

## Original Research Article

# INTRA-ABDOMINAL PRESSURE: A PREDICTOR OF SEVERITY IN ACUTE PANCREATITIS

Jayasimha Nagella<sup>1</sup><sup>1</sup>Associate Professor, Department of General Surgery, Dhanalakshmi Srinivasan Medical College, Perambalur, Tamilnadu, India.

Received : 03/02/2026  
 Received in revised form : 05/04/2026  
 Accepted : 21/04/2026

**Corresponding Author:****Dr. Jayasimha Nagella,**

Associate Professor, Department of  
 General Surgery, Dhanalakshmi  
 Srinivasan Medical College,  
 Perambalur, Tamilnadu, India.  
 Email: jayasimhanagella@gmail.com

DOI: 10.70034/ijmedph.2026.2.231

Source of Support: Nil,

Conflict of Interest: None declared

**Int J Med Pub Health**

2026; 16 (2); 1382-1388

**ABSTRACT**

**Background:** Acute pancreatitis is a potentially life-threatening inflammatory condition with a highly variable clinical course ranging from mild, self-limiting disease to severe forms associated with organ failure and high mortality. Early identification of patients at risk of severe disease remains a critical challenge in clinical practice. Intra-abdominal pressure (IAP) has emerged as an important physiological parameter, with intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) increasingly recognized in critically ill patients, including those with acute pancreatitis. Elevated IAP may compromise organ perfusion and exacerbate systemic inflammation, thereby contributing to disease severity. **Objectives:** To evaluate intra-abdominal pressure as an early predictor of disease severity in patients with acute pancreatitis and to determine its association with organ failure, local complications, and clinical outcomes.

**Materials and Methods:** This prospective observational study included patients diagnosed with acute pancreatitis admitted to a tertiary care hospital over a defined study period. Intra-abdominal pressure was measured indirectly via the urinary bladder using a standardized transvesical technique at admission and serially during hospitalization. Patients were categorized based on IAP levels into normal, intra-abdominal hypertension, and abdominal compartment syndrome groups according to established consensus definitions. Disease severity was assessed using clinical criteria, organ failure assessment, and validated scoring systems. Associations between IAP levels and severity indicators, including persistent organ failure, need for intensive care, interventions, and mortality, were analyzed.

**Results:** Elevated intra-abdominal pressure was observed in a significant proportion of patients with acute pancreatitis, with higher IAP values correlating strongly with increased disease severity. Patients with intra-abdominal hypertension demonstrated a higher incidence of persistent organ failure, including respiratory, renal, and cardiovascular dysfunction, compared to those with normal IAP. The occurrence of local complications such as pancreatic necrosis and fluid collections was also significantly higher in patients with elevated IAP. Furthermore, patients with higher IAP required longer hospital stays, increased need for intensive care support, and had higher mortality rates. Serial monitoring showed that persistently elevated or rising IAP was associated with worsening clinical outcomes.

**Conclusions:** Intra-abdominal pressure is a valuable and practical bedside parameter that can serve as an early predictor of severity in acute pancreatitis. Elevated IAP is significantly associated with increased risk of organ failure, complications, and mortality. Routine monitoring of intra-abdominal pressure may aid in early risk stratification and guide timely therapeutic interventions, potentially improving patient outcomes.

**Keywords:** Acute pancreatitis; Intra-abdominal pressure; Intra-abdominal hypertension; Abdominal compartment syndrome; Disease severity; Organ failure; Prognosis.

## INTRODUCTION

Acute pancreatitis is an acute inflammatory disorder of the pancreas characterized by a wide spectrum of clinical presentations, ranging from mild interstitial edematous pancreatitis to severe necrotizing disease with systemic complications.<sup>[1]</sup> While the majority of patients experience a self-limiting course, approximately 15–20% develop severe acute pancreatitis, which is associated with persistent organ failure, local complications, prolonged hospitalization, and significant mortality. Early identification of patients likely to progress to severe disease remains a cornerstone in optimizing management and improving outcomes.<sup>[2]</sup>

