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## Acute pancreatitis – epidemiology, etiology, procedures and treatment: a retrospective cohort study

### Ostre zapalenie trzustki – epidemiologia, etiologia, procedury medyczne i leczenie: retrospektywne badanie kohortowe

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#### Keywords

acute pancreatitis, etiology, severity, epidemiology

#### Słowa kluczowe

ostre zapalenie trzustki, etiologia, ciężkość choroby, epidemiologia

#### Conflict of interest

#### Konflikt interesów

None

Brak konfliktu interesów

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#### Summary

**Introduction.** Acute pancreatitis (AP) is an inflammation of the pancreas which is the most frequently caused by cholelithiasis and alcohol abuse. The morbidity of AP in regard with certain etiological factor differs between the European countries with alcoholic AP to be most prevalent in Eastern Europe.

**Aim.** The aims of the study were to retrospectively assess the etiology of AP and to evaluate correlation between the etiology of AP and demographic data, CRP (C-reactive protein), WBC (white blood cells) count on admission, duration of hospitalization, severity and mortality of AP.

**Material and methods.** The history of patients hospitalized from September 1<sup>st</sup> 2014 to August 31<sup>st</sup> 2016 in the Department of Digestive Tract Diseases in Lodz, Poland due to acute pancreatitis of any etiology was retrospectively assessed. Two means were compared using Student's t-test with 95% confidence interval. Three means were compared using ANOVA with Tukey's test as a post-hoc test. Correlations were assessed using r-Pearson correlation with linear regression. Chi-square test was used when comparing groups or Fisher's exact probability test when the sample size was lower than 5. P value less than 0.05 was considered.

**Results.** Alcoholic abuse was the major etiological factor of AP which occurred in 149 patients (52.3%), followed by: biliary (27%), cancer (2.5%), hypertriglyceridemia-induced, iatrogenic, drug-related (0.7% for all). The exact cause was not clarified in 46 patients (16.1%). Mean age of patients with alcoholic AP was significantly lower than patients with biliary AP ( $42.7 \pm 0.98$  vs  $60.23 \pm 1.95$ ;  $p < 0.001$ ). Among all patients, females were significantly older compared to males ( $p < 0.001$ ). Alcoholic AP was significantly more common in males than females ( $p < 0.001$ ). There was no relationship between etiology and severity of AP ( $p = 0.61$ ). There was a statistically significant correlation between the CRP on admission and length of hospitalization ( $p < 0.001$ ,  $r = 0.2433$ ). Also, concentration of CRP on admission was significantly higher in patients with moderate and severe compared with mild disease ( $p < 0.01$  and  $p < 0.001$ , respectively).

**Conclusions.** We demonstrated that alcohol is a major etiological factor of AP in patients admitted to our Department and affects mostly males below 65 years old. Female above 40 years old more frequently suffers from biliary AP. CRP can be regarded a marker of clinical severity and it could potentially be used to rapidly predict the necessity of longer hospitalization in these patients on admission.

#### Streszczenie

**Wstęp.** Ostre zapalenie trzustki (OZT) jest procesem zapalnym trzustki spowodowanym najczęściej przez kamice żółciową lub alkohol. Zachorowalność na OZT w zależności od głównego czynnika etiologicznego różni się w krajach Europy z przewagą OZT o etiologii alkoholowej w Europie Wschodniej.

**Cel pracy.** Celem badania była retrospektywna ocena etiologii OZT oraz określenie korelacji pomiędzy etiologią OZT a danymi demograficznymi, poziomem białka C-reaktywnego (CRP) i liczbą leukocytów (WBC) przy przyjęciu, długością trwania hospitalizacji oraz ciężkością i śmiertelnością OZT.

**Materiał i metody.** Poddano ocenie retrospektywnej historii choroby pacjentów hospitalizowanych od 1 września 2014 do 31 sierpnia 2016 roku w Klinice Chorób Przewodu Pokarmowego w Łodzi z powodu OZT. Dwie zmienne zostały porównane przy użyciu testu t-studenta z 95% przedziałem ufności. Trzy zmienne porównano przy pomocy testu ANOVA z testem Tuckeya jako analizą post-hoc. Korelację oceniono przy użyciu korelacji r-Pearsona z regresją liniową. Testu Chi<sup>2</sup> używano, porównując grupy, a test dokładnego prawdopodobieństwa Fishera – w przypadku, gdy liczność grupy była mniejsza od 5. Wartość P mniejsza od 0,05 była uznawana za istotną statystycznie.

