"MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX AND ITS CORRELATION WITH CLINICAL OUTCOME IN ACUTE PANCREATITIS - A ONE YEAR HOSPITAL BASED CROSS SECTIONAL STUDY

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ABBREVIATIONS

CT	Computed Tomography
CECT	Contrast Enhanced Computed Tomography
CTSI	Computed Tomography Severity Index
MCTSI	Modified Computed Tomography Severity Index
MRI.	Magnetic Resonance imaging
MRCP	Magnetic Resonance Cholangiopancreatography
AVG.	Average
PANC.	Pancreas
SR.	Serum
APACHE	Acute Physiology, Age and Chronic Health Evaluation
IV	Intra Venous
RAC	Revised Atlanta classification
PE.	Pleural effusion
VASC.	Vascular
ROC	Receiver Operating Characteristic curve
AUC	Area under the curve
AUROC	Area under the Receiver Operating Characteristic curve

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ABSTRACT

INTRODUCTION

Acute pancreatitis is an inflammatory condition of the pancreas that can range from mild to severe, with severe cases risking multi-organ failure and increased mortality. Early identification of high-risk patients is crucial for appropriate intervention. To aid this process, various severity index scoring systems have been developed, including CT-based systems like Balthazar's initial work, the CT Severity Index (CTSI), and the Modified CT Severity Index (MDCTSI). These tools help clinicians assess disease severity, predict outcomes, and tailor treatment plans. Given the prevalence of alcohol-induced acute pancreatitis in the country of study and its associated challenges, developing a reliable prognostic scoring system is vital for improving patient management and resource allocation in this context.

OBJECTIVE:

To investigate the correlation between MCTSI grading and clinical outcomes in acute pancreatitis patients.

MATERIALS AND METHODS:

This one-year hospital-based cross-sectional study was conducted at KLE's Dr. Prabhakar Kore Hospital and MRC, Belagavi, Karnataka, India, from January 1, 2023, to December 31, 2023. The study included 40 patients with acute pancreatitis, as determined by the sample size calculation. Patients were evaluated using a Revolution EVO Wipro GE 128-slice CT scanner. The Modified CT Severity Index (MCTSI) was used to classify acute pancreatitis as mild (0-2 points), moderate (4-6 points), or severe (8-10 points). Clinical outcome parameters, including length of hospital stay, need for ICU admission, need for intervention, organ failure, and mortality, were recorded. Statistical analysis was performed using SPSS version 16

software, employing Pearson Chi-square tests and Area under the Receiver Operating Characteristic curve (AUROC) to compare CT severity scoring with patient outcomes.

RESULTS:

The mean age was 39.4 years, with 92.5% male patients. Chronic alcohol abuse was the most common etiology (65%). MCTSI grading showed 30% mild, 40% moderate, and 30% severe cases. Significant correlations were found between MCTSI grade and hospital stay duration (p=0.0001), ICU admission (p=0.0001), need for intervention (p=0.0001), and end-organ failure (p=0.0001).

CONCLUSION:

MCTSI demonstrated high utility in predicting clinical outcomes and complications in acute pancreatitis. Strong correlations were observed between MCTSI grading and adverse events, including ICU admission, interventions, complications, and organ failure. MCTSI showed high sensitivity and specificity in predicting these outcomes, highlighting its potential as a valuable prognostic tool for early evaluation and risk stratification in acute pancreatitis patients.

KEYWORDS:

Modified computed tomography severity index, acute pancreatitis, clinical outcome, ICU admission, organ failure, complications.

INTRODUCTION

Acute pancreatitis is a condition characterised by inflammation of the pancreas, leading to abdominal pain & increased levels of pancreatic enzymes. While the condition is typically mild and can be treated with supportive care in most instances, about 10% to 20% of cases become severe. These severe cases are associated with a higher risk of serious health problems, such as failure of multiple organs or infection and necrosis of the pancreas, which can significantly increase morbidity & mortality.

In the critical hours following patient admission, clinicians face the urgent task of identifying those at risk of progressing to multi-organ failure. This timely assessment is crucial for implementing appropriate interventions, which may include fluid resuscitation, respiratory support, and intensive care measures. To aid in this decision-making process, severity index scoring systems have been developed. These tools facilitate rapid evaluation of patient status, enabling healthcare providers to stratify risk and allocate resources effectively. By leveraging such scoring methods, clinicians can more accurately predict outcomes and tailor treatment plans, potentially mitigating the progression of organ dysfunction and improving patient prognosis. The utilization of these scoring systems represents a valuable approach in the ongoing effort to enhance early recognition and management of critically ill patients.

Studies have explored the potential of the CT-based scoring systems in cases of acute pancreatitis. Research findings suggest that these systems offer varying degrees of effectiveness in assessing disease severity, with some showing statistical significance. This highlights the potential value of CT-based scoring systems as a complementary tool in evaluating acute pancreatitis cases.

The evolution of CT-based scoring systems for acute pancreatitis began with Balthazar's pioneering work. His initial system evaluated pancreatic inflammation using CT scans, laying the groundwork for future developments. Balthazar later enhanced this approach by creating the CTSI, which considered inflammation of pancreas and the degree of necrosis.

The CTSI remained the primary assessment tool for a period until Mortele & colleagues introduced the MDCTSI. This updated system expanded on the CTSI by incorporating extrapancreatic complications alongside pancreatic inflammation and necrosis. This more comprehensive approach provided a broader assessment of acute pancreatitis severity.

In our country, alcoholism is a significant contributor to acute pancreatitis cases, presenting substantial medical and socio-economic challenges. The development of a reliable scoring system capable of prognosticating the course and outcome of acute pancreatitis, including the complications associated with it, would be immensely valuable. Such a tool could greatly enhance the management and treatment strategies for this serious condition, potentially improving patient outcomes and resource allocation.

AIMS & OBJECTIVES:

AIM:

To investigate the association between the MDCTSI of patients diagnosed with pancreatitis and their clinical outcomes.

OBJECTIVES:

1. Assess the usefulness of CT in the patients with acute pancreatitis for their prompt diagnosis.
2. Identify and assess complications using the MDCTSI.
3. To categorize the CT findings of patients with acute pancreatitis according to the MDCTSI.
4. To link the grading systems with patient outcomes in terms of:
    i. Failure of organ systems
    ii. Mortality
    iii. Span of stay in the hospital
5. To determine the sensitivity, specificity & positive predictive value of the MDCTSI in predicting the aforementioned complications.

REVIEW OF LITERATURE

ANATOMY OF PANCREAS

Crucial organ in the digestive & endocrine systems is the pancreas, playing a vital role in maintaining blood sugar levels and aiding in the digestion of food. This soft, elongated, flat gland approximately measuring twelve to twenty cm in length. Positioned in the retroperitoneal space, with the stomach placed anterior to it and is bordered on the right side by the C-loop of the duodenum. [1]

PARTS OF PANCREAS

1. **Head of Pancreas:** The head of the pancreas is nestled within the concavity of the duodenum, contributing to an intricate network of the gastrointestinal tract.
2. **Uncinate Process**: Emerging from the lower part of the head, the uncinate process extends deep to the superior mesenteric vessels, showcasing the complex vascular relationships in this region.
3. **Neck of the Pancreas**: The neck serves as the constricted portion between the head and the body of the pancreas, facilitating the seamless flow of digestive enzymes and hormones.
4. **Body of the Pancreas**: Positioned behind the stomach, the body of the pancreas is a vital site for the production and secretion of pancreatic juices essential for digestion.
5. **Tail of the Pancreas**: Extending towards the left end of the pancreas, the tail contacts the spleen and traverses the lienorenal ligament, emphasizing its close anatomical relationship with adjacent structures. [2]

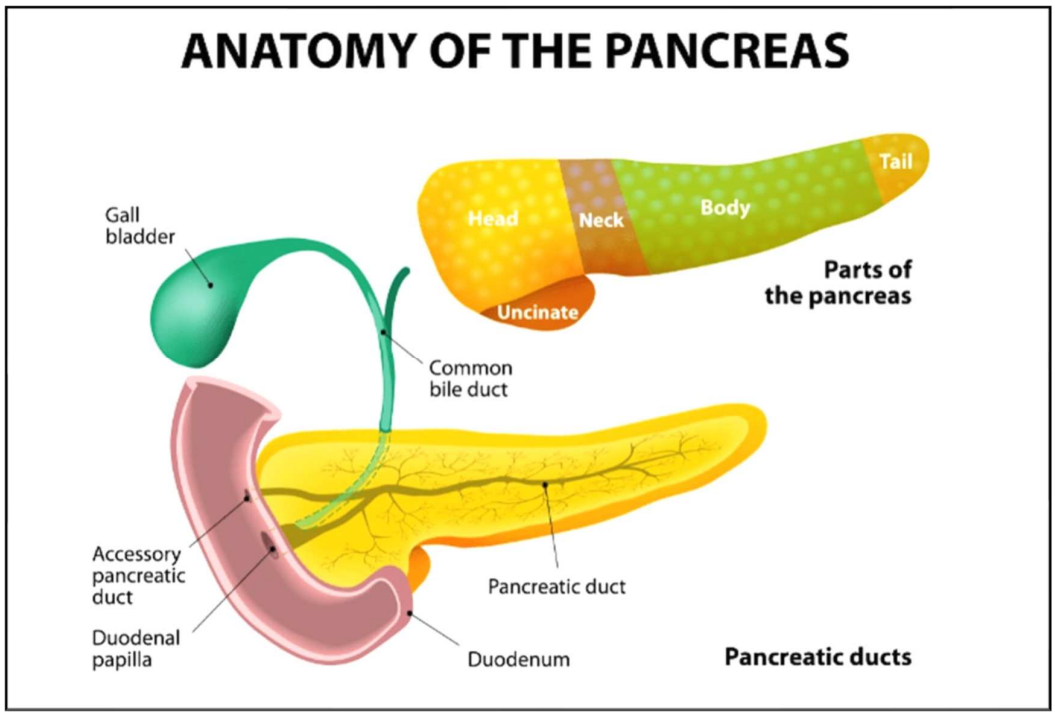


FIGURE 1. :-ANATOMY OF PANCREAS.

- **RADIOLOGICAL MEASUREMENTS**

In radiological imaging, the avg. normal measurements of the pancreas provide crucial insights into its dimensions:

- Head of pancreas : 23 +/- 3mm
- Neck of pancreas : 19 +/- 2.5mm
- Body of pancreas : 20 +/- 3mm
- Tail of pancreas : 15 +/- 2.5mm

BLOOD SUPPLY OF PANCREAS

ARTERIAL SUPPLY:

i. Superior Pancreaticoduodenal Artery

ii. Inferior Pancreaticoduodenal Artery

iii. Pancreatic Branches of splenic Artery

VENOUS DRAINAGE:

- Splenic vein drains the body and neck of the pancreas

- Superior mesenteric vein and portal vein drains the head of the pancreas.

LYMPHATIC DRAINAGE:

- Pancreatic lymphatic fluid is drained through the splenic, celiac & superior mesenteric lymph nodes, forming a crucial part of the lymphatic system's network for immune response and fluid balance.

Understanding the intricate blood supply and lymphatic drainage of the pancreas is essential for comprehending its physiological functions and the potential implications of vascular or lymphatic-related disorders in this vital organ.

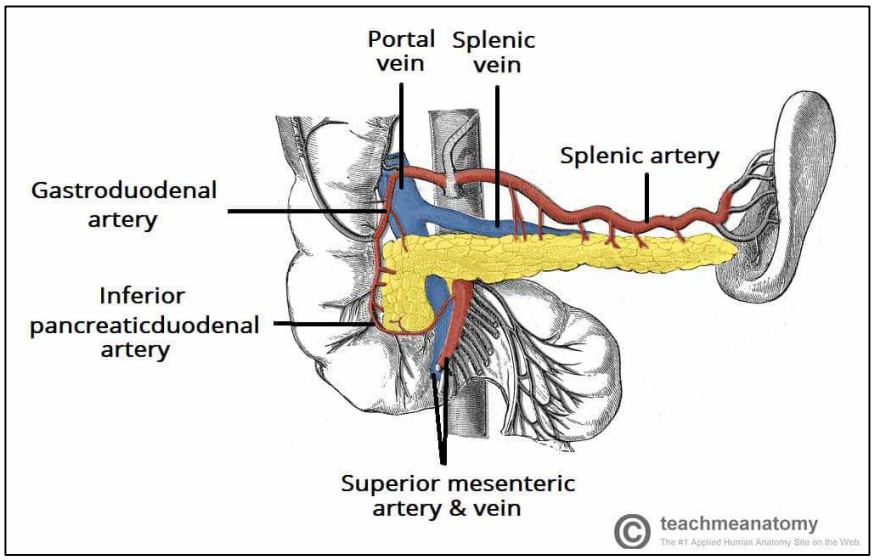


FIGURE 2: BLOOD SUPPLY OF THE PANCREAS

FUNCTIONS OF PANCREAS [3]

Pancreas is a dual-function gland, exhibiting characteristics of both endocrine and exocrine glands.

1. **Exocrine Function:**

- The exocrine pancreas functions through the acinus and its draining ductule.

2. **Endocrine Function**:

The endocrine pancreas encompasses Islets of Langerhans which is a cluster of cells

The islets of Langerhans in the pancreas contain several specialized cell types:

1. **Alpha cells** : produce glucagon, which raises blood glucose by converting fats and proteins into glucose between meals.
2. **Beta cells** : secrete insulin and amylin, lowering blood glucose by inhibiting glucagon release and slowing gastric emptying.
3. **Delta cells** : release somatostatin, which inhibits hormone secretion and reduces nutrient absorption in the small intestine.
4. **Gamma cells** : generate a polypeptide that decreases appetite.
5. **Pancreatic polypeptide-producing cells** : create a substance that acts as a cholecystokinin antagonist, suppressing pancreatic secretion while stimulating gastric secretion.

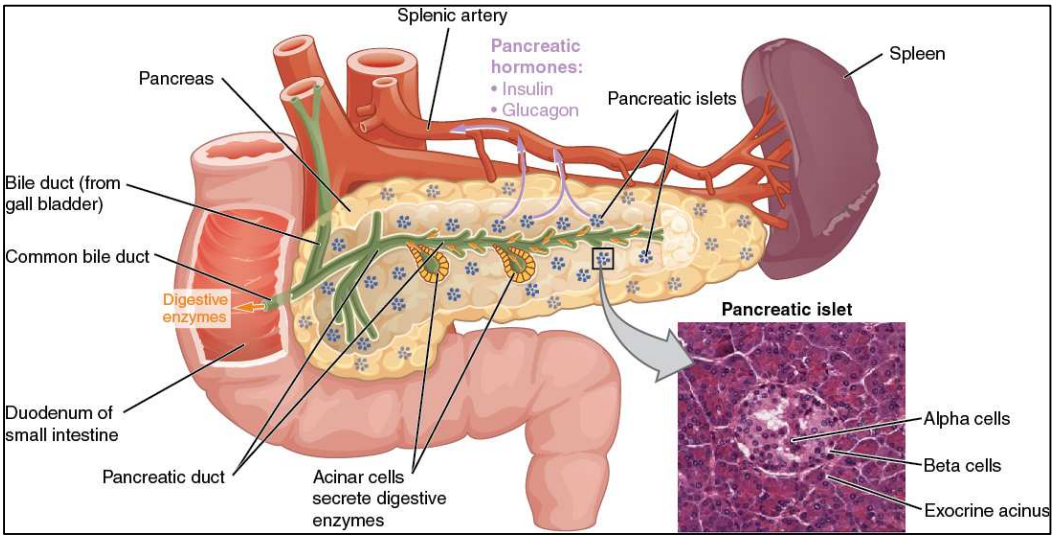


FIGURE 3 : PANCREATIC STRUCTURE AND CELLULAR COMPOSITION

The pancreas is susceptible to various diseases due to its critical roles in digestion and blood glucose regulation:

1. **Pancreatitis:** An inflammatory condition of the pancreas that can be acute or chronic.
2. **Pancreatic Cancer:** Ranked as the fifth leading cause of cancer-related deaths globally, known for its aggressive nature and high mortality rates at diagnosis.
3. **Type 1 Diabetes**: Results from dysfunction of the pancreas's endocrine component.

Given its dual function in digestive processes and glucose regulation, the pancreas's health is crucial for overall well-being. Diseases affecting this organ can have far-reaching consequences on an individual's health.

ACUTE PANCREATITIS

One of the common conditions of abdomen is acute pancreatitis characterized by a diverse spectrum of clinical presentations. The severity of this condition can range from mild abdominal discomfort to life-threatening multi-organ failure,

potentially resulting in mortality. In the majority of cases, the pancreas recovers its normal structure and function, provided no necrotic damage [4] has occurred. However, only a small fraction of severe cases are identified as such upon initial presentation.

While the overall mortality rate associated with acute pancreatitis is approximately 10-15%, a significant majority of cases (around 80%) are self-limiting and resolved without intervention. Despite its potential severity, most episodes of acute pancreatitis are manageable and do not lead to permanent pancreatic impairment[5].

The aetiology of acute pancreatitis is multifactorial, with most causative factors inducing acinar cell injury. The resulting pancreatic pathology can manifest in various forms, ranging from oedema to necrosis and life-threatening complications.

Some of the common etiologies include gallbladder disease, alcohol abuse, hypertriglyceridemia, endoscopic retrograde cholangiopancreatography and trauma. Less common causes encompass genetic factors (such as cystic fibrosis), ischemia, vasculitis, pancreatic divisum, and certain infections (including ascariasis, Coxsackie virus, mumps, herpes, and cytomegalovirus).

PATHOPHYSIOLOGY & COURSE OF THE DISEASE

The pathophysiological mechanisms of acute pancreatitis can be delineated into three sequential phases. [6]

1. The **initiating phase** involves the premature intracellular activation of the proteolytic enzyme trypsin within the acinar cells of the pancreas. This aberrant

activation catalyzes a cascade of activation for various other destructive digestive enzymes harboured within the pancreatic parenchyma.

2. The **second phase** is characterized by the induction of an inflammatory response confined to the pancreatic tissue itself, resulting in intrapancreatic inflammation.
3. In the **third phase**, the inflammatory process transcends the boundaries of the pancreas, leading to extrapancreatic inflammation.

The progression and severity of acute pancreatitis are influenced by several factors, including pancreatic parenchymal necrosis, extrapancreatic retroperitoneal fat necrosis, the presence of bioactive compounds in pancreatic ascitic fluid, and potential secondary infection of necrotic tissue.

In the early stages, multi-organ dysfunction arises due to the effects of inflammatory mediators and activated leukocytes. Later stages, typically from the second week onwards, are characterized by local and systemic septic complications, often involving gram-negative enteric organisms, with Escherichia coli being the most prevalent.

Acute pancreatitis presents a spectrum of severity, with the majority of patients experiencing a mild form of the disease. However, a significant minority, approximately 10-20% of cases, progress to develop systemic inflammatory response syndrome (SIRS). This complication can potentially lead to multisystem organ dysfunction or pancreatic necrosis. It is crucial to note that necrotic changes typically manifest within the initial 24-48 hours of onset and generally remain stable throughout the acute phase of the illness. [7]

The cardinal manifestation being pain in abdomen in patients with acute pancreatitis. This pain is typically localized in the epigastric region, although it may present as a more diffuse discomfort across the upper abdomen. Characteristically, the

pain is constant and severe in nature, often radiating to the back. In most instances, patients also experience accompanying symptoms of nausea and vomiting. This combination of symptoms serves as a key diagnostic indicator for clinicians evaluating potential cases of acute pancreatitis.

Accurate and timely identification of the underlying cause is paramount when evaluating severe abdominal discomfort, as numerous life-threatening conditions may present with similar symptoms. The diagnostic process must consider a broad spectrum of potential aetiologies, including inflammatory disorders of the gastrointestinal tract, vascular emergencies affecting abdominal organs, and acute cardiac events. Additionally, in women of reproductive age, gynaecological crises warrant consideration. Given that many of these conditions necessitate immediate medical intervention or surgical management, healthcare providers must employ a systematic approach to differentiate between these entities efficiently. This multifaceted differential diagnosis underscores the complexity of abdominal pain assessment and highlights the critical nature of swift, precise medical decision-making in emergency settings.

