



# Identification of Livestock-Associated Methicillin-Resistant *Staphylococcus aureus* (LA-MRSA) in Community Hospitals In Southern Ontario, Canada

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## INTRODUCTION

• Reports of LA-MRSA in hospitalized individuals in Canada have been rare,<sup>1</sup> despite its presence in animals and food in the country. However, the majority of human surveillance involves tertiary-care facilities in metropolitan areas that may not be representative of community hospitals.

• Since LA-MRSA may be more likely in milder community-associated disease, particularly in rural areas, tertiary-care hospital data may not adequately the situation with LA-MRSA.

• To determine if LA-MRSA strains are present in community hospitals, two surveillance studies were conducted in parallel.

## OBJECTIVES

### Study 1

To determine the types of MRSA present in patients in selected community hospitals over a one year period.

### Study 2

To determine the prevalence of MRSA in the hospital environment and compare MRSA strains between patients and the environment.

## MATERIALS AND METHODS

• In 2010, three community hospitals (A, B, and C) located in southern Ontario, Canada, were enrolled. These healthcare facilities offer a wide spectrum of care and have >150 beds and >100,000 patient visits on an annual basis. All hospitals use targeted screening for MRSA, focusing on patients with designated risk factors (e.g. admission from longterm care, previous hospitalization), but screening of all admitted patients is not performed.

### Study #1

• Patient specimens from MRSA infections and colonization were collected, prospectively, for one year. Only one MRSA isolate from infection and colonization sites were collected per patient.

### Study #2

• In 2010, sampling of environmental surfaces located in the general environment and patient rooms in the medical and surgical wards were sampled once a week for four consecutive weeks.

• A sterile electrostatic cloth was wiped over the surface to be sampled up to a maximum area of 20 cm x 20 cm. Cloths were then placed in individual sterile bags.

• MRSA isolates from patients present in the medical and surgical wards during the study period were also collected. Participating hospitals conduct targeted screening for MRSA colonization.

### Sampling Processing

• Enrichment culture methods for electrostatic cloths<sup>2</sup> and patient samples<sup>3</sup> that were selective for MRSA were used. All isolates were *spa* typed<sup>4</sup> and LA-MRSA strains underwent *Apal* PFGE.<sup>5</sup> PCR for the presence of the genes encoding the Pantone-Valentine leukocidin (PVL) toxin was also performed.<sup>6</sup>

• PFGE patterns were analyzed using the Tenover criteria<sup>7</sup>.

• LA-MRSA isolates were investigated for susceptibility to tiamulin and tetracycline using broth microdilution.

## RESULTS

• 763 MRSA isolates from patients have been analyzed for study #1. One (0.13%) patient isolate, a nasal specimen from Hospital C, was identified as the ST398-associated *spa* type t034 (Table 1).

• Overall, 12.8% (113/881) of environmental samples were contaminated with MRSA (Table 1). Of these, 13 (11.5%) were *spa* type t034, which was identified in Hospitals A and B only. Data on t034 isolates are presented in Table 2. None of the LA-MRSA isolates were positive for PVL toxin genes. No patient (n=43) was identified with this *spa* type during the study period.

TYPE	STUDY 1 (%)	STUDY 2 (%)
CMRSA-1 (ST45)	9 (1.2)	0
CMRSA-2 (ST5)	695 (81.1)	67 (59.3)
CMRSA-3 (ST241, CC8)	2 (0.26)	0
CMRSA-4 (ST36, CC9)	2 (0.26)	0
CMRSA-5 (ST8)	9 (1.2)	29 (25.7)
CMRSA-7 (ST1, CC1)	1 (0.13)	0
CMRSA-8 (ST22, CC2)	1 (0.13)	0
CMRSA-10 (ST8, USA300)	22 (2.9)	4 (3.5)
<i>spa</i> t034 (ST398)	1 (0.13)	13 (11.5)
Non-epidemic clone	21 (2.8)	0

Table 1: Distribution of Canadian epidemic MRSA (CMRSA) epidemic types identified in study 1 (n=763) and study 2 (n=113). Sequence type (ST) and clonal complex (CC) are provided for each clone.