**Wyniki.** Spożycie alkoholu było głównym czynnikiem etiologicznym OZT i wystąpiło u 149 pacjentów (52,3%), kolejno przed przyczyną żółciową (27%), rakiem (2,5%), OZT wywołanym hipertriglicerydemią, jatrogennym OZT oraz OZT wywołanym lekami (po 0,7%). Dokładna przyczyna nie została wyjaśniona u 46 pacjentów (16,1%). Średnia wieku dla chorych z OZT o alkoholowej etiologii była istotnie statystycznie niższa niż u pacjentów z żółciopochodnym OZT ( $42,7 \pm 0,98$  vs  $60,23 \pm 1,95$ ;  $p < 0,001$ ). Spośród wszystkich pacjentów, kobiety były istotnie statystycznie starsze w porównaniu z mężczyznami ( $p < 0,001$ ). OZT o etiologii alkoholowej występowało istotnie statystycznie częściej u mężczyzn niż kobiet ( $p < 0,001$ ). Nie znaleziono związku między etiologią a ciężkością choroby ( $p = 0,61$ ). Znaleziono istotną statystycznie korelację pomiędzy poziomem CRP przy przyjęciu a długością hospitalizacji ( $p < 0,001$ ,  $r = 0,2433$ ). Ponadto, poziom CRP przy przyjęciu był istotnie statystycznie wyższy u pacjentów z umiarkowaną i ciężką postacią choroby w porównaniu do łagodnej postaci OZT (odpowiednio:  $p < 0,01$  oraz  $p < 0,001$ ).

**Wnioski.** Wykazaliśmy, iż alkohol jest głównym czynnikiem etiologicznym OZT u pacjentów przyjętych na nasz Oddział i dotyczy głównie mężczyzn poniżej 65. roku życia. Kobiety powyżej 40. roku życia częściej przebyły żółciopochodne OZT. CRP może być uznany za marker klinicznej ciężkości choroby i może potencjalnie zostać wykorzystany do szybkiego przewidywania konieczności dłuższej hospitalizacji u pacjentów przy przyjęciu do szpitala.

## INTRODUCTION

Acute pancreatitis (AP) is an inflammation of the pancreas characterized by an acute epigastric pain radiating to the back, a concomitant elevated activity of serum pancreatic enzymes (amylase and lipase) and/or characteristic abnormalities demonstrated on computed tomography (CT) scan, magnetic resonance imaging (MRI), or transabdominal ultrasonography (USG). Generally, two types of AP are observed: interstitial edematous pancreatitis and necrotizing pancreatitis. The revised Atlanta Classification of AP distinguished three grades of severity: (i) a mild form which is characterized by absence of organ failure and local or systemic complication; (ii) a moderate form in which transient ( $< 48$  h) organ dysfunction and/or local or systemic complication occurs and (iii) a severe form characterized by a persistent organ failure ( $> 48$  h) (1). In Poland incidence rate of AP is estimated on 72.1/100 000 patients per year and is one of the highest in European countries (2). A mild course of the disease is observed in 80.7% of patients. The incidence of severe AP is noted in roughly 7% of patients and has been increasing over the past years (2, 3). Noteworthy, cholelithiasis and alcohol abuse are two major etiological factors of AP (4-7). The third most common cause of AP is hypertriglyceridemia (8).

AP is associated with increased mortality rate reaching up to 60% in severe disease (2). Treatment of AP depends on severity of the disease. However, the therapeutic options are few with intensive hydration and pain reduction as a basic management. Antibiotic therapy is recommended only if concomitant extra-pancreatic infection or infected necrosis are present. To date, detailed data concerning epidemiology and etiology of acute pancreatitis in Poland are not known.

## AIM

The aim of this study was to estimate the etiology of AP and to evaluate correlation between the etiology of AP and demographic data, C-reactive protein (CRP), white blood cells (WBC), duration of hospitalization, severity and mortality of AP in Department of Digestive Tract Diseases Norbert Barlicki Memorial Teaching Hospital No. 1 in Łódź.

