ANTAGONISM OF AMINOGLYCOSIDE ANTIBIOTIC ACTION

S.G.B. Amyes* and J.T. Smith, Microbiology Section, Department of Pharmaceutics, The School of Pharmacy, University of London, 29/39 Brunswick Square, London WC1N 1AX, U.K.

Currently the sensitivity of bacteria to aminoglycoside antibiotics seems to be tested on almost any medium without regard to the effect of potential antagonists. It has been noted that some minimal media are less suitable than complex media for testing streptomycin sensitivity (Pearce & Meynell, 1968). However, until now, no comprehensive guide to the antagonists of aminglycoside action is available, as has been established with trimethoprim and sulphonamides (Amyes & Smith, 1974; 1976).

To investigate the presence of potential antagonists in laboratory media, minimum inhibitory concentrations (MIC) of five aminoglycosides were determined against the sensitive organism E.coli 114 and also against derivatives of this strain resistant to aminoglycoside antibiotics. A variety of commonly available commercial media were used and the tests were also performed on Davis-Mingioli (DM)(Davis & Mingioli, 1950) and M9 minimal media. The MIC of streptomycin, spectinomycin and bluensomycin, with each organism, was significantly higher on minimal media. Similarly, the D-aminoglycosides kanamycin and neomycin exhibited raised MIC values on minimal media. Significant, but generally smaller, variations in MIC values were found amongst the commercial media, with Difco Nutrient Agar almost invariably exhibiting the lowest MIC value.

To test whether minimal media contained antagonists to other antibiotics which affect bacterial ribosomes, similar MIC experiments were performed using tetracycline and chloramphenicol. No significant variation in MIC was observed with either drug on any of the media tested. This suggests that the antagonism observed with aminoglycosides is either specific to their precise mode of irreversible ribosome inhibition or to a direct reaction between the aminglycoside antibiotics and their antagonists.

As phosphate is a major component of DM and M9 media, its effect on the MIC of aminoglycosides was tested by adding phosphate to Difco Nutrient Agar in varying concentrations. As the concentration of phosphate increases, the MIC for both sensitive and resistant bacteria increased progressively with all five antibiotics. However, the level of antagonism caused by phosphate often fell short of that observed in DM and M9 media and it was thus apparent some other components of the media were also antagonistic. When the other components of DM medium were tested, it was found that magnesium sulphate, at its concentration in DM medium, raised the MIC by two-fold and ammonium sulphate and sodium citrate each gave a two-to-five-fold increase. The presence of all three components raised the MIC about five-fold, i.e. an additive effect. A similar effect was observed with the components of M9 medium.

The results show that great care must be taken in the selection of a suitable medium for testing the sensitivity of bacteria to aminoglycoside antibiotics. Minimal media contains so many contributory antagonists that it is difficult to visualize how meaningful results can be obtained with such media. Difco Nutrient Agar shows the least antagonism and would seem to be the most suitable medium for estimating sensitivity and resistance to aminoglycoside antibiotics.

We wish to thank Mrs L.E. Summers for excellent technical assistance.

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* Present Address: Department of Bacteriology, University Medical School, University of Edinburgh, Teviot Place, Edinburgh EH8 9AG.