A descriptive analysis of bacterial isolates from revision surgical samples and the empirical antibiotic coverage, at a specialist orthopaedic hospital

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Introduction:

Appropriate empirical antibiotic prophylaxis for patients undergoing revision surgery for infection requires prior knowledge of local microbiology to optimise infection eradication. At the Royal National Orthopaedic Hospital (RNOH), a combination of Ceftriaxone, Amikacin and Teicoplanin is used for patients undergoing revision arthroplasty until culture results are available. Our aim was to assess the adequacy of this regimen and alternative antibiotic combinations against bacteria isolated from revision cultures.

Methods:

We performed a retrospective analysis of microbiological data from arthroplasty revision culture samples taken between January and December 2020. Only bacterial isolates were included. Susceptibility data were analysed for:

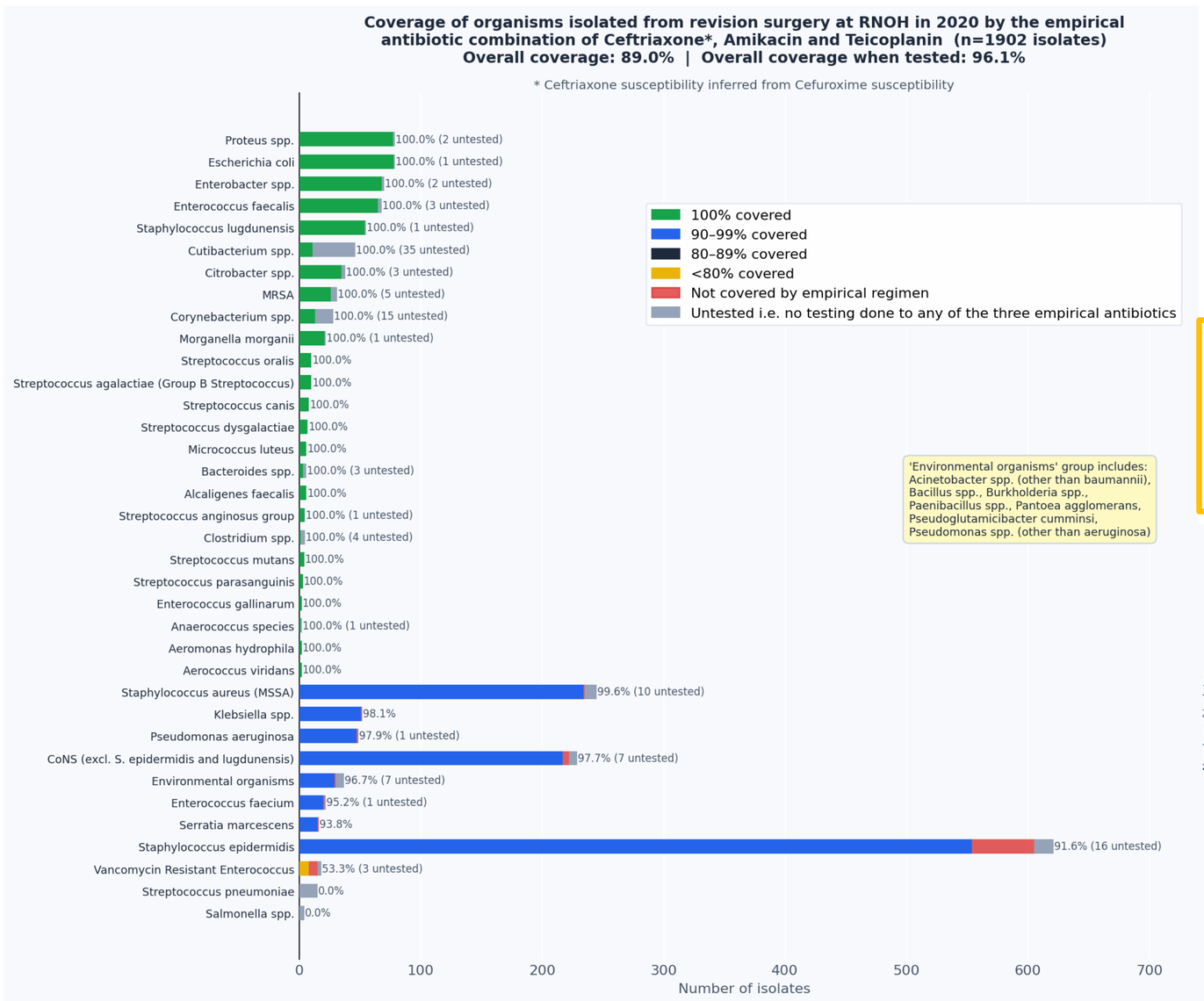
- **Ceftriaxone/Amikacin/Teicoplanin (Regimen 1)**
- **Meropenem/Teicoplanin (Regimen 2)**
- **Meropenem/Vancomycin (Regimen 3)**

Isolate coverage was defined as susceptibility to at least one antibiotic within a regimen. Susceptibility testing was performed using Phoenix automated system and interpreted using EUCAST clinical breakpoints for antimicrobial susceptibility.

