Strength in Bacterial *Pseudomonas Aeruginosa* Sample

ORIGINAL

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Abstract

Objective: To identify bacterial resistance in Pseudomonas aeruginosa isolates through records of Intensive Care patients.

Method: documentary and quantitative study, conducted with 90 records of patients who were admitted from January 2013/2015. They take into account the ethical aspects of research with human, having CAAE: 42260815.8.0000.5183.

Results: About the reason for admission to *septicemia* predominated with 16.7%. Of invasive procedures the central venous catheter prevailed 19.1%, and the presence of invasive mechanical ventilation 18.1%. It was found that *Pseudomonas aeruginosa* was found in tracheal secretion and show resistance to the tested antibiotics.

Conclusions: The records of the records revealed that men were more likely to contract infection. Research has relevant information to the nursing staff of the Intensive Care Unit, it proves what are the prevalent microorganisms in the interim, it is important for health decision-making.

Introduction

In recent decades, the drug correlated potential bacterial infections evolved considerably and frightening way increasing the prescription and consumption of antibacterial drugs. Regarding the resistance of bacteria to certain antibiotics that directly affect the evolution of im-

proved patient, It has shown high, followed by a concern on the part of health authorities, the worsening of the clinical condition of the patient, imposing limitations to treatment. [1]

Infections caused by resistant pathogens as potentially *Pseudomonas* aeruginosa, *Klebsiella* pneumoniae e *Acinetobacter* baumannii, They are growing problems in the world and in Intensive Care Units (ICU's) in brazilian hospitals that constitute the flagship in the prevalence of this type of infection in the hospital system, either by the complexity of critically ill patients, or the high consumption of antimicrobials in these units. [2]

The continuing emergence of resistant microorganisms in health institutions and in the community is a major challenge of the XXI century. Concurrently with this condition, it is observed that characteristics routinely adopted as audit antimicrobials, hand hygiene, isolation of patients and in-service education, has not always brought the expected contribution to the control of this resistance. In this context, strains of microorganisms are able to multiply in the presence of higher concentrations of antimicrobial agents than those derived from human therapeutic measures. The development of bacterial resistance is a natural biological phenomenon and spread with disordered introduction of antimicrobial agents in clinical practice. [3]

The Hospital Infections (HI) have risen to new forms of resistance, especially in Intensive Care Units. These infections are considered more serious in these centers, being highly complex, receiving severe dependent patients of intensive support. IH rates in this sector, ranging from 18% to 54%, it is 5 to 10 times higher than in other hospital admission units. It is responsible for between 5% a 35% of all hospital infections and approximately 90% of the outbreaks occurring in these sectors. The patients in ICU's mortality rates commonly range between 9% and 38%, which can reach up to 60% due to resistance of the bacteria. [4]

The causes are multifactorial it is related to antibiotics used correctly or empirically determining the course of infection. In cases of nosocomial bacteremia pathogens may have antibiotic resistance with an increase in morbidity and mortality. Infections caused by microorganisms in the bloodstream have been of great social impact on the diagnostic and therapeutic care in critically ill patients. [5]

Whereas bacterial resistance to antimicrobial agents, this spreads in such a way that impairs patients with hospital-acquired infections, and the prognosis varies depending on the general state of the host. Although these infections are a major cause of death in most cases can be prevented. The bacteria resulting from infections in hospitals, such as *Pseudomonas aeruginosa* can display natural aversion and to acquire resistance to various antibiotics, caused by the low permeability of the membrane among other factors [3].

The realization of this research was motivated from the above listed considerations and experience coming from other work carried out in the Institutional Program of Scientific Initiation Volunteers (PIVIC), besides the practice in the disciplines (Surgical nursing and Critical patient), performed in hospitals, when the execution of nursing activities. Faced with the above listed clarifications and considering the relevance of the theme, felt herself the need to identify through the records filed with the Hospital Infection Control Commission (CCIH) bacterial resistance by *Pseudomonas aeruginosa* isolated from patients in the adult Intensive Care Unit, pediatric and neonatology.

Method

This is a descriptive documentary study using a quantitative approach. The research was conducted in a Federal Public Hospital located in the city of João Pessoa - Paraiba. For its development a previous contact was needed with the Management Service Medical and Statistical File (SAME), autho-

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rizing access to information filed in CCIH, sector responsible for keeping the records of inpatients in Intensive Care Unit, affected by infection by different bacteria.

