Acute Pancreatitis: Radiological Detection and Clinical Significance of Pancreatic Ascites, Pleural and Parapancreatic Fluid Effusions

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Abstract: Fluid collections are common manifestations of local complications of acute pancreatitis (AP). The determination of fluid collections is important in stratifying the severity of the course of acute pancreatitis and choosing the appropriate management. In this study, the frequency of detection of fluid effusions by various instrumental methods and their clinical significance in 677 patient was assessed, taking into account the severity of the course of AP and anatomical localization of fluid accumulations. The computed tomography (CT) method showed its advantage in detecting fluid effusions in the pleural cavities, while the ultrasound method showed its indisputable significant advantage in the diagnosis of fluid effusions located parapancreatically and in the lesser sac: the highest frequency of detection of fluid effusion was in 65.3% of all patients in the general group using CT compared to 39% using ultrasound and 12.5% using chest X-ray ($p<0.05$). Each of the above methods showed different sensitivity depending on the anatomical areas of fluid effusion detection. In particular, the CT method revealed the presence of fluid in the pleural cavities in 50.7% of the total group, in the abdominal cavity in 36.0% of cases, and only in 8.0% of cases in the parapancreatic or lesser sac. The opposite picture was revealed when using the ultrasound method, in which fluid was found in the parapancreatic/lesser sac in the largest number of cases – 28.1%, in the abdominal cavity – in 22.6% of cases, and in the pleural cavity – in 14.3% of cases.

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Introduction

The development of acute pancreatitis (AP) complications is a decisive and important determinant of its course and consequences. Mortality of patients without complications is about 3%, that of patients with pancreatic necrosis is 15%, and for patients with persistent organ failure it reaches up to 35% (Vivian et al., 2019). Fluid effusions are frequent manifestations of local complications of AP. In particular, fluid parapancreatic collections occur in 5–15% of cases (Poornachandra et al., 2011). Pancreatic ascites occurs with a frequency of 30 to 40% (Samanta et al., 2019). The incidence of pleural effusion in AP reaches 34% (Zeng et al., 2021). A number of studies have shown that all three types of fluid effusions are a common complication of AP, have a higher accuracy in reflecting the severity of AP than scoring systems, and they are a reliable indicator for predicting the severity of the course of AP within 24 hours after admission (Maringhini et al., 1996; Ocampo et al., 2008; de Oliveira et al., 2019).

Fluid effusions can be easily detected during diagnostic imaging (Zeng et al., 2023). Ultrasound, X-ray method and computed tomography (CT) method are standard for detection of fluid accumulation in AP. All three methods have different specificity, accuracy, reproducibility, practicality, and economy, which, accordingly, limits their application (Dhaka et al., 2015; Ortiz Morales et al., 2019; Hu et al., 2023).

The question of the development of fluid effusions in AP requires further study. A clear understanding of the pathogenesis of the appearance of fluid effusions in various cavities at AP is necessary. In recent years, significant progress has been made in understanding the development and clear differentiation of the four types of parapancreatic fluid accumulations (Zhao et al., 2015). Individual studies have appeared that also described various pathogenetic variants of pancretogenic ascites (Dugernier et al., 2000; Bush and Rana, 2022). There is a number of works that describe the clinic and diagnosis of pleural effusion (Browne and Pitchumoni, 2006; Karki et al., 2019; Luiken et al., 2022) and it has been repeatedly demonstrated that they tend to accumulate on the left side (Kumar et al., 2018). With small volumes, all three types of fluid effusions can be easily regressed against the background of infusion therapy of AP. When their volume increases, there is a need for certain interventions and the risk of fatal consequences rises (Ocampo et al., 2008).

Recently, several studies have attempted to quantify the volume of pleural effusion obtained during early CT studies, with the hope that this will be a valuable biomarker for determining the prognosis of AP (Yan et al., 2021). However, there are still no unified criteria for localization and fluid effusions volumes that can be considered clinically significant. Although complications determine outcome and mortality in patients with AP, there is limited data on the relationship between fluid effusions and the severity of AP. Understanding the relationship of fluid effusions with the severity of AP, treatment outcomes and their rapid detection can improve early diagnosis and reduce mortality from AP complications.

The purpose of the work was to evaluate the frequency of detection of fluid effusions by various instrumental methods and their clinical significance, taking into account the severity of the course of AP, their anatomical location and genesis of AP.

