Case Series

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Urinary tract infections older adults at Mohammed VI University Hospital of Oujda: case series

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Background: Due to its incidence, clinical polymorphism and severity, urinary tract infection is an important problem in elderly. The objectives of the authors' work were to establish the bacteriological profile of urinary tract infection and/or colonization in the elderly and then to study drug resistance of bacterial strains isolated.

Materials and methods: This is a 36 months retrospective study from 22 March 2016 to 11 May 2019. The study included urinary specimens of persons aged 65 years or over, hospitalized or consulting at the authors' hospital. Urines were processed according to the recommendations of the medical microbiology reference system and European Committee on Antimicrobial Susceptibility Testing.

Results: The authors collected 6552 requests for cytobacteriological examination of urine. Most of the specimens was collected in the middle stream ($n = 5503$; 84%). Cultures were sterile in 49.77% of cases. Positive in 50.22% of cases. Among positive samples we had 53.41% polymorphic cultures, 32.75% urinary tract infection, and 13.82% urinary tract colonization. Gender distribution showed a sex ratio at 0.62. Gram-negative bacilli, with *Escherichia coli as* the main species, dominated the isolated bacteria. Resistance rates of *E. coli* strains that we isolated were 70% for amoxicillin, 36.31% for amoxicillin-clavulanate and 25% for ciprofloxacin. A high resistance rate was seen for third generation cephalosporins. Least resistance recorded to nitrofurantoin.

Conclusion: ITU in the elderly is diverse and significantly different from that of younger patients, through its high contamination rate, difficulty in acquiring clinical information, high rate of asymptomatic bacteriuria, and high proportion of multidrug resistant bacteria.

Keywords: antibiotic resistance, bacteriological profile, case series, elderly, urinary tract infection

Introduction

UTI are the main or second cause of infection in the elderly[1–3]. they are 20 times more frequent in the elderly[1]. It represents ~25% of all infections in the elderly[4]. Prevalence of asymptomatic bacteriuria varies between 15–30% in men and 25–50% in women[5,6]. This high prevalence of asymptomatic infections is accompanied by an increase in symptomatic UTI[7]. UTI causes 15.5% of hospitalizations and 6.2% of deaths attributed to an infectious disease in patients over 65 years of age[8]. Due to its incidence, clinical polymorphism, and severity, UTI is an important problem in elderly. Empirical antibiotic therapy is usually applied here and for this, knowledge of the common uropathogens and their susceptibility to commonly used antibiotics is needed.

The main objectives of our study is to establish the bacteriological profile of urinary tract infection and/or colonization in the elderly, and then to study drug resistance of bacterial strains isolated.

HIGHLIGHTS

- Urinary tract infection (UTI) is common in older adults.
- Urinary tract infection is a real public health problem in older adults. This raises the question of how to manage UTI in the elderly, both diagnostically and therapeutically.
- Through our study, we were able to demonstrate that our geriatric population does not deviate from what is reported in the literature on UTI in older adults.
- Contamination and colonization rates must encourage prescribers in our institution to rationalize the prescription of UTI and to ensure strict compliance with the preanalytical requirements of this examination.

Materials and methods

This is a 36 months retrospective case series study from 22 March 2016 to 11 May 2019. This case series has been reported in line with the PROCESS Guideline[9]. The study included urinary specimens of persons aged 65 years or over, hospitalized or

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consulting at our hospital. Requests for cytobacteriological examination of urine (CBEU) were ordered on the hospital informatics system (HOSIX, SIVSA Soluciones Informáticas). Prescribers were required to answer a survey of clinical informations useful for the interpretation of the CBEU results.

In the laboratory, as soon as we received the urine samples, technicians checked their compliance with the requirements of the medical microbiology reference (REMIC)[10]. Depending on the non-conformity found, specimens were eliminated, examined under reserve of the non-conformity found or kept in the laboratory until correction of the non-conformity. In all cases, a report of the non-conformity was sent to the prescriber through the laboratory's informatics system (iLAB, SIVSA Soluciones Informáticas). Compliant urine was processed according to the recommendations of the REMIC[10]. We used Brillance UTI Agar chromogenic culture medium (Oxoid) for culture, UF-1000i automat (Sysmex) for urine cytology and the BD Phoenix 100 automaton (Becton Dickinson) for identification of the isolated bacteria. Antibiotic susceptibility testing was performed according to the European Committee on Antimicrobial Susceptibility Testing (EUCAST)[11]. Results were interpreted according to the recommendations of the REMIC[10]. Non-compliant urine samples and duplicates were excluded from our study. Urine dipstick screening for UTI and mycobacteria were not performed in our study.

