

Risk Factors Associated with Multidrug-Resistant Bacterial Infections in Patients with Renal Replacement Therapy

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Received: February 18, 2022, Manuscript No. IPADM-22-11586; **Editor assigned:** February 21, 2022, PreQC No. IPADM-22-11586 (PQ); **Reviewed:** March 07, 2022, QC No. IPADM-22-11586; **Revised:** March 11, 2022, Manuscript No. IPADM-22-11586 (R); **Published:** March 18, 2022, DOI: 10.36648/1698-9465.22.18.1487

Citation: Mejia RAE, Zarza MAM (2022) Risk Factors Associated with Multidrug-Resistant Bacterial Infections in Patients with Renal Replacement Therapy. Arch de Medicina Vol:18 No:1

Abstract

The demand for patients in need of hemodialysis worldwide leads health units to assume the responsibility of providing quality care and warmth to reduce morbidity during the hospital stay, even more so for patients who are in critical areas. Hemodialysis and prolonged bedtime in critical areas make patients susceptible to what are currently known as infections associated with health care, which together with the problem of bacterial resistance make the prolongation of hospital stay and treatment longer. In this work, through a review of the current literature, the main risk factors associated with infections by multidrug-resistant germs in patients with renal replacement therapy will be identified to make it available to all health personnel.

Keywords: Risk factors; Hemodialysis; Infections; Multidrug resistant; Critical; Chronic kidney disease

Introduction

Terminal chronic kidney disease is a public health problem that affects patients of all ages, as a consequence, the need to resort to renal replacement therapy procedures is increasing; hence, it is considered pertinent to identify the main risk factors associated with infections by Multidrug-Resistant Bacteria (MDR) in critically ill patients and thus avoid morbidity and mortality during the treatment of these patients [1,2].

In this way, the demand for patients in need of hemodialysis worldwide and in Latin America is increasing, and this leads health units to assume the responsibility of providing quality care and warmth to reduce morbidity during hospital stay. Hospital, even more so for patients who are in critical areas, mainly in order to avoid infections [2,3]. Hemodialysis and prolonged bed rest in critical areas make patients susceptible to what are currently called health care associated infections, which, together with the problem of bacterial resistance, make prolonged hospital stay and treatment be longer [4].

Specifically, the main infectious process in patients with chronic kidney disease undergoing dialysis treatment are urinary

tract infections and this incidence increases as the disease progresses and the defensive mechanisms against infection deteriorate [5]. In dialysis patients they are responsible for high rates of hospitalization, followed only by pulmonary infection and sepsis [6]. In the case of renal transplant recipients, bacteriuria (35-80%) and its progression to UTI due to previous infections in the transplanted kidney, manipulation of the urinary tract, and immunosuppressive medication are even more common [7]. The appearance of UTI is the first cause of bacteremia in these patients and implies an increased risk of the appearance of kidney failure and graft failure [8].

Methodology

A systematic bibliographic search was carried out in databases such as: PubMed, science direct, Wiley, Google Scholar, Plos one. The collection and selection of data was carried out in journals indexed in the first and second language from the years 2000 to 2021, using the following descriptors such as: chronic kidney disease, risk factors, risk factors, infections, multidrug-resistant bacteria, drug therapy. Kidney replacement, review articles were used, such as originals, letters to the editor, cases and clinical studies.

Results

Kidney failure diseases today represent a rare and complex pathology, but in its early stages it is frequent and easy to treat, at present only a small proportion of patients evolve towards terminal renal failure with its associated complications and the need for treatment. Dialysis and renal replacement therapy. This evolution towards the loss of kidney function has a progressive course, which can be influenced by early action on its main causes: High Blood Pressure (HBP) and diabetes mellitus. In addition, these patients have a greater tendency to present urinary tract infections due to different microorganisms. In recent years, the prevalence of infections caused by Multidrug-Resistant Bacteria (MDR) has been increasing, significantly affecting their functional class. [9].

Thus, a microorganism is considered multidrug-resistant when it shows a lack of susceptibility (intermediate or resistant) to at

least one agent in three or more antimicrobial categories [10]. They can present different resistance mechanisms such as Blee (extended-spectrum beta-lactamase), AMPC type Beta lactamase and carbapenemases [11]. Currently there is a sustained growth in the incidence of urinary tract infections in patients with renal replacement therapy, which have become a challenge for their treatment because there are few effective antibiotics, they are for parenteral use and have side effects important which associates them with a bad evolution [12].

So much so that, Infectious complications in CKD constitute an important source of morbidity and mortality, especially in patients undergoing renal replacement therapy, be it hemodialysis, peritoneal dialysis or kidney transplant, presenting an infectious process with a frequency three times higher [13]. The appearance of infections in CKD is independently associated with progression to end-stage CKD, cardiovascular ischemia, congestive heart failure, and mortality [14].

