The research objective is to study presepsin as an inflammation marker to improve diagnosis of severe pneumonia and sepsis in patients on hemodialysis.

Materials and methods. 42 patients with severe pneumonia, sepsis, chronic glomerulonephritis and nephropathy aged from 17 to 77 years were examined. Among them, 18 patients received hemodialysis. Presepsin level was quantified on immunochemiluminiscent analyzer Pathfast (Mitsubishi Chemical Medience Corporation, Japan).

Results. Presepsin level in hemodialysis patients with severe pneumonia was 4431.2±2448.41 pg/ml. In hemodialysis patients with pneumogenic sepsis, presepsin was 7256.1±1547.14 pg/ml. Presepsin in hemodialysis patients with chronic glomerulonephritis and nephropathy was 2204.0±240.75 pg/ml. There was no difference between the presepsin level in patients with severe pneumonia, pneumogenic sepsis and hemodialysis patients with chronic glomerulonephritis and nephropathy. Presepsin in hemodialysis patients with pneumogenic sepsis was higher than in hemodialysis patients with chronic glomerulonephritis and nephropathy.

Conclusion. High presepsin level is an indication of an active infection process and/or an effect of hemodialysis. Possible underestimation of the progression of severe pneumonia and sepsis in hemodialysis patients should be taken into account. Pneumogenic sepsis in hemodialysis patient may be considered if presepsin level is three times higher than the original one.

Key words: presepsin, pneumonia, sepsis, hemodialysis.

Presepsin (PSP) is used as a biomarker of bacterial infection [1]. It is known that PSP is secreted by kidneys and increases when their functions are impaired [1, 2].

At the same time, the diagnosis of pneumonia and sepsis in hemodialysis patients causes difficulties in general and depending on the identification of biomarkers. Further research is needed to determine the role of PSP in the diagnosis of pneumonia, sepsis in hemodialysis patients.

The research objective is to study PSP to improve the effectiveness of diagnosis of severe pneumonia and sepsis in hemodialysis patients. For this purpose, the PSP level was determined in the following groups: 1) hemodialysis patients with pneumonia, sepsis, 2) hemodialysis patients without infectious complications, 3) patients with pneumonia, sepsis.

Materials and methods

42 patients were examined. The patients were treated in the Department of Pulmonology, Department of Nephrology, Department of Resuscitation and Intensive Care of the Regional Clinical Hospital in the period from 2014 to 2018. The age of patients varied from 17 to 77 years, the mean age was 53.5±2.40 years (±m). Among them, there were 25 men (59.5%) and 17 women (40.5%). All patients were divided into 5 groups. The first group consisted of patients with severe pneumonia (n=5, 11.9%), the second group – with pneumogenic sepsis (n=9, 21.4%), the third group – with chronic glomerulonephritis (CGN), nephropathy (n=4, 9.5%). Patients in groups 1–3 received hemodialysis. Patients with pneumogenic sepsis (n=4, 9.5%) were treated with hemodialysis on urgent indications due to the acute renal damage. The fourth and fifth groups consisted of patients with severe pneumonia and pneumogenic sepsis who did not receive hemodialysis (n=13, 31.0% and n=11, 26.2%).

The PSP level was quantified with the use of the immunochemiluminiscent analyzer Pathfast (Mitsubishi Chemical Medience Corporation, Japan). The measurement results are presented in picograms per milliliter, pg/ml. PSP was determined at admission. Patients were managed in accordance with existing clinical recommendations and standards.

Statistical processing of the data was carried out using the Statistica V. 10.0 software package. To determine statistically significant differences, Mann–Whitney U-test was used. The differences were considered significant at p<0.05.

Results and discussion

The PSP level in patients with severe pneumonia and chronic hemodialysis patients with severe pneumonia is presented in Table 1. In patients with severe pneumonia, the PSP level was lower than in chronic hemodialysis patients with severe pneumonia.
Table 1

PSP in patients with severe pneumonia and chronic hemodialysis patients with severe pneumonia

| Indicator                | Patients with severe pneumonia (1) | Chronic hemodialysis patients with severe pneumonia (2) | p  |
|--------------------------|------------------------------------|-------------------------------------------------------|----|
| PSP at admission         | \( \bar{X} \pm m \)               | \( \bar{X} \pm m \)                                    | 1-2|
| n=13                     | 362.6±76.29                       | 4431.2±2448.41                                       | p=0.010|

Note: PSP is for presepsin.