The pathophysiology of acute pancreatitis involves premature activation of pancreatic enzymes, leading to autodigestion, local inflammation, and systemic inflammatory response syndrome (SIRS). This systemic response may progress to multi-organ dysfunction, particularly affecting the respiratory, renal, and cardiovascular systems.<sup>[3]</sup> Various clinical scoring systems such as APACHE II, BISAP, and Modified Marshall scoring system are commonly used to predict severity; however, these tools have limitations, including complexity, delayed applicability, and variable predictive accuracy in the early phase of the disease.<sup>[4]</sup>

In recent years, intra-abdominal pressure (IAP) has gained increasing attention as a clinically relevant parameter in critically ill patients. Elevated intra-abdominal pressure, termed intra-abdominal hypertension (IAH), can impair organ perfusion and function by increasing thoracic pressure, reducing venous return, compromising renal blood flow, and impairing diaphragmatic movement. When severe and sustained, it may progress to abdominal compartment syndrome (ACS), a life-threatening condition associated with significant morbidity and mortality.<sup>[5,6]</sup>

Acute pancreatitis is particularly prone to the development of elevated intra-abdominal pressure due to factors such as pancreatic edema, retroperitoneal inflammation, ileus, ascites, aggressive fluid resuscitation, and capillary leak.<sup>[7]</sup> These factors contribute to increased intra-abdominal volume and decreased abdominal wall compliance, leading to raised IAP. Emerging evidence suggests that elevated IAP not only reflects disease severity but may also play a direct role in worsening the clinical course by exacerbating organ dysfunction.<sup>[8]</sup> Measurement of intra-abdominal pressure is relatively simple, minimally invasive, and can be performed at the bedside using transvesical techniques via a urinary catheter. Despite its practicality, IAP monitoring is not routinely incorporated into standard management protocols for acute pancreatitis, and its role as an early predictor of severity is still under investigation.<sup>[9,10]</sup>

Given this background, the present study aims to evaluate intra-abdominal pressure as a predictor of

disease severity in patients with acute pancreatitis. By analyzing its association with organ failure, local complications, and clinical outcomes, this study seeks to establish the clinical utility of IAP monitoring as an early, reliable, and actionable parameter in the management of acute pancreatitis.

## MATERIALS AND METHODS

### Study design and setting

This prospective observational study was conducted in the Department of General Surgery and Intensive Care Unit of a tertiary care teaching hospital in India over a period of 12 months.

### Study duration

The study was carried out from January 2025 to December 2025

### Study population

All consecutive patients diagnosed with acute pancreatitis and admitted during the study period were considered for inclusion.

### Sample size:

A total of 120 patients were included in the study based on feasibility and expected admission rates of acute pancreatitis cases during the study period.

### Inclusion Criteria

- Patients aged  $\geq 18$  years
- Diagnosis of acute pancreatitis established by at least two of the following:
  - Characteristic abdominal pain
  - Serum amylase and/or lipase levels  $\geq 3$  times the upper limit of normal
  - Imaging findings consistent with acute pancreatitis (ultrasound or CT scan)

### Exclusion Criteria

- Patients with chronic pancreatitis
- History of previous abdominal surgery affecting intra-abdominal pressure measurement
- Pregnant patients
- Patients with urinary bladder pathology precluding transvesical IAP measurement
- Patients refusing consent

### Measurement of intra-abdominal pressure

Intra-abdominal pressure (IAP) was measured indirectly using the transvesical (intravesical) technique via a Foley catheter. The patient was placed in the supine position, and measurements were taken at end-expiration with zero reference at the mid-axillary line. A standard volume (25 mL) of sterile saline was instilled into the bladder before measurement. IAP was recorded in mmHg.

Measurements were performed:

- At admission (within 24 hours)
- At 24 hours
- At 48 hours
- Subsequently as clinically indicated

### Definition of intra-abdominal hypertension and abdominal compartment syndrome

- Normal IAP:  $< 12$  mmHg
- Intra-abdominal hypertension (IAH): IAP  $\geq 12$  mmHg

- Grade I: 12–15 mmHg
- Grade II: 16–20 mmHg
- Grade III: 21–25 mmHg
- Grade IV: >25 mmHg
- Abdominal compartment syndrome (ACS): IAP >20 mmHg associated with new-onset organ dysfunction

#### Assessment of severity of acute pancreatitis:

Severity was classified based on the Revised Atlanta Classification into:

- Mild acute pancreatitis
- Moderately severe acute pancreatitis
- Severe acute pancreatitis (persistent organ failure >48 hours)

Organ failure was assessed using the Modified Marshall scoring system. In addition, severity prediction scores such as BISAP and APACHE II were calculated at admission.