Material and Methods

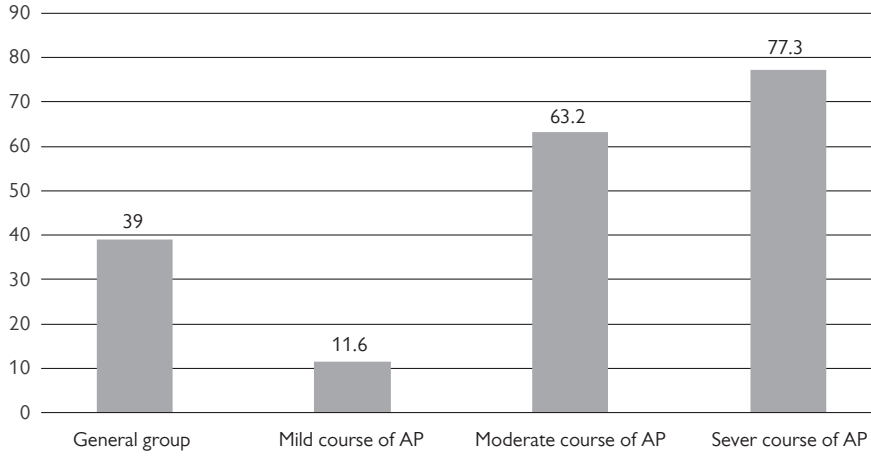
We retrospectively analysed the data of 677 patients with AP who were treated at the surgical department and the intensive care unit of the Vinnytsia city clinical hospital of emergency medical care and the Vinnytsia regional clinical hospital named after Pirogov during the period from 2017 to 2023. Collection and processing of clinical and laboratory material was carried out in compliance with all ethical principles of the Declaration of Helsinki.

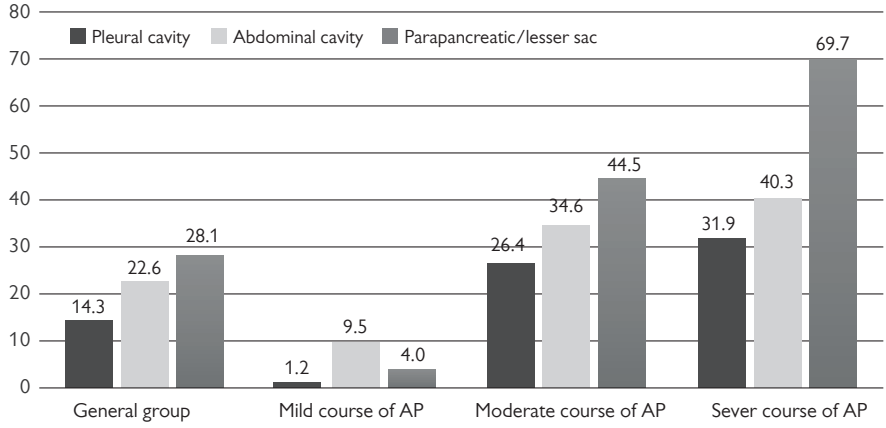
All patients were divided into three severity groups according to the criteria of Atlanta 2012. Mild acute pancreatitis is not accompanied by organ failure, local or systemic complications. Moderate acute pancreatitis is determined by the presence of transient organ failure and/or local complications. The severe course of acute pancreatitis is characterized by persistent organ failure, that is, organ failure lasting more than 48 hours (Banks et al., 2013).

Among all examined 677 patients, 356 patients had a mild course of AP, 192 patients had a moderate course, and 129 patients had a severe course. According to the etiology, the distribution was as follows: alcoholic genesis of AP consisted of 95 (14%) cases, biliary – 126 (18.7%), alimentary – 254 (37.5%), postoperative – 52 (7.7%), post-traumatic – 6 (0.9%), medicinal – 9 (1.3%), of unknown etiology – 135 (19.9%) cases. There were 411 (60.7%) men, 266 (39.3%) women.

Detection of liquid was carried out by three methods – ultrasonic, X-ray and computer tomography. All fluid effusions were divided into three groups by localization: in the pleural cavities, in the abdominal cavity and parapancreatic/or in the lesser sac. Visualization of fluid effusions was carried out during the entire period of treatment. When "traces of fluid" appeared in the studied anatomical areas, which did not affect the clinical course of the disease and had no clinical significance, resolved quickly on their own, the last cases were stratified as mild AP.

For statistical data analysis, normality was assessed using the Shapiro-Wilk test. Continuous variables were described as medians and interquartile ranges. Categorical variables were expressed as frequencies and percentages and data comparisons in independent samples were conducted using χ^2. Statistical evaluation was performed using the SPSS statistical package and a P-value < 0.05 was considered statistically significant.





	P1-2	P1-3	P1-4	P2-3	P2-4	P3-4
Accumulation of fluid in cavities according to ultrasound	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.0100**
Pleural cavity	**<0.0001**	**0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.3000**
Abdominal cavity	**<0.0001**	**0.0010**	**<0.0001**	**<0.0001**	**<0.0001**	**0.3100**
Parapancreatic/lesser sac	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**

P1-2 – marked reliability when comparing the general group (n=677) and the group with a mild course (n=356); P1-3 – general group and moderately severe (n=192); P1-4 – of the general group and with a severe course of AP (acute pancreatitis) (n=129); P2-3 – mild and moderately severe; P2-4 – mild and severe; and P3-4 – moderately severe and severe course of AP according to the χ^2 criterion for independent samples.