In the majority of acute pancreatitis cases, patients present with low-grade fever. The occurrence of high-grade fever may indicate cholangitis, necessitating further investigation. Pulmonary examination often reveals pleural effusion, predominantly on the left side, though bilateral involvement is not uncommon. Cardiovascular assessment typically demonstrates tachycardia.

Abdominal examination in less severe cases reveals epigastric or diffuse abdominal pain with mild distension. In contrast, more severe presentations are characterized by exquisite abdominal tenderness, peritoneal signs i.e., rigidity & tenderness and diminished bowel sounds due to ileus. A small percentage of patients

(approximately 3%) may exhibit ecchymoses near the umbilicus (Cullen's sign) or in the flanks (Grey-Turner's sign), indicative of local pancreatic inflammation spread. [8].

The estimation of serum amylase levels remains the gold standard for diagnosing acute pancreatitis. Elevation is defined as a value exceeding the normal range's upper limit by 3 times. A comprehensive study which was prospective in nature reported sensitivity and specificity of 82% and 90%, respectively [9] for elevated amylase levels. Typically, serum amylase levels begin to rise in a duration of 2 hours of pain onset and comes back to normal within 3-6 days. However, this diagnostic test has several constraints. [10]

Sr. amylase levels might be within normal limits in cases of acute pancreatitis which are related to hypertriglyceridemia, delayed measurement, or underlying chronic pancreatitis (due to diminished baseline amylase production). Furthermore, amylase is produced in various non-pancreatic sites, including ovaries, salivary gland & fallopian tubes. [11] Elevated serum amylase levels can also occur in other intra-abdominal conditions such as intestinal ischemia, perforation, or obstruction, as well as in head trauma, renal failure, and lung cancer.

Lipase, another pancreatic enzyme, is also utilized in diagnosis of acute pancreatitis [9]. When lipase levels exceed more than the upper limit of the normal range by 3 times, its diagnostic accuracy surpasses that of amylase. Lipase demonstrates higher sensitivity (95%) and specificity (96%) compared to amylase, partly due to fewer non-pancreatic sources. Additionally, the longer half-life of lipase results in prolonged elevation in serum compared to amylase. However, it is important to note that the levels of either enzyme do not correlate with the etiology or severity of acute pancreatitis.

Atlanta's symposium compiled a classification based on clinical features in patients with acute pancreatitis in 1992 [Table 1].

Mild acute pancreatitis	Characterized by pancreatic inflammation with limited impact on organ function, leading to a smooth and complication-free recovery process
Severe acute pancreatitis	A more serious form of pancreatic inflammation accompanied by significant localized complications, which may include tissue death (necrosis), formation of abscesses or fluid-filled sacs (pseudocysts), and impairment of vital organ functions.
Organ failure	A critical condition defined by the following criteria: 1. Circulatory Shock: Systolic blood pressure drops below 90 mmHg 2. Respiratory Distress: Arterial oxygen pressure (PaO2) falls to 60 mmHg or lower 3. Kidney Dysfunction: Serum creatinine levels exceed 2 mg/dL after fluid replacement therapy 4. Severe Gastrointestinal Haemorrhage: Blood loss surpasses 500 mL within a 24-hour period

TABLE 1: ATLANTA CLASSIFICATION [12]

The severity of acute pancreatitis is primarily influenced by two critical factors: necrosis of the pancreas & multi-organ system failure. A significant challenge for clinicians lies in the early identification and appropriate management of patients at risk of developing multi system failure. Comprehensive care strategies include fluid instillation, pulmonary support, and ICU care when necessary.

EVALUATION OF CLINICAL SERVERITY:

Clinical evaluation done bedside of the patient has been found to be unreliable in determining disease severity and predicting outcomes. Research by McMahon et al. (1980) indicated that only a minority of severe pancreatitis cases were accurately predicted at initial presentation. [13]

In the realm of acute pancreatitis research, recent studies have delved into the prognostic value of haemoconcentration as an early harbinger of disease severity & subsequent organ dysfunction. Concurrently, investigators have scrutinized discrete biomarkers for their predictive capacity, with particular attention given to elevated Sr. creatinine (surpassing two mg/dL) and hyperglycaemia (exceeding 250 mg). [14] [15] These singular indicators complement the established multifaceted scoring paradigms, notably Ranson's criteria & the APACHE II algorithm, which amalgamate identifiers of systemic inflammatory response and compromised organ function.

A seminal contribution to the field emerged from Ranson and colleagues, who devised a prognostic framework specifically tailored for alcohol-induced pancreatitis. This scoring system encompasses 11 objective parameters, (Table 2), with a quintet assessed upon hospital admission and the remaining sextet evaluated over the ensuing 48-hour period. The clinical utility of this schema is exemplified by its stratification power: patients exhibiting two or fewer positive indicators faced a mortality risk

below 1%, whereas those manifesting six or more criteria confronted a dire prognosis with 100% mortality. This striking dichotomy underscores the imperative for prompt and precise severity assessment in guiding therapeutic interventions and optimizing patient outcomes in the context of acute pancreatitis. [16]

AT PRESENTATION	WITHIN 48 HRS
Age > 55 yrs	PCV fall > 10%
Glucose > 200 mg/dL	PaO2 < 60 mm Hg
WBC > 16,000/mm3	BUN elevation >5mg/dL
AST > 250 IU/L	Base deficit > 4 mEq/L
LDH > 350 IU/L	Sr. calcium < 8mg/dL

TABLE 2: EARLY SIGNS OF PROGNOSIS BY RANSON'S

A single major constraint of this system is that the intermediate values of three to five doesn't accurately prognosticate the occurence of necrosis or failure of organ system. Another constraint is that a 48-hour period is necessitated for complete data collection, by which time the prognostic information may be too belated to aid the patient.

The Glasgow criteria were introduced as a simplified alternative to Ranson's criteria but also required a 48-hour period for complete assessment. Subsequent modifications did not significantly improve accuracy compared to criteria by Ranson's.

The Acute Physiology and Chronic Health Evaluation (APACHE II) methodology was devised to gauge disease severity at the point of hospital admission, incorporating 12 distinct variables that reflect the function of seven critical organ systems. Interestingly, its predictive accuracy enhanced after a 48-hour interval, with an APACHE II score of 9 at this juncture proving equivalent to Ranson's criteria[17] in prognostic value. A notable advantage of this system lies in its capacity for daily reassessment, enabling clinicians to monitor therapeutic efficacy. However, the multitude of variables renders the APACHE II system somewhat cumbersome in practice.

Radiographic evidence of pleural effusion upon admission has emerged as a potent indicator of impending severe disease course. A pivotal study conducted by Heller and colleagues in 1997 revealed a striking disparity: an overwhelming majority (85%) of patients who developed severe pancreatitis exhibited pleural effusion on initial chest radiographs, in stark contrast to a mere 9% of those who experienced mild disease progression.

The pioneering Balthazar grading system leveraged plain computed tomography (CT) findings for disease assessment. This classification scheme demonstrated that higher grades, particularly D and E, correlated strongly with elevated rates of morbidity and mortality. This correlation underscores the prognostic significance of early radiological findings in acute pancreatitis and highlights the potential of imaging-based scoring systems in risk stratification. (Table 3)

ORIGINAL BALTHAZAR GRADE	CT FINDING
A	CT scans reveal a pancreas with normal appearance.
B	Imaging shows an increase in pancreatic size or enlargement.
C	CT findings indicate pancreatic inflammation and/or alterations in the surrounding peripancreatic fat tissue.
D	Singular, localized fluid collection in the peripancreatic region
E	CT images demonstrate either multiple (>/2) fluid collections or the presence of retroperitoneal air.

TABLE 3: GRADING SYSTEM BY BALTHAZAR

The CTSI (Table 4) represents a refined iteration of the grading system developed by Balthazar and colleagues in 1990. This enhanced classification scheme integrates both non-contrast and contrast-enhanced CT findings, thereby providing a more comprehensive assessment of pancreatic pathology. The CTSI's innovation lies in its incorporation of pancreatic necrosis evaluation, which is visualized following intravenous contrast administration.

This advanced scoring system amalgamates the morphological features observed on plain CT scans with the precise delineation of pancreatic parenchymal perfusion defects visible on contrast-enhanced images. By quantifying the extent of pancreatic necrosis and integrating this information into the pre-existing classification framework, the CTSI offers a more nuanced and accurate prognostic tool.

The CTSI's dual-modality approach allows for a more granular stratification of disease severity, potentially guiding clinicians in tailoring therapeutic interventions. This refined methodology underscores the evolving role of advanced imaging techniques in the prognostication and management of acute pancreatitis, highlighting the synergy between technological advancements and clinical acumen in improving patient outcomes.

PROGNOSTIC INDICATORS		**POINTS**
Panc. Inflammation	A. Normal panc.	0
	B. Enlargement of panc.	1
	C. Inflammation of pancreas with/ without changes in peripancreatic fat	2
	D. Solitary peripancreatic fluid collection	3
	E. 2 or more fluid collections or retroperitoneal air	4
Panc. Necrosis	Absent	0
	Less than 30%	2
	30 to 50%	4
	More than 50%	6

TABLE 4: BALTHAZAR CTSI SCORING (2004) [18]

The cumulative CTSI score, derived from summing these components, facilitates the stratification of acute pancreatitis into three severity categories:

- Mild: CTSI score 0 to 3
- Moderate: CTSI score 4 to 6
- Severe: CTSI score 7 to 10

The evolution of acute pancreatitis severity scoring systems continued to progress, driven by the recognition that existing models, including the CT Severity Index (CTSI), had limitations in their prognostic capabilities. Notably, the CTSI did not account for extrapancreatic complications, which can significantly influence patient outcomes.

In response to this gap, Mortele [19] and colleagues introduced an innovative severity scoring system in 1990. This refined approach incorporated extrapancreatic and vascular complications into the established Balthazar CTSI framework. This integration aimed to provide a more comprehensive assessment of disease severity and potential systemic involvement.

A key modification in this new system was the recalibration of the pancreatic necrosis scoring. The distinction between necrosis exceeding 30% and 50% was eliminated, as statistical analysis revealed no significant difference in disease outcomes between these two thresholds. This adjustment streamlined the scoring process without compromising its predictive accuracy.

By encompassing a broader spectrum of complications and refining the necrosis assessment, this enhanced scoring system sought to offer clinicians a more nuanced and accurate tool for prognostication in acute pancreatitis. The incorporation

of extrapancreatic factors represented a significant stride towards a more holistic evaluation of disease severity, potentially guiding more tailored therapeutic approaches and improving patient management strategies.

PROGNOSTIC INDICATORS		**POINTS**
Panc. Inflammation	Normal panc.	Zero
	Structural pancreatic anomalies, with potential inflammatory manifestations or peripancreatic adipose tissue modifications	Two
	Fluid accumulations within or surrounding the pancreas, or fat necrosis in the peripancreatic region	Four
Panc. Necrosis	-	Zero
	Less than or equal to 30%	Two
	More than 30%	Four
Other Complications	One or more of following: Ascites, Pleural Effusion, parenchymal complications, vascular complications or gastrointestinal tract involvement.	Two

TABLE 5: MORTELE MODIFIED CTSI SCORING (2004) [19]

The aggregate score derived from these domains informs the severity classification:

1. Mild: MDCTSI : 0 to 2
2. Moderate: MDCTSI : 4 to 6
3. Severe MDCTSI: 8 to 10

In the course of acute pancreatitis, the necessity for an immediate computed tomography (CT) scan within the first 48-72 hours of hospitalization is not universally accepted. [20] The initial clinical approach focuses on aggressive fluid resuscitation, gastrointestinal rest, pain management, and vigilant monitoring for the occurrence of organ dysfunction. It is important to see that necrosis is identified precisely 48–72 hours after the onset of pancreatitis [21]. Although CECT scans are frequently done upon admission, their impact on early clinical management remains unsubstantiated. The protocol of care during the initial few days includes fluid instillation, rest to the bowel, management of pain and vigilant assessment for the progression to organ failure.

MRI, specifically magnetic resonance cholangiopancreatography (MRCP), is gaining prominence in acute pancreatitis management. MRCP excels in delineating pancreatic duct anatomy and identifying choledocholithiasis. In terms of detecting pancreatic necrosis and assessing disease severity, MRCP's accuracy is comparable to CT scans. Nevertheless, CT scanning remains the preferred radiological modality due to its rapidity and cost-effectiveness. [22, 23]

The majority of acute pancreatitis cases (80-90%) are classified as interstitial pancreatitis. Majority of these patients recover within a few days & are discharged within four to seven days of admission. A small fraction (< ten%) progress to transient organ failure. A minute percentage (< three %) of pancreatitis cases progress to persistent organ failure and mortality, despite appropriate treatment.

Among all the patients, 10-20% of them were diagnosed with necrotizing pancreatitis, half of those progress to organ failure, which is typically longer in duration and persistent. If there is no presence of organ dysfunction, the mortality rate

for necrotizing pancreatitis is 0-3%. However, even the involvement of single-organ system failure elevates mortality to approximately 10%, while multi-system organ failure dramatically increases rate of mortality to 40-50%.

When a patient's condition fails to improve within the initial days, a CECT scan is employed to differentiate between interstitial and necrotizing pancreatitis. Lack of improvement is characterized by long standing abdominal pain necessitating pain killers, ongoing leucocytosis or increased body temperature, or the persistence or progression of organ failure.

While CT stands a high predictive value in identifying necrosis, it doesn't always differentiate between unsterile and sterile necrosis if there is no retroperitoneal air. Pancreatic infections typically present between the first & third week of hospitalization. Fungal infections may present later, at four to six weeks or beyond, particularly in patients who have received antibiotics which are broad-spectrum range. Percutaneous CT-guided ctyology (FNA) is utilized to detect infected necrosis. Management of infected pancreatic necrosis involves emergency surgical necrosectomy and targeted antibiotic therapy. For critically ill patients unable to undergo surgical intervention, percutaneous drainage via catheter is employed to mitigate toxicity and stabilize the condition of patient, with the possibility of delayed necrosectomy if necessary.

If the aspirate taken percutaneously is sterile, the condition is termed sterile necrosis. However, in cases of pancreatic duct disruption, patients may remain toxic despite a sterile aspirate due to the enzymes of pancreas being leaked into the peripancreatic necrotic tissue.

After about four weeks or more, the inflammatory process typically resolves, resulting in either a pseudocyst or walled-off necrosis, depending on the presentation initially.

Acute pancreatitis can lead to various complications, including those affecting blood vessels and the formation of fluid accumulations around the pancreas. Although uncommon, thrombosis may develop in the portal, superior mesenteric, or splenic veins. Another rare vascular issue is the formation of pseudo aneurysms, most frequently observed in the splenic artery. These pseudo aneurysms are believed to result from the pancreatic enzymes breaking down the arterial wall.

In conclusion, the management of acute pancreatitis requires a comprehensive approach, incorporating timely radiological assessment, aggressive supportive care, and vigilant monitoring for potential complications. The judicious use of imaging modalities, particularly CT and MRI, plays a crucial role in guiding treatment decisions and improving patient outcomes in this complex and potentially life-threatening condition.

REVIEW OF STUDIES

Bollen et al. [24] examined 196 cases in a prospective study, comparing the efficiency of the CTSI and MCTSI. Both scoring systems demonstrated robust interobserver reliability and exhibited significant correlations with key severity indicators, including mortality rates, duration of intensive care unit (ICU) stays, organ failure incidence, necessity for interventional procedures, pancreatic infection occurrence, and overall disease severity.

When juxtaposed with the APACHE II scoring system, the CT-based indices showed superior performance in predicting pancreatic infection and the need for intervention. Conversely, APACHE II demonstrated greater accuracy in forecasting systemic complications. Utilizing optimized threshold scores (>4 for CTSI, >6 for MCTSI), both CTSI and MCTSI achieved comparable diagnostic precision, with noteworthy sensitivity and specificity for identifying severe clinical presentations. The researchers concluded that both CT-based scoring systems offer equivalent efficacy in assessing morphological severity and predicting the clinical trajectory of acute pancreatitis.

Anuradha Kapali et al [25] conducted a focused prospective analysis of 39 acute pancreatitis cases. Their study employed the MCTSI to grade severity based on contrast-enhanced CT imaging and subsequently correlated these grades with various clinical outcomes. The results revealed a significant association between elevated MCTSI grades and increased ICU admission rates, prolonged ICU stays, and extended overall hospitalization periods.

The MCTSI demonstrated impressive predictive accuracy across multiple clinical parameters. The MCTSI demonstrated good accuracy in predicting systemic complications (sensitivity 100%, specificity 91.8%), local complications (sensitivity 100%, specificity 43%), and the necessity for ICU admission (sensitivity 76.9%, specificity 52%). The study concluded that the MCTSI grading system can be effectively used to predict the possibility of developing complications, the need for interventions, and the requirement for ICU care in patients with acute pancreatitis.

Dr. Manu R. et al. [26] conducted a study to assess the efficacy of the modified CT severity index (MCTSI) in predicting outcomes for 50 acute pancreatitis cases, confirmed by elevated amylase and lipase levels.

Contrast-enhanced CT scans were performed within 3 days to grade severity using both the CT severity index (CTSI) and MCTSI. The study population was predominantly male (86%) with a mean age of 26-30 years. Chronic alcohol abuse was the primary etiology (76%), followed by gallstones (16%). All patients presented with abdominal pain, and 92% experienced vomiting. CT findings revealed pancreatic inflammation in all cases, with 54% showing <30% necrosis and 16% showing >30% necrosis. Extrapancreatic complications were observed in 52% of cases. MCTSI grading classified 6% as mild, 70% as moderate, and 24% as severe pancreatitis. The study reported no mortality, but organ failure occurred in 38% of cases, with hepatic failure being most common (22%). Systemic infection was observed in 36% of patients, and 10% required surgical intervention. Hospital stays ranged from 3-25 days (mean 9.5 days). The researchers correlated CTSI/MCTSI grades with clinical outcomes such as organ failure, infection, and duration of hospitalization.

Patrick W Vriens et al. [27] performed a prospective observational study to evaluate the CTSI as an early prognostic indicator in acute pancreatitis.

The study included 79 patients and reported an overall complication rate of 57% & a mortality rate of 9%. Those with CTSI of 0 to 3 had complication and mortality rates of 42% and 2% respectively, those with CTSI of 4 to 6 had rates of 81% and 19%, and those with CTSI of 7 to 10 had rates of 100% and 33%. Notably, subsequent CT scans did not alter the initial prognosis. The study concluded that early

CTSI correlated strongly with the incidence of complications, sepsis, mortality, and the need for ICU admission.

Banday et al. [28] conducted a research focusing on the MDCTSI in evaluating acute pancreatitis & its association with outcomes clinically. Their findings indicated that the Modified CT Severity Index demonstrated a stronger statistical correlation with clinical outcomes, including length of hospital stay, development of infection, occurrence of organ failure, and overall mortality. Additionally, the index showed predictive value for the necessity of interventional procedures.

Biswanath et al. [29] evaluated the efficacy of CT severity indices about clinical outcomes and their alignment with the revised Atlanta classification (RAC) for acute pancreatitis severity.

The research evaluation demonstrated a high degree of correspondence between the MCTSI and the revised Atlanta classification system, with congruence observed in 9 out of 10 evaluations. CTSI showed slightly lower alignment, matching RAC assessments in approximately 4 out of 5 instances. Both scoring methods yielded identical results in nearly three-quarters of the examined cases. Statistical analysis utilizing advanced comparison techniques revealed that both CTSI and MCTSI exhibited robust associations with various patient outcomes, achieving statistical significance. However, neither index showed a meaningful correlation with the duration of critical care unit admissions. The researchers determined that while both scoring systems displayed strong relationships with clinical progression and substantial agreement with RAC categorization, the MCTSI demonstrated superior detection capabilities but less precision compared to the CTSI when distinguishing between mild and more severe forms of pancreatic inflammation.

