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Review Article

Surgery Section

Diagnostic and Prognostic Utility of C-reactive Protein and Urinary Trypsinogen Activation Biomarkers in Acute Pancreatitis: A Narrative Review

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ABSTRACT

Acute Pancreatitis (AP) is a leading gastrointestinal cause of hospital admission and has an unpredictable early course. Although most cases are mild, a subset progresses to necrosis and/or persistent organ failure with substantial morbidity and mortality. Early identification of high-risk patients remains a clinical priority. The present review aims to critically appraise the diagnostic and prognostic utility of C-Reactive Protein (CRP) and urinary trypsinogen-based markers, including urinary trypsinogen-2 and urinary Trypsinogen Activation Peptide (uTAP) in AP, with emphasis on clinically relevant outcomes. The present narrative review was conducted using a structured literature search of PubMed/MEDLINE, Scopus, Web of Science, the Cochrane Library, and Google Scholar, evaluating CRP and/or urinary trypsinogen markers in human AP. Eligible studies included those on diagnostic accuracy and prognostic outcomes related to conditions like pancreatic necrosis and Intensive Care Unit (ICU) admission. Urinary trypsinogen markers may indicate early enzyme activation, aiding rapid diagnosis and risk assessment, especially shortly after symptoms begin. CRP, an acute-phase reactant driven by Interleukin (IL)-6, becomes more valuable when measured over time; in particular, a 48-hour CRP correlates well with severe AP and adverse outcomes. The performance of these biomarkers is timing-dependent and varies by method. Using urinary trypsinogen testing followed by CRP measurement may enhance patient triage and outcomes, but standardisation and validation are necessary for wider use.

Keywords: Biomarkers, Disease severity, Pancreatic necrosis, Risk assessment

INTRODUCTION

The AP is an inflammatory disorder of the exocrine pancreas that arises when local acinar-cell stress and ductal perturbation trigger premature activation of digestive zymogens and amplify innate immune signalling. Clinically, AP is among the most common gastrointestinal indications for acute hospitalisation, and Iannuzzi JP et al., showed that the incidence of AP increased globally over a 56-year period from 1961 to 2016, with a pooled average annual percent change of 3.07% (95% CI: 2.30-3.84; n=34); translating into a substantial health-system burden driven by emergency presentations, prolonged inpatient care, critical care utilisation, and downstream complications [1]. Mechanistically, diverse aetiologies most commonly biliary obstruction and alcohol exposure converge on shared injury pathways. Transient ampullary obstruction and bile reflux can increase intraductal pressure and disrupt acinar secretion, while alcohol and its metabolites promote endoplasmic reticulum stress, mitochondrial dysfunction, oxidative injury, and altered intracellular calcium handling. These insults facilitate co-localisation of lysosomal hydrolases with zymogen granules, promoting intra-acinar trypsin generation; downstream activation of nuclear factor-κB (NF-κB) and inflammasome pathways drives early cytokine production (IL-1β, IL-6, TNF-α), chemokine-mediated neutrophil recruitment, microvascular dysfunction, and capillary leak. When the inflammatory response escapes pancreatic containment, Damage Associated Molecular Patterns (DAMPs), complement activation, and endothelial injury propagate Systemic Inflammatory Response Syndrome (SIRS) and perturb distant organ perfusion, thereby linking a local pancreatic event to Multi-Organ Dysfunction Syndrome (MODS) [2].

Although most patients experience a mild, self-limited course with resolution of organ dysfunction and minimal local complications, a clinically important minority (approximately 15-20%) develops severe disease characterised by pancreatic and/or peripancreatic necrosis, persistent organ failure, and systemic complications [2]. International consensus definitions (Revised Atlanta Classification) emphasise organ failure duration as the key discriminator: severe AP is defined by persistent organ failure lasting >48 hours, whereas moderately severe AP includes transient organ failure and/or local complications without sustained organ failure [3]. Because organ failure may be evolving during the first 24-48 hours, early clinical assessment can underestimate subsequent severity, which contributes to the well-recognised unpredictability of the early disease course [4]. This biological and clinical heterogeneity makes early risk stratification central to care [5,6].

Ranson's criteria require 11 parameters and cannot be fully calculated until 48 hours after admission, limiting usefulness at first contact; APACHE II is comparatively complex and is most practical in monitored/ICU contexts; and Bedside Index for Severity in Acute Pancreatitis (BISAP), while simpler and calculable early, still depends on five parameters and may have modest sensitivity/positive predictive value for severe outcomes [7-9]. These constraints have driven interest in rapidly available biomarkers that reflect the underlying pathobiology of AP and can support early diagnosis and prognostication. Among the best studied are CRP and urinary trypsinogen-based markers, which capture complementary phases of the disease process. CRP is a hepatocyte-derived acute-phase pentraxin whose transcription is primarily upregulated by IL-6, with additional modulation by IL-1β and other inflammatory mediators [10]. In AP, CRP correlates with the magnitude of systemic inflammation and has been repeatedly associated with pancreatic necrosis, persistent organ failure, and adverse clinical outcomes. However, its kinetics impose an important limitation: CRP rises progressively over the first 24-48 hours and typically performs best as a severity marker when measured or repeated around 48 hours after symptom onset/admission, rather than immediately at presentation [11,12].

Urinary trypsinogen markers, in contrast, are conceptually upstream: they aim to detect early intrapancreatic enzyme activation and acinar injury. Trypsinogen-2 and TAP can appear in urine early because pancreatic enzyme activation and cellular disruption increase circulating concentrations and renal filtration of these molecules [13]. Point-of-care urinary trypsinogen-2 dipstick assays have been evaluated as rapid screening tools on admission [14,15]; uTAP has similarly been explored as a mechanistic marker of early trypsinogen activation. The principal appeal of these assays is temporal - detection within hours of symptom onset can support early diagnostic confirmation in emergency/acute care contexts, particularly when serum enzymes or imaging are equivocal - but real-world uptake has been constrained by factors including test availability, cost, heterogeneity in performance across populations and disease spectra, and uncertainty regarding the most informative threshold/assay format for routine workflows [16,17].

Given that CRP predominantly reflects the systemic acute-phase response (a downstream, time-dependent integrator of inflammatory severity), whereas urinary trypsinogen-based measures more directly index early pancreatic enzyme activation (an upstream event closer to the initiating biology), a comparative understanding of their diagnostic and prognostic roles is clinically important. This review, therefore, aims to analyse CRP and urinary trypsinogen in AP, linking their biological bases to practical clinical applications, highlighting limitations that affect bedside implementation, and evaluating whether combined or sequential use can strengthen early diagnosis and risk stratification to improve overall management of AP.

MATERIALS AND METHODS

A literature search was conducted across PubMed/MEDLINE, Scopus, Web of Science, the Cochrane Library, and Google Scholar to identify human studies on CRP and urinary trypsinogen markers in AP. Studies included were original clinical research that assessed the diagnostic and prognostic value of CRP and urinary trypsinogen markers in AP, focusing on outcomes like confirmed AP diagnosis, severity stratification, and key clinical endpoints such as organ failure and mortality.

C-Reactive Protein (CRP)

The CRP has repeatedly shown time-dependent prognostic utility rather than strong 'rule-in' diagnostic specificity at presentation. In an early morphologic staging study, CRP ≥120 mg/L within five days identified necrotising pancreatitis with 84% accuracy and the CRP peak typically occurred on days 3-4, supporting its role as a subacute marker of evolving pancreatic injury rather than an admission test [18]. Alfonso V et al., (2003) reported good discrimination for pancreatic necrosis with CRP 200 mg/L giving 88% sensitivity/75% specificity, and a higher threshold 279 mg/L trading sensitivity for specificity , importantly, CRP ≤200 mg/L at 72 h was highlighted as clinically useful to rule out necrosis with high probability, whereas higher values warranted additional evaluation for necrosis [19]. More recent evidence has reinforced the timing-dependent utility of CRP in necrotising disease; in a 2024 systematic review and meta-analysis, CRP showed poor predictive accuracy for infected pancreatic necrosis within the first 72 hours of admission (pooled AUC 0.69; 95% CI 0.62–0.76) but good accuracy after 72 hours (pooled AUC 0.88; 95% CI 0.75-1.00), indicating that persistently elevated CRP is more useful as a later marker of necrotic or infective progression than as an isolated early predictor [20]. In a biomarker cohort of 150 confirmed AP cases assessed by Atlanta criteria, CRP did not separate mild vs severe disease on admission, but became prognostically informative by day 3, where Receiver Operating Characteristic (ROC) analysis for systemic complications showed CRP day-3 AUC 0.69 with an empiric cutoff of 214 mg/L (reflecting the delayed hepatic acute-phase response to cytokine signalling) [21].

In a retrospective cohort study of 379 patients with confirmed AP, Cardoso FS et al., found that CRP measured at 48 hours showed good prognostic discrimination for clinically important outcomes, with AUC 0.81 for predicting severe AP, AUC 0.77 for pancreatic necrosis, and AUC 0.79 for in-hospital mortality, indicating that 48-hour CRP reflects the intensity of the systemic inflammatory response and correlates with both local necrotic complications and adverse outcomes [22]. In a larger retrospective analysis using revised Atlanta outcomes (n=337 first-episode AP), the 48-h CRP 'trajectory' added actionable discrimination: a rise >900 mg/L from admission to 48 h had likelihood ratios comparable to an absolute CRP >1500 mg/L within 48 h (both yielding similar +LR/–LR), while the optimal absolute 48-h threshold for severe disease using the more stringent definition was >1900 mg/L, reinforcing that repeat CRP measurement improves early risk stratification versus a single admission value [11]. In a Portuguese cohort, CRP at 24 hour showed clinically relevant prognostic discrimination: the ROC for in-hospital mortality was AUC 0.80 and no deaths occurred when CRP <60 mg/L at 24 hour, whereas higher CRP categories aligned with higher mortality risk- suggesting value as an early 'reassurance' marker when low [23]. In a retrospective analysis of 161 patients with AP, Cho JH et al., evaluated 24-hour CRP for early severity prediction and reported that a 24-hour CRP threshold of ≥214 mg/L was associated with severe disease, with moderate overall discriminative ability (AUC 0.68; 95% CI 0.57-0.78) - suggesting that markedly elevated CRP at 24 hours can support early risk stratification, although its predictive performance is limited when used alone [24]. In a single-centre study of 225 patients with AP that examined the prediction of a complicated clinical course, Ahmad R et al., found that CRP measured at 48 hours was more informative than earlier measurements, showing moderate discrimination for complicated AP (AUC 0.70) and yielded a sensitivity of 68.09% and specificity of 66.89% [12]. Finally, beyond 'severity' labels, CRP has been linked to specific downstream complications, widely available marker that can flag patients who may later require prolonged monitoring, ICU-level support, and step-up interventions for necrosis-related collections [25]. Collectively, these primary data support a consistent clinical pattern: CRP is rarely decisive at admission, but serial measurement at 24-72 h meaningfully supports severity stratification and necrosis/complication risk, with thresholds clustering around 150-279 mg/L (depending on timing, outcome definition, and population) [Table/Fig-1] [9,12,13,19,23,26-32].

While CRP is the most commonly used inflammatory marker in AP, other biomarkers such as IL-6 and procalcitonin have also been investigated. IL-6 rises earlier than CRP and correlates closely with disease severity; however, its limited availability and higher cost restrict its routine use. Procalcitonin has shown promise in identifying infected pancreatic necrosis and bacterial complications but is less specific for overall disease severity. In comparison, CRP remains practical and widely accepted inflammatory marker for severity assessment in AP [33,34]. Despite its clinical utility, CRP has several limitations that restrict its role in early diagnosis. The delayed rise of CRP, with peak levels occurring 48 to 72 hours after disease onset, limits its effectiveness in the early phase of AP when critical management decisions are often required. Additionally, CRP is a non-specific marker and may be elevated in a wide range of inflammatory, infectious, or malignant conditions, reducing its specificity for AP. Furthermore, CRP reflects systemic inflammation rather than direct pancreatic enzyme activation. Consequently, patients with early or mild AP may have normal or only mildly elevated CRP levels despite ongoing pancreatic injury. These limitations highlight the need for complementary biomarkers that can detect AP earlier in its clinical course and provide insight into pancreatic-specific pathology [35].

Domain	Biomarker	Primary study	Clinical endpoint	Timing or cut-off	Sensitivity (%)	Specificity (%)	Other key metric(s)
Diagnostic	uTryp-2	Kemppainen EA et al., [26]	Diagnosis of Acute Pancreatitis (AP)	Rapid urine test	94.0	95.0	50/53 AP cases are positive
	uTryp-2	Kylänpää-Bäck M et al., [27]	Diagnosis of Acute Pancreatitis (AP)	Dipstick in ED cohort	96.0	92.0	All 9 severe attacks were detected
	uTryp-2	Jang T et al., [28]	Diagnosis of Acute Pancreatitis (AP)	Point-of-care urine test	100.0	96.0	Positive despite nondiagnostic lipase/amylase in some cases
	uTryp-2	Abraham P [29]	Diagnosis of Acute Pancreatitis (AP)	Suspected AP cohort	73.9	94.6	
Prognostic	CRP	Alfonso V et al., [19]	Pancreatic necrosis	72 h; 200 mg/L	88.0	75.0	AUC 0.862 (95% CI 0.778-0.946)
	CRP	Alfonso V et al., [19]	Pancreatic necrosis	72 h; 279 mg/L	72.0	88.0	Higher-specificity threshold
	uTAP	Neoptolemos JP et al., [30]	Severe Acute Pancreatitis (AP)	24 h; >35 nmol/L	58.0	73.0	Median uTAP 37 vs 15 nmol/L in severe vs mild AP
	CRP	Neoptolemos JP et al., [30]	Severe Acute Pancreatitis (AP)	24 h; >1500 mg/L	0.0	Not stated**	Poor early sensitivity
	uTAP	Neoptolemos JP et al., [30]	Severe Acute Pancreatitis (AP)	48 h	83.0	72.0	Combined testing not superior to uTAP alone
	CRP	Neoptolemos JP et al., [30]	Severe Acute Pancreatitis (AP)	48 h	86.0	61.0	Improved performance at 48 h
	uTAP	Tenner S et al., [31]	Severe attack/organ failure/CT necrosis	Admission; ≥10 ng/mL	100.0	85.0	NPV 100% for mild disease
	uTryp-2	Lempinen M et al., [13]	Severe Acute Pancreatitis (AP)	Admission	72.0	81.0	
	uTAP	Lempinen M et al., [13]	Severe Acute Pancreatitis (AP)	Admission	64.0	82.0	
	CRP	Lempinen M et al., [13]	Severe Acute Pancreatitis (AP)	Admission	29.0	93.0	Low early sensitivity
	uTryp-2	Lempinen M et al., [13]	Severe Acute Pancreatitis (AP)	24 h	82.0	78.0	Improved at 24 h
	uTAP	Lempinen M et al., [13]	Severe Acute Pancreatitis (AP)	24 h	52.0	92.0	More specific, less sensitive
	CRP	Lempinen M et al., [13]	Severe Acute Pancreatitis (AP)	24 h	84.0	72.0	
	uTryp-2	Huang QL et al., [32]	Severe Acute Pancreatitis (AP)	Within 24 h of symptom onset	65.7	66.4	AUC 0.724; NPV 88.4%
	uTAP	Huang QL et al., [32]	Severe Acute Pancreatitis (AP)	>35 nmol/L	63.2	65.8	AUC 0.722
	CRP	Ahmad R et al., [12]	Complicated Acute Pancreatitis (AP)	48 h; >1900 mg/L	68.09	66.89	AUC 0.70
	CRP	Cardoso FS et al., [23]	In-hospital mortality	24 h; <60 mg/L	Not stated	Not stated	NPV 100% when CRP <60 mg/L
	CRP	Cardoso FS et al., [23]	Walled-off necrosis	Maximum CRP; 185.5 mg/L	92.9	81.8	AUC 0.893

[Table/Fig-1]: Diagnostic and prognostic performance of CRP, urinary trypsinogen-2, and urinary Trypsinogen Activation Peptide (TAP) n in AP across representative primary studies [12,13,19,23,26-32].
**Specificity is not clinically meaningful when sensitivity is 0%

Urinary Trypsinogen and Trypsinogen Activation Peptide (TAP)

Urinary trypsinogen has emerged as an important biomarker for the early diagnosis of AP, as it directly reflects premature pancreatic enzyme activation an event central to the pathogenesis of the disease. Under physiological conditions, trypsinogen is secreted by pancreatic acinar cells into the duodenum, where it is activated to trypsin. In AP, intracellular activation of trypsinogen leads to the release of activated enzymes and enzyme precursors into the systemic circulation, which are subsequently filtered and excreted by the kidneys [36]. Two forms of urinary markers have been extensively studied: urinary trypsinogen-2 and uTAP. Trypsinogen-2 is a major isoenzyme released during pancreatic injury and is rapidly excreted in urine due to its relatively low molecular weight. TAP, a small peptide cleaved during the conversion of trypsinogen to trypsin, serves as a highly specific indicator of intrapancreatic trypsin activation. Because uTAP is generated at the earliest stages of enzyme activation, its presence in urine closely mirrors the initial pathological events of AP [13,14].

For diagnosis, early prospective cohorts of patients presenting with acute abdominal pain consistently showed a high rule-out value for uTryp-2 [26]. Similarly, in a larger prospective ED screening cohort of 525 consecutive abdominal-pain patients, suggesting that marked early protease-pathway activation is common in more aggressive disease phenotypes [27]. Subsequent point-of-care ED work reinforced that uTryp-2 can be positive even when traditional enzymes are not yet diagnostic: Jang T et al., noted that 7/17 had diagnostic CT findings plus a positive urine trypsinogen test despite non-diagnostic plasma lipase/amylase consistent with early urinary accumulation from high circulating load and reduced tubular reabsorption during systemic inflammation [28]. A prospective ED study from India illustrated that accuracy can vary with case-mix, timing, and reference standard, but specificity remains high when the dipstick is positive [29]. For severity stratification and clinically meaningful endpoints (e.g., necrosis and persistent organ failure), uTAP and uTryp-2 show complementary patterns [30]. A mechanistically consistent finding observed by Tenner S et al., where among patients presenting within 48 hour of symptom onset, an admission uTAP ≥10 ng/mL identified severe attacks (defined by organ failure and/or CT necrosis) with 100% sensitivity and 85% specificity, and had NPV 100% for mild disease supporting uTAP as an early 'high-risk' signal when measured close to onset [31]. Direct head-to-head comparisons also provide quantitative triage metrics; urinary protease-pathway markers peak earlier, whereas CRP becomes informative as systemic inflammation and necrosis

evolve [13]. Huang QL et al., observed that uTryp-2 had 65.7% sensitivity, 66.4% specificity, and NPV 88.4% for severe disease (AUC 0.724), closely paralleling uTAP, while CT severity index was highly specific (95.3%) but less sensitive (47.4%), illustrating a pragmatic trade-off: urine biomarkers can screen early severity risk before radiologic necrosis is fully established [32]. Supporting this time-dependent biology, a study focused on urinary trypsinogen-2 as a severity marker (Hedström J et al.,) reported moderate discrimination for severe vs mild pancreatitis (AUC 0.730) and stronger discrimination for necrotising vs non-necrotising disease (AUC 0.876), consistent with higher and more sustained enzyme activation in necrosis-prone attacks [37]. Collectively, these primary studies indicate that uTryp-2 is particularly useful for rapid early diagnosis/rule-out in acute abdominal pain pathways, while uTAP and (to a lesser extent) uTryp-2 provide early severity enrichment for endpoints driven by sustained enzyme activation and downstream inflammatory amplification (persistent organ failure and necrosis), with the strongest performance when sampling is anchored to time since symptom onset rather than time since admission.

The CRP and urinary trypsinogen represent two fundamentally different approaches to biomarker-based assessment of AP. While CRP reflects the downstream systemic inflammatory response, urinary trypsinogen directly mirrors early pancreatic enzyme activation. Understanding these differences is essential for determining their optimal clinical applications and limitations. One of the most important distinctions between CRP and urinary trypsinogen lies in the timing of their elevation. Urinary trypsinogen levels rise within hours of symptom onset, making it a highly sensitive marker for early diagnosis of AP. This early detectability provides a significant advantage in emergency settings, where rapid confirmation of diagnosis can guide prompt initiation of supportive therapy and appropriate patient triage. In contrast, CRP levels increase more slowly, typically becoming significantly elevated 24 to 48 hours after the onset of inflammation. As a result, CRP has limited utility in the early diagnostic phase of AP. However, this delayed rise aligns with the progression of systemic inflammation, making CRP more suitable for assessing disease severity and predicting complications during the subsequent course of illness [38].

CONCLUSION(S)

Overall, the evidence indicates that CRP and urinary trypsinogen-based markers (urinary trypsinogen-2 and uTAP) provide complementary information in AP. Urinary trypsinogen assays reflect early intrapancreatic enzyme activation and can support rapid diagnosis and early risk enrichment soon after symptom onset, particularly in emergency settings, whereas CRP- driven by the IL-6-mediated hepatic acute-phase response- is most informative when measured serially, typically 24-72 hours, for predicting necrosis, persistent organ failure, and other adverse outcomes. Used pragmatically, an approach that combines early urinary trypsinogen testing with repeat CRP measurement can improve early triage and severity stratification, but broader clinical adoption will depend on standardisation of assays and thresholds, integration with validated severity scores, and prospective validation across diverse patient populations.

REFERENCES

[1] Iannuzzi JP, King JA, Leong JH, Quan J, Windsor JW, Tanyingoh D, et al. Global Incidence of Acute Pancreatitis Is Increasing Over Time: A Systematic Review and Meta-Analysis. Gastroenterology. 2022;162(1):122-34.

[2] Venkatesh K, Glenn H, Delaney A, Andersen CR, Sasson SC. Fire in the belly: A scoping review of the immunopathological mechanisms of acute pancreatitis. Front Immunol. 2022;13:1077414.

[3] Foster BR, Jensen KK, Bakis G, Shaaban AM, Coakley FV. Revised Atlanta Classification for Acute Pancreatitis: A Pictorial Essay. Radiographics. 2016;36(3):675-87.

[4] Trikudanathan G, Yazici C, Evans Phillips A, Forsmark CE. Diagnosis and management of acute pancreatitis. Gastroenterology. 2024;167(4):673-88.

[5] Metri A, Bush N, Singh VK. Predicting the severity of acute pancreatitis: Current approaches and future directions. Surgery Open Science. 2024;19:109-17.

[6] Tenner S, Baillie J, DeWitt J, Vege SS. American College of Gastroenterology guideline: Management of acute pancreatitis. Am J Gastroenterol. 2013;108(9):1400-15; 16.

[7] Chandra S, Murali A, Bansal R, Agarwal D, Holm A. The Bedside Index for Severity in Acute Pancreatitis: A systematic review of prospective studies to determine predictive performance. J Community Hosp Intern Med Perspect. 2017;7(4):208-13.

[8] Zhu J, Wu L, Wang Y, Fang M, Liu Q, Zhang X. Predictive value of the Ranson and BISAP scoring systems for the severity and prognosis of acute pancreatitis: A systematic review and meta-analysis. PLoS One. 2024;19(4):e0302046.

[9] Larvin M, McMahon MJ. APACHE-II score for assessment and monitoring of acute pancreatitis. Lancet. 1989;2(8656):201-05.

[10] Zhou HH, Tang YL, Xu TH, Cheng B. C-reactive protein: Structure, function, regulation, and role in clinical diseases. Front Immunol. 2024;15:1425168.

[11] Stirling AD, Moran NR, Kelly ME, Ridgway PF, Conlon KC. The predictive value of C-reactive protein (CRP) in acute pancreatitis – is interval change in CRP an additional indicator of severity? HPB (Oxford). 2017;19(10):874-80.

[12] Ahmad R, Bhatti KM, Ahmed M, Malik KA, Rehman S, Abdulgader A, et al. C-reactive protein as a predictor of complicated acute pancreatitis: Reality or a myth? Cureus. 2021;13(11):e19265.

[13] Lempinen M, Stenman UH, Finne P, Puolakkainen P, Haapiainen R, Kemppainen E. Trypsinogen-2 and trypsinogen activation peptide (TAP) in urine of patients with acute pancreatitis. J Surg Res. 2003;111(2):267-73.

[14] Yasuda H, Kataoka K, Takeyama Y, Takeda K, Ito T, Mayumi T, et al. Usefulness of urinary trypsinogen-2 and trypsinogen activation peptide in acute pancreatitis: A multicenter study in Japan. World J Gastroenterol. 2019;25(1):107-17.

[15] Zaki M, Ali R, EL-Naggar D, Ammar M. The Predictive value of urinary Trypsinogen-2 dipstick for early diagnosis of acute pancreatitis in intensive care. QJM: An International Journal of Medicine. 2023;116.

[16] Andersen AM, Novovic S, Ersbøll AK, Jorgensen LN, Hansen MB. Urinary trypsinogen-2 dipstick in acute pancreatitis. Pancreas. 2010;39(1):26-30.

[17] Kamer E, Unalp HR, Derici H, Tansug T, Onal MA. Early diagnosis and prediction of severity in acute pancreatitis using the urine trypsinogen-2 dipstick test: A prospective study. World J Gastroenterol. 2007;13(46):6208-12.

[18] Uhl W, Büchler M, Malfertheiner P, Martini M, Beger HG. PMN-elastase in comparison with CRP, antiproteases, and LDH as indicators of necrosis in human acute pancreatitis. Pancreas. 1991;6(3):253-59.

[19] Alfonso V, Gómez F, López A, Moreno-Osset E, del Valle R, Antón MD, et al. Valor de la proteína C reactiva en la detección de la necrosis en la pancreatitis aguda [Value of C-reactive protein level in the detection of necrosis in acute pancreatitis]. Gastroenterol Hepatol. 2003;26(5):288-93. Spanish.

[20] Tarján D, Szalai E, Lipp M, Verbói M, Kói T, Erőss B, et al. Persistently high procalcitonin and c-reactive protein are good predictors of infection in acute necrotizing pancreatitis: A systematic review and meta-analysis. Int J Mol Sci. 2024;25(2):1273.

[21] Fisic E, Poropat G, Bilic-Zulle L, Licul V, Milic S, Stimac D. The role of IL-6, 8, and 10, sTNFr, CRP, and pancreatic elastase in the prediction of systemic complications in patients with acute pancreatitis. Gastroenterol Res Pract. 2013;2013:282645.

[22] Cardoso FS, Ricardo LB, Oliveira AM, Canena JM, Horta DV, Papoila AL, et al. C-reactive protein prognostic accuracy in acute pancreatitis: Timing of measurement and cutoff points. Eur J Gastroenterol Hepatol. 2013;25(7):784-89.

[23] Cardoso FS, Ricardo LB, Oliveira AM, Horta DV, Papoila AL, Deus JR, et al. C-Reactive Protein at 24 hours after hospital admission may have relevant prognostic accuracy in acute pancreatitis: A retrospective cohort study. GE Port J Gastroenterol. 2015;22(5):198-203.

[24] Cho JH, Kim TN, Chung HH, Kim KH. Comparison of scoring systems in predicting the severity of acute pancreatitis. World J Gastroenterol. 2015;21(8):2387-94.

[25] Almeida N, Fernandes A, Casela A. Predictors of severity and in-hospital mortality for acute pancreatitis: Is there any role for c-reactive protein determination in the first 24 hours? GE Port J Gastroenterol. 2015;22(5):187-89.

[26] Kemppainen EA, Hedström JI, Puolakkainen PA, Sainio VS, Haapiainen RK, Perhoniemi V, et al. Rapid measurement of urinary trypsinogen-2 as a screening test for acute pancreatitis. N Engl J Med. 1997;336(25):1788-93.

[27] Kylänpää-Bäck M, Kemppainen E, Puolakkainen P, Hedström J, Haapiainen R, Perhoniemi V, et al. Reliable screening for acute pancreatitis with rapid urine trypsinogen-2 test strip. Br J Surg. 2000;87(1):49-52.

[28] Jang T, Uzbielo A, Sineff S, Naunheim R, Scott MG, Lewis LM. Point-of-care urine trypsinogen testing for the diagnosis of pancreatitis. Acad Emerg Med. 2007;14(1):29-34.

[29] Abraham P. Point-of-care urine trypsinogen-2 test for diagnosis of acute pancreatitis. J Assoc Physicians India. 2011;59:231-32.

[30] Neoptolemos JP, Kemppainen EA, Mayer JM, Fitzpatrick JM, Raraty MG, Slavin J, et al. Early prediction of severity in acute pancreatitis by urinary trypsinogen activation peptide: A multicentre study. Lancet. 2000;355(9219):1955-60.

[31] Tenner S, Fernandez-del Castillo C, Warshaw A, Steinberg W, Hermon-Taylor J, Valenzuela JE, et al. Urinary trypsinogen activation peptide (TAP) predicts severity in patients with acute pancreatitis. Int J Pancreatol. 1997;21(2):105-10.

[32] Huang QL, Qian ZX, Li H. A comparative study of the urinary trypsinogen-2, trypsinogen activation peptide, and the computed tomography severity index as early predictors of the severity of acute pancreatitis. Hepatogastroenterology. 2010;57(102-103):1295-99.

[33] Staubli SM, Oertli D, Nebiker CA. Laboratory markers predicting severity of acute pancreatitis. Crit Rev Clin Lab Sci. 2015;52(6):273-83.
[34] Shakeev K, Klyuyev D, Ogizbayeva A, Baltabayeva A, Avdienko O, Derevyashkina X. Comparative evaluation of the prognostic accuracy of IL-6 and Angiopoietin-2 for early severity assessment in acute pancreatitis: A systematic review. Diseases. 2026;14(1):24.
[35] Zhao Y, Xia W, Lu Y, Chen W, Zhao Y, Zhuang Y. Predictive value of the C-reactive protein/albumin ratio in severity and prognosis of acute pancreatitis. Front Surg. 2022;9:1026604.
[36] Geisz-Fremy A. Pathologically relevant trypsinogen activation in pancreatitis. Am J Physiol Gastrointest Liver Physiol. 2026;330(2):G87-G97.
[37] Hedström J, Sainio V, Kemppainen E, Puolakkainen P, Haapiainen R, Kivilaakso E, et al. Urine trypsinogen-2 as marker of acute pancreatitis. Clin Chem. 1996;42(5):685-90.
[38] Meher S, Mishra TS, Sasmal PK, Rath S, Sharma R, Rout B, et al. Role of biomarkers in diagnosis and prognostic evaluation of acute pancreatitis. J Biomark. 2015;2015:519534.

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