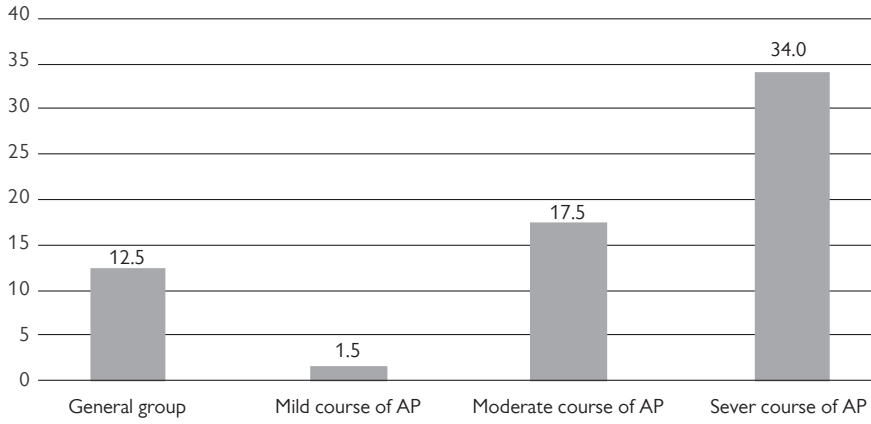
Figure 1 – Frequency of cases of fluid effusions in cavities in patients with acute pancreatitis according to ultrasound data (number of cases in %).

Results

According to ultrasound data, the above analysis of fluid accumulation in different locations (pleural, abdominal cavity, parapancreatic, and in the lesser sac) revealed that in the total group of patients (n=677), fluid effusions were noted in 39% of patients (Figure 1). Accordingly, in the group with the mild course of AP, fluid effusions were determined in 11.6%; in the group with an average severity of the AP course it was 63.2%, and in the group with severe course of AP, the number was the largest – 77.3%. We should immediately note that in the group with a mild course, it was a minimal, clinically insignificant amount of fluid – for example, a small amount of ascitic fluid interloop in the abdominal cavity, or a small strip of fluid with a column of up to 1 cm in the lesser sac, or some rounding of the pleural sinus. We considered this volume of fluid to be clinically insignificant, so we stratified these cases as mild. Therefore, fluid accumulation syndrome according to ultrasound data was most frequently determined in the group with a severe course with high reliability ($p<0.0001$ according to the χ^2 test for independent samples) in relation to all other groups, while it was less frequently recorded in the group with mild course of AP, which demonstrates high statistical reliability for all analysed groups of patients ($p<0.0001$).

The distribution of fluid effusions in the general group of patients with AP in different locations according to ultrasound data was as follows: in the pleural cavity fluid effusion was detected in 14.0%, in the abdominal cavity in 22.6%, in the parapancreatic/lesser sac in 28.1%. The number of these cases increased significantly ($p<0.0001$) in the group with moderately severe (26.4, 34.6 and 44.5%, respectively) and severe course of AP (31.9, 40.3 and 69.7%, respectively). Comparing the frequency of fluid accumulation in groups with different severity of AP, it was found that significant differences in groups with moderate and severe course were observed only in the case of fluid accumulation in the parapancreatic/lesser sac (44.5 and 69.7%, $p<0.0001$), while in the case of fluid accumulation in the pleural (26.4 and 31.9%) and abdominal cavity (34.6 and 40.3%) no significant differences were determined ($p=0.30$ and 0.31, respectively). In turn, in the group with a mild course of AP according to ultrasound, the presence of fluid in the pleural cavity was registered in 1.2%, in the abdominal cavity in 9.5%, and in the parapancreatic/lesser sac in 4.0% of cases, respectively. The frequency of registration of these cases was the lowest among all analysed groups, which carried high statistical reliability ($p<0.0001$) and was logically expected.

The analysis of the chest X-ray pictures showed that the fluid in the pleural cavity was present in 12.5% of patients of the general group (Figure 2). The largest number of these cases was observed in the group with a severe course of AP – 34.0%, the smallest in the group with a mild course – 1.5%, which had a high statistical significance compared to all other groups of patients ($p<0.01$). There was no statistical significance in the frequency of determination of fluid in the pleural cavity



	P1-2	P1-3	P1-4	P2-3	P2-4	P3-4
Accumulation of fluid in the pleural cavity	**<0.0001**	0.11	**<0.0001**	**<0.0001**	**<0.0001**	**0.002**

P1-2 – marked reliability when comparing the general group (n=535) and the group with a mild course (n=272); P1-3 – general group and moderately severe (n=160); P1-4 – of the general group and with a severe course of AP (acute pancreatitis) (n=103); P2-3 – mild and moderately severe; P2-4 – mild and severe; and P3-4 – moderately severe and severe course of AP according to the χ^2 criterion for independent samples.

