ORIGINAL RESEARCH

Retrospective study: Evaluation of CT imaging spectrum in acute pancreatitis, its severity and complications in tertiary care center

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ABSTRACT

Aims and objectives: Our emphasis is to describe the spectrum of imaging findings of acute pancreatitis with its severity, age distribution, CECT findings and complications of AP, considering revised Atlanta classification system (2012)[5] and MCTSI [3-9].

Materials and methods: A cross sectional study was conducted from 1st sept 2019 to 30th oct 2021 on patients coming for CT scan of acute onset upper abdominal pain with nausea and vomiting within 7days of onset of symptoms. Reporting was done by 4 radiologists using recent terminology of revised Atlanta classification system (2012)[5-7-12]and MCTSI introduced by Mortele et al [3-9] in 2004.

Results; Revised Atlanta classification system (2012)[5] sub divide AP into mild, moderate and severe according to MCTSI. It also describes various terminology used in reporting of case of AP. Current study reveals that acute pancreatitis commonly affect male -36 patients (85.7%), with peak incidence and prevalence is among 30-39 year of age group 21 patients (50%). In cases of AP, AIEP is most common 30 (71.4%) patients, and in AIEP moderate involvement 23 (54.7%) of pancreases is common. ANP is less common but more severe form of AP and affect male with moderate to severe involvement of pancreas and also more complications associated with it. Female affected by AP is less common and only cases of AIEP found with mild to moderate involvement. On CECT imaging findings bulky and edematous pancreas with peri pancreatic fat stranding is found in almost all patients. Other findings seen in cases of moderate and severely involved pancreas is in decreasing order as Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis-23 (54.7%), ascites- 20 (47.6%), pleural effusion-19 (45.2)%, MPD involvement-7 (16.6%), GIT and mesentery involvement-6 (14.2%), PPC -6(14.2%), WON-5 (12%), cholelithiasis- 4 (9.5%), pancreatic necrosis-2 (4.7%). Peak age group of AP is found to be from 30-39y which affect 21 (50) % patients.

Conclusion; MCTSI is a simple scoring system to apply and predict severity accurately, whichhelps in making early diagnosis of acute pancreatitis,triaging of patients according to severity, establishment of treatment, management of associated complications and for follow up examinations. Recent terminology of revised Atlanta classification system is easy to understand and uniformly accepted by clinicians.

Keywords: Contrast enhanced computerized tomography (CECT), Acute Pancreatitis(AP), AcuteInterstitial Edematous Pancreatitis (AIEP), Acute Necrotizing Pancreatitis (ANP), Modified computerized tomography severity index (MCTSI),

Revised Atlanta Classification System, Pseudo Pancreatic Cyst (PPC), Walled Of Necrosis (WON)s.

INTRODUCTION

Inflammation of pancreas because of auto digestion of the pancreatic tissue by pancreatic enzymes which lead to dysfunction of the gland, is known as pancreatitis[1]. It can be acute; representing an acute onset of inflammatory process of the pancreas, or chronic; which represent slowly progressing inflammation and continue damage of parenchyma leads to permanent injury to the pancreas[3-13].

INCIDENCE AND PREVALENCE

The incidence of acute pancreatitis is increasing worldwide contributing to be one of the major sources of hospitalization[3]. The global incidence of AP is 34 cases per 100,000 of general population per year[1-11]. Recurrent AP developed in 21% of the patients after the first episode of AP[1], and chronic pancreatitis developed in 36% of patients after recurrent acute pancreatitis[1]. Most common aetiology of acute Pancreatitis in adult includes alcohol consumption[2-10], gallstone disease, and high triglyceride levels[2], while in pediatric patient causes of pancreatitis is trauma, viral infections and systemic diseases[3].

According to the revised Atlanta classification system (2012) clinical sign and symptoms includes abdominal pain typically in epigastric region, and radiating to the back and serum amylase or lipase levels more than three times higher than normal [4-12]. It classified AP as mild, moderate, andsevere[1]based on severity, and acute interstitial edematous pancreatitis and acute necrotising pancreatitis based on pathologic changes[1].

