Pancreatitis in Rheumatoid Arthritis and the Role of Systemic AA Amyloidosis in the Pathogenesis of Pancreatitis – A Postmortem Clinicopathologic Study of 161 Patients

Miklós Bély¹, Ágnes Apáthy²

¹Department of Pathology, Hospital of the Order of the Brothers of Saint John of God, Budapest, Hungary.
²Department of Rheumatology – St. Margaret Clinic Budapest, Hungary.

dr.bely.miklos@gmail.hu


Abstract

The prevalence of pancreatitis is higher in rheumatoid arthritis (RA) than in the general population. The aim of this study was to determine the prevalence of acute liponecrotic (aLnP), acute relapsing liponecrotic (aRelLnP), and chronic liponecrotic pancreatitis (chrLnP) in RA, and analyze the possible role of systemic and pancreatic AA amyloidosis (sAAa and pAAa) in the pathogenesis of pancreatitis.

Patients and Methods: At the National Institute of Rheumatology 9475 patients died between 1969 and 1992; among them 161 had RA and all of them were autopsied. RA was confirmed clinically according to the criteria of the American College of Rheumatology (ACR). Tissue samples of pancreas were available for histologic evaluation in 118 of 161 patients. Prevalence and histological patterns of pancreatitis were determined at autopsy and characterized histologically. sAAa and pAAa was specified histologically, based on evaluation of 5 organs (heart, lung, liver, kidney and pancreas) in each of the patients.

Demographics of different patient cohorts were compared with the Student (Welch) t-probe. The relationship between aLnP, aRelLnP or chrLnP and sAAa or pAAa were analyzed by Pearson’s chi-squared (χ²) test.

Results: Multiple liponecrotic foci (LnP) were found in 15 (12.71 %) of 118 patients; aLnP existed in 8 (53.33 %), aRelLnP in 4 (26.67 %), and liponecrotic foci in combination with chronic fibrotic pancreatitis (chrLnP) in 3 (20.0 %) of these 15 patients. Systemic AAa complicated RA in 29 (24.58 %) of 118 patients. Amyloid A deposition was detected in blood vessel walls, and on different tissue structures of pancreas in 26 (89.66 %) of 29 cases; in 3 (10.34 %) of 29 patients Amyloid A deposits were not found in the pancreas. In 8 (30.77 %) of 26 patients with pAAa was extreme severe.

Discussion and Conclusions: In elderly female RA patient the risk of LnP was higher comparing those with males or with LnP not associated RA patient, and the elderly female patients with LnP died significantly earlier.

sAAa, as basic complication of RA, may develop in both sexes, and at any time in the course of the disease, and pAAa is closely connected with it.
PANCREATITIS IN RHEUMATOID ARTHRITIS AND THE ROLE OF SYSTEMIC AA AMYLOIDOSIS IN THE PATHOGENESIS OF PANCREATITIS – A POSTMORTEM CLINICOPATHOLOGIC STUDY OF 161 PATIENTS

**In essence sAAa not influence the prevalence of pancreatitis, but at higher disease activity, massive amyloid A deposition in the walls of the pancreatic arterioles, small and medium size arteries can cause local ischemia and lead to a special form of LnP, namely to aReLnP (the connection between extreme severe pAAa and aReLnP was significant). Marked pAAa should be regarded an important vasculogenic factor in pathogenesis of aReLnP, which may be regarded as a special manifestation of autoimmune pancreatitis or a new vasculogenic entity in RA.**

Long term progressive accumulation of amyloid A deposits in the vessel walls and different structures of the pancreas may be associated with chrLnP, but the connection (link) between pAAa and chrLnP was not significant. This means, that pAAa is only partially responsible for chrLnP, and other reasons should be considered as well.

**Keywords:** Rheumatoid arthritis, pancreatitis, systemic and pancreatic AA amyloidosis

**ABBREVIATIONS**

RA = Rheumatoid Arthritis

ACR = American College of Rheumatology

aLnP – acute liponecrotic pancreatitis

aReLnP – acute relapsing liponecrotic pancreatitis

chrP – chronic pancreatitis

chrReIP – chronic relapsing pancreatitis

chrLnP – chronic liponecrotic pancreatitis

eIP – edematous inflammatory pancreatitis or “serous” infection associated pancreatitis

sAAa – systemic AA amyloidosis

pAAa – pancreatic AA amyloidosis

SD – Standard Deviation

NS – Not Significant

H-E – Hematoxylin-Eosin staining

PAS – Periodic Acid Schiff reaction

**INTRODUCTION**

The prevalence of pancreatitis is higher in rheumatoid arthritis (RA) than in the general population [1].