Adhishwari Priyadarshini Parhi et al[30] investigated the predictive value of the MCTSI for complications and outcomes in acute pancreatitis patients. Their findings indicated that higher MCTSI scores were significantly associated with increased rates of organ failure ($p<0.002$), systemic infection ($p=0.001$), and prolonged hospital stays ($p<0.01$).

The study, which involved 50 patients, categorized cases as mild (40%), moderate (42%), and severe (18%) based on MCTSI grading. A strong correlation was observed between higher MCTSI scores and increased organ failure rates, with 30% of mild cases, 33% of moderate cases, and 100% of severe cases developing organ failure. Systemic infection rates also correlated with MCTSI severity, mild in 15% of cases, 42% of moderate, and 88% of severe cases. Mean hospital stay duration increased with MCTSI grade severity, ranging from 7 days for mild cases to 14 days for severe cases. However, the need for surgical intervention did not show a significant correlation with MCTSI scores. The study reported a 2% mortality rate, with one fatality in a severe pancreatitis case following surgical necrosectomy. The researchers concluded that MCTSI serves as a reliable prognostic indicator, particularly for predicting organ failure, infection, and length of hospital stay in acute pancreatitis cases

MATERIALS AND METHODS

SOURCE OF DATA:

A one-year Hospital-based cross-sectional study was conducted on the patients who met the inclusion criteria and did not get excluded at KLE's Dr. Prabhakar Kore Hospital and MRC, Belagavi, Karnataka, India.

METHOD OF COLLECTION OF DATA:

I. STUDY DESIGN: A one-year hospital-based cross-sectional study.

II. STUDY PERIOD: 1st January 2023 to 31st December 2023

III. STUDY AREA: KLE's Dr. Prabhakar Kore Hospital and MRC, Belagavi, Karnataka, India.

IV. SAMPLE SIZE: 40

The formula used for sample size calculation is,

$$n = p\,(100-p)Z^2\,E^2$$

where n is the sample size required, p is the percentage occurrence of a state or condition (proportion or prevalence), E is the percentage maximum error required, Z is the value corresponding to level of confidence required.11.9% patients with moderate acute pancreatitis had intervention. Considering similar result, at 95% confidence level and 10% of maximum error, the sample size is given by,

$n = 11.9\times (100-11.9) \times 1.96^2\ 10^2$

n = 40. 28889≈40

Hence, minimum sample size required is **40.** As sample size increases, accuracy of result also increases.

INCLUSION CRITERIA:

All patients having a clinical, laboratory, or ultrasonographic diagnosis of acute pancreatitis, referred to the radiology department at Dr. Prabhakar Kore Charitable Hospital and Research Centre in Belgaum.

EXCLUSION CRITERIA:

1. Individuals with a documented history of hypersensitivity to iodine-based contrast media.
2. Subjects exhibiting impaired renal parameters, as indicated by Sr. creatinine levels exceeding 1.5 mg/dL post-rehydration therapy.
3. Expectant mothers or those in any stage of pregnancy.
4. Patients presenting with signs of chronic pancreatitis, such as intraductal calcifications, ductal strictures, or parenchymal calcifications.
5. Cases involving other pancreatic pathologies, including but not limited to pancreatic neoplasms or cystic lesions.
6. Individuals who have undergone any form of pancreatic surgical intervention in the past.

These criteria were established to ensure the study's specificity and to minimize confounding factors that could potentially influence the assessment of acute pancreatitis. By excluding these patient subgroups, the research aims to focus on a more homogeneous population, thereby enhancing the validity and reliability of the findings.

DATA COLLECTION PROCEDURE:

- Examinations will be conducted by using Revolution EVO Wipro GE,128 slice CT
- Clinical outcome data was gathered by visiting surgical wards and reviewing patient records. The collected clinical information encompassed demographic details, comprehensive medical history including presenting symptoms, physical assessment (both localized and systemic) such as heart rate, blood pressure, respiratory rate, body temperature, and jaundice. Additionally, any history suggesting potential causes like gallstone issues, alcohol consumption, abdominal trauma, medication use, metabolic disorders, or recent surgical procedures was noted.

IMAGING TECHNIQUES:

- CT scans of the abdomen were conducted using the Revolution EVO Wipro GE,128 slice CT
- Both non-contrast and contrast-enhanced scan of the abdominal and pelvic regions were acquired in axial planes and reconstructed in other views.
- Continuous axial sections measuring 5mm in thickness, with 5mm intervals and a wide field of view, were obtained from the xiphoid process to the pubic symphysis. These scans were performed before and after administering oral contrast (10-20ml of water-soluble agent in 500-1000ml of distilled water) and IV non-ionic iodinated contrast at a dose of 1.5-2ml/kg, injected at a rate of 3-4ml/s. All images were evaluated using various soft tissue window settings.

1. The MDCTSI was established by summing the points given below and acute pancreatitis was then classified as:

   Mild grade : MCTSI score 0 to 2

   Moderate grade : MCTSI score 4 to 6

   Severe grade : MCTSI score 8 to 10

PROGNOSTIC INDICATORS		**POINTS**
Panc. Inflammation	Normal panc.	zero
	Structural panc. anomalies, with potential inflammatory manifestations or peripancreatic adipose tissue modifications	Two
	Fluid accumulations within or surrounding the pancreas, or fat necrosis in the peripancreatic region	Four
Panc. Necrosis	-	Zero
	Less than or equal to 30%	Two
	More than 30%	Four
Extra Pancreatic Complications	One or More of following: Ascites, PE, parenchymal complications, vasc. complications or gastrointestinal tract involvement.	Two

TABLE.6 MORTELE MODIFIED CT SEVERITY INDEX SCORING (2004) FOR ACUTE PANCREATITIS

Clinical Outcome Parameters:

1. Duration of hospitalizations measured in days
2. Necessity for admission to the Intensive Care Unit (ICU)
3. Requirement for invasive interventions, such as percutaneous aspiration & drainage, or debridement done surgically.
4. Manifestation of failure of organ system, defined by:

   a) Arterial oxygen pressure (PaO2) below 60 mm Hg or need for mechanical ventilation b) Systolic blood pressure lower than 90 mm Hg

   c) Serum creatinine exceeding 300 μmoles/L or urine output less than 500 mL over 24 hours
5. Mortality

STATISTICAL ANALYSIS

Data compilation and initial entry were performed using Microsoft Excel (Microsoft Office 10). Subsequent analysis were conducted using software of SPSS of 16th version (IBM SPSS Statistics, New York). The findings were presented through various pictorial diagrams.

To assess the independence of variables, the Pearson Chi-square test was employed, specifically evaluating the cross-tabulation of CTSI and MCTSI severity gradings. These categorical variables were taken as statistically significant if the p-value <\ to 0.05.

Comparative efficacy of the CT severity scoring systems in relation to patients' clinical outcomes was evaluated using the Area Under the Receiver Operating Characteristic curve (AUROC). This method provided a quantitative measure of the scoring systems' predictive accuracy.

OBSERVATION & RESULTS

TABLE 7 : DISTRIBUTION OF AGE IN STUDY POPULATION

AGE GROUPS	NO OF PATIENTS	% OF PATIENTS
<=29yrs	9	22.50
30-39yrs	16	40.00
>=40yrs	15	37.50
Total	40	100.00
Mean	39.45	
SD	13.69	

The mean age in our study was 39.4 years. Our study population comprised majorly patients of age group 30-39 years.

FIGURE 1: PIE CHART DEPICTING AGE DISTRIBUTION AMONG STUDY GROUP.

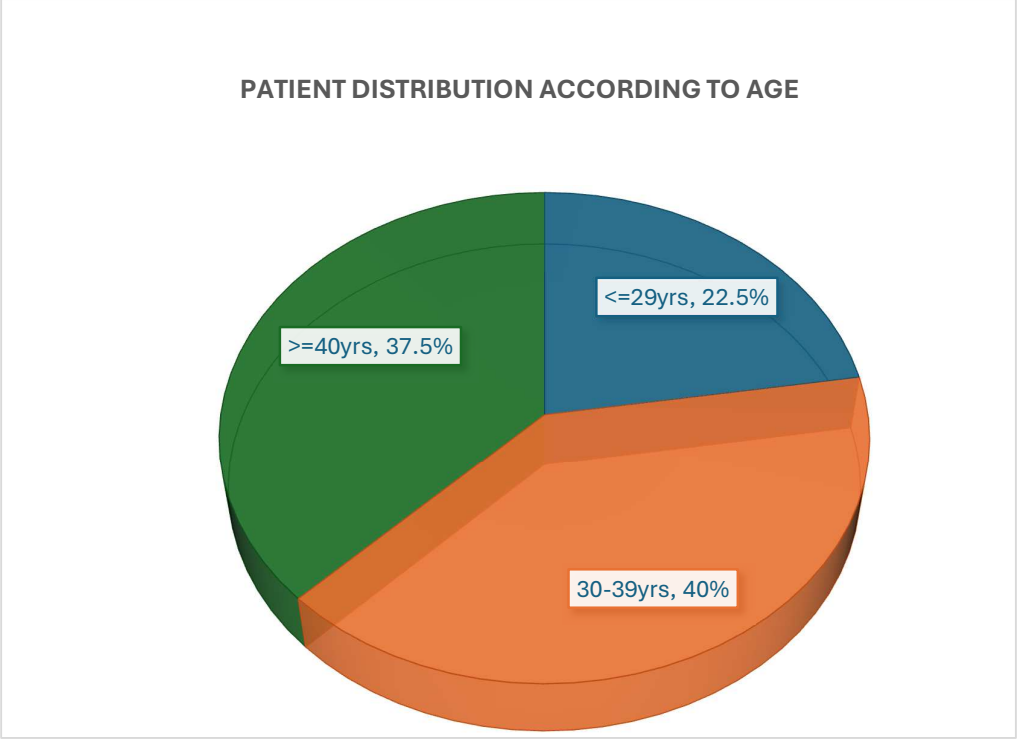


TABLE 8: DISTRIBUTION OF GENDER IN STUDY POPULATION

GENDER	NO. OF PATIENTS	% OF PATIENTS
M	37	92.50
F	3	7.50
Total	40	100.00

Our study comprised of 92.5% males(M) and 7.5% females (F)

FIGURE 2 : PIE CHART DEPICTING GENDER WISE DISTRIBUTION AMONG STUDY GROUP.

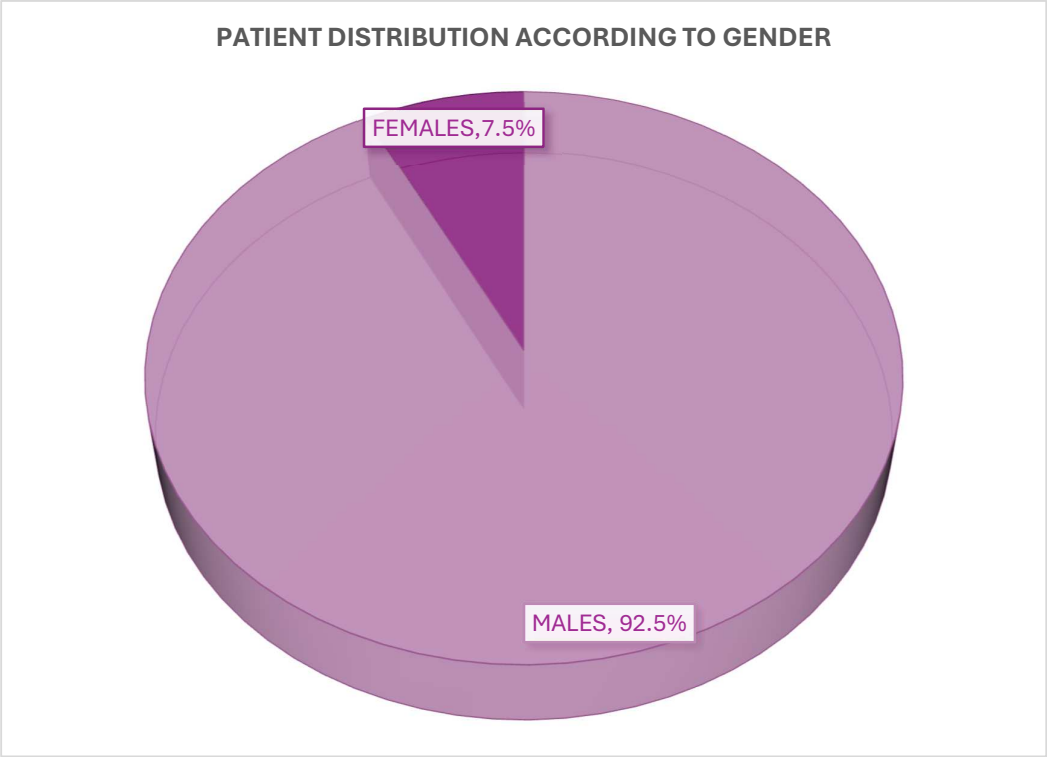


TABLE 9 : DISTRIBUTION OF AETIOLOGY IN STUDY POPULATION

AETIOLOGY	NO OF PATIENTS	% OF PATIENTS
Alcoholic	26	65.00
Cholelithiasis	6	15.00
Cholelithiasis, alcoholic	4	10.00
Others	4	10.00
Total	40	100.00

In our study population, the most common cause was found to be alcoholism (65%), followed by cholelithiasis. (15%).

FIGURE 3: PIE CHART DEPICTING AETIOLOGY WISE DISTRIBUTION AMONG STUDY GROUP

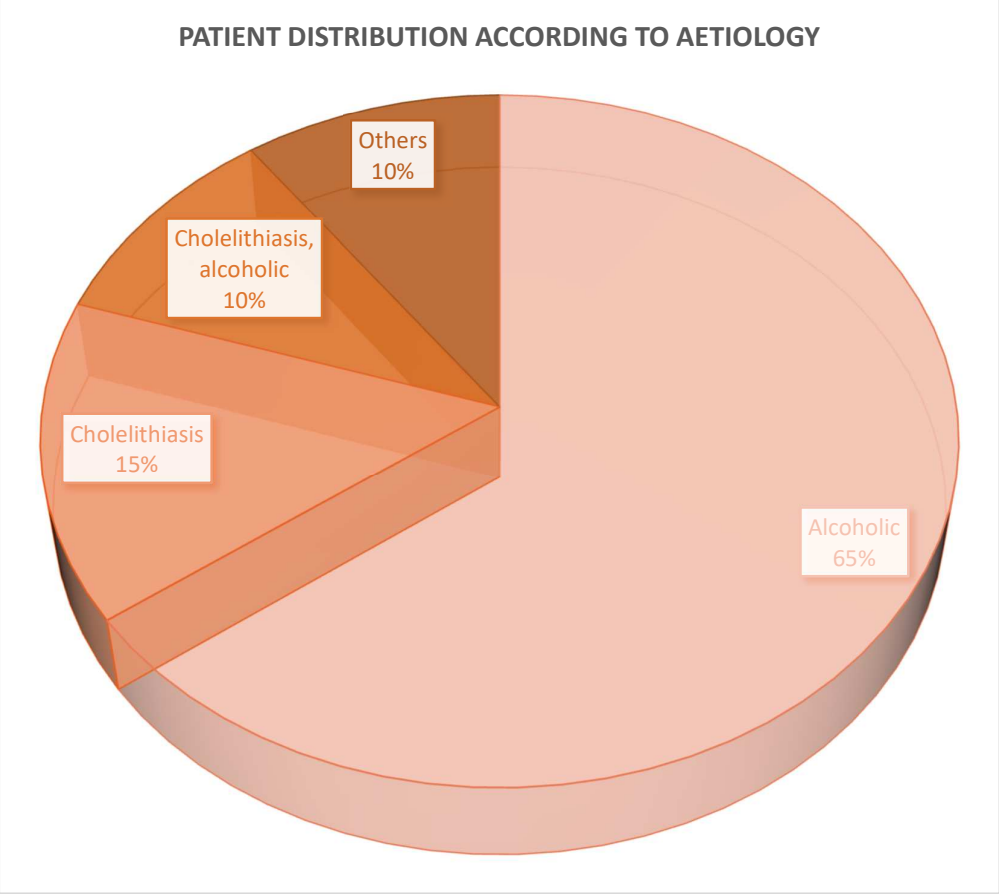


TABLE 10: DISTRIBUTION OF LEVELS OF SERUM AMYLASE IN STUDY POPULATION

SR. AMYLASE	NO OF PATIENTS	% OF PATIENTS
Normal	8	20.00
Raised	32	80.00
Total	40	100.00

In our study population, Sr. amylase was raised in 80% of patients.

FIGURE 4: BAR-GRAPH DEPICTING DISTRIBUTION OF LEVELS OF SERUM AMYLASE IN STUDY POPULATION

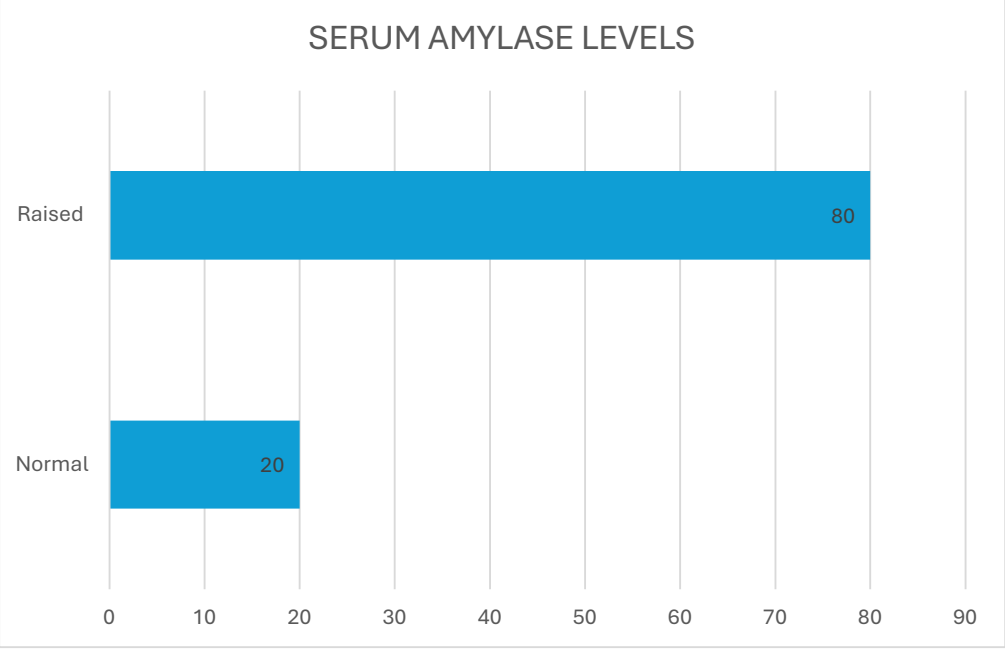


TABLE 11 : DISTRIBUTION OF LEVELS OF SERUM LIPASE IN STUDY POPULATION

SERUM LIPASE	NO OF PATIENTS	% OF PATIENTS
Normal	8	20.00
Raised	32	80.00
Total	40	100.00

In our study population, serum lipase was raised in 80% of patients.