Figure 2 – The frequency of cases of fluid effusion in the pleural cavity in patients with acute pancreatitis according to the data of chest X-ray (number of cases in %).

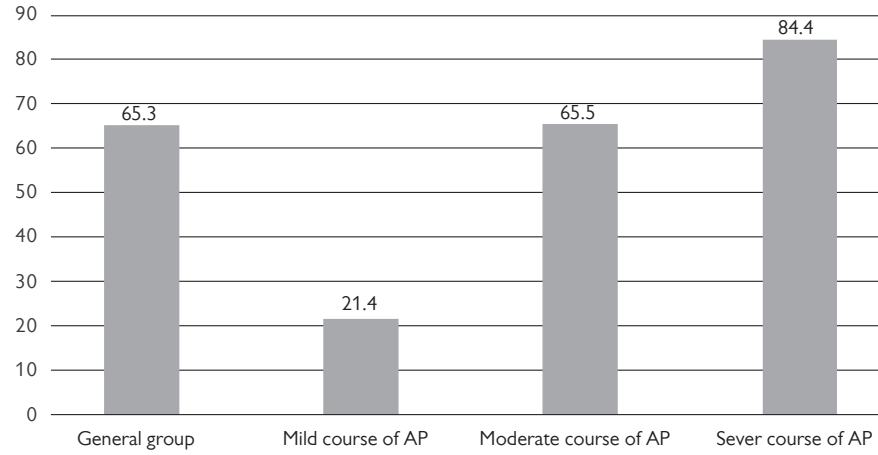
between the general group and the group with moderately severe AP (12.5 and 17.5%, p=0.11).

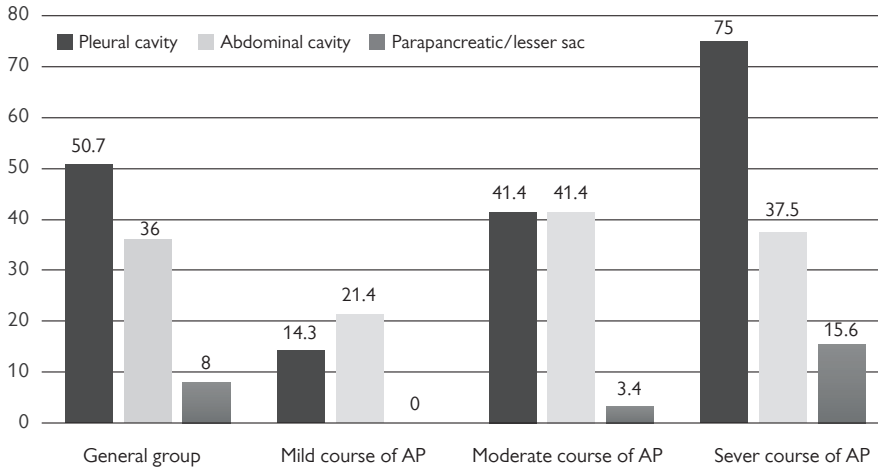
According to CT data, the analysis of fluid cases showed that in 65.3% of cases in the general group, the presence of fluid accumulation syndrome was present (Figure 3). This was not statistically significant only in relation to the group with a moderately severe course of AP (65.3 and 65.5%, p=0.99).

In patients with a mild course of AP, fluid effusion syndrome was determined in 21.4%, moderately severe – in 65.5%, and severe – in 84.4% of cases. Between the groups with a moderate and severe course of AP, no significant difference was obtained by the χ^2 criterion (p=0.09) due, in our opinion, to a small number of patients who underwent CT.

In the intergroup analysis, statistical significance was determined only by the frequency of fluid registration in the pleural cavity. Thus, the largest share of these patients (75.0%) was observed in the group with a severe course of AP, which was reliable in relation to all analysed groups of patients (50.7, 14.3 and 41.4%, p=0.01, p=0.0001, and p=0.008, respectively).

We also performed an analysis of fluid accumulation depending on the etiology of AP. The analysis of ultrasound data (Figure 4) revealed that the frequency of fluid

