INCIDENCE OF THE INFECTIVE ENDOCARDITIS IN PATIENTS WITH TUNNELED CATHETERS IN ONE BULGARIAN DIALYSIS CENTER PER YEAR

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ABSTRACT
Background: Infections are common complications among patients on chronic hemodialysis. Catheter-related bloodstream infections (CRBSIs) are estimated to be 0.15 to 3.5 cases per 1000 catheter-days (CD) in case of tunneled catheters, and the frequency of bacterial endocarditis is estimated at 3.5 to 10% of these.

Materials and methods: We retrospectively present data from the study, which was conducted in our clinic for a one-year period from January 1 to December 31, 2018. The average number of patients undergoing hemodialysis was 104, and 33 (32%) of them had tunneled catheters. There was 12,045 total CD. We took chemocultures of all patients with clinical signs dubious about CRBSIs. All patients with positive chemocultures were examined by echocardiography.

Results: We have found 19 episodes of CRBSIs in 15 patients (1.5/1000 CD). We found a total of 21 causative microbial agents in positive chemocultures, two of which were polymicrobial. Thirteen of the bacteria (62%) were Gram-positive [G (+)] and eight Gram-negative [G (-)] (38%). The most common G (+) bacterium was Staphylococcus aureus 9 and G (-) – Citrobacter coseri. In six patients (32%) with CRBSIs, we found bacterial endocarditis. Four of them (67%) were infected with G (-) negative agent, and two (33%) – with G (+).

Conclusions: We conclude that our high incidence of bacterial endocarditis is probably due to the fact that we have examined all of the patients for this complication and that gram-negative bacteria are more often the cause of bacterial endocarditis in patients undergoing hemodialysis with a tunnel catheter.

Keywords: hemodialysis, tunneled hemodialysis catheters, catheter-related bloodstream infections (CRBSIs), infectious endocarditis.

INTRODUCTION
Vascular access continues to be the “Achilles’ heel” for hemodialysis patients. Despite existing initiatives to increase the proportion of patients treated with hemodialysis with permanent vascular access, the use of tunneled catheters for hemodialysis treatment is increasing worldwide. Their share is estimated at not less than 25% in patients treated with hemodialysis after 90 days of its initiation and up to 80% in patients starting this treatment [1].

Infections are common complications for hemodialysis patients. Patients undergoing hemodialysis by central venous catheter, such as vascular access, have a 2- to 3-fold increased risk of hospitalization associated with infections compared with patients with an arteriovenous fistula or prosthesis [2]. Catheter-related blood stream infections (CRBSIs) have a reported incidence of 1.1 to 5.5 episodes per 1000 catheter-days (CD) and are associated with increased morbidity, hospitalizations, and death [3, 4].

Infectious endocarditis (IE) is a microbial infection of the endothelial lining of the heart, which usually involves natural or prosthetic valves but can also affect the adjacent structure of the valve, wall mucosa, or cardiovascular devices. Duke’s criteria for infective endocarditis combine primary and secondary clinical criteria. Positive blood culture results for IE and evidence of endocardial involvement from echocardiography are Duke’s two main criteria. The small criteria are fever, predisposing heart condition, vascular events, immunological changes, microbiological and echocardiographic evidence that do not meet the main criterion. The simultaneous presence of the two main criteria allows the clinical diagnosis of IE. In addition, it is possible in the presence of only one primary and three secondary criteria or in the presence of five secondary criteria. In addition to certain IEs, possible and rejected categories are also defined by Duke criteria [5, 6]. The first case of infectious endocarditis in a hemodialysis patient was reported in 1966 [7]. The incidence of IE complicating bacteremic episodes in hemodialysis patients is 2% to 6% [8].
MATERIALS AND METHODS
We studied the incidence of infectious endocarditis in hemodialysis patients, treated with a tunneled catheter and a clinically manifested catheter-associated blood infection within one year: from January 1 to December 31, 2018. The number of our hemodialysis patients for the same period was 104. Thirty-three of them (32%) had a tunneled catheter as the only vascular access. All patients with clinical evidence of catheter-associated blood infection received blood cultures according to current regulations. Blood culture medium BD BactecRPlus Aerobic / F (Bacton, Dickinson and Company, Sparks, MD 21152) was used. To study the antibiotic susceptibility of the isolated causative agent, we used the Bauer-Kurby disk-diffusion method or determination of the minimum inhibitory concentration (MIC) via the Vitek 2 automatic system. Patients with positive blood culture underwent a mandatory echocardiographic examination using an ultrasound machine GE Vivid S60 Ultrasound Machine. Patients who met Duke’s criteria for diagnosing IE were treated by a cardiologist and nephrologist for 4 to 6 weeks.

