Evaluation of molecular and biochemical methods to detect carbapenemase-producing Acinetobacter baumannii

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Background and aim

Over the last years carbapenem-resistant strains have registered a great increment that also includes an increment of multi-resistant and carbapenemase-producing Acinetobacter baumannii.

In this study we evaluated classical PCR, a specific real-time kit and two biochemical methods, namely CarbaAcinetoNP and BlueCarba Test, for rapid detection of carbapenemase-producing A. baumannii, so as to avoid its spread in the hospitals setting.

Material and methods

74 A. baumannii and 1 Acinetobacter jejunii were included in the study.

All strains were identify by Maldi-TOF Vitek MS following an extraction protocol with acetonitrile.

Antimicrobial susceptibilities to imipenem and meropenem were assayed by microdiluition method and interpreted according to the EUCAST breakpoints.

Carbapenemases detection was performed by two biochemical tests, namely CarbaAcineto NP (1) and BlueCarba Test (2), two molecular tests, namely classical PCR for common carbapenemases blaVIM, blaNDM, blaOXA-23, blaOXA-24, blaOXA-48, blaOXA-51, blaOXA-58 e blaOXA-143 and real time PCR by DupliC™RealTimeMDR A.baumannii OXA Genotyping (Euroclone, Milan). With this kit identification of A. baumannii relies on the blaOXA-51 gene. The kit detects the most common OXA enzymes blaOXA-23, blaOXA-24, blaOXA-51, blaOXA-58 e blaOXA-143.

Results:

MICs carbapenems distribution is reported in Figure 1.

66 out of 74 A. baumannii strains plus the A. jejunii strain produced carbapenemases.

47 A. baumannii (63.5%) harboured blaOXA-23, 8 blaOXA-24 (10.9%), and 6 blaOXA-58 (8.1%). 5 A. baumannii strains harboured a blaVIM gene. A. jejunii harboured blaOXA-58.

8 strains did not harbour any tested genes, which also accorded to their lower MICs for carbapenems (Figure 2)

Both biochemical tests, namely CarbaAcineto NP and BlueCarba, gave positive results on 91% of carbapenemases producer strains. For four strains positive results where obtained only after streaking them on plates plus imipenem 2 mg/L for two-three days. Five strains resulted negative to both test also after being repeated several times.

Conclusions

There is an excellent agreement between the classical PCR and the Real Time PCR performed by DupliC™RealTimeMDR A.baumannii OXA Genotyping.

The latter system is also able to discriminate A. baumannii from other Acinetobacter spp (producing or not producing carbapenemases) and to reveal the presence of the ISAba1blaOXA-51 junction.

The biochemical tests resulted less sensitive, possibly because of absent or insufficient gene expression.

References

2. Pettinari L, Novara A, Pietta L. BlueCarba, an easy biochemical test for detection of diverse carbapenemases producers directly from bacterial cultures. JCM 2015: 51: 4201-3

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