

# Detection of MRSA and MSSA CC398 isolates in osteoarticular infections in patients of a Spanish Hospital

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## Background

Previous studies have shown a significant relationship between high density swine areas (HDSA), and methicillin-resistant *S. aureus* (MRSA) CC398 prevalence at hospital level.

Tetracycline resistance (Tet<sup>R</sup>) has been evidenced as a phenotypic marker for detection of livestock-associated (LA) MRSA, specially of CC398 lineage.

There are few data on the presence of LA-MRSA in osteoarticular infections in our hospital, located in a HDSA.

The objective of this study was to determine the resistance phenotype/genotype, the virulence content, and molecular typing of *S. aureus* from osteoarticular infections.



## Methods

All 68 *S. aureus* isolates recovered during July2020-December2021 from osteoarticular infections in a Spanish hospital located in a HDSA were included in this study (one isolate/patient).

The phenotype/genotype of antimicrobial resistance was evaluated by Microscan, and PCR-sequencing

*spa*-typing was analysed by PCR-sequencing in all isolates. A PCR specific for the CC398 lineage was performed in this collection, and the Immune Evasion Cluster (IEC) genes were determined by PCR in CC398 isolates.



## Results

### MRSA

14 isolates

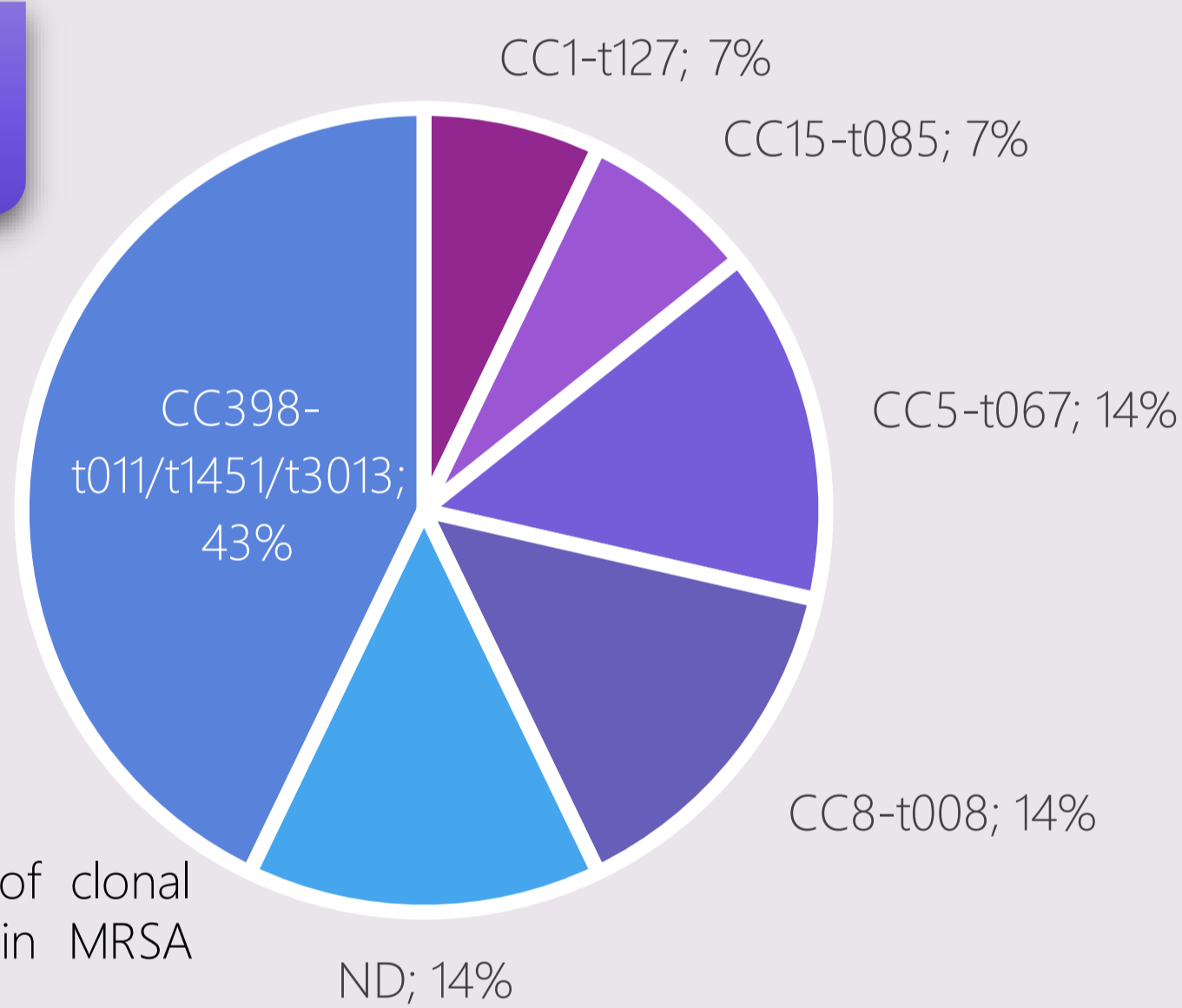


Figure 1. Frequency of clonal complexes detected in MRSA isolates

### MSSA

54 isolates

A high diversity of *spa*-types and clonal complexes were detected among MSSA isolates

45 different *spa*-types were identified, belonging to 18 CCs.