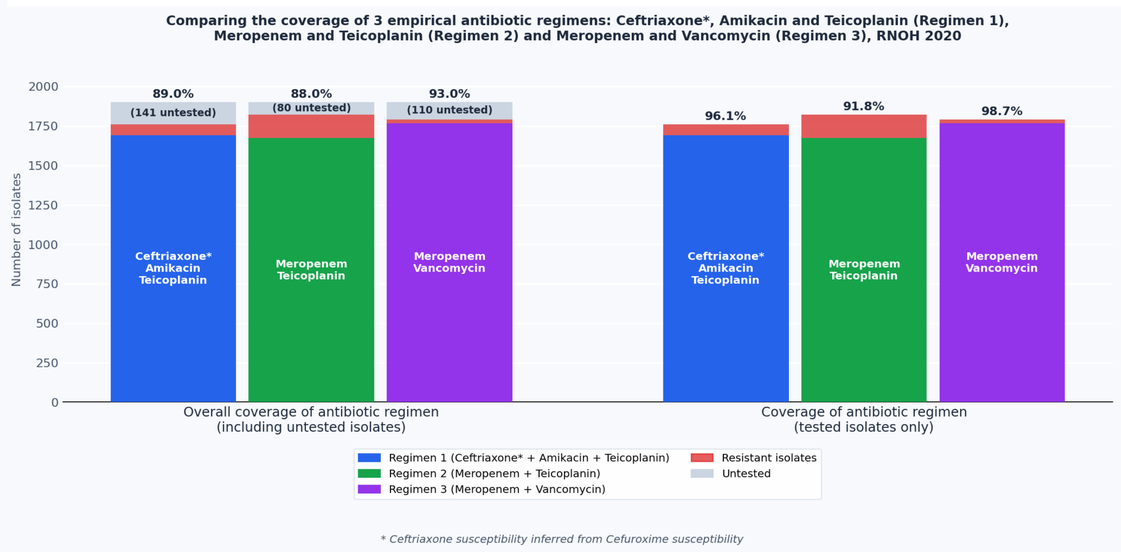
Positive bacterial isolates from revision tissue surgical samples, RNOH 2020

Microorganisms (1902 isolates)	% of Total Isolates
Aerobic gram positive bacteria	**73.7%**
Staphylococcus epidermidis	32.6%
Staphylococcus aureus (MSSA 88.8% / MRSA 11.2%)	14.5%
Coagulase negative Staphylococci (excluding S. epidermidis and S. lugdunensis)	12.0%
Staphylococcus lugdunensis	2.9%
Streptococcus species	3.3%
Enterococcus species (non-VRE 83.6% / VRE 16.4%)	5.8%
Corynebacterium species	1.5%
Other	1.1%
Aerobic or facultatively anaerobic gram negative bacteria	**23.2%**
Enterobacterales (excluding chromosomal AmpC organisms)	13.2%
Enterobacterales with chromosomal AmpC (Enterobacter spp., Klebsiella aerogenes, Citrobacter freundii, Serratia spp., Morganella spp.)	5.9%
Pseudomonas species	2.9%
Other	1.2%
Anaerobic bacteria	**3.1%**
Cutibacterium species	2.4%
Other	0.7%

Results:

