The Evaluation of Biochemical and Microbiological Parameters in the Diagnosis of Emphysematous Pyelonephritis

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Emphysematous pyelonephritis (EPN) is a severe, necrotizing infection of the renal parenchyma, produced by gas-forming Gram-negative bacilli. Even though only few cases are reported in the literature, the disease is not so rare and can become life-threatening if the diagnose is not quick and the therapeutic measures efficient. The biochemical analysis are the first line diagnostic, indicating the severity of the infection. The aim of our study was to evaluate the importance of biochemical parameters, as first line diagnosis and also of the microbiological parameters, as etiologic diagnosis, in severe renal infections produced by gas forming bacilli mainly in diabetic patients, predominantly women, with obstructive nephrolithiasis.

Keywords: emphysematous pyelonephritis, diabetus mellitus, urinary infection

The severe kidney infections are: pyelonephritis, pyonephrosis and pyonephritis. All these clinical forms of renal diseases are the subject of a noisy clinical picture, with fever and abdominal symptoms, ranging from mild abdominal pain to septic shock [1]. Emphysematous pyelonephritis (EPN) is a rare form of pyelonephritis, an acute necroizing infection with gas, limited in the collecting system, renal parenchyma or extending to the perinephric and pararenal space, caused by Gram-negative, gas-forming bacilli, (E. coli, Klebsiella, Proteus, Pseudomonas spp are the most commonly reported etiological agents) [2]. When the patient has a severe urinary infection, with noisy clinical symptoms (fever and abdominal pain), we have to take into discussion the diagnosis of EPN mainly if the patient has major risk factors associated: diabetes mellitus, urinary obstruction and is of female gender.

First line diagnosis relies on biochemical parameters: acute inflammatory tests for the diagnosis of acute, severe infection, biochemical tests for the evaluation of the general condition of the patient and microbiological tests in order to find the etiology of the infection But in order to differentiate EPN from other similar, more common renal infections, an ultrasound and a CT scan examination is needed [3]. The ultrasound can help in diagnosing urinary retention and lithiasic obstruction, but it has proven ineffective in showing gas production in the renal parenchyma. The CT scan is the gold standard method for the diagnosis of EPN because it is capable of locating areas of gas production and dead tissue [4, 25, 26].

When the patient has a clinical severe renal disease, we have to take into discussion the possibility of an EPN diagnosis and pay attention to the biochemical tests telling much about inflammation, unbalanced diabetes and renal failure. The microbiological tests are used to confirm the etiology. All these parameters must be followed during the evolution of the disease.

Since early 1900s, antibiotics have been used in infectious diseases, the most of them being used to treat infections in humans and animals. Sometimes the medical antibiotic therapy is enough to treat the infection, at other times urgent nephrectomy is the solution to avoid a life-threatening general sepsis. EPN is considered a major urological emergency in order to avoid high morbidity and mortality [5].

Experimental part

This retrospective study was performed at the Academic Emergency Hospital Urology Department, Sibiu, Romania, between the 1st of January 2012 and the 31st of December 2016 and included all the patients admitted in the hospital with the diagnosis of severe kidney infection. We found 189 patients with this diagnose and we analyzed their laboratory tests (biochemistry and microbiological tests). We also checked their radiological investigations and we divided the patients with pyelonephritis, pyonephrosis and pyonephritis.

We further considered only the 121 patients with the diagnosis of pyelonephritis and looked for those with EPN, as a form of pyelonephritis.

We analyzed all the significant biochemical parameters, recorded in the patients files (number of leucocytes, number of trombocytes, C-Reactive Protein, urea, creatinine, glucose and glicated hemoglobin) and also the microbiological parameters (uroculture, hemoculture).

All these parameters were tested in the Clinical Laboratory of our hospital and because the hospital has an centralized electronic system, we could see the last 5 years results of all our patients.

The ultrasound investigation helped us in diagnosing urinary retention and obstruction and the CT scan confirmed the gas infiltration of the renal parenchyma, collecting system, or perinephric tissue [26].