## MATERIAL AND METHODS

The history of patients hospitalized over the period of 2 years, from September 1<sup>st</sup> 2014 to August 31<sup>st</sup> 2016 due to acute pancreatitis of any etiology was retrospectively assessed. Medical histories were collected by searching the hospital records with the database search of ICD-10 code "K85" as a main diagnosis. Patients were re-evaluated towards AP prior to the inclusion based on Atlanta Recommendations defined as a presence of two of the three following criteria: (i) typical abdominal pain; (ii) activity of amylase and/or lipase increased above threefold of normal range; (iii) characteristic abnormalities in abdominal imaging. Necrotic pancreatitis was recognized when areas of necrosis, affecting the pancreas and/or peripancreatic tissues was observed in abdominal CT scan. Patient was excluded if the criteria were not fulfilled or the data was incomplete. Following items were collected whenever it was possible: sex, age, duration of hospitalization, day of the week of admission, etiology, level of CRP on admission, level of WBC on admission, imaging results, type (edematous or necrotic), severity, the need of antibiotics, the need of medical nutrition therapy, comorbidities, local and systemic complications, mortality. Alcoholic AP was defined when patients had a history of alcohol consumption within 48 h before symptom

onset or patient had a history of alcohol abuse with no signs of other possible causes. Biliary pancreatitis was defined when there was a gallstone or biliary sludge on USG or CT. The etiology was considered to be idiopathic when causative factors could not be identified from a detailed clinical and drug history or after initial investigations. We relied on the Revised Atlanta Classification (1) and American College of Gastroenterology (ACG) Guidelines (9).

**Statistical analysis**

Statistical analysis was performed using software Statistica 12.5 (Statistica, Tulsa, Oklahoma) and GraphPad Prism 5.0 (GraphPad Software, Inc, La Jolla, CA). Two means were compared using Student’s t-test with 95% confidence interval. Three means were compared using ANOVA with Tukey’s test as a post-hoc test. Correlations were assessed using r-Pearson correlation with linear regression. Chi-square test was used when comparing groups or Fisher’s exact probability test when the sample size was lower than 5. Compared values were evaluated for outliers using Grubbs’ Test and excluded if found to be significant outliers. P value less than 0.05 was considered as significant.

**RESULTS**

Our study included 285 patients with AP hospitalized in Department of Digestive Tract Diseases. Thirty four patients (11.9%) were hospitalized more than once. Twenty two patients discharged from hospital on request before completing the treatment. Thirteen patients was transferred to intensive care unit (4.6%) and seven patients died (2.5%). Median age of death was 65.3 (range: 38-95). Sudden cardiac arrest was the cause of death in all patients what was accompanied by total respiratory failure in 3 of them.

**Epidemiology**

The majority of our cohort was male – 65.6% (tab. 1). The ratio of male to female was 1.91:1. Mean age of patients was 50.01 ± 1.02. In our cohort 137 patients (48.1%) were between 40-64 years. The youngest patient was 20, the oldest was 95 years old. Overall, females were significantly older compared to males (p < 0.001) (fig. 1). Mean duration of hospitalization was 10.54 ± 0.47 days with no statistically significant gender differences (p = 0.92). We found no correlation between the age of patients and the duration of hospitalization in our cohort (p = 0.015) (fig. 2). Friday was the most common day of admission to hospital among our patients (17.6%).

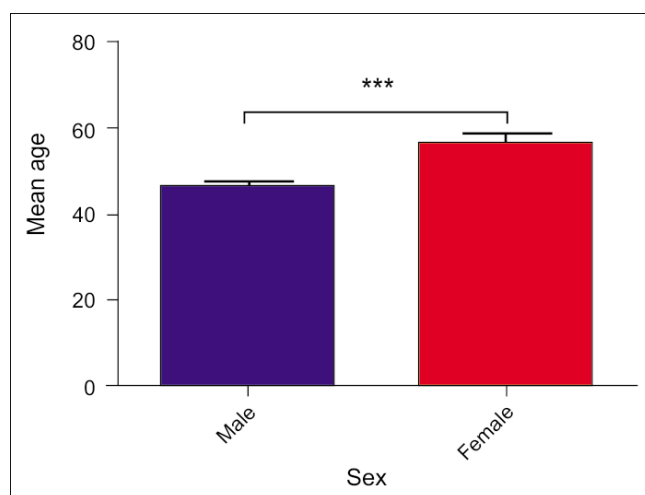
**Laboratory results**

Mean level of CRP on admission to the hospital was 63.47 ± 5.76 (range: 0.2-441.2) and there was no significant difference between male and female (p = 0.75). There was weak significant correlation between the level of CRP and the duration of hospitalization (p < 0.001) (fig. 3). Higher mean levels of CRP