FIGURE 5 : BAR-GRAPH DEPICTING DISTRIBUTION OF LEVELS OF SERUM LIPASE IN STUDY POPULATION

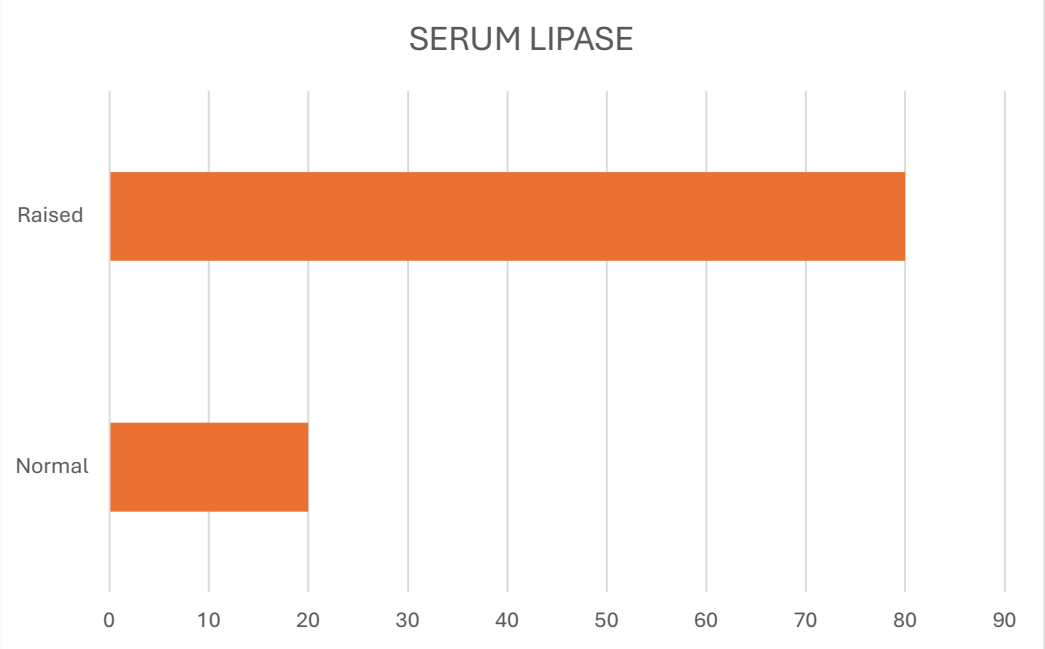


TABLE 12 : TABLE SHOWING DISTRIBUTION OF SYSTEMIC INFECTION (LEUCOCYTOSIS) AMONG STUDY POPULATION

LEUCOCYTOSIS	NO OF PTS	% OF PTS
Present	23	57.50
Absent	17	42.50
Total	40	100.00

In our study population, 57.5 % patients presented with leucocytosis.

FIGURE 6 : PIE CHART DEPICTING DISTRIBUTION OF SYSTEMIC INFECTION (LEUCOCYTOSIS) AMONG STUDY POPULATION

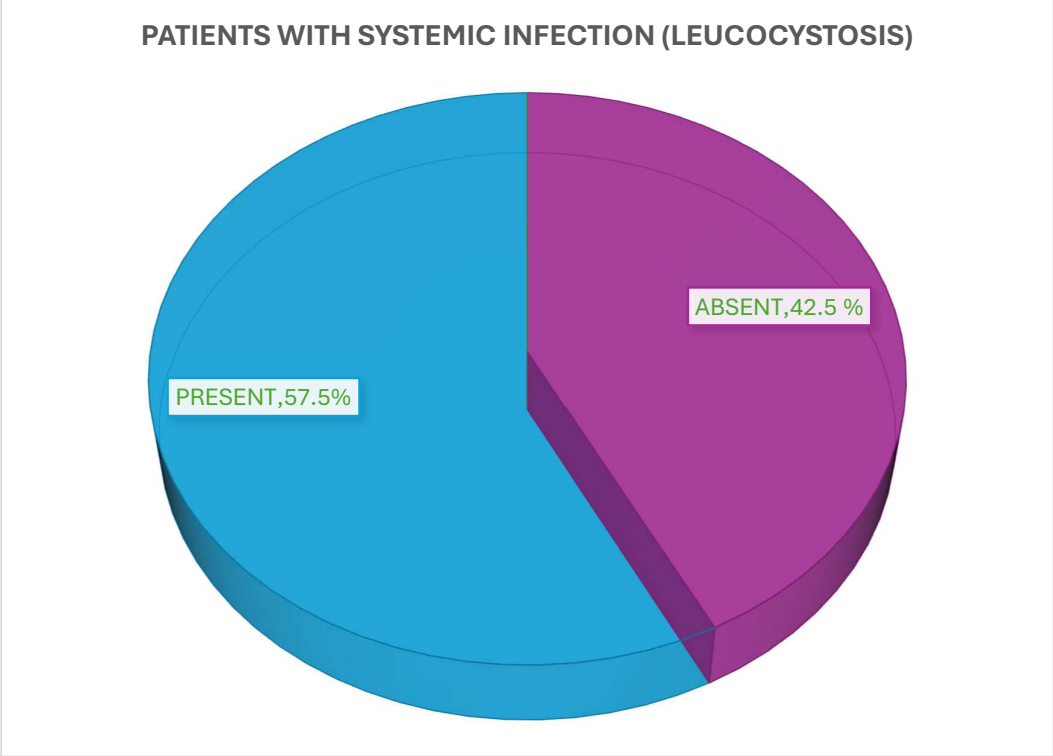


TABLE 13 : DISTRIBUTION OF PATIENTS ACCORDING TO EXTRA PANCREATIC COMPLICATIONS

EXTRA PANCREATIC COMPLICATIONS	NO OF PTS	% OF PTS
Pleural effusion	12	30.00
Pleural effusion, ascites	3	7.50
Portal vein thrombosis	1	2.50
Portal vein thrombosis, pleural effusion	1	2.50
Portal vein thrombosis, splenic vein thrombosis	1	2.50
Portal vein thrombosis, splenic vein thrombosis, pleural effusion	2	5.00
Portal vein, portosplenic confluence, splenic vein thrombosis, pleural effusion, bilateral renal infarct,	1	2.50
Portosplenic thrombosis, pleural effusion	1	2.50
Splenic vein thrombosis, pleural effusion	1	2.50
TOTAL :	23	57%

In our study, 23 (57%) out of 40 patients had extra-pancreatic complications, the most common extra pancreatic complication was found to be pleural effusion (52%) , followed by Ascites (13%). 23 of 40 cases had complications which were extra pancreatic.

FIGURE 7 : PIE CHART DEPICTING DISTRIBUTION OF PATIENTS ACCORDING TO EXTRA PANCREATIC COMPLICATIONS

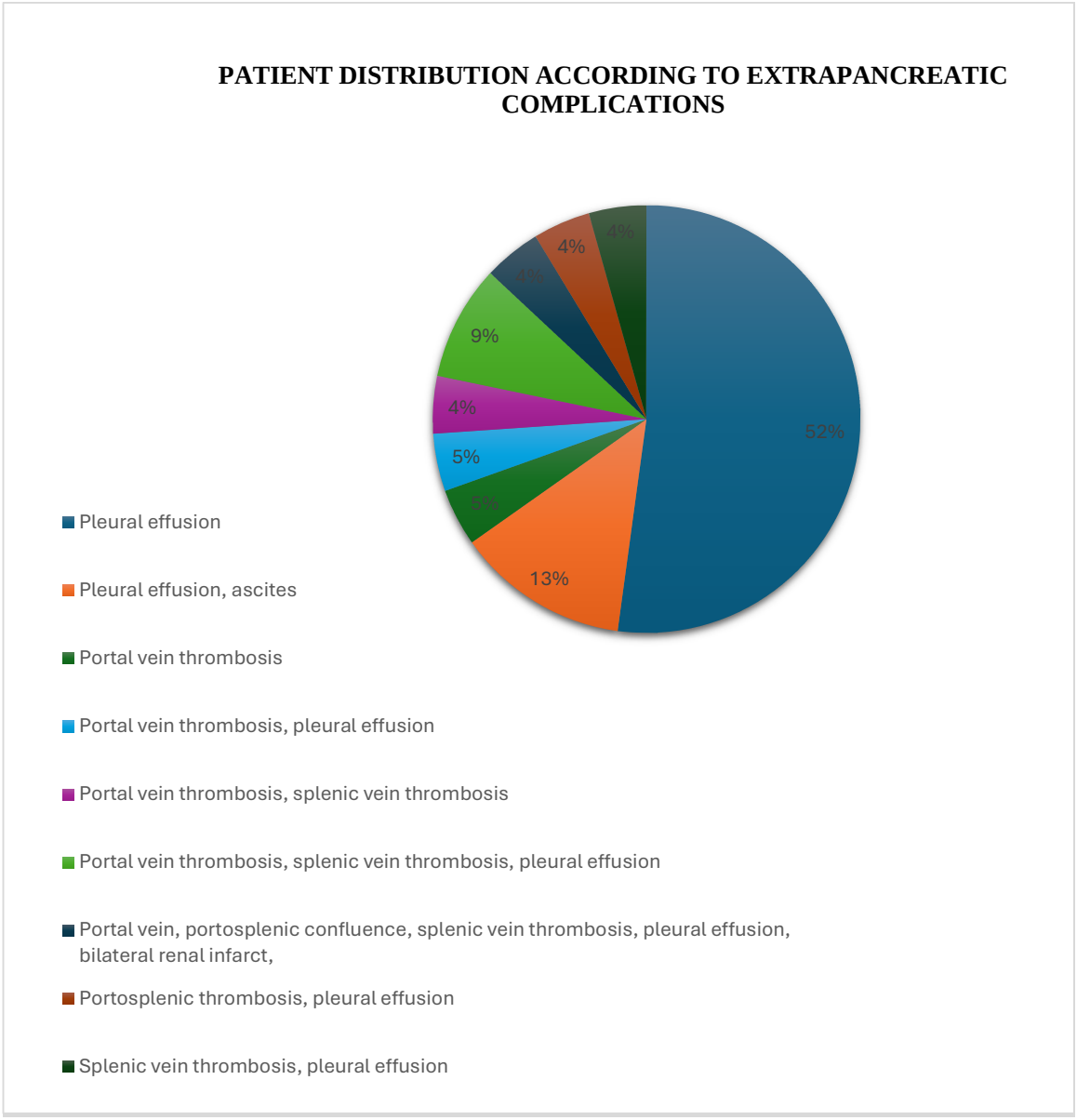


TABLE 14 : DISTRIBUTION OF PATIENTS ACCORDING TO MDCTSI GRADES

MDCTSI GRADE	NO OF PTS	% OF PTS
Mild	12	30.00
Moderate	16	40.00
Severe	12	30.00
Total	40	100.00

In our study population, majority of patients were graded as moderate (40%), followed by mild (30%) and severe (30%).

FIGURE 8 : PIE CHART DEPICTING DISTRIBUTION OF PATIENTS ACCORDING TO MDCTSI GRADES

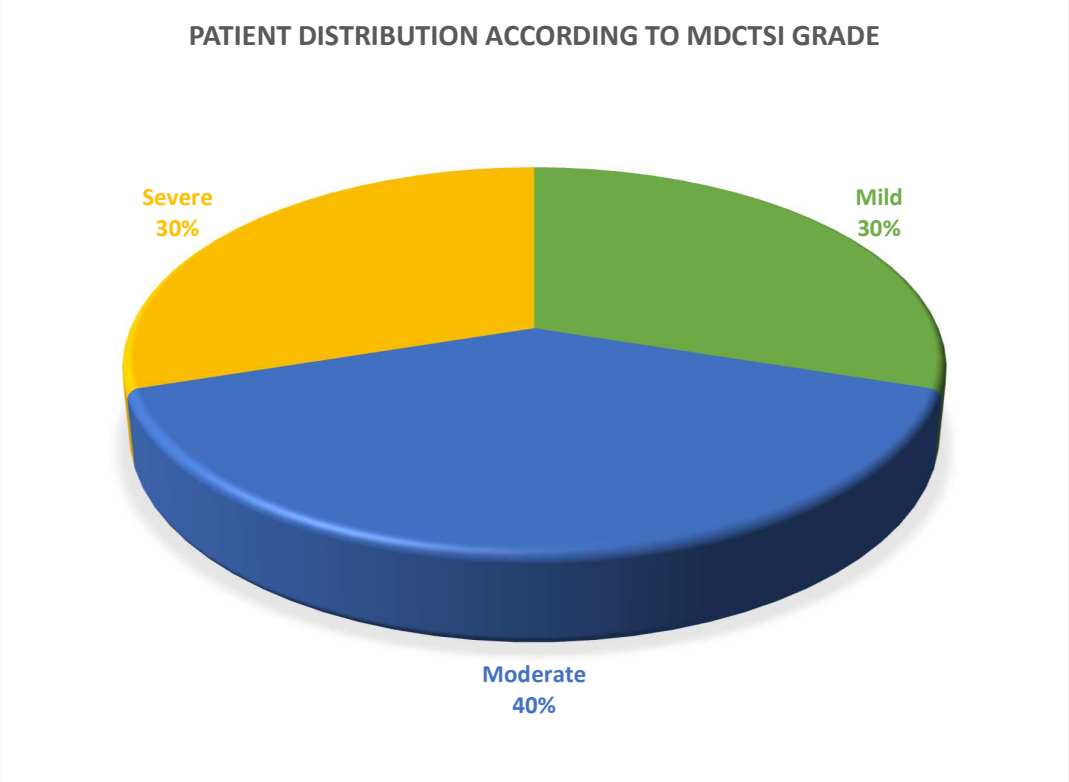


TABLE 15 : DISTRIBUTION OF PATIENTS ACCORDING TO NEED FOR ICU ADMISSION

ICU ADMISSION	NO OF PTS	% OF PTS
Present	20	50.00
Absent	20	50.00

In our study population, 50% of the patients required ICU admission.

FIGURE 9 : COLUMN-GRAPH DEPICTING DISTRIBUTION OF PATIENTS ACCORDING TO NEED FOR ICU ADMISSION

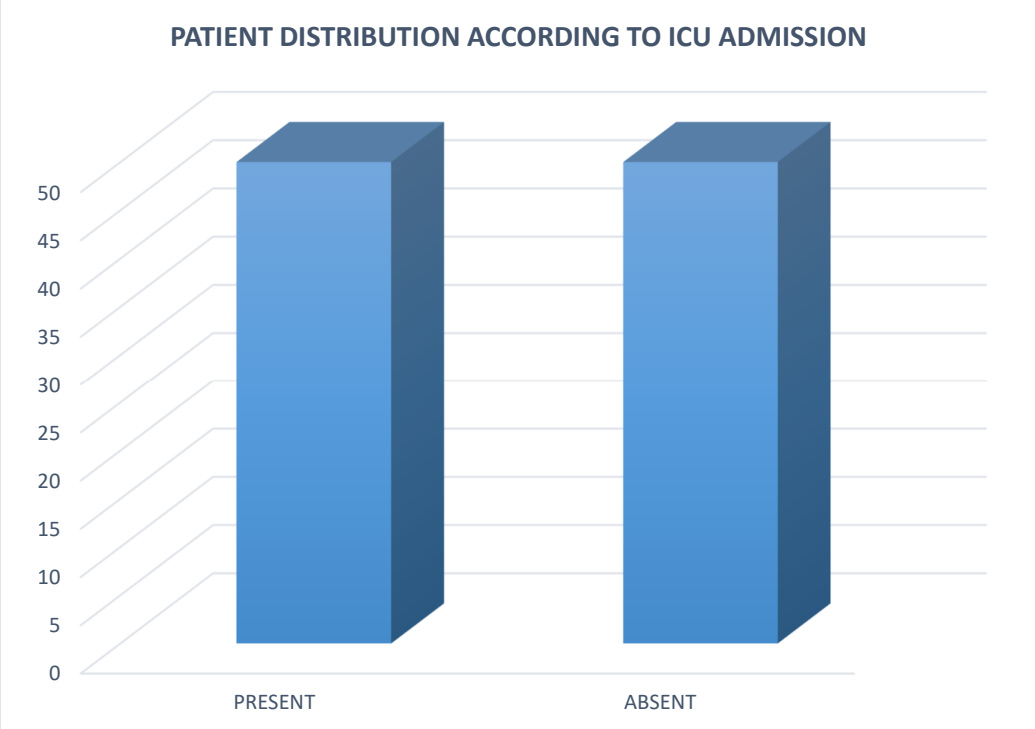


TABLE 16 : DISTRIBUTION OF PATIENTS ACCORDING TO NEED FOR INTERVENTION

INTERVENTION		NO OF PATIENTS	% OF PATIENTS
Present	USG guided aspiration of pseudocyst	4	10
	Surgical necrosectomy	5	12.5
Absent		31	77.50
Total		40	100

In our study population,9 (22.5%) of the patients required intervention, out of which 4 (10%) of the patients required intervention in the form of USG guided aspiration of pseudocyst whereas 5 (12.5%) of the patients required intervention in the form of surgical necrosectomy.

FIGURE 10 : PIE CHART DEPICTING DISTRIBUTION OF PATIENTS ACCORDING TO NEED FOR INTERVENTION

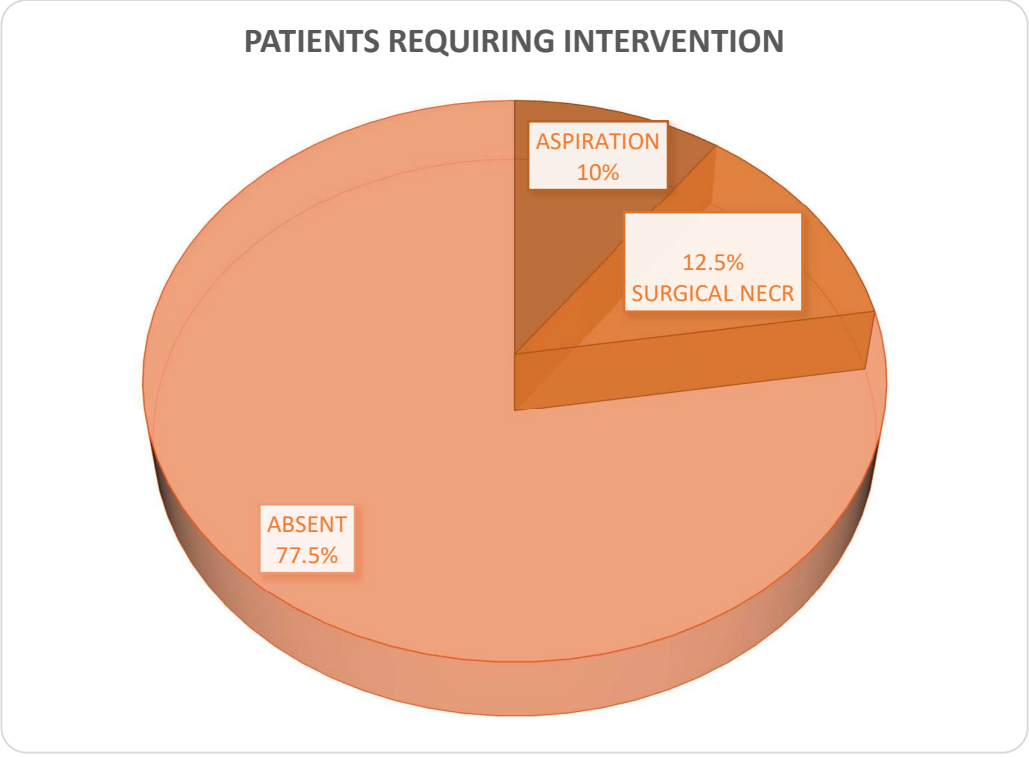


TABLE 17 : DISTRIBUTION OF PATIENTS ACCORDING TO PRESENCE/ ABSENCE OF ORGAN FAILURE

ORGAN FAILURE		NO OF PATIENTS	% OF PATIENTS
Present	Respiratory	11	27.5
	CVS	7	17.5
	Hepatic	9	22.5
	Haematological	-	-
	Renal	-	-
	CNS	-	-
Absent		27	67.50

In our study population, 13 (32.5%) of the patients had organ failure.

Out of the 13 patients who developed organ failure, 11 (27.5%) of these patients had respiratory failure i.e., those with Pao2 of less than 60 mm Hg or respiratory rate more than 30/ min or those in need for ventilatory support.

CVS failure was seen in 7 (17.5%) of the patients which was defined in the terms of systolic blood pressure less than 90 mm Hg.

