Detection of Carbapenemase-producing organisms via MALDI-TOF

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INTRODUCTION

Carbapenem antibiotics have been considered to be the last resort for the treatment of life threatening infections. Carbapenemases are enzymes which inhibit most β-lactam antibiotics, including carbapenems and they have been reported in Enterobacteriaceae, P. aeruginosa, and others. The emergence of carbapenem-resistant enterobacteriaceae(CRE) poses major threat to public health. Among carbapenem-resistant enterobacteriaceae, some of them carry resistance determinants in motile genetic elements and they are capable of transferring the resistance to other microorganisms. Hence, they are called carbapenemase-producing enterobacteriaceae(CPE) . When CRE is detected from a patient, it is important to rapidly detect whether the resistant orgranism can be spread to others. Recently, MALDI-TOF MS has been adopted as a universal tool for the identification of microorganism and several attempts have been made to use this technology beyond the identification to more complicated characterization of microorganism. In this study, we used a MALDI-TOF MS based approach for the detection of specific peak which can be helpful for the differentiation of CPE from other CRE.

METHOD

The cohort was composed of 51 CRE clinical isolates collected from patients between December 2016 and October 2018 at the Kyungpook National University Hospital. Among the clinical isolates, 39 samples had CPE mobile elements which were confirmed by PCR. Among those, six samples had NDM-5 and 28 samples had both NDM-5 and OXA-181. Proteins were obtained with the tube extraction method and MALDI-TOF MS spectra were obtained. Using MALDIquant R program, mass spectra were analyzed to find any peak difference between CPE negative microorganism and CPE positive microorganism.

RESULT

When control samples(ATCC *E. coli*) and NDM-5 CPE samples were compared, *m/z* 9744.45 Da were found to be the most differentiating peak. When control samples(ATCC E.coli) and CPE which has NDM-5 and OXA-181 compared, *m/z* 3022.34 Da were found to be the most differentiating peak. Further study for the confirmation of the peaks is in need.

