Does nasal colonization with Methicillin-resistant Staphylococcus aureus (MRSA) in pig farmers persist after holidays from pig exposure?

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Abstract

Background: In Germany, it has been reported that up to 86% of pig farmers are colonized with Methicillin-resistant Staphylococcus aureus (MRSA) in the nares, at least intermittently. However, little is known about the long-term persistence of colonization, especially when the farmers do not have daily contact to pigs. Here, we analyzed whether an absence from work during the summer holidays had an impact on nasal MRSA colonization rates of pig farmers.

Method: Farmers with daily exposure to pigs during their work routine provided nasal swabs taken at the last three days before their summer leave 2010 and three additional swabs obtained at the first three days after return to work. Every first MRSA isolate was characterized using sequence-based typing of the S. aureus protein A gene (spa).

Results: Among 35 farmers screened, the length of the summer leave was <7d for two farmers, 7-14d for 22 and >14d for two farmers. MRSA was detected in at least one swab from 27 farmers (77%). From these, 16 (59%) were tested positive in all six swabs obtained before and after absence from work; three famers (9%) were tested positive before and negative in all three swabs obtained after the holidays; seven (20%) were tested negative in the swab obtained on the first day after return. One farmer (4%) was tested MRSA negative in all swabs before the leave and positive in all swabs after return from the holidays. The distribution of spa types was t011 (63%), t034 (22%), t108 (7%), t1197 and t1451 (each 4%).

Conclusion: We confirmed a high rate of intermittent MRSA carriage (77%) among German pig farmers. Mostly, holidays did not have an impact on colonization. Only 14% of the farmers lost MRSA during their leave and remained negative for three days after return.

Introduction

Methicillin-resistant Staphylococcus aureus (MRSA) has been reported to colonize livestock (pigs, cattle, poultry) in the most European countries. In Germany, up to 70% of all pig farms [1, 2] are affected. Among the MRSA from livestock reservoirs, isolates belonging to one particular clonal complex (CC), CC398 as defined by multilocus sequence typing (MLST), are predominant and account for more than 90% of all isolated strains [1]. Moreover, it has been described that MRSA CC398 is frequently transmitted to persons with a direct contact to the animals leading to colonization rates of up to 86% among farmers from MRSA positive units [3]. However, a Dutch study has recently shown that persons with occupational exposure to the animals might be colonized only inpersistently. Field workers with a short-term exposure up to 3h daily were positive directly after their visit on a pig farm. But 94% appeared negative when a second nasal swab was collected 24 hours later [4]. Currently, little is known about the MRSA colonization dynamics of persons with a direct and regular contact to livestock. Therefore we invastigated whether an absence from the pig farm during the summer holidays had an impact on MRSA carrier rates among German pig farmers.

Material and Methods

Farmers in the German part of the Dutch-German border region (North Rhine-Westphalia, Lower Saxony) with daily exposure to pigs provided nasal swabs taken during the last three days before their summer leave 2010. Three additional swabs were obtained during the first three days after return to work. All swabs were obtained from the individual farmers in the morning before their first contact to the animals. All nasal swabs were streaked directly onto MRSA-ID (bioMérieux)

and were enriched using a selective medium (Phenolred mannitol broth + ceftizoxime/aztreonam). After 24h of incubation every enrichment culture was plated on MRSA-ID agar. Suspicious colonies were confirmed as MRSA using VITEK2 automated systems and mecA PCR. Every first MRSA isolate of each participant was characterized by sequence-based typing of the S. aureus protein A gene (spa) as described [5]. Cluster formation of spa types was done using the Based Upon Repeat Pattern (BURP) algorithm of the Ridom StaphType software (Ridom GmbH, Münster) with preset parameters as recommended [6].

Results

Among 35 farmers screened, the length of the summer leave was <7d for two farmers, 7-14d for 22 and >14d for two farmers (Table 1). MRSA was detected in at least one swab from 27 farmers (77%). 8 farmers were never tested positive (23%). From these, 16 farmers (59%) were tested positive in all six swabs obtained before and after vacation; three famers (9%) were tested positive before and negative in all three swabs obtained after the holidays; seven farmers (20%) were tested negative in the swab obtained on the first day after return, but positive in at least one consecutive sample. One farmer (4%) was tested MRSA negative in all swabs before the leave and positive in all swabs after return from the holidays. The distribution of spa types was t011 (63%), t034 (22%), t108 (7%), t1197 and t1451 (each 4%). According to the spa repeat pattern, BURP indicated that all spa types belonged to one group.

Discussion

We have found a high MRSA carrier rate among German pig farmers; 77% of which were colonized at least intermittently. All farmers were colonized with spa types indicative for the MRSA CC398 lineage. This confirms previous investigations where it was shown that the colonization rate in this group of persons varies between 23% and 86% [3, 7, 8]. This finding is important, since, especially for nosocomial infections, it has been demonstrated that the colonization with MRSA is a major risk factor for the development of subsequent illness [9]. Swabs were only taken from the anterior nares, as the predilective sites of MRSA carriage. This might lead to an underestimate of the colonization rates, because the farmers might have been colonized at other body sites.