The aim of this study was to determine the prevalence of *acute liponecrotic* (aLnP), *acute relapsing liponecrotic* (aReLnP), and *chronic liponecrotic pancreatitis* (chrLnP) in RA, and analyze the possible role of systemic and pancreatic AA amyloidosis (sAAa and pAAa) in the pathogenesis of pancreatitis.

**PATIENTS AND METHODS**

At the National Institute of Rheumatology 9475 patients died between 1969 and 1992; among them 161 with RA and all of them were autopsied [2].

RA was confirmed clinically according to the criteria of the American College of Rheumatology (ACR) [3].

Tissue samples of pancreas were suitable for histologic evaluation in 118 of 161 patients.

Prevalence and histological patterns of pancreatitis were determined at autopsy and characterized histologically [4, 5].

Systemic AAa was specified histologically, based on evaluation of 5 organs (heart, lung, liver, kidney and pancreas) in each of the patients. Amyloid A deposition was diagnosed according to Romhányi [6] by a modified (more sensitive) Congo red staining [7]. Amyloid A deposits were identified in serial sections by immunohistochemical and histochemical methods [8, 9].

The extent of amyloid A deposition was evaluated by semi-quantitative, visual estimation on a 0 to 3 plus scale, based on the number of involved tissue structures in a light microscopic field [2].

("0": no amyloid deposits, "1": Sporadic, minimal amyloid deposits on different tissue structures,
"2": less than five, resp. "3": five or more involved tissue structures in a microscopic field at objective magnification of x20

Demographics of different patient cohorts were compared with the Student (Welch) t-probe [10]. The relationship between \( aLnP \), \( aRelLnP \) or \( chrLnP \) and \( sAAa \) or \( pAAa \), furthermore between \( sAAa \) and \( pAAa \) were analyzed by chi-squared test [10].

**Glossary of Definitions**

**Histologic Patterns of Pancreatitis [4, 5]**

**Liponecrotic pancreatitis** (\( LnP \)) – multiple acinar liponecrotic foci, with or without inflammatory reaction, with or without hemorrhages

**Acute liponecrotic pancreatitis** (\( aLnP \)) – acinar liponecrotic foci usually in the same stage and similar size of necrosis, with or without inflammatory reaction, with or without hemorrhages

**Acute relapsing liponecrotic pancreatitis** (\( aRelLnP \)) – acinar liponecrotic foci in different stage and size of necrosis, with or without inflammatory reaction, hemorrhages, calcification (saponification) or liquefaction (pseudocyst formation)

**Chronic pancreatitis** (\( chrP \)) – multifocal or diffuse fibrotic interstitial pancreatitis with more or less explicit (pronounced) glandular atrophy, with or without ductal changes: plugges (concentrated secretum of exocrine glands), ductal dilatation (ductectasia), ductal proliferation, and metaplasia

**Chronic relapsing pancreatitis** (\( chrRelP \)) – focal accentuated diffuse fibrotic interstitial pancreatitis usually with pronounced glandular atrophy and ductal changes

**Chronic liponecrotic pancreatitis** (\( chrLnP \)) – liponecrotic foci in combination with histological characteristics of \( chrP \) or \( chrRelP \)

**Edematous inflammatory pancreatitis** or “serous” infection associated pancreatitis (\( eIP \)) – usually a mild diffuse edematous inflammatory interstitial pancreatitis without acinar cell necrosis or hemorrhages

The prevalence of \( chrP \), \( chrRelP \) and \( eIP \) were not evaluated in this study

"Prevalence" of systemic AA amyloidosis – concerns the presence of amyloid A deposits in the wall of blood vessels of different calibers or on different tissue structures of various organs

**Size of Blood Vessels [11] in Tissue Samples with Branches of Splenic Artery, Upper and Lower Gastroduodenal Arteries**

**Arteriole** (\( a \)) – no internal or external elastic membrane, <500 micrometers in diameter

**Small artery** (\( A \)) – only internal elastic membrane present, vessels 500-1000 micrometers in diameter

**Medium size artery** (\( AA \)) – internal and external elastic membrane are present – vessel >1000 micrometers in diameter

**Venule** (\( v \)), **small vein** (\( V \)), **medium size vein** (\( VV \)) – accompanying (\( a \)), (\( A \)) or (\( AA \))

**Results**

Multiple liponecrotic foci (\( LnP \)) were found in 15 (12.71 \%) of 118 patients; \( aLnP \) existed in 8 (53.33 \%), \( aRelLnP \) in 4 (26.67 \%), and liponecrotic foci in combination with chronic fibrotic pancreatitis (\( chrLnP \)) in 3 (20.0 \%) of these 15 patients.