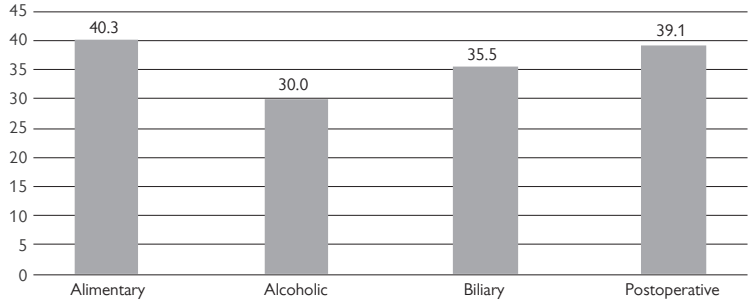


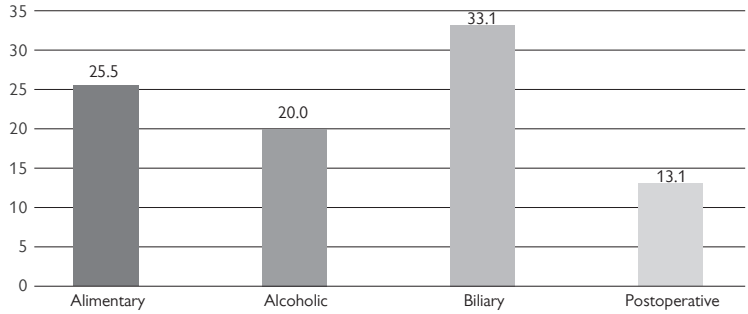


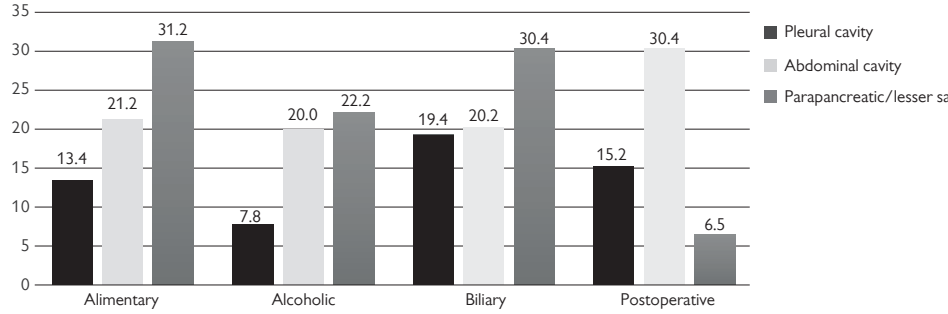
	P1-2	P1-3	P1-4	P2-3	P2-4	P3-4
Accumulation of fluid in cavities according to CT data	**0.002**	0.99	**0.04**	**0.007**	**<0.0001**	*0.090*
Pleural cavity	**0.010**	0.40	**0.01**	*0.080*	**0.0001**	**0.008**
Abdominal cavity	0.290	0.61	0.88	0.200	0.2800	0.760
Parapancreatic/lesser sac	0.270	0.41	0.23	0.480	0.1200	0.110

P1-2 – marked reliability when comparing the general group (n=75) and the group with a mild course (n=14); P1-3 – general group and moderately severe (n=29); P1-4 – of the general group and with a severe course of AP (acute pancreatitis) (n=32); P2-3 – mild and moderately severe; P2-4 – mild and severe; and P3-4 – moderately severe and severe course of AP according to the χ^2 criterion for independent samples.

Figure 3 – The frequency of cases of fluid effusions in cavities in patients with acute pancreatitis according to the computed tomography (CT) scan data (the number of cases is given in %).



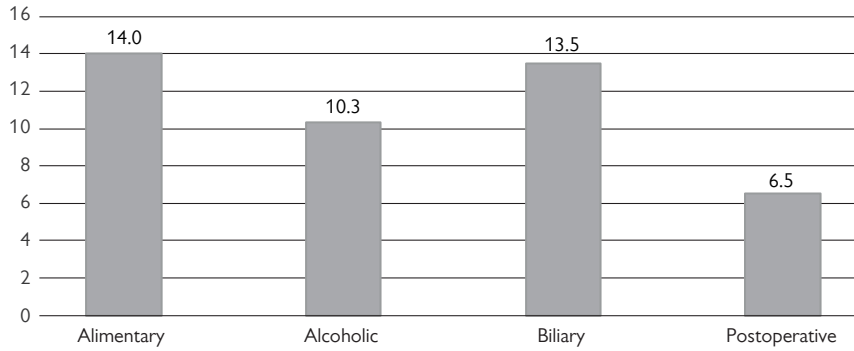




According to ultrasound data	**P1-2**	**P1-3**	**P1-4**	**P2-3**	**P2-4**	**P3-4**
Accumulation of fluid in cavities	0.09	0.38	0.8900	0.40	0.28	0.660
Accumulation of fluid in more than one location	0.30	0.13	*0.0700*	**0.03**	0.31	**0.010**
Pleural cavity	0.15	0.14	0.7500	**0.02**	0.18	0.530
Abdominal cavity	0.81	0.82	0.1700	0.98	0.17	0.160
Parapancreatic/lesser sac	0.11	0.68	**0.0006**	0.26	**0.02**	**0.002**

P1-2 – significance indicated when comparing the group with alimentary (n=231) and alcoholic (n=90); P1-3 – between alimentary and biliary (n=124); P1-4 – between alimentary and postoperative (n=46); P2-3 – between alcoholic and biliary; P2-4 – between alcoholic and postoperative; and P3-4 – between biliary and postoperative AP (acute pancreatitis) based on the χ^2 test for independent samples.