In contrast to investigations among probe collectors suggesting a high rate of intermittent carriage, the majority of farmers in this study (59%) were still colonized on the day after return from the holidays. This might indicate that those persons with regular contact to the pigs are persistently colonized whereas persons with sporadical contact [4] might rather be "contaminated" (e.g. via dust inhalation) than "colonized". Interestingly, 29% of the farmers were tested positive before the leave and negative on all or at least the first day after return. This could be due to an intermittent carriage which was cleared during the holidays. However, 70% of these farmers were tested MRSA positive again on day two or three after their return which could either show a re-colonization after the first contact to the animals or could be explained by a lack of sensitivity of the nasal swabs used to detect carriage. Only 9% of the farmers remained MRSA negative in all three swabs after their holidays. From a practical point of view, these results are useful for recommendations regarding decolonization therapies. When elective surgical procedures are planned, farmers are often tested positive in an MRSA screening performed prior to the intervention. Our data indicate that in most cases, it is necessary to perform decolonization therapies (e.g. using mupirocin nasal ointment and antiseptic body washes), since even absenting from the stables for more than 7 days is unlikely to clear colonization.

Conclusion

In conclusion, absence from the pig holdings during the summer leave mostly did not have an impact on MRSA colonization of pig farmers. Only 9% of the farmers lost MRSA during their leave and remained negative for three days after return. This suggests that farmers are more likely to be nasally colonized with MRSA CC398 rather than "contaminated" via dust inhalation or hand contact.

Table 1 MRSA colonization of German pig farmers before and after a summer leave from the pig holdings.

Farmer No.	before holidays			Length of holidays	after holidays			*spa* type
	day 1	day 2	day 3		day 4	day 5	day 6	
1	-	-	-	<7 days	-	-	-	-
2	+	+	+	7-14 days	+	+	+	t011
3	-	-	-	7-14 days	+	+	+	t011
4	+	+	+	7-14 days	+	+	+	t011
5	-	-	-	7-14 days	-	-	-	-
6	-	-	-	7-14 days	-	-	-	-
7	+	+	+	7-14 days	+	+	+	t011
8	+	-	-	7-14 days	-	-	-	t034
9	+	+	+	7-14 days	+	+	+	t034
10	-	-	-	7-14 days	-	-	-	-
11	+	+	+	7-14 days	+	+	+	t011
12	+	+	+	7-14 days	+	+	+	t011
13	+	+	+	7-14 days	+	+	+	t011
14	-	-	+	7-14 days	-	-	-	t011
15	-	-	-	7-14 days	-	-	-	-
16	+	+	+	7-14 days	-	-	+	t108
17	+	+	-	7-14 days	-	+	+	t108
18	+	+	+	7-14 days	-	+	-	t034
19	+	+	+	7-14 days	+	+	+	t011
20	+	+	+	>14 days	+	+	+	t034
21	+	+	+	>14 days	+	+	+	t1451
22	-	-	-	7-14 days	-	-	-	-
23	+	-	+	7-14 days	-	-	-	t011
24	-	-	+	7-14 days	-	-	+	t011
25	+	+	+	7-14 days	+	+	+	t011
26	+	+	+	7-14 days	+	+	+	t011
27	+	+	+	<7 days	+	+	+	t011
28	+	-	+	7-14 days	-	+	-	t011
29	-	-	-	7-14 days	-	-	-	-
30	-	-	-	7-14 days	-	-	-	-
31	+	+	+	7-14 days	-	+	+	t034
32	+	+	+	7-14 days	+	+	+	t011
33	+	+	+	7-14 days	+	+	+	t011
34	+	+	+	7-14 days	+	+	+	t1197
35	+	+	+	7-14 days	-	-	+	t034

References

1. European Food Safety Authority. Analysis of the baseline survey on the prevalence of methicillin-resistant Staphylococcus aureus(MRSA) in holdings with breeding pigs, in the EU, 2008, Part A: MRSA prevalence estimates; on request from the EuropeanCommission. EFSA Journal 2009;7(11):1376.
2. Köck R, Harlizius J, Bressan N, et al. Prevalence and molecular characteristics of methicillin-resistant Staphylococcus aureus (MRSA) among pigs on German farms and import of livestock-related MRSA into hospitals. Eur J Clin Microbiol

Infect Dis 2009 Nov;28(11):1375-82.
3. Cuny C, Nathaus R, Layer F, Strommenger B, Altmann D, Witte W. Nasal colonization of humans with methicillin-resistant Staphylococcus aureus (MRSA) CC398 with and without exposure to pigs. PLoS One 2009;4(8):e6800.
4. van Cleef BA, Graveland H, Haenen AP, et al. Persistence of Livestock-Associated Methicillin-Resistant Staphylococcus aureus in Field Workers after Short-Term Occupational Exposure to Pigs and Veal Calves. J Clin Microbiol 2011 Mar;49(3):1030-3.
5. Mellmann A, Friedrich AW, Rosenkotter N, et al. Automated DNA sequence-based early warning system for the detection of methicillin-resistant Staphylococcus aureus outbreaks. PLoS Med 2006 Mar;3(3):e33.
6. Mellmann A, Weniger T, Berssenbrugge C, et al. Based Upon Repeat Pattern (BURP): an algorithm to characterize the long-term evolution of Staphylococcus aureus populations based on spa polymorphisms. BMC Microbiol 2007;7:98.
7. Voss A, Loeffen F, Bakker J, Klaassen C, Wulf M. Methicillin-resistant Staphylococcus aureus in pig farming. Emerg Infect Dis 2005 Dec;11(12):1965-6.
8. Denis O, Suetens C, Hallin M, et al. Methicillin-resistant Staphylococcus aureus ST398 in swine farm personnel, Belgium. Emerg Infect Dis 2009 Jul;15(7):1098-101.
9. Köck R, Becker K, Cookson B, et al. Methicillin-resistant Staphylococcus aureus (MRSA): burden of disease and control challenges in Europe. Euro Surveill 2010;15(41).