Acute pancreatitis (AP) is a significant clinical problem. There have been no prospective epidemiological data on AP in Poland. The aim of this study is to estimate prevalence, etiology and severity of acute pancreatitis in the Świętokrzyskie Voivodeship population, involving risk factors of this disease.

**Material and methods.** In 2011 prospective observation was conducted in all departments of surgery of the Świętokrzyskie Voivodeship. The inclusion criterion of the study, a definite diagnosis of AP, was met in 1044 hospitalized patients. According to our assumption that repeated hospitalization is considered as a new case if occurred more than 60 days after the previous one, 1004 patients were included in the further analysis.

**Results.** The incidence rate was 99.96/100,000. Incidence rate among woman was 72/100,000 and incidence among men was 130.24/100,000 (p < 0.05). Median age of AP patients was 53 years. Median age among woman (65 years) was significantly (p < 0.005) higher than among man (47 years). Incidence rate for the first episode was 79.7/100,000 citizens. Main causes of AP included cholelithiasis (30.1%), alcohol (24.1%), coexisting cholelithiasis and alcohol abuse (2.9%), pancreatic cancer (1%), AP after ERCP (0.7%). Basing on modified Atlanta criteria, severe AP was diagnosed in 7%, moderate in 12.3%, and mild in 80.7% of patients. Mean duration of hospitalization of patients with severe AP was 14.8, moderate – 16.7, mild – 7.1 days. Mortality rate for AP was 3.9%. Mean age of deceased women was 74 years and was significantly higher than in the group of men (61 years). Mortality rate in severe AP was 52.9% and was significantly (p < 0.05) higher than mortality in moderate (no deaths) or mild AP (0.2%).

**Conclusions.** Incidence rate of AP in the Świętokrzyskie Voivodeship population is among the highest in Poland. Our study indicates that new Atlanta classification, that differentiates between moderate and severe AP, needs to be implemented to the clinical practice, since the latter carries high mortality in severe cases.

**Key words:** acute pancreatitis, epidemiology, classification Atlanta

Acute pancreatitis (AP) is a significant clinical problem. Epidemiological data acquired over the last several decades in various countries indicate increasing prevalence of both acute and chronic pancreatitis (1-6).

High geographic variability exists in incidence rate of AP, ranging from 15.9 / 100,000 to 73.4 / 100,000. The lowest rates have been observed in the Netherlands (15.9 / 100,000), the highest ones in Finland (73.4 / 100,000). There have been no prospective epidemiological data on AP in Poland. High inter-country variability in AP prevalence may reflect different risk factors (7, 8). They include increasing prevalence of obesity, cholelithiasis among women and differences in alcohol consumption. Routine testing for pancreatic enzymes in patients with abdominal pain has been also suggested to result in increased AP detection (9).

Cholelithiasis etiology dominates in majority of presented studies and applies mainly to
Prevalence and progression of acute pancreatitis in the Świętokrzyskie Voivodeship population

MATERIAL AND METHODS

Bioethics Committee of Faculty of Health Sciences, Jan Kochanowski University in Kielce approved this study. The study was conducted between January and December 2011. The study enrolled patients admitted to departments of surgery of the Świętokrzyskie Voivodeship due to acute pancreatitis. The inclusion criterion of the study, according to modified Atlanta classification, required presence of two out of three items: severe abdominal pain indicating acute pancreatitis, amylase or lipase activity more than three times above the upper normal limit, typical image indicating AP in ultrasound imaging or computed tomography imaging (CT). In the Świętokrzyskie Voivodeship, patients with AP were hospitalized exclusively at departments of surgery. Hospitalizations at departments of internal medicine could have only be sporadic and did not markedly affect the incidence rate. A physician at the department documented the diagnostic procedures and patient treatment that involved collection of medical history, physical examination and analysis of performed tests and treatment progression. The study was based on specific criteria included in the prepared “Case Report Form for an acute pancreatitis patient”. The medical history was to establish risk factors and principal complaints reported by the patient. The physical examination involved assessment of general health and functioning of systems and organs. Subsequently severity and progression of acute pancreatitis were assessed using prognostic scales: Balthazar, Ranson, and APACHE II scales. These assessment used results of biochemistry and imaging studies (US, CT). Diagnostic procedures performed for each patient with acute pancreatitis were guided by his/her condition and clinical indications. In January 2012 verification of registration of AP cases was performed, by comparing a hospital database of patients hospitalized due to AP at departments of surgery according to ICD 10: K85. To prepare reliable epidemiological data in relation to the population of this voivodeship, the study enrolled also patients hospitalized in hospitals located outside the Świętokrzyskie Voivodeship who were paid for Świętokrzyski Branch of National Health Fund. Concurrently, patients whose registered address of residence was...
outside the voivodeship were excluded from the study. Readmission was considered as new cases if more than 60 days elapsed since the previous hospitalization.