Mild AP, Patients of mild AP generally do not have local or systemic complications and without organ failure, and very rare mortality. These group of patients generally do not require pancreatic imaging (CECT) in emergency setting on admission to the hospital [4] (Fig.1). **Moderate AP** characterized by the presence of transient organ failure, if it resolves within 48 h or local or systemic complications in the absence of persistent organ failure[1] (Fig.2, 3 A & B). **Severe AP,** Patients of this type are more likely to develop Systemic Inflammatory Response Syndrome (SIRS) and characterized by persistent single or multiorgan failure, and have an increased mortality rate up to 36% - 50%[1-2](Fig. 4). So, it is essential to identify this groups of patients within 24 hrs of onset of symptoms to reduce morbidity and mortality[2].

In relation to time of onset of disease process, Acute pancreatitis is divided into **Early phase within 1st week and Late phase, after 1st week, that indicate** persistent systemic signs of ongoing inflammation.Day of onset of epigastric pain is considered as 1st day of acute pancreatitis rather than the day on which patient presented to hospital[1].

ACUTE INTERSTITIAL EDEMATOUS PANCREATITIS (AIEP)

It is inflammation of pancreas with or without peripancreatic soft tissue involvement. These may be associated with or without peripancreatic fluid collection without necrosis of pancreatic or peripancreatic soft tissue. This is more common than acute necrotizing pancreatitis.On CECT, the appearance of pancreatic parenchymal tissue is homogeneous enhancement, with or without adjacent fat stranding; and may have peripancreatic fluid (Fig.1 & 2), of these around 5-10% patients turned in to necrotizing pancreatitis[1] (ANP). Fluid collection in AIEP is sub divided according to course of disease as, collection within 4 weeks (<4wks) without internal solid component and without confined wall is termed as peripancreatic fluid collections (Fig.5). If these collected fluid persist for more than 4 weeks there may be well defined wall formation around it called as pseudo pancreatic cyst (Fig.6). Cyst contains only fluid without any necrotic component (Table -1).

ACUTE NECROTIZING PANCREATITIS (ANP)
Defined as pancreatic parenchymal necrosis with or without necrosis of peripancreatic soft tissue (Fig. 3A &4). it is More severe form of AP and associated with high morbidity and mortality [4]. Pancreatic necrosis is divided into three morphologic subtypes, based on anatomical areas of necrosis involved-(a) pancreatic parenchyma only (Fig.3A), (b) peripancreatic tissues only, (c) both pancreatic parenchyma and peripancreatic tissues [1-4] (most common) (Fig.4). Patients with isolated peripancreatic necrosis have a better prognosis than those with parenchymal necrosis [4].

Collections of ANP is subdivided according to time of onset of disease, as collection that develops < 4 weeks of onset and lacks a discrete wall is termed as acute necrotic collection (ANC) [4] (Fig.4). A collection that persists > 4 weeks and develops a discrete wall is called as walled-off necrosis (WON) [4](Fig.3B) (Table-1). Both an ANC and WON can be sterile or infected. A pancreatic abscess develops with superadded infection of necrotic tissue by microorganism called infected necrosis. On CECT necrotic area appears as non-enhancing pancreatic parenchyma or non-enhancing heterogeneously appearing peri pancreatic collection.

RECURRENT ACUTE PANCREATITIS (RAP)
RAP is defined as a syndrome of multiple distinct acute inflammatory responses originating within the pancreas in individuals with genetic, environmental, traumatic, morphologic, metabolic, biologic, and/or other risk factors who experienced 2 or more episodes of documented AP, separated by at least 3 months[1].