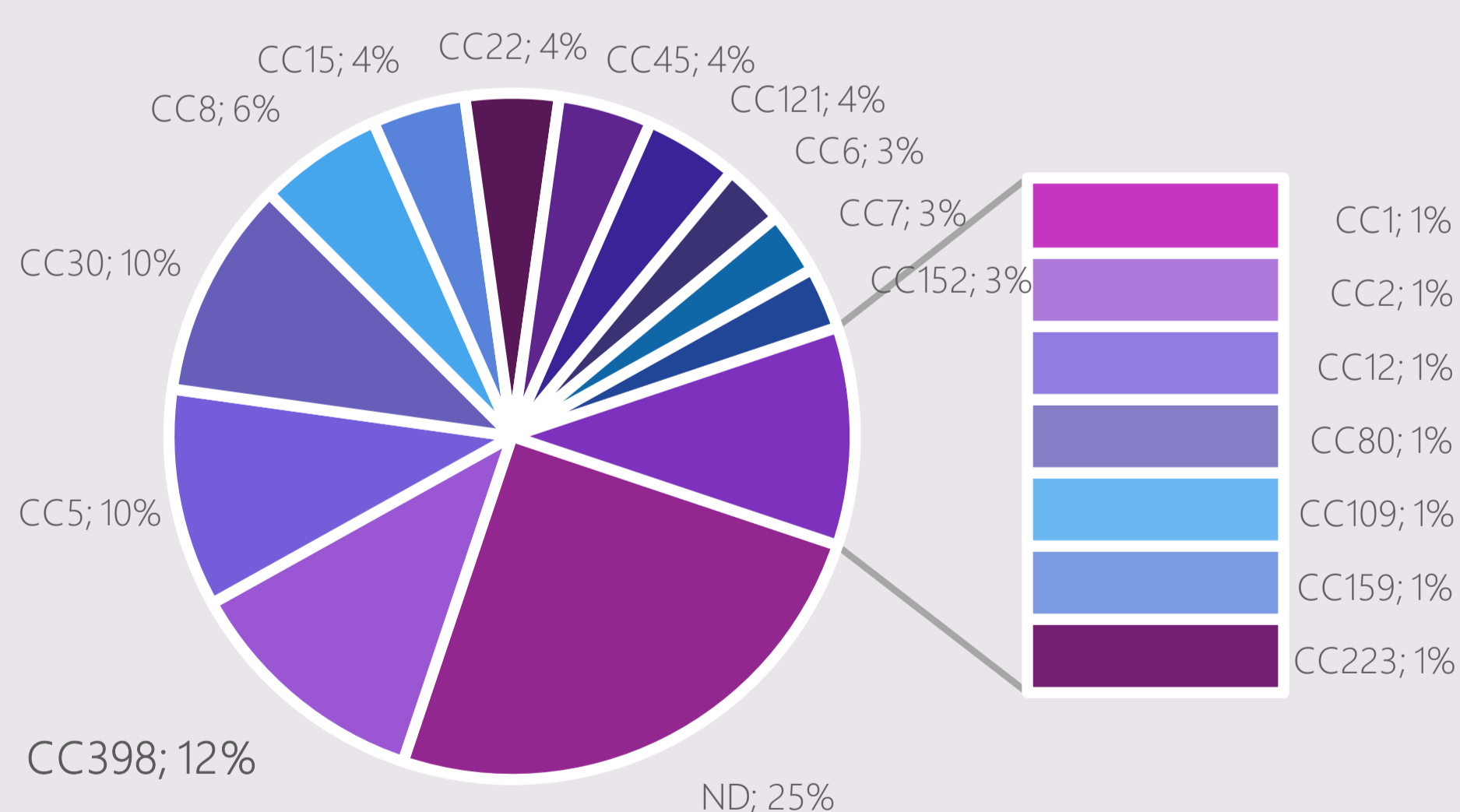


Figure 2. Frequency of clonal complexes detected in MSSA isolates

### Resistance

- 34,6% of isolates were multi-drug resistant, being 14 MRSA and 13 MSSA.
- The percentage of resistance were higher in MRSA than in MSSA isolates