The PSP level in patients with pneumogenic sepsis and chronic hemodialysis patients with pneumogenic sepsis was lower than in chronic hemodialysis patients with pneumogenic sepsis.

Table 2

PSP in patients with pneumogenic sepsis and chronic hemodialysis patients with pneumogenic sepsis

| Indicator                | Patients with pneumogenic sepsis (1) | Chronic hemodialysis patients with pneumogenic sepsis (2) | p  |
|--------------------------|--------------------------------------|-------------------------------------------------------|----|
| PSP at admission         | \( \bar{X} \pm m \)               | \( \bar{X} \pm m \)                                    | 1-2|
| n=11                     | 1415.6±297.83                       | 7062.0±1046.08                                        | p=0.002|

PSP in hemodialysis (chronic and on urgent indications) patients with severe pneumonia, pneumogenic sepsis, CGN, and nephropathy is presented in Table 3. There was no difference in the PSP level in patients with severe pneumonia and hemodialysis (chronic and on urgent indications) patients with pneumogenic sepsis, CGN, and nephropathy. PSP in hemodialysis patients with pneumogenic sepsis was higher than in hemodialysis patients with CGN and nephropathy. Data on the PSP level can indicate an increase of the PSP level in hemodialysis patients with pneumogenic sepsis compared to chronic hemodialysis patients with CGN and nephropathy.

Table 3

PSP in hemodialysis patients with severe pneumonia and pneumogenic sepsis compared to patients with CGN and nephropathy

| Indicator                | Hemodialysis patients with severe pneumonia (1) | Hemodialysis patients with pneumogenic sepsis (2) | Hemodialysis patients with CGN and nephropathy (3) | p  |
|--------------------------|-------------------------------------------------|--------------------------------------------------|----------------------------------------------------|----|
| PSP at admission         | \( \bar{X} \pm m \)               | \( \bar{X} \pm m \)                                    | \( \bar{X} \pm m \)                                     | 1-2|
| n=5                      | 4431.2±2448.41                               | 7256.1±1547.14                                   | 2204.0±240.75                                       | 1-3|
| n=9                      |                                                  |                                                  |                                                   | 2-3|
|                           | \( p=0.142 \)                                | \( p=0.713 \)                                     | \( p=0.037 \)                                       |    |

There was no difference between the PSP level in chronic hemodialysis and hemodialysis on urgent indications patients with pneumogenic sepsis and the PSP level in only chronic hemodialysis patients with pneumogenic sepsis (p=0.841).

We obtained data on the higher PSP level in chronic hemodialysis patients with severe pneumonia and pneumogenic sepsis compared to patients with severe pneumonia and pneumogenic sepsis. These data may indicate the effect of chronic hemodialysis on the PSP level in severe pneumonia and pneumogenic sepsis.

PSP in only chronic hemodialysis patients with severe pneumonia, pneumogenic sepsis, CGN, and nephropathy is presented in Table 4. There was no difference in the PSP level in patients with severe pneumonia and only chronic hemodialysis patients with pneumogenic sepsis, CGN, and nephropathy. PSP in only chronic hemodialysis patients with pneumogenic sepsis was higher than in chronic hemodialysis patients with CGN and nephropathy. Data on the PSP level can indicate an increase of the PSP level in chronic hemodialysis patients with pneumogenic sepsis compared to chronic hemodialysis patients with CGN and nephropathy.