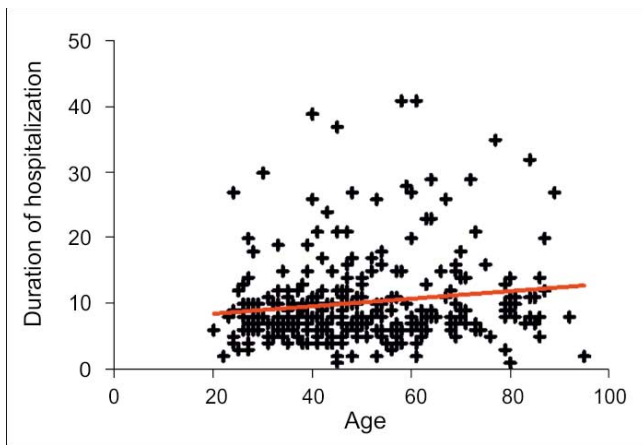
**Tab. 1.** Characteristics of patients with acute pancreatitis

Acute pancreatitis (N = 285), n (%)	
Sex	
female	98 (34.4%)
male	187 (65.6%)
Age, years	
≤ 39	90 (31.6%)
40-64	137 (48.1%)
≥ 65	58 (20.3%)
Mean age	50.01 ± 1.02
female	56.77 ± 1.86
male	46.47 ± 1.12
Etiology	
alcohol abuse	149 (52.3%)
cholelithiasis	77 (27.0%)
idiopathic	49 (17.2%)
cancer (pancreatic or of major duodenal papilla)	6 (2.1%)
hypertriglyceridemia	2 (0.7%)
post-ERCP	2 (0.7%)
drug-related	2 (0.7%)
Mean level of CRP on admission p = 0.75	63.47 ± 5.76
female	63.22 ± 9.65
male	59.55 ± 6.66
Mean level of WBC on admission p = 0.83	12.41 ± 0.28
female	12.32 ± 0.33
male	12.20 ± 0.45
Mean duration of hospitalization p=0.92	10.54 ± 0.47
female	10.49 ± 0.74
male	10.59 ± 0.61
Day of the week on admission	
monday	36 (12.6%)
tuesday	44 (15.4%)
wednesday	49 (17.2%)
thursday	40 (14.0%)
friday	50 (17.6%)
saturday	37 (13.0%)
sunday	29 (10.2%)
Deaths	7 (2.5%)
female	3
male	4

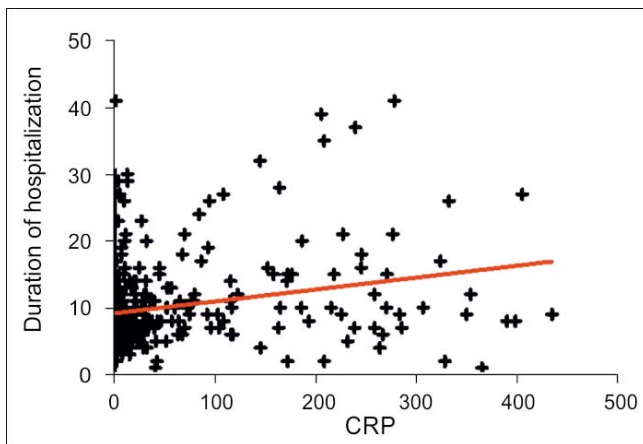
ERCP – endoscopic retrograde cholangiopancreatography; CRP – C-reactive protein; WBC – white blood cells



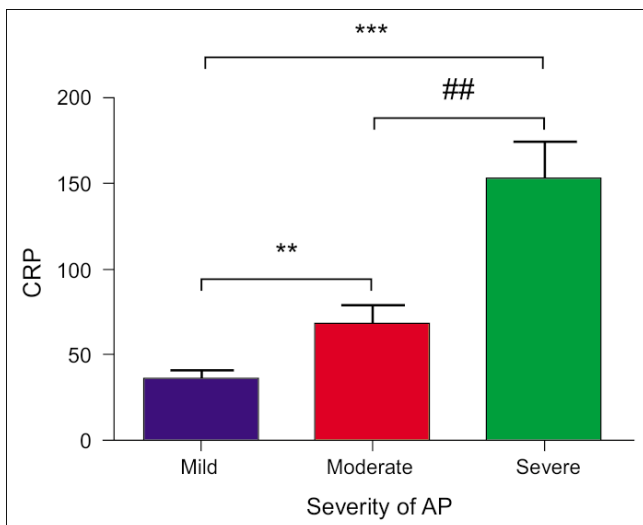
**Fig. 1.** Overall females were significantly older compared to males in our cohort (p < 0.001). Data represent mean ± SEM. Groups compared using Student’s t-test  
\*\*\*p < 0.001, as compared with male group



