

Results of the Rapidec® CARBA NP test in El Salvador

DOI: 10.5377/alerta.v6i1.15451

José Eduardo Olivia Marín^{1*}, María José Luna Boza², Miguel Oscar Grande Figueroa³, Reina Esmeralda Villatoro Ventura⁴, Rene Guillermo Santos Herrera⁵, Ana Patricia Orellana de Figueroa⁶, Milagro Arenys Velásquez Escobar⁷, Zonia Elizabeth Cruz⁸, Ana Alejandra Rivera Láinez⁹, Patricia Evelyn Henríquez¹⁰, Patricia Danne Orellana Morales¹¹, Naomi Iihoshi¹², David Saúl Rodríguez Araujo¹³, Rhina Domínguez¹⁴

- 1,14. National Institute of Health in El Salvador, San Salvador, El Salvador.
- 2,3. National Laboratory of Public Health of El Salvador, San Salvador, El Salvador.
4. Executive Secretary of the Council of Ministers of Health of Central America (SE-COMISCA), San Salvador, El Salvador.
5. ECHO/SE-COMISA, San Salvador, El Salvador.
6. Ministry of Health (MINSAL), San Salvador, El Salvador.
7. San Miguel National Hospital, San Miguel, El Salvador.
8. Dr. María Isabel Rodríguez National Women's Hospital, San Salvador, El Salvador.
9. Santa Ana National Hospital, Santa Ana, El Salvador.
10. Benjamin Bloom National Children Hospital, San Salvador, El Salvador.
11. Rosales National Hospital, San Salvador, El Salvador.
12. SE-COMISCA, New Mexico, United States of America.
13. SE-COMISCA, San Salvador, El Salvador.

* Correspondencia

✉ jose.oliva@salud.gob.sv

1.  0000-0002-6005-0558

4.  0000-0002-2412-2083

14.  0000-0001-7860-0602

OPEN ACCESS

Resultados del uso de prueba Rapidec® CARBA NP en El Salvador

Citación recomendada según versión digital:

Oliva J, Luna MJ, Grande O, Villatoro E, Santos R, Figueroa P. *et al.* Results of the Rapidec® CARBA NP test in El Salvador. *Alerta*. 2023;6(1):88-90. DOI: 10.5377/alerta.v6i1.15451

Received:

December 16, 2022.

Accepted:

January 4, 2023.

Published:

January 30, 2023.

Author contribution:

JEOM¹: study conception and manuscript design, bibliographic search, data analysis, writing, revision, and editing. MJLB², MOGF³, MAV⁷, ZEC⁸, AARL⁹, PEH¹⁰, PDOM¹¹: data collection. REVV⁴: concepto y diseño del manuscrito, recolección de datos. RGS⁵, APOF⁶: concepción y diseño del manuscrito. NI¹², DSRA¹³, RD¹⁴: manejo y análisis de datos, redacción, revisión y edición.

Conflicts of interest:

The authors declare there are no conflicts of interest.

Dear editor:

Nowadays, there are commercially available rapid carbapenemase tests that can generate results in less than two hours. One of these tests is Rapidec® CARBA NP, based on the direct detection of carbapenemase hydrolysis by carbapenemase-producing bacteria. The agility in detecting these enzymes is relevant in our country, as described in the article by Villatoro *et al.* in *Alerta* in 2018. They reported that carbapenemase-producing bacteria were isolated in 26 of 31 hospitals in El Salvador from 2014 to 2016¹.

This test analyzed the presence of carbapenemases in 122 isolated samples belonging to the *Enterobacteriaceae* family, as well as in non-fermenting bacilli, with decreased susceptibility or resistance profiles to any of the following carbapenemics: ertapenem, imipenem or meropenem. These were analyzed from five hospitals in the public health network of El Salvador between March 2020 and August 2021.

The isolated samples were obtained from both sterile and non-sterile samples (blood, urine, feces, and purulent secretions, in addition to others). Reading and interpretation of the rapid test was conducted in laboratories where it was performed following the instructions of the manufacturer. Subsequently, they were delivered

to the National Public Health Laboratory (LNSP) for confirmation.