Hepatic failure was seen in 9 (22.5%) of patients which was defined as Sr. bilirubin levels greater than 3 mg/dL (100 micro mol/ L)

Haematological failure was defined in terms of patients with haematocrit level of more than 50 % or WBC less than 2,000 /mm^3 or platelet count of less than 40,000 / mm^3.

Renal failure was defined in terms of patients with Sr. creatinine levels increase to ≥1.5 times baseline within 7 days or urine output of less than 500 ml/ 24hrs or by the need of peritoneal dialysis.

Central nervous system failure was defined as patient with Glasgow coma score of less than 6.

FIGURE 11: PIE CHART DEPICTING DISTRIBUTION OF PATIENTS ACCORDING TO PRESENCE/ ABSENCE OF ORGAN FAILURE

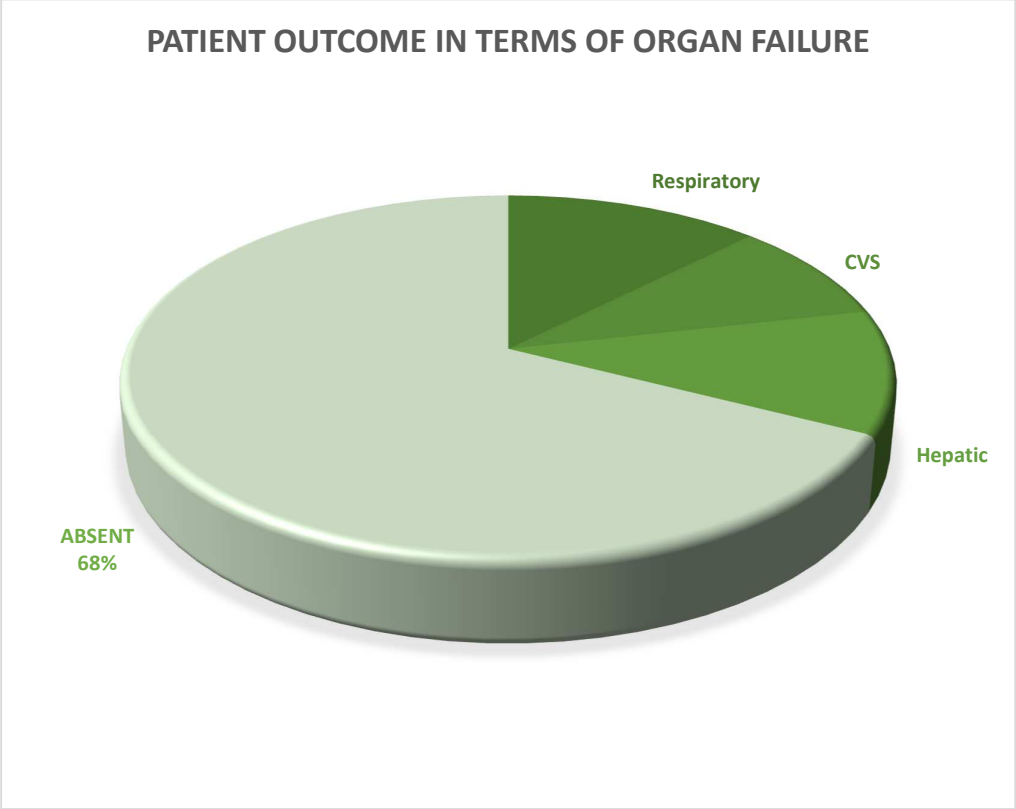


TABLE 18 : TABLE OF ASSOCIATION BETWEEN AGE AND MDCTSI GRADES

Age groups	MDCTSI grades								χ^2	p-value
	Mild	%	Moderate	%	Severe	%	Total	%		
<=29yrs	1	11.11	3	33.33	5	55.56	9	22.50	4.2720	0.3700
30-39yrs	6	37.50	7	43.75	3	18.75	16	40.00		
>=40yrs	5	33.33	6	40.00	4	26.67	15	37.50		
Total	12	30.00	16	40.00	12	30.00	40	100.0		

There was no significant association of age with the grade of MDCTSI (p value – 0.3700)

FIGURE 12 : CLUSTERED BAR GRAPH DEPICTING ASSOCIATION BETWEEN AGE AND MDCTSI GRADES

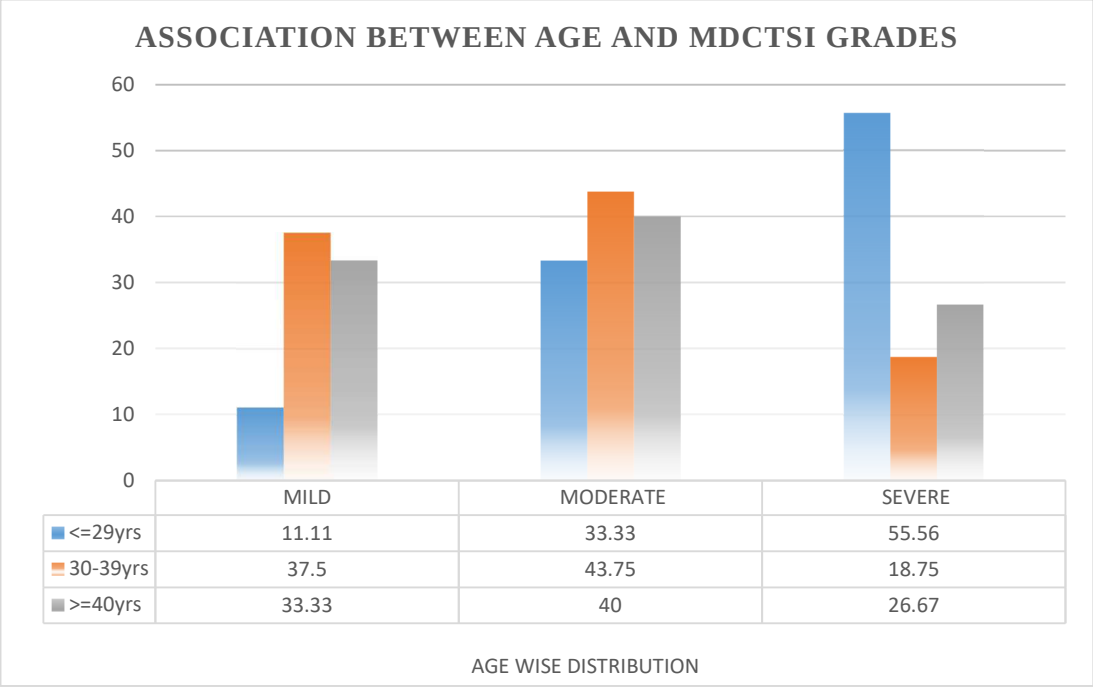


TABLE 19 : TABLE OF ASSOCIATION BETWEEN GENDER AND MDCTSI GRADES

Gender	MDCTSI grades								χ^2	p-value
	Mild	%	Moderate	%	Severe	%	Total	%		
Male	9	24.32	16	43.24	12	32.43	37	92.50	7.5680	0.0230*
Female	3	100.0	0	0.00	0	0.00	3	7.50		
Total	12	30.00	16	40.00	12	30.00	40	100.0		

*p<0.05

There was significant association of gender with the grade of MDCTSI (p value – 0.0230)

FIGURE 13 : CLUSTERED BAR GRAPH DEPICTING ASSOCIATION BETWEEN GENDER AND MDCTSI GRADES

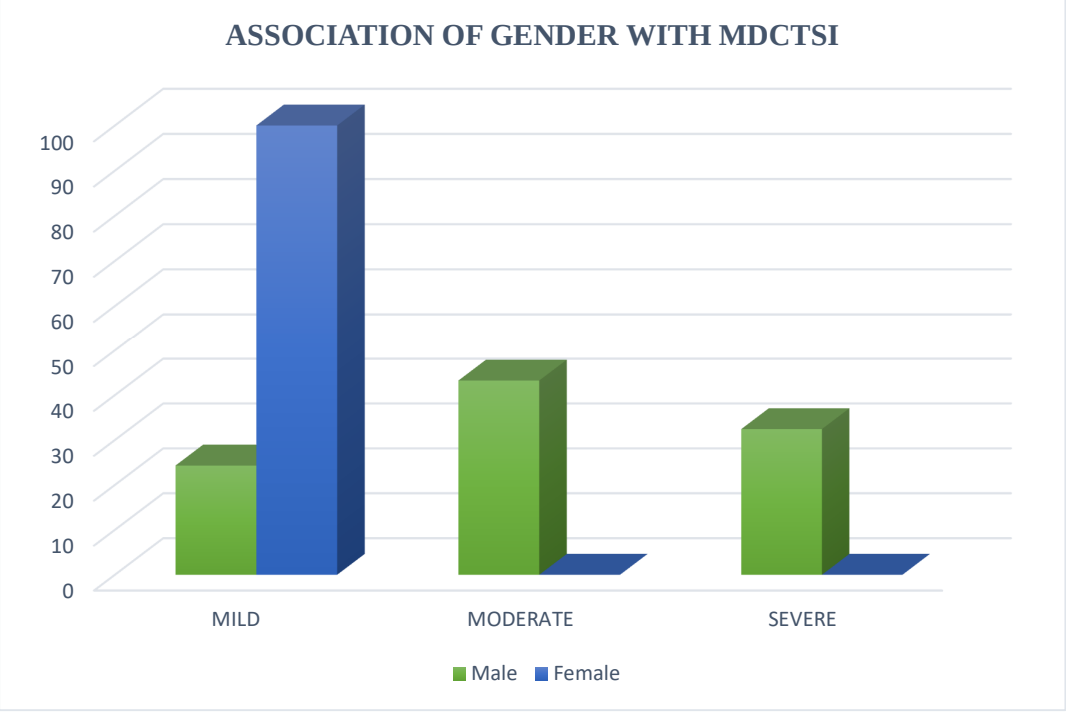


TABLE 20 : TABLE OF ASSOCIATION BETWEEN AETIOLOGY AND MDCTSI GRADES

Etiology	MDCTSI grades								χ^2	p-value
	Mild	%	Moderate	%	Severe	%	Total	%		
Alcoholic	5	19.23	11	42.31	10	38.46	26	65.00	7.5210	0.2750
Cholelithiasis	4	66.67	1	16.67	1	16.67	6	15.00		
Both	1	25.00	2	50.00	1	25.00	4	10.00		
Others	2	50.00	2	50.00	0	0.00	4	10.00		
Total	12	30.00	16	40.00	12	30.00	40	100.0		

In our study there was no significant correlation between the MCTSI severity grading and the aetiology of acute pancreatitis in our study.

FIGURE 14 : CLUSTERED BAR GRAPH DEPICTING ASSOCIATION BETWEEN AETIOLOGY AND MDCTSI GRADES

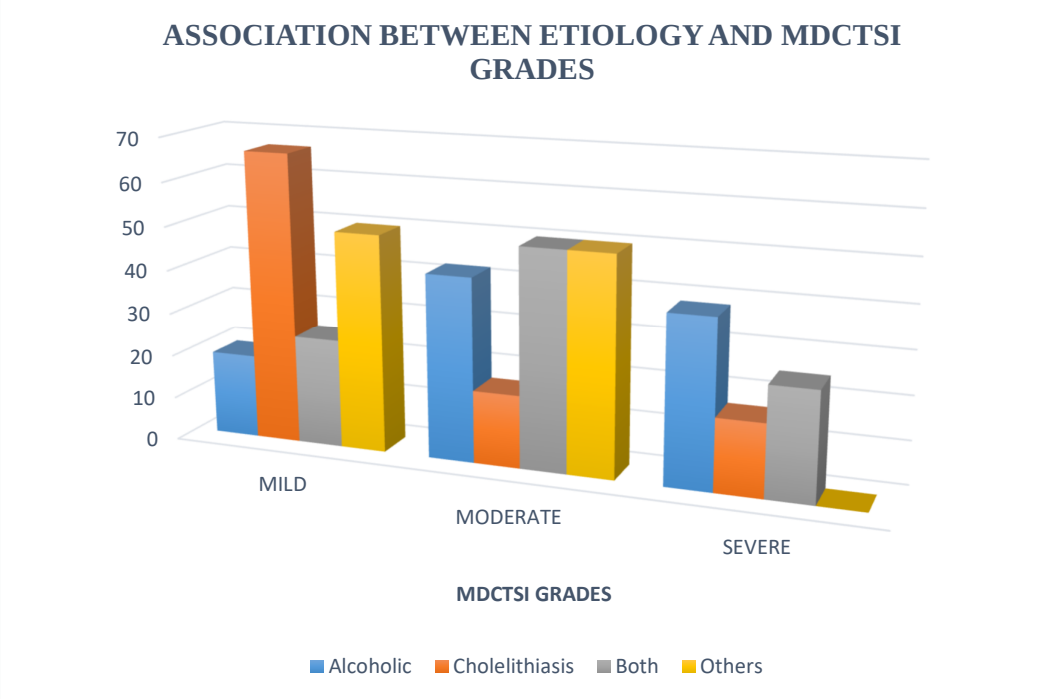


TABLE 21 : TABLE OF ASSOCIATION OF MDCTSI GRADES WITH DURATION OF HOSPITAL STAY

MDCTSI grades	N	Min	Max	Mean	SD	SE	95% CI for mean	
							Lower	Upper
Mild	12	4.00	8.00	6.08	1.08	0.31	5.39	6.77
Moderate	16	6.00	13.00	8.94	2.21	0.55	7.76	10.11
Severe	12	8.00	17.00	12.00	3.46	1.00	9.80	14.20
Total	40	4.00	17.00	9.00	3.31	0.52	7.94	10.06
H-value	17.8454							
p-value	0.0001*							
Pair wise comparisons by Tukeys multipleposthoc procedures								
Mild vs Moderate	P=0.0107*							
Mild vs Severe	P=0.0001*							
Moderate vs Severe	P=0.0060*							

*p<0.05

Our study revealed a noteworthy correlation between the severity classifications derived from the MCTSI and the length of time patients remained under inpatient care. Specifically, higher MCTSI grades were found to correspond with extended periods of hospitalization, indicating that this imaging-based assessment tool may serve as a valuable predictor of resource utilization and recovery trajectories in clinical settings. This finding underscores the potential utility of the MCTSI in guiding treatment planning and resource allocation for patients presenting with acute pancreatic inflammation.

FIGURE 15 : COMBINATION CHART (BAR AND LINE CHART) DEPICTING ASSOCIATION OF MDCTSI GRADES WITH DURATION OF HOSPITAL STAY

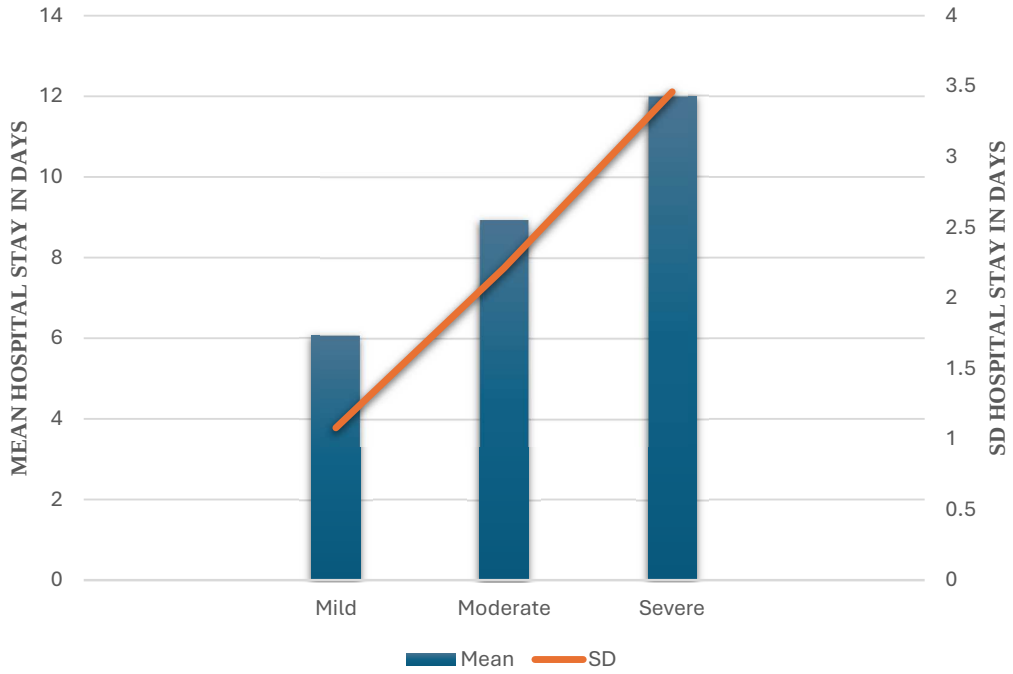


TABLE 22: TABLE OF ASSOCIATION OF MDCTSI GRADES WITH ICU ADMISSION

ICU admission	MDCTSI grades								χ^2	p-value
	Mild	%	Moderate	%	Severe	%	Total	%		
No	12	60.00	8	40.00	0	0.00	20	50.00	24.000	0.0001*
Yes	0	0.00	8	40.00	12	60.00	20	50.00		
Total	12	30.00	16	40.00	12	30.00	40	100.0		

*p<0.05

Our study revealed a noteworthy correlation between the severity classifications derived from the MCTSI and the patients requiring ICU admissions (p-0.0001)

FIGURE 16: COLUMN GRAPH DEPICTING ASSOCIATION OF MDCTSI GRADES WITH ICU ADMISSION

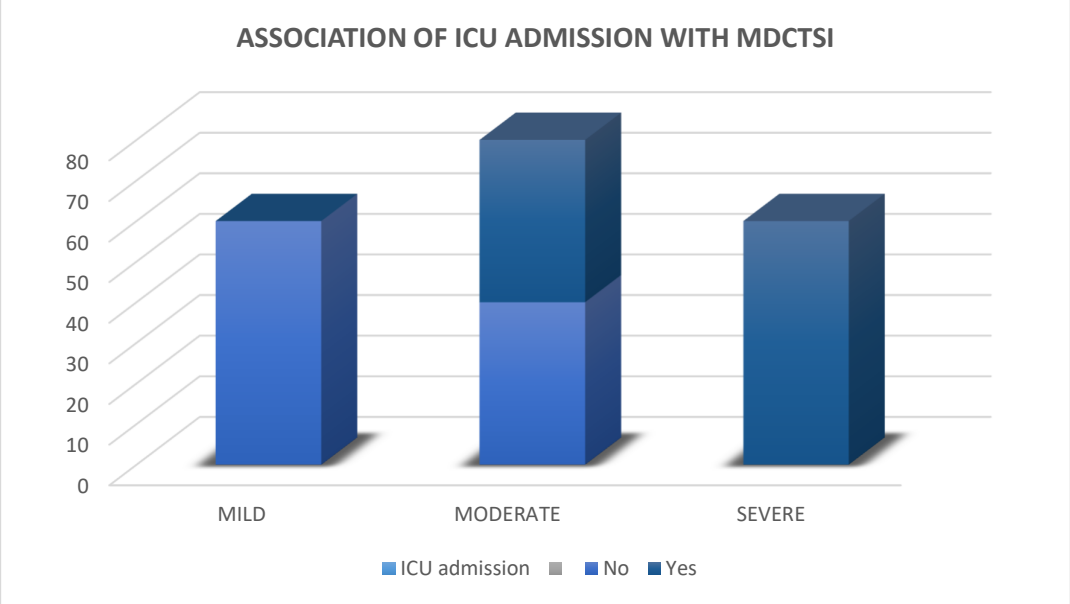


TABLE 23 : TABLE OF ASSOCIATION OF MDCTSI GRADES WITH NEED FOR ANTIBIOTICS

Antibiotics	MDCTSI grades								χ^2	p-value
	Mild	%	Moderate	%	Severe	%	Total	%		
No	12	60.00	8	40.00	0	0.00	20	50.00	24.000	0.0001*
Yes	0	0.00	8	40.00	12	60.00	20	50.00		
Total	12	30.00	16	40.00	12	30.00	40	100.0		