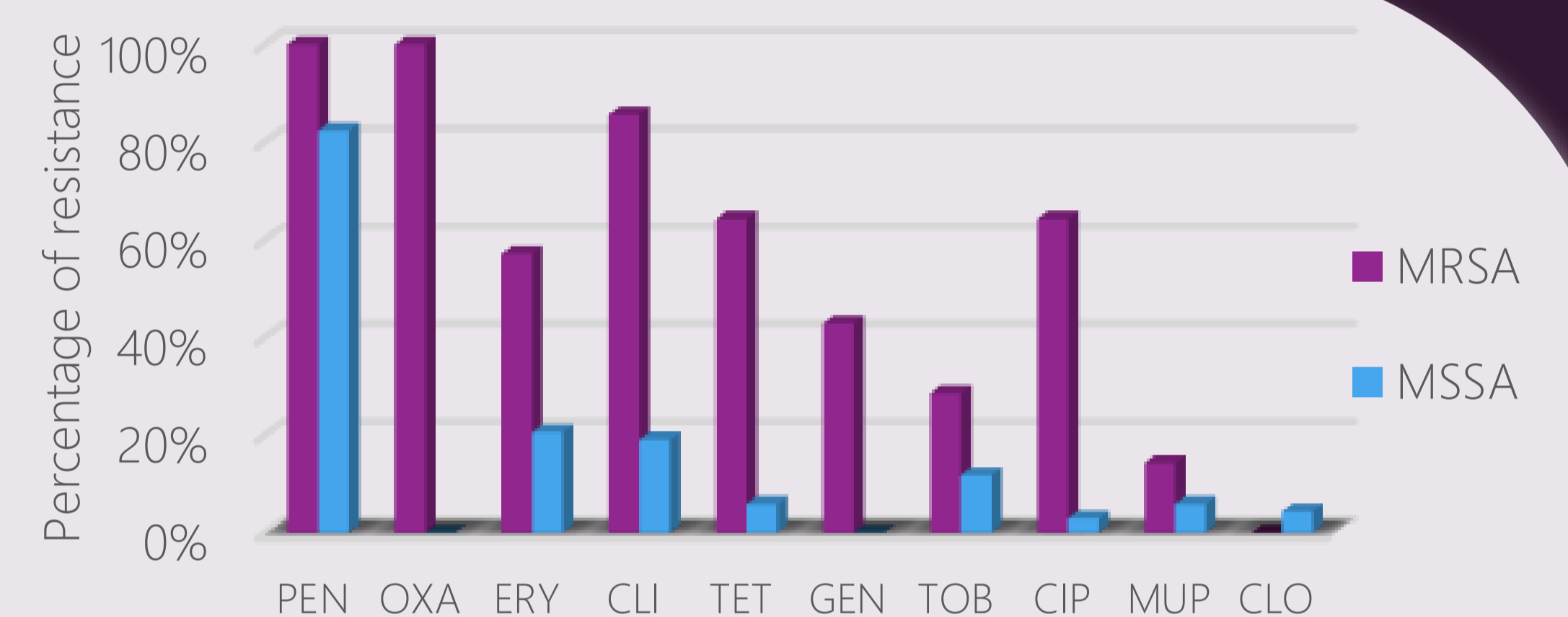


Figure 3. Phenotype of resistance of the 68 *S. aureus*

PEN, penicillin; OXA, oxacillin; ERY, erythromycin; CLI, clindamycin; TET, tetracycline; GEN, gentamicin; TOB, tobramycin; MUP, mupirocin; CLO, chloramphenicol

Table 1. Genotype of resistance of the 68 *S. aureus*.

