Rethinking UTI Diagnosis: How gold *is* the 'gold standard' and how much does AST really matter?

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Introduction

The current 'gold standard' method for UTI diagnosis is the culture method. Growing uropathogens in culture allows species identification and antibiotic sensitivity testing (AST). However, there are recognized limitations of the culture method[1]. These include:

- A bias towards fast-growing organisms easily grown on the selective agar
- Slow time to result
- An inability to clinically characterize 'mixed growth' samples
- Arbitrary clinical cut-off values (number of organisms per ml of urine) which may not relate to infection

The overall aim of this study was to analyse results provided by culture methods for UTI diagnosis and estimate its potential effectiveness for clinical decision making. Specific aims were to:

- Determine the prevalence of 'no growth' and 'mixed growth' samples, and of each individual uropathogen
- Determine resistance rates for each pathogen
- Estimate the potential effectiveness of these culture results for making clinical decisions

Methods

The results of all 80,981 urine samples processed by the Public Health Wales laboratory in Cardiff in 2022 were collated and analysed.

Prevalence and resistance data was collected and analysed using Datastore

Results

Of 80,981 urine samples analysed, 22,775 (28%) were negative following flow cytometry analysis and were not cultured.

Of 58,206 urine samples cultured, only 33% returned a clinically positive result (**Figure One**)

Figure Two shows the prevalence of the most common uropathogens in samples with specified results. The most common uropathogen was *E.coli* (58%).

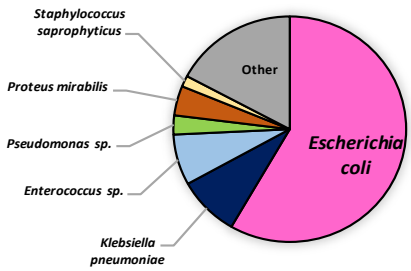

Figure Two. Uropathogen prevalence, Cardiff, 2022.

Resistance rates varied by pathogen (**Table One**). Resistance to nitrofurantoin in *E.coli* was low (2.4%) but resistance to trimethoprim amongst *E.coli* isolates was higher (30.5%).

Trimethoprim resistance was high for all species routinely tested.

Only 24% of all samples analysed returned an AST result.

AST results relevant to the first-choice antibiotics of nitrofurantoin or trimethoprim were obtained for only 16% and 19% of all urines tested, respectively.

Overall resistance to nitrofurantoin was 2.8% and to trimethoprim 32%, representing 0.44% and 6% of total samples tested, respectively.

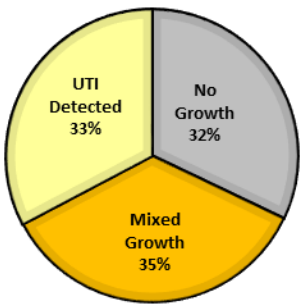

Figure One. Results from all cultured urines, Cardiff, 2022.

Species	Nitro R (%)	Trim R (%)
E.coli	2.4	30.5
K.pneumoniae	n/a	40.4
Enterococcus spp	3.9	n/a
E.faecalis	0	n/a
E.faecium	83	n/a
Pseudomonas spp	n/a	n/a
Proteus mirabilis	n/a	49.6
S.saprophyticus	0	3

Table One. AST results for the most common pathogens, Cardiff, 2022.

Discussion and Conclusion

These results highlight issues with the effectiveness of laboratory culturing. Over one third of all samples cultured did not return a useable clinical result due to mixed growth and AST results were returned for less than one quarter of all samples tested.

The clinical utility of AST depends on the specific antibiotic and species being tested. With nitrofurantoin resistance currently so low in most species routinely tested, knowing whether there is an infection and which bacteria is causing it will have more impact than performing sensitivity testing for this antibiotic. However, for trimethoprim, resistance rates are higher and more variable so AST has more potential clinical impact.

Acknowledgements

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References

1 Szlachta-McGinn et al., (2022). Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9459428/pdf/main.pdf

Conflict of interest statement: EH and JN are co-founders and directors of Llusern Scientific, a company who hope to commercialise the Lodestar DX UTI POC test system