**Fig. 2.** Correlation between the age of patients and the duration of hospitalization in our cohort followed by a linear regression analysis



**Fig. 3.** Correlation between the level of CRP and the duration of hospitalization in our cohort followed by a linear regression analysis



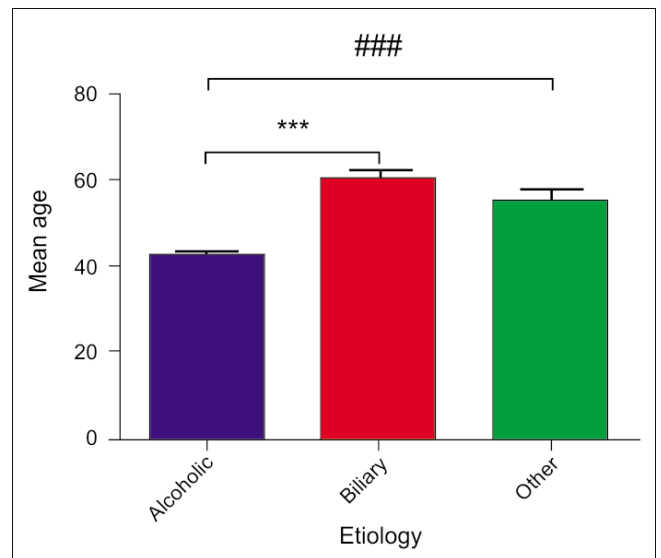
**Fig. 4.** Mean level of CRP was significantly higher in patients with severe course of AP compared with patients with mild ( $p < 0.001$ ) and moderate ( $p < 0.01$ ) course of the disease. Data represent mean  $\pm$  SEM. Groups compared using ANOVA with Tukey's test as a post-hoc test  
 \*\*\* $p < 0.001$ , as compared with mild group  
 ## $p < 0.001$ , as compared with moderate group  
 \*\* $p < 0.01$

on admission was significantly associated with more severe course of AP compared with mild ( $p < 0.001$ ) and moderate ( $p < 0.01$ ) course of disease (fig. 4). Mean level of WBC on admission to the hospital was  $12.41 \pm 0.28$  (range: 2.71-33.55). No statistically significant difference between man and female was observed ( $p = 0.83$ ). No correlation between the level of WBC and duration of hospitalization was demonstrated ( $p = 0.0273$ )

### Etiology

Alcoholic AP was the most common etiological factor in our cohort and occurred in 149 patients (52.3%). Biliary AP was diagnosed in 77 cases (27%). Pancreatic or major duodenal papilla cancer was detected as a cause of AP in 6 patients (2.1%). Hypertriglyceridemia-induced, iatrogenic and drug-related AP occurred in every 2 patients (0.7% for all). Despite the full examination the cause was not elucidated in 49 patients (17.2%).

Mean age of patients with alcoholic AP was significantly lower than patients with biliary AP ( $p < 0.001$ ) (fig. 5). Alcoholic AP was significantly more often diagnosed in males than females ( $p < 0.001$ ) (tab. 2).



**Fig. 5.** Mean age of patients with alcoholic AP was significantly lower compared to patients with biliary AP ( $p < 0.001$ ) and other cause of AP ( $p < 0.001$ ). Data represent mean  $\pm$  SEM. Groups compared using ANOVA with Tukey's test as a post-hoc test  
 \*\*\* $p < 0.001$ , as compared with biliary group  
 ### $p < 0.001$ , as compared with other group

Patients with alcoholic AP were hospitalized for a mean of  $9.76 \pm 0.54$  days and was usually admitted to the hospital on Wednesday (17.6%). Hospitalization of patients with biliary AP lasted for a mean of  $10.46 \pm 0.75$  days with a most common day of admission as Friday (23.4%). There was no significant difference between the mean level of CRP on admission in patients with alcoholic AP and patients with biliary AP ( $63.43 \pm 8.10$ ; range: 0.2-435.1 vs.  $57.71 \pm 9.43$ ; range: 0.87-354.1). Also, no statistically significant difference in the mean level of WBC between the two groups was revealed ( $12.63 \pm 0.37$ ; range: 2.71-28.94 vs.  $12.25 \pm 0.55$ ; range: 4.1-24.59). One patient with