The population consisted of all internal Intensive Care Unit from January 2013 to January 2015. The sample is composed of 90 sheets of 92 patients and results of microbiological tests carried out. As selection criteria were considered: patients with infection in the period of data collection and those with results of microbiological tests with resistance and sensitivity of antimicrobial. As data collection instrument was used the forms filled in by the hospital CCIH nurses who perform the active search of patients. This instrument contained data on: age, sex, hospitalization motive, types of invasive procedures, types of pathogens and resistance patterns and antibiotic sensitivity to antibiotics tested in the examinations.

Data collection was performed in the physical space of CCIH in April and May 2015 by statistical survey, taking into account the ethical aspects of research with human beings and the project was approved by the Ethics Committee of the Federal University of Paraíba under protocol n° 07/2015, CAAE: 42260815.8.0000.5183. As for the results, they were analyzed and justified in the light of literature concerning the matter.

Results and Discussion

The age of participants ranged from less than 1 year to 90 years with 43.9%, with a predominance of females 36.7%. With advancing age, chronic diseases become more prevalent. In this condition such diseases require prolonged treatments may be followed by dysfunctions and/or some degree of dependence. [6]

About the reasons for hospitalization, there is a predominance in **Table 1** for *Septicemia* with 22 (16.7%) cases, followed by *Pneumonia* 21 (15.9%). The *Septicemia* may occur as a result of various

Table 1. Hospitalization Motive of patients in the Intensive Care Unit of the Federal Public Hospital. João Pessoa /PB, 2013-2015.

| Reason for hospitalization	f	%
Septicemia	22	16.7
Pneumonia	21	15.9
Acute Respiratory Failure	16	12.1
Hypertension	8	6.1
Cerebrovascular accident	7	5.3
Chronic obstructive pulmonary disease	6	4.5
Chronic Renal Failure	6	4.5
Congestive heart failure	5	3.8
Acute Renal Failure	4	3.0
Diabetes mellitus	3	2.3
Others	34	25.8
Total	132	100

Source: Direct search, records of CCIH/ Federal Public Hospital-JP/PB, 2013-2015.* Other: Purpura; Bacterial meningitis; Tetanus; chronic neuropathy; Pierre Robin syndrome; Acute myocardial infarction; Acute lung edema; Pertussis; Dengue Hemorrhagic; Bronchiectasis; Enterocolitis necrotizing; Systemic lupus erythematosus; Exogenous intoxication; Hemolytic anemia; Post- Stop Cardiorespiratory; Alzheimer; Hypospadias; Convulsion; Anorexia; Cholelithiasis; Hepatitis; Leptospirosis; Chagas disease; Cardiac arrhythmia.

infectious processes with different "entry doors", which are identified in the course of a detailed anamnesis physical examination, only confirmed from laboratory tests for your diagnosis. [2]

Pneumonia was the second most frequent reason, has extensive mortality and morbidity in patients in ICU's, It is the most important disease in people over 65 years and in patients with comorbidities. Pneumonias are classified as community-acquired and hospital, but also include people residing in nursing homes or permanent care integrations. [7]

As for invasive procedures in 90 chips surveyed patients, it was found that the central venous catheter had a higher prevalence 17 (19.1%) and invasive mechanical ventilation 16 (18.1%) **(Figure 1)**. The central venous catheter suitable safe access to syste-

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Figure 1: Types of invasive procedures in patients admitted to the Intensive Care Unit of the Federal Public Hospital. João Pessoa/PB, 2013-2015.
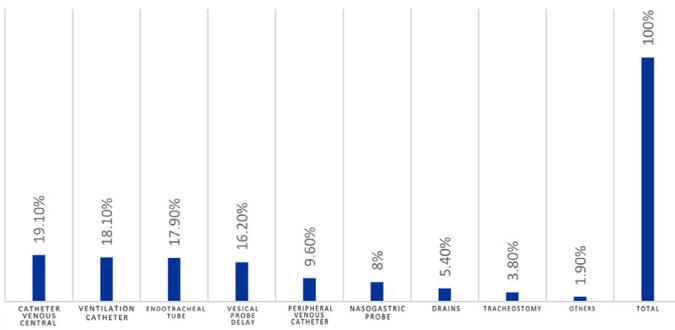
Source: Direct search, records of CCIH/ Federal Public Hospital-JP/PB, 2013-2015. Others: Central Catheters Peripherally Inserted (PICC); Total Parenteral Nutrition; (NPT), Correction Omphalocele with screen; Gastrostomy.

