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Editorial

We start this pioneering work, which do not seek perfection as much as aiming to provide a scientific window that opens a wide area for all the distinctive pens, both in the University of Sabratha or in other universities and research centers. This emerging scientific journal seeks to be a strong link to publish and disseminate the contributions of researchers and specialists in the fields of applied science from the results of their scientific research, to find their way to every interested reader, to share ideas, and to refine the hidden scientific talent, which is rich in educational institutions. No wonder that science is found only to be disseminated, to be heard, to be understood clearly in every time and place, and to extend the benefits of its applications to all, which is the main role of the University and its scholars and specialists. In this regard, the idea of issuing this scientific journal was the publication of the results of scientific research in the fields of applied science from medicine, engineering and basic sciences, and to be another building block of Sabratha University, which is distinguished among its peers from the old universities.

As the first issue of this journal, which is marked by the Journal of Applied Science, the editorial board considered it to be distinguished in content, format, text and appearance, in a manner worthy of all the level of its distinguished authors and readers.

In conclusion, we would like to thank all those who contributed to bring out this effort to the public. Those who lit a candle in the way of science which is paved by humans since the dawn of creation with their ambitions, sacrifices and struggle in order to reach the truth transmitted by God in the universe. Hence, no other means for the humankind to reach any goals except through research, inquiry, reasoning and comparison.

Editorial Committee

Notice

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Publication instructions

The journal publishes high quality original researches in the fields of Pure Science, Engineering and Medicine. The papers can be submitted in English or Arabic language through the Journal email (jas@sabu.edu.ly) or CD. The article field should be specified and should not exceed 15 pages in single column.

All submitted research manuscripts must follow the following pattern:

- Title, max. 120 characters.
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- Introduction.
- Methodology.
- Results and Discussion.
- Conclusion.
- Acknowledgments (optional).
- References.

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Invitation

The Editorial Committee invites all researchers "Lectures, Students, Engineers at Industrial Fields" to submit their research work to be published in the Journal. The main fields targeted by the Journal are:

- Basic Science.
- Medical Science & Technology.
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Refereeing

The Editorial Committee delivers researches to two specialized referees, in case of different opinions of arbitrators the research will be delivered to a third referee.

Editorial Committee

CONTENTS

ANTIMICROBIAL RESISTANCE IN UROPATHOGEN ISOLATES FROM PATIENTS WITH URINARY TRACT INFECTIONS

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Abstract

Because uncontrolled and wide spread use of antibiotics, the resistance pattern of uropathogens is changing drastically, specifically in developing countries, such as Libya. The aim of the study was to identify the common causes of urinary tract infection (UTI) causing pathogens in the city of Alzawiya, Libya and to check the performance of available antibiotics used by those patients. Study design: random 203 UTI patients who exhibited general UTI systems were included in current study. A questioner was prepared to input the information associated with the experiment including symptoms of disease, age, sex, laboratory diagnosis and antimicrobial susceptibility. Place and duration of study: Arriada laboratories, Alzawiya, Libya, between May 2023 and Dec 2023. Methodology: midstream clean-catch urine samples were collected from 203 suspected urinary tract infection patients of different age and sex groups. Uropathogens were identified by standard and specific microbiological techniques and antimicrobial susceptibility pattern was determined by Kirby Bauer Disc diffusion method following clinical and laboratory standards institute (CLSI) guidelines. findings: Sixty-one (30%) urine samples yielded significant bacteriuria of which 50 (82%) were obtained from female patients and 11 (18%) from male patients. Out of 61UTI patients, the prevalence of E. coli was 36 (59%) whereas for K. pneumonia was 18 (29.5%). Five were identified as Pseudomonas. aureuginosa while 2 were identified as Proteus. Mirabilis. most of the organisms were moderately resistant to Sulphamethoxazole, Cefuroxime, Cefixime and Nitrofurantion. E. coli showed 97.2% sucsebtibility to Amikacin (35/36, 97.2%) and resistant to Sulphamethoxazole (19/36, 52.7%). Klebsiella. Pneumonia was sucsebtible to Amikacin (18/18, 100%) and resistant to Sulphamethoxazole (11/18, 61.1%). P. aeuruginosa was found to show susceptibility to Ciprofloxacin and Amikacin (5/5, 100%) and 100% resistant to Cefuroxime (5/5, 100%). Proteus. Mirabilis found to be sucsebtible to Ciprofloxacin, Amikacin and Cefixime (2/2, 100%) and 100% resistant to Cefuroxime and Nitrofurantion (2/2, 100%). Conclusion: urinary tract infection has high prevalence in females than males in the area of study with most commonly bacterial isolates of E. coli and K.pneumonia. Although high percentage of

uropathogens isolates developed a resistance against available used antibiotics, it seems that combined use of antibiotics is more effective against a particular uropathogen.

Keywords: urinary tract infection; antibiotic resistance; prevalence; E. coli; Amikacin.

Introduction

Urinary tract infection (UTI) classified as one of the most common infectious diseases (Seifu1 and Gebissa, 2013). UTI is most often caused due to bacteria, but may also include fungal and viral infections (Amdekar *et al*., 2011). Gram-negative bacteria cause 90% of UTI cases while gram-positive bacteria cause only 10% of the cases. The most frequent isolated uropathogen is *Escherichia coli*, accounting for 65%–90% of urinary tract infections (Gupta *et al*., 2001, Weekes 2015). The relative frequency of uropathogens varies depending upon age, sex, catheterization, hospitalization and previous exposure of antimicrobials (Haider 2010, Raz R *et al*., 2000).