The patient with CKD more frequently has risk factors for the acquisition of infections by various microorganisms. On the one hand, uremia causes alterations in the humoral response, lymphocyte function, macrophages and polymorphonuclear cells [15,16]. On the other hand, the underlying cause of CKD is sometimes a condition that compromises the normal evacuation of urine and the integrity of the urinary tract, or involves its manipulation (vesicoureteral reflux, neurogenic bladder, urethral valves, prostatism, bladder catheterization, renal catheterization, complicated lithiasis, polycystosis). In other cases, diabetes is the underlying cause of both CKD and the increased susceptibility to UTI onset and its worse course, especially in older female patients.

A study was found that was carried out at the Hospital "Dr. Teodoro Maldonado Carbo" (HTMC) IESS regional in Guayaquil in the critical care units of this institution. Within this research, a finite population of 136 critically ill patients has been considered, in critical condition during a period of 6 months between October 2014 to March 2015 and who underwent hemodialysis either before admission or who started their treatment during their hospital stay, regardless of the reason for admission.

The male sex was the most affected by bacterial infections (MDR) resulting in 23 infected (79.31%) of the global population, The ages that were affected were between 35 and 50 years old, 4 (13.79%) were found, among the 50 to 65 as well as between 65 to 80 years in each of them were 8 (27.58%), in the group of patients older than 80 years 9 (31.03%) being this the most affected population. The main reasons for admission of the affected patients were respiratory failure, which corresponded to 15 patients.

All patients who acquired (MDR) were subjected to mechanical ventilation regardless of their degree and all of these patients died.

In another study carried out in Buenos Aires, Argentina by Rubén Schiavelli and company, during the time in which the study was carried out, 594 kidney transplant patients were hospitalized, of which 282 (47.5%) were due to infections and

186 (31.30%) had a diagnosis of ITU. The presence of multiresistant germs was found in 58 of them (31.18%) who presented 105 episodes of UTI, 36 had a single infection and 22 suffered more than one. The distribution by gender was 26 (44.82%) women and 32 (55.17%) men; the average age was 50.52 ± 14.24 years, with a range between 26 and 81 years.

In this study, those patients with prolonged hospitalizations (greater than 15 days and those who underwent surgery for complications related to the transplant, 18.9 were infected by (MDR) were observed Data similar to those published in a study on 417 patients in which surgical intervention within 3 months post-transplant had an incidence of 20%. It is noted that they present an infection mechanism that includes colonization by (MDR) through greater exposure of the hospital flora. Now, although in this study, being a carrier of (MDR) is also put as a risk factor for a picture of worsening or decline of their underlying disease. Regarding the distribution found of the microorganisms, it showed a higher frequency of *Klebsiella pneumoniae* 53.21% of which 67.2% were ESBL producers and 32.8% were resistant to carbapenem. In a study conducted on 108 patients it was observed that the appearance of KI Carbapenem-resistant *ebsiella pneumonia* and ESBL-producing *Klebsiella* were similarly distributed. On the other hand, in a study carried out in Spain by Núria Boixader Dumanjó and company where an outbreak of Methicillin-resistant *Staphylococcus aureus* was described in the hemodialysis unit that is part of the infrastructure of the Regional Hospital of level AB. The following data were characterized in patient's age over 60 years, pluripathology diabetes, skin lesions among others, Poor hygiene, repeated hospitalizations, Catheter carriers, Residents in geriatric residences and social health centers.

Discussion

Similarly, in the degree study of Ortega villamil jefferson carried out at the Dr. Albert Gilber Hospital in Guayaquil Ecuador, Hospitalization was associated with surgical interventions to change the catheter more frequently and an increase in the consumption of antibiotics, considered as one of the main risk factors for the appearance of resistant strains, it was also found that 41% of the patients were diabetic. There was a history of previous catheter infection in 32% of the patients. The highest prevalence in terms of sex was that 60% of men presented infection by (MDR) compared to 40% of women, black race and having hypertension was also a fact that I highlight in this study,

Conclusion

After a systematized review where the main studies found were evaluated, we can conclude that the population with CKD has a high prevalence of specific risk factors for the acquisition of infections, which appears more frequently the more advanced the disease is stage of kidney disease. The main germ (MDR) isolated was *Klebsiella pneumoniae* in most of the data reviewed. These infections were more frequent in the elderly (65 to 80 years, the main age group), although it is already very

clear that the main risk factor in terms of sex for UTI episodes is the female sex due to anatomy, the male sex was the group that had the highest prevalence in terms of infections by (MDR). On the other hand, it was also found that patients suffering from non-communicable underlying diseases such as diabetes and high blood pressure. Those patients who undergo kidney transplantation due to post-transplant treatment with immunosuppressant's are more likely to present these infections. Subjects in need of mechanical ventilation regardless of grade with a long-term hospital stay (>15 days) in addition to those who underwent surgery with a percentage of infected in 18.9%. Given this, health education for healthcare personnel and family members is essential to facilitate the adoption of protocols, the monitoring of infected patients and to reduce infection statistics, the door is left open for new researchers to continue investigating this topic because the information found is limited regarding this population group, and the studies reviewed had limitations, such as a small population, they were reports of isolated cases, among others, which is why this topic should continue to be studied.

Interest conflict

The authors have declared no conflict of interest.

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