A total of 115 isolated samples were included in the analysis since seven of those received at the LNSP were not viable. The isolated bacteria were: *Acinetobacter baumannii* (58/50.4 %), *Klebsiella pneumoniae* (21/18.3 %), *Escherichia coli* (18/15.7 %), *Pseudomonas aeruginosa* (10/8.7 %), *Enterobacter cloacae* (7/6 %) and *Proteus mirabilis* (1/0.9 %). The above is in agreement with that reported by Villatoro *et al.* in 2018: from 2014 to 2016, *A. baumannii* was the most frequently identified carbapenemase-producing bacterium in El Salvador (85 %)¹.

Of the 115 isolated samples tested, 104 were classified as carbapenemase-positive and 11 as carbapenemase-negative using the LNSP carbapenemase detection algorithm: ethylenediamine tetraacetic acid, phenylboronic acid, Triton Hodge test, and the modified carbapenemase inactivation method. Of the 104 positive carbapenemases, 49 were categorized as metallo-beta-lactamase producing (MBL) and 55 as oxacillinase (OXA) producing. *Klebsiella pneumoniae* carbapenemase-producing isolates (KPC) were not detected. The detection of carbapenemases per isolated microorganism was distributed as follows: *Acinetobacter baumannii* (three MBL and 55 OXA), *Klebsiella pneumoniae* (18 MBL), *Escherichia coli* (17 MBL), *Pseu-*

domonas aeruginosa (six MBL) and *Enterobacter cloacae* (five MBL).

Some countries such as México, Panamá, Puerto Rico y Cuba, así como Costa Rica, República Dominicana, Trinidad & Tobago, Colombia, Venezuela, Perú, Ecuador, Brasil, Paraguay, Uruguay, Argentina y Chile^{2,3} have identified variants of KPC, New Delhi metallo-beta-lactamase (NDM), Verona integron-encoded metallo-beta-lactamase (VIM) and imipenemase metallo-beta-lactamase (IMP), in *Enterobacteriaceae*, *K. pneumoniae*, *P. aeruginosa* and *A. baumannii*.

The most frequently detected carbapenemase-producing bacteria were: *Acinetobacter baumannii*, *Klebsiella pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Enterobacter cloacae*. This data is similar to those reported by other studies carried out in Latin America. They are as follows: *A. baumannii*, *K. pneumoniae*, *E. coli* and *E. cloacae* as KPC and NDM producing, *P. aeruginosa* as a producer of KPC, VIM and IMP, as well as *A. baumannii* producers of VIM and IMP³.

Rapidec® CARBA NP test showed a positive predictive value of 99 %. This value is consistent with that reported in other kinds of studies (92.6-100 %) ^{4,5}. The LNSP did not confirm the presence of carbapenemases in 11 of the 115 isolated samples. Of these isolated samples, ten were tested with the Rapidec® CARBA NP test and the LNSP's carbapenemase detection algorithm, and one with the algorithm alone. Of the bacteria where the presence of carbapenemases was not confirmed, four were *P. aeruginosa* with resistance to carbapenems due to membrane impermeability plus efflux pumps, as well as three *K. pneumoniae*, two *E. cloacae* and one *E. coli*, producers of extended-spectrum beta-lactamase (ESBL) and one *P. mirabilis* with no mechanism of bacterial resistance detected.

Several factors could have led to the 11 discordant results in local laboratories, which could be exogenous to the test itself: divergence in color interpretation among observers⁶, culture incubation time that may not have allowed for full enzyme expression⁷, the time interval between the reception of the clinical sample and the start of processing, the existence of hypermuroid colonies⁸, the presence of AmpC beta-lactamase⁹, insufficient bacterial inoculum and/or the presence of isolated samples with weak carbapenemase activity¹⁰.

Rapidec® CARBA NP is a rapid test used to confirm the presence of carbapenemases in *Enterobacteriaceae* and Gram-negative bacilli such as *A. baumannii* and *P. aeruginosa*. Rapidec® CARBA NP can be

used in clinical settings to support the choice of antibiotics and infection control committees in their antimicrobial optimization programs. It also contributes to the timely detection and management of healthcare-associated infections, which are fundamental in controlling the spread of antimicrobial resistance in hospitals.

