ANTIMICROBIAL PHENOTYPIC RESISTANCE PROFILES OF *STAPHYLOCOCCUS HYICUS* ISOLATES INVOLVED IN EXUDATIVE EPIDERMITIS IN SUCKLING PIGLETS IN QUEBEC

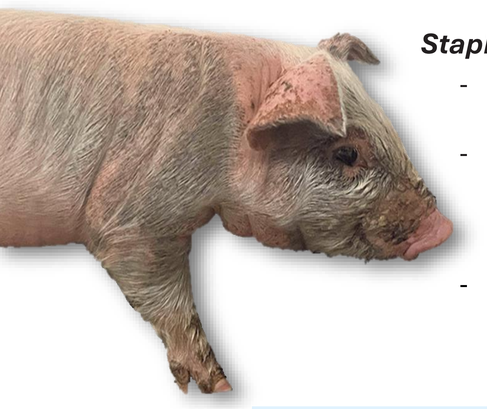
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INTRODUCTION

Exudative epidermitis (EE)

- Suckling and weaned piglets
- Generalized or localized clinical form
- Caused by *Staphylococcus hyicus*



Staphylococcus hyicus

- Gram-positive skin commensal bacteria
- Several virulence factors as exfoliative toxins (ExhA, ExhB, ExhC, ExhD, SHETA,SHETB)
- Antimicrobial resistance (AMR) could impair treatment efficacy

OBJECTIVE

Describe the frequency and profiles of phenotypic AMR in *S. hyicus* isolated from suckling piglets with EE.

MATERIEL AND METHODS

Source population

- Quebec breeding sites with EE outbreaks (≥ 4 litters with EE in the same farrowing batch)

Selection of piglets with EE in each breeding site

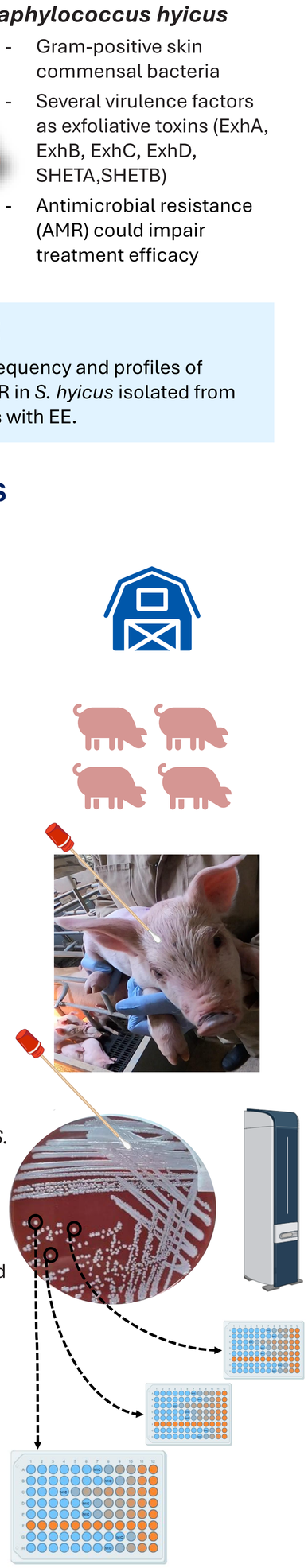
- Four piglets with EE from different litters

Sampling piglets with EE

- One swab per piglet prior to EE treatment

Laboratory analyses

- Each swab cultured to isolate *S. hyicus*
- Positive culture confirmed by MALDI-TOFF
- Minimum inhibitory concentrations (MICs) obtained for up to 3 isolates per swab
  - Broth microdilution (Sensititre)
  - 19 antimicrobials (10 classes)



Descriptive statistics

- MIC results classified according to resistance breakpoints established according to CLSI[1] or literature[2].
- Percentage of resistant isolates described for each antimicrobial and class. A site or piglet was defined as resistant for an antimicrobial when at least one resistant isolate was detected.
- The number of sites, piglets and isolates in each ARM profile were described.

RESULTS

Most frequent resistance

- Penicillin (Table 1)
  - 78% of the sites
  - 67% of piglets
  - 59% of isolates
- Followed by florfenicol, ampicillin and clindamycin

No resistance

- Ceftiofur, danofloxacin, enrofloxacin, gentamycin and neomycin (Table 1)

Table 1. Percentage of site, piglet and isolate with ≥ 1 *S. hyicus* resistant isolate for the 19 antimicrobials tested by MIC.

Class and Antimicrobials	Code	% with ≥1 resistant isolate		
		Site (n=9)	Piglet (n=36)	Isolate (n=104)
Beta-Lactams		78	67	59
Ampicillin	AMP	67	31	19
Ceftiofur	XNL	0	0	0
Penicillin	PEN	78	67	59
Quinolones		0	0	0
Danofloxacin	DAN	0	0	0
Enrofloxacin	ENR	0	0	0
Amphenicols		78	56	46
Florfenicol	FLR	78	56	46
Aminocyclitols		33	25	19
Spectinomycin	SPE	33	25	19
Aminoglycosides		0	0	0
Gentamycin	GEN	0	0	0
Neomycin	NEO	0	0	0
Sulfonamides		22	8	3
Sulfadimethoxine	SUD	22	8	3
Trimethoprim/ Sulfamethoxazole	SXT	0	0	0
Lincosamides		56	33	31
Clindamycin	CLI	56	33	31
Macrolides		11	11	12
Tylosin	TYL	11	11	12
Tilmicosin	TIL	11	11	12
Tulathromycin	TUL	11	11	12
Gamithromycin	GAM	11	11	12
Tildipirosin	TIP	11	11	12
Pleuromutilins		44	22	19
Tiamulin	TIA	44	22	19
Tetracyclines		33	11	8
Tetracycline	TCY	33	11	8

