Pig Veterinary Society

Methicillin resistant *Staphylococcus aureus* (MRSA)

The Pig Veterinary Society is a specialist division of the British Veterinary Association. Members are veterinary surgeons who have a special interest in pigs, representing all sectors of the pig industry – private practitioners, academics, veterinary surgeons employed within the animal feed and pharmaceutical sectors and by Government. The Pig Veterinary Society exists to assist its members to care for pigs, through dissemination of knowledge about health, disease, the pig's welfare and its management.

Methicillin resistant *Staphylococcus aureus* (MRSA) has been found in many normal domestic animals, including pigs. Infection in pigs appears to be more prevalent in some EU countries, including Germany and the Netherlands. While this is a concern, the specific strain of the MRSA organism found in these pigs is different from that normally found in hospital or community infections of people with MRSA.

What is MRSA ?

Staphylococcus aureus is a bacterium that lives primarily on the skin of people and is frequently associated with infections there, such as spots and boils. It can also often be carried in the nasal cavity, without being associated with any signs of disease. In hospital situations, it can cause infections of surgical wounds or implants, especially after complicated operations, such as hip replacements. Patients, who have compromised immune systems, or are very young or very old, might also be more easily infected or susceptible.

Problems have developed over time with treatments for these types of hospital infections. When these infections first occurred, patients were treated with penicillins, but the bacteria eventually developed an enzyme (beta-lactamase) that gave them resistance to the first generation of penicillins and synthetic penicillins (such as amoxicillin). Stronger (beta-lactamase resistant) versions of penicillins were then developed for use, such as methicillin and the cephalosporins. The most recent development is MRSA which can resist these new penicillins. Table 1 has a summary of this situation.

As a result, when hospital infections now occur with MRSA, there is a limited range of effective antibiotics which can be used, such as vancomycin.

What about MRSA from pigs in man?

The main concern in the Netherlands and Germany is that farmers, stockmen, vets and meat processors have a higher carriage rate than the normal population and are positive carriers when screened to go into hospital. In one Dutch survey using nasal swabs they found 50% of conventional pig farmers were positive carriers of MRSA (Wulf and others, 2008) and only 0.03% in the general population and in a German survey, it was found in 36% of pig vets, 14% of meat inspectors and 38% of diagnostic centre workers, who also visited pig farms (Blaha and others, 2008).

The sequence type found in pigs and veal calves is primarily MRSA ST398. This is not related to human hospital epidemic strains but potentially it can cause disease in humans if wounds become infected or it gets into the blood stream. Most of the time, this MRSA, like most Staph aureus, will colonise the nose and cause no problem to the healthy carrier.

What effects does MRSA have on the pig?

Surveys have shown up to 30 % of healthy pigs carry a range of *Staphylococcus aureus* infections in their nose (eg. Wulf and others, 2008). Any MRSA present among these infections probably have little to no effect on the pig as *S. aureus* is not a primary pathogen in the pig, more of an opportunist. In young piglets, which have skin damage or infected navels or gums after teeth clipping, then the organism can penetrate into the blood stream and cause a variety of infections. In one survey of 4,000 submissions to a diagnostic laboratory in Holland (Van der Wolf and others, 2008) only 97 isolates (2.4% of cases) of *S. aureus* were found affecting various organs. Only 19% of these (0.5% of submissions) involved MRSA, demonstrating the low clinical impact of infection.

Where has this MRSA come from and has it spread to the UK?

This is the million dollar/Euro question that is being asked and how far has it spread? There appears to be a high incidence in the Netherlands and Germany, but it must be remembered that they are neighbours and there is a high level of pig flow between the countries. Sweden has shown that it is not present there yet (Eliasson-Selling and others, 2008). Ireland recently reported a very low incidence of 2% in industry associated personnel. In the UK a survey of dust

samples is going on in conjunction with the breeder herd salmonella survey in over 300 herds. The organism can survive in dust and surveys have shown that it is quite a good way of testing farms, giving results similar to nasal swabbing of pigs. When you think of pig farms, dust is probably the main way this organism can spread from animal to man and why pig farmers and vets are commonly colonised. To date there are no reports of high levels of infection, suggesting that the UK has a low or negligible incidence. In a recent survey in cattle, involving several hundred isolates of *S. aureus*, no MRSA were found. This was looked at particularly as cloxacillin, which is similar to methicillin, is commonly used in the dairy industry for mastitis treatment.

So what has induced or selected for this particular resistance development? It is too broad a statement to say that it is just antimicrobial use. It is necessary to look for changes that have taken place recently, not only in pig medicine but in other areas too such as calf medicine. Increased usage of cephalosporins may have played some role.

What should we do about biosecurity?

Until the results of the EU survey in the UK are known next year, extreme caution should be applied. Pigs should not be purchased from continental Europe, or only from herds that are MRSA negative. This is another question you should ask the breeder before purchasing stock. If pigs are already purchased, quarantine them on arrival and test them before they are mixed with the main herd. The rapid spread of the infection would appear to be faster than would be expected, as a result of antimicrobial use alone. It has now been tracked back in various breeding pyramids in Holland (Broens and others, 2008) confirming suspicions that this may be how it has been so widely and quickly spread in their national herd. To date, MRSA has not been reported in the UK pig herd; let's try to keep it that way.

Summary

Everyone in the pig industry should be aware of MRSA and take care to ensure that they do not unnecessarily contribute to the introduction from Europe or its spread among pigs.

The PVS recommends that a full risk assessment be carried out and a formal national strategy developed.

References

Blaha, T. and others (2008) Proceedings of the 20th IPVS Congress, vol 2, p310

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Eliasson-Selling, L. and others (2008) Proceedings of the 20th IPVS Congress, vol 2, p 308

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Table 1. Beta lactam antibiotics and cephalosporins mode of action and resistance

Antibiotic type	Mode of action	Mode of resistance
Penicillin	Cell wall	Beta lactamase production
Amoxycillin	Cell wall	Beta lactamase production
Clavulanic acid	Beta lactamase inhibition	Extended-spectrum beta lactamases (ESBLs)
Methicillin	Cell wall – beta lactamase resistant	Genetic changes to cell wall binding proteins
Cephalosporins (1st generation)	Cell wall – beta lactamase resistant	Cephalosporinases
Cephalosporins (3rd & 4th generation)	Cell wall – Cephalosporinase resistant	Genetic changes to cell wall binding proteins

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