*p<0.05

Our study revealed a noteworthy correlation between the severity classifications derived from the MCTSI and the patients requiring antibiotic administration (p-0.0001)

FIGURE 17: COLUMN GRAPH DEPICTING ASSOCIATION OF MDCTSI GRADES WITH ANTIBIOTIC ADMINISTRATION

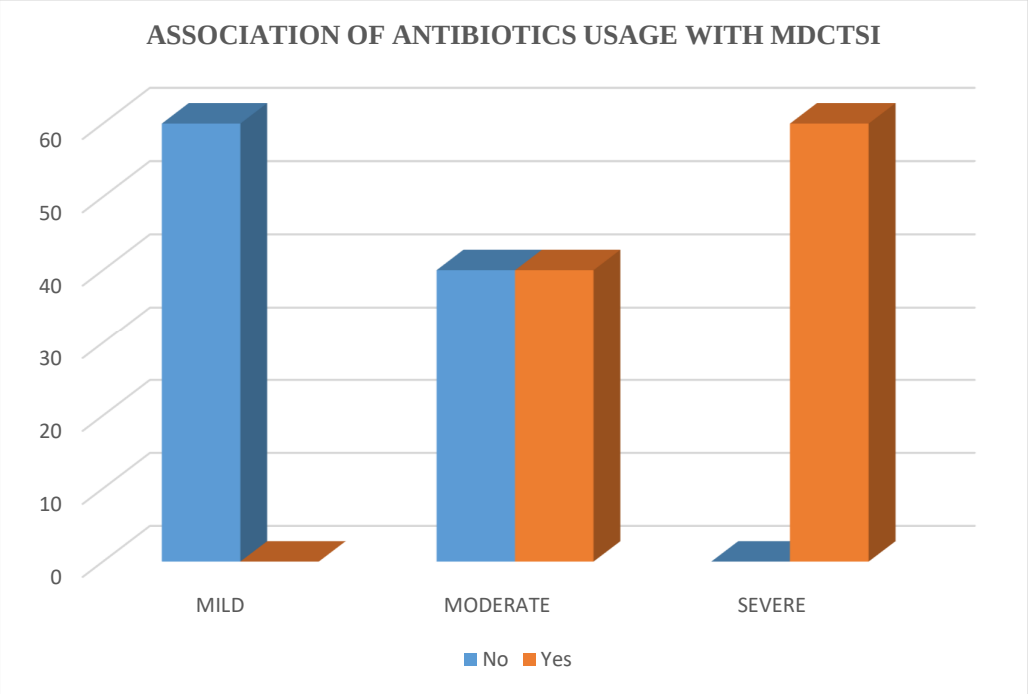


TABLE 24: TABLE OF ASSOCIATION OF MDCTSI GRADES WITH NEED FOR INTERVENTION

Intervention	MDCTSI grades								χ^2	p-value
	Mild	%	Moderate	%	Severe	%	Total	%		
No	12	38.71	15	48.39	4	12.90	31	77.50	20.141	0.0001*
Surgical necrosectomy	0	0.00	0	0.00	5	100.0	5	12.50		
Usg guided aspiration of psuedocyst	0	0.00	1	25.00	3	75.00	4	10.00		
Total	12	30.00	16	40.00	12	30.00	40	100.0		

*p<0.05

Our study revealed a noteworthy correlation between the severity classifications derived from the MCTSI and the patients with need for intervention (p-0.0001)

FIGURE 18: COLUMN GRAPH DEPICTING ASSOCIATION OF MDCTSI GRADES WITH NEED FOR INTERVENTION

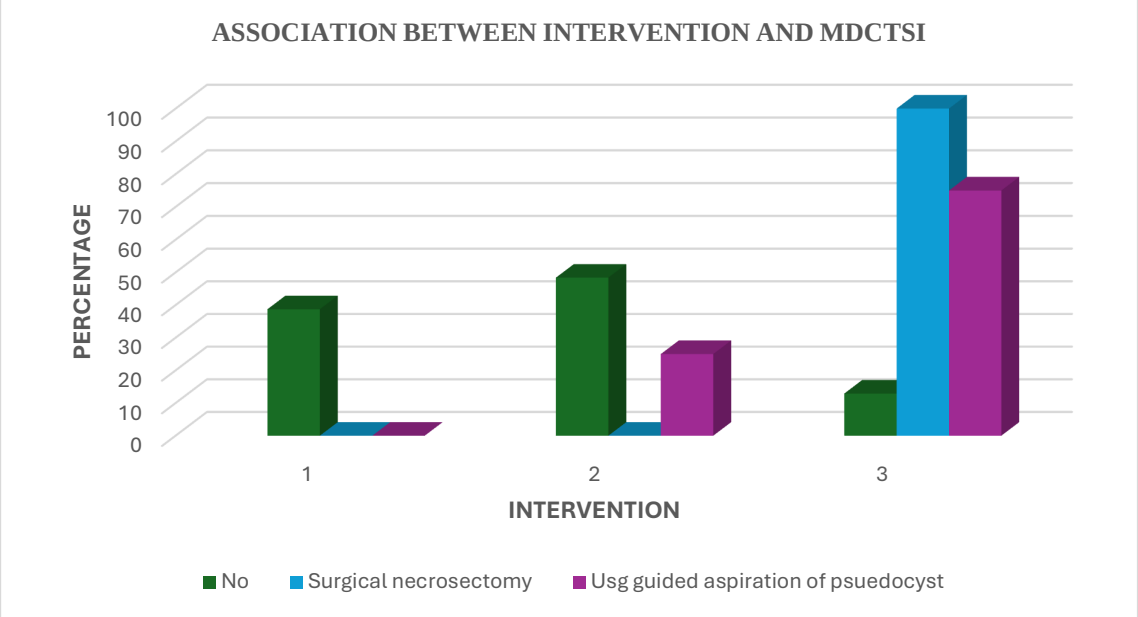


TABLE 25 : TABLE OF ASSOCIATION OF MDCTSI GRADES WITH ORGAN FAILURE

Organ failure	MDCTSI grades								χ^2	p-value
	Mild	%	Moderate	%	Severe	%	Total	%		
No	12	44.44	12	44.44	3	11.11	27	67.50	16.068	0.0001*
Yes	0	0.00	4	30.77	9	69.23	13	32.50		
Total	12	30.00	16	40.00	12	30.00	40	100.0		

*p<0.05

Our study revealed a noteworthy correlation between the severity classifications derived from the MCTSI and the patients with organ failure (p-0.0001)

FIGURE 19: COLUMN GRAPH DEPICTING ASSOCIATION OF MDCTSI GRADES WITH ORGAN FAILURE

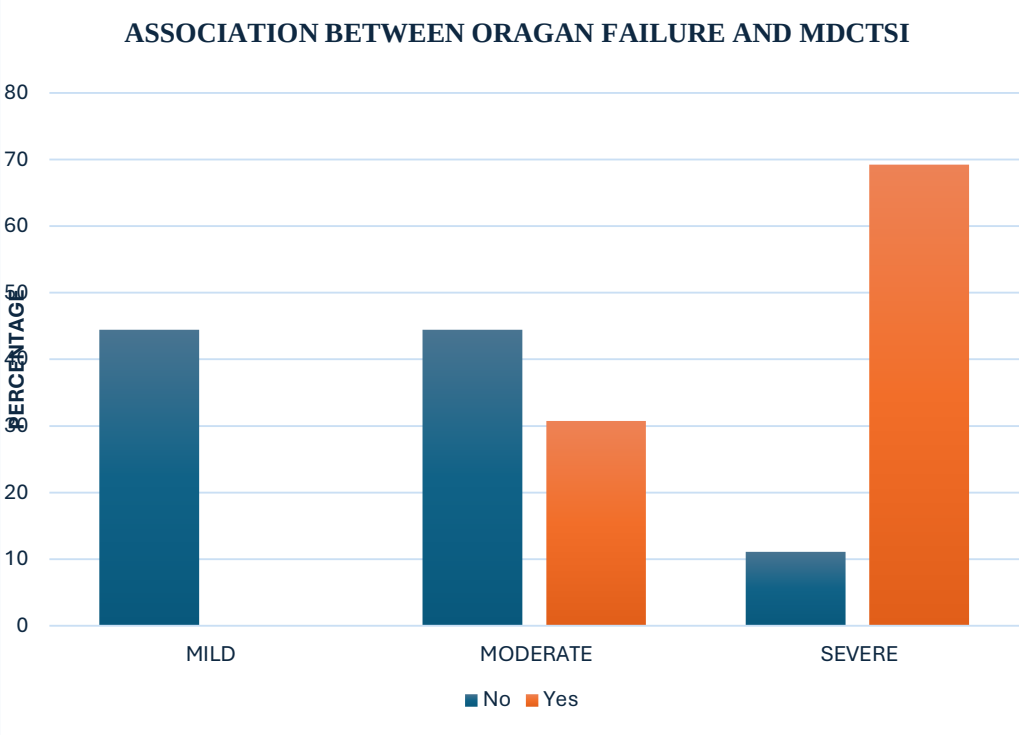
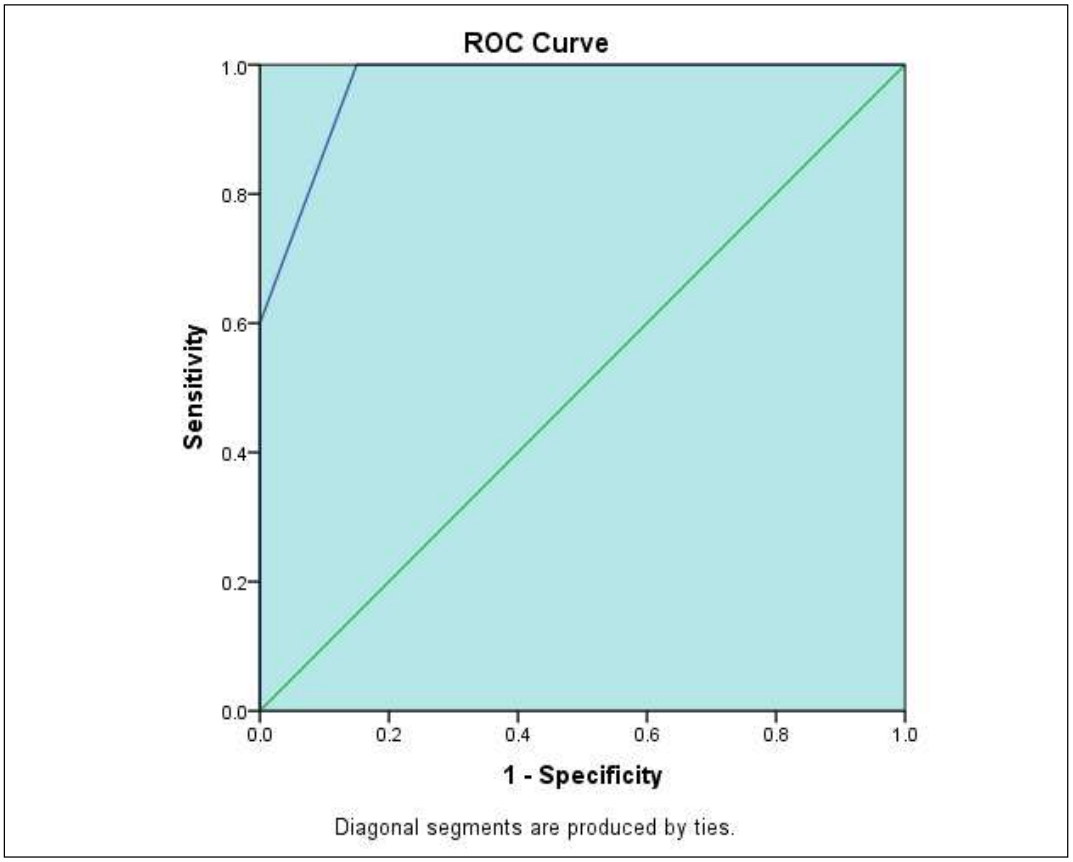


TABLE 26: ROC CURVE IN PREDICTION OF ICU ADMISSION BY MDCTSI

Area	Std. Error	p-value	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.9700	0.0230	0.0001*	0.9260	1.0000

*p<0.05

FIGURE 20: PREDICTING THE ICU ADMISSION BY MDCTIS USING ROC CURVE



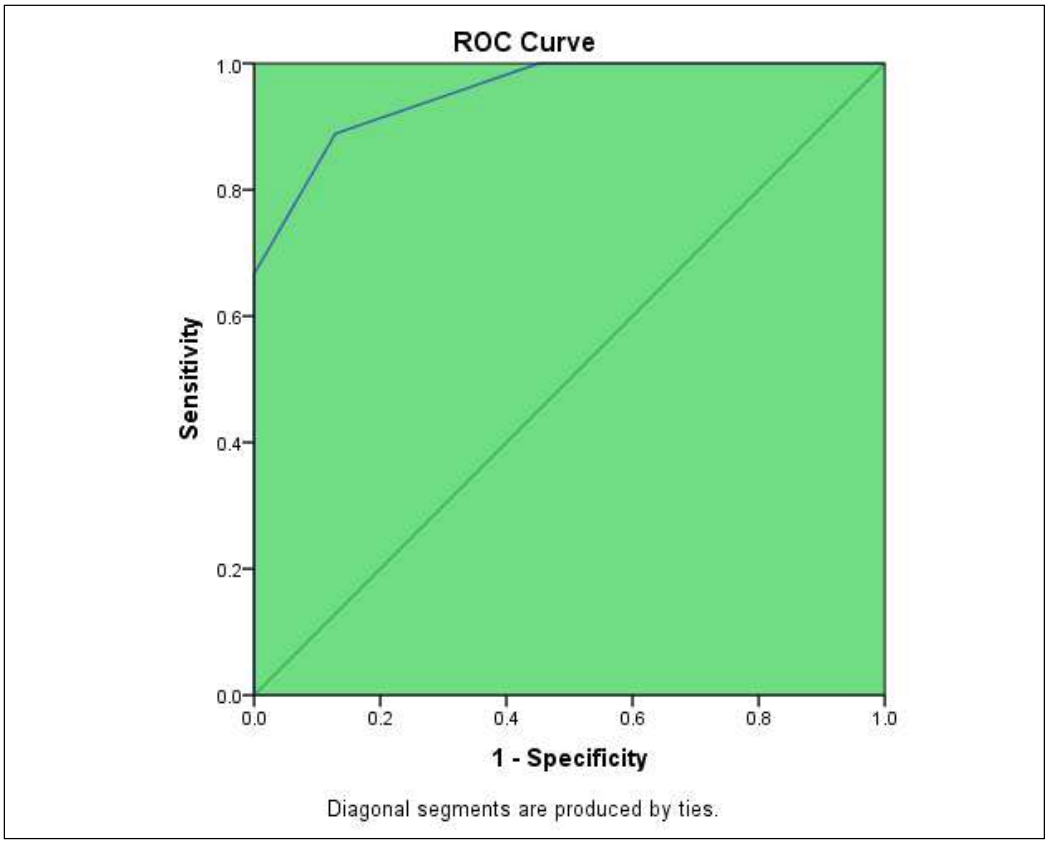
The curve reaches high sensitivity (close to 1.0) while maintaining a relatively high specificity (low false positive rate). Area under the curve is significantly large (0.9700).

TABLE 27: ROC CURVE IN PREDICTION OF INTERVENTION BY MDCTSI

Area	Std. Error	p-value	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.9530	0.0370	0.0001*	0.8820	1.0000

*p<0.05

FIGURE 21: PREDICTING THE NEED FOR INTERVENTION BY MDCTIS USING ROC CURVE



The area under the ROC curve (AUC) is very large, 0.9530

The curve reaches a sensitivity (true positive rate) of nearly 1.0 while maintaining a relatively low false positive rate (1 - specificity)

DISCUSSION

Acute pancreatitis is a medical condition characterized by sudden inflammation of the pancreas, leading to abdominal pain and increased levels of pancreatic enzymes. While the condition is typically mild and can be treated with supportive care in most instances, about 10% to 20% of cases become severe. Multiple clinical scoring systems exist to assess the severity of acute pancreatitis however, a single clinical scoring system is unable to evaluate outcome of patients clinically with statistical significance. At this point, severity scoring systems based on Computed Tomography are considered.

This was a cross sectional study conducted from January 2023 to December 2023 in KLE's Dr. Prabhakar Kore Hospital and research institute, Belagavi. A total of 40 patients identified as acute pancreatitis on the basis of clinical features or lab investigations or ultrasound were included in this study. CECT abdomen and pelvis was done for these patients and graded according to the MDCSTI. The grades were correlated with outcome of patient in terms of systemic complications leading to end-organ failure, local complications, duration of hospital stay and need of an ICU facility.

Our study investigated the utility of the modified computed tomography severity index (MDCTSI) in predicting clinical outcomes and complications in patients with acute pancreatitis. Our findings demonstrate that MDCTSI grading correlates well with the development of systemic complications such as organ failure and infections in acute pancreatitis patients.

CHARACTERISTICS OF OUR STUDY POPULATION:

AGE DISTRIBUTION:

The research cohort exhibited a mean participant age of 39.4 years. The most frequently represented demographic comprised individuals in their fourth decade of life, accounting for two-fifths of the total sample. This age distribution aligns with the predominant underlying causes observed, specifically excessive alcohol consumption and gallstone formation, which typically manifest during this life stage. The prevalence of these etiological factors in this particular age range offers insight into the demographic patterns associated with the condition under investigation.

GENDER DISTRIBUTION:

Our investigation revealed a substantial gender disparity among participants, with males constituting the vast majority at over nine-tenths (92.5%)of the sample, while females represented less than one-tenth(7.5%).

These findings echo the demographic trends observed in a larger-scale investigation by Lankish [31], which examined over 602 individuals with sudden-onset pancreatic inflammation. Their research elucidated connections between patient age, sex, and the intensity of the condition. Notably, both studies identified the highest occurrence rates among individuals aged 31 to 40, suggesting a consistent pattern in the demographic profile of those affected by this acute digestive disorder.

ETIOLOGY:

The most common cause in our study turned out to be chronic alcohol abuse constituting 65%, followed by cholelithiasis which constitutes 10% of the cases.

These observations are similar to studies by Dugernier et all [32] Freeny et al [33] : These studies observed similar results, which seem to suggest that they found chronic alcohol abuse(60%) as etiological agent or cause to be predominant for the condition under investigation.

In contrary, Study by Bollen et al [24] : This study showed that biliary stones (gallstones) (34%) were the predominant etiological agent for the condition being studied as compared to alcohol abuse (22%).

Study by Jauregui et al [34] : Similar to the study by Bollen et al [24] , this study also found biliary stones (53%) to be the predominant etiological agent for the condition under investigation.

LAB INVESTIGATIONS:

Diagnostic tests revealed elevated pancreatic enzyme levels in approximately four-fifths (80%) of the participants, underscoring the importance of these markers in identifying acute pancreatic inflammation.

The study also examined the occurrence of systemic infections, a known complication of this condition. Nearly three-fifths of the cohort exhibited signs of widespread infection, manifesting as an abnormal increase in white blood cell count. Among those affected, less than one-fifth had mild pancreatic involvement, while about one-third presented with moderate severity, and nearly half experienced severe inflammation, as categorized by the modified computed tomography severity index (MCTSI). Notably, systemic infections were observed in half of the participants with

moderate pancreatic inflammation and in more than nine-tenths of those with severe cases, indicating a potential correlation between disease severity and infection risk.

EXTRA-PANCREATIC COMPLICATIONS:

Extra-pancreatic complications like pleural effusion, vascular complications like portal vein thrombosis, porto-splenic confluence thrombosis, splenic vein thrombosis, parenchymal complications like renal infarct was observed in our study.