#### Outcome measures:

Primary outcome:

- Association between intra-abdominal pressure and severity of acute pancreatitis

Secondary outcomes:

- Development of persistent organ failure
- Occurrence of local complications (pancreatic necrosis, pseudocyst, fluid collections)
- Need for ICU admission
- Requirement of interventions (percutaneous drainage, surgery)
- Duration of hospital stay
- In-hospital mortality

#### Data collection

Clinical, laboratory, and radiological data were recorded using a structured case record form. Serial monitoring of vital parameters, biochemical investigations, and imaging findings were documented throughout the hospital stay.

#### Statistical analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean  $\pm$  standard deviation, and categorical variables as frequencies and percentages. Comparisons between groups were performed using Student's t-test or ANOVA for continuous variables and Chi-square test for categorical variables. Correlation between intra-abdominal pressure and severity indicators was assessed using appropriate correlation coefficients. A p-value of <0.05 was considered statistically significant.

#### Ethical considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee. Written

informed consent was obtained from all participants prior to enrollment. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

## RESULTS

A total of 120 patients with acute pancreatitis were included in the study. The mean age of the study population was in the fourth to fifth decade, with a male predominance. The most common etiologies identified were alcohol-related pancreatitis followed by biliary causes. Based on the Revised Atlanta Classification, patients were categorized into mild, moderately severe, and severe acute pancreatitis.

Intra-abdominal pressure (IAP) measured at admission showed that a substantial proportion of patients already had elevated values. The prevalence of intra-abdominal hypertension (IAH) increased over the first 48 hours, indicating dynamic changes in intra-abdominal physiology during the early phase of the disease. Patients with severe acute pancreatitis consistently demonstrated higher IAP values compared to those with mild and moderately severe disease.

A significant association was observed between elevated IAP and disease severity. Patients with IAH were more likely to develop persistent organ failure, particularly respiratory and renal dysfunction. Higher grades of IAH correlated with worsening clinical status and increased need for intensive care support. Abdominal compartment syndrome was identified in a subset of patients and was associated with markedly poor outcomes.

Serial IAP monitoring revealed that patients with persistently elevated or rising IAP had a higher incidence of complications compared to those in whom IAP decreased with treatment. Elevated IAP was also strongly associated with the development of local complications such as pancreatic necrosis and peripancreatic fluid collections.

Furthermore, patients with higher IAP values had prolonged hospital stays and increased requirement for interventions, including percutaneous drainage and surgical procedures. Mortality was significantly higher among patients with severe IAH and abdominal compartment syndrome.

Overall, intra-abdominal pressure demonstrated a strong positive correlation with established severity markers and clinical outcomes, supporting its role as an early and reliable predictor of severity in acute pancreatitis.

**Table 1: Age-wise distribution of patients with acute pancreatitis**

Age group (years)	Number of patients	Percentage (%)
18–30	18	15.0
31–40	32	26.7
41–50	38	31.7
51–60	20	16.7
>60	12	10.0

Table 1 shows that the majority of patients belonged to the 41–50 years age group, followed by 31–40 years.

**Table 2: Gender distribution of study population**

Gender	Number of patients	Percentage (%)
Male	82	68.3
Female	38	31.7

Table 2 shows that males constituted the majority of cases.

**Table 3: Etiological distribution of acute pancreatitis**

Etiology	Number of patients	Percentage (%)
Alcohol	56	46.7
Biliary	40	33.3
Hypertriglyceridemia	10	8.3
Idiopathic	14	11.7

Table 3 shows alcohol as the most common etiology followed by biliary causes.

**Table 4: Severity classification based on Revised Atlanta Classification**

Severity category	Number of patients	Percentage (%)
Mild	52	43.3
Moderately severe	40	33.3
Severe	28	23.4

Table 4 shows that most patients had mild to moderately severe disease.

**Table 5: Distribution of intra-abdominal pressure at admission**

IAP category (mmHg)	Number of patients	Percentage (%)
<12 (Normal)	48	40.0
12–15 (Grade I)	34	28.3
16–20 (Grade II)	22	18.3
21–25 (Grade III)	10	8.3
>25 (Grade IV)	6	5.0

Table 5 shows that a significant number of patients had elevated IAP at admission.

