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EXTENDED ABSTRACT

Antimicrobial susceptibility profile of bacteria associated with urinary tract infections in Aveiro, 2021

Leonor Rodrigues[1], Miriam Rocha[2], Ana Rute Nunes[2], Teresa Raposo[2], Vera Afreixo[1,3]

[1]Department of Mathematics, University of Aveiro, Aveiro, Portugal
[2]Sector of Microbiology, Avelab - Medical Clinical Analysis Laboratories, Aveiro, Portugal
[3]CIDMA – Center for Research & Development in Mathematics and Applications, University of Aveiro, Aveiro, Portugal

Introduction:

Urinary tract infections (UTIs) are among the most common bacterial infections. These affect around 150 million people per year globally [1], [2]. UTI diagnosis and treatment at an early stage is essential, as it allows the reduction of morbidity rates [3]. However, this implies that in many cases antimicrobial therapy is prescribed empirically. To administer an appropriate empirical therapy, it is essential to know the main bacteria involved in UTIs, as well as their susceptibility profiles. This knowledge allows for the control of increased antimicrobial resistance (AMR) [3], which has reached alarming levels in pathogens associated with UTIs and beyond, resulting from the generalized and indiscriminate use of antimicrobial agents [4].

This work aims to assess the antimicrobial susceptibility profiles of the most frequent bacterial isolates associated with UTIs in the community of the district of Aveiro, to establish appropriate empirical therapies.

Methods:

The data used in this work included the results of the antimicrobial susceptibility testing (AST) performed on urine samples from patients with UTI, that is, with a positive urine culture. These samples were collected in the collection points of the medical clinical analysis laboratory Avelab between 02/01/2021 and 31/12/2021. The identification of bacteria and AST were performed with the automated system BD Phoenix™ and the European Committee on Antimicrobial Susceptibility Testing (EUCAST) recommendations were considered. According to EUCAST, there are three interpretative categories: a bacteria can be resistant (R), susceptible with increased exposure (I) or susceptible with a standard dosing regimen (S) to an antimicrobial agent [5].

The process of cleaning, analyzing and presenting the data was based on the guidelines proposed by the Clinical and Laboratory Standards Institute (CLSI) [6] and carried out using the package AMR of the software R [7]. The data was filtered to correspond to the samples collected in sites in the district of Aveiro that do not correspond to nursing centers. Only the first isolate of a given bacteria specie per patient was considered, to avoid the calculation of susceptibilities estimates biased in favor of isolates from patients that appear more frequently [6]. Only bacteria species associated with at least 30 samples were considered, to reduce misinterpretations of susceptibility estimates, since the smaller the sample size, the greater the uncertainty associated with the estimate [6], [8]. For each combination of microorganism / antimicrobial agent, the percentage of susceptibility was calculated: S+I/S+I+R [6]. Only the results of the combinations with clinical relevance were presented [6]. For each bacteria comparisons between all the relevant antimicrobial agents were performed using the Cochran's Q test. The significance level used was 5%.

Results:

During the period of study, were performed 17842 bacteriological examinations to urine, of which 3256 (18.2%) resulted in a positive culture. In this study were considered a total of 2538 bacterial isolates. The isolates of Escherichia coli are the most frequent (1702, 67.1%), followed by Klebsiella pneumoniae (293, 11.5%). For example, it is observed that the susceptibility estimate of Escherichia coli to amoxicillin (61%) is lower than the susceptibility estimate to cefuroxime (92%). Thus, for the empirical treatment of uncomplicated UTIs, the second antimicrobial agent should be chosen. Regarding all bacteria, except for Streptococcus agalactiae, were found significant differences in the susceptibility estimates between at least two antimicrobial agents. All of these results are depicted in figure 1.

Keywords:
Bacteria, Susceptibility, Urinary tract infections

Corresponding author:
Leonor Rodrigues
leonorcrodrigues@ua.pt

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		Beta - lactams									Aminoglycosides		Others					
	Microorganism	Amoxicillin	Amoxicillin / Clavulanic acid	Aztreonam	Cefotaxime	Ceftazidime	Cefuroxime	Imipenem	Meropenem	Piperacillin / Tazobactam	Amikacin	Tobramycin	Ciprofloxacin	Fosfomycin	Levofloxacin	Nitrofurantoin	Trimethoprim / Sulfamethoxazole	p**
		Antimicrobial agent																
Gram Negative Bacteria	*Escherichia coli* (n = 1702)	61	72	–	–	–	92*	–	–	–	–	–	87	98*	–	99*	82	<0.001
	Klebsiella pneumoniae (n = 293)	R	56	–	–	–	67*	–	–	–	–	–	70	–	–	–	72	<0.001
	Proteus mirabilis (n = 179)	60	86	–	–	–	91*	–	–	–	–	–	74	–	–	R	75	<0.001
	Pseudomonas aeruginosa (n = 53)	R	R	81	R	85	R	92	96	85	94	88	70	–	65	–	–	<0.001
	Klebsiella oxytoca (n = 39)	R	77	–	–	–	82*	–	–	–	–	–	100	–	–	–	97	<0.001
	Citrobacter koseri (n = 38)	R	89	–	100	–	–	–	–	–	–	–	100	–	–	–	100	0.029
Gram Positive Bacteria	*Staphylococcus saprophyticus* (n = 130)	–	–	R	–	R	–	–	–	–	–	–	100	R	–	100*	83	<0.001
	Enterococcus faecalis (n = 72)	100	100	R	R	R	R	–	–	–	–	–	79*	–	–	100*	–	<0.001
	Streptococcus agalactiae (n = 32)	100	–	R	–	R	100	–	–	–	–	–	–	–	94	97*	–	0.300

> 80% of susceptibility; between 50 and 80% of susceptibility; < 50% of susceptibility

– > Antimicrobial agent not tested or not reported

R Intrinsic resistance

* Only use this antimicrobial agent in case of uncomplicated urinary tract infections

** Cochran's Q test

Figure 1 - Antimicrobial susceptibility profile of the most frequent bacterial isolates associated with UTIs in the community of the district of Aveiro.

Discussion:

The most frequent bacterial isolates found in this study were the same as those found in the literature [9]. One of the limitations of this study was that only samples collected from Avelab collection centers were considered. However, it was assumed that the sample considered is representative of the district of Aveiro: Avelab is the largest medical clinical analysis laboratory in this region; this study considered approximately 55 collection points spread across it. Similar to this study, it is important that in future works rules for the description of antimicrobial susceptibility profiles of bacteria are followed (e.g. CLSI guidelines), as it increases the credibility of the results obtained, as well as makes them comparable between institutions and even within the same institution.

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