Percentage with resistance to ≥ 1 antimicrobial

- 100% of sites
- 83% of piglets
- 75% of isolates

Percentage with multidrug resistance (≥ 3 classes)

- 56 % of sites
- 39 % of piglets
- 34 % of isolates

AMR profiles

- 38 profiles within the104 isolates (Fig. 1)
- Isolates were resistant to up to 9 antimicrobials from 6 classes.
- The most frequent profile had intermediate resistance to spectinomycine and was identified in 44% of the sites, 31% of piglets and 22% of isolates.
- 88% and 67% of profiles were unique to one site or piglet, respectively.
- Multiple AMR profiles were observed in 94% piglets.

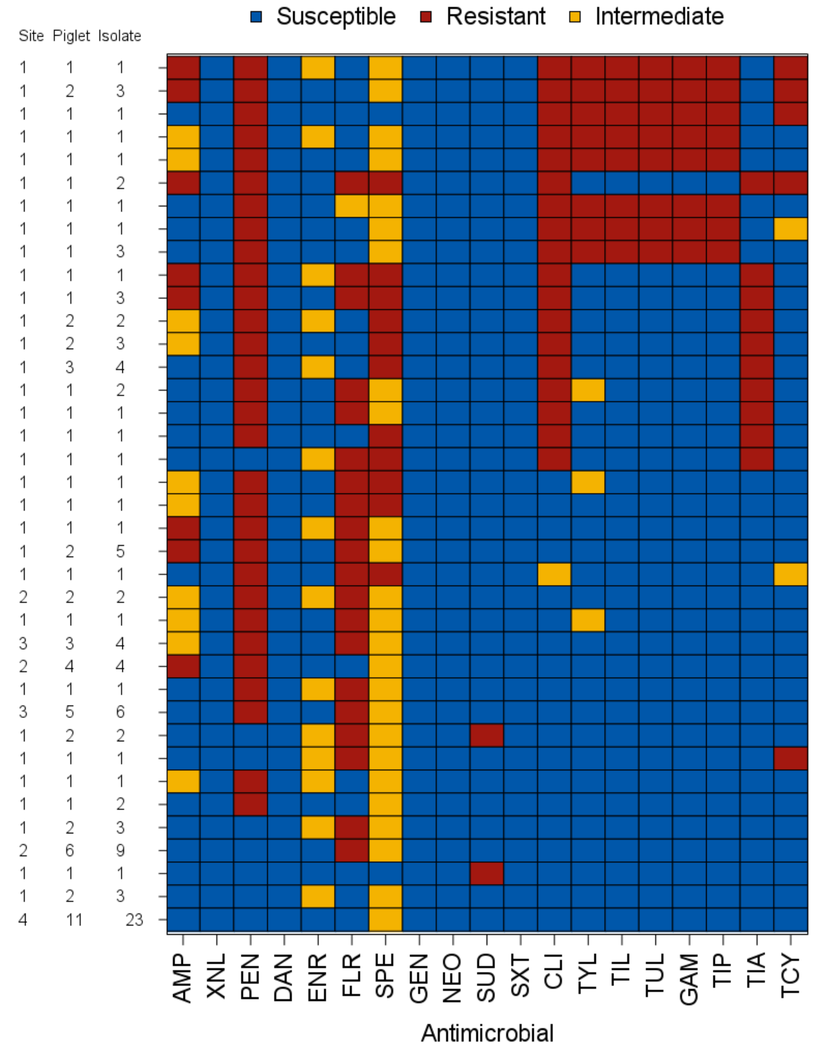


Figure 1. Number of sites, piglets and isolates observed for each AMR S. hyicus profiles detected (9 sites, 36 piglets, 104 isolates).

DISCUSSION

- No resistance breakpoints specific to *S.hyicus* in pigs were available, and thus we had to rely on those established for other Staphylococcus species or animal hosts.
- MIC was used instead of Kirby-Bauer to obtain more precise data, allowing comparison with future studies and revision of results if specific breakpoints become available.
- The high frequency of resistance and multidrug resistance is concerning and could explain treatment failures reported by field veterinarians.
- Fortunately, aminocyclitols or aminoglycosides, commonly used with mineral oil and antiseptic for topical treatment were found less frequently resistant.
- Absence of resistance to ceftiofur and quinolones is in line with the ban of Category 1 (very high importance in humane medicine) antimicrobials.
- Most (88%) AMR profiles were observed on only one site suggesting genetic heterogeneity between strains from different sites.
- The diversity of AMR profiles among isolates from the same piglet suggests that testing multiple isolates when investigating an EE case would increases the likelihood of detecting resistance.

CONCLUSION

- The AMR frequency and variability revealed the importance of antibiogram for targeted treatment.
- This first evaluation of AMR at site, piglet and isolate levels highlighted that the number of pigs sampled per site and number of isolates tested per swab could influence AMR results.
- AMR can explain some treatment failures but other factors (e.g. route of antibiotic administration, initiation of treatments vs. EE onset, strain virulence) also need to be investigated.
- Whole genome sequencing will be performed to characterize and compare genetic diversity between sites, piglets and isolates. Resistance genes will be described in relation to phenotypic resistance. Virulence genes will be investigated in the perspective of orienting alternative treatment strategies development (e.g. phage therapy, autogenous vaccine).

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