AP etiology

Analysis of AP included history aimed at establishing data on alcohol consumption, comorbidities, ingested drugs, surgical history, ERCP. Biliary etiology was established basing on US, CT imaging, MRI and/or ERCP.

Incidence

Incidence rate was calculated by dividing the number of new cases in 2011 (numerator) by the population at risk of the Świętokrzyskie Voivodeship (denominator). To obtain more reliable data, citizens of the voivodeship who were treated in hospitals located outside this voivodeship were added, while patients whose registered address of residence was outside the voivodeship were subtracted from the number of patients treated at the hospitals of the Świętokrzyskie Voivodeship.

Mortality rate

Mortality rate reflects severity of the disorder assessed through the most adverse event – death. Hospital mortality rate in AP was calculated by dividing number of deaths due to AP (numerator) by the number of patients suffering from this disease (denominator) and multiplying it by 100%.

RESULTS

As of 31.12.2010, 1,266,014 citizens were recorded in the Świętokrzyskie Voivodeship, including 1,004,402 aging 20 years and more (482,175 men and 522,227 women) (20). There are 16 departments of surgery on the territory of the Świętokrzyskie Voivodeship who admit patients with signs and symptoms indicating acute pancreatitis. In 2011, 1044 patients suffering from acute pancreatitis were hospitalized in hospitals of the Świętokrzyskie Voivodeship. According to adopted assumptions, repeated hospitalization was considered a new case of AP if occurred more than 60 days after the previous hospitalization, further analysis included 1004 patients. This group was composed of 376 women and 628 men. The incidence rate was 99.96/100,000. Incidence rate among woman was 72/100,000 and incidence among men was 130.24/100,000. Incidence rates in groups of women and men were significantly different (p < 0.05; test statistics: z = 4.09739; two-sided critical area p = 4.178 e-005).

Median age of AP patients was 53 years (minimum 20 years; maximum 90 years). Median age among woman (65 years; minimum 23 years; maximum 90 years) was significantly (p < 0.005) higher than among man (47 years; minimum 20 years; maximum 75 years).

The incidence rate for the first episode was 79.7/100,000 citizens. Acute pancreatitis recurrences, recorded in interviews with patients, interpreted as repeated AP episodes without any time constraints, were found in 229 patients (22.8%). During the one-year study period, an AP recurrence occurred in 13 patients. Repeated hospitalizations more than one year after the previous hospitalization occurred in 37 patients. The other patients were hospitalized more than once due to AP. Alcohol was a dominant factor for recurrent AP, accounting for 32.8% of repeated cases. Cholelithiasis as the etiologic factor was confirmed in 18.8% patients, and cholelithiasis and alcohol abuse together in 5.2% patients with recurrent AP. Pancreatic cancer was diagnosed in ten patients (1%). AP cause was not found in the remaining 41.5% patients despite another AP episode. Acute pancreatitis on the background of chronic pancreatitis occurred in 22 (2.2%) of patients (tab. 1).

Etiology

Cholelithiasis was the main cause of AP (30.1%; 50.8% women and 17.7% men). Alcohol was the cause of AP in 24.1% cases (2.7% women and 36.9% men). Coexisting cholelithiasis and alcohol abuse was found in 2.9% cases (1.1% women and 4% men). Pancreatic cancer was diagnosed in ten patients (1%). AP after ERCP occurred in seven cases (0.7%). AP developed during pregnancy in one case. The
Prevalence and progression of acute pancreatitis in the świętokrzyskie voivodeship population

Table 1. The incidence rate of AP according to age groups for women and men

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of patients per age group</th>
<th>Number of subjects per age group</th>
<th>Incidence rate per 100,000</th>
<th>Number of men with AP in age groups</th>
<th>Incidence rate per 100,000</th>
<th>Number of women with AP in age groups</th>
<th>Incidence rate per 100,000</th>
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</thead>
<tbody>
<tr>
<td>20-24</td>
<td>39</td>
<td>99060</td>
<td>39,37</td>
<td>29</td>
<td>50632</td>
<td>57,27</td>
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<tr>
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<td>52</td>
<td>56021</td>
<td>92,82</td>
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<td>65</td>
<td>49124</td>
<td>132,32</td>
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<tr>
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<td>71</td>
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<td>277,90</td>
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<tr>
<td>Total</td>
<td>1004</td>
<td>1 004 402</td>
<td>99,96</td>
<td>628</td>
<td>482 175</td>
<td>130,24</td>
<td>376</td>
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</tbody>
</table>

cause was not found in the remaining 41.2% of patients.

