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SUSPECTED METHICILLIN-RESISTANT *Staphylococcus aureus* INFECTIONS AT SEA

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ABSTRACT

Background: Methicillin-resistant Staphylococcus aureues (MRSA) has been increasingly reported as the cause of community acquired skin infections in individuals without established risk factors. MRSA infections have been reported in multiple settings, but not yet in the commercial maritime industry.

Objective: To evaluate the incidence of skin and soft tissue infections at sea over the past 5 years, and to see if there are trends in reported clinical features that suggest MRSA as the pathogen.

Methods: A retrospective chart review was undertaken of all cases reported from 2002 until 2006 to a single tele-medical advice service for ships at sea. Since microbiologic diagnosis is not feasible at sea, cases were evaluated for the following features which may suggest MRSA: the presence of pus, small abscess or furuncle, or suspected spider bite.

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Results: From 2002 to 2006 the percentage of cases that were skin infections rose from 5.5 to 8.8%. In 2002, 36% had features consistent with MRSA infection and 74 % had them in 2006 ($p < .05$). Across all years approximately 25% of cases required an I&D procedure at sea or upon arrival in port.

Conclusions: The number of skin infections reported to a single tele-medical advice service has increased in the past five years. Furthermore, the proportion of cases with features common to MRSA infections doubled. Planners for health care at sea should consider stocking appropriate antibiotics for suspected MRSA and ensure medical officers are trained to perform I&D (incision and drainage) in order to treat this increasingly common skin infection.

INTRODUCTION

Methicillin-resistant Staphylococcus aureus (MRSA) infections have traditionally occurred in hospitalized patients, patients on prolonged courses of antibiotics and patients with other co-morbid conditions.[1-3] However, since the 1990's the epidemiology of MRSA infections has changed, with an increasing number of community-acquired MRSA infections in patients without traditional risk factors.[2-6] MRSA infections have been reported in clusters of patients among intravenous (IV) drug abusers,[7] urban or poor children,[4,8] athletes in sporting teams,[9,10] daycare centers,[11,12] prisoners,[5,13-16] and military recruits.[5,17-23] In a recent large, multi-center study in the United States, MRSA was the predominant causative organism for all patients presenting with purulent skin infections to emergency departments in eleven different US cities.[3] Community-acquired MRSA has been reported in European countries and other areas as well.[24-27]

Since numerous reports suggest that community-acquired MRSA infections are easily transmitted among people in close contact, and since community-acquired MRSA infections are a growing concern in the general population, it stands to reason that crew of seagoing vessels may be another population at risk. LaMar et al.[28] reported two cases of MRSA skin infections aboard a US naval ship. Subsequent surveillance nasal swab cultures of 125 crewmembers in the same berthing areas found that 6.4% were asymptomatic carriers. There are no reports of MRSA in the commercial shipping or fishing industry. Identifying cases of proven MRSA infections at sea is difficult since most medical care is provided by medical officers with limited medical training, and the ability to culture wounds is impractical or impossible in this environment. However, the

expanding literature suggests there may be clinical features associated with MRSA infections[3] making a presumptive diagnosis at sea possible.

This study presents a unique cohort of commercial vessels who utilize a single tele-medical advice system, often supplemented by digital photographs of skin infections for the physicians to review. Using previously identified features of community acquired MRSA infections, this cohort may provide insights into the prevalence and features of suspected MRSA infections in the seafaring population.

METHODS

A retrospective chart review was undertaken of all cases reported to Maritime Medical Access (MMA), a tele-medical advice service to ships at sea run by the George Washington University Department of Emergency Medicine in Washington, DC, USA. The service covers approximately 200 United States-flagged ships including cargo, tanker, tug, fishing, and pleasure cruise vessels. Communication between the vessel and medical advice physician occurs primarily by satellite telephone, and at times by facsimile or electronic mail. When possible, the case is supplemented by digital photographs sent to the physician via electronic mail.

All cases of skin and soft tissue infections from 2002 through 2006 were reviewed by the authors. Cases of traumatic wounds with or without infections, genital lesions presumed to be sexually transmitted in origin, and dermatologic conditions felt not to have a bacterial etiology (such as fungal and allergic rashes) were excluded. Since microbiologic diagnosis is not feasible at sea, cases were evaluated for the following features which may suggest MRSA based on the work of Moran[3]: the presence of pus, small abscess or furuncle, possible "spider bite", or infections requiring the performance of incision and drainage (I&D) by the medical officer or physician if evaluated in port.

