PROGNOSTIC VALUE OF CONTRAST ENHANCED CT SCAN COMPARED TO CLINICAL SEVERITY GRADING SYSTEM IN ACUTE PANCREATITIS

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ABSTRACT

Purpose: To evaluate the prognostic value of contrast enhanced CT (CECT) in predicting the severity of acute pancreatitis and compared it to the prognostic signs as detectable clinically. Other signs on plain film radiography and sonography were also analyzed.

MATERIALS AND METHODS

Twenty patients with clinical diagnosis of acute pancreatitis at Srinagarind hospital, Khon Kaen University between January 1993-January 1999, who underwent CECT study of pancreas, were reviewed retrospectively. CECT grade, degree of necrosis and severity index (Balthazar) were determined. Ranson's objective prognostic signs, duration of hospitalization, morbidity, mortality and etiology were evaluated.

RESULT

The CT grading was grade A in 1 patient (5%); grade B, 2 patients (10%); grade C, 0 patient (0%); grade D, 6 patients (30%); and grade E,11 patients (55%). Pancreatic pseudocyst occurred in 4 patients. Surgical drainage was required in 1 patient.

Pancreatic abscess developed in 1 patient, which improved clinically by conservative treatment. Two patients with CT grade E had pancreatic necrosis more than 50%. The mean duration of hospitalization in patients with pancreatitis grade A, B, D, E were 7, 7.5, 7.3, 11.82 days respectively. The severity of pancreatitis was also graded by clinical's prognostic signs as 0-2 signs in 12 patients (70.58%), 3-4 signs in 3 patients (17.64%), 5-6 signs in 1 patient (5.88%), and 7 or more signs in 1 patient (5.88%). The patients who had 3 or more early objective prognostic signs were in CT grade E category, and 80% of them had gland necrosis. In this study, the patient had 10% morbidity and no mortality. The plain film radiography and ultrasonography findings were also shown.

CONCLUSION

CECT provides excellent anatomic, morphologic representation of the pancreas and peripancreatic tissue. The patient who were categorized as having pancreatitis in Balthazar's grade E were clinically more severe, had more morbidity and longer hospitalization than the other grades.

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INTRODUCTION

Previous reports[1,2] in the literatures showed that severe pancreatitis was missed in 30 to 40 percent of the patients if based on the clinical and laboratory data. In the remaining cases, the disease was diagnosed at the time of laparotomy or at postmortem examination.

The most common etiologies of acute pancreatitis are heavy alcohol abuse and cholelithiasis. The pathophysiology is controversial but appears to be related to a temporary or permanent blockage of the pancreatic duct leading to a sudden release of enzymes into the adjacent interstitial tissue. Alcohol has a toxic effect and chemical alteration of the exocrine secretion with the development of protein precipitates within the pancreatic ducts. The activated enzymes lead to autodigestive fat necrosis and nonspecific inflammation of the pancreas and peripancreatic tissues.

Acute pancreatitis has been conveniently classified into acute interstitial (edematous) and acute hemorrhagic or necrotizing pancreatitis. Acute edematous pancreatitis is a mild, self -limiting disease while the necrotizing variety is a severe, life-threatening condition associated with frequent complications and high mortality.[3]

A careful history taking and physical examination will often raise clinical suspicion of acute pancreatitis in the differential diagnosis of a patient presenting with acute abdominal pain. Accurate diagnosis including the extent of disease is needed for appropriate management.

The aim of CT scan in patients with acute pancreatitis is not to make a diagnosis, as this can usually be done on the basis of clinical findings, laboratory data, and more simple imaging methods such as ultrasonography and plain film radiography, but rather to predict its complications.

The CT scanning can accurately confirm and offer excellent anatomic and morphologic representation of the pancreas and peripancreatic tissue.

Balthazar et al.[4] noted that a grading system of abdominal CT scan obtained early in the course of acute pancreatitis has considerable predictive value in identifying patients at high risk of developing serious complication.

The purpose of this study was to evaluate the prognostic value of CECT in acute pancreatitis and correlate it with the clinical severity and complication as proposed by Ranson. Other signs on conventional radiography and sonography were also evaluated.

