

Ventilator Associated Pneumonia (VAP) at the Surgical Resuscitation Unit of Joseph Ravoahangy Andrianavalona Teaching Hospital, Antananarivo, Madagascar: Germs Involved and Sensitivity to Antibiotics

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Abstract

Introduction: Ventilator associated pneumonia (VAP) is a nosocomial infection frequently encountered in resuscitation unit. Our objectives were to determine the bacteriological characteristics of the VAP observed in the surgical resuscitation department of the Joseph Raseta Andrianavalona (JRA) teaching hospital as well as the sensitivity of the germs involved to antibiotics.

Patients and Methods: This is a single-center, prospective and descriptive study performed in the surgical resuscitation department of JRA teaching hospital, Antananarivo, Madagascar, over a 12-month period from January to December 2014. Adult patients aged 18 years of age and older who had a VAP with a bacteriological score and an available antibiogram were included. Excluded from the study all patients who did not have a cyto-bacteriological examination despite the presence of pneumonia signs. The results are expressed in number and percentage.

Results: Thirty-two patients were retained during the study period. The average age of the patients was 46 years old. We observed a male predominance (75%). High blood pressure was the most common antecedent (28.12%). Thirty-six bacteria were isolated. All the germs observed were multiresistant to antibiotics. *Acinetobacter* (37.49%), *Klebsiella* (34.37%) and *Staphylococcus aureus* (9.37%) were the most common organisms found in our study. Amikacin (72.22%), Colistin (69.44%) and Imipenem (63.88%) were the antibiotics in which the germs were more sensitive.

Conclusion: In the case of VAP without antibiogram, Amikacin, Colistin and Imipenem should be used as probabilistic treatment in our department.

Keyword: VAP; Resuscitation; Germs; Antibiotic Sensitivity

Introduction

Ventilator associated pneumonia (VAP) is one of the nosocomial infections which is commonly encountered in resuscitation, in the second place after urinary tract infection. It corresponds to "any pneumonia occurring in a patient whose breathing is assisted by a machine either invasively via an endotracheal tube or a tracheotomy or non-invasively via a face mask, or another method within 48 hours of the occurrence of the infection". VAP is seen in 10 to 25% of the patients under mechanical ventilation [1,2]. The VAP constitutes one of the first causes of morbi-mortality in resuscitation unit. They increase considerably the costs and the length of hospitalization [3]. The

objectives of this study were to determine the bacteriological characteristics of the VAP observed in the surgical resuscitation department of JRA teaching hospital Madagascar and the sensitivity of the germs involved to the antibiotics.

Methods

We conducted a prospective and descriptive study, carried out in the surgical resuscitation department of the JRA teaching hospital, Antananarivo, Madagascar over a 12-month period from January 2014 to December 2014. Adult patients aged 18 years old and over who presented a VAP with a bacteriological result and an available antibiogram have been included. The bacteriological samples resulted of endotracheal aspiration. All patients who did not have a cytobacteriological examination despite the presence of signs of pneumonia were excluded from the study. The results are expressed in number and percentage.

Results

Thirty-two patients were retained during the study period. The average age of patients was 46 years with extremes of 17 and 81 years. We observed a male predominance (75.60%). Regarding the antecedent, 9 patients or 28.12% had arterial hypertension, 01 patient or 3.12% each had a history of chronic respiratory failure, alcoholism, smoking, diabetes mellitus and heart failure. Fever (96.87%) and bronchial congestion (84.37%) were the most common clinical signs (Table 1).

Table 1: The Epidemiological and Clinical Characteristics of the Patients

Characteristics	Effective (n = 32)	Percentage (%)
Average age (years)	46	
Gender		
Male	24	75
Female	8	35
Antecedents		
Arterial hypertension	9	28,12
Chronic respiratory insufficiency	01	3,12
Alcoholism	01	3,12
Smoking	01	3,12
Diabetes	01	3,12
Heart failure	01	3,12
Clinical Signs		
Fever ≥ 38°C	31	96,87
Bronchial congestion	27	84,37
Purulent secretions at the suction endotracheal	10	31,25

Arterial Hypertension: Systolic Blood Pressure > 140 mmHg and/or diastolic Blood Pressure >90 mmHg

Represents the epidemiological and clinical characteristics of the patients. Thirty-six bacteria were isolated from samples. All germs are multidrug-resistant to antibiotics. Among them, the *Acinetobacter* (37.49%), *Klebsiella* (34.37%) and *Staphylococcus aureus* (9.37%) were the most isolated germs. Table 2 shows the frequency of the isolated bacteria.