Table 1: Pancreatic and Peripancreatic fluid Collection				
Pancreatitis Subcategory	**Time after Onset of Pain (wks.)**	**Collection**	**Location**	**Imaging Features**
IEP	**<4 wks.**	**APFC**	**Extra pancreatic**	**Homogeneous, fluid attenuation, conforms to retroperitoneal structures, no wall or solid component**
Necrotizing pancreatitis	**<4 wks.**	**ANC**	**Intra- and/or extra pancreatic**	**Inhomogeneous*, non-liquefied components†, no wall with necrotic component**
IEP	**>4 wks.**	**Pseudocyst**	**Extra pancreatic**	**Homogeneous, fluid filled, circumscribed, encapsulated with fibrous wall without necrotic component**
Necrotizing pancreatitis	**>4 wks.**	**WON**	**Intra- and/or extra pancreatic**	**Inhomogeneous, non-liquefied components, encapsulated with wall**
Sources; -References 5. Note; -Any collection may become infected. ANC = acute necrotic collection, APFC = acute peripancreatic fluid collection, IEP = interstitial edematous pancreatitis, WON = walled-off necrosis. *Early ANCs may be homogeneous; follow-up computed tomography (CT) performed in 2nd week may help clarify status. †Includes solid-appearing components or fat globules within fluid. ‡Rarely, persistent pancreatic leak or disconnected duct may lead to intrapancreatic Pseudocyst.				

Table- 2: Modified CT Severity Index	
Prognostic Indicator	**Points**
Pancreatic inflammation	
• Normal pancreas	**0**
• Intrinsic pancreatic abnormalities with or without inflammatory changes inperipancreatic fat	**2**
• Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis	**4**
Pancreatic necrosis	
None	**0**
$\leq 30\%$	**2**
$> 30\%$	**4**
Extra pancreatic complications (one or more of pleural effusion, ascites, vascular complications, parenchymal complications, or gastrointestinal tract involvement)	**2**

MATERIALS AND METHODS

A cross sectional study was conducted in department of radio-diagnosis in LNMC and JK hospital Bhopal, from 1st sept 2019 to 30th oct 2021.Patients coming for abdominal CT scan for acute onset upper abdominal pain with nausea and vomiting within 7 days of onset of symptoms. we included patient of all age group, excluding patients having any history of abdominal surgery or interventional procedures and patients having chronic pancreatitis. CT scans were performed on GE Optima 264 slice Scanner (264 Channel configuration) using the following scanner parameters - 5 mm thick slice, reconstructed to 0.625- 1 mm, 100-120 KVp and variable mAs ranging from 30-70 with a Pitch of 0.99-1.22mn, matrix 512 x 512, FOV 350mm X 350mm, starting from 2cm above upper border of diaphragm to ischial tuberosity. Reporting was done by 4 radiologists using recent terminology of revised Atlanta classification system (2012)[5] and MCTSI introduced by Mortele et al [3-9] in 2004. The MCTSI is a 10-point Scoring system based on inflammation of Pancreas[2-6] and was calculated after CECT study and were graded in to mild (0-2) moderate (4-6) and severe (8-10) (Table 2).

800 patients underwent abdominal NCCT or CECT scan during study period, out of these 42 found to have AP, of which 30 patients have AIEP, among these 6 pt. have PPC. 9 patients diagnosed as ANP among which 5 have WON. Only 4 patientshaving recurrent acute pancreatitis (RAP) (Table 3).

Table 3: spectrum of acute pancreatitis				
AP	**Total cases**	**Mild (0-2)**	**Moderate (4-6)**	**Sever (8-10)**
AIEP	30 (6 have PPC) -(71.4%)	7 (16.6%)	23 (54.7%)	none
ANP	9 (5 have WON) -(21.4%)	none	3 (7.1%)	6 (14.2%)
RAP	3 (7.1%)	none	3 (7.1%)	none
Total	42	7 (16.6%)	29 (68.9%)	6 (14.2 %)
Abbreviations: AP- acute pancreatitis, AIEP- Acute interstitial edematous pancreatitis, ANP- Acute necrotizing pancreatitis (ANP), RAP- Recurrent acute pancreatitis, PPC- pseudo pancreatic cyst, WON- walled of necrosis.				