**Tab. 2.** Comparison of etiological factors of acute pancreatitis

	<b>Alcoholic AP N = 149</b>	<b>Biliary AP N = 77</b>	<b>Other N = 59</b>	<b>P value</b>
Gender <sup>a</sup>				
female	28 (18.8%)	41 (53.2%)	29 (49.2%)	< 0.001
male	121 (81.2%)	36 (46.8%)	30 (50.8%)	
Age, year <sup>a</sup>				
≤ 39	65 (43.6%)	8 (10.4%)	17 (28.8%)	< 0.001
40-64	79 (53.0%)	36 (46.8%)	22 (37.3%)	
≥ 65	5 (3.4%)	33 (42.8%)	20 (33.9%)	
Mean age <sup>b</sup>	42.7 ± 0.98	60.23 ± 1.95	55.14 ± 2.56	< 0.001
Mean level of CRP on admission <sup>b</sup>	63.43 ± 8.10	57.71 ± 9.43	53.51 ± 10.84	0.76
Mean level of WBC on admission <sup>b</sup>	12.63 ± 0.37	12.25 ± 0.55	11.36 ± 0.48	0.17
Mean duration of hospitalization <sup>b</sup>	9.76 ± 0.54	10.46 ± 0.75	10.55 ± 0.89	0.64
Day of the week on admission <sup>a</sup>				
monday	25 (16.8%)	8 (10.4%)	3 (5.1%)	0.32
tuesday	20 (13.4%)	13 (16.9%)	11 (18.6%)	
wednesday	26 (17.4%)	13 (16.9%)	10 (17.0%)	
thursday	24 (16.1%)	8 (10.4%)	8 (13.6%)	
friday	18 (12.1%)	18 (23.4%)	14 (23.8%)	
saturday	19 (12.8%)	9 (11.7%)	9 (15.3%)	
sunday	17 (11.4%)	8 (10.4%)	4 (6.8%)	
Severity <sup>a</sup>				
mild	78 (52.3%)	41 (54.5%)	30 (50.8%)	0.61
moderate	57 (38.3%)	24 (31.2%)	23 (39.0%)	
severe	14 (9.4%)	12 (15.6%)	6 (10.2%)	
Deaths <sup>c</sup>	1 (0.7%)	4 (5.2%)	2 (3.4%)	0.06
Transferred to ICU <sup>c</sup>	4 (2.7%)	6 (7.8%)	3 (5.1%)	0.19

Data are expressed as: mean ± SEM; AP – acute pancreatitis; CRP – C-reactive protein; WBC – white blood cells; ICU – intensive care unit

<sup>a</sup>Chi-square analysis with adjusted standardized residuals and Bonferroni correction

<sup>b</sup>ANOVA test followed by Tukey's test

<sup>c</sup>Fisher Exact Probability test

alcoholic AP and 4 patients with biliary AP died during the hospitalization. Although no statistical significance was achieved, increased mortality in patients with biliary AP was observed (p = 0.06).

**Characteristic of episodes**

Interstitial edematous pancreatitis was observed in 272 patients (95.4%) while 13 patients developed necrotizing pancreatitis. The majority of patients (52.3%) had a mild form of AP. Severe pancreatitis occurred in 32 patients (11.2%). Table 3 describes the occurrence of local and systemic complications in detail.

**Comorbidity**

In our cohort majority of patient with AP suffered from other diseases. Hypertension occurred in 103 patients (36.1%). Thirty patients (10.5%) suffered from other cardiovascular system diseases (e.g. atrial fibrillation, coronary disease, cardiac insufficiency). There was 33 patients with diabetes including two patients with recently diagnosed diabetes. Level of glucose was measured in 157 patients and the mean level of glucose was 7.66 mmol/l. In 114 patients level of cholesterol was tested and the mean level of cholesterol was 5.04 mmol/l. Mean level of triglycerides which was measured in 155 patients with AP was 3.65 mmol/l. In 7 patients level of triglycerides was above 11.29 mmol/l. Chronic pancreatitis was diagnosed earlier in 10 patients (3.5%).

**Imaging tools**

Each patient had USG performed on admission to establish the diagnosis of AP. CT scan was conducted in 122 patients (42.8%), in 14% of cases between 1<sup>st</sup> to 3<sup>rd</sup> day to exclude different diagnoses and in 26.3%

**Tab. 3.** Detailed characteristic of episodes of acute pancreatitis

<b>Characteristics of events</b>	
Type of AP	
interstitial edematous pancreatitis	272 (95.4%)
necrotizing pancreatitis	13 (4.6%)
Severity of AP	
mild	149 (52.3%)
moderate	104 (36.5%)
severe	32 (11.2%)
Local complications	
fluid collections	93 (32.6%)
pleural fluid	45 (15.8%)
peritoneal fluid	13 (4.6%)
peripancreatic necrosis	9 (3.2%)
thrombosis of the splenic vein	7 (2.5%)
thrombosis of portal veins	6 (2.1%)
thrombosis of superior mesenteric vein	1 (0.3%)
Systemic complications	
hyperglycemia ≥ 7.0 mmol/l	71 (24.9%)
hyperglycemia 5.6-6.9 mmol/l	42 (14.7%)
intestinal obstruction	16 (5.6%)
cardiac arrest	11 (3.9%)
renal failure	8 (2.8%)
heart failure	6 (2.1%)
respiratory failure	6 (2.1%)
purtscher retinopathy	1 (0.3%)

AP – acute pancreatitis

of patients between 5<sup>th</sup> to 7<sup>th</sup> day to assess the complications and severity of AP. 52 patients with biliary AP had endoscopic retrograde cholangiopancreatography (ERCP) done to eliminate gallstone within the common bile duct. Magnetic resonance cholangiopancreatography (MRCP) was performed in 1 person.

### Nutrition and antibiotics in acute pancreatitis

In the majority of patients with AP oral feeding was started after the relief of abdominal pain and/or nausea. Enteral nutrition through nasojejunal tube was used in 80 patients (28%). Parenteral nutrition was administered in 22 patients (7.7%).

Antibiotics were administered in 212 patients (74.4%). The majority of patients (86.8%) was treated with Ciprofloxacin usually combined with Metronidazole. Carbapenems was used in 59 patients. Detailed information about antibiotics was described in the table 4.

**Tab. 4.** Procedures and treatment used in patients with acute pancreatitis

Medical procedures and treatment n (%)	
Ultrasonography	285 (100%)
CT	122 (42.8%)
on days 1-3	40 (14.0%)
on days 5-7	75 (26.3%)
MRCP	1 (0.35%)
ERCP	52 (18.2%)
Oral feeding after symptoms relieve	183 (64.2%)
Enteral nutrition using nasojejunal feeding tubes	80 (28.0%)
Parenteral nutrition	22 (7.7%)
Antibiotics	212 (74.4%)
ciprofloxacin	184/212 (86.8%)
metronidazole	167/212 (78.8%)
carbapenems	59/212 (27.8%)
cephalosporin	24/212 (11.3%)
amoxicillin	6/212 (2.8%)
amikacin	4/212 (1.9%)
linezolid	4/212 (1.9%)
rifaximin	3/212 (1.4%)
vancomycin	3/212 (1.4%)
doxycycline	1/212 (0.5%)

CT – computed tomography; MRCP – magnetic resonance cholangiopancreatography; ERCP – endoscopic retrograde cholangiopancreatography

## DISCUSSION

The results of our retrospective study shows several interesting facts regarding the epidemiology of AP in Łódź. First of all, we showed that the vast majority of AP episodes was caused by alcohol (52.3%). The second cause of AP was the presence of gallstones in biliary tract (27%). Such two factors as main causes of AP are in accordance with worldwide trends. The main factor is various depending on part of the world. Cholelithiasis is the most common etiological factor in Mediterranean country (Croatia, Greece, Italy, Spain) (10), United Kingdom (11) or China (12). Alcohol abuse was the most frequently factor caused AP in Northern (Finland) (13) and Eastern Europe (10), especially in Russia (14-16). In Polish population the incidence rate of AP continuously in-

creases. Two studies describing the epidemiology of AP in Polish cities were published so far: in Kielce (3) and Trzebnica (4). In Kielce region the main causes of AP were gallstones and alcohol (30.1 and 24.1%, respectively) (3). Bogdan et al. reported that alcohol abuse was the main factor of AP in 49% of patients, while cholelithiasis occurred in 27% of patients with AP in Trzebnica (4). These data shows how sparse the epidemiological situation of AP can be within the country. We feel it is of great importance to perform similar studies in different regions of Poland to more precisely predict the needs of regional medical centers. Patients with unknown etiology of AP in our study accounted for 17.2% of cases. It was in accordance with medical literature which reports that idiopathic AP occurs up to approximately 20% of cases (17).

Moreover, our study showed that male suffered from AP about twice as frequently as female (ratio: 1.91:1). In our study the majority of the patients with alcoholic AP were young male, whereas biliary AP was frequently among older female, which is agreeable with the available data (3, 6, 18-20). This finding may be supported by the fact that alcohol consumption is preferred mainly by the young and middle-aged people, especially by men. Also, the prevalence of cholelithiasis increases with age and female gender is one of main risk factor of gallstones creations due to higher levels of estrogens that increase the biliary cholesterol secretion (21, 22).

Furthermore, in the present study the majority of patients (52.3%) displayed the mild course of AP. Severe AP diagnosed based on revised Atlanta Classification occurred in 11.2% of cases. Koziel and Głuszek (3) observed severe course of AP in 7% of patients in Kielce region. In our study percentage of severe AP and mortality rate was higher in biliary AP compare to alcoholic but no significant difference was achieved. The data regarded influence of disease severity on mortality in these patients is sparse. Cho et al. (23) reported that the patients with alcohol-induced AP more frequently developed necrotizing AP and that the higher mortality rate of AP occurs in patients with alcohol-induced AP. Kotán et al. (24) showed severe course and higher mortality in biliary AP, while Andersen et al. (25) concluded that severity course and mortality were not affected by etiology in their study. Nevertheless it was proved that severe course of AP develops more often in older patients (26) and that mortality rate correlates distinctly with advanced age and increases rapidly after the age of 50 (27, 28). The results we obtained could be explained clinically as what we mentioned above. Age is one of the primary risk of cholelithiasis which could further predispose to the development of AP and older patients suffers from other concomitant diseases that can exacerbate the patient's clinical condition.

Another of our goals was to examine the associations between the levels of available inflammatory parameters (CRP and WBC) on admission and the duration of hospitalization. Our study demonstrated that higher level of CRP on admission was significantly associated with longer duration of hospitalization ( $p < 0.001$ ). No correlation for WBC was found for that case. Also,

we showed that patients with severe and moderate course of AP tend to have significantly higher levels of CRP on admission. Párniczky et al. (29) reported that CRP and WBC were the most sensitive predictors of severe course of AP. In literature CRP is commonly used to assess severity (30). However, CRP is non-specific proteins which level increase in infectious and other inflammatory diseases and is not recommended to be used as prognostic factor of severe AP (9). Nonetheless, CRP is a good indicator of acute inflammatory state with a rather short half-life of 19 hours that according to our results can be used for quick assessment on admission.

Moreover, we demonstrated that medical procedures (imaging, nutrition) were carried out in accordance with the latest recommendations of ACG (9). Abdominal CT scan was performed usually between the 5<sup>th</sup> and 7<sup>th</sup> day of hospitalization when patient's clinical condition did not improve or 1<sup>st</sup> to 3<sup>rd</sup> day in case patients in whom the diagnosis was unclear. The majority of the patients with biliary AP had therapeutic ERCP performed to remove gallstones from the biliary tract what is accordance with strong recommendation of ACG (9). Oral feeding was started in the majority of patients after the symptoms relieved. In case of severe or moderate AP enteral nutrition using nasojejunal feeding tube was used. Parenteral nutrition was used only when the enteral nutrition was not tolerated or the individual daily caloric requirements were not met.

Our study is not devoid of limitations. First of all and most important was the number of patients included in

study that was relatively small. Within two years 285 patients were hospitalized due to the AP in our Department. Small group, especially in case of other etiology of AP prevented examining precise dependence of epidemiology, severity course and mortality. Moreover, we could not extract some data which we desired – such as body mass index – because it was not include in the patient's record. For a full picture of epidemiological situation in Łódź Voivodship we suggest the multicenter, prospective study to be performed in further research.

## CONCLUSIONS

We lack the studies concerning epidemiology and etiology of acute pancreatitis in certain regions of Poland. Our retrospective study demonstrated that alcohol is a major etiological factor of AP in patients admitted to hospital in Łódź and affects mostly males below 65 years old. Presence of cholelithiasis is a second caused of AP affecting mainly females above 40 years old. Finally, we state that the level of CRP can be regarded as a marker of clinical severity, it could potentially be used on admission to rapidly predict the necessity of longer hospitalization in these patients.

## Acknowledgements

Supported by grant from the Medical University of Łódź 502-03/5-006-02/502-54-231-18 to NF.

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