It is estimated that about 35 % of healthy women suffer from symptoms of urinary tract infection at some point in their life. The prevelance of UTI is greater in women as compared to men, which may be either due to anatomical predisposition or other host factors (Schaeffer *et al*., 2001). Vaginal colonization with uropathogens precedes most UTIs and sexual activity, pregnancy, obstruction are among the other factors contributing to increas frequency of UTI in female (Stamm 2005). Indiscriminate use of antimicrobial agents is a common practice in underdeveloped and many developing countries that often leads to emergence of resistant microorganisms to one or several of these agents with gradual narrowing of scope for effective molecules to combat bacterial infections including UTIs (Gold and Moellering 1996). As a common practice, empirical antimicrobial treatment is initiated before the laboratory results of urine culture are available which may lead to emergence and spread of antimicrobial resistant strains. Factually antimicrobial resistance is one of the principal causes of failure of treatment from infectious diseases and a great concern for UTIs (Gupta 2002). The incidence and pattern of antimicrobial susceptibility of uropathogens are dependent on many factors and constantly changing with the ever increasing use of antimicrobials, continuous monitoring of the susceptibility pattern is of paramount importance for not only selecting appropriate drugs but also for rational choice of empirical therapy (Bauza and Cercenado 2002). The present study was carried out to determine the recent status of prevalence of bacterial pathogens and their antimicrobial susceptibility in UTI patients with the aim to disseminate information about choice of empirical antibiotics.

The emergence of antibiotic resistance in the management of UTIs is a serious public health issue. Particularly in the developing countries where there is high level of

poverty, illiteracy and poor hygienic practices, there is also high prevalence of fake and spurious drugs of questionable quality in circulation (Weekes 2015, Fagan., *et al* 2015). The easy availability in the community without prescription and low cost make the drugs subject to abuse (Manikandan *et al*., 2011). A report showed that high incidence of resistance to the commonly prescribed antibiotic agents was observed in some regions (Emiru *et al* 2013, Moges 2002). Even though, there are few published information concerning the etiology and resistance pattern of UTIs in some hospitals (Weekes LM 2015). This study was conducted in order to assess the prevalence of bacterial uropathogens and their vitro susceptibility patterns to commonly used antibiotic agents amongst patients with complaints of UTI in Arriada Laboratory, Al zaweya, Libya.

Materials and Methods

experimental study was carried out in Alreyada laboratory, Al zaweya Libya, from May 2023 to Dec 2023. The study included patients attending clinics, who were confirmed to have UTI signs and symptoms by the attending Clinician. All the patients with no history of antimicrobial drug administration for UTIs in the last two weeks. In order to identify the risk factors, all the suspected cases of UTI was performed using a structured questionnaire. The Self-administered questionnaire was carried out to capture demographic data, and counseling for specimen collection.

Two hundred and three (203) morning midstream urine samples were collected from patients who attended to Arriada Laboratory in Al Zaweya Libya in sterile bottles. Collected urine was examined within 3 hours in the bacteriology laboratory for diagnosis of the uropathogens and the result of the examination was added to the questionnaire. All the collected data were entered and analyzed using SPSS 27.0 version.

Isolation and Identification of Bacteria from Urine Samples

Diagnosis of the bacterial uropathogens was done at microbiology laboratory. Each sample of midstream urine was inoculated CLED agar (Cystine Lactose Electrolyte Deficient) and incubated at 37°C for 24 h (Cheesbrough, 2009). After incubation, cultures were sub-cultured on blood agar and macConkey agar media, positive UTI was recorded upon the appearance of 100,000 Colony Forming Units (CFU) permilliliter on blood, macConkey agar (Harding *et al*., 2002). Identification of bacteria was established based on their gram staining and cultural morphological as well as biochemical characteristics as described in the book of Cheesbrough (2009).

Antimicrobial Susceptibility Testing

Antimicrobial susceptibility tests were performed according to standards of Clinical and Laboratory Standards Institute (CLSI) guidelines using Kirby ‘Bauer’s disc

diffusion method. Briefly, bacterial suspensions in physiological saline solution were spread platted on Mueller-Hinton Agar. Antimicrobial-impregnated disks, selected based on CLSI, were then placed on the culture medium surface. Commercially available antibiotic sensitivity discs used, including Trimethoprime (25 µg), amoxicillin/clavulanic acid (20/10µg), ciprofloxacin (5 µg), cefuroxime (30 µg), Amikacin (30 µg), nitrofurantoin (300µg) and cofixime (5 µg) were tested. After incubating the plates at 37°C for 18–24 hours, the diameter (nearest whole mm) of the inhibition zones for each antibiotic was measured. The interpretation breakpoints were based on whether the bacterium was susceptible (S), intermediate (I), or resistant (R) to the tested drugs according to the CLSI recommendations.

Results

A total of 203 urine samples processed during the study period, 152 (74.9%) were collected from female patients and 51 (25.1%) from male patients. Sixty-one (30%) urine samples yielded significant bacteriuria of which 50 (82%) were obtained from female patients and 11 (18%) from male patients Table (1).

Table (1): Gender Distribution for Rate of Isolation in Urine Culture (n = 203).

Sex	No of sample	Growth of uropathogens n(%)	no growth of uropathogens n(%)
Male	51 (25.1)	11 (18)	51 (33.5)
Female	(74.38)151	(81.9)50	(66.44)101
Total	203	61	152

Antibiotic Susceptibility and Resistance of the Uropathogens

Out of 61UTI patients, the prevalence of *E. coli* was 36 (59%) whereas for *K. pneumonia* was 18 (29.5%). Five were identified as *Pseudomonas. aureuginosa* while 2 were identified as *Proteus. mirabilis* Tables (2).

Table (2): Pattern of Bacteria Isolated from Urine Culture (n = 199).

Bacteria	Number	