Median age of patients diagnosed with cholelithiasis was significantly higher (p < 0.05) than in alcoholic AP (66 years versus 44 years). Median age of patients with AP of unexplained etiology was 55 years (standard deviation 18.7).

According to modified Atlanta classification, severe AP was diagnosed basing on clinical parameters and eventually systemic inflammatory reaction (SIRS) and/or organ failure persisting for more than 48 hours with or without local complications. Moderate acute pancreatitis was defined as presence of acute fluid collections, pseudocysts, pancreatic necrosis or necrosis of peripancreatic tissues and/or pancreatic abscess, SIRS shorter than 48 hours. Mild acute pancreatitis was defined as lack of organ failure and/or local complications (fig. 1).

Basing on these criteria, severe AP was diagnosed in 70 patients, which accounted for 7% of all disease cases. Severe AP was more common in men versus women, but this difference did not reach statistical significance. Mean age of affected men was significantly lower than of affected women (tab. 2).

Etiological factors of severe AP included cholelithiasis in 22 patients (31.4%), alcohol in 16 (22.9%), while no etiological factor was found in the remaining patients.

Moderate AP was diagnosed in 123 patients (12.3%). This group consisted of 40 women (32.5%) and 83 men (67.5%) (tab. 3).

Acute pancreatitis was mild in 80.7% of cases. Average hospitalization duration for severe AP was 14.8 days (standard deviation 12; minimum 0; maximum 109 days), for moderate AP 16.7 (standard deviation 11.5; minimum 1; maximum 79 days). Average hospitalization duration for mild AP was 7.1 days (standard deviation 3.8; minimum 1; maximum 36 days). Univariate analysis of variance

Fig. 1. Causes of AP according to age
demonstrated statistically significant correlation (p < 0.05) between AP severity and duration of hospitalization. Mortality rate due to AP was 3.9% (39 deaths), including 4.8% (18 deaths) in women and 3.3% (21 deaths) in men. Mean age of deceased women was 74 years (median 82.5; standard deviation 16.8) and was significantly higher than in the group of men – 61 years (median 60 years; standard deviation 17.0).

Thirty seven patients with severe AP died. Mortality rate in severe AP was 52.9% and was significantly (p < 0.05) higher than mortality rate in moderate (no deaths) and mild (0.2%) AP. Patients with severe AP died for circulatory-respiratory failure (37.8%) and multiorgan failure (35.1%) (tab. 4).

**DISCUSSION**

Literature reports progressive increase of hospitalizations due to AP over the recent years. There are no epidemiological data on AP incidence in Poland. Limited reports concern analysis of hospitalizations at a single hospital. Computer resources of National Health Fund and published complex analysis of Homogeneous Patient Group related to services provided between 2009 and 2001 in the whole Poland, with breakdown into specific voivodeship branches of National Health Fund remain the principal source of epidemiological data (21). Data of National Institute of Hygiene (NIH) *Badanie Chorobowości Szpitalnej Ogólnej* (Study of General Hospital Morbidity) (22) is another source. However, comparative analysis of these reports does not clearly indicate AP incidence in Poland. Basing on NHF data we can assume that the incidence rate in adult Poles is 70/100,000, according to PIH data – 76.2/100,000 citizens. According to database of Świętokrzyski Voivodeship Branch NHF, 1038 patients were hospitalized due to AP (103.3/100,000) in 2011. Such high inci-
Incidence rate results from recording of all hospitalizations, also of rehospitalizations, according to ICD 10: K85. Annual observation of AP cases allows for very reliable verification of the diagnosis and classification of AP severity according to Atlanta classification modified in 2008 and 2009 (23).

Results of our own studies indicate that AP incidence rate in the Świętokrzyskie Voivodeship is much higher (99.9/100,000) than reported in other studies and NHF data for the general Poland population and higher than reported in other countries. It may be related to degree of poverty in the studied voivodeship. Existence of such correlation has been suggested by English studies (24). High incidence rate was also recorded for first episodes of AP (79.7/100,000).

