ß-lactam resistance in Gram negative bacteria

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Microorganisms have evolved a variety of mechanisms to express resistance to β-lactam antibiotics which include alterations in the penicillin binding proteins (PBPs), decreased permeability (OMP and efflux pump) and β-lactamases. The most common mechanism of resistance to this group of antimicrobials are ß-lactamases which hydrolyse the amide bond in the ß-lactam ring of these agents, producing acidic derivatives which have no antibacterial properties. Since the first report of the ß-lactamase enzyme many enzymes with a wide range of substrate specificities have been reported worldwide.

Gram-negative bacteria produce a much greater variety of ß-lactamases than gram-positive bacteria. In gram negatives, the ß-lactamases which have gained importance in recent years are the extended-spectrum ß-lactamases (ESBLs) which confer resistance to penicillins, monobactamas and newer cephalosporins, including cefotaxime, ceftazidime and cefepime, plasmid mediated AmpC enzymes which share the same substrate profile as the ESBLs as well as being resistant to the ß-lactamase inhibitors and carbapenemases which hydrolyse carbapenems and are encoded by genes carried on mobile genetic elements .

Due to the selective pressure of ß-lactam usage, bacteria will continue to evolve new mechanisms to resist these antimicrobials. Limited use of antibiotics and awareness of the resistance mechanisms may help to minimize the level of resistance.

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