggested that an ideal or desirable detection system should have high sensitivity and positive predictive value.²⁴ It should be able to detect necrosis early in the course of disease. Similar to his suggestion, in our study, CECT imaging had shown very high sensitivity (100%) and positive predictive value (97.3%), whereas the serum amylase levels though had a high sensitivity (100%) the positive predictive value (52%) was found to be comparatively lower.

Literature shows that a good clinician can clinically diagnose acute pancreatitis in only 34% cases and along with serum levels of lipase and amylase available it was only 40% of the cases.²⁵ Importantly, it was quoted that the diagnosis of fatal necrotising pancreatitis was missed in almost 30-40% of patients by the routine clinical or serum examination and it is also difficult to study the spectrum of the disease through this type of examination. In the current study with the use of CECT imaging technique, we were able to study the disease spectrum as mild, moderate and severe and in our study, moderate type of acute pancreatitis was found to be more common.

The accuracy of CECT detection of pancreatic necrosis is almost 90% and its specificity increases with increasing percentage of pancreatic necrosis. Specificity of CT is about 50%, if there are only small areas of necrosis; however, in more than 30% necrosis, specificity of CT is 100% and in our study, majority of the patients had necrosis of pancreas

involving 30-50% of the gland and almost similar type of results was shown in the studies done by McMahon MJ et al and Corfield AP et al.^{20,25}

The most common complication detected by CECT in our study patients was pleural effusion followed by ascites and a very small group of patients had abscess and pseudocyst of pancreas and this observation was almost in par with the studies done by Kirby JM et al and Bruennler T et al.^{26,27}

CONCLUSIONS: CECT is the most important gold standard technique both for diagnosis as well as for predicting the prognosis in acute pancreatitis. The CT severity index and the necrosis score correlates well with the occurrence of local complications. The clinicians should routinely send the patient for the CT imaging whenever he suspects pancreatitis clinically, instead of only doing a serological testing for pancreatic enzymes, as early detection and prompt intervention would prevent serious morbidity and mortality among the patients of acute pancreatitis.

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