In a study conducted in the Trzebnicki Province (a single hospital, retrospective study), an estimated annual AP prevalence was 64.4/100,000, including 42.3/100,000 first episodes of AP. Severe AP occurred in 5-15% of cases (25).

The highest incidence rates are recorded in the eldest age groups. Biliary etiology predominates in the elderly women (median age 66 years), and alcoholic etiology in young men (41 years). Cholelithiasis was the most common etiological factor of AP in the study group (34%). Such results were obtained in most studies presented in the literature. Cholelithiasis as the etiological factor accounted for 60.5% AP cases in China (26), 40-45% in the United Kingdom (5), 48.5% in Norway (27), 38.4% in Sweden (1), 17% in Japan (28). In Poland 35.5-48% are presumed to be caused by cholelithiasis (29, 30). Alcohol abuse is another important etiological factor of AP. Other causes are diagnosed rarely. Modern diagnostic methods reveal cause of AP in majority of cases and literature reports that idiopathic AP accounts for up to approximately 20% of cases. However, cases of unknown etiology were common in the analyzed group and accounted for 41% of cases. Probably this is caused by lack of access to modern imaging studies (EUS, ERCP) that are used to confirm biliary etiology, in smaller hospitals and low inquisitiveness in the disease etiology, mainly in milder cases.

Alcohol abuse is one of the principal causes of AP and accounts for 17 – 60% of cases (5, 27, 31). Establishment of alcoholic etiology is very important since it saves costs related to searching for other causes of AP, but on the other hand may be difficult due to problems in obtaining information from the patient and his/her family. Scales prepared to assess alcohol consumption have low sensitivity and specificity (32). Alcohol is the main etiological factor in Finland, USA and Japan (27, 28). In a small Polish study it accounted for 60.5% of AP cases (29), while in other studies for 36%, 44% AP cases (11, 30). The alcoholic AP was diagnosed in 24.1% of patients in the analyzed material. It is regarded as the predominant etiological factor in recurrent AP, especially in men (1, 2). Alcoholic etiology was determined in the study group on the basis of alcohol abuse by the patient. No survey methods or specific laboratory tests were used to determine alcoholic etiology. Therefore, we can assume that the cause remained undiscovered in certain part of patients abusing alcohol. AP is a complication occurring in 1-10% patients undergoing ERCP (31, 33). In Polish studies, 1.1% of patients developed acute pancreatitis after the ERCP procedure. Its risk factors included accidental contrasting of the pancreatic duct, mechanical lithotripsy, sphincterotomy using initial incision of the papilla and dilatation of the common bile duct (34). AP occurred in 0.7% patients after the ERCP procedure in the studied population from the Świętokrzyskie Voivodeship.

The study authors have not found any publication in the Polish literature that would include changes in AP classification according to recommendations of modified Atlanta classification. The data published on NHF web pages do not include moderate forms of AP. Therefore reported incidence of severe AP is overestimated. Severe AP diagnosed basing on the new criteria was found in 7% of patients. NHF reports indicate 114 cases of severe pancreatitis treated in hospitals of the Świętokrzyskie Voivodeship, accounting for 9.9% of all disease cases (21). Studies conducted by Hammel et al. indicated the need to include three new categories in the assessment of AP severity. Severe AP identifies patients with high AP incidence and mortality, moderate with high incidence and low mortality, and mild with low incidence and low mortality (35). It has been emphasized that duration of hospitalization in moderate cases is similar to that in the severe AP, but mortality is similar to
that in mild AP. Classification of patients into three AP categories enables qualification of patients into homogenous severity groups (35, 36). Results of these studies were included in the report of the European Pancreatic Club in 2009 in Szeged (Hungary) (23). Results of our own studies confirm these observations. Duration of hospitalization was similar in severe and moderate AP (14.8 versus 16.7 days), but mortality in severe AP was significantly higher versus moderate form (52.9 versus 0%).

CONCLUSIONS

Acute pancreatitis is a serious epidemiological problem in an adult population of the Świętokrzyskie Voivodeship. The incidence rate is amongst the highest in Poland. Comparison of incidence according to NHF data and date collected in our own studies revealed certain discrepancies related to very detailed analysis of final diagnosis in this study. Reliable verification of collected material resulted in determination of etiology of acute pancreatitis according to sex and age ranges. Common withdrawal from detailed diagnostic procedures that could establish AP cause was found. Cause of AP remained unexplained in as many as 41.2% of patients. The conducted study indicates that the new Atlanta classification, differentiating moderate and severe AP, indicating high mortality in severe AP, needs to be implemented in the clinical practice.

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