Table 3: imaging Findings associated with mild moderate and sever AP			
	Mild	**Moderate**	**Sever**
AIEP	(M: F= 4male:3 female) Edematous and bulky pancreas with adjacent fat stranding's.	(M: F- 20 male:3 female) Fat stra. (22pts), Ascites (15pts), PE (14pts), PPFC (8pts), PPC (6 pts), cholelithiasis (4 pts), Mesentery and omental invol. (2 pts), MPD invol. (2 pts).	none
ANP	**none**	(M: F- 3 male: 0 female) Fat stra. (3 pts), WON (3 pts), Pancreatic collection (2 pts), MPD invol. (2 pts).	(M: F- 6 male:0 female) Ascites (5 pts), MPD invol (3 pts), PPFC (4 pts), PE (2 pts), pancreatic necrosis (2 pts), Mesentery +omental +GI invol (4 pts), WON (2 pts).
RAP		(M: F-3:0) PPFC (2), PE (3), fat strand. (2)	
Abbreviations: PE- Pleural effusion, PPFC-peri pancreatic fluid collections, PPC pancreatic pseudo cyst, WON-walled of necrosis, MPD-main pancreatic duct, AP- acute pancreatitis, AIEP- Acute interstitial edematous pancreatitis, ANP- Acute necrotizing pancreatitis (ANP), RAP- Recurrent acute pancreatitis			

Table 4: Spectrum of acute Pancreatitis according to age distribution							
Age	<10	10-19	20-29	30-39	40-49	50-59	>60
AP (M: F is 40:8)	1	2	3	21	7	4	4

Table 5: Male female ratio of AP	
	AP + RAP
Male	36 (85.7%)
Female	6 (14.3%)