MATERIALS AND METHODS

The CECT of the pancreas in 20 patients with clinical diagnosis of acute pancreatitis at Srinagarind hospital, Khon Kaen University between January 1993 – January 1999, were reviewed.

The diagnosis of acute pancreatitis was based on the history and clinical findings such as abdominal pain penetrating to the back, nausea and vomiting, abdominal tenderness and guarding, and high level serum and/or urine amylase.

The severity of pancreatitis was graded using Ranson's prognostic sign (Table 1): 0 to 2 positive signs; 3 to 4 positive signs; 5 to 6 positive signs; and 7 or more positive signs.

A dynamic CT scan was performed after a bolus injection of 100 ml, 300% contrast medium, using GE 9800 scanner or a spiral CT (Toshiba Exvision) taken at 60 seconds after initiation of injection of the contrast medium by mechanical

injector at the rate of 3 cc/sec.

CECT grade, degree of necrosis and severity index (Balthazar's criteria) (Table 2) were determined.

The patients included 14 men and 6 women with a mean age of 41.6 years, range from 23 – 76 years. The mean age of men and women are 38.24, and 49.37 years respectively.

The etiology of acute pancreatitis was chronic alcohol abuse in 14 patients, obstructive jaundice in 2, cholelithiasis in 1, DM in 1, post ERCP in 1, and miscellaneous in 2 patients.

Ranson's prognostic signs, duration of hospitalization, morbidity, mortality and etiology were analyzed.

RESULTS

CLINICAL COURSE

Nineteen patients recovered and were discharged from the hospital without local pancreatic complications requiring surgery. Pancreatic pseudocyst developed in 4 patients, (20%). One of them had persistent pancreatic pseudocyst that required operation. Pancreatic abscess occurred in one patient (5%) which improved by conservative treatment. The diagnosis in this patient was the presence of gas bubble in the collection and the small bowel study excluded a fistula to the gastrointestinal tract.

CECT AND CLINICAL COURSE

The relationship between the CECT grading, CT severity index (CTSI) and clinical course is shown in Table 3 and 4 respectively. There were pancreatitis grade A in 1 patient; grade B, 2 patients; grade D, 6 patients; grade E, 11 patients. No patient was classified as grade C. In grade E pancreatitis, the average hospital stay was 11.32 days while grade A, B and D were 7, 7.5 and 7.3 days respectively. Six patients with CT grade E had pancreatic necrosis. Four of them (66.66%) had gland necrosis less than 30% and 2 patients (33.33%) had gland necrosis more than 50%. The mean duration of hospitalization in patients with CTSI 0-3, 4-6 and 7-10 were 5.88, 12.22 and 11.5 days respectively.

CT AND PROGNOSTIC SIGNS.

The Ranson's early objective prognostic signs were evaluated in 17 patients. The severity of pancreatitis was graded by prognostic signs as 0-2 signs in 12 patients (70.58%), 3-4 signs in 3 patients (17.64%), 5-6 signs in 1 patient (5.88%), 7 or more signs in 1 patient (5.88%). The occurrence of local pancreatic complications related to the CECT grading and number of prognostic sign was shown in Table 5. Four of five patients (80%) who had 3 or more prognostic signs had pancreatic necrosis, were in CT grade E category. Pancreatic abscess developed in the patient who had 7 prognostic sign. The abscess was detected after the patient was discharged for 28 days. The relationship between Ranson's prognostic signs and clinical course was shown in table 6. The mean duration of hospitalization in the patients with 0-2, 3-4, 5-6, and 7 or more prognostic signs were 7.75, 14, 10, 15 days respectively.

In this study, the patients had 10% morbidity and no mortality.

The findings on plain film radiography and ultrasonography are shown in Table 7 and 8.

Table 1. Ranson's early objective prognostic signs.