Figure 4 – Presence of fluid accumulation based on ultrasound data depending on the etiological variant of acute pancreatitis (number of cases provided in %).



According to X-ray data	P1-2	P1-3	P1-4	P2-3	P2-4	P3-4
Fluid accumulation in the pleural cavity	0.40	0.90	0.24	0.50	0.53	0.28

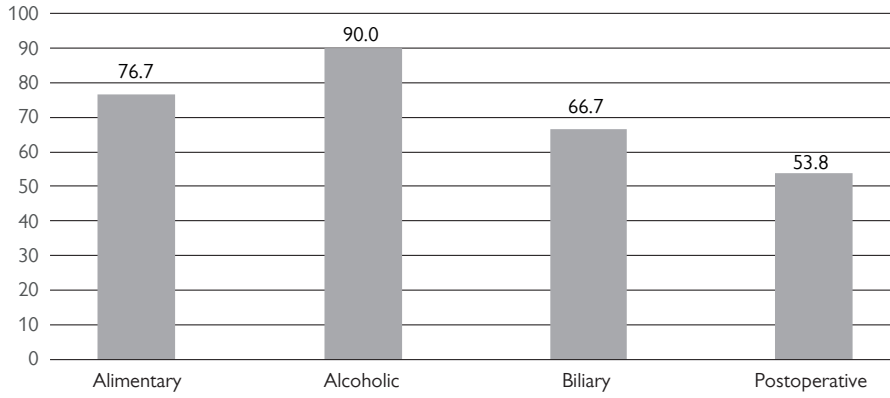
P1-2 – significance indicated when comparing the group with alimentary (n=200) and alcoholic (n=78); P1-3 – between alimentary and biliary (n=111); P1-4 – between alimentary and postoperative (n=31); P2-3 – between alcoholic and biliary; P2-4 – between alcoholic and postoperative; and P3-4 – between biliary and postoperative AP (acute panreatitis) based on the χ^2 test for independent samples.

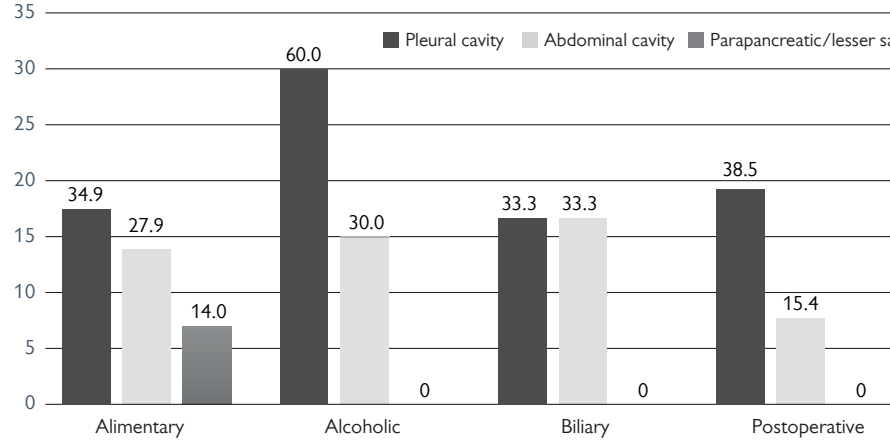
Figure 5 – Presence of fluid accumulation in the pleural cavity based on chest X-ray depending on the etiological variant of acute pancreatitis (number of cases provided in %).

effusions in different locations did not show significant differences depending on the etiological variant of AP (p>0.05). There were slightly more cases of fluid effusions in patients with alimentary etiology (40.3%) and less in the group with alcoholic AP (30.0%). The differences between these groups tended to be significant (p=0.09) according to the χ^2 test for independent samples.

On the other hand, during the analysis of cases with fluid accumulation in more than one location, it was found that the highest number of such cases was observed in the biliary genesis of AP, demonstrating statistical significance compared to alcoholic and postoperative (33.1% compared to 20.0% and 13.0%, p=0.03 and p=0.01, respectively). Additionally, multicavity fluid accumulations were more frequently observed in the alimentary genesis group compared to the postoperative group (with a tendency towards significance – 25.5% compared to 13.0%, p=0.07).

The highest number of cases of fluid effusions in the pleural cavity, indicated by ultrasound findings, was observed in patients with the biliary genesis, and this was statistically significant only in comparison with the group with alcoholic AP (19.4% compared to 7.8%, p=0.02). Fluid accumulation in the abdominal cavity showed no significant differences between the groups and was observed in 20.0–30.4% of cases (p>0.15). On the other hand, fluid accumulation in the para-pancreatic/lesser sac was registered significantly less frequently in the postoperative group compared to all other etiological variants of AP (6.5% compared to 31.2, 22.2, and 30.4%, p=0.0006, p=0.02, and p=0.002, respectively).