Results

During the study period, we collected 6552 requests for CBEU. Emergency departments were at the forefront of those requesting CBEU ($n=1925$; 29%), followed by outpatient departments ($n=1722$; 26%), medical departments ($n=1305$; 19%), the anaesthesia/resuscitation department ($n=433$; 6%) and then by surgical departments ($n=354$; 5%). In 29% of cases ($n=1929$) CBEU was performed after starting antibiotic therapy. Most of the specimens was collected in the middle stream ($n=5503$; 84%). Proportion of samples taken by other methods ($n=360$; 5.49%), but without specifying which ones, was not negligible. Cultures were sterile in 49.77% ($n=3261$) of cases and positive in 50.22% ($n=3291$) cases. Among positive samples we had 53.41% ($n=1758$) polymorphic cultures, 32.75% ($n=1078$) urinary tract infection, and 13.82% ($n=455$) urinary tract colonization. The prevalence of colonization is about 15.65% in women and 12.67% in men. Among elderly subjects with urinary tract infections, the gender distribution showed low difference for both sexes with a sex ratio at 0.62. 71 (1.23%) cases were occurred in immunocompromised elderly persons and 5 (0.08%) cases were care-related infections. In both urinary tract infections and urinary tract colonization, Gram-negative bacilli, with *Escherichia coli* as the main species (Table 1), dominated the isolated bacteria. Figure 1 show the resistance rates of *Enterobacteriaceae* to the main antibiotics recommended for the treatment of urinary tract infections in the elderly.

Table 1

Distribution of germs isolated during the culture of urinary tract infection

			UTI		UTC	
Groupe	**Family**	**Species**	***n***	**%**	***n***	**%**
Gram-negative bacilli	*Enterobacteriaceae*	*Escherichia coli*	674	62.52	284	62.41
		Klebsiella pneumoniae	142	13.17	75	16.48
		Klebsiella oxytoca	7	0.64	2	0.43
		Klebsiella aerogenes	3	0.27	1	0.21
		Enterobacter cloacae	28	2.59	10	2.19
		Citrobacter braakii	3	0.27	1	0.21
		Citrobacter koseri	5	0.46	1	0.21
		Citrobacter freundii	2	0.18	1	0.21
		Salmonella Spp	2	0.18	0	0
		Shigella flexneri	1	0.0009	0	0
	Moraxellaceae	*Acinetobacter baumanii*	22	2.04	3	0.65
	Pseudomonadacea	*Pseudomonas aeruginosa*	37	3.43	10	2.19
		Proteus mirabilis	16	1.48	7	1.53
	Morganellaceae	*Morganella morganii*	3	0.38	2	0.43
Gram-positive cocci	*Staphylococcaceae*	*Staphylococcus aureus*	31	1.13	16	3.52
		Staphylococcus epidermidis	7	0.75	5	1.09
		Staphylococcus heamolyticoccus	3	0.27	3	0.65
		Staphylococcus saprophyticus	4	0.37	0	0
	Streptococcaceae	*Streptococcus spp*	9	0.83	3	0.65
	Enterococcaceae	*Enterococcus spp*	32	2.96	12	2.63
		Enterococcus faecalis	36	3.33	18	3.95
		Enterococcus faecium	11	1.02	1	0.21

UTC, urinary tract colonization; UTI, urinary tract infections.

Discussion

UTI is common in the elderly and is the second most common site of community-acquired bacterial infection after respiratory infections. It is therefore a real public health problem[12,13]. This raises the question of how to manage UTI in the elderly, both diagnostically and therapeutically.

Increasing age is a risk factor for UTI[14]. Aging disrupts, acquired immunity due to T-cell dysfunction and a blunted cytokine-mediated inflammatory response[14] and normal defence mechanisms include the ability to empty completely, acidification of urine by organic acids, and production of immunoglobulins[14,15]. Women are particularly susceptible to UTI because of their shorter urethral length and frequent vaginal colonization[16]. Older women may also be more affected because of loss of pelvic floor muscle tone and associated prolapse[16]. Although rates tend to even out in aging men due to impaired normal voiding primarily associated with benign prostatic hyperplasia[16]. The main consequence of these micturition difficulties is the generation of a turbulent retrograde urine flow, allowing the ascent of uropathogens to the bladder and eventually to the prostate, which explains the high frequency of prostatic involvement in men with UTI[13]. This explain the sex ratio in our series at 0.62. In fact, urinary tract infections in young adults is about 0.04 (one male for 25 females), but this difference decreases significantly in elderly (1 male for 2 or 3 females)[3].