Out of the 40 patients included in our study, 23 of the patients presented with pleural effusion comprising of 57% of the study population. The extra-pancreatic complications were observed more in patients with severe and moderate grade of pancreatitis.

MDCTSI GRADING:

The CT of the patients were given a score from 0-10 which were classified into mild (score of 2), moderate (ranging from score of 4 to 6) and severe (ranging from score of 8 to 10)

Out of the 40 patients included in our study, majority of the patients were graded as moderate (40%) followed by mild (30%) and severe (30%) grades.

Studies conducted by Bollen et al[24] as well as Mortele et al. [19] employed analogous classification schemes to our research. In the study by Bollen et al., they categorized pancreatic inflammation severity into three tiers: approximately two-fifths of cases were deemed mild, slightly more than one-third were classified as moderate, and less than one-fifth were considered severe. This distribution diverges from our findings, which revealed a lower proportion of mild cases. The discrepancy may be

attributed to the selective application of advanced imaging techniques in our study. Specifically, computed tomography with contrast enhancement is typically reserved for instances where the diagnosis remains ambiguous or when complications are suspected, rather than being routinely used in milder presentations of the condition. This practice likely resulted in an underrepresentation of less severe cases in our imaging-based analysis.

CLINICAL OUTCOME OF THE PATIENTS:

The majority of patients required hospitalization periods ranging from 4 to 17 days. On average, those with mild pancreatitis stayed for 6 days, while moderate cases necessitated 8 days, and severe cases extended to 12 days.

A robust statistical correlation (p value – 0.0001) was observed between the patient's MDCTSI classification and the overall time duration of inpatient care.

Research conducted by Mortele [19] published in 2004, demonstrated a significant correlation between the MDCTSI severity grade & the length of hospitalization. Their findings indicated average stays of 3 days for mild cases, 8 days for moderate cases, and 12 days for severe instances of pancreatitis. The discrepancies in hospital stay durations between these two studies may be attributed to variations in institutional management protocols, individual physician preferences, and evolving standards in acute pancreatitis care.

ICU ADMISSION:

In our study involving 40 patients, 20 patients (50%) required admission to the intensive care unit (ICU). We observed a significant association (p-value = 0.0001)

between the need for ICU admission and the modified CT severity index (MDCTSI) grade of the patients.

Among the 20 patients who needed ICU admission, 12 (60%) were graded as having severe acute pancreatitis, while 8 (40%) were graded as having moderate acute pancreatitis according to the MDCTSI. Interestingly, all patients graded as having severe pancreatitis (100%) required ICU admission. However, among the 16 patients graded as having moderate pancreatitis, only 8 (50%) needed to be admitted to the ICU.

In summary, our study found a strong correlation between the severity of acute pancreatitis, as determined by the MDCTSI grading, and the requirement for ICU admission. While all patients with severe pancreatitis necessitated ICU care, only half of the patients with moderate pancreatitis required admission to the ICU.

NEED FOR INTERVENTION:

Our study included interventions such as surgical debridement, aspiration, or drainage of pseudocysts as part of our observations. Out of the total study population of 40 patients, 9 patients (22.5%) required an intervention. Among these 9 patients, 5 underwent surgical debridement, while 4 required aspiration of pseudocysts.

Notably, 8 out of the 9 patients (88%) who needed an intervention were graded as having severe acute pancreatitis according to the MDCTSI, while only 1 patient (12%) was graded as having moderate pancreatitis.

We found a significant association (p-value = 0.0001) between the need for an intervention and the MDCTSI grades. Specifically, 66% of the patients graded as

having severe pancreatitis required an intervention, whereas only 6% of the patients with moderate pancreatitis needed an intervention.

Our findings are consistent with the study by Bollen et al. [24] , which demonstrated a significant association between the development of local complications, the need for intervention, and the grade of pancreatitis according to the MDCTSI grading system.

In summary, our study revealed that those cases with severe acute pancreatitis, as determined by the MDCTSI, were more likely to require interventions such as surgical debridement or pseudocyst aspiration compared to those with moderate pancreatitis. This aligns with previous research highlighting the correlation between pancreatitis severity and the necessity for interventional treatment.

END ORGAN FAILURE :

In our study, organ dysfunction was defined using a modified scoring system, considering respiratory, renal, and cardiovascular function. Impairment was indicated by specific threshold values or clinical interventions in each system.

The investigation revealed that nearly one-third of the study participants experienced organ failure. Among these cases, less than a third had moderate pancreatic inflammation, while more than two-thirds exhibited severe inflammation according to the modified computed tomography severity index (MCTSI).

In our study, 13 out of 40 patients (32.5%) were found to have end-organ failure. When examining the distribution of organ failure across severity categories, it

was observed in slightly less than one-third (30%) of moderate cases and more than two-thirds (69%) of severe cases. Statistical analysis demonstrated a strong correlation between the occurrence of systemic complications and the severity classification of pancreatic inflammation, with a probability value indicating high significance ($p = 0.0001$)

Our findings diverge from the seminal research conducted by Koenraad J. Mortele [19] which failed to establish a meaningful link between the CTSI and the incidence of organ dysfunction.

In our investigation, we observed no fatalities attributable to pancreatitis. This outcome contrasts with the research conducted by Bollen et al. [24], which reported a mortality rate of 6% among their patient cohort. Similarly, the study led by Mortele and his team documented a 1.5% mortality rate in their sample population.

The disparity in mortality rates across these studies may be indicative of variations in patient demographics, severity of cases, treatment protocols, or advancements in pancreatitis management over time. It's worth noting that the absence of mortality in our study could suggest effective treatment strategies, early intervention, or potentially a less severe patient population compared to the referenced studies.

The accuracy of MCTSI in predicting ICU admission was as follows: Sensitivity = 100%, Specificity = 85.00%, Positive predictive value = 86.96%, Negative predictive value = 100%.

The accuracy of MCTSI in predicting intervention was as follows: Sensitivity = 99%, Specificity = 100%, Positive predictive value = 100%, Negative predictive value = 91.18%.

This prospective study has demonstrated the significant utility of the modified computed tomography severity index (MCTSI) in predicting clinical outcomes and complications in patients with acute pancreatitis. The main findings highlight the strong correlation between MCTSI grading and various adverse events, including the need for intensive care unit (ICU) admission, requirement for interventions, development of systemic and local complications, prolonged hospital stay, and end-organ failure.

Notably, the inclusion of extra pancreatic complications in the MCTSI grading system contributed to its superior performance compared to the conventional CT severity index (CTSI) in predicting these adverse outcomes. The MCTSI exhibited high sensitivity and specificity in predicting ICU admission, interventions, and organ failure, underscoring its potential as a valuable prognostic tool in the early evaluation and risk stratification of acute pancreatitis patients.

The accurate prediction of severity and complications using the MCTSI can guide clinical decision-making, such as early transfer to higher care centres, prompt initiation of interventions, and appropriate allocation of resources. This study's strengths include its prospective design, well-defined criteria for assessing outcomes and complications, and a standardized approach to MCTSI grading across a diverse range of clinical outcomes.

While the relatively small sample size and single-centre nature of the study are potential limitations. Additionally, exploring the integration of the MCTSI with other

clinical scoring systems or biomarkers may enhance its predictive accuracy and clinical utility.

In conclusion, this study demonstrates that the MCTSI is a valuable and practical tool for the early assessment of acute pancreatitis severity, prediction of complications, and guiding clinical management decisions. The potential impact of the MCTSI on improving patient outcomes and optimizing resource utilization in the management of acute pancreatitis is promising and warrants further investigation and implementation in clinical practice.

CONCLUSION

1. The modified CT severity index (MCTSI) demonstrated a significant correlation with the necessity of ICU admission, the duration of ICU stay, and the total duration of hospital stay for patients with acute pancreatitis.
2. The modified CT grading system based on MCTSI showed a direct correlation with the development of local and systemic complications in patients with acute pancreatitis.
3. The MCTSI can be used as a predictive tool to assess the possibility of developing local and systemic complications, as well as the necessity of ICU admission in patients with acute pancreatitis.
4. The MCTSI can effectively predict the need for interventions in the management of patients with acute pancreatitis.
5. The inclusion of extra pancreatic complications in the CT scoring system (MCTSI) showed a significant correlation with end-organ failure and adverse clinical outcomes, suggesting that MCTSI may be a more useful scoring system compared to the conventional CT severity index (CTSI).
6. The research findings underscore the efficacy of the MDCTSI in evaluating and categorizing the intensity of pancreatic inflammation when applied early in the disease course. This method proves particularly valuable when utilized within 72 hours of symptom manifestation, offering insights into potential disease trajectories and patient outcomes.

To conclude, MDCTSI has shown considerable merit in forecasting the progression, potential complications, necessity for medical interventions, and overall clinical results in individuals presenting with acute pancreatic inflammation. A key

strength of this updated approach lies in its incorporation of complications extending beyond the pancreas itself, thereby augmenting its predictive capabilities. Consequently, this refined assessment method may offer superior clinical utility compared to its predecessor, particularly in guiding treatment strategies and estimating prognosis for patients experiencing this acute digestive disorder.

SUMMARY

- This cross-sectional study was conducted from January 2023 to December 2023 at KLE's Dr Prabhakar Kore Hospital and Research Institute in Belagavi, India.
- It included 40 cases which were identified as acute pancreatitis based on clinical features, lab investigations, or ultrasound findings. These patients underwent contrast-enhanced computed tomography (CECT) of the abdomen and pelvis, and their pancreatitis severity was graded according to the modified computed tomography severity index (MCTSI). The study aimed to investigate the utility of MCTSI in predicting clinical outcomes and complications in acute pancreatitis patients.
- The study population had a mean age of 39.4 years, with the majority (40%) being in the 30-39 age group. There was a predominance of male patients (92.5%). The most common etiology was chronic alcohol abuse (65%), followed by cholelithiasis (10%).
- Laboratory investigations revealed raised serum amylase and lipase levels in about 80% of patients. Systemic infection, manifested as leukocytosis, was observed in 57.5% of patients and was more common in those with moderate (50%) and severe (91%) pancreatitis according to MCTSI grading.
- Local complications, including pseudocysts and walled-off necrosis, were identified in 25% of patients. These complications were more prevalent in patients with moderate (25%) and severe (66%) pancreatitis. Extra-pancreatic complications, such as pleural effusion, vascular complications (e.g., portal vein thrombosis) and parenchymal complications (e.g., renal infarct), were also observed, with pleural effusion being the most common (57%).

- The MCTSI grading system classified patients into mild (grade 2), moderate (grades 4 and 6), and severe (grades 8 and 10) categories. In this study, the majority of patients were graded as moderate (40%), followed by mild (30%) and severe (30%).
- The study found a strong correlation (p-value = 0.0001) between the MCTSI grade and the total duration of hospital stay. The mean hospital stay was 6 days for mild, 8 days for moderate, and 12 days for severe pancreatitis.
- Intensive care unit (ICU) admission was required for 50% of patients, and there was a significant association (p-value = 0.0001) between the need for ICU admission and the MCTSI grade. All patients with severe pancreatitis (100%) required ICU admission, while only 50% of those with moderate pancreatitis needed ICU care.
- Interventions, such as surgical debridement or pseudocyst aspiration, were required for 22.5% of patients. A significant association (p-value = 0.0001) was found between the need for intervention and the MCTSI grade, with 66% of patients with severe pancreatitis requiring an intervention compared to only 6% of those with moderate pancreatitis.
- End-organ failure was observed in 32.5% of patients, with a significant association (p-value = 0.0001) between the development of systemic complications and the MCTSI grade. End-organ failure was seen in 30% of patients with moderate pancreatitis and 69% of those with severe pancreatitis.
- The study found a significant correlation between the MCTSI grade and the development of local and systemic complications, the necessity of ICU admission, the duration of ICU stay, and the total duration of hospital stay. The inclusion of extra-pancreatic complications in the MCTSI grading system showed a significant

correlation with end-organ failure and adverse clinical outcomes, suggesting that MCTSI may be a more useful scoring system compared to the conventional CT severity index (CTSI).

- The study has concluded that the MCTSI is a valuable asset for screening and accurate classification of severity in acute pancreatitis patients, as well as for predicting clinical outcomes when used within 72 hours of symptom onset. The inclusion of extra-pancreatic complications in the scoring system further enhances its predictive value, making MCTSI a potentially more useful tool compared to the conventional CTSI for the management and prognostic evaluation of acute pancreatitis cases.

LIMITATIONS

1. All patients with acute attacks of pancreatitis were included in study irrespective of whether first attack or relapse of pancreatitis. Hence, difference between first attacks and relapses could not be differentiated.
2. The sample size was inadequate to evaluate mortality and morbidity prediction based on CT criteria
3. The study included only patients who underwent contrast-enhanced computed tomography (CECT), which may have led to a selection bias towards more severe cases of acute pancreatitis, as CECT is often not performed in mild cases unless complications are suspected.

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ANNEXURES – I

CONSENT FORM FORMAT

KAHERs JNMC BELAGAVI INFORMED CONSENT FORM

"MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX AND ITS CORRELATION WITH CLINICAL OUTCOME IN ACUTE PANCREATITIS-

-A ONE YEAR HOSPITAL BASED CROSS SECTIONAL STUDY"

Name of Student/Principal Investigator: REG NO. BS0121006

Name of Guide/Co Investigators: DR. _____

Objective:

1. To identify the CT features of clinically suspected acute pancreatitis and grade the features according to modified CT severity index of acute pancreatitis.

2. To compare the modified CT severity index of acute pancreatitis with clinical outcome of the patients.

Introduction:

Acute pancreatitis is a challenging disease which presents itself as acute abdominal pain and elevated pancreatic enzymes. In the majority of cases, acute pancreatitis is mild and resolves with conservative therapy.

Modified Computed Tomography based severity scoring system comes into play at this level. Many studies have pointed out the usefulness of modified CT based severity

scoring system in the setting of acute pancreatitis with varying levels of statistical significance

This study aimed to correlate the Modified computed tomography severity index (MCTSI) grading system with patient outcome in terms of organ failure, mortality and duration of hospital stay.

Explanation of procedure:

I request you to kindly participate in the study titled study

"MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX AND ITS CORRELATION WITH CLINICAL OUTCOME IN ACUTE PANCREATITIS- - A ONE YEAR HOSPITAL BASED CROSS SECTIONAL STUDY"

at Dr. Prabhakar Kore Charitable Hospital and Medical Research Centre, Belgaum" is being conducted by **REG NO. BS0121006**, Post Graduate in Radio-Diagnosis at J. N. Medical College Belgaum, Karnataka, under the guidance of **DR. _____** Professor and Head, Dept. of Radio-Diagnosis, J. N. Medical College, Belgaum.

We request you to participate in this study as you are eligible to be included. During the study you will be asked questions regarding your present and past medical history and you will be required to answer to the best of your knowledge. You will also be clinically examined as per the protocol drawn.

Study will be conducted over a period of one year. Once the patient signs the informed consent history and examination will be recorded as per proforma.

If you agree to participate in the study, please furnish the details pertaining to the study.

Withdrawal from participation in the study: Participation in this study is voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will/will not have nor get any benefits by participating in this study. The data gathered will help the population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person from identifying you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purposes and or presented to scientific groups. However, your identity will never be revealed.

Questions: In case of any questions with regard to this study, you are free to contact: "Name of student/PI, mobile number, email ID" If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study

"MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX AND ITS CORRELATION WITH CLINICAL OUTCOME IN ACUTE PANCREATITIS- - A ONE YEAR HOSPITAL BASED CROSS SECTIONAL STUDY"

My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

PROFORMA

Name:

Age:

Sex:

Occupation:

Address:

Ph.No:

IP/OP No:

Ref Dr:

Date of interview :

Date of admission :

Date of discharge :

Clinical complaints: Abdominal pain (Yes / No)

Vomiting (Yes / No)

Fever (Yes / No)

Jaundice (Yes / No)

Past History: H/O gallstones (Yes / No)

Personal history: Alcohol consumption (Yes / No) Clinical diagnosis:

1. Clinical parameters

LAB PARAMETERS		**RANGE**
WBC count		4000-11,000
Serum Lipase		30-120 U/L
Serum Amylase		0-160 U/L

a) Blood investigations

2 **. USG FINDINGS**

MODIFIED CT SEVERITY INDEX

PROGNOSTIC INDICATORS		POINTS	SCORE
Pancreatic Inflammation	Normal Pancreas	0	
	Intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat.	2	
	Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis	4	
Pancreatic Necrosis	None	0	
	<= 30%	2	
	> 30%	4	
Extra Pancreatic Complications	One of more of the following: 1. Pleural Effusion 2. Vascular Complications 3. Parenchymal Complications 4. Gastrointestinal tract involvement	2	

EVALUATION OF PATIENT'S OUTCOME

PARAMETERS		OBSERVATIONS
1. Duration of Hospital Stay (Days)		
2. Intensive Care Unit (ICU) admission	Present / Absent	
3. Percutaneous/surgical intervention procedures	1. Surgical necrosectomy	
	2. USG guided aspiration of pseudocyst	
4. Evidence of organ failure :	1. CNS : GCS < 6	
	2. Respiratory : PaO2 < 60mm Hg or need of ventilation or Respiratory rate > 25beats/min	
	3. CVS : systolic BP of < 90 mm Hg	
	4. Renal : Serum creatinine of > 3.0 mg/ dl or urine output of < 500ml /24 h	
	5. Hepatic : serum bilirubin > 3mg/dl	
	6. Haematological system failure : severe sepsis	
5. Mortality		

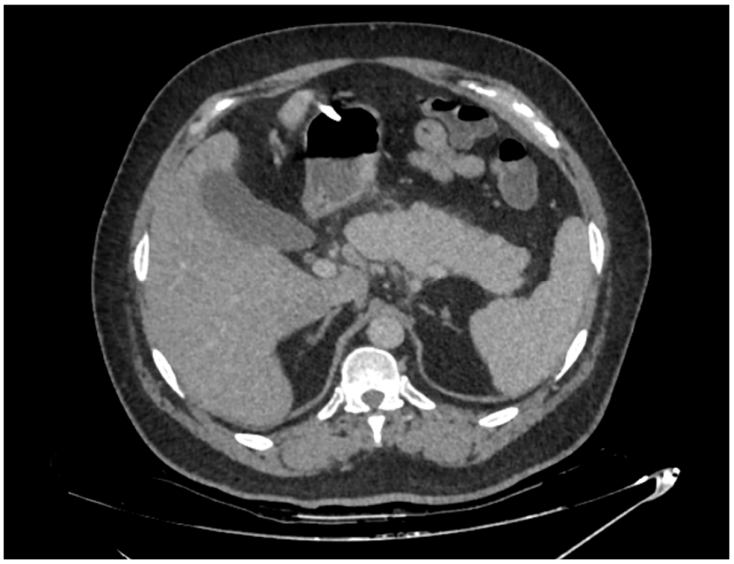
COURSE DURING THE HOSPITAL STAY

Management done:

DRUGS PRESCRIBED	DOSAGE	DURATION

CASE IMAGES

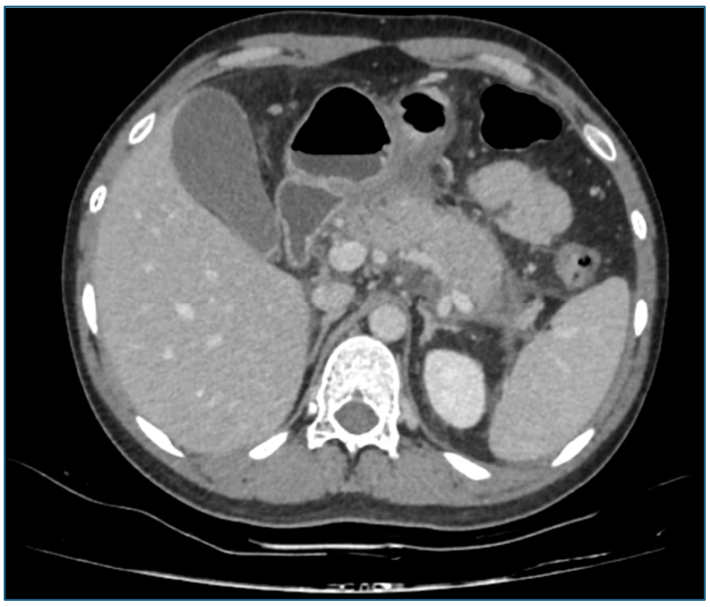
CASE 1: 42 year old male patient with complaints of fever and abdominal pain.