Antibiotic resistance	Resistance genes (n° of isolates)
Penicillin	<i>blaZ</i> (63)
Oxacillin	<i>mecA</i> (10)
Erythromycin-Clindamycin	<i>erm(A)</i> (15), <i>erm(C)</i> (9), <i>erm(T)</i> (11), <i>mph(C)</i> (2), <i>vga(A)</i> (1)
Tetracycline	<i>tet(K)</i> (13), <i>tet(M)</i> (6)
Gentamicin-Tobramycin	<i>aac(6)-Ie-aph-(2)-Ia</i> (5), <i>ant(4)-Ia</i> (5)
Chloramphenicol	<i>cat<sub>p221</sub></i> (2)

### CC398

12 CC398 isolates were detected (17.6%)

4 MRSA (t011, t1451, and t3013)  
All were Tet<sup>R</sup> and IEC negative

8 MSSA (t571, t1451, and t3625)

7/8 showed ERY-CLI<sup>Ind</sup> phenotype, and contained *erm(T)* and *scn* genes

Table 2. Characteristics of the 12 CC398 isolates of this study

	<i>spa</i> -type (n° of isolates)	Resistance phenotype	Resistance genotype
MRSA	t011 (4)	PEN, OXA, ERY <sup>2</sup> , CLI <sup>3</sup> , TET, GEN <sup>1</sup> , TOB <sup>1</sup> , CIP <sup>3</sup> , CLO <sup>1</sup> , MUP <sup>1</sup>	<i>blaZ</i> , <i>mecA</i> , <i>tet(K)</i> , <i>tet(M)</i> , <i>erm(A)</i> <sup>2</sup> , <i>erm(C)</i> <sup>2</sup> , <i>erm(T)</i> <sup>2</sup> , <i>aac(6)-Ie-aph-(2)-Ia</i> <sup>1</sup> , <i>ant(4)-Ia</i> <sup>1</sup> , <i>cat<sub>p221</sub></i> <sup>1</sup>
	t1451 (1)	PEN, OXA, TET, GEN, TOB, CIP	<i>blaZ</i> , <i>tet(K)</i> , <i>tet(M)</i> , <i>aac(6)-Ie-aph-(2)-Ia</i> , <i>ant(4)-Ia</i>
	t3013 (1)	PEN, OXA, ERY, CLI*, TET, GEN, TOB, CIP, MUP	<i>blaZ</i> , <i>tet(K)</i> , <i>erm(A)</i> , <i>erm(C)</i> , <i>erm(T)</i> , <i>mph(C)</i> , <i>aac(6)-Ie-aph-(2)-Ia</i> , <i>ant(4)-Ia</i>
MSSA	t571 (5)	PEN, ERY <sup>1</sup> , CLI*, TOB <sup>1</sup>	<i>blaZ</i> , <i>erm(A)</i> <sup>3</sup> , <i>erm(C)</i> <sup>1</sup> , <i>erm(T)</i> , <i>ant(4)-Ia</i> <sup>1</sup>
	t1451 (2)	PEN, ERY <sup>1</sup> , CLI* <sup>1</sup> , GEN <sup>1</sup> , TOB <sup>1</sup>	<i>blaZ</i> , <i>erm(A)</i> <sup>1</sup> , <i>erm(T)</i> <sup>1</sup> , <i>aac(6)-Ie-aph-(2)-Ia</i> <sup>1</sup> , <i>ant(4)-Ia</i> <sup>1</sup>
	t3625 (1)	PEN, ERY, CLI*	<i>blaZ</i> , <i>erm(T)</i>

A number in superscript reflects when not all isolates of the group have the referred characteristic  
PEN, penicillin; OXA, oxacillin; ERY, erythromycin; CLI, clindamycin; TET, tetracycline; GEN, gentamicin; TOB, tobramycin; CLO, chloramphenicol; MUP, mupirocin



## Conclusions

- MRSA and MSSA-CC398 isolates were frequently identified among osteoarticular infections in this hospital
- TET<sup>R</sup> or ERY-CLI<sup>Ind</sup> resistance seems to be good phenotypic marker for detection of CC398 isolates of animal and human clades, respectively.
- The emergence of multiresistant LA-MRSA lineages in these osteoarticular infections should be monitored, especially in HDSA.

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