RESULTS
We identified nineteen episodes of CRBSIs in fifteen patients, with two episodes per person reported in four patients. The overall survival of the tunneled catheters in the study was 12,045 catheter days. Thus, the frequency of CRBSIs we found was 1.5 episodes per 1000 CD. We found a total of 21 causative microbial agents in positive chemocultures, two of which were polymicrobial. Thirteen of the bacteria (62%) were Gram-positive [G (+)] and eight (38%) – Gram-negative [G (-)]. The most common G (+) bacterium was Staphylococcus aureus – 9 and G (-) – Citrobacter coseri. In six patients (32%), we found a sufficient number of criteria for the diagnosis of infectious (bacterial) endocarditis. Four of them (67%) were infected with G (-) negative agent, and two (33%) – with G (+) (Fig. 1).

Fig. 1. Distribution of the causes of bacterial endocarditis.

We found vegetations of the aortic valve in three of the patients (50%), in two of the mitral valve and in one of the tricuspid valves (Fig. 2). One patient underwent surgical treatment – placement of a mechanical prosthesis on the aortic valve, after 8 weeks of antibiotic treatment. The follow-up of patients in the next 12 months did not show any case of new or endocardial reinfection, as well as manifestations of hemodynamically significant valve dysfunction and/or heart failure.

Fig. 2. Vegetation of the tricuspid valve (our case).

DISCUSSION
Chronic kidney disease (CKD) is becoming more common worldwide. Its incidence averages 9.1% (8.5 to 9.8%) of the world’s population, and the total number of patients with CKD is estimated at 700 million in 2017. GBD Chronic Kidney Disease Collaboration reported for the period from 1990 to 2017 the reduction of the global age-standardized mortality for cardiovascular diseases by 30.4%, for various neoplasms – 14.9% and for chronic obstructive pulmonary diseases (COPD) – 41.3%. Unfortunately, such a decrease is not reported in CKD (2.8% decrease) [9].

CKD is characterized by increased mortality from cardiovascular and infectious complications in these patients, which account for about 70% of their mortality. Various disorders of innate and adaptive immunity, known in
patients with CKD, are considered to be the main causes of these complications [10]. Gülmez Ö. cites data from studies in 2017, according to which the incidence of IE among hemodialysis patients is estimated at 6% or the age-adjusted ratio of these cases is estimated at 17.9 cases per 100,000 patient-years, while for the rest of the population estimated a frequency of 1.7-6.2 cases / 100,000 patient-years [11]. Similar results are mentioned by other authors [12].

The frequency of CRBSIs we found was 1.5 episodes/1000 CD. It is comparable to the frequency from 1.1 to 5.5 episodes / 1000 CD that was reported in 2016 by Miller L. et al. [4]. At the same time, the relative share of patients with proven IE is higher (32%) than previously reported [1, 12]. In our opinion, this difference is due to the fact that in our study, all patients with clinical data on CRBSIs and an isolated microbial agent were tested for IE by echocardiography, which is not widely used. In addition, we theorize that we could link the increased proportion of IE in our study to the high incidence of G (-) bacteria that have been found to cause more serious damage in the course of sepsis. Saturbatico M. et al. (2015) found significantly higher levels of proinflammatory cytokines (TNF-α, IL-8, IL-12) in patients with sepsis caused by G (+) bacteria than in those with sepsis caused by G (+) bacteria [13].

The recommended behavior for cases with data for CRBSIs is threefold: systemic antibiotic use, antimicrobial locking (instillation) solutions, and catheter management. In the presence of an infectious complication such as IE, antibiotic treatment is recommended for at least six weeks [4, 14].

According to Beathard G. (1999), patients with tunneled catheters and signs of CRBSI, together with positive blood culture, can be treated in several ways:
- to remove the catheter;
- to change the catheter with the help of a metal guidewire;
- to change the catheter with the help of a metal guidewire and to make a new exit site and a new tunnel;
- the catheter to remain until the infection is treated [15].

Tunneled catheters must be removed from patients with CRBSI due to some of the following states: severe sepsis; purulent thrombophlebitis; endocarditis; continuing bloodstream infection despite more than 72 hours of antibiotic therapy that the microorganism is sensitive to; infections caused by S. aureus, P. aeruginosa, fungi or Mycobacterium [16].

CONCLUSIONS

We conclude that the high incidence of infectious endocarditis in our study is probably due to the fact that we examined all patients for this complication by echocardiography and that G (-) bacteria are more likely to cause bacterial endocarditis in patients undergoing hemodialysis with a tunnel catheter. We recommend that the echocardiographic examination should become a part of the rules of good clinical practice for the diagnosis and treatment of catheter-related bloodstream infections in hemodialysis patients with central venous catheters.

In this way, we would be able to better manage this serious complication, thus reducing its unfavorable results - early surgical treatment and high mortality.

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