Methicillin-resistant *Staphylococcus aureus*

Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a well-known cause of nosocomial infections worldwide. Nosocomial infections are the result of treatment in a hospital or a healthcare facility, but secondary to the patient's original condition. MRSA has recently become implicated as a community-acquired and zoonotic pathogen. Given that MRSA can infect animals as well as humans, there is concern surrounding the potential for MRSA to become a bacterial foodborne pathogen.

Background

S. aureus is commonly associated with purulent infections, food poisoning and toxic shock syndrome. People and animals are frequently asymptomatic carriers of *S.* aureus and suffer no detrimental effects. When penicillin began to be mass produced in the 1940s, antibiotic-resistant isolates of *S.* aureus began to appear in hospital settings. By 1970, approximately 70 to 85 percent of community strains of *S.* aureus demonstrated resistance to penicillin.

Unfortunately, researchers and medical professionals are witnessing the same trend develop with *S.* aureus resistance to methicillin. First developed in 1959, methicillin was introduced in 1961, and was commonly used to treat staphylococcal infections resistant to penicillin. In the same year that methicillin was introduced, methicillin-resistant Staphylococcus aureus was isolated from a hospital patient in the United Kingdom.

The first detection of MRSA in animals was in mastitic cows in 1972. Subsequent research has identified MRSA in cats, dogs, cattle, horses, monkeys, goats, seals, chickens, pigs, sheep, rabbits, as well as a guinea pig, a turtle, a bat, a parrot and a chinchilla. Clinical presentation of the disease in animals is as varied as it is in humans and includes mastitis, pyoderma, arthritis, osteomyelitis, abscesses, pneumonia and bacteremia.

There are very few reports documenting the prevalence of MRSA in cattle raised for beef production. A 2008 study investigated the burden of MRSA in beef cattle populations. Of the 301 cattle sampled, MRSA was not detected. The researchers concluded that the burden of MRSA in the cattle population sampled was negligible, and the most sensitive site for surveillance was the nares. The researchers recommend that given the zoonotic nature of MRSA, periodic monitoring would provide further insight into the burden of MRSA in beef cattle.

The zoonotic nature of MRSA does add another facet to the already multi-dimensional challenge of ensuring food safety. The scientific community must address not only management protocols for humans, but also for certain animals, primarily horses, pigs and dogs. A review of current scientific information available regarding MRSA revealed that the most apparent needs to address this pathogen appear to be in veterinary settings, equine populations and swine production.

MRSA as a foodborne pathogen

To date, foodborne transmission of MRSA resulting in disease is a rare occurrence. In 1995, a food-initiated outbreak of MRSA occurred in a hospital in the Netherlands. The second reported case of MRSA food contamination took place in the United States in 2001. It is possible that more cases of staphylococcal food poisoning may occur, but

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because affected people rarely seek medical attention and even in events where S. aureus is identified, it is not always subjected to antimicrobial susceptibility testing.

Research needs

It is clear that more research needs to be done regarding MRSA and its risk potential as a foodborne pathogen. Researchers specializing in beef safety research have recommended that a national assessment of prevalence in raw produce and food animals in various stages of production, as well as during and after processing, is needed to adequately estimate the foodborne hazard posed by MRSA.

For the beef industry, conducting periodic surveillance should be a goal to establish a baseline level and to help gauge any fluctuations. Because slaughter-level safety interventions are critical for controlling foodborne hazards in beef, it will also be important to evaluate existing safety strategies and their ability to prevent, reduce or eliminate MRSA and other staphylococcal species during and after processing. Cooperation with the dairy industry will also be critical to address risks associated with MRSA-associated mastitis and its potential subsequent impact on beef safety.

Summary

Methicillin-resistant *Staphylococcus aureus* is a well-known cause of secondary infections in hospital and healthcare facilities worldwide. There is concern that the proliferation of antimicrobial resistant pathogens may lead to situations where certain classes of antibiotics are ineffective in dealing with infection. Thus, it is important to understand and assess the risk that these pathogens represent. MRSA does have zoonotic associations, so there are concerns that it could be spread as a foodborne pathogen. However, research in this area is limited and should be pursued to better understand MRSA's risk to food safety, and beef safety specifically.

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