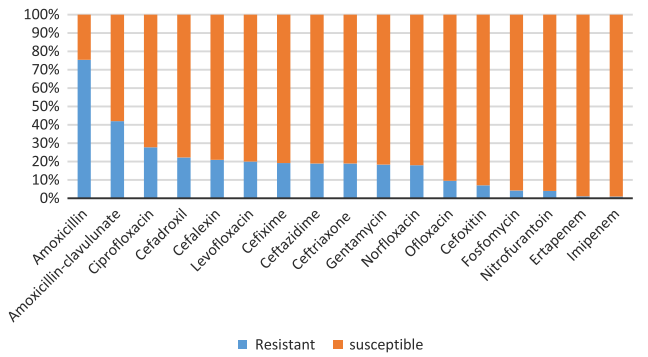

Figure 1. Resistance profile of isolated Enterobacteriaceae to antibiotics used to treat urinary tract infections.

Symptoms of UTI include incontinence, dysuria, increased frequency of micturition, haematuria, and/or suprapubic pain. In pyelonephritis, there is usually a tendency for fever and flank tenderness[17]. In healthy elderly, diagnostic elements are similar to those of younger patients. In frail elderly patients, symptoms are often frustrated or atypical: confusion, fall, slipping syndrome, fever, recent incontinence, and decompensation of a comorbidity[17]. Nevertheless, diagnosis remains difficult because of the high prevalence of asymptomatic bacteriuria (colonization)[12]. In our study, we report a colonization rate of 13.82% ($n=455$). This colonization rate is relatively higher compared with a study of general population conducted previously in our department, which reported a colonization rate of 8.84% ($n=1\,451$)[18]. Prevalence of colonization in our study was 15.65% in women and 12.67% in men. It is relatively low compared with what is reported in the literature[5,6,12]. Prevalence of asymptomatic bacteriuria range from 15 to 30% in men and from 25 to 50% in women[5,6]. In long-term care facilities, these percentages are even higher: from 15 to 40% in men and from 25 to 50% in women[12]. This low colonization rate in our study is relatively distorted by several parameters. It could be explained by prescription abuse, due to the frailty of the elderly, diagnostic tests are sometimes performed in an abusive manner[19]. Another reason is the contamination rate in our study, which concerns one out of two positive samples (53.41%; $n=1758$), which constitutes a considerable diagnostic loss. Finally, clinical evaluation is often limited by the difficulty of obtaining a reliable history from patients who are often unable to communicate their symptoms adequately[12,20–23]. Differentiating urinary tract infection and asymptomatic bacteriuria can be a challenge in older adults. Diagnosis of UTI must be based on a thorough clinical evaluation, presence of new genitourinary signs and symptoms, and the exclusion of other possible diagnoses[12,20–23].

CBEU the gold standard that can confirm urinary tract infection. Although, it is the most frequently performed microbiological examination in the microbiology laboratory, it is one of the most difficult to interpret because its performance is affected by many factors[18].

Urine sample is sometimes difficult to obtain in the elderly (frequency of incontinence, cognitive disorders, …). Then, catheterization is the only method that could be considered[13]. The diagnosis of ITU by catheterization is widely questioned. Obtaining a mid-steam sample or sample from a new catheter provides a specimen without contamination, and has been shown to improve clinical outcomes[24]. The risk in catheterized older adults ranges from 3 to 10% per day of catheterization, eventually reaching 100% in adults with chronic indwelling catheters[15]. The presence of a transurethral urinary catheter removes the natural defence mechanisms against retrograde microbial colonization of the bladder[13]. There is then a risk of bacterial dissemination ascending to the renal parenchyma or diffusion to the prostate[13]. It is difficult to sterilize these reservoirs of bacteria and leads to the use of more and more aggressive antibiotics that could select resistant bacteria[13,25,26]. Indwelling urethral catheter management in urinary tract infections is also important, especially in patients who are frequently catheterized. To accelerate symptom resolution in catheter-associated urinary tract infections, authors opinions differ on the benefit of catheter replacement[25–27]. In our study, ~4.6% of urine was collected by indwelling catheter. The problem does not exist if competent health care personnel perform this method of sampling, the major problem is when personnel who are ignorant of the purpose of the CBEU, the risk of contamination and all the consequences that this entails (diagnostic delay, lost time, and money, …). Large majority of professionals is conscious of this, many do not allow enough time for patients to have a valid urine sample, under the pretext that the workload does not allow it. This is the case, for example, in emergency departments, where 29% of the requests for CBEU in our study came from.

