

## Microbiological Aspects of Peritonitis in Patients on Continuous Ambulatory Peritoneal Dialysis: A Monocentric Five Years Follow up Study

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Received date: November 3, 2015; Accepted date: December 4, 2015; Published date: December 15, 2015

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### Abstract

Peritonitis is a serious complication of continuous ambulatory peritoneal dialysis (CAPD). CAPD peritonitis usually occurs due to contamination by bacteria from the skin or the environment of the inserted catheter. The aim of this study was to analyze data about microbial cause of peritonitis in patients on CAPD monitored at University Clinical Centre of Republic of Srpska, Bosnia and Herzegovina in five years period, from October 2010 till October 2015. In the five-year period 69 samples of peritoneal dialysate were examined. The most common isolates were Gram +ve bacteria: *Staphylococcus aureus* in 9 cases (32.1%), coagulase-negative *Staphylococcus* 5 (17.6%) and the Gram -ve bacteria *Escherichia coli* 4 (14.2%) and *Enterobacter* 3 (10.7%). In one case *Candida* spp. (3.6%) was isolated. All the Gram positive isolates were sensitive to ciprofloxacin and vancomycin. Among *Staphylococcus* spp. there were no methicillin resistant strains. The findings of culture of peritoneal dialysate is important for the proper choice of antimicrobial therapy. The use of systemic vancomycin and ciprofloxacin administration is a simple and efficient first-line protocol antibiotic therapy for PD peritonitis.

**Keywords:** Continuous ambulatory peritoneal dialysis; peritonitis; peritoneal dialysis

### Introduction

Continuous ambulatory peritoneal dialysis (CAPD) is used as an alternative to haemodialysis for the management of patients with end-stage renal failure. In this procedure the patient's own peritoneal membrane is used to dialyze waste products from the patient's blood [1]. CAPD uses a closed system of commercially prepared sterile dialysate fluid in a bag, connected to a Tenckhoff catheter which leads the fluid in and out of the peritoneal cavity. This achieves hyperosmolar ultrafiltration across the peritoneal membrane [1,2].

Peritonitis is a common complication of CAPD. Around 18% of the infection-related mortality in those patients is the result of peritonitis [1,3].

Although quality standards demand an infection rate <0.67 episodes/patient/year on dialysis, the reported overall rate of CAPD associated infection is 0.24-1.66 episodes/patient/year [2].

Peritonitis is associated with significant morbidity, removing the catheter, transfer to hemodialysis, transient loss of ultra filtration, and possible permanent damage to the peritoneum [3,4]. In some circumstances can be fatal. CAPD peritonitis usually occurs due to contamination by bacteria from the skin or the environment of the inserted catheter [2,5]. Peritonitis treatment should aim for rapid resolution of inflammation and preservation of peritoneal membrane function.

The majority of CAPD infections are unimicrobial, and in some cases is polymicrobial [6,7]. Infection may involve the catheter exit site, subcutaneous tunnel, or the peritoneum [5,6].

Clinical manifestations of infection in patients undergoing CAPD include: cloudy dialysis effluent, abdominal pain and tenderness, fever, nausea, vomiting, chills, erythema at the catheter site, discharge at the catheter site and catheter malfunction [1,4].

### Materials and Methods

The aim of this study was to analyze data about microbial cause of peritonitis in patients on CAPD monitored at University Clinical Centre of Republic of Srpska, Bosnia and Herzegovina in five years period, from October 2010 till October 2015. There was 19 patient monitored during 5 years with 31 peritonitis episode. The incidence was 0.32 episode/patient/year. Only one isolate per peritonitis episode per one patient was taken into account, to avoid duplicating isolate. Negative culture results included also the control samples after treatment. Cultivation. All the samples of peritoneal dialysate were cultivated on previously described technique [1]. Shortly, 5 to 10 ml of peritoneal dialysate was inoculated into a pair of BacT/Alert blood culture bottles, and inoculated into vials with growth media containing absorbent surface for possible presence of antimicrobial drugs. The inoculated bottles were incubated at 37°C for at least 5 days. Identification of the isolated organism and antibiotic susceptibility testing was performed by the VITEK 2 Card for the identification and antimicrobial susceptibility testing (VITEK 2 System, bioMerieux, Marce l' Etoile, France).

### Results

In the five-year period 69 samples of peritoneal dialysate were examined. Positive were 28 (40.6%) and negative 41 (59.4%). Negative culture results included also the control samples after treatment. The most common isolates were Gram +ve bacteria: *Staphylococcus aureus* (*S.aureus*) in 9 cases (32.1%), coagulase-negative *Staphylococcus*

(CoNS) 5 (17.6%) and from the Gram-negative *Escherichia coli* (*E.coli*) 4 (14.2%) and *Enterobacter* 3 (10.7%). In one case was isolated *Candida* spp. (3.6%). The results were shown in table 1.