Admission diagnosis	During initial 48 hours
Age > 55 years	Hematocrit falls greater than 10 % points
White blood cell count >16,000/mm^3	Blood urea nitrogen rise > 5 mg/100 ml
Blood glucose > 200 mg/ml	Serum calcium level < 8 mg/100 ml
Serum lactic dehydrogenase > 350 IU/L	Arterial pO_2 < 60 mm Hg
Serum glutamic oxaloacetic Transminase > 250 IU/100ml	Base deficit greater than 4 mEq/L
	Estimated fluid sequestration > 6 L

Table 2. Balthazar's CECT grading and scoring system.

CT grade	Score	Definition
A	0	Normal pancreas
B	1	Focal or diffuse pancreatic enlargement/ heterogeneity
C	2	Intrinsic pancreatic abnormality/ haziness/ streaky in peripancreatic fat
D	3	Single, ill-defined fluid collection
E	4	Two or multiple ill-defined fluid collection or pancreatic or or peripancreatic or peripancreatic gas
Gland Necrosis %	Necrotic score	Definition
None	0	Uniform pancreatic enhancement
< 30	2	Non-enhancement of region(s) of gland equivalent in size to the pancreatic head
30-50	4	Non-enhancement of 30% to 50% of the gland
> 50	6	Non-enhancement of over 50% of the gland

Severity index = grade score + necrotic score

Table 3. Relationship between CECT grading and clinical course

CT grade	Number of Patient (%) (n=20	Mean hospital stay (days)	Abscess (%)	Pseudocyst (%)
A	1 (5)	7	0	0
B	2 (10)	7.5	0	0
C	0 (0)	-	0	0
D	6 (30)	7.3	0	0
E	11 (55)	11.32	1 (5)	4 (20)

Table 4. Relationship between CTSI and clinical course

CTSI	Number of Patient (%) (n=20)	Mean hospital stay (days)	Abscess (%)	Pseudocyst (%)
0-3	9 (45)	5.88	0	0
4-6	9 (45)	12.22	1 (5)	3 (15)
7-10	2 (10)	11.5	0	1 (5)

Table 5. The occurrence of local pancreatic complication related to the initial CT findings and number of positive prognostic signs.

CT	Positive prognostic signs									
Grade	0	1	2	3	4	5	6	7	8	*
A	0									
B	00									
C	00	0	0							00
D	PP	PN0		0nn		P+N		A+n		n

0 = no complication; P = pancreatic pseudocyst; A = pancreatic abscess;
n = pancreatic necrosis < 30%; N = pancreatic necrosis > 50%
* = Ranson's prognostic signs were not available to evaluated.

Table 6. Relationship between prognostic signs and clinical course

Ranson's score	Number of Patient (%) (n = 17)	Mean hospital stay (days)	Abscess (%)	Pseudocyst (%)
0-2	12 (70.58)	7.75	0	2 (11.76)
3-4	3 (17.64)	14	0	2 (11.76)
5-6	1 (5.88)	10	0	0
7 or more	1 (5.88)	15	1 (5.88)	0

Table 7. Radiographic findings

Plain films	No of patient (%) (n = 18)
Normal	5 (27.78)
Bowel ileus	4 (22.22)
Pleural effusion (bilateral)	3 (16.67)
(left)	1 (5.56)
Widening of gastrocolic space	4 (22.22)
Colon cut off	3 (16.67)
Pancreatic calcification	2 (11.11)
Gassless abdomen	1 (5.56)
Gastric distention	1 (5.56)

Table 8. Ultrasound pattern

Ultrasound pattern	No of patient (%) n = 15
Normal finding	6 (40)
Inhomogenous hypoechoic of the pancreas	5 (33.33)
Fluid collection	5 (33.33)
Enlarged pancreas	4 (26.67)
Pancrease was obscured by bowel gas	2 (13.33)

Fig. 1. CT study demonstrating a normal pancreas in a patient with clinical pancreatitis (grade A).

