



Microbiological Diagnosis of Ventilator-Associated Pneumonia Caused by Gram Negative Bacteria Resistant to Carbapenems Using a Fast Molecular Method.

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Background: Ventilator-associated pneumonia (VAP) is one of the most important healthcare-associated infections. The burden of VAP regarding morbidity and mortality is significant. Most of the etiological agents of VAP are Gram negative organisms, and a proportion of them could be resistant to carbapenems. GeneXpert Carba-R is a molecular test originally designed to detect rectal colonization by microorganisms expressing resistant genes to carbapenems (NDM, KPC, VIM, IMP, OXA-48).

Objective: The aim of this study was to determine how useful it is to use GeneXpert Carba-R directly in clinical samples of aspirates of bronchial secretion in patients with VAP.

Methods: This is a prospective observational study with a sample of patients that developed VAP at the intensive care unit of Hospital Dr. Fernando Vélez Paiz (Managua, Nicaragua) between April 2021 and December 2021. The diagnostic criteria of the CDC for VAP were used. Samples of bronchoalveolar secretions were processed using GeneXpert Carba-R and by bacteriological conventional culture. The molecular method GeneXpert Carba-R was able to detect genes as NDM, KPC, VIM, OXA-48 and IMP. The presence of any of them was considered as a microorganism resistant to carbapenems, and the result was correlated with the final identification and susceptibility pattern obtained in the bacteriological culture using the system Vitek2.

Results: A total of 45 patients were recruited in the study. Twenty-seven patients (60%) had at least one gene of resistance detected by GeneXpert Carba-R (Figure 1). Thirty bacteria were isolated in the cultures. The bacteria identified were *Acinetobacter baumannii* (36%), *Klebsiella pneumoniae* (27%), and *Pseudomonas aeruginosa* (23%). The most frequent gene detected was NDM (81%) (Figure 2). The sensitivity and the specificity of the GeneXpert Carba-R for the diagnosis of an organism resistant to carbapenems were 86.7% (95% CI: 71.1-95.8) and 93.3% (95% CI: 80.7-100%) respectively (Table 2). The risk factors for a VAP with an organism expressing a gene of resistance were diabetes mellitus, an extended stay in ICU, SOFA score > 2 points, mechanical ventilation ≥ 8 days, and having septic shock at admission (Table 3).

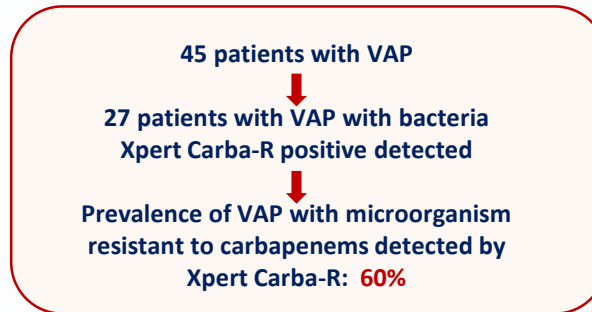


Figure 1.- Prevalence of microorganism resistant to carbapenems diagnosed by Xpert Carba-R

Microbiology of Ventilator-Associated Pneumonia	N=30 (%)
<i>Acinetobacter baumannii</i>	11 (36)
<i>Klebsiella pneumoniae</i>	8 (27)
<i>Pseudomonas aeruginosa</i>	7 (23)
<i>Serratia marcescens</i>	2 (7)
Other Gram negative bacteria	2 (7)

Table 1.- Microbiology of Ventilator-Associated Pneumonia

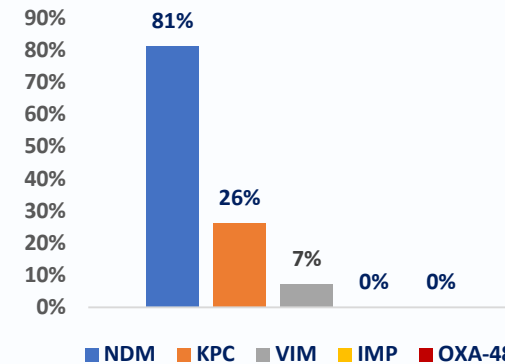


Figure 2.- Genes detected by Xpert Carba-R in respiratory samples of patients with VAP.

Diagnostic accuracy measures	% (95% CI)
Sensitivity	86.7 (71.1-95.8)
Specificity	93.3 (80.7-100.0)
Positive Predictive Value	96.3 (79.1-99.8)
Negative Predictive Value	77.8 (51.9-92.6)

Table 2.- Diagnostic accuracy of Xpert Carba-R for VAP caused by bacteria resistant to carbapenems.

Risk Factors for VAP	OR (95% CI)
Diabetes mellitus	62.5 (9.34-417.98)
Length of stay in ICU ≥ 8 days	43.7 (7.09-269.78)
SOFA ≥ 2 points	6.4 (1.40-29.2)
Mechanical ventilation ≥ 8 days	5.5 (1.43-21.09)
Septic shock at the admission	4.4 (1.15-16.81)

Table 2.- Risk factors for VAP cause by bacteria resistant to carbapenems diagnosed by Xpert Carba-R

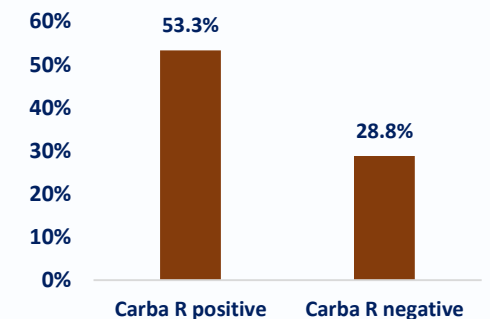


Figure 3.- Mortality in patients with VAP caused by organism resistant to carbapenems

Conclusion: To process directly GeneXpert Carba-R using samples of bronchoalveolar secretions was useful in the diagnosis of VAP caused by microorganisms resistant to carbapenems. The most frequent gene detected in our population was NDM.

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