Systemic \( AAA \) complicated \( RA \) in 29 (24.58 \%) of 118 patients. Amyloid A deposition was detected in blood vessel walls (arterioles, small and medium size arteries, veins), and on different tissue structures (interstitial and reticular collagen fibres, nerves, periductal basal membranes) of pancreas in 26 (89.66 \%) of 29 cases; in 3 (10.34 \%) of 29 patients Amyloid A deposits were not found in the pancreas.

Marked (extreme severe) amyloid A deposition (≤1.3/pancreas) was found in the walls of arterioles, small and medium size arteries, and on different tissue structures of the pancreas in 8 (30.77 \%) of 26 patients with \( AA \).

Demographics, onset and duration of \( RA \) associated or complicated by \( LnP \) and \( sAAa \) or \( pAAa \) are summarized in Table 1.
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Comparing the age, sex, onset of RA, and duration of disease at the time of death there was no significant difference between female (p< 0.85, p< 0.33, p< 0.039) and male (p< 0.91, p< 0.47, p< 0.78) RA patients with (n=15) and without LnP (n=103) LnP (p< 0.96, p< 0.19, p< 0.11) except duration of RA of female patients.

The mean age of female patients, complicated by or associated with LnP was higher at onset of RA comparing those without LnP (55.44 years versus 50.15; p= 0.333 – NS), and the elderly female patients with LnP died significantly earlier (7.44 years versus 14.93; p< 0.0396) (Tables 1-2).

Comparing the age, sex, onset of RA, and duration of disease

<table>
<thead>
<tr>
<th>Table 1. Sex, mean age with SD, range, onset and disease duration of RA patients with (n=15) or without LnP (n=103), and with (n=29) or without sAAa (n=89), furthermore with pAAa (n=26) including extreme severe (n=8) or moderate cases (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
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<tr>
<td>RA patients (total)</td>
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<tr>
<td>Female</td>
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<td>RA patients (pancreas)</td>
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<td>AAa of pancreas (pAAa)</td>
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<td>Extreme severe pAAa</td>
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<td>Male</td>
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<td>Mild or moderate pAAa</td>
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<td>Female</td>
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<td>Male</td>
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</tbody>
</table>

Glossary to Table 1

RA: Rheumatoid Arthritis; LnP: Liponecrotic Pancreatitis (including aLnP, aRelLnP and chrLnP)

sAAa: systemic AA amyloidosis; pAAa: pancreatic AA amyloidosis; SD: Standard deviation

Comparing the age, sex, onset of RA, and duration of disease at the time of death there was no significant difference between female (p< 0.85, p< 0.33, p< 0.039) and male (p< 0.91, p< 0.47, p< 0.78) RA patients with (n=15) and without LnP (n=103) LnP (p< 0.96, p< 0.19, p< 0.11) except duration of RA of female patients.

The mean age of female patients, complicated by or associated with LnP was higher at onset of RA comparing those without LnP (55.44 years versus 50.15; p= 0.333 – NS), and the elderly female patients with LnP died significantly earlier (7.44 years versus 14.93; p< 0.0396) (Tables 1-2).

Comparing the age, sex, onset of RA, and duration of disease at the time of death there was no significant difference between female (p< 0.85, p< 0.33, p< 0.039) and male (p< 0.91, p< 0.47, p< 0.78) RA patients with (n=15) and without LnP (n=103) LnP (p< 0.96, p< 0.19, p< 0.11) except duration of RA of female patients.
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disease at the time of death there was no significant difference between female (p< 0.998, p< 0.40, p< 0.36) and male (p<0.29, p<0.50, p<0.63) RA patients with (n=29) and without sAAa (n=89) (p< 0.24, p< 0.17, p< 0.29).

