PHENOXYPEN ®

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Susceptibility of porcine *Streptococcus suis* isolates: MIC-values for penicillin V and penicillin G

Introduction

According to Good Veterinary Practice and the 'One Health'-concept, narrow-spectrum antimicrobial treatment is preferred above broad-spectrum treatment. Phenoxypen® (phenoxymethylpenicillin or penicillin V) is the first narrow-spectrum penicillin for use in drinking water of pigs available in the EU. To determine the susceptibility of *S. suis* strains towards narrow-spectrum penicillins, the Minimal Inhibitory Concentrations (MIC) of *S. suis* isolates from diseased pigs were investigated. The MIC is the lowest concentration of an antimicrobial substance that, under defined in *vitro* conditions, prevents the growth of a specific bacterial strain within a defined time period.

Materials & Methods

A total of 37 unrelated *S. suis* isolates from diseased pigs were obtained from different veterinary diagnostic laboratories. The isolates were identified by MALDI-TOF MS and PCR-tests. MIC-values were determined using broth microdilution methods according to CLSI-standards[3,4,7,8] .

14 isolates from diseased pigs in Belgium were obtained between 2010 and 2014[1]. For these isolates the MIC for penicillin V was determined (0.06 µg/ml to 128 µg/ml)[2]. 23 isolates from diseased pigs in Belgium, Germany, The Netherlands and Romania were obtained between 2019 and 2024[5]. For these isolates the MIC for penicillin G was determined (0.0625 µg/ml to 4 µg/ml)[6].

Results

The results are summarized in table 1.

Antibiotic	*S. suis* from 2010 - 2024 (n=37)														
MIC (µg/ml)	≤0.0625	0.125	0.25	0.5	1	2	4	8	16	32	64	128	MIC_{50}	MIC_{90}	S / I / R[7]
Penicillin V/G	31	3	0	3	0	0	0/-	0/-	0/-	0/-	0/-	0/-	≤0.0625	0.125	92% / 8% / 0%

Table 1: MIC-distribution (penicillin G or V) of 37 *S. suis* isolates from diseased pigs in Belgium, Germany, The Netherlands and Romania, MIC50, MIC90 and the percentage of susceptible (S), intermediate (I) and resistant (R) strains.

92% (34 out of 37 isolates) of the *S. suis* strains showed a MIC of ≤ 0.125 µg/ml and were considered fully susceptible to penicillin treatment. 8% (3 out of 37 isolates) of the strains showed an intermediate susceptibility of 0.5 µg/ml. None of the investigated strains showed resistance to penicillins (MIC of ≥ 1 µg/ml).

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Conclusions & Discussion

To determine the susceptibility of *S. suis* strains towards narrow-spectrum penicillins, such as Phenoxypen®, the Minimal Inhibitory Concentrations (MIC) of *S. suis* isolates from diseased pigs were investigated. According to the CLSI-breakpoints[7], strains with a MIC of ≤ 0.25 µg/ml are considered to belong to the wild type population and fully susceptible to penicillin treatment. Strains with a MIC of ≥ 1 µg/ml are considered to have acquired genetic alterations, which result in resistance to penicillin treatment. Strains with a MIC of 0.5 µg/ml are considered to be intermediately susceptible. Infections due to isolates with intermediate susceptibility may still be treatable with penicillin.

The 37 strains from the four European countries were highly susceptible to penicillin G or penicillin V. This investigation concerned only a limited number of *S. suis* strains. However, these results correspond to other published results as shown in table 2 and 3.

Antibiotic	*S. suis* from 2015 - 2016 (n=131)														
MIC (µg/ml)	0.0156	0.0313	0.0625	0.125	0.25	0.5	1	2	4	8	16	32	MIC_{50}	MIC_{90}	S / I / R[7]
Penicillin G	12	66	29	5	5	6	3	1	1	1	0	2	0.0313	0.5	89% / 5% / 6%

Table 2: MIC-distribution of 131 *S. suis* isolates from diseased pigs from 5-9 European countries[9], MIC50, MIC90 and the percentage of susceptible (S), intermediate (I) and resistant (R) strains.

Antibiotic	*S. suis* from 2024 (n=473)															
MIC (µg/ml)	0.0156	0.0313	0.0625	0.125	0.25	0.5	1	2	4	8	16	32	64	MIC_{50}	MIC_{90}	S / I / R[7]
Penicillin G	50	258	101	30	12	13	3	4	2	0	0	0	0	0.0313	0.125	96% / 3% / 2%

Table 3: MIC-distribution of 473 S. suis isolates from diseased pig from The Netherlands[10], MIC50, MIC90 and the percentage of susceptible (S), intermediate (I) and resistant (R) strains.

While sensitivity to penicillin G and penicillin V is virtually identical, the suitability for administration via drinking water differs for both natural penicillins. Unlike penicillin G, penicillin V is highly water-soluble and acid stable. As a result, penicillin V retains its activity after passing through the acidic environment of the stomach. Together with the high susceptibility of streptococci to penicillins, it makes the innovative registration of Phenoxypen® a valuable addition to metaphylaxis and treatment options for *S. suis* infections in swine.

References

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