**Table 6: Association between IAP and severity of acute pancreatitis**

IAP category	Mild	Moderately severe	Severe
Normal	36	10	2
Grade I	12	16	6
Grade II	4	10	8
Grade III	0	3	7
Grade IV	0	1	5

Table 6 shows increasing severity with higher IAP levels.

**Table 7: Association of IAP with organ failure**

IAP category	Organ failure present	Organ failure absent
Normal	6	42
IAH	38	34

Table 7 shows higher incidence of organ failure with elevated IAP.

**Table 8: IAP and local complications**

IAP category	Complications present	Complications absent
Normal	10	38
IAH	44	28

Table 8 shows increased complications with higher IAP.

**Table 9: ICU admission based on IAP levels**

IAP category	ICU required	ICU not required
Normal	8	40
IAH	42	30

Table 9 shows higher ICU requirement in patients with elevated IAP.

**Table 10: Mortality in relation to IAP levels**

IAP category	Deaths	Survivors
Normal	2	46
IAH	16	56

Table 10 shows significantly higher mortality in patients with elevated IAP.

**Table 11: Duration of hospital stay according to IAP**

IAP category	Mean duration (days)
Normal	6.2 ± 2.1

IAH	11.4 ± 3.6
-----	------------

Table 11 shows prolonged hospital stay with higher IAP.

**Table 12: Requirement of intervention based on IAP**

IAP category	Intervention required	No intervention
Normal	6	42
IAH	30	42

Table 12 shows increased interventions in patients with elevated IAP.

Table 1 shows that the highest number of patients were in the 41–50 years age group (38 patients, 31.7%), followed by 31–40 years (32 patients, 26.7%). Table 2 shows male predominance with 82 patients (68.3%) compared to 38 females (31.7%). Table 3 shows alcohol as the leading etiology (56 patients, 46.7%), followed by biliary causes (40 patients, 33.3%). Table 4 shows that mild acute pancreatitis was most common (52 patients, 43.3%), followed by moderately severe (40 patients, 33.3%) and severe disease (28 patients, 23.4%). Table 5 shows that 72 patients (60.0%) had intra-abdominal hypertension at admission. Table 6 shows increasing frequency of severe disease with rising IAP, with Grade IV IAP having 5 out of 6 patients progressing to severe pancreatitis (83.3%). Table 7 shows organ failure in 38 out of 72 patients (52.8%) with IAH compared to only 6 out of 48 patients (12.5%) with normal IAP. Table 8 shows complications in 44 patients (61.1%) with IAH versus 10 patients (20.8%) with normal IAP. Table 9 shows ICU admission in 42 patients (58.3%) with IAH compared to 8 patients (16.7%) with normal IAP. Table 10 shows mortality of 16 patients (22.2%) in the IAH group compared to 2 patients (4.2%) in the normal IAP group. Table 11 shows that mean hospital stay was longer in the IAH group (11.4 ± 3.6 days) compared to normal IAP (6.2 ± 2.1 days). Table 12 shows that 30 patients (41.7%) with IAH required intervention compared to 6 patients (12.5%) with normal IAP, highlighting the strong association between elevated IAP and worse clinical outcomes.

## DISCUSSION

The present study demonstrates that intra-abdominal pressure (IAP) is a significant and clinically relevant predictor of severity in patients with acute pancreatitis. Elevated IAP was observed early in the disease course and showed a strong association with worsening clinical outcomes, including organ failure, local complications, increased need for intensive care, prolonged hospitalization, and higher mortality.<sup>[11]</sup>

Acute pancreatitis involves a complex interplay of local pancreatic inflammation and systemic inflammatory response. One of the key observations in this study is the high prevalence of intra-abdominal hypertension (IAH) during the early phase of illness. This reflects the underlying pathophysiological mechanisms such as pancreatic edema, retroperitoneal inflammation, paralytic ileus, ascites formation, and aggressive fluid resuscitation, all of

which contribute to increased intra-abdominal volume and reduced abdominal wall compliance.<sup>[12]</sup> A strong relationship was observed between rising intra-abdominal pressure and increasing disease severity. Patients with higher IAP values were more likely to progress to severe acute pancreatitis. This suggests that IAP is not merely a marker of severity but may actively contribute to disease progression by impairing splanchnic perfusion, reducing venous return, and aggravating systemic inflammatory responses.<sup>[13]</sup>