Suprapubic puncture is an invasive method, which avoids any contamination of the urine, but its delicate execution requires ultrasound detection and the intervention of a trained medical team[10]. This technique is therefore rarely used[10]. In our study, only two patients benefited from this method of sampling. Consequently, it would be essential to sensitize health professionals to the abandonment of catheter sampling and to encourage other methods of sampling that would not induce urine contamination.

Regardless of the sampling method adopted, interpretation of a CBEU is never possible if the laboratory does not know how the examined urine was collected. Indeed, in such situation, we would neither know what significant threshold of bacteriuria should be adopted, nor whether the germs isolated in culture should be considered (confirmed uropathogens) or not (contaminants of the perineal flora)[10]. Approximately 5.49% ($n=317$) of the CBEU included in our study did not specify the mode of collection. In these cases, we were unable to interpret the CBEU without calling the physicians to specify the sampling method.

In our study, *E. coli* represented 61% of the isolates. Similar results are reported in series such as Smithson *et al.*[16] who isolated *E. coli* in 62.2% of UTI in the elderly. However, we observe an increased frequency of infections due to other Gram-negative bacteria such as *Klebsiella pneumoniae* which is in accordance with previous studies[12,16,28].

E. coli and other species of the *Enterobacteriaceae* family show variable levels of resistance to the tested antibiotics. Resistance rates of *E. coli* strains that we isolated were 70% for amoxicillin, 36.31% for the combination amoxicillin-clavulanate and 25% for ciprofloxacin. These rates increased in our study are in agreement with the results of Smithson et al. series, with a resistance rate of 71.4% to amoxicillin, 16.2% to Amoxicillin-clavulanate and 48% to Fluoroquinolones[16]. In our study, for nitrofurantoin we recorded only 1% resistant strains. Regarding the worrying rates of resistance to third generation cephalosporins, our study agrees with other studies with a resistance rate of 13%[12,16,28]. Nowadays, we are experiencing a worldwide proliferation of extended-spectrum beta-lactamase strains which is a major public health threat[29]. The usual first-line therapeutic

choices, that is, penicillins and cephalosporins are in-vitro ineffective against extended-spectrum beta-lactamase -producing *E. coli* and *K. pneumoniae* strains, and coresistance to other agents narrows further the therapeutic armamentarium[29,30]. Carbapenems are the most reliable and in severe cases, the only treatment option. However, their judicious use is needed to avoid development of carbapenemase producing strains[30]. Treatment becomes even more challenging in the presence of risk factors such as higher age, comorbidity, and immunosupression. Many times, physicians resort to prescribing broad-spectrum antibiotics over specific antibiotics in the view of resistance of the causative organism to the antibiotic[31]. Poor patient compliance and incomplete course of antibiotic therapy have resulted in the evolution of resistance to many of these antibiotics[31]. Various studies done worldwide have shown changing patterns in the aetiology of UTI in ederly[12]. The present trends of the uropathogens and their susceptibility to various antibiotics are essential to formulate guidelines for the empirical treatment of UTI while awaiting the culture sensitivity.

Conclusion

Urinary tract infection is one of the most common bacterial infections in geriatrics. ITU in the elderly is diverse and significantly different from that of younger patients, through its high contamination rate, difficulty in acquiring clinical information, high rate of asymptomatic bacteriuria, and higher proportion of multidrug resistant bacteria.

Overall, through our study we were able to demonstrate that our geriatric population does not deviate from what is reported in the literature on UTI in elderly patients. However, discrepancies that we have raised concerning urinary contamination and colonization must encourage prescribers in our institution to rationalize the prescription of UTI and to ensure strict compliance with the preanalytical requirements of this examination.

Ethical approval

This study was exempt from ethical approval at our institution, as it was an observational finding in regular practice.

Consent to participate

The study was conducted on anonymous biological samples. It does not concern any personal data that could directly or indirectly identify a specific person.

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Authors' contributions

All authors have made substantial contributions to all of the following: (1) the conception and design of the study, (2) drafting the article and revising it critically for important intellectual content, (3) final approval of the version to be submitted.

Conflicts of interest disclosure

The authors declare that they have no competing interests.

Provenance and peer review

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