Figure 2: Types of pathogens found in patients admitted to the Intensive Care Unit of the Federal Public Hospital. João Pessoa /PB, 2013-2015.
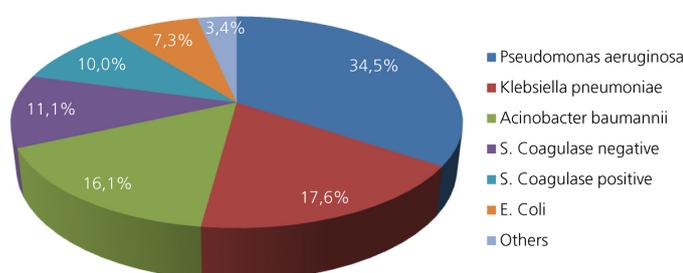
Source: Direct search, records of CCIH/ Federal Public Hospital-JP/PB, 2013-2015

mic circulation and allows administration of higher volume of medicines, but may damage fabrics when extravasation occurs by a central or peripheral access. Enables the monitoring of central venous pressure and collecting blood samples for cultures and other tests. Generally, the placement of a central catheter includes contraindication to the infection area at the insertion site and vein thrombosis. [8]

The nursing professionals when dealing with patients who wear central venous catheter must have scientific expertise, for prevention and maintenance of possible complications related to the use of intra-

vascular devices, becoming aware of the foreseeable consequences and attributable to its own action and omission on care. The nursing interventions enable observations, clinical and scientific practice, effective monitoring providing prevention and control of adverse effects, resulting in security for the professional and the quality of care by exempting the most risk to the patient. [9]

Mechanical ventilation (MV) or ventilatory support, totally or partially substitutes mechanical ventilation and consists of a support method for the treatment of acute respiratory failure (ARF) or chronic worsened. This support provides improved gas exchange and decreased work of breathing of the patient, can be noninvasively through an external interface, or invasive with an endotracheal tube or tracheostomy tube. [10]

The most prevalent pathogens found from the results of microbiological tests were: *Pseudomonas aeruginosa*, which accounted for 21 (34.5%), and *Klebsiella* pneumoniae 18 (17.6%) **(Figure 2)**. *Pseudomonas* part of a group of non-fermentative bacteria, are usually arranged in pairs of cells resembling a single cell has a greenish-blue located in various clinical isolates. They are Gram-negative bacilli which do not form spores, commonly movable, straight or slightly curved typically arranged in pairs. *Pseudomonas aeruginosa* grows spontaneously in a variety of culture media and have as distinctive identification, colony size, hemolytic activity, odor and pigmentation that are detected in some specific biochemical and fast. [11]

In the practice of antibiotic resistance mechanisms have become especially common in nosocomial settings. These mechanisms include modification in permeability of the cell membrane which interrupts the antibiotic into the cell, pumping the antibiotic out of the same, and the flow mechanism, genetic mutation that changes the target of the antibiotic, and consequently does not affect the functioning of the bacteria, nor the development of the ability to degrade or inactivate the antibiotic. [12]

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Table 2. Standard resistance and bacterial sensitivity to antibiotics tested in examinations in intensive care unit patients. Federal Public Hospital. João Pessoa/ PB, 2013-2015.

Antibiotic																							
Espécimes and location of the sample																							
AMI	AMP	ANF	CEF	CEF	CEF	CEF	CIP	ECA	ERT	GEN	IMI	LEV	LIN	MER	MET	OXA	POL	RIF	TAZ	TEI	TIG	UNA	VAN
P. aeruginosa Tracheal Secretion (21)																							
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
K. pneumoniae Hemoculture (18)																							
R	R	-	R	R	R	-	-	-	R	-	R	R	-	R	-	-	S	-	-	-	S	-	S
Ac. baumannii Tracheal Secretion (15)																							
R	R	-	R	R	R	R		-	R	R	S	R	-	R	-	-	S	-	-	S	-	-	-
S. coagulase negative Hemoculture (12)																							
-	-	-	-	-	R	S	-	-	S	R	S	-	-	S	R	R	-	-	-	-	S	-	S
S. coagulase positive nib catheter (17)																							
-	R	-	S	-	-	-	-	-	-	S	-	S	-	S	-	S	-	-	-	-	-	-	-
Urine culture Escherichia coli (9)																							
S	R	-	-	S	R	R	S	-	S	S	S	R	-	S	-	-	-	-	-	-	-	-	-