The age, sex of RA patients and onset of disease did not influence the amyloid A deposition in the pancreas; there was no significant difference between female (p< 0.81, p< 0.23, p< 0.43) and male (p< 0.82, p< 0.63, p< 0.61) RA patients with sAAa (n=29) and pAAa (n=26) (p< 0.51, p< 0.20, p< 0.36); furthermore between female (p< 0.73, p< 0.13, p< 0.30) and male (p< 0.71) RA patients with extreme severe AAa of pancreas (n=8) and mild or moderate AAa of pancreas (n=18) (p< 0.36, p< 0.08, p< 0.18) (Table 2).

sAAa and pAAa complicated RA in both sexes, and at any time in the course of the disease. The relationship between sAAa and pAAa was very strong positive and significant (association's coefficient=1, χ²=97.191, p <0.00000).

### Table 2. The statistical correlations ("p" values of significance) between female and male RA patients with and without LnP and sAAa or pAAa

<table>
<thead>
<tr>
<th>RA patients n=118</th>
<th>Age</th>
<th>Onset of disease</th>
<th>Disease duration</th>
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</thead>
<tbody>
<tr>
<td>RA pts. n=118 versus RA with LnP n=15</td>
<td>p&lt; 0.97</td>
<td>p&lt; 0.24</td>
<td>p&lt; 0.15</td>
</tr>
<tr>
<td>Female n=80 versus n=10</td>
<td>p&lt; 0.87</td>
<td>p&lt; 0.38</td>
<td>p&lt; 0.064</td>
</tr>
<tr>
<td>Male n=38 versus n=5</td>
<td>p&lt; 0.93</td>
<td>p&lt; 0.52</td>
<td>p&lt; 0.80</td>
</tr>
<tr>
<td>RA pts. n=118 versus RA with sAAa n=29</td>
<td>p&lt; 0.36</td>
<td>p&lt; 0.29</td>
<td>p&lt; 0.40</td>
</tr>
<tr>
<td>Female n=80 versus n=24</td>
<td>p&lt; 0.99</td>
<td>p&lt; 0.51</td>
<td>p&lt; 0.49</td>
</tr>
<tr>
<td>Male n=38 versus n=5</td>
<td>p&lt; 0.35</td>
<td>p&lt; 0.55</td>
<td>p&lt; 0.66</td>
</tr>
<tr>
<td>with LnP n=15 versus without LnP n=103</td>
<td>p&lt; 0.96</td>
<td>p&lt; 0.19</td>
<td>p&lt; 0.11</td>
</tr>
<tr>
<td>Female n=10 versus n=70</td>
<td>p&lt; 0.85</td>
<td>p&lt; 0.33</td>
<td>p&lt; 0.0396</td>
</tr>
<tr>
<td>Male n=5 versus n=33</td>
<td>p&lt; 0.91</td>
<td>p&lt; 0.47</td>
<td>p&lt; 0.78</td>
</tr>
<tr>
<td>with sAAa n=29 versus without sAAa n=89</td>
<td>p&lt; 0.24</td>
<td>p&lt; 0.17</td>
<td>p&lt; 0.29</td>
</tr>
<tr>
<td>Female n=24 versus n=56</td>
<td>p&lt; 0.99</td>
<td>p&lt; 0.40</td>
<td>p&lt; 0.36</td>
</tr>
<tr>
<td>Male n=5 versus n=33</td>
<td>p&lt; 0.29</td>
<td>p&lt; 0.50</td>
<td>p&lt; 0.63</td>
</tr>
<tr>
<td>with sAAa n=29 versus pAAa n=26</td>
<td>p&lt; 0.51</td>
<td>p&lt; 0.20</td>
<td>p&lt; 0.36</td>
</tr>
<tr>
<td>Female n=24 versus n=21</td>
<td>p&lt; 0.81</td>
<td>p&lt; 0.23</td>
<td>p&lt; 0.43</td>
</tr>
<tr>
<td>Male n=5 versus n=5</td>
<td>p&lt; 0.82</td>
<td>p&lt; 0.63</td>
<td>p&lt; 0.61</td>
</tr>
<tr>
<td>Extreme severe pAAa (≤1.3) n=8 versus mild or moderate (&gt;1.3) pAAa n=18</td>
<td>p&lt; 0.36</td>
<td>p&lt; 0.08</td>
<td>p&lt; 0.18</td>
</tr>
<tr>
<td>Female n=5 versus n=16</td>
<td>p&lt; 0.73</td>
<td>p&lt; 0.13</td>
<td>p&lt; 0.30</td>
</tr>
<tr>
<td>Male n=3 versus n=2</td>
<td>p&lt; 0.71</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Glossary to Table 2

