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A PROSPECTIVE STUDY ON SERUM D-DIMER LEVEL AT THE ADMISSION FOR PREDICTION OF SEVERITY OF ACUTE PANCREATITIS

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ABSTRACT

Background: Acute pancreatitis is an inflammatory condition with a variable clinical course, ranging from mild to severe forms that can lead to significant morbidity and mortality. Early prediction of disease severity is crucial for appropriate management. Serum D-dimer, a fibrin degradation product, may serve as a predictive biomarker for the severity of acute pancreatitis due to its association with coagulation and inflammatory processes. **Methods:** This prospective observational study was conducted at the General Surgery department of Victoria Hospital, BMCRI, Bengaluru, from April 2024 to July 2024. A total of 60 patients diagnosed with acute pancreatitis and admitted within 24 hours of symptom onset were enrolled. Serum D-dimer levels were measured at admission, day 3 and 5. Patients were assessed for complications, including acute pancreatic fluid collection, acute necrotic collection, organ failure, pancreatic necrosis, and persistent organ failure. Statistical analysis was performed using SPSS version 22, with a p-value of <0.05 considered significant. **Results:** The mean serum D-dimer levels were significantly higher in patients with severe complications such as pancreatic necrosis and persistent organ failure compared to those with no complications . A significant correlation was found between elevated D-dimer levels and the severity of complications, with the highest levels observed in patients with pancreatic necrosis. Age and sex did not significantly influence the occurrence of complications. The study findings suggest that serum D-dimer levels at admission are a reliable predictor of the severity of acute pancreatitis. **Conclusion:** Serum D-dimer levels at admission are significantly associated with the severity of acute pancreatitis and may serve as a valuable prognostic marker for early identification of patients at risk for severe complications. Incorporating D-dimer testing into the initial assessment could improve clinical management and patient outcomes.

KEYWORDS

Acute pancreatitis, D-dimer, Severity prediction, Complications, Prognostic biomarker

INTRODUCTION

Acute pancreatitis (AP) is an acute inflammatory condition of the pancreas that can range in severity from mild, self-limiting episodes to severe, life-threatening cases with significant morbidity and mortality. The global incidence of acute pancreatitis has been on the rise, with studies indicating a rate of 34 per 100,000 population annually [1]. The condition is primarily triggered by factors such as gallstones, chronic alcohol consumption, hypertriglyceridemia, and certain medications [2]. Despite advances in critical care and supportive treatment, predicting the course and severity of acute pancreatitis remains a clinical challenge. This challenge is compounded by the fact that severe acute pancreatitis (SAP), which accounts for approximately 20% of cases, can lead to complications such as necrosis, organ failure, and systemic inflammatory response syndrome (SIRS), contributing to a mortality rate as high as 30% [3].

The pathophysiology of acute pancreatitis involves the premature activation of digestive enzymes within the pancreas, leading to autodigestion, inflammation, and necrosis of pancreatic tissue. This can extend to systemic inflammation, resulting in multi-organ failure. Early identification of patients at risk for severe outcomes is critical for improving prognosis through timely and aggressive management, including intensive monitoring, fluid resuscitation, and, when necessary, surgical intervention [4].

However, the scoring systems have limitations, particularly in their complexity and the need for repeated assessments over time. For instance, the Ranson criteria require 48 hours to complete, delaying the initiation of appropriate therapeutic measures [5]. Consequently, there has been increasing interest in identifying simple, reliable biomarkers that can be measured at admission and provide an early indication of disease severity. One such biomarker that has garnered attention is serum D-dimer.

D-dimer is a fibrin degradation product that is generated during the process of fibrinolysis, where the body breaks down blood clots. Elevated levels of D-dimer are commonly associated with conditions involving coagulation and thrombotic events, such as deep vein thrombosis, pulmonary embolism, and disseminated intravascular coagulation (DIC) [6]. The role of D-dimer in acute pancreatitis is linked to the disease's underlying pathophysiology. During acute pancreatitis, the inflammatory response triggers the activation of the coagulation cascade, leading to microvascular thrombosis and subsequent fibrinolysis. This process results in elevated D-dimer levels, which reflect both the extent of inflammation and the activation of the coagulation system [7].