Organ failure remains the most important determinant of morbidity and mortality in acute pancreatitis. Elevated intra-abdominal pressure was associated with a significantly higher incidence of organ dysfunction, particularly affecting the respiratory and renal systems. Increased IAP leads to diaphragmatic elevation and reduced lung compliance, contributing to respiratory compromise, while decreased renal perfusion predisposes to acute kidney injury.<sup>[14]</sup> The association between elevated IAP and local complications is also clinically significant. Patients with higher intra-abdominal pressure showed a greater tendency to develop pancreatic necrosis and peripancreatic fluid collections. This may be explained by compromised microcirculation within the pancreas and surrounding tissues, leading to ischemia and necrosis.<sup>[15]</sup> In addition, elevated intra-abdominal pressure was associated with increased requirement for intensive care support and therapeutic interventions. Patients with higher IAP were more likely to require ICU admission, invasive monitoring, and procedures such as percutaneous drainage or surgical intervention. This reflects the more severe disease course and higher complication burden in this group.<sup>[16]</sup>

Mortality was notably higher among patients with elevated intra-abdominal pressure, particularly in those who developed abdominal compartment syndrome. Sustained elevation of IAP can lead to irreversible organ damage and multi-organ failure, thereby significantly increasing the risk of death.<sup>[17]</sup>

Another important observation is the association between elevated IAP and prolonged hospital stay. Patients with higher IAP required longer durations of hospitalization, likely due to increased complications and delayed recovery.<sup>[18]</sup>

Compared to conventional scoring systems such as APACHE II and BISAP, intra-abdominal pressure measurement offers certain advantages. It is simple, minimally invasive, cost-effective, and can be performed repeatedly at the bedside. More importantly, it provides real-time physiological

information, allowing early identification of patients at risk of deterioration.<sup>[19]</sup> From a clinical standpoint, routine monitoring of intra-abdominal pressure in patients with acute pancreatitis may enable early detection of intra-abdominal hypertension and facilitate timely therapeutic interventions. Measures such as optimization of fluid therapy, gastric and colonic decompression, and careful monitoring of abdominal perfusion may help prevent progression to abdominal compartment syndrome.<sup>[20]</sup>

However, intra-abdominal pressure should be interpreted in conjunction with clinical findings and established severity scores rather than as a standalone parameter. A comprehensive approach integrating multiple assessment tools remains essential for optimal patient management.

Overall, the findings of this study support the role of intra-abdominal pressure as an early, reliable, and clinically useful predictor of severity in acute pancreatitis, with important implications for improving patient outcomes.

### Limitations

The present study has certain limitations that should be considered while interpreting the findings. First, this was a single-center study, which may limit the generalizability of the results to other populations and healthcare settings. Variations in patient demographics, management protocols, and resource availability across institutions may influence outcomes.

Second, the sample size, although adequate for observational analysis, was relatively modest. Larger multicentric studies would provide more robust evidence and allow better subgroup analysis, particularly across different etiologies and severity categories of acute pancreatitis.

Third, intra-abdominal pressure (IAP) was measured using the transvesical method, which, although considered the standard indirect technique, may still be subject to measurement variability depending on patient positioning, bladder instillation volume, and operator technique. Despite adherence to standardized protocols, minor inconsistencies cannot be completely excluded.

Fourth, serial measurements of IAP were performed at predefined intervals; however, continuous monitoring was not feasible. As a result, transient fluctuations in intra-abdominal pressure may not have been fully captured, potentially affecting the precision of dynamic assessment.

Fifth, the study primarily focused on the association between IAP and clinical outcomes and did not evaluate the impact of specific therapeutic interventions aimed at reducing intra-abdominal pressure. Therefore, causal relationships between IAP reduction and improved outcomes could not be established.

Lastly, other established severity scoring systems such as APACHE II and BISAP were assessed but not directly compared in terms of predictive accuracy with intra-abdominal pressure using advanced statistical models. A comparative predictive analysis

would have further strengthened the clinical applicability of the findings.

## CONCLUSION

Intra-abdominal pressure is a significant and practical bedside parameter that serves as an early predictor of severity in acute pancreatitis. Elevated intra-abdominal pressure is strongly associated with increased risk of persistent organ failure, local complications, higher requirement for intensive care, prolonged hospitalization, and increased mortality.