Germs Involved	Effective (N = 36)	Percentage (%)
<i>Klebsiella</i> :		
• <i>Pneumoniae</i>	10	31,25
• <i>Sp</i>	01	3,12
		} 34,37%
<i>Acinéto</i> bacter :		
• <i>Sp</i>	07	21,87
• <i>Baumanii</i>	05	15,62
		} 37,49%
<i>Staphylococcus aureus</i>	03	9,37
<i>Corynebacterium sp</i>	02	6,25
<i>Escherichia Coli</i>	01	3,12
<i>Enterobacter gergoviae</i>	01	3,12
<i>Enterococcus faecalis</i>	01	3,12
<i>Citrobacter freundii</i>	01	3,12
<i>Proteus mirabilis</i>	01	3,12
<i>Enterobacter aerogenes</i>	01	3,12
<i>Streptococcus pyogènes</i>	01	3,12
<i>Serratia liquefaciens</i>	01	3,12

Table 2: Frequency distribution of isolated bacteria.

A Patient can have 2 germs

In our study, the combinations of Ceftriaxone-Metronidazole were the first line antibiotics used to treat the VAP. After the results of the antibiogram, Amikacin (72.22%), Colistin (69.44%) and Imipenem (63.88%) were the antibiotics in which the germs were more sensitive. Figure 1 shows the distribution according to the sensitivity of bacteria to antibiotics.

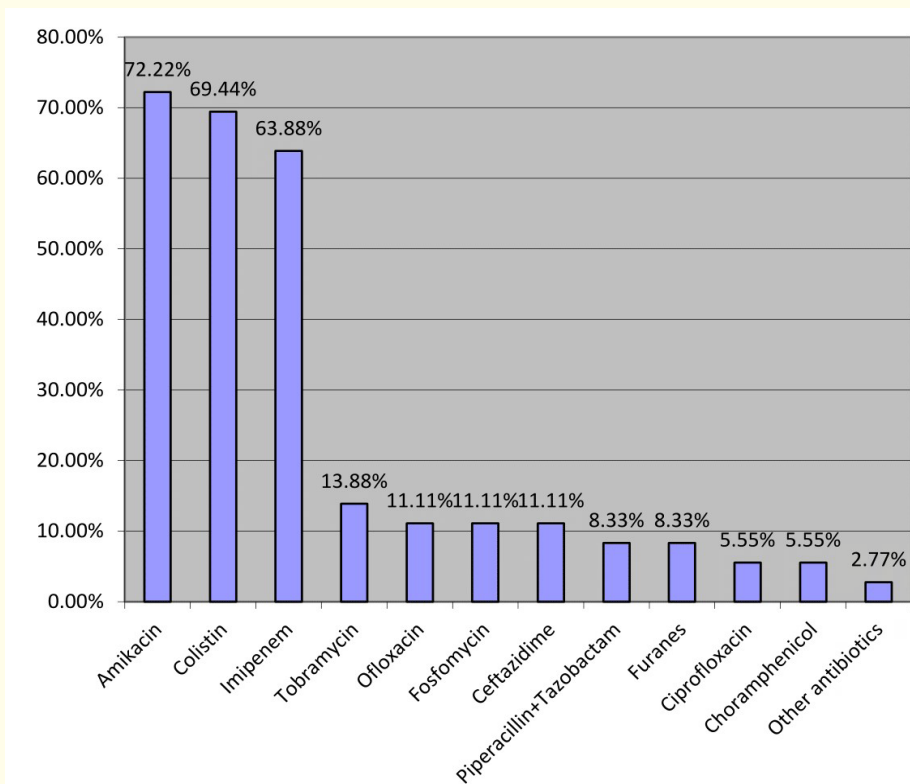


Figure 1: Distribution According to the Sensitivity of Bacteria to Antibiotics.
 Other antibiotics: ampicillin, fusidic acid, cefoxitin, ceftriaxone, doxycycline, gentamycin, kanamycin, nitrofurantoin, netilmicin, pristinamycin, pefloxacin, rifampicin, spiramycin, tetracycline, ticarcillin + clavulanic acid, teicoplanin, thiamphenicol, vancomycin.

Klebsiella has a sensitivity of 100% to Amikacin, 85% to Imipenem and 40% to Colistin. *Acinetobacter* has a sensitivity of 92.25% to Colistin, 75.71% to Amikacin and Imipenem. *Staphylococcus aureus* were sensitive to Imipenem in 66%, to amikacin in 33.33% and were resistant to colistin. Of the 32 patients, 09 patients or 28.13% died. Table 3 shows the distribution of patients according to the sensitivity to antibiotics of the most observed germs.