According to CT data	**P1-2**	**P1-3**	**P1-4**	**P2-3**	**P2-4**	**P3-4**
Accumulation of fluid in cavities	0.35	0.47	0.10	0.19	*0.06*	0.51
Pleural cavity	0.14	0.92	0.81	0.21	0.30	0.78
Abdominal cavity	0.89	0.71	0.36	0.86	0.39	0.29
Parapancreatic/lesser sac	0.20	0.17	0.15	–	–	–

P1-2 – significance indicated when comparing the group with alimentary (n=43) and alcoholic (n=10);
P1-3 – between alimentary and biliary (n=12); P1-4 – between alimentary and postoperative AP (acute pancreatitis) (n=13); P2-3 – between alcoholic and biliary; P2-4 – between alcoholic and postoperative; and P3-4 – between biliary and postoperative AP based on the χ^2 test for independent samples.

Figure 6 – Presence of fluid accumulation in cavities based on computed tomography (CT) data depending on the etiological variant of acute pancreatitis (number of cases provided in %).

The analysis of chest X-ray and cases of fluid accumulations in the pleural cavity (Figure 5) indicated the absence of significant differences between the groups ($p>0.20$). Fluid accumulation was observed in 14.0% of cases in the alimentary group, 10.3% in the alcoholic group, 13.5% in the biliary group, and 6.5% in the postoperative group of AP.

Results of the analysis of computer tomography data (Figure 6) indicated that fluid accumulation was less frequently observed in the postoperative AP compared to the alcoholic group (with a tendency towards significance – 53.8 vs. 90.0%, $p=0.06$). The lack of statistical significance in such significant differences in percentages is undoubtedly associated with the small number of patients included in this analysis (see caption on the figure). In patients with alimentary and biliary AP fluid was present in 76.7% and 66.7% of cases, respectively.

It was found that the number of cases of fluid accumulation in different locations did not reach statistical significance when comparing between groups. Specifically, cases of fluid accumulation in the pleural cavity showed only a tendency towards an increased frequency in patients with alcoholic AP compared to all other etiological variants (60.0% compared to 34.9, 33.3, and 38.5%, respectively, $p>0.10$).

When fluid accumulation occurred in the abdominal cavity, a slightly lower frequency of cases was observed in the postoperative group compared to other variants of acute pancreatitis (15.4% compared to 27.9, 30.0, and 33.3%, respectively, $p>0.25$). In the case of fluid accumulation in the parapancreatic/lesser sac, it was detected only in the group with alimentary acute pancreatitis (14.0%), while in other variants of acute pancreatitis, it was not identified in any case.

Discussion

Fluid effusions are inevitable in the development of severe forms of AP, when the inflammatory process spreads beyond the boundaries of the pancreas. The issue of finding risk factors for the severity of the course of AP and predicting the outcome of treatment remains important.

According to the Atlanta 2012 classification criteria, the main criteria for the severity of the course of AP are the presence of symptoms of organ failure and local or systemic complications (Banks et al., 2013). Fluid effusions belong to complications of AP and increase the risk of mortality in severe AP (Maringhini et al., 1996). That is why the early detection of fluid effusions during hospitalization or in the early stages of the disease, the awareness of their development and clinical significance, represents the most informative diagnostic method at different phases of the disease, help to predict the clinical course of AP and enable to start the appropriate therapy.

Undoubtedly, the main role in visualization and evaluation systems in the treatment of AP belongs to the methods of ultrasound diagnostics and computed tomography,

however, these methods have limitations in terms of accuracy, reproducibility, practicality, and cost-effectiveness (Hu et al., 2023).

When analysing the clinical material, we encountered the situation that in a large part of patients when imaging by various methods, clinically insignificant small volume fluid effusions in various cavities were detected, which were insufficient to stratify these cases to moderate or severe. It was the appearance of a small amount of ascitic fluid between the intestinal loops in the abdominal cavity, or a strip of fluid in the lesser sac, or some rounding of the pleural sinus. Therefore, this question also needs an answer: what volume of fluid effusion is clinically significant and can be interpreted as a complication of AP, and which has no clinical manifestation and spontaneously disappears against the background of infusion therapy?

Among all research methods, CT verification showed the highest frequency of fluid effusion detection – in 65.3% of all patients in the general group compared to 39% using ultrasound and 12.5% according to the chest X-ray data, which is similar to the data of other authors (Yan et al., 2021).

As for the detection of anatomical locations of fluid effusions by the CT method, it was registered in 50.7% in pleural cavities, in 36.0% of cases in the abdominal cavity, and only in 8.0% in the parapancreatic/lesser sac. The absolutely opposite picture was found in comparison with the data of the ultrasound examination, where in most of cases, liquid was detected precisely in the parapancreatic/lesser sac – 28.1%, in the abdominal cavity – in 22.6% of cases, and in the smallest amount in the pleural cavity – 14.3% (Figure 1).