Table 4

PSP in hemodialysis patients with severe pneumonia and pneumogenic sepsis compared to patients with chronic hemodialysis

| Indicator                | Hemodialysis patients with severe pneumonia (1) | Hemodialysis patients with pneumogenic sepsis (2) | Hemodialysis patients with CGN and nephropathy (3) | p  |
|--------------------------|-------------------------------------------------|--------------------------------------------------|----------------------------------------------------|----|
| PSP at admission         | \( \bar{X} \pm m \)               | \( \bar{X} \pm m \)                                    | \( \bar{X} \pm m \)                                     | 1-2|
| n=5                      | 4431.2±2448.41                               | 7256.1±1547.14                                   | 2204.0±240.75                                       | 1-3|
| n=9                      |                                                  |                                                  |                                                   | 2-3|
|                           | \( p=0.142 \)                                | \( p=0.713 \)                                     | \( p=0.037 \)                                       |    |
Table 4

| Indicator | Chronic hemodialysis patients with severe pneumonia (1) | Chronic hemodialysis patients with pneumogenic sepsis (2) | Chronic hemodialysis patients with CGN and nephropathy (3) | p |
|-----------|--------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------|---|
| X ±m      | 4431.2±2448.41 n=5                                     | 7062.0±1046.08 n=5                                      | 2204.0±240.76 n=4                                          |   |

The literature data on changes of the PSP level in chronic hemodialysis patients with pneumonia, pneumogenic sepsis are limited.

An increase of the PSP level in sepsis and acute renal damage (ARD) to 1523 (293-16764) pg/ml is known [1].

Nakamura Y. et al. studied PSP in patients with and without ARD, with and without sepsis [3]. Authors determined that the PSP median value increases with an increase in the severity of ARD in the groups of patients with and without sepsis. In the group without ARD, the PSP border level was 670 pg/ml, in patients with ARD, the PSP level was higher by 864 pg/ml. The researches concluded that the PSP level can be used to determine sepsis in patients with less severe forms of ARD. However, with a significant decrease in renal functioning, PSP can be unreliable.

In their study, Takahashi G. et al. determined the PSP border level to diagnose sepsis accompanying ARD, which was detected by various indicators [4]. In ARD being determined by lipocalin associated with neutrophil gelatinase (NGAL), the PSP border level amounted to 828 pg/ml.

The data obtained in our study show an increase in the PSP level in hemodialysis or only chronic hemodialysis patients with pneumogenic sepsis compared to hemodialysis patients not having infectious complications.

Nagata T. et al. in their study determined the PSP levels in patients with reduced glomerular filtration rate (GFR) depending on the stage of chronic kidney disease (CKD, KDIGO, 2012) and in chronic hemodialysis patients with anuria (excluding patients with an infection, cancer, liver diseases, autoimmune disorders, using steroids and immunodepressants) [5]. With reduced GFR and no infection, the PSP levels increased depending on the stage of CKD to a maximum of 251.0 (213–297.5) pg/ml at stage 5 of CKD. The PSP median value in hemodialysis patients made 1160.0 (1070.0–1400.0) pg/ml. After obtaining these results, the PSP level was measured in hemodialysis patients before, immediately after and in 2 days after hemodialysis. After hemodialysis, the PSP level decreased from 1510 (1280–1670) pg/ml to 753 (542–1210) pg/ml. The results obtained by the authors suggested that PSP is filtered in hemodialysis. The increase in PSP in hemodialysis patients is due to reduced clearance and/or increased PSP production.

Conclusions

1. The presepsin level in hemodialysis patients with pneumonia, pneumogenic sepsis made 5469.5±2862.58 pg/ml and 7256.1±1547.14 respectively. Presepsin in hemodialysis patients with chronic glomerulonephritis and nephropathy was 2204.0±240.75 pg/ml. High presepsin level is an indication of an active infection process and/or an effect of hemodialysis.

2. There was no difference between the presepsin level in patients with severe pneumonia, pneumogenic sepsis and hemodialysis patients with chronic glomerulonephritis, nephropathy. Thus, it is possible to assume the underestimation of the development of severe pneumonia, sepsis in hemodialysis patients.

3. Pneumogenic sepsis in hemodialysis patients may be considered if the presepsin level is three times higher than the original one.

Conflict of interest. The authors declare that there is no conflict of interest.

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