Outbreak of Methicillin-Resistant *Staphylococcus aureus* ST398 in a Dutch Nursing Home

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CONCISE COMMUNICATION

Outbreak of Methicillin-Resistant *Staphylococcus aureus* ST398 in a Dutch Nursing Home

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We describe an outbreak of methicillin-resistant *Staphylococcus aureus* (MRSA) ST398 in a nursing home in the Netherlands. Seven residents and 4 healthcare workers were identified with MRSA ST398, but 2 of the healthcare workers carried other strains. This study demonstrates that MRSA ST398 can spread in nursing homes.

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Traditionally, methicillin-resistant *Staphylococcus aureus* (MRSA) has been considered a hospital-associated pathogen. Recently, MRSA has expanded its territory to the community, causing severe infections in previously healthy persons all over the world.[1] In 2003, a new clone of MRSA was identified that was related to an extensive reservoir found in pigs and veal calves.[2,3] People who are in direct contact with pigs and veal calves have a high carriage rate of this MRSA (23% and 29%, respectively).[2,4] Using multilocus sequence typing (MLST), the vast majority of these strains belong to sequence type 398 (ST398). Transmission within families, as well as single cases of colonized healthcare workers, have been described.[2,5] However, up to now there have been few reports of transmission of MRSA ST398 in healthcare settings. In the hospital setting, MRSA ST398 is reported to be less transmissible than other MRSA types.[6] We describe an outbreak of MRSA ST398 in a nursing home.

METHODS

Setting

This is a prospective epidemiologic analysis of an outbreak of MRSA ST398 that occurred in a nursing home in the Netherlands from October 2010 to February 2011. The nursing home is located in the southeast of the Netherlands in a region with a high density of pigs (~3,000 pigs per square kilometer). The nursing home consists of 3 separate wards, with a total of 51 residents living in individual units. Incident cases were defined as residents and healthcare workers with MRSA obtained from clinical cultures (ie, wound) or surveillance cultures (ie, anterior nares, throat, and perineum).

Outbreak Investigation

In October 2010, MRSA was cultured from a wound on the leg of a resident. Subsequently, more extensive screening cultures of this resident were obtained in November 2010, which showed that he was also colonized in the throat, nose, and perineum. At the same time, another resident of the same ward had a wound culture with MRSA-positive test results. Subsequent screening in December 2010 of contacts among residents and healthcare workers of this ward revealed additional residents and healthcare workers with MRSA. Because of the high prevalence of MRSA in this ward, a screening of the other 2 wards was performed in January 2011.

Infection Control Measures

According to the current national guidelines for the control of MRSA in nursing homes, transmission-based precautions were taken when there was physical contact with residents who carried MRSA. This means that gowns and gloves were worn when contact with the residents or their equipment was anticipated.[7] Also, instructions on hand hygiene were given. The healthcare workers who carried MRSA were temporarily suspended from work, and decolonization of all colonized subjects was initiated with mupirocin nasal ointment, chlorhexidine wash, and systemic treatment with clarithromycine and rifampicin.

Microbiologic Methods

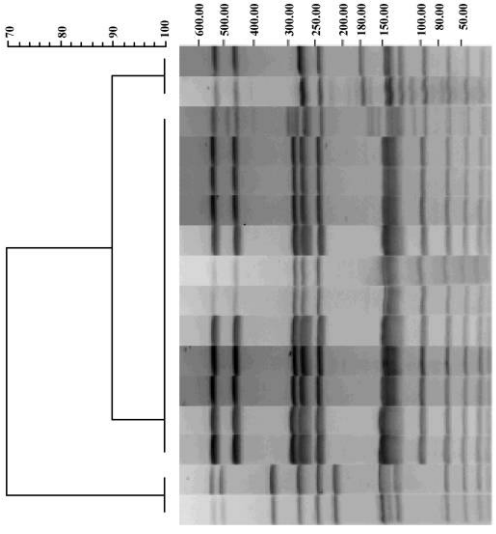
Nose, throat, and perineum swab samples were obtained from residents and healthcare workers. Samples were directly inoculated onto chromID MRSA (bioMérieux). In addition, broth enrichment containing Mueller-Hinton broth supplemented with 6.5% NaCl was inoculated using the same swabs. Direct-inoculated as well as overnight enriched–inoculated plates were read after 18–24 hours of incubation at 35°C–37°C.

From the 11 individuals who were found to harbor MRSA, 16 MRSA isolates were genotyped by staphylococcal protein A (*spa*) typing. In addition, all isolates were genotyped by pulsed-field gel electrophoresis (PFGE) using the restriction enzyme *Cfr*9I according to previously described methods.[8]

RESULTS

Epidemiology of MRSA

The additional screening of the first ward in December 2010 revealed 3 residents and 1 healthcare worker with MRSA. Subsequent screening of the other 2 wards in January 2011 revealed another 2 residents and 3 healthcare workers who were colonized with MRSA. During the 2 months preceding the sampling, the 4 colonized healthcare workers had worked



Resident/HCW No.	Date	*Spa*-Type	PFGE cluster	te	tr	er	cl	to	ci	va	ri	fu	li	mu
HCW 1	Dec 2010	t108	A_2	R	S	S	S	S	S	S	S	S	S	S
HCW 1	Feb 2011	t108	A_2	R	S	S	S	S	S	S	S	S	S	S
Resident 1	Oct 2010	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 4	Dec 2010	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 5	Dec 2010	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 3	Dec 2010	t011	A	R	R	S	S	S	R	S	S	S	S	S
HCW 3	Jan 2011	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 7	Jan 2011	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 6	Jan 2011	t011	A	R	R	S	S	S	R	S	S	S	S	S
HCW 4	Jan 2011	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 1	Nov 2010	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 2	Nov 2010	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 3	Jan 2011	t011	A	R	R	S	S	S	R	S	S	S	S	S
Resident 3	Feb 2011	t011	A	R	R	S	S	S	R	S	S	S	S	S
HCW 2	Apr 2009	t011	B	R	R	R	R	I	S	S	S	S	S	S
HCW 2	Jan 2011	t011	B	R	R	R	R	I	S	S	S	S	S	S