Fig.1- 58y old female, CECT axial image shows bulky and edematous pancreatic head body and tail with mild peri pancreatic fat stranding-acute interstitial edematous pancreatitis (MCTSI score -2- mild AIEP).
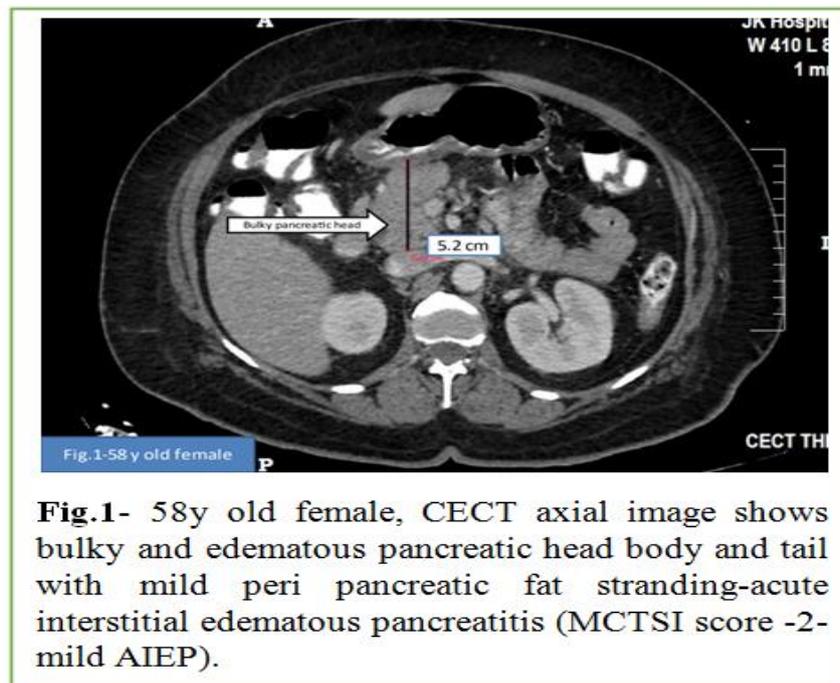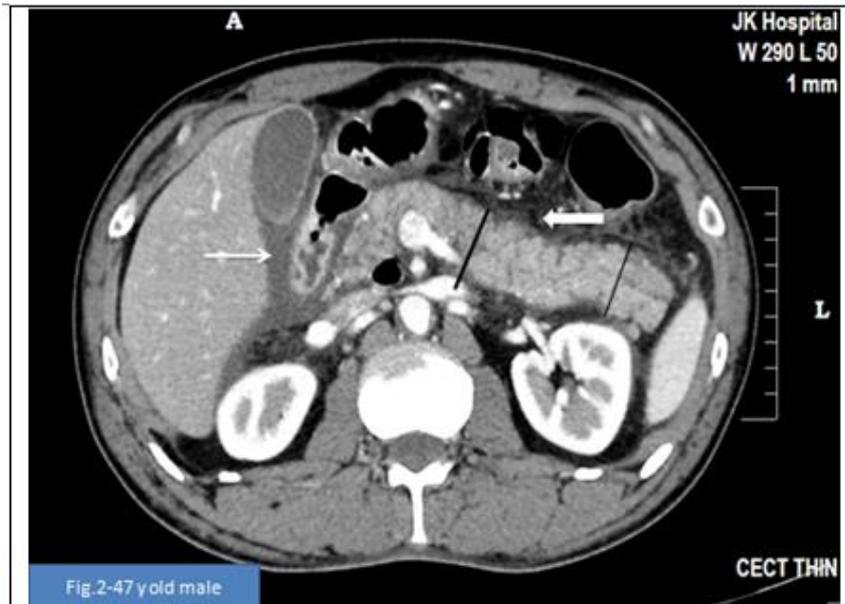
Fig.2- 47y old male CECT axial image shows bulky and edematous pancreas with peri pancreatic fat stranding and ascites. (MCTSI-4 moderate AIEP).
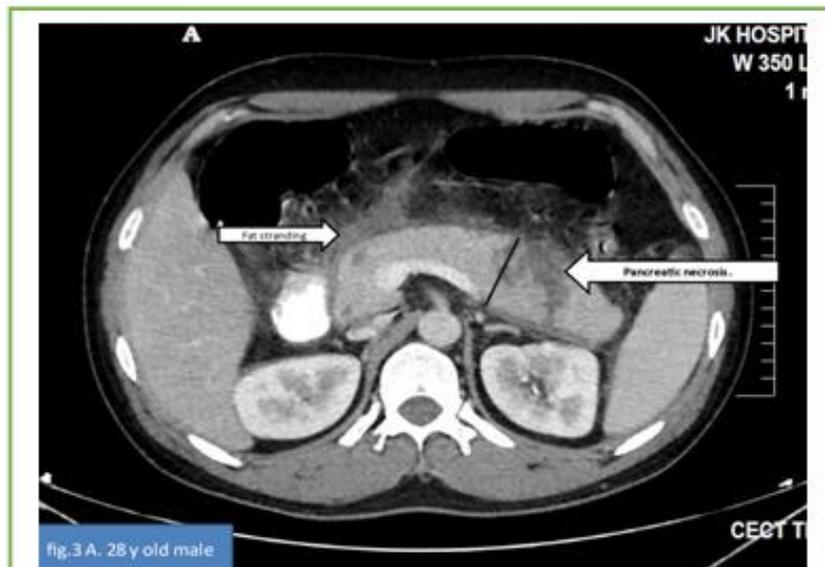
Fig.3 A- 28y old male CECT axial image shows bulky and edematous pancreatic body and tail with non-enhancing heterogeneous pancreatic necrosis (<30%) and peripancreatic fat stranding. (MCTSI-6 moderate ANP).