Source: Direct Direct search, records of CCIH/ Federal Public Hospital-JP/PB, 2013-2015. Legend: R: resistance; S: Sensitivity; AMI: Amikacin; AMP: Ampicillin; ANF: Amphotericin B; CEF: Cefepime; CEF: Cefexina; CEF: Cephalexin; CIP: Ciprofloxacin; ACE- Ecalta; ERT: Ertapenem; GEN: Gentamicin; IMI: imipenem; LEV- levofloxacin; LIN: Linezolid; MER: Meropenem; MET: Metronidazole; OXA: oxacillin; POL: Polymyxin B; RIF: Rifampin; TAZ: Tazocim; TEI: teicoplanin; TIG: Tifeciclina; UMA: Unasyn; VAN: Vancomycin. Antibiotic. Espécimes / Local da coleta.

Klebsiella pneumoniae KPC produces an enzyme called carbapenamase, which were found in this bacterium. The *KPC* is an enzyme produced by *Enterobacteriaceae*, and assigns resistance carbapenem antibiotics, which include a widely used class in the treatment of infections involving *Enterobacteriaceae.* [12]

KPC, is often found in *K. pneumoniae*, has high potential to spread, is a bacterium with the ability to transfer genetic material and resistance genes. [13] Easy dissemination impedes the control of epidemics, and leaves on alert health professionals, such infections have extremely difficult to treat and raise the high mortality rates. Although it is common in *Klebsiella pneumoniae*, *KPC* and can be identified in other bacteria, such as: *Enterobactercloacae, Citro-* *bacterfreundii, Salmonella spp, E. coli Pseudomonasspp.* [14]

Prevention is safe weapon in the fight against *Klebsiella pneumoniae,* whereas treatment is difficult for their resistance to antimicrobials. This manner, doctors and nurses should take precautions for hand hygiene, as well as visitors, use gloves and masks when needed for more effective prevention. The isolation of patients suspected of contamination and concern for the cleanliness of the premises is an important issue to prevent the spread of the bacteria with the expression *KPC* phenotype in Intensive Care Units.

The bacteria found tested for greater resistance to antibiotics can be seen in **Table 2**. In this, it is found that P. aeruginosa was resistant to all anti-

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biotics casting. Microbiological tests were carried out 92 searches the records 90; 21 which tracheal secretion tests produced results which showed the identical bacterial resistance to all antibiotics tested.

Pseudomonas aeruginosa is the bacterium responsible for most respiratory infections in the ICU, serious and immunosuppressed patients undergoing invasive procedures. These microorganisms have great resistance to penicillins, cephalosporins of 1st and 2nd generation and sulfonamides beyond the diverse resistance to other antimicrobials. The rational use of antimicrobials is based on the microbial profile data and bacterial resistance in the ICU. Of all the microorganisms found, the most common means of transmission was the hands of health professionals immersed in assistance in addition to equipment, solutions, medications and contaminated materials. Nursing function is to control the spread of these bacteria within the ICU, for providing direct care to critical patients, performs invasive procedures. [15]

Another important action included in the infection control in ICU patients is the care in storage and dispensing drugs, which can lose its effect due to the arrangement in this inappropriate procedure, as well as their administration that need to be on schedule and correct measurement, the delay disables its efficacy particularly antibiotics. [16]

About antimicrobial resistance, manifests itself *Pseudomonas aeruginosa* that was resistant to several drugs and is intrinsically able to acquire resistance to any antimicrobial. Resistance is defined as three or more classes of antibiotics, even when a sensitive. This resistance is seen as the combination of different mechanisms either alone or in the action of strong resistance mechanism. [17]

KPC confers resistance to meropenem, ertapenem, imipenem (carbapenems), and inactivates the β-lactam agents: cephalosporins, penicillinase aztreonam. Vulnerable patients *Klebsiella pneumoniae* producing *KPC* are those with comorbidities in-

cluding transplant recipients, neutropenic patients, artificial ventilation and for extended periods presenting colonization to potentially resistant bacteria. [12]

The collection place with a predominance of tracheal aspirates was characterized by being an aspirated obtained endotracheal tubes where present contamination of the catheter by passing this and the path of colonized populated areas, making it difficult to interpret the results of cultures. Tracheal aspiration is a procedure indicated in intensive care units, presenting effective in removing tracheobronchial secretions, and more satisfactory when performed after respiratory physiotherapy.