Main Germs Observed	Sensitivity of Germs to Antibiotics		
	Amikacin	Colistin	Imipenem
<i>Acinetobacter</i>	75,71%	92,25%	75,71%
<i>Klebsiella</i>	100%	40%	85%
<i>Staphylococcus aureus</i>	33,33%	0%	66%

Table 3: Distribution according to the sensitivity to antibiotics of the 3 main germs observed

Discussion

In our study, the average age of patients was 46 years old which is inferior to the data observed in the literature. This could be explained by the high representativeness of severe head trauma in our study population which is the prerogative of young subjects. According to other studies, the average age of patients was around 60 years old [4-7].

Concerning the gender, our male predominance resembles to those cited in the literature. Indeed, the male sex is an independent risk factor for nosocomial pneumonia [6-9].

High blood pressure was the most common antecedent in our study. There is no particular relationship between arterial hypertension and nosocomial pneumonia, but it is an important cardiovascular risk factor for the pathologies which are frequently encountered in intensive care unit.

Acinetobacter (37.49%), *Klebsiella* (34.37%) and *Staphylococcus aureus* (9.37%) were the most observed pathogens. Our series is distinguished from other bibliographic data by the absence of *Pseudomonas aeruginosa*, which is frequently noted in many studies. It is a bacterium that is often transmitted by aerosolization [10-13].

According to the American guidelines, the choice of the empiric antimicrobials depends on the presence or absence of a multiresistant bacteria risk factor. If there is a risk factor, it is recommended to introduce anti-*Pseudomonas*, combination of betalactamine (Cefepime, Ceftazidime, Imipenem, Meropenem, Piperacillin-Tazobactam) and fluoroquinolone (Ciprofloxacin or Levofloxacin) or Aminoglycoside plus Linezolid or Vancomycin (if MRSA risk) [14]. In our series, we used in the first intention the ceftriaxone-metronidazole combination. After the antibiogram, Amikacin (72.22%), Colistin (69.44%) and Imipenem (63.88%) were the antibiotics in which the germs are sensitive. *Klebsiella* has a sensitivity of 100% to Amikacin, 85% to Imipenem and 40% to Colistin. *Acinetobacter* has a sensitivity of 92.25% to Colistin, 75.71% to Amikacin and Imipenem. *Staphylococcus aureus* has a sensitivity of 66% to Imipenem, 33.33% to Amikacin, and it is resistant to Colistin. *Klebsiella pneumoniae* is a common bacterium in urinary tract, respiratory tract and sepsis infections. This strain is resistant (or intermediate) to all beta-lactams including the third generation of Cephalosporin, Aztreonam, Cefpirome, Cefepime, Cefoxitin, Imipenem and combinations with beta-lactamase inhibitors; all aminoglycosides, including Isepamycin; fluoroquinolones; Cotrimoxazole, Chloramphenicol, cyclins, and Rifampicin. It is normally sensitive to colistin (MIC: 0.5 mg / l) [15].

Acinetobacter resistance is highly variable across Europe, with generally a very high percentage of resistance in the southern Europe and lower percentages in the northern Europe. The combined resistance to fluoroquinolones, aminoglycosides and carbapenems was

20% or more in 12 of 23 countries reporting sensitivity results for 10 or more strains, highlighting that therapeutic options for patients infected with *Acinetobacter* are limited. Resistance to polymyxins (antibiotics of last resort) was observed in 5% of strains isolated, mainly in the southern Europe [16]. Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the most common causes of nosocomial antibiotic-resistant infections worldwide. Although vancomycin remains the treatment of choice for MRSA, none of the *Staphylococcus aureus* isolates were sensitive. Linezolid is an alternative to treating MRSA [17].

The mortality rate of VAP in our study (28.13%) was similar to data from the literature. According to the studies, the rate varies between 24 to 76%. The existence of a VAP increases the risk of death of the patient by 2 to 10 [18,19].

Conclusion

VAP is a common nosocomial infection in the surgical resuscitation department of the JRA teaching hospital. Amikacin, Colistin and Imipenem should be used as empirical treatment in case of VAP when waiting for the antibiogram results, in our unit.

State of Current Knowledge on the Subject

- The most observed organism in the literature is *Pseudomonas aeruginosa*.
- Probabilistic antibiotic therapy in VAP consists of a combination of betalactamine (cefepime, ceftazidime, imipenem, meropenem, piperacillin-tazobactam) and fluoroquinolone (ciprofloxacin or levofloxacin) or aminoglycoside plus linezolid or vancomycin (if risk of MRSA).
- The mortality rate varies from 24 to 76%.

Contribution of Our Study to Knowledge

The most common organisms in our study were *Acinetobacter*, *Klebsiella* and *Staphylococcus aureus*. The most germ-sensitive antibiotics were amikacin, colistin and imipenem. The mortality rate was 28.13%.

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