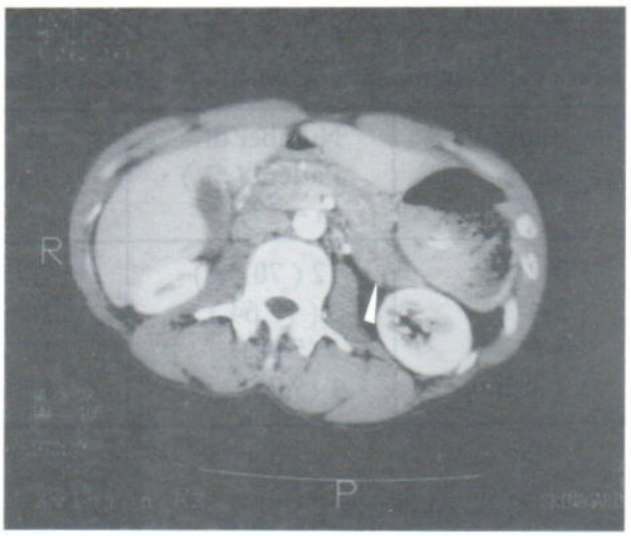

Fig. 2. CT study showing diffuse enlargement of the pancreas without peripancreatic inflammatory changes or fluid collection (grade B).

Fig. 3. CT study of a patient with pancreatitis showing fluid collection (arrow) in the left anterior pararenal space (grade D). Associated fatty liver is noted.

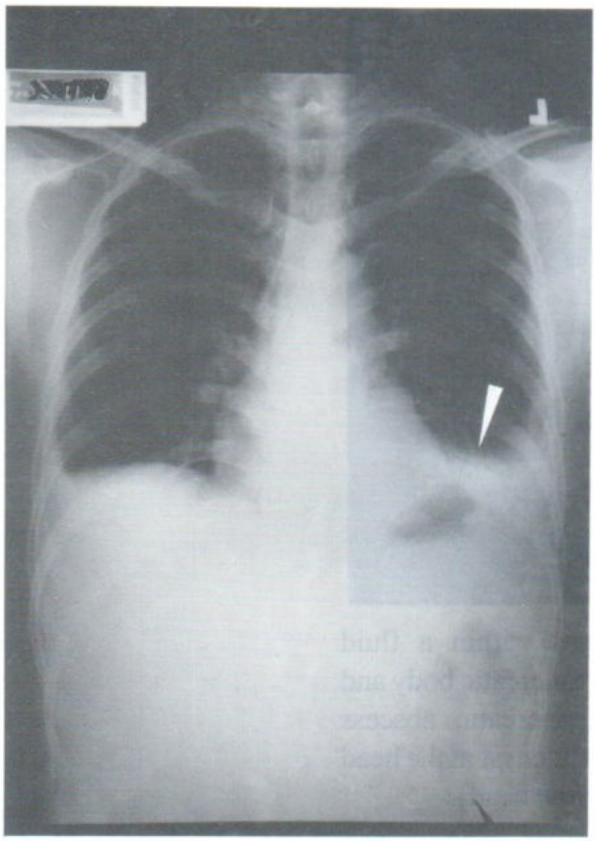

Fig. 4A. Conventional chest film shows left pleural effusion.

