Towards rational decision making in antimicrobial therapy. An annotated bibliography

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Towards rational decision making in antimicrobial therapy. An annotated bibliography

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Abstract. An overview of the recent progress made during the period 2003-2008 for the determination of the susceptibility to antimicrobials of bacteria associated with fish diseases is provided in the form of an annotated bibliography. Some key papers related to current practice, epidemiological cut-off values, the disc diffusion test protocol and antimicrobial susceptibility are briefly outlined.

Keywords. Antimicrobial therapy – Antimicrobial resistance – Susceptibility – Fish disease bacteria.

Vers une prise de décisions rationnelle en matière de thérapie antimicrobienne. Bibliographie commentée

Résumé. *Une révision des récents progrès faits sur la période 2003-2008 concernant la détermination de la sensibilité des bactéries liées aux maladies des poissons par rapport aux antimicrobiens, est présentée sous la forme de bibliographie commentée. Sont brièvement soulignés certains articles-clés portant sur les pratiques actuelles, les valeurs limite épidémiologiques, le protocole des tests de diffusion sur disques et la sensibilité antimicrobienne.*

Most-clés. *Thérapie antimicrobienne – Résistance antimicrobienne – Sensibilité – Bactéries causant des maladies des poissons.*

I – Introduction

At the Izmir meeting, Dr Peter Smith delivered a paper with the title "Towards rational decision making in antimicrobial therapy". The main aim of this paper was to provide an overview of the current methods available for the determination of the susceptibility to antimicrobials of bacteria associated with fish diseases. However, the period between the writing and presentation of this paper, in 2003, and the preparation of the current volume of the proceedings in 2008 has been one of rapid development in this field. The author of this paper has himself authored or co-authored over 20 peer-reviewed papers on issues that relate to this topic between 2003 and 2008. As a consequence of these developments, the information originally provided in the paper presented in Izmir must now be considered as seriously and significantly out-of-date and as no longer representing the opinions of its author. The author has, therefore, decided to withdraw the paper from this volume of the proceedings.

However, the editors of these proceedings have very kindly allowed the author to present a brief annotated bibliography of the papers that have been published during 2003-2008 that he considers to have been of major significance for the issues that he discussed at the conference.

II – General reviews

Smith, P., 2008. Antimicrobial resistance in aquaculture. In: Bernoth E.-M. (ed.), Changing trends in managing aquatic animal disease emergencies. *Rev. sci. tech. Off. int. Epiz.*, 27, p. 243-264.

Smith, P.R., Le Breton, A., Horsberg, T.E., and Corsin, F., 2008. Guidelines for antimicrobial use in aquaculture. In: L. Guardabassi, L.B. Jensen and H. Kruse (eds), *Guide to Antimicrobial Use in Animals*. Oxford: Blackwell Publishers.

Two reviews of the use of antimicrobials in aquaculture published in 2008 cover much of the same material as was covered in the original presentation made in Izmir in 2003.

III – Current Practice

Smith, P., 2006. Breakpoints for disc diffusion susceptibility testing of bacteria associated with fish diseases: A review of current practice. *Aquaculture*, 261, p. 1113-1121.

Smith, P., 2007. A survey of methods and protocols currently being used to determine antimicrobial susceptibility of bacteria associated with fish disease. *Bull. Eur. Assoc. Fish Pathol*., 27, p. 18-22.

Two papers reporting a survey of current practice in European laboratories. They demonstrate that most laboratories use disc diffusion methods but that there is considerable uncertainty as to how these should be interpreted.

IV – Should we seek clinical breakpoints or epidemiological cut-off values?

Smith, P., 2008. A cost-benefit analysis of the application of pharmacokinetic/pharmacodynamic-based approaches to setting disc diffusion breakpoints in aquaculture: a case study of oxolinic acid and Aeromonas salmonicida. *Aquaculture*, 284, p. 2-18.

An analysis of the potential for using pharmacokinetic (PK) and pharmacodynamic (PD) approaches to the setting of interpretive criteria for susceptibility test data generated in aquaculture. It indicates that this approach would be expensive and time-consuming and probably would not improve the quality of advice that could be offered by laboratory scientists to health care professionals. The review concludes that efforts should be concentrated on the development of epidemiological cut-off values rather than on attempting to derive clinical breakpoints from PK/PD data.

V – The basic disc diffusion test protocol and suggested modifications

Alderman, D. and Smith, P., 2001. Development of draft protocols of standard reference methods for antimicrobial agent susceptibility testing of bacteria associated with fish disease. *Aquaculture*, 196, p. 211-243.

The first standard disc diffusion test protocols. It is strongly argued that these should be treated as providing the basic elements of any future test protocols.