Axial CECT shows enlarged and edematous pancreas with mild adjacent fat stranding.

No obvious evidence of fluid or necrosis noted.

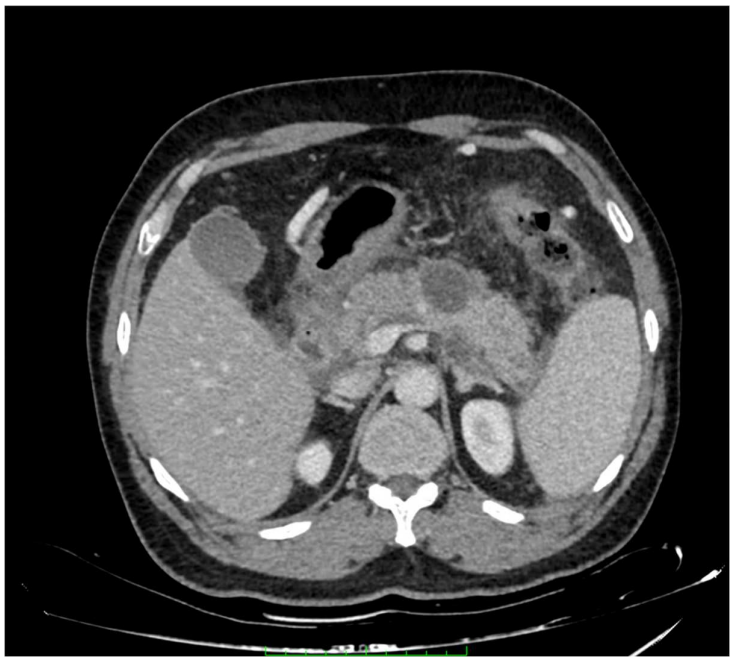
CASE 2: 50 year female with complaints of abdominal pain and vomiting

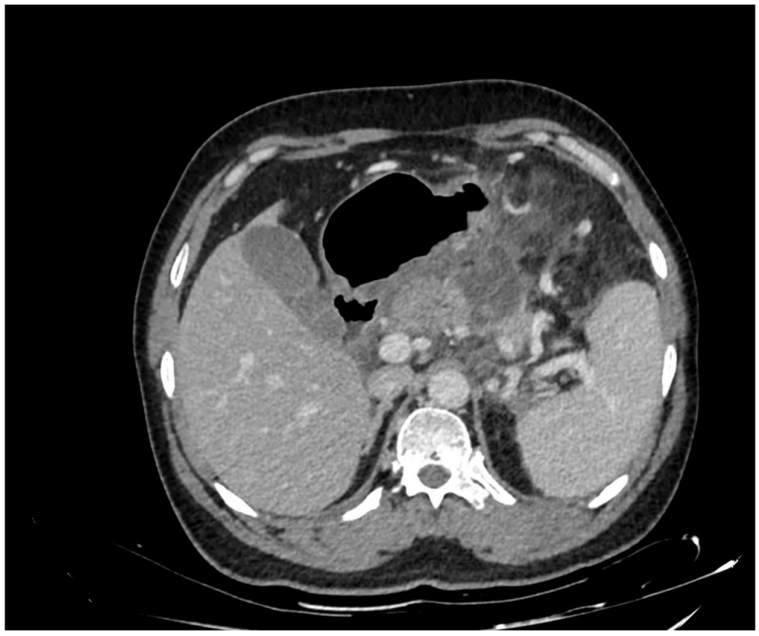


Axial CECT shows enlarged and edematous pancreas with surrounding fluid and stranding.

Homogenous enhancement of pancreas noted with no evidence of necrosis.

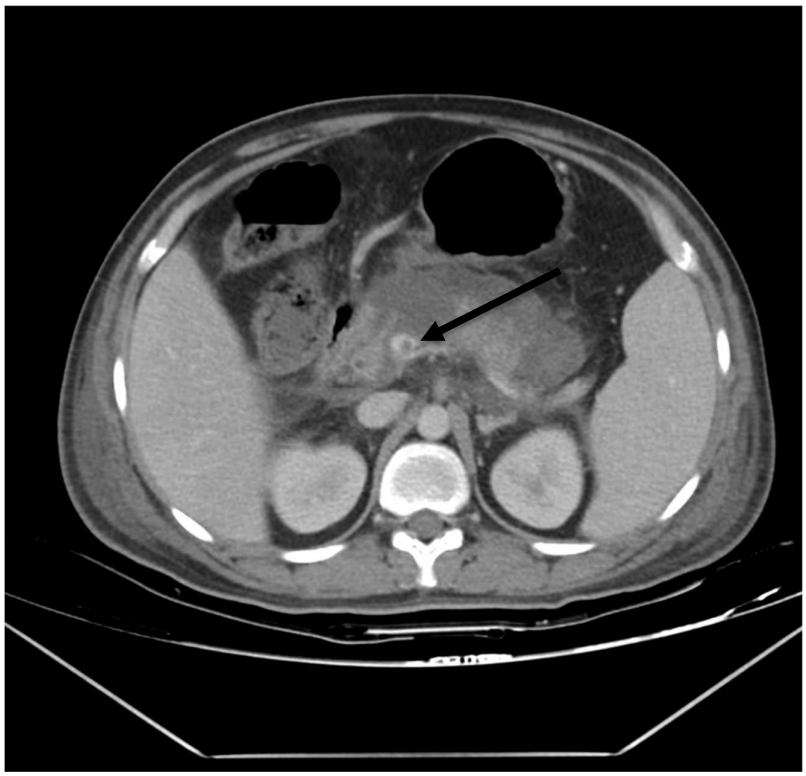
CASE 3: 36 year old male patient with complaints of abdominal pain, fever and jaundice





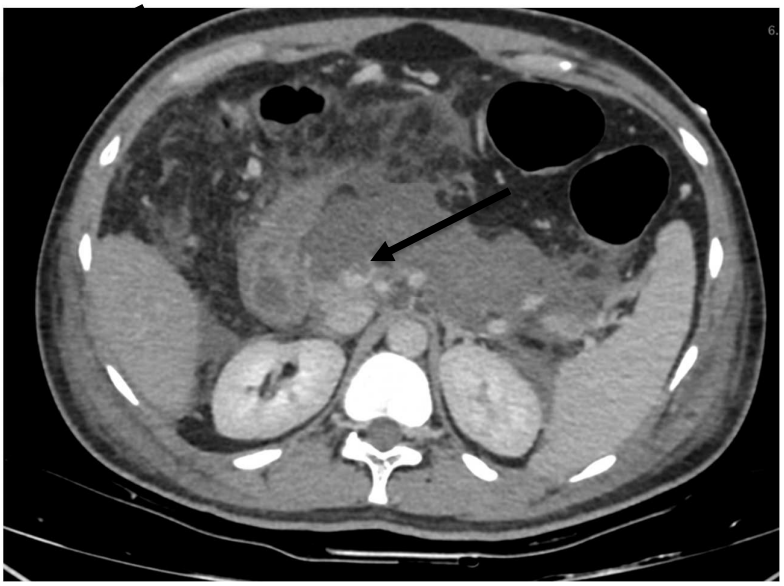
Axial CECT shows enlarged pancreas with ill-defined non enhancing hypodense area in the body of the pancreas which is seen to communicate with a well-defined peripancreatic necrotic collection noted along the greater curvature of the stomach suggestive of acute necrotizing pancreatitis with necrotic collection

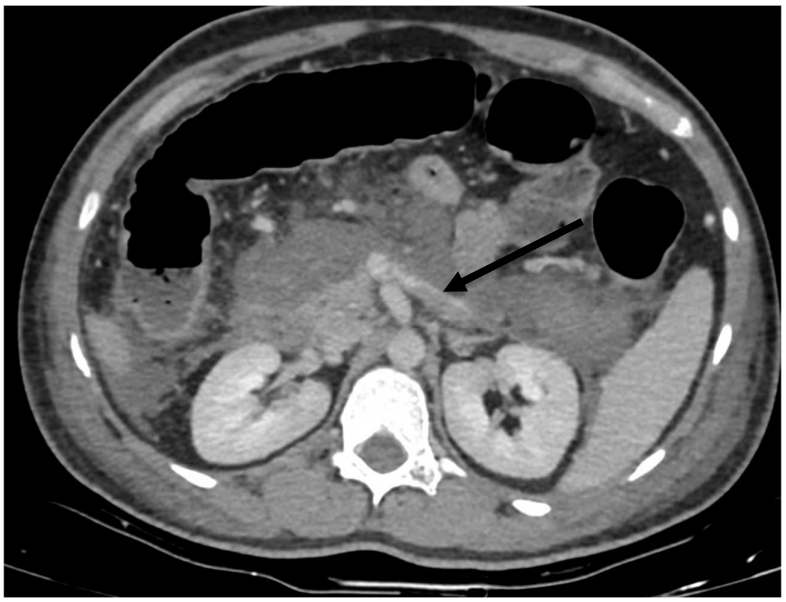
CASE 4: 26 year old male patient with complaints of severe abdominal pain with fever and sepsis.



Axial CECT shows bulky pancreas with multiple non enhancing intra-parenchymal and peripancreatic necrotic collection in body and tail region with ill-defined necrotic fluid and fat stranding. Partial hypodense filling defect noted involving the porto-splenic confluence, superior mesenteric and splenic vein…suggestive of thrombosis

CASE 5: 30 year old male patient with fever and abdominal pain with features of sepsis and altered sensorium.





Axial CECT image shows a non enhancing hypodense peripancreatic fluid collection, in the body region with the fluid tracking along the bilateral perinephric space, bilateral lateral conal fascia and into the pelvic cavity. Hypodense filling defect noted involving the porto-splenic confluence that is seen extending to the main portal vein & splenic vein suggestive of thrombosis.

Master Chart

S.NO	AGE	SEX	CHIEF COMPLAINTS	ETIOLOGY	SR.AMYLASE	SR LIPASE	LEUCOCYTOSIS (SYSTEMIC INF)	PANCREATIC INFLAMMATION POINTS	PANCREATIC NECROSIS	EXTRA-PANCREATIC COMPLICATIONS	PSEUDOCYST	WALLED OFF NECROSIS	MDCTSI SCORE	MDCTSI GRADE	DURATION OF HOSP STAY	ICU ADMISSION	ANTIBIOTICS	INTERVENTION	ORGAN FAILURE	MORTALITY
1	69	M	ABDOMINAL PAIN, VOMITING	CHOLELITHIASIS, ALCOHOLIC	RAISED (442)	RAISED(560)	N	2	-	PLEURAL EFFUSION	N	N	4	MODERATE	9	N	N	N	N	N
2	29	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	NORMAL	NORMAL	N	4	-	PLEURAL EFFUSION	N	N	6	MODERATE	11	N	N	N	RESPIRATORY (30/MIN)	N
3	32	M	ABDOMINAL PAIN, VOMITING	OTHERS	RAISED (400)	RAISED (800)	N	4	-	PORTAL VEIN THROMBOSIS, SPLENIC VEIN THROMBOSIS-	N	N	6	MODERATE	13	Y	Y	N	N	N
4	36	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (500)	RAISED (850)	N	2	-	-	N	N	2	MILD	5	N	N	N	N	N
5	24	M	ABDOMINAL PAIN, VOMITING	OTHERS	NORMAL	NORMAL	N	4	-	PLEURAL EFFUSION	N	N	6	MODERATE	8	N	N	N	N	N
6	39	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	NORMAL	NORMAL	13000	4	-	-	N	N	4	MODERATE	8	N	N	N	N	N
7	23	M	ABDOMINAL PAIN, VOMITING	CHOLELITHIASIS, ALCOHOLIC	RAISED (400)	RAISED (750)	12600	4	2	PLEURAL EFFUSION	N	N	8	SEVERE	9	Y	Y	N	N	N
8	34	F	ABDOMINAL PAIN, VOMITING	OTHERS	RAISED (150)	RAISED (200)	N	2	-	-	N	N	2	MILD	6	N	N	N	N	N
9	37	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (400)	RAISED (480)	12000	4	4	PORTAL VEIN THROMBOSIS, SPLENIC VEIN THROMBOSIS, PLEURAL EFFUSION-	N	Y	10	SEVERE	16	Y	Y	SURGICAL NECROSECTOMY	RESPIRATORY (30/MIN), S.BILIRUBIN- 3.2 MG/DL	N
10	76	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	NORMAL	NORMAL	N	2	-	PLEURAL EFFUSION	N	N	4	MODERATE	10	N	N	N	N	N
11	56	F	ABDOMINAL PAIN, VOMITING	CHOLELITHIASIS	RAISED (200)	RAISED (400)	11500	2	-	-	N	N	2	MILD	6	N	N	N	N	N
12	32	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (400)	RAISED(560)	15000	4	2		Y	N	6	MODERATE	9	Y	Y	USG GUIDED ASPIRATION OF PSUEDOCYST	RESPIRATORY (30/MIN)	N
13	30	M	ABDOMINAL PAIN, VOMITING, JAUNDICE	ALCOHOLIC	RAISED (400)	RAISED (480)	12000	4	-	PORTAL VEIN THROMBOSIS, PLEURAL EFFUSION	Y	N	6	MODERATE	13	Y	Y	N	CVS (90/60 MM/HG)	N
14	35	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (480)	RAISED (800)	16000	4	4	PORTAL VEIN, PORTO-SPLENIC CONFLUENCE, SPLENIC VEIN THROMBOSIS, PLEURAL EFFUSION, BILATERAL RENAL INFARCT,	N	Y	10	SEVERE	15	Y	Y	SURGICAL NECROSECTOMY	RESPIRATORY (32/MIN), CVS (90/60MM/HG), S. BILIRUBIN - 3.5 MG/DL	N
15	42	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (400)	RAISED (560)	12000	4	2	PLEURAL EFFUSION	N	N	8	SEVERE	8	Y	Y	N	N	N
16	36	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (200)	RAISED (280)	12000	2	-	-	N	N	2	MILD	7	N	N	N	N	N
17	32	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	NORMAL	NORMAL	N	2	-	-	N	N	2	MILD	6	N	N	N	N	N
18	20	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	CHOLELITHIASIS, ALCOHOLIC	RAISED (480)	RAISED (640)	15000	4	2	-	N	N	6	MODERATE	9	Y	Y	N	N	N
19	45	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (400)	RAISED (640)	N	4	2	SPLENIC VEIN THROMBOSIS, PLEURAL EFFUSION	N	N	8	SEVERE	15	Y	Y	N	S. BILIRUBIN : 3.1 MG/DL	N
20	46	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	CHOLELITHIASIS	RAISED (120)	RAISED(250)	15000	2	-	-	N	N	2	MILD	8	N	N	N	N	N
21	25	M	ABDOMINAL PAIN, VOMITING, FEVER	ALCOHOLIC	RAISED (400)	RAISED (720)	12600	4	4	PORTAL VEIN THROMBOSIS, SPLENIC VEIN THROMBOSIS, PLEURAL EFFUSION-	N	Y	10	SEVERE	15	Y	Y	SURGICAL NECROSECTOMY	RESPIRATORY (35/MIN), CVS : 90/60 MM/HG	N
22	56	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (200)	RAISED (400)	N	4	-	-	N	N	4	MODERATE	6	N	N	N	N	N
23	47	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (360)	RAISED (480)	13700	4	2	PLEURAL EFFUSION	N	N	8	SEVERE	8	Y	Y	N	N	N
24	34	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (640)	RAISED (720)	15000	4	4	PLEURAL EFFUSION	N	Y	10	SEVERE	17	Y	Y	SURGICAL NECROSECTOMY	RESPIRATORY (30/MIN), S.BILIRUBIN- 3.2 MG/DL	N
25	40	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (200)	RAISED(250)	N	4		PLEURAL EFFUSION	N	N	6	MODERATE	6	N	N	N	N	N
26	31	M	ABDOMINAL PAIN, VOMITING	CHOLELITHIASIS, ALCOHOLIC	RAISED (300)	RAISED (400)	12000	2	-	-	N	N	2	MILD	7	N	N	N	N	N
27	24	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (200)	RAISED (360)	N	2	-	-	N	N	2	MILD	4	N	N	N	N	N
28	45	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (200)	RAISED (280)	N	4	2	-	N	N	6	MODERATE	8	Y	Y	N	N	N
29	27	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (400)	RAISED (800)	20000	4	4	PLEURAL EFFUSION, ASCITES	Y	N	10	SEVERE	13	Y	Y	USG GUIDED ASPIRATION OF PSUEDOCYST	RESPIRATORY (30/MIN), CVS (90/60 MM/HG), S.BILIRUBIN- 3.2 MG/DL	N
30	35	M	ABDOMINAL PAIN, VOMITING	OTHERS	NORMAL	NORMAL	N	2	-	-	N	N	2	MILD	6	N	N	N	N	N
31	35	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (200)	RAISED (400)	12000	4	-	PLEURAL EFFUSION, ASCITES	N	N	6	MODERATE	6	Y	Y	N	N	N
32	70	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	CHOLELITHIASIS	RAISED (400)	RAISED (560)	13000	4	-	PLEURAL EFFUSION	N	N	6	MODERATE	10	Y	Y	N	N	N
33	58	M	ABDOMINAL PAIN, VOMITING, FEVER	CHOLELITHIASIS	RAISED (460)	RAISED (800)	12000	4	2	PLEURAL EFFUSION, ASCITES	Y	N	8	SEVERE	10	Y	Y	USG GUIDED ASPIRATION OF PSUEDOCYST	RESPIRATORY (30/MIN), S.BILIRUBIN- 3.2 MG/DL	N
34	46	M	ABDOMINAL PAIN, VOMITING	CHOLELITHIASIS	NORMAL	NORMAL	N	2	-	-	N	N	2	MILD	7	N	N	N	N	N
35	55	F	ABDOMINAL PAIN, VOMITING, JAUNDICE	CHOLELITHIASIS	RAISED (200)	RAISED (400)	N	2	-	-	N	N	2	MILD	5	N	N	N	N	N
36	58	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	RAISED (400)	RAISED (360)	15000	2	-	-	N	N	2	MILD	6	N	N	N	N	N
37	26	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (300)	RAISED (480)	18000	4	4	PLEURAL EFFUSION	Y	N	10	SEVERE	9	Y	Y	USG GUIDED ASPIRATION OF PSUEDOCYST	RESPIRATORY (35/MIN), CVS (90/60 MM/HG), S.BILIRUBIN- 3.2 MG/DL-	N
38	32	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (480)	RAISED (640)	12000	4	-	PORTOSPLENIC THROMBOSIS, PLEURAL EFFUSION	N	N	6	MODERATE	10	Y	Y	N	RESPIRATORY (30/MIN), CVS (90/60 MM/HG), S.BILIRUBIN- 3.0 MG/DL	N
39	29	M	ABDOMINAL PAIN, VOMITING, FEVER, JAUNDICE	ALCOHOLIC	RAISED (400)	RAISED (640)	14000	4	2	PORTAL VEIN THROMBOSIS	N	Y	8	SEVERE	9	Y	Y	SURGICAL NECROSECTOMY	RESPIRATORY (30/MIN), CVS (90/60 MM/HG), S.BILIRUBIN- 3.2 MG/DL	N
40	32	M	ABDOMINAL PAIN, VOMITING	ALCOHOLIC	NORMAL	NORMAL	N	2	-	PLEURAL EFFUSION	N	N	4	MODERATE	7	N	N	N	N	N

YES - (Y)
NO - (N)

MALE - (M)
FEMALE - (F)