Isolate	Number	%
<i>Staphylococcus aureus</i>	9	32.1%
<i>Coagulase negative Staphylococcus</i>	5	17.9%
<i>Streptococcus viridans</i>	1	3.6%
<i>Erysipelotrix rhusiopathiae</i>	1	3.6%
Gram Positive (total)	16	57.2%
<i>Escherichia coli</i>	4	14.2%
<i>Enterobacter</i>	3	10.7%
<i>Pseudomonas aeruginosa</i>	2	7.1%
<i>Klebsiella pneumoniae</i>	1	3.6%
<i>Haemophylus influenzae</i>	1	3.6%
Gram Negative (total)	11	39.2%
<i>Candida</i> spp	1	3.6%
Total	28	100%

**Table 1:** Isolates from the peritoneal fluid in patients on peritoneal dialysis with peritonitis monitored in University Clinical Centre of Republic of Srpska from 2010 till 2015.

The Gram positive isolates was sensitive to Ciprofloxacin and Vancomycin. Among *Staphylococcus* spp. there were no methicillin resistant strains. Among Gram negative bacteria, half of the isolates were beta lactamase producers, and all the strains were sensitive to carbapenems and trimetoprom- sulfometoxasole.

## Discussion

This is the first study about microbial cause of peritonitis in patients on CAPD in University Clinical Centre of Republic of Srpska, which is the referral hospital for peritoneal dialysis program in this part of Bosnia.

Peritonitis is the most frequent cause of CAPD failure, with an important impact on patient mortality [1,6]. In two studies published 2009, it has been shown that catheter-related peritonitis occurred in about 20% of patients and exit site infection was responsible for catheter removal in more than one-fifth of cases [5,8]. Similar as it was in our study, Gram-positive cocci such as *Staphylococcus epidermidis* (*S. epidermidis*), other CoNS, and *S. aureus* are the most frequent etiological agents of CAPD peritonitis worldwide [9,10]. The spectrum of organisms associated with CAPD peritonitis varies geographically [2,10]. For example, Gram-ve CAPD is more frequent than Gram+ve peritonitis in the CAPD population in India and is associated with worse outcome [11]. Though a wide spectrum of organisms are responsible for CAPD peritonitis, it is important to note that a significant proportion of the infections are culture negative [12,13]. The Renal Association suggested that it is necessary that appropriate laboratory samples are obtained before starting of antimicrobial therapy [1].

Correct microbiological culturing of peritoneal effluent is of great importance in establishing of the responsible the microorganisms. Identification of the organism and antimicrobial susceptibility testing will not only help guide antibiotic selection but the type of organism can indicate the possible source of infection [12,13]. The rapid blood-culture techniques (e.g., BacT/Alert) may speed up isolation and identification. Yoon et al., 2010 have shown that the blood culture method using the BacT/Alert system is useful for culturing dialysates and improves the positive culture rate in patients with suspected peritonitis compared to the conventional culture method [13].

Peritonitis caused by Gram +ve bacteria has a significantly higher resolution rate than either polymicrobial peritonitis or Gram -ve peritonitis [1,6]. Isolation of Gram negative bacteria (with or without Gram +ve bacteria) or fungi carries a worse prognosis and generally should be treated with early catheter removal and appropriate antimicrobial therapy [14,15]. Fungal peritonitis is usually preceded by multiple episodes of bacterial peritonitis and poses a significant risk of removing of the patient from the PD program [16]. Fungal peritonitis is relatively uncommon and is caused mainly by *Candida* species.

The use of systemic Vancomycin and Ciprofloxacin administration is a simple and efficient first-line protocol antibiotic therapy for CAPD peritonitis - success rate of 77% [17]. However, for fungal CAPD peritonitis, it is now standard practice to remove PD catheters in addition to antifungal treatment for a minimum of 3 weeks and subsequent transfer to hemodialysis [16].

For the prevention of the exit site infection caused by *Staphylococcus* spp. in patients on CAPD, the mupirocin treatment has been recommended [18].

## Conclusion

The results of our study are comparable with the findings of similar studies in the Europe. The culture of peritoneal dialysate is important for the proper choice of antimicrobial therapy. To prevent CAPD associated infections, prophylactic antibiotic administration before catheter placement, adequate patient training, exit-site care, and treatment for *S. aureus* nasal carriage should be employed.

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