FIGURE 1. Dendrogram of the pulsed-field gel electrophoresis (PFGE) data from 16 methicillin-resistant *Staphylococcus aureus* (MRSA) ST398 isolates. Next to the dendrogram the PFGE of *Cfr*9I macrorestriction fragments, host, sample date, *spa* type, PFGE cluster type, and antibiotic resistance patterns are given. ci, ciprofloxacin; cl, clindamycin; er, erythromycin; fu, fusidic acid; HCW, healthcare worker; I, intermediate sensitivity; li, inezolid; mu, mupirocin; R, resistant; ri, rifampicin; S, sensitive; te, tetracycline; tr, trimethoprim/sulfamethoxazole; to, tobramycin; va, vancomycin.

on all 3 wards and had been in contact with all residents. Altogether, the rate of MRSA carriage within residents was 7 of 51 (13.7%). In healthcare workers the rate was 4 of 76 (5.3%).

In total, 6 of the 7 affected residents were successfully decolonized with a single course. However, one resident failed initial treatment and was treated again with the same regimen, which failed also. This resident had been living on a pig farm until recently and reported regular visits to his son at the pig farm. In contrast, none of the other residents had contact with livestock.

Two of the 4 colonized healthcare workers reported contact with livestock. Healthcare worker 1 lived on the grounds of a pig farm, but she only sporadically had contact with pigs herself. After receiving treatment she was recolonized within 1 month. Healthcare worker 2 lived on a veal calf farm, and she reported frequent contact with livestock. Eradication of colonization was not attempted in this healthcare worker due to the anticipated risk of recolonization. Healthcare worker 3, who did not have livestock contact, was successfully treated with mupirocin nasal ointment and chlorhexidine wash. At present, she has had MRSA-negative test results for 3 months. Healthcare worker 4, who did not have livestock contact, became MRSA negative without receiving any treatment. In March 2011, all healthcare workers and residents who had MRSA-positive test results were consecutively screened for the presence of MRSA. Only the index case and the healthcare workers who had contact with livestock were still colonized with MRSA. All other healthcare workers and residents had MRSA-negative test results 3 times.

All isolated strains were resistant to tetracycline. The resistance profiles of all confirmed MRSA strains are depicted in Figure 1.

Molecular Typing

Relatedness of the MRSA strains was confirmed by PFGE with *Cfr*9I restriction digestion in 12 of the 16 isolates.[8] Only the MRSA isolates originating from the 2 healthcare workers who reported livestock contact carried MRSA that had a different PFGE cluster type (Figure 1). Strains can also be subdivided into 3 different resistance profiles. Each PFGE cluster corresponds to a unique resistance profile.

Moreover, *spa* typing showed that 14 of the 16 strains were *spa* type t011. Only the isolates originating from healthcare worker 1 were *spa* type t108. Both *spa* types are very frequently found within MRSA ST398.

DISCUSSION

To date, only one outbreak of MRSA ST398 in a Dutch hospital has been reported.[9] We report the first outbreak, to our knowledge, of MRSA ST398 in a nursing home that comprised 7 residents and 2 healthcare workers. The MRSA strain responsible for this outbreak was *spa* type t011, which belongs to MLST type ST398. The most likely source for this outbreak was the 98-year-old male resident number 3. The index case had been living on a pig farm until recently, before he moved to the nursing home. He reported regular visits to his son at the pig farm. We assume that healthcare workers transmitted the outbreak strain to other residents because the index case

did not have direct contact with the other MRSA-positive residents. Moreover, there was repeated intense physical contact between colonized healthcare workers and the index case due to his obesity and immobility. Furthermore, none of the other colonized residents had contact with pigs or veal calves.

Although we did not assess the compliance to hand hygiene of healthcare workers, this is generally low in nursing homes and may have contributed to the spread of MRSA. When the outbreak was detected, the importance of hand hygiene was communicated to all healthcare workers. Hand sanitizer dispensers were placed at the entrances of all patients' rooms. By doing this the compliance to proper hand hygiene was probably increased.

Two additional healthcare workers had MRSA-positive test results during the outbreak period, but they carried other strains. These healthcare workers reported contact with livestock and had worked for a long time in the nursing home. One of the healthcare workers who had contact with livestock had a similar *spa* type of the outbreak-related strain, but the PFGE pattern was clearly different and the resistance profile also showed major differences. We concluded that they were not involved in this outbreak on the basis of these differences. The MRSA ST398 strains isolated from these healthcare workers were not found in any other residents, who all had been screened. This suggests that healthcare workers who are colonized with MRSA ST398 and comply with proper hygiene precautions are not a significant risk for transmission. It is unclear whether host adaptation of this animal-derived strain plays a role in its transmissibility.

In conclusion, several studies have demonstrated that transmissibility of MRSA ST398 is probably lower than hospital-associated MRSA strains.[5,6] However, this outbreak of MRSA ST398 in a community setting shows that substantial human-to-human transmission can occur. Further adaptation to humans may occur, and if MRSA ST398 can successfully spread from human to human, it may pose a significant public health problem in the future. Therefore, careful monitoring of the evolution and epidemiology of MRSA ST398 is important.

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