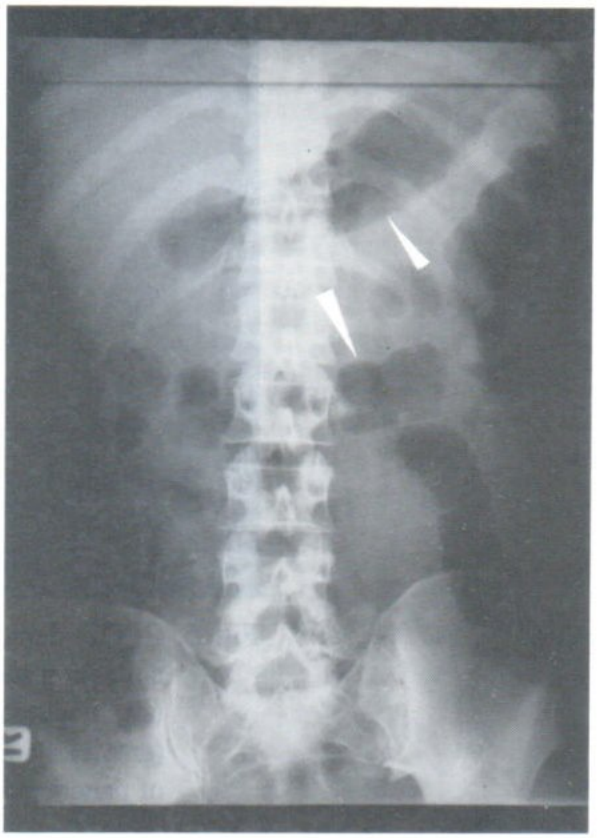

Fig. 4B. Conventional radiograph of the abdomen shows widening of gastrocolic space.

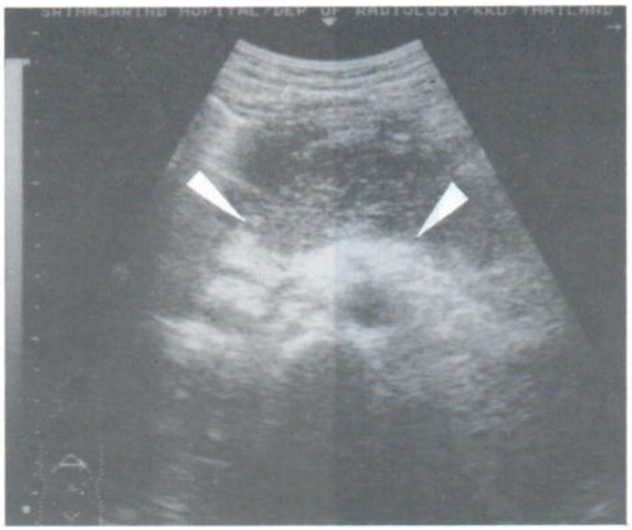

Fig. 4C. Axial sonogram shows diffuse enlargement of the pancreas with inhomogenous decrease parenchymal echo pattern.

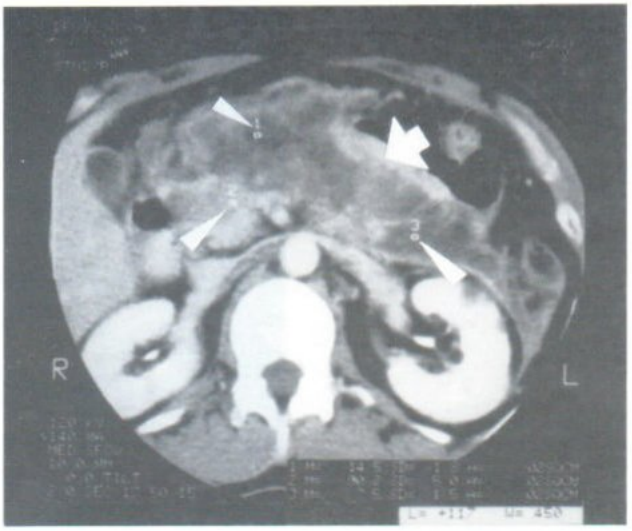

Fig. 4D. CECT demonstrate diffuse enlargement of the pancreas with area of decreased enhancement at body and tail (arrow) (grade E with pancreatic necrosis>50%)

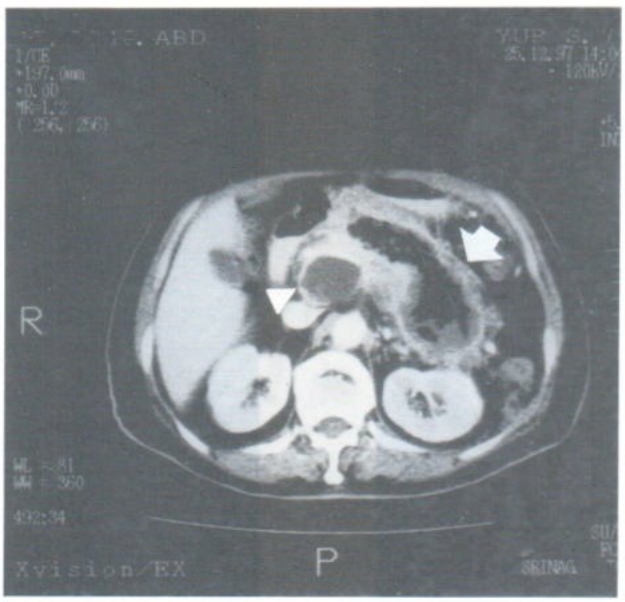

Fig. 5. CECT demonstrate gas within a fluid collection at region of pancreatic body and tail, suggestion for pancreatic abscess (arrow). Pancreatic pseudocyst at the head of pancreas is note (arrow head).

