The Brazilian Journal of
INFECTIOUS DISEASES

www.elsevier.com/locate/bjid

Original article

Morbimortality study of infection in patients undergoing different types of dialysis in a renal replacement therapy center

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ARTICLE INFO

Article history:
Received 7 May 2013
Accepted 18 August 2013
Available online 3 January 2014

Keywords:
Hospital infection
Morbimortality
Renal replacement therapy center
Hemodialysis
Bacteria
Sensitivity profiles

ABSTRACT

Introduction: Renal replacement therapy is the treatment of end-stage chronic kidney disease and can be performed through dialysis catheters, arteriovenous fistulas/grafts, and peritoneal dialysis. Patients are usually immunocompromised and exposed to invasive procedures, leading to high rates of infection and increased mortality.
Objectives: To compare the prevalence of infection and related deaths, as well as the sensitivity profile of the putative bacteria in patients treated with peritoneal dialysis, arteriovenous fistula hemodialysis and catheter hemodialysis.
Methods: This is case–control study. Six hundred forty-four patients undergoing renal replacement therapy were selected. Patients were divided into three groups according to the modality of dialysis treatment: peritoneal dialysis (126 patients), arteriovenous fistula hemodialysis (326 patients), and catheter hemodialysis (192 patients).
Results: One hundred sixteen patients (18.01%) developed infection. There was a higher incidence of infection in the peritoneal dialysis group (44 patients; 34.92%; OR: 3.32; CI 95% = 2.13–5.17; $p = 0.0001$). In the catheter hemodialysis group, 48 patients (25%) had infection (OR: 1.88; CI 95%: 1.24–2.85; $p = 0.0035$). In the arteriovenous fistula hemodialysis group, 24 patients (7.36%) developed infection (OR: 0.19; CI 95%: 0.12–0.31; $p = 0.0001$). Five patients (4.31%) died due to infection (four in the peritoneal dialysis group and one in the catheter hemodialysis group). There were no deaths due to infection in the arteriovenous fistula hemodialysis group.
Conclusions: Peritoneal dialysis is the treatment with greater risk of infection and mortality, followed by catheter hemodialysis. The lowest risk of infection and mortality was observed in arteriovenous fistula hemodialysis group.

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http://dx.doi.org/10.1016/j.bjid.2013.08.007

Introduction

Chronic kidney disease (CKD) has high prevalence and incidence worldwide, particularly in Brazil.[1] Although the National Kidney Foundation (NKF)[2] in 2002 has proposed staging CKD in order to slow the advance toward the functional failure of the kidneys, difficulties such as lack of early diagnosis, inadequate treatment in the early stages, delayed specialized monitoring, and the complexity of the disease lead many people to need renal replacement therapy (RRT).[1–3] RRT can be implemented through hemodialysis (HD), peritoneal dialysis (PD), and renal transplantation. Each treatment has its own characteristics, advantages, disadvantages, and complications.[4] Peritoneal dialysis allows the patient home treatment decreasing outpatient visits. Hemodialysis can be performed through a central catheter (CH) inserted in the internal jugular or subclavian vein or through an arteriovenous fistula (AVF) preferably in the upper limbs whose optimal functionality delay varies from one to three months.[5,6] Nosocomial infection is one of the most serious complications and the second cause of death in dialysis patients.[7] The risk factors that predispose to nosocomial infection in RRT may be influenced by patient characteristics, site of dialysis access, and disorders of the skin and mucous membranes[8]; and comorbidities such as diabetes mellitus, anemia, cardiovascular disease, immunosuppression, and metabolic imbalances.[4,5] Peritonitis is the most frequent infection in patients undergoing PD, and septicemia is the most frequent complication among patients on HD, especially when conducted through a central venous catheter. The kind of vascular access for HD has significant influence on patient survival. Catheters are associated with substantially greater risk of septicemia, hospitalization, and mortality compared to AVF.[9] There are few studies in Brazil evaluating infection rates, the prevalent microorganisms and the susceptibility profile of bacterial infections associated with RRT. These data may be useful for empirical anti-infective therapy in these patients, as well as to better evaluate the choice of dialysis treatment aiming at preventing infections. The objective of the present study was to compare the prevalence of infection and related deaths, as well as the sensitivity profile of the putative bacteria in RRT treated patients.

Methods

This is a case–control study. The study sample consisted of 644 patients treated in the RRT outpatient center at Santa Casa de Misericordia de Ponta Grossa Hospital during a 29-month period. Patients on RRT who developed nosocomial infection (116 patients) were considered as cases. Patients who did not develop infection (528 patients) were considered as controls. Nosocomial infections were considered when the Commission of Hospital Infection Control (CHIC) identified the case as such, based on clinical features, complementary blood tests, and culture results of biological material. Unconfirmed cases of infection by the CHIC were excluded. The patients were divided into three groups according to the type of dialysis treatment: PD (116 patients), CH (192 patients), and arteriovenous fistula hemodialysis (AVH) (326 patients). The study was approved by the local ethics committee.

Statistical analysis

To compare categorical variables, two-tailed *Fisher*'s exact test with *Bonferroni* correction for multiple comparisons was used. To evaluate the effect size *Odds Ratio* (OR) was calculated with 95% confidence interval (CI) and its transformation in probability (p). The samples were properly tested for normality by *Anderson–Darling* test. The presence of *outliers* was checked by the *Grubbs* test. The statistical power of the sample was computed in each comparison. Results are presented as mean ± standard deviation (SD). Analyses, including descriptive statistics, were performed using EPI INFO program. $p < 0.05$ was considered statistically significant.

Results

Of the 644 patients who underwent dialysis during the study period, 116 (18.1%) developed some infection (63 male; 57.22 ± 12.76 years). One hundred fifty-six infections were reported. Seventy-one (45.51%) infections (56.14 ± 11.22 years) were in patients on PD, 60 (38.46%) infections (59.82 ± 13.33 years) in patients on CH, and 25 (16.2%) infections in patients on AVH (53.8 ± 14.7 years) (Table 1).

Comparison between groups

Of the 126 patients undergoing PD, 44 (34.92%) had at least one infection during the study period, which was significantly higher than that in the other two groups (OR: 3.32; CI 95%: 2.13–5.17; $p = 0.0001$). CH also showed up as a risk factor for the development of infection with 48 (25%) of the 192 infected patients (OR: 1.8824; CI 95%: 1.24–2.85; $p = 0.0035$). The lowest incidence of infection was observed in AVH group: 24 (7.36%) of 326 patients (OR: 0.19; CI 95%: 0.12–0.35; $p = 0.0001$). For all comparisons made, the statistical power was greater than 99%, with a consequent error – beta less than 1% (Table 2).

Individual comparison between groups

Comparing the groups individually, AVH turned out to be the safest method with less infections, resulting in lower incidence of morbidity when compared with CH (OR: 0.23; CI 95%: 0.14–0.40; $p = 0.0001$) and PD (OR: 0.14; CI 95%: 0.08–0.25; $p = 0.0001$). There was no statistically significant difference between the incidence of infections in the PD group and the CH group (OR: 0.62; CI 95%: 0.38–1.01; $p = 0.0593$). The statistical power to detect these differences was 100% in both cases, therefore no beta error (Table 3).

Deaths

Of patients infected (116), five died due to infection, with an overall mortality rate of 4.31%. There were four deaths (9.09%)