Results and discussions

After performing laboratory tests and radiological investigations we diagnosed 121 out of 189 patients (64%) with pyelonephritis, 59 out of 189 patients (31%) with pyonephrosis and 9 out of 189 patients (5%) with pyonephritis, all being complications of preexisting renal stones.

Because diabetes mellitus is a well known risk factor for EPN [6] we attentively looked for those with renal infection and diabetes and we found 49 out of 189 (25%) patients with this association. Among the 121 patients with pyelonephritis, only 8 patients (6.6%) developed EPN. All the 8 patients with EPN were diabetic and had urolithiasis, 6 of them with obstruction. The median age was 59 years and the sex distribution was 6 females versus 2 males.
In our study all the 8 patients with EPN were diabetic patients, but not all the diabetic patients involved in the study developed EPN. Urolithiasis was an associated pathology in all the 8 patients with EPN. All EPN patients received antibiotic therapy and 2 of them required percutaneous drainage because of advanced disease. Despite of the intensive treatment 2 of the 8 patients died. Emphysematous pyelonephritis was first described in 1898 and since then the number of reported cases was not very big [7-12]. In the USA, in a busy urologic department, only 1-2 cases were encountered per year [13]. In our experience we had approximately the same incidence (8 patients in 5 years). However, a study made by Al-Geizawi et al. in 2010 [14] concluded that EPN is vastly underreported. Having our own experience with this disease during the last 5 years, we wanted to compare our finding with the literature theories related to EPN. The first step diagnosis relies on the biochemical tests about the inflammation status of the patients and about their general status. In our study we concluded that there

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<tr>
<th>Biochemical analytes</th>
<th>Patients</th>
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<td></td>
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<tr>
<td>Leukocytosis (mmc)</td>
<td>18325</td>
</tr>
<tr>
<td>Platelets (mmc)</td>
<td>53000</td>
</tr>
<tr>
<td>Urea (mg/dl)</td>
<td>69.0</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>1.86</td>
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<tr>
<td>Glucose (mg/dl)</td>
<td>269.0</td>
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<tr>
<td>HbA1c (%)</td>
<td>8.5</td>
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We analyzed the following biochemical analytes: number of leucocytes, number of platelets, C-Reactive Protein (CRP), urea, serum creatinine, glucose, glycosylated hemoglobin and microbiological tests: uroculture and hemoculture.

Analyzing the biochemical parameters of the 121 patients with pyelonephritis, we found leucocytosis, trombocytopenia, modified urea and creatinine, increased CRP, increased glucose and increased glycosylated hemoglobin. There was no difference between the mean values of these biochemical analytes in the patients with pyelonephrities and emphizematous pyelonephrities.

We analyzed the urocultures of all the 121 patients with pyelonephritis and we found E. coli positive in 73 patients (60.3%) of the urocultures, Klebsiella spp in 27 patients (22.3%) and other Gram negative bacili: Proteus in 13 patients (10.8%), Pseudomonas in 8 patients (6.6%) of the urocultures. There was no significant difference in the etiologia of the urinary tract infection between the patients with pyelonephritis and emphizematous pyelonephritis.

We analyzed the following microbiological analytes: uroculture and hemoculture.

Studying the hemocultures of the 121 patients with pyelonephritis we found 25 out of 121 patients (20%) positive with E coli.
Emphysematous pyelonephritis is a rare but severe kidney infection with acute necrosis in renal parenchyma and perirenal space. Infection is caused by gaseous uropathogens and requires early diagnosis and initiation of treatment. The risk factors for a renal infection to become EPN are: unballanced diabetes, obstructive urolithiasis and female gender. Biochemical and microbiological tests: leucocytes, platelets, urea, serum creatinine, glucose, glicated hemoglobin, are the first line diagnosis. The prognostic factors related to diabetes and also those related to the general status of the patient, relies also on biochemical data. Severe prognosis factors are the modified values of are serum creatinine (high) and number of platelets (low). Analyzing these cases we could compare our work to others and improve the knowledges concerning this life-threatening renal disease, and recommend a more aggressive treatment.

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