The interpretation of D-dimer levels must be made in conjunction with clinical assessment and other diagnostic findings.

Given the potential of D-dimer as a predictive marker, this study was designed to prospectively evaluate the serum D-dimer levels at admission in patients with acute pancreatitis and assess their correlation with disease severity. The study also aimed to compare D-dimer levels across different categories of pancreatitis complications, such as pancreatic necrosis, organ failure, and persistent organ failure, to further elucidate the role of D-dimer in predicting severe outcomes. By focusing on patients admitted within 24 hours of symptom onset, the study sought to determine whether early measurement of D-dimer could provide valuable prognostic information that could guide clinical decision-making and improve patient management.[8].

Methodology

A prospective observational study was done on 60 patients from April 2024 to July 2024 in department of General Surgery , Bangalore Medical College and Research Institute and hospitals affiliated to it. After obtaining institutional ethical clearance the study was conducted.

Participants included in the study were patients aged 18 years and above, diagnosed with acute pancreatitis within 24 hours of symptom onset. Patients provided informed consent before participation. Exclusion criteria including patients aged below 18 or over 70, those with a prehospital interval exceeding 24 hours, chronic or recurrent pancreatitis, known coagulative disorders, recent myocardial or cerebral infarctions, pregnancy, cancer, or recent infections.

The study employed a purposive sampling method, where participants were selected based on the inclusion and exclusion criteria mentioned above. The study did not involve predefined study groups as it was a single cohort observational study. However, patients were stratified post hoc based on the severity of acute pancreatitis, as determined by

clinical and laboratory parameters, including serum D-dimer levels. The primary study parameter was the serum D-dimer level measured at admission, and on days 3 and 5 post-admission.

A detailed medical history was recorded, including baseline demographic data, etiology, and clinical examination findings.

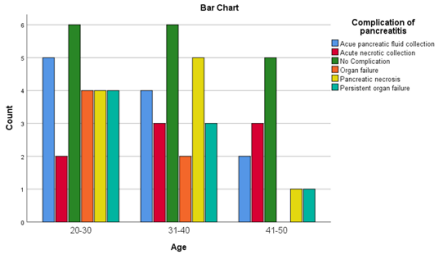
RESULT AND ANALYSIS

Comparison of Age and Complications of Pancreatitis

The analysis of complications of pancreatitis across different age groups reveals that the distribution of complications was relatively similar among the age brackets of 20-30 years, 31-40 years, and 41-50 years. The 20-30 years age group had a slightly higher number of cases with no complications (6 cases) and persistent organ failure (4 cases). The 31-40 years age group also presented a similar distribution, while the 41-50 years age group showed fewer complications overall, with only one case of pancreatic necrosis and persistent organ failure. The Pearson chi-square test indicated no statistically significant association between age and the occurrence of complications (p-value = 0.803).

Table: Comparison on Age and Complication of pancreatitis

	Complication of pancreatitis						Total
Age	Acue pancreatic fluid collection	Acute necrotic collection	No Complication	Organ failure	Pancreatic necrosis	Persistent organ failure	
20-30	5	2	6	4	4	4	25
31-40	4	3	6	2	5	3	23
41-50	2	3	5	0	1	1	12
Total	11	8	17	6	10	8	60
Pearson chi-square = 6.147, p-value = 0.803							

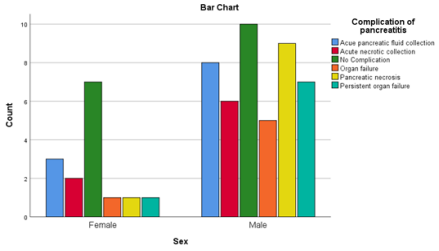


Comparison of Sex and Complications of Pancreatitis

When comparing the complications of pancreatitis between sexes, males were found to have a higher occurrence of complications across all categories except for no complications, where females had 7 cases compared to 10 in males. Males had a notably higher incidence of pancreatic necrosis (9 cases) and persistent organ failure (7 cases) compared to females. Despite these differences, the Pearson chi-square test did not show a statistically significant association between sex and the type of complication (p-value = 0.481), suggesting that sex may not be a significant factor in the development of pancreatitis complications.