Regardless of the type and the system when the collection right way not realized, may generate controversy, requiring training of professionals for their safe handling. Aspiration is a widely used procedure in bedridden patients who are unable to voluntarily expel tracheobronchial pulmonary secretions, leading to such benefits as: the prevention of infection, the permeable support airway, promotion of gas exchange, blood oxygenation incrementing and improves lung function. The collection of tracheal secretions should be used only for research colonization by potentially resistant germs, for epidemiological assessment. [18]

The occurrence of hospitalized patients colonized or infected by resistant microorganisms deserves all the attention of the Hospital Infection Control Commission (CCIH). The above mentioned committee is responsible for planning and standardization with regard to the prevention of infections in hospitals, through the completion, implementation, maintenance and evaluation of the program responsible for the control of hospital infection, in which submerges the collection, analysis and dissemination of data, as well as regulations on the consistent use of antimicrobials, methods for microorganism transmission prevention; standardizations of precautionary measures and control of hospital infection

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and relevant education for professionals, among other aspects. [19]

In health services, especially in the clinical status of patients and the variety of conducts performed. Infections caused by resistant pathogens potentially in patients in intensive care establish the prevalence of this type of infection, which is directly related to high consumption of antimicrobials in inpatient units. Resistant microorganisms have different behavior, as the mechanism of resistance and susceptibility patterns in different regions of the world, hindering generalizations. [20]

The term resistant bacteria is used to determine the organisms resistant to a large number of antimicrobials. The expressions of resistance in bacteria can arise in various ways, such as the inappropriate use of antimicrobials. [14]

Patients infected with resistant bacteria require longer hospital stays are at increased risk of mortality and use more powerful antimicrobial agents, which are normally more costly and more toxic. Bacterial resistance to antibiotics in hospitals is a public health problem, so that countries need to come together to implement measures and monitor studies for better understanding of infections, focusing its actions on prevention and control and accurate diagnostic measures for the purpose of rational use of antimicrobial. [21]

Conclusion

Considering the relevance of the study is crucial prior knowledge in relation to pathogens that are home to the intensive care units of the hospital under study. These health professionals should include the harmful effects that can affect the internal patients who are in critical condition, seeking resoluteness for each situation.

Given the magnitude of the problem, to which we might encounter during the nursing care provided to patients of these units is necessary upgrade of the nursing staff so that everyone can take the

same conduct as the prevention and control of resistant pathogens.

With the findings of this study, it was possible to identify the microorganism that stood out in inpatients and had an infection during hospitalization. This result provides relevant information to health professionals working in the intensive care unit on the most common species of bacteria in this sector, and what it means for the patient care team and hospital.

Regarding the type of bacteria resistant to antibiotics routinely used in the various results of the culture, there was a predominance of *Pseudomonas aeruginosa*, followed by pathogens such as: *Klebisiella pneumoniae*, *Acinetobacter baumannii*, among others. Some antibiotics for catheter tip culture and other procedures were documented as to their effectiveness. bacterial resistance to different antibiotics used routinely for all that were internal to treatment in the intensive care unit was identified.

We point out that occurrence of a nosocomial infection does not necessarily indicate that the hospital or your staff have made a mistake in the care provided. The medical liability, cool with respect to this situation occurs when there is evidence that doctors or hospital staff were negligent or reckless as to compliance with the appropriate standards of care, and that an infection has resulted in inconsistent performance with current standards in the institution.

In view of this, it is recommended that the service nursing staff should carry out a continuous monitoring on the use of antibiotics daily in line with the bacteria presented by patients in the infectious process. It should be emphasized that the nurse as an educator par excellence, should adopt preventive measures for the control of bacterial resistance among inpatients, as a practice of differentiated quality of care.

This research presents a dimension in a new look at the nursing students, and serve as a reference

source for professionals working in Intensive Care Units. It was found that is a starting point for new discoveries of bacterial resistance in the hospital and infection control, serving as a warning for the quantitative resistance of cases found during the study period.

To reduce the risk of infection is important to note that the choice of the type of catheter, the local option and aseptic technique during the procedure, as well as proper care for the patient by family members and health professionals, who will maintain direct contact with the patient, will make a difference in the patient's recovery process.

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