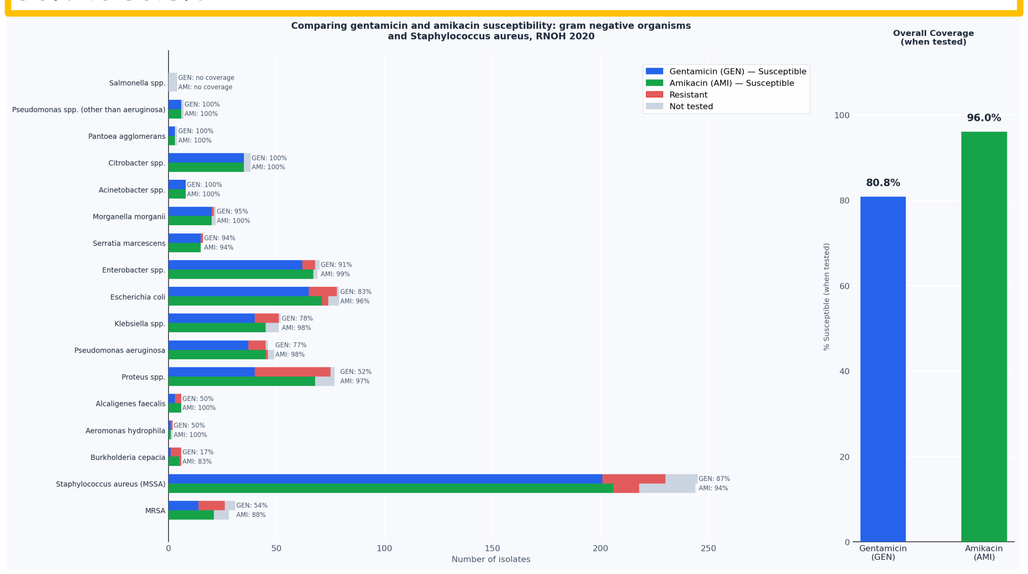


A total of 1902 bacterial isolates were analysed. Aerobic gram-positive organisms predominated with *Staphylococcal species* accounting for the majority. Almost a quarter of isolates were aerobic or facultatively anaerobic gram-negative organisms. When susceptibility testing was performed, Regimens 1, 2 and 3 all covered over 90% of isolates



Further analysis:

Amikacin covered a significantly larger proportion of isolated gram-negative bacilli and *Staphylococcus aureus* than Gentamicin: 96% vs 80.8%



Coagulase negative Staphylococci: susceptibility to Methicillin, Teicoplanin and Vancomycin, RNOH revision surgery samples 2020

Organism	Total Isolates	Untested Isolates (Methicillin)	Methicillin % Susceptible (when tested)	Untested Isolates (Teicoplanin)	Teicoplanin % Susceptible (when tested)	Untested Isolates (Vancomycin)	Vancomycin % Susceptible (when tested)
Staphylococcus epidermidis	621	65	31%	29	81%	25	99%
Staphylococcus haemolyticus	68	7	20%	2	85%	16	100%
Staphylococcus petrasii	2	1	100%	1	100%	0	100%
Staphylococcus pettenkoferi	4	0	100%	0	100%	0	100%
Staphylococcus capitis	83	10	48%	4	100%	1	100%
Staphylococcus caprae	29	1	89%	1	100%	1	100%
Staphylococcus cohnii	14	1	69%	1	100%	0	100%
Staphylococcus sciuri	4	0	0%	0	100%	0	100%
Staphylococcus hominis	8	0	75%	0	100%	0	100%
Staphylococcus lugdunensis	55	2	74%	2	100%	1	100%
Staphylococcus saccharolyticus	4	2	100%	2	100%	1	100%
Staphylococcus warneri	13	0	100%	0	100%	0	100%
TOTAL	**905**	**89**	**39%**	**42**	**86%**	**45**	**100%**

Methicillin
Teicoplanin
Vancomycin

Amongst the *Coagulase negative Staphylococci*, a low proportion were methicillin susceptible (39%).

There was Teicoplanin resistance noted in *Staphylococcus epidermidis* (19%) and *Staphylococcus haemolyticus* (15%) of tested isolates.

There was almost 100% susceptibility to Vancomycin, when tested

Conclusion:

In our revision culture samples, gram-positive organisms, particularly *Staphylococci*, were most frequently isolated. The significant proportion of gram-negative organisms (23.2%) likely reflects the complex case-load at a tertiary centre, where previous surgery, prior antibiotic therapy and spinal surgery are risk factors. Our hospital's regimen (Regimen 1) provides acceptable empirical coverage and is broadly comparable to Meropenem/glycopeptide regimens. Vancomycin provided better gram-positive coverage in comparison to Teicoplanin, but this needs to be balanced with practical difficulties including administering Vancomycin infusions and monitoring levels. Gentamicin resistance was relatively high, supporting the use of Amikacin in this cohort. Limitations include the inclusion of all positive isolates in the analysis, including possible contaminants in patients undergoing aseptic revisions. Pharmacokinetic/pharmacodynamic aspects were beyond the scope of this analysis.