Hospital <sup>1</sup>	General Environment		Patient Rooms <sup>2</sup>	
	No. (%)	Surfaces	No. (%)	Surfaces
A	6 (46.2)	Blood pressure machine Computer keyboard Isolation cart Glove box holder Public telephone Hand rail	2 (15.4)	Visitor chair handle End of patient's bed
B	3 (23.1)	Antibacterial wipes container Nursing station chair handles Hand rail	2 (15.4)	Overbed table Wooden shelf

<sup>1</sup>Hospital A = MRSA identified during visit 4 only; Hospital B = MRSA identified during visit 3 only  
<sup>2</sup>Hospital B = both surfaces were located in the same patient room and the patient was MRSA positive; Hospital B = surfaces located in 2 different patient rooms but on the same ward. One patient was positive for MRSA the other patient was MRSA negative.

Table 2: Data on *spa* type t034 MRSA isolates (n=13) identified from surfaces sampled in the general environment and patient rooms.

• Tiamulin and tetracycline susceptibility data for LA-MRSA isolates are presented in Table 3 and PFGE patterns are presented in Figure 1.

• All hospital environment isolates were indistinguishable on PFGE except for H424 (the tiamulin resistant isolate), which was closely related. The human isolate, MF386, was different, but related, to the hospital environment isolates.

Isolate ID	Source	Tetracycline	Tiamulin
MF386	Patient - nasal	> 16	1
H404	Environment - chair handles	> 16	1
H405	Environment - shelf	> 16	1
H424	Environment - hand rail	> 16	> 32
H426	Environment - overbed table	> 16	1
H437	Environment - antibacterial pump	> 16	1
H498	Environment - glove box holder	> 16	1
H499	Environment - isolation cart	> 16	1
H502	Environment - telephone	> 16	1
H509	Environment - hand rail	> 16	1
H510	Environment - chair handles	> 16	1
H513	Environment - end of bed	> 16	1
H514	Environment - keyboard	> 16	1
H515	Environment - blood pressure machine	> 16	1

Table 3: Antimicrobial susceptibility ( $\mu$ g/mL) of *spa* type 539 MRSA isolates identified in study 1 and 2.

## CONCLUSIONS

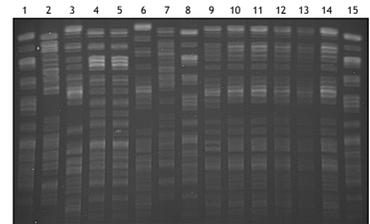


Figure 1: *Apal* PFGE of selected MRSA isolates. Lanes 1, 8, 15: CMRSA-5 (ST8); Lane 3: MF386 ST398; Lanes 4-5: CMRSA-2 (ST5); Lane 7: CMRSA-10 (USA300, ST8); Lines 9-14: H424, H404, H426, H498, H499, H510

## CONCLUSIONS

• To our knowledge, this is the first report of t034 MRSA in the hospital environment in Canada. This *spa* type is associated with ST398 and the predominant *spa* type found in pigs and pig farmers in Canada.<sup>8</sup> This strain has also been found in a limited number of human infections in the country.<sup>1</sup>

• *spa* type 539 was not identified in any hospitalized patient during the environmental surveillance study. The discordance between patient MRSA strains and MRSA strains suggest unidentified reservoirs or sources, such as hospital staff, visitors, or unscrubbed patients. The presence of LA-MRSA in the hospital in the absence of recognized disease is not particularly surprising because of the lower transmissibility of this clone in hospitals compared to other strains.

• All LA-MRSA strains were resistant to tetracycline, as is typical. However, only one strain was resistant to tiamulin, in contrast to a recent report of widespread tiamulin resistance in porcine ST398 from Canada.<sup>9</sup>

• LA-MRSA identified here are closely related on PFGE to LA-MRSA isolated from pigs in the province. The participating hospitals serve rural communities where pig farming is present, which may increase the likelihood of LA-MRSA exposure. The role of livestock contact on the presence of LA-MRSA in patients and the environment in community-hospitals requires further study.

• Further surveillance is required for a better understanding of LA-MRSA strains in Canadian community hospitals.

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