The molecular epidemiology of extended-spectrum beta-lactamase producing organisms

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Extended-spectrum beta-lactamase (ESBL) producing organisms have fascinated scientists and frustrated clinicians and microbiologists for more than 20 years. Much insight has been gained with respect to the beta-lactamases themselves. In many cases their crystal structure has been deduced and tremendous insights have been gained into the structure-function relationships of these enzymes[1]. Yet, from a clinical perspective, we may still see outbreaks of infection within hospitals or other healthcare facilities[2]. As is widely reported, there are also significant issues with respect to acquisition of ESBL-producing organisms in the community[3]. This is a tremendously important problem from a global perspective as it threatens use of many common antibiotics when patients present from the community to the emergency department.

Diestra and colleagues are to be congratulated on their assessment of the molecular epidemiology of ESBL-producing *Klebsiella pneumoniae* and *Escherichia coli* from eleven Spanish hospitals[4]. Many articles have evaluated the molecular epidemiology of ESBL producers from single institutions. However, this viewpoint is always skewed and poorly generalisable. Diestra and colleagues did well to include institutions from across the country – although not giving a complete national picture their perspective is sufficiently broad to provide some interesting information.

Firstly, with *K. pneumoniae* clusters of infection tend to occur. These clusters are typically limited to single institutions, although there is previously reported data to suggest that inter-hospital, inter-region and even inter-continental spread of ESBL-producing *K. pneumoniae* may occur[2]. In a single institution study, Harris and colleagues have attempted to quantify the importance of patient-to-patient transmission in ESBL-producing *K. pneumoniae* acquisition[5]. In their hospital's intensive care units, of patients who acquired colonization with ESBL-producing *K. pneumoniae*, 52% had patient-to-patient transmission as defined by similar PFGE type and hospital time overlap. This study used perianal culture rather than clinical cultures to derive their specimens[5]. These results demonstrate a need for further studies to assess the utility and cost-effectiveness of active surveillance for ESBL-producing *K. pneumoniae* and its prevention by use of contact precautions.

In contrast, Diestra and colleagues found much greater clonal diversity with *E. coli*[4]. This finding is not unexpected, although there are occasional studies which have shown that hospital outbreaks of ESBL-producing *E. coli* may occur[6]. The reason why ESBL-producing *K. pneumoniae* is more likely to cause clusters of infection than *E. coli* has not been fully explored. While scores of scientists study bacterial pathogenesis, attention must surely be placed by the scientific community on the reasons why some strains are more "hospital-adapted" than others. Ability to attenuate bacterial colonization of hands, inanimate surfaces within the hospital environment and medical devices will be an important step in reducing hospital-acquired infections.

The final piece of interesting information to be gained from this study is the spectrum of ESBL types characterized. As has been observed worldwide, the CTX-M type ESBLs are clearly predominant. This now appears to be true within hospitals and in the community[3]. Some dominant SHV types continue to be important with SHV-12 holding a prominent place in this regard. In contrast, TEM type ESBLs are now almost non-existent in Spanish hospitals.

One of the impacts of ESBL-producing organisms is their effect on empiric antibiotic use. Typically, an individual and an institutional response to ESBL-producers is increased use of carbapenems or beta-lactam/beta-lactamase inhibitor combinations. Recent trends around the world have included the advent of KPC and metallo-beta-lacatamses capable of hydrolysing carbapenems and plasmid-mediated AmpC beta-lactamases which are resistant to inhibition by currently available beta-lactamase inhibitors. Looking forward, it would be wise to complement surveillance of the molecular epidemiology of ESBL producing *Enterobacteriaceae* with surveillance of carbapenem and beta-lactamase inhibitor resistant *K. pneumoniae* and *E. coli* as well. Spain is indeed fortunate that collaborative multi-institutional studies such as this are readily performed and published so that such trends can be readily identified.

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