RA: Rheumatoid Arthritis; LnP: Liponecrotic Pancreatitis (including aLnP, aRelLnP and chrLnP)

sAAa: systemic AAamyloidosis; pAAa: pancreatic AAamyloidosis

Four (2 aRelLnP and 2 chrLnP – 26.66 %) of 15 LnP were associated with sAAa (aLnP was not associated with sAAa). There was no significant correlation between LnP and sAAa (χ²=0.0405, p <0.840). The link between aRelLnP and sAAa (χ²=0.3730, p <0.541) or chrLnP and sAAa was also not significant (χ²=1.0734, p <0.30) (Table 3).

The same cases of LnP (aRelLnP n=2 and chrLnP n=2) were associated with pAAa (aLnP was not associated with pAAa). There was no significant correlation between LnP and pAAa (χ²=0.2146, p <0.643). The link between aRelLnP and pAAa (χ²=0.5765, p <0.447) or chrLnP and pAAa was also not significant (χ²=1.4014, p <0.236) (Table 3).
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Two (50.0 %) of 4 patients with aRelLnP was accompanied by extreme severe amyloid A deposits (≤1.3/pancreas) in the walls of arterioles, small and medium size arteries, and on different tissue structures of the pancreas (aLnP or chrLnP was not associated with marked pAAa). There was a significant correlation between aRelLnP and marked pAAa ($\chi^2=6.1825, p <0.013$) (Table 3).

**Table 3.** The statistical correlations (“p” values of significance) between LnP, aRelLnP or chrLnP and sAAa or pAAa, furthermore between LnP, aRelLnP or chrLnP and marked pAAa (≤1.3/pancreas) (aLnP was not associated with sAAa or pAAa or marked pAAa)

<table>
<thead>
<tr>
<th>Pancreatitis</th>
<th>LnP</th>
<th>aRelLnP</th>
<th>chrLnP</th>
</tr>
</thead>
<tbody>
<tr>
<td>sAAa</td>
<td>$\chi^2=0.0405, p &lt;0.840$</td>
<td>$\chi^2=0.3730, p &lt;0.541$</td>
<td>$\chi^2=1.0734, p &lt;0.30$</td>
</tr>
<tr>
<td>pAAa</td>
<td>$\chi^2=0.2146, p &lt;0.643$</td>
<td>$\chi^2=0.5765, p &lt;0.447$</td>
<td>$\chi^2=1.4014, p &lt;0.236$</td>
</tr>
<tr>
<td>Marked pAAa</td>
<td>$\chi^2=0.2819, p &lt;0.595$</td>
<td>$\chi^2=6.1825, p &lt;0.013$</td>
<td>$\chi^2=0.4761, p &lt;0.490$</td>
</tr>
</tbody>
</table>

Amyloid A deposits in the wall of blood vessels, with acinar liponecrotic foci are demonstrated in Figures 1-4.

Original magnifications correspond to the 24x36 mm transparency slide – the correct height: weight ratio is 2:3.

The printed size may be different, therefore it is necessary to indicate the original magnifications corresponding to a fixed size.

![Figure 1a-d. RA, Aaa, Pancreas](image)

Amyloid A deposits in the wall of arterioles in association with liponecrotic pancreatitis

(a) H-E, x20  (b) Same as (a) Congo red, x20  (c) Same as (a), H-E, x50  (d) Same as (a), H-E, x125
Figure 2a-d. RA, AAa, Pancreas
Marked amyloid A deposits in the wall of arterioles and small artery in association with focal liponecrotic pancreatitis
(a) PAS, x125 (b) Same as (a) Congo red, x50 (c) Same as (a) PAS, x125 (d) Same as (b) Congo red, x125

Figure 3a-d. RA, AAa, Pancreas
Marked amyloid A deposits in the wall of arterioles, small arteries and medium size arteries in association with focal liponecrotic pancreatitis
(a) H-E, x20 (b) Same as (a) Congo red, x20 (c) Same as (a) H-E, x50 (d) Same as (a) H-E, x125
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Discussion

It is generally accepted, that multi-organ dysfunction associated with sAAa hampers the chances of survival of RA patients [13]. Acute pancreatitis caused by sAAa is a rare, and late complication of RA and the fatal outcome can be expected [14, 15, 16].