Data were analyzed descriptively and the proportion of suspected MRSA infections in 2002 and 2006 were compared with the Fisher's exact test. Data were analyzed using SPSS 15.0 for Windows (SPSS, Inc, Chicago, IL , USA) . The study was approved by the Office of Human Research at The George Washington University.

RESULTS

In 2002 MMA covered 99 vessels and 200 individual cases for medical advice. In 2006 the service covered 200 vessels and 520 cases for medical advice. The types of

ocean going vessels included in the cohort in 2006 are shown in Figure 1. In 2002, 11 of 200 cases (5.5%) were skin and soft tissue infections; in 2006 this grew to 46 of 520 cases (8.8%). Although the percentage of all cases that were skin and soft tissue infections increased each year of the study, this growing trend between 2002 and 2006 was not statistically significant. Figure 2 shows the percentage of all cases that were skin and soft tissue infections in each year of the study.

In the first year of the study, 36% (n=4) of reviewed cases had features consistent with MRSA infection. This grew to 74 % (n=34) in year five. This increase in the percentage of cases with features suggestive of MRSA was statistically significant ($p < 0.05$) and is summarized by year in Figure 3. Across all study years, 25% of all cases of skin and soft tissue infections required an incision and drainage procedure at sea, or upon arrival in port.

Figure 1. Types of vessels in the cohort, 2006

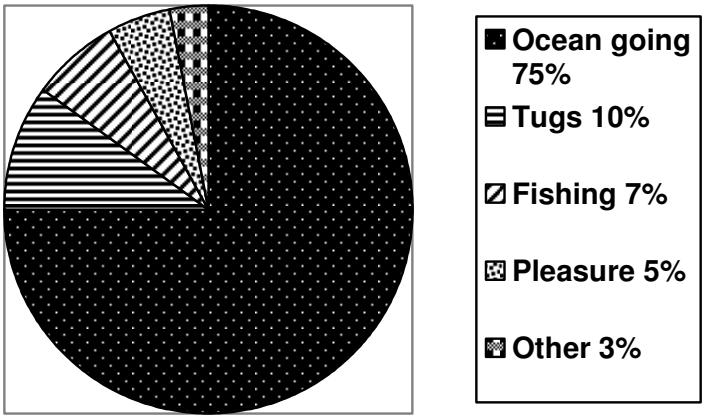


Figure 2. Percentage of all reported cases that were skin infections

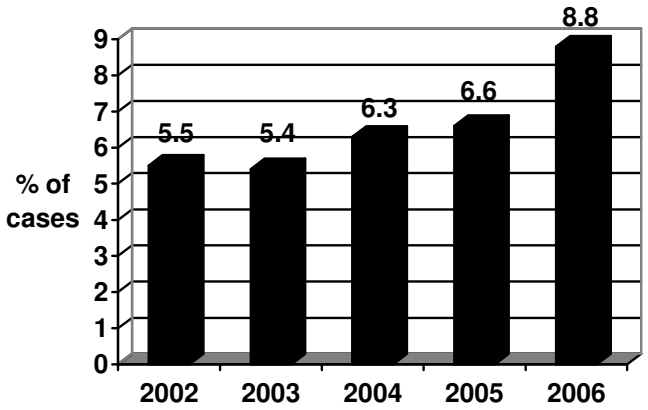
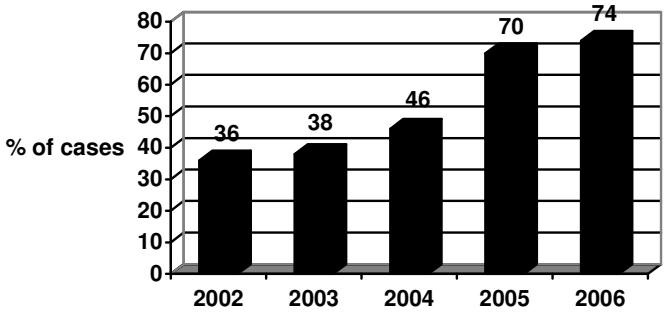


Figure 3. Percentage of all skin infections with features of MRSA



DISCUSSION

This study may be the first to document a growing trend of virulent soft tissue infections characteristic of community-acquired MRSA in the commercial marine industry. This is consistent with reports of other populations at risk for this entity because they are confined in close contact or share living facilities. All vessels in the cohort were US-flagged, however it is common for crewmembers to be multi-national. Thus community acquired MRSA infections may be common to countries other than the United Sates. This growing trend of suspected MRSA infections at sea may have several implications for those responsible for the health and well-being of mariners.