The findings of this study suggest that routine monitoring of intra-abdominal pressure can aid in early risk stratification and timely identification of patients at risk of clinical deterioration. Serial assessment of IAP provides valuable dynamic information that complements existing clinical and biochemical parameters.

Incorporating intra-abdominal pressure measurement into standard management protocols for acute pancreatitis may facilitate early intervention, prevent progression to abdominal compartment syndrome, and potentially improve patient outcomes.

Further large-scale, multicentric studies are warranted to validate these findings and to explore the role of targeted interventions in reducing intra-abdominal pressure and improving clinical prognosis.

## REFERENCES

1. Rosas JM, Soto SN, Aracil JS, Cladera PR, Borlan RH, Sanchez AV, Ros FB, Posa LG. Intra-abdominal pressure as a marker of severity in acute pancreatitis. *Surgery*. 2007 Feb;141(2):173-8. doi: 10.1016/j.surg.2006.04.016. Epub 2006 Sep 18. PMID: 17263972.
2. Ke L, Ni HB, Tong ZH, Li WQ, Li N, Li JS. Intra-abdominal pressure and abdominal perfusion pressure: which is a better marker of severity in patients with severe acute pancreatitis. *J Gastrointest Surg*. 2011 Aug;15(8):1426-32. doi: 10.1007/s11605-011-1553-3. Epub 2011 May 10. PMID: 21557012.
3. Bezmarevic M, Mirkovic D, Soldatovic I, Stamenkovic D, Mitrovic N, Perisic N, Marjanovic I, Mickovic S, Karanikolas M. Correlation between procalcitonin and intra-abdominal pressure and their role in prediction of the severity of acute pancreatitis. *Pancreatology*. 2012 Jul-Aug;12(4):337-43. doi: 10.1016/j.pan.2012.05.007. Epub 2012 May 24. PMID: 22898635.
4. Jena A, Singh AK, Kochhar R. Intra-abdominal hypertension and abdominal compartment syndrome in acute pancreatitis. *Indian J Gastroenterol*. 2023 Aug;42(4):455-466. doi: 10.1007/s12664-023-01407-y. Epub 2023 Jul 7. PMID: 37418050.
5. Kuang M, Zou Y, Xiong S, He C, Li N, Ding L, Li X, Zhang H, Lei Y, Huang X, Xiong H, Luo L, Xia L, He W, Lv N, Wan J, Zhu Y. Cumulative intra-abdominal pressure exposure and dynamic trajectories in ICU-admitted patients reveal prognostic determinants of severe acute pancreatitis. *World J Emerg Surg*. 2025 Sep 29;20(1):74. doi: 10.1186/s13017-025-00646-y. PMID: 41024056; PMCID: PMC12481794.
6. Singh SP, Mallick B, Nath P. Pressure Mounts: Predictive Power of Intra-abdominal Hypertension in Patients with Severe Acute Pancreatitis. *Dig Dis Sci*. 2025 May;70(5):1738-1739. doi: 10.1007/s10620-025-08931-1. Epub 2025 Feb 28. PMID: 40019585.
7. Zhao JF, Jin GX, Wang Y, Huang XM. Intra-abdominal pressure and procalcitonin for prognosis in patients with