According to our data sAAa or pAAa may develop in both sexes, and at any time in the course of the disease. Systemic AAa or amyloid A deposits in the pancreas not increased the risk of LnP ($\chi^2=0.0405$, p <0.84 – NS; $\chi^2=0.2146$, p <0.64 – NS resp.). In our patient cohorts the prevalence of liponecrotic (aReLnP or chrLnP) pancreatitis in association with sAAa or pAAa was present in the same 4 (3.39 %) of 118 patients, and complicated RA in the later stage of the disease, in agreement of others [14, 15, 16]. The mean age of our patients complicated with sAAa or pAAa was more than 47 years at onset of RA, and the mean age of the patients was more than 61 years at death.

The precursor of amyloid A is produced by the liver, and the amount of amyloid A deposits in the pancreas depend on the amount of production, namely on the activity of the disease.

Progressive deposition of amyloid A may lead to chrLnP in time, but its role in the pathogenesis of chrLnP was not exclusive in our patient cohorts; the correlation between them was not significant ($\chi^2=1.4014$, p <0.236 – NS). Other reasons of chrLnP (gallstones, acute alcohol abuse, etc. [4, 5, 12] could have played also a role.

The close and significant connection between severe pancreatic AAa and aReLnP ($\chi^2=6.1825$, p <0.013) suggests a causal relationship between them; even the massive amyloid A deposition in the blood vessels of pancreas may lead to a special multi (mico) focal acute pancreatitis.

Massive amyloid A deposition in the walls of the pancreatic arterioles, small and medium size arteries (branches of splenic artery, upper and lower gastroduodenal arteries) can lead to local ischemia and to regressive changes in the pancreatic gland. This process is more or less widespread and multifocal,
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depending on the number of involved vessels. The size of necrobiotic areas is determined by the size of involved blood vessels. Multi-(micro)-focal necrosis of the pancreas caused by diminished blood supply is followed by regressive (necrotic) acinar changes, with or without reactive inflammation, hemorrhages, calcification (saponification) or liquefaction (pseudocyst formation), and later fibrosis, depending on the stages of the pathological process.

sAAa and pAAa is a progressive cumulative process [17]. The progressive and cumulative deposition of amyloid A in the pancreas involving more and more blood vessels of different sizes, thus the regressive changes accumulate with time, and exist in different stages at death. Different size and stage of focal necrosis, and the co-existent marked pAAa, furthermore the lack of vasculitis, ductal or other reasons may identify this type of pancreatitis.

The progressive and cumulative process of pAAa with multi-(micro)-focal necrosis of the pancreas (aRelLnP or chrLnP pancreatitis) may cause recurrent or intractable pain in the upper abdomen [2, 15].

This form of pancreatitis may be regarded a special manifestation of sAAa or a new vasculogenic entity caused by massive pancreatic amyloid A deposition in RA. The strong and significant statistical association between severe pAAa and aRelLnP support the relationship between these two pathological process in RA.

Plausible similar changes of pancreas may be expected in other autoimmune diseases complicated with sAAa, involving marked (massively) the pancreatic blood vessels.

CONCLUSION

In elderly female RA patient the risk of LnP was higher comparing those with males or with LnP not associated RA patient, and the elderly female patients with LnP died significantly earlier.

sAAa, as basic complication of RA, may develop in both sexes, and at any time in the course of the disease, and pAAa is closely connected with it.

In essence sAAa not influence the prevalence of pancreatitis, but at higher disease activity, massive amyloid A deposition in the walls of the pancreatic arterioles, small and medium size arteries can cause local ischemia and lead to a special form of LnP, namely to aRelLnP (the connection between extreme severe pAAa and aRelLnP was significant). Marked pAAa should be regarded an important vasculogenic factor in pathogenesis of aRelLnP, which may be regarded as a special manifestation of autoimmune pancreatitis or a new vasculogenic entity in RA.

Long term progressive accumulation of amyloid A deposits in the vessel walls and different structures of the pancreas may be associated with chrLnP, but the connection (link) between pAAa and chrLnP was not significant. This means, that pAAa is only partially responsible for chrLnP, and other reasons should be considered as well.

REFERENCES


Pancreatitis in Rheumatoid Arthritis and the Role of Systemic AA Amyloidosis in the Pathogenesis of Pancreatitis – A Postmortem Clinicopathologic Study of 161 Patients