CLSI., 2006. *Methods for antimicrobial disk susceptibility testing of bacteria isolated from aquatic animals*, Approved guideline M42-A, Clinical and Laboratory Standards Institute (CLSI), Wayne, Pennsylvania.

A development of the Alderman and Smith (2001) test protocols that attempts to limit inter-laboratory variation by the introduction of rigorous external quality control (QC) requirements.

Smith, P., 2008. How difficult is it to achieve compliance with the quality control requirements of the Clinical and Laboratory Standards Institute's guideline M42-A? *Aquaculture*, 276, p. 1-4.

An analysis of the ability of the QC requirements of M42-A to reduce inter-laboratory variation and the limitations of this approach for laboratories handling <100 isolates a year.

Smith, P., Fleming, G.T.A. and Carroll, C., 2008. Reducing inter-operator variation in disc diffusion assays by the inclusion of internal controls in a standard susceptibility test protocol. *Aquaculture*, 285, p. 273-276.

An initial investigation of the modification of the basic Alderman and Smith (2001) protocol by the inclusion of internal controls. The QC work required by this approach would be very significantly less than is required by the CLSI M42-A (CLSI, 2006) approach and the method would, therefore, be suitable for laboratories handling <100 strains per year.

VI – Attempts to set epidemiological cut-off values

Miller, A. and Reimschuessel, R., 2006. Epidemiological cut-off values for antimicrobial agents against *Aeromonas salmonicida* isolates determined by frequency distributions of minimal inhibitory concentration and diameter of zone of inhibition data. *Am. J. Vet. Res*., 67, p. 1837-1843.

An application of the CLSI M42-A protocols to the setting of epidemiological cut-off values for *Aeromonas salmonicida* and four antimicrobial agents. In this approach the epidemiological cut-off values are proposed as agent- and protocol-specific but are presented as laboratory-independent.

Douglas, I., Ruane, N.M., Geary, M., Carroll, C., Fleming, G.T.A., McMurray, J. and Smith, P., 2007. The advantages of the use of discs containing single agents in disc diffusion testing of the susceptibility of *Aeromonas salmonicida* to potentiated sulphonamides. *Aquaculture*, 272, p. 118-125.

Ruane, N.M., Douglas, I., Geary, M., Carroll, C., Fleming, G.T.A. and Smith, P., 2007. Application of normalised resistance interpretation to disc diffusion data on the susceptibility of *Aeromonas salmonicida* to three quinolone agents. *Aquaculture*, 272, p. 156-167.

Smith, P. and Christofilogiannis, P., 2007. Application of normalised resistance interpretation to the detection of multiple low level resistance in strains of *Vibrio anguillarum* obtained from Greek fish farms. *Aquaculture*, 272, p. 223-230.

Smith, P., Ruane, N.M., Douglas, I., Carroll, C., Kronvall, G. and Fleming, G.T.A., 2007. Impact of inter-lab variation on the estimation of epidemiological cut-off values for disc diffusion susceptibility test data for *Aeromonas salmonicida*. *Aquaculture*, 272, p.168-179.

A series of papers that investigate inter-laboratory-variation and the application of normalised resistance interpretation (NRI) as a method to overcome the difficulties it raises. They particularly address the value of NRI in detecting low-level resistances. The NRI approach would generate agent- and laboratory-specific but protocol-independent epidemiological cut-off values.

Smith, P., Fleming, G.T.A. and Carroll, C., 2008. Reducing inter-operator variation in disc diffusion assays by the inclusion of internal controls in a standard susceptibility test protocol. *Aquaculture*, 285, p. 273-276.

This paper (discussed above) presents a slightly different approach to interpreting disc diffusion data that is still epidemiological in that it relies only on examination of in-vitro phenotypes. Interpretive criteria would be protocol- and laboratory-independent and might also be agent-independent.

VII – Antimicrobial susceptibility and clinical outcomes

Coyne, R., Smith, P., Dalsgaard, I., Nilsen, H., Kongshaug, H., Bergh, Ø. and Samuelsen, O., 2006. Winter ulcer disease of post-smolt Atlantic salmon: An unsuitable case for treatment? *Aquaculture*, 253, p. 171-178.

A paper that illustrated some of the difficulties that are encountered in attempting to assess the clinical outcomes of a therapy on a commercial fish farm.

Smith, P. and O'Grady, P., 2006. Laboratory studies of the clinical significance of disc diffusion data for oxolinic acid against *Aeromonas salmonicida*. *Bull. Eur. Assoc. Fish Pathol*., 26, p. 229-230.

One of the few papers that presents data relating the clinical success of a therapy and data on the susceptibility of the bacterium believed to have been involved.