Antibiotic treatment on board should begin with agents likely to cover MRSA as beta-lactam antibiotics traditionally used for gram positive skin infections may not be adequate. As with all infections, resistance patterns may vary by geographic location. However, published reports of community-acquired isolates of MRSA suggest they may be susceptible to oral preparations of trimethoprim/sulfamethoxazole, tetracyclines, clindamycin, and linezolid.[3,29] Of these, only trimethoprim/sulfamethoxazole and doxycycline are included in the recommended medicine chest contents by the US Public Health Service.[30] The most recent recommended medication list by the World Health Organization is in press (International Medical Guide for Ships, 3rd edition) at the time of this study.

For otherwise uncomplicated purulent MRSA infections, treatment with incision and drainage may be more important than antibiotic treatment or choice of antibiotic. In some clinical studies there was no association between patient outcome and the susceptibility of the MRSA isolate to the prescribed antibiotic.[3,31] Thus MRSA skin infections in patients who are not seriously ill or immunocompromised may be cured by drainage procedures alone. Medical officers at sea should then be trained in performing simple incision and drainage of cutaneous abscesses, as our data show that this procedure is necessary in approximately 25% of all skin infections. Incision and drainage are included in the International Maritime Organization (IMO) model curriculum 1.15 for medical care at sea[32] and a US Coast guard STCW approved Medical Person in Charge certification course.[33] It is not covered in the more basic USCG Medical Provider course[33] or IMO Model curriculum 1.14 for first aid [32].

Skin to skin and fomite transmission seem to be the source of outbreaks of MRSA. Thus on board ships, adequate facilities for personal hygiene are important for primary prevention. Fomite sources on board may be shared uniforms, personal protective gear, shared towels, razors and other personal items, and physical fitness equipment. Shared equipment that regularly contacts the mariners' skin should be cleaned on a regular

basis. If an individual seafarer has suspected MRSA, the wound should be kept covered at all times, and bandages changed if they become soaked with drainage. The infected seafarer should wash his or her hands frequently, and should not share any personal items or protective gear with others. Clothes, towels and bed linens should be washed with detergent and hot water regularly. Health care workers can spread MRSA, so medical officers should wear gloves when treating these patients and adhere to strict hand-washing before and after all patient encounters. MRSA is not spread by aerosol or droplets, so strict quarantine is not warranted.

Limitations of this study include those seen in retrospective reviews, especially selection bias as data was not collected prospectively. The cohort included only US-flagged ships, and most of community acquired MRSA has been reported in the US. Nevertheless, infectious diseases rarely limit themselves to geopolitical boundaries and this clinical problem is likely important to ships flagged in many other countries. Since the cohort only used a single medical advice service, the decision to perform incision and drainage may be influenced by the practice patterns of a single group of physicians. Also, it is possible that the shore side urban experience of the medical advice service physicians led to increased recognition of this entity.

The main limitation was the lack of culture results to confirm the presence of MRSA. However, culturing specimens at sea, and keeping them viable until the next port of call where there may or may not be a suitable laboratory makes bacterial culture very impractical. There is a growing body of literature suggesting that most community acquired purulent skin infections are due to MRSA, thus simply the presence of pus may be enough for most clinicians to presume MRSA to be the cause in high-prevalence areas. The case definition for this study was based on a large multi-center study by Moran et al of culture proven MRSA that also tracked clinical features3. Features in this study suggesting MRSA were: a purulent infection, any antibiotic use in the past month, reported spider bite, history of MRSA in the past, and close contact with someone with a similar infection. Of these, the presence of purulence and history of spider bite were features most commonly captured in this retrospective study. Of note, there was only one instance of a cluster of purulent skin infections occurring at the same time on board the same vessel in the study group.

CONCLUSIONS

Skin infections at sea account for 5-10% of all cases resulting in a call to our tele-medical advice service. In the past five years there has been a significant rise in the

proportion of skin and soft tissues infections that are purulent in nature. Based on epidemiologic and laboratory studies in the US and elsewhere, MRSA is becoming the predominant organism causing these purulent skin infections. Planners for medical care at sea should ensure that medical chests contain appropriate antibiotics for these infections and that medical officers are trained to perform simple incision and drainage. Good hygiene is the best primary preventive method and is essential if an index case occurs on board.

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