Fig.3 B - same patient CECT axial and coronal images show well defined non enhancing heterogeneously hypodense lesion in head of pancreas- walled of necrosis (WON).
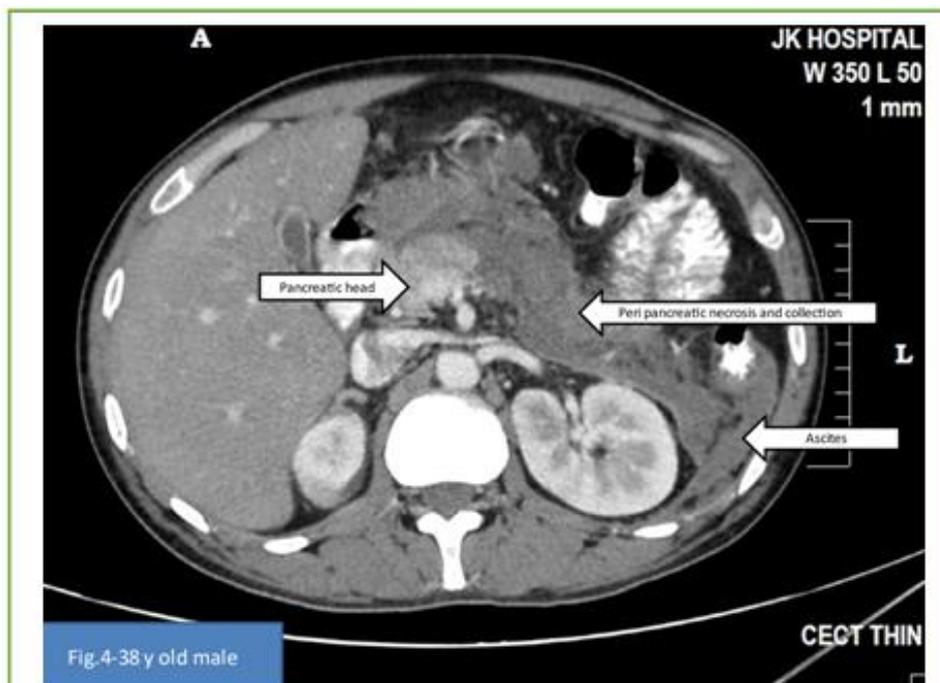
Fig.4- 38 y old male, CECT axial image shows, peri pancreatic fluid collections and non-enhancing pancreatic (<30%) and peri pancreatic fat necrosis with ascites. (MCTSI -8-severe ANP).
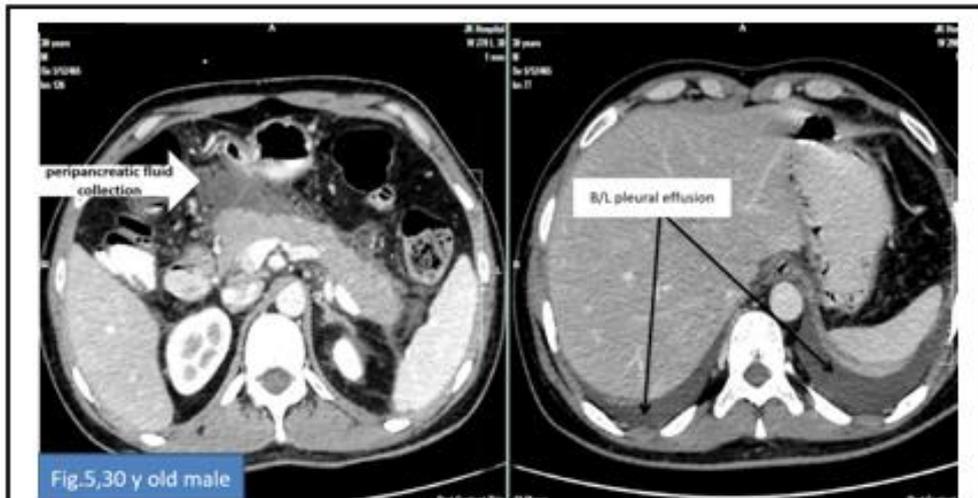
Fig.5- 30 y old male having AIEP with MCTSI-6, CECT axial image shows peri pancreatic fluid collection with bilateral pleural effusion.