The same regularity was determined in the identification of fluid fusions by the CT method in the group with a severe course of AP (75.0, 37.5 and 15.6%, respectively). In the group with a moderately severe course, the frequency of fluid detections in the pleural and abdominal cavities was the same (41.4, 41.4 and 3.4%). On the other hand, in the group with a mild course of AP, fluid in the abdominal cavity (21.4%) it was determined somewhat more often, and it was absent in the parapancreatic/lesser sac.

However, despite the high informativeness of the CT method in the visualization of fluid effusions of all three localizations in AP and the possibility of detecting even minimal liquid volumes, the use of CT of both the abdominal cavity and the chest is limited at the early stage after hospitalization. At the same time, the X-ray method is a standard method for suspected pleural effusion, which can be performed at the patient's bedside. The frequency of detection of pleural effusion by X-ray method was the smallest – 12.5%. In our opinion it may be related to fluid redistribution during performing an X-ray examination of the chest cavity in the supine position, which often reduced the visualization of some volumes of fluid. And for the diagnosis of pancreatogenic ascites and parapancreatic accumulations, this method is not informative at all.

The ultrasound method of examining both the pleural and abdominal cavity and parapancreatic tissues is the gold standard of the initial visualization method in the early period of the patient's stay in the hospital and later for dynamics, with the

possibility of repeated execution without harm to the patient's body, even in the ward. And although the ultrasound method yielded to the CT method in the total number of detected fluid effusions, it showed its indisputable significant advantage in the diagnosis of fluid effusions located parapancreatically and in the lesser sac (28.2 vs. 8%).

Comparing the methods of visualization of fluid effusions, it is obvious that pancreatogenic ascites and pleural effusion contain a purely liquid part in their composition, so CT scans are well visualized from the first days of their appearance. While parapancreatic fluid accumulations, depending on their type, have both fluid and necrotic components in their composition, so they will have a more heterogeneous appearance when visualized. In addition, with necrotic forms of AP, early CT scanning may underestimate both the presence and degree of necrosis itself, which is consistent with the data of other authors (Bezmarević et al., 2019). Also, in the acute phase, it is difficult to distinguish between acute peripancreatic fluid collection and acute necrotic collections. Therefore, here we see significantly better results of diagnosing parapancreatic fluid effusions and effusions in the lesser sac by the ultrasound method.

We also analysed the frequency of detection of fluid effusions by different imaging methods in different etiological forms of AP. Analysis of ultrasound data did not reveal significant differences in the frequency of detection of fluid effusion of different localizations depending on the etiological variant of AP ($p>0.05$), instead it revealed more frequent detection of multicavity accumulations of fluid in biliary genesis (33.1%). The similar absence of a reliable difference in the detection of pleural effusion in different etiological forms of AP occurred during chest X-ray. Analysis of computed tomography data revealed less fluid accumulation in postoperative genesis of AP compared to the alcoholic (with a tendency to significance – 53.8 vs. 90.0%, $p=0.06$).

Separately, we would like to draw attention to the high informativeness of the ultrasound method in the diagnosis of fluid effusions in patients with postoperative pancreatitis, in whom diagnosis is always difficult against the background of postoperative analgesia and an erased clinical picture. In this group of patients, the ultrasound method turned out to be the most informative for all anatomical locations of fluid. In our sample, among 677 patients, in 52 AP had a postoperative genesis. Of them, 25 had endoscopic retrograde cholangiopancreatography (ERCP)-induced pancreatitis, and 27 had postoperative acute pancreatitis after abdominal operations. Thus, the ultrasound method detected fluid effusions in the general group with postoperative acute pancreatitis in 27 cases, the X-ray method in 2 cases, and the CT method in 7 cases.

Though our study was limited, as we did not study the volumes of fluid effusions, nor did we take into account the timing of radiological studies depending on the phases (early or late), we found general trends in the study groups and directions that require further study.

Conclusion

Subgroup analysis revealed a different frequency of detection of fluid effusions by different imaging methods depending on the severity of the course of AP. In particular, the CT method was more informative in the diagnosis of pleural effusions, while the ultrasound method was more informative in the diagnosis of parapancreatic effusions and effusions of the lesser sac. Both these methods showed the same informativeness for the diagnosis of fluid effusion in the abdominal cavity. The use of the X-ray method for visualization of pleural effusion in AP yields to ultrasound and CT methods. The choice of the method of diagnosis of fluid effusions should be individual, depending on the phase of the pathological process, the anatomical location of the effusion, taking into account the severity of AP.

We consider the in-depth study of the early diagnosis of fluid effusions as potential markers of the severity of AP to be promising. A clear algorithm for choosing a method of visualizing fluid effusions in a specific anatomical area in a certain phase of the pathological process is necessary, as well as the understanding of clear volumes of fluid effusions, which are clinically significant and are important for the stratification of the severity of AP.

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