Acknowledgments

To the Centers for Disease Control and Prevention for their support in sponsoring the laboratory tests necessary to conduct the study.

Funding

Rapidec® CARBA NP tests were donated to the Ministry of Health by the Centers for Disease Control and Prevention through the Cooperative Agreement with the Executive Secretariat of the Council of Ministers of Health of Central America and the Dominican Republic.

References

1. Villatoro E, Cardoza R, de Fuentes Z, Hernández C. Identificación de bacterias resistentes a antibióticos carbapenémicos en hospitales de El Salvador. *Alerta*. 2018;1(2): 8-15. DOI: [10.5377/alerta.v1i2.7135](https://doi.org/10.5377/alerta.v1i2.7135)
2. Escandón-Vargas K, Reyes S, Gutiérrez S, Villegas MV. The epidemiology of carbapenemases in Latin America and the Caribbean. *Expert Rev Anti Infect Ther*. 2017;15(3):277-297. DOI: [10.1080/14787210.2017.1268918](https://doi.org/10.1080/14787210.2017.1268918)
3. García-Betancur JC, Appel TM, Esparza G, Gales AC, Levy-Hara G, Cornistein W, et al. Update on the epidemiology of carbapenemases in Latin America and the Caribbean. *Expert Rev Anti Infect Ther*. 2021;19(2):197-213. DOI: [10.1080/14787210.2020.1813023](https://doi.org/10.1080/14787210.2020.1813023)
4. Elawady B, Ghobashy M, Balbaa A. Rapidec® Carba NP for Detection of Carbapenemase-Producing *Enterobacteriaceae* in Clinical Isolates: A Cross-Sectional Study *Surg Infect*. 2019;20(8):672-676. DOI: [10.1089/sur.2019.084](https://doi.org/10.1089/sur.2019.084)
5. Hombach M, von Gunten B, Castelberg C, Bloemberg GV. Evaluation of the Rapidec® Carba NP Test for Detection of Carbapenemases in *Enterobacteriaceae*. *J Clin Microbiol*. 2015;53(12):3828-3833. DOI: [10.1128/JCM.02327-15](https://doi.org/10.1128/JCM.02327-15)
6. Mancini S, Kieffer N, Poirel L, Nordmann P. Evaluation of the RAPIDEC® CARBA NP and β-CARBA® tests for rapid detection of Carbapenemase-producing

- Enterobacteriaceae. *Diagn Microbiol Infect Dis.* 2017;88(4):293-297. DOI: [10.1016/j.diagmicrobio.2017.05.006](https://doi.org/10.1016/j.diagmicrobio.2017.05.006)
7. McMullen AR. Multicenter evaluation of the RAPIDEC® CARBA NP assay for the detection of carbapenemase production in clinical isolates of Enterobacterales and *Pseudomonas aeruginosa*. *Eur J Clin Microbiol Infect Dis.* 2020;39(11):2037-2044. DOI: [10.1007/s10096-020-03937-1](https://doi.org/10.1007/s10096-020-03937-1)
 8. U. S. Food and Drug Administration. 510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION DECISION SUMMARY ASSAY ONLY TEMPLATE. FDA. 2020. [citado 28 febrero 2022]. Available in: https://www.accessdata.fda.gov/cdrh_docs/reviews/K162385.pdf
 9. Thomson G, Turner D, Brasso W, Kircher S, Guillet T, Thomson K. High-Stringency Evaluation of the Automated BD Phoenix CPO Detect and Rapidec® Carba NP Tests for Detection and Classification of Carbapenemases. *J Clin Microbiol.* 2017;55(12):3437-3443. DOI: [10.1128/JCM.01215-17](https://doi.org/10.1128/JCM.01215-17)
 10. Jousset AB. False-Positive Carbapenem-Hydrolyzing Confirmatory Tests Due to ACT-28, a Chromosomally Encoded AmpC with Weak Carbapenemase Activity from *Enterobacter kobei*. *Antimicrob Agents Chemother.* 2019;63(5). DOI: [10.1128/AAC.02388-18](https://doi.org/10.1128/AAC.02388-18)