Fig. 1 Result of linear discriminant analysis of NDM-5 CPE samples

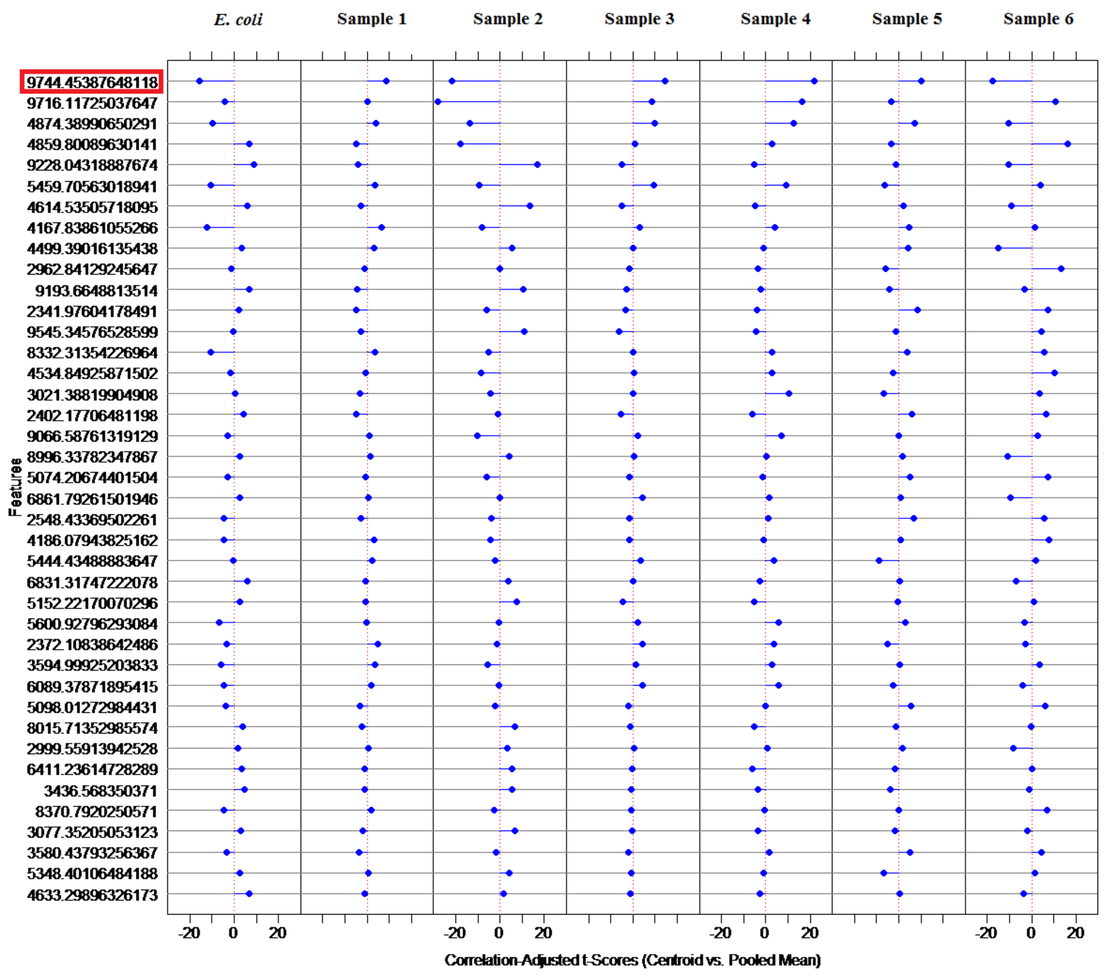
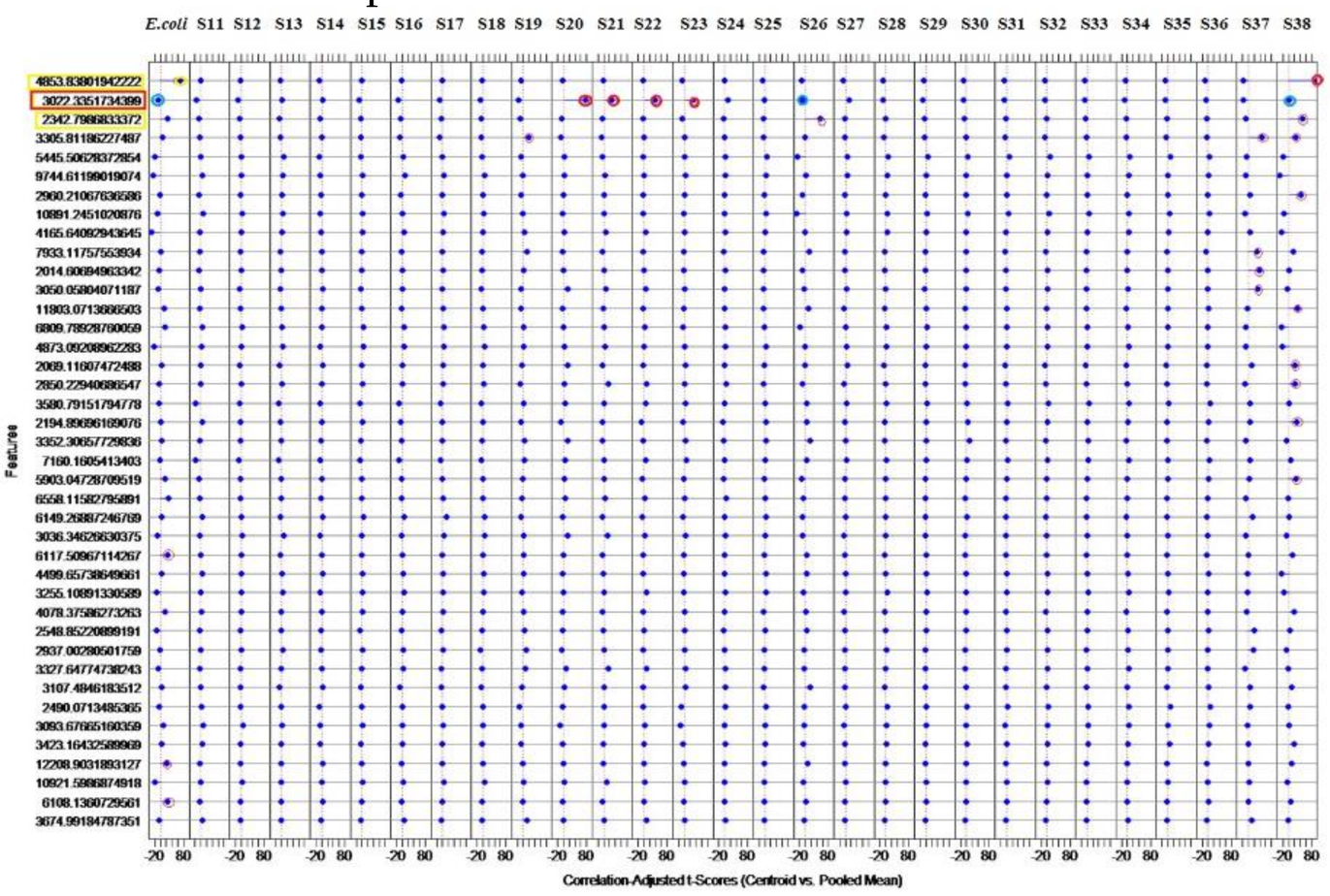


Fig. 2 Result of linear discriminant analysis of NDM-5,OXA-181 CPE samples



CONCLUSIONS

Application of MALDI-TOF MS for the rapid detection of CPE is a cheap, reliable, and clinically useful method and will be very helpful for the prompt control of infections caused by CRE.

REFERENCES

Gibb, S. and Strimmer, K. (2012). MALDIquant: a versatile R package for the analysis of mass spectrometry data. Bioinformatics, 28(17): 2270–2271