Comparison on Sex and Complication of pancreatitis

	Complication of pancreatitis						Total
Sex	Acue pancreatic fluid collection	Acute necrotic collection	No Complication	Organ failure	Pancreatic necrosis	Persistent organ failure	
Female	3	2	7	1	1	1	15
Male	8	6	10	5	9	7	45
Total	11	8	17	6	10	8	60
Pearson chi-square = 4.492, p-value = 0.481							



Complications of Pancreatitis: Descriptive Statistics

The descriptive statistics of complications show that the mean D-dimer levels were highest in patients with pancreatic necrosis (mean = 1105.90), followed by those with persistent organ failure (mean = 986.75) and organ failure (mean = 898.00). Patients with no complications had the lowest mean D-dimer level (mean = 168.35), significantly lower than those with other complications. The standard deviation was highest in the organ failure group, indicating greater variability in D-dimer levels within this group. The p-value of 0.000 suggests that the differences in mean D-dimer levels across the complication types were statistically significant.

Complication of pancreatitis

	N	Mean	Std. Deviation	Minimum	Maximum	P value
Acue pancreatic fluid collection	11	652.73	263.842	317	1352	0.000
Acute necrotic collection	8	671.50	248.225	377	1092	
No Complication	17	168.35	40.034	112	240	
Organ failure	6	898.00	349.955	538	1471	
Pancreatic necrosis	10	1105.90	288.242	619	1650	
Persistent organ failure	8	986.75	241.346	681	1337	
Total	60	662.58	416.067	112	1650	

Correlation Between Various Complications of Pancreatitis

The correlation analysis between various complications of pancreatitis revealed significant differences in D-dimer levels. Patients with no complications had significantly lower D-dimer levels compared to those with acute pancreatic fluid collection (mean difference = 484.374), acute necrotic collection (mean difference = 503.147), and pancreatic necrosis (mean difference = 937.547), all with p-values < 0.001. Additionally, pancreatic necrosis showed significantly higher D-dimer levels compared to acute pancreatic fluid collection (mean difference = 453.173) and acute necrotic collection (mean difference = 434.400). The significant correlations highlight the potential of D-dimer levels as a marker for predicting the severity of pancreatitis complications.

Correlation Between Various Complication Of Pancreatitis

(I) Complication of pancreatitis	(J) Complication of pancreatitis	Mean Difference (I-J)	Std. Error	Sig.
Acue pancreatic fluid collection	Acute necrotic collection	-18.773	108.068	1.000
	No Complication	484.374*	89.995	0.000
	Organ failure	-245.273	118.036	0.314
	Pancreatic necrosis	-453.173*	101.619	0.001
	Persistent organ failure	-334.023*	108.068	0.035
Acute necrotic collection	Acue pancreatic fluid collection	18.773	108.068	1.000
	No Complication	503.147*	99.715	0.000
	Organ failure	-226.500	125.605	0.472
	Pancreatic necrosis	-434.400*	110.320	0.003
	Persistent organ failure	-315.250	116.287	0.090
No Complication	Acue pancreatic fluid collection	-484.374*	89.995	0.000
	Acute necrotic collection	-503.147*	99.715	0.000
	Organ failure	-729.647*	110.440	0.000
	Pancreatic necrosis	-937.547*	92.687	0.000
	Persistent organ failure	-818.397*	99.715	0.000
Organ failure	Acue pancreatic fluid collection	245.273	118.036	0.314
	Acute necrotic collection	226.500	125.605	0.472

	No Complication	729.647*	110.440	0.000
	Pancreatic necrosis	-207.900	120.101	0.518
	Persistent organ failure	-88.750	125.605	0.980
Pancreatic necrosis	Acue pancreatic fluid collection	453.173*	101.619	0.001
	Acute necrotic collection	434.400*	110.320	0.003
	No Complication	937.547*	92.687	0.000
	Organ failure	207.900	120.101	0.518
	Persistent organ failure	119.150	110.320	0.887
Persistent organ failure	Acue pancreatic fluid collection	334.023*	108.068	0.035
	Acute necrotic collection	315.250	116.287	0.090
	No Complication	818.397*	99.715	0.000
	Organ failure	88.750	125.605	0.980
	Pancreatic necrosis	-119.150	110.320	0.887

DISCUSSION OF STUDY RESULTS

The analysis showed that the occurrence of complications varied across different age groups, with younger patients (20-30 years) having a slightly higher incidence of complications like persistent organ failure and pancreatic necrosis compared to older age groups. However, the Pearson chi-square test revealed no statistically significant association between age and the type of complication (p-value = 0.803), indicating that age alone may not be a decisive factor in the development of severe complications.

The sex-based comparison showed that males had a higher incidence of severe complications such as pancreatic necrosis and persistent organ failure compared to females. Despite these observations, the Pearson chi-square test indicated no statistically significant association between sex and the type of complication (p-value = 0.481).

The descriptive statistics provided a detailed analysis of the serum D-dimer levels across different complication types. The mean D-dimer levels were highest in patients with pancreatic necrosis (mean = 1105.90 ng/mL), followed by those with persistent organ failure (mean = 986.75 ng/mL) and organ failure (mean = 898.00 ng/mL). Patients with no complications had significantly lower mean D-dimer levels (mean = 168.35 ng/mL). The high D-dimer levels observed in patients with severe complications suggest a strong association between increased coagulation activity and the severity of acute pancreatitis. The significant differences in D-dimer levels, as indicated by the p-value of 0.000, underscore the potential of D-dimer as a biomarker for predicting severe outcomes in acute pancreatitis. These findings have demonstrated elevated D-dimer levels in patients with severe forms of the disease, likely due to the extensive inflammatory response and microvascular thrombosis that occur in severe pancreatitis.

The correlation analysis further elucidated the relationships between various complications and D-dimer levels. Patients with no complications had significantly lower D-dimer levels compared to those with acute pancreatic fluid collection, acute necrotic collection, organ failure, pancreatic necrosis, and persistent organ failure. The mean difference in D-dimer levels was particularly pronounced between patients with no complications and those with pancreatic necrosis (mean difference = 937.547 ng/mL, p-value = 0.000) and persistent organ failure (mean difference = 818.397 ng/mL, p-value = 0.000). These findings suggest that D-dimer levels are directly proportional to the severity of the complications, with the highest levels observed in the most severe cases. The significant correlations indicate that D-dimer could serve as a reliable marker for early identification of patients at risk for severe pancreatitis, allowing for timely intervention and potentially improving clinical outcomes.

First, they highlight the potential use of serum D-dimer levels as a simple and cost-effective biomarker for early prediction of the severity of acute pancreatitis. . Early identification of patients at risk for severe complications could facilitate prompt and aggressive management, including intensive care unit admission, close monitoring, and targeted therapeutic interventions. Moreover, D-dimer measurement, being a routine laboratory test, could be easily integrated into the standard care protocol for patients presenting with acute pancreatitis.

The relatively small sample size may limit the generalizability of the results, and larger studies are needed to confirm the findings. Additionally, the study was conducted in a single center, which may introduce selection bias. Future studies should aim to include a more diverse patient population across multiple centers to validate the predictive value of D-dimer in different clinical settings. Furthermore, while the study focused on the predictive value of D-dimer at admission, the dynamic changes in D-dimer levels over time and their relationship with disease progression warrant further investigation.

CONCLUSION

In conclusion, this study demonstrated that elevated serum D-dimer levels at admission are significantly associated with the severity of acute pancreatitis and could serve as a valuable prognostic marker. The findings support the incorporation of D-dimer testing into the initial assessment of patients with acute pancreatitis, particularly for identifying those at risk for severe complications. Future research should focus on validating these results in larger, multicenter studies and exploring the role of serial D-dimer measurements in predicting disease progression and guiding therapeutic decisions.

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