DISCUSSION

In this study, 55% of the patients was classified as pancreatitis grade E. However, since pancreatitis is a clinical diagnosis, only the severe cases were investigated by CT scan.

The reported success of ultrasonography in demonstrating the pancreas in patients with acute pancreatitis is as high as 74.5%.[5] However, gas-filled loop of bowel may obscure the pancreas from full ultrasonographic evaluation. A comparison between ultrasonography and computed tomography[6] in patients with pancreatitis have shown that CT scan is significantly more accurate in this setting.

Potential roles for CT evaluation in patients with acute pancreatitis are : 1) to confirm or refute the clinical diagnosis of pancreatitis; 2) to identify early in their course the patients with a high risk of local complication; 3) to diagnose the occurrence of local complications.

A spectrum of morphologic changes on CECT, depends on the severity of the inflammatory process. Balthazar et al.[7] have categorized this spectrum into five grades: grade A- normal pancreas; grade B- pancreatic enlargement; grade C- gland enlargement and peripancreatic soft tissue inflammotory changes; grade D- enlarged gland, peripancreatic inflammatory changes and single peripancreatic fluid collection; and grade E- two or multiple fluid collections or the presence of gas in or adjacent to the pancreas (abscess formation).

For disease staging, the presence of gland necrosis is important. Bradley et al.[8] and Johnson et al.[9]found that pancreatic necrosis can be detected by dynamic CT as a focal or diffuse area of diminished parenchymal contrast enhancement.

Balthazar et al.[4] have combined the CT-based staging of acute pancreatitis with the presence of necrosis to generate the CT severity index. Patients with a high CTSI had 92% morbidity and 17% mortality; patients with a low CTSI had 2% morbidity and no mortality.

Ranson et al.[10] conducted a prospective study and found that increasing number of Ranson's prognostic signs correlates significantly with the more severe form of pancreatitis. The mortality associated with 0-2 prognostic signs is less than 1%, 3-4 prognostic signs = 16%; 5-6 signs = 40%; and 7 signs or more = 100%.

These indicators have prognostic importance. They help to identify a subgroup of patients at risk of increased morbidity and mortality, who should be targeted for more drastic and specific therapeutic measures.

Balthazar et al.[4] found the relationship between prognostic signs and severity of pancreatitis. Increased CT grade score correlated with the increasing number of prognostic signs. Infected abscess occurred with an increased incidence in patients with several prognostic signs.

Ranson et al.[11] noted that the radiographic detection of gas within a fluid collection may be an extremely valuable sign of infection. While this finding can be due to communication of the fluid collection with the gastrointestinal tract. Gas was present in 22% in his series at the time of diagnosis of pancreatic abscess. The incidence of pancreatic abscess increased with increasing clinical severity.

In Varnacchia's study[12], no clear prognostic value of CTSI in predicting pancreatic abscess was demonstrated on the baseline CT scan in his patient's population.

One of our patients who was categorized

as severe (7 or more prognostic signs)according to Ranson's prognostic sign developed pancreatic abscess. However, the number is limited, no conclusion could be drawn.

CONCLUSION

CECT severity staging correlates favorably with the severity of clinical signs. The patients who were categorized clinically as having 3 or more prognostic signs were in CT grade E category, and highly correlated to gland necrosis. CECT also offers excellent anatomic, morphologic representation of the pancreas and peripancreatic tissue. Pancreatitis in Balthazar grade E had higher morbidity, requires longer hospitalization than the other grades.

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