Fig.6- 34 y old male CECT axial and coronal images shows a large thick walled homogenous PPC originated from pancreatic head coursing subdiaphragmatic space and extended inferiorly.
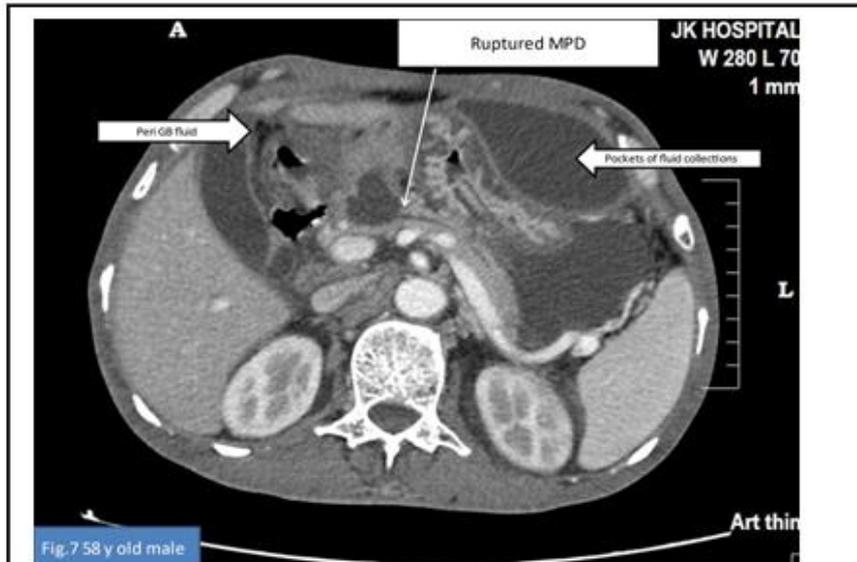
Fig.7- 58 y old male, CECT axial image shows ruptured MPD in head and neck region communicated to thick walled peripherally enhancing loculated collections (PPC) in peri pancreatic region, laser sac and greater omentum with ascites-AIEP with PPC.
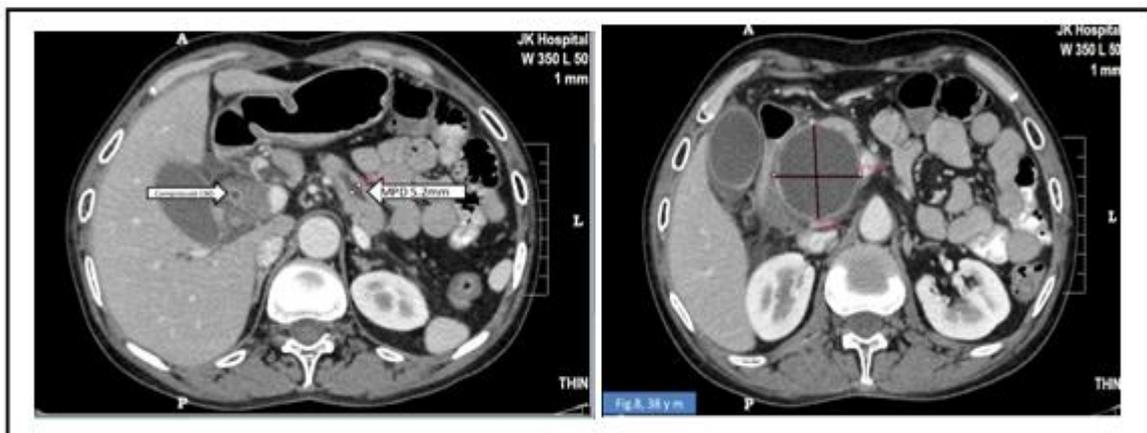
Fig.8- CECT axial image shows a large thick-walled collection in pancreatic head region compressing MPD and CBD causing distal dilated MPD and ascites. ANP with WON- MCTSI- 8.

RESULTS

Revised Atlanta classification system (2012)[5] sub divide AP into mild, moderate and severe according to MCTSI. It also describes various terminology used in reporting of case of AP. In our study it is found that acute pancreatitis commonly affect male 36 patients (85.7%) with peak incidence and prevalence is among 30-39 year of age group 21 patients (50%). In cases

of AP, AIEP is most common 30(71.4%) patients, and in AIEP moderate involvement 23 (54.7%) of pancreases is common. ANP is less common but more severe form of AP and affect male with moderate to severe involvement of pancreas and also more complications associated with it. Female affected by AP is less common and only cases of AIEP found with mild to moderate involvement. On CECT imaging findings bulky and edematous pancreas with peri pancreatic fat stranding is found in almost all patients. Other findings seen in cases of moderate and severely involved pancreas is in decreasing order as Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis-23 (54.7%), ascites- 20 (47.6%), pleural effusion-19 (45.2)%, MPD involvement-7 (16.6%), GIT and mesentery involvement- 6 (14.2%), PPC -6(14.2%), WON-5 (12%), cholelithiasis- 4 (9.5%), pancreatic necrosis-2 (4.7%). Peak age group of AP is found to be from 30-39y which affect 21 (50) % patients.

DISCUSSION

Revised Atlanta classification system (2012)[5] sub divide AP into mild, moderate and severe according to MCTSI. It also describes various terminology used in reporting of AP which is well accepted by clinicians and it minimizes confusion occurring regarding terminology used in reporting system. Early diagnosis and quick severity assessment help in triaging patients for management and predicting their outcome.

Total 800 patients underwent abdomen CT examination in same duration of study, 42 were diagnosed as acute pancreatitis, the incidence and prevalence in patient undergone for abdominal CT scan is 5.25%. Our findings are similar to previous study[2]. Of these 36 (85.7%) patients were male and 6 (14.3%) females. We categorize these patients based on CT imaging as mild, moderate and severe and also described imaging findings, prevalence of AIEP, ANP, RAP, their complications and age distributions. Based on MCTSI we found that prevalence of Mild -7 (16.6%) (Fig.1), moderate-29 (68.9%) (Fig.2,3 A & B), and severe- 6 (14.2 %) (Fig.4), cases. AIEP is found in 30 patients (71.4%) out of which 6 (14.2%) patients have PPC. ANP is found in 9 (21.4%) patients of whom 5 (12%) patients have WON, and RAP is found in 3 (7.1%) patients. All the mild cases 7 (16.6%) have AIEP and all sever cases 6 (14.2 %) have ANP. Cases of moderate involvement are most common 29 (68.9%), of these AIEP is most common and found in 23 (54.7%) of patients, 3 (7.1%) patients of ANP and 3 (7.1%) patients of RAP. Therefore, it is concluded that most of case of AIEP have mild to moderate involvement while in cases of ANP; involvement of pancreases is moderate to severe.

CECT findings in all mild cases are bulky and edematous pancreas (either part of pancreas or whole pancreas). In addition to this, common findings of moderate and severely involve pancreatitis is- Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis-23 (54.7%), ascites- 20 (47.6%), pleural effusion-19 (45.2)%, MPD involvement-7 (16.6%), GIT and mesentery involvement-6 (14.2%), PPC -6(14.2%), WON-5 (12%), cholelithiasis- 4 (9.5%), pancreatic necrosis-2 (4.7%). Peak age group of AP is found to be from 30-39y which affect 21 (50) % patients.

CONCLUSION

CECT helps in making early and accurate diagnosis of acute pancreatitis. MCTSI is simple and easy to apply for assessment of severity of AP. With helps of CECT we can also sub classify AP into AIEP and ANP and its complications. It helps in early diagnosis, triaging of patients according to severity, establishment of treatment, management of complications associated with it and for follow up examinations. Variousterminologies for AP used by revised Atlanta classification 2012 is universally accepted by clinicians which remove inter observer misinterpretations.

CONFLICT OF INTEREST
Nil

SOURCE OF SUPPORT
Nil

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