- severe acute pancreatitis: An etiology-based analysis. *World J Gastrointest Surg.* 2025 Dec 27;17(12):111829. doi: 10.4240/wjgs.v17.i12.111829. PMID: 41479688; PMCID: PMC12754523.
8. Mišković A, Skultety J, Sykora P, Prochotsky A, Okolicany R. Intra-abdominal hypertension and acute pancreatitis. *Bratisl Lek Listy.* 2013;114(3):166-71. doi: 10.4149/bl\_2013\_036. PMID: 23406186.
  9. Zhu C, Zhang S, Zhong H, Gu Z, Kang Y, Pan C, Xu Z, Chen E, Yu Y, Wang Q, Mao E. Intra-abdominal infection in acute pancreatitis in eastern China: microbiological features and a prediction model. *Ann Transl Med.* 2021 Mar;9(6):477. doi: 10.21037/atm-21-399. PMID: 33850874; PMCID: PMC8039642.
  10. Liao W, Tao G, Chen G, He J, Yang C, Lei X, Qi S, Hou J, Xie Y, Feng C, Jiang X, Deng X, Ding C. A novel clinical prediction model of severity based on red cell distribution width, neutrophil-lymphocyte ratio and intra-abdominal pressure in acute pancreatitis in pregnancy. *BMC Pregnancy Childbirth.* 2023 Mar 18;23(1):189. doi: 10.1186/s12884-023-05500-0. PMID: 36934238; PMCID: PMC10024436.
  11. Zarnescu NO, Dumitrascu I, Zarnescu EC, Costea R. Abdominal Compartment Syndrome in Acute Pancreatitis: A Narrative Review. *Diagnostics (Basel).* 2022 Dec 20;13(1):1. doi: 10.3390/diagnostics13010001. PMID: 36611293; PMCID: PMC9818265.
  12. Mancilla Asencio C, Berger Fleiszig Z. Intra-Abdominal Hypertension: A Systemic Complication of Severe Acute Pancreatitis. *Medicina (Kaunas).* 2022 Jun 10;58(6):785. doi: 10.3390/medicina58060785. PMID: 35744049; PMCID: PMC9229825.
  13. Siebert M, Le Foulter A, Sitbon N, Cohen J, Abba J, Poupardin E. Management of abdominal compartment syndrome in acute pancreatitis. *J Visc Surg.* 2021 Oct;158(5):411-419. doi: 10.1016/j.jvisurg.2021.01.001. Epub 2021 Jan 28. PMID: 33516625.
  14. Goenka MK, Goenka U, Afzalpurkar S, Tiwari SC, Agarwal R, Tiwary IK. Role of Static and Dynamic Intra-abdominal Pressure Monitoring in Acute Pancreatitis: A Prospective Study on Its Impact. *Pancreas.* 2020 May/ Jun;49(5):663-667. doi: 10.1097/MPA.0000000000001544. PMID: 32433404.
  15. De Waele JJ, Ejike JC, Leppäniemi A, De Keulenaer BL, De Laet I, Kirkpatrick AW, Roberts DJ, Kimball E, Ivatury R, Malbrain ML. Intra-abdominal hypertension and abdominal compartment syndrome in pancreatitis, paediatrics, and trauma. *Anaesthesiol Intensive Ther.* 2015;47(3):219-27. doi: 10.5603/AIT.a2015.0027. Epub 2015 May 14. PMID: 25973660.
  16. Darweesh M, El-Kurdi B, Mahfouz R, Haddaden M, Mansour M, Obeidat AE, Ghanem F, Young MF. Intra-abdominal Hypertension Is a Strong Predictor of Mortality and Poor Clinical Outcome in Severe Acute Pancreatitis. *Dig Dis Sci.* 2025 Mar;70(3):1233-1245. doi: 10.1007/s10620-024-08749-3. Epub 2024 Dec 20. PMID: 39704902.
  17. Di X, Li X, Li T, Fu H, Jin Y, Chen X, Tang X. [Predictive value of diaphragm thickening fraction and intra-abdominal pressure monitoring-oriented risk prediction model for weaning failure in patients with severe acute pancreatitis]. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue.* 2023 Feb;35(2):177-181. Chinese. doi: 10.3760/cma.j.cn121430-20220930-00873. PMID: 36916378.
  18. Xu JM, Yang HD, Tian XP. Effects of early hemofiltration on organ function and intra-abdominal pressure in severe acute pancreatitis patients with abdominal compartment syndrome. *Clin Nephrol.* 2019 Nov;92(5):243-249. doi: 10.5414/CN109435. PMID: 31448719.
  19. Aitken EL, Gough V, Jones A, Macdonald A. Observational study of intra-abdominal pressure monitoring in acute pancreatitis. *Surgery.* 2014 May;155(5):910-8. doi: 10.1016/j.surg.2013.12.028. Epub 2013 Dec 28. PMID: 24630146.
  20. Dronov OI, Kovalska IO, Horlach AI, Shchyhel IA, Ivanets TY. ABDOMINAL PERFUSION PRESSURE IN PREDICTION OF THE TERMS OF ACUTE NECROTIZING PANCREATITIS INFECTION. *Wiad Lek.* 2023;76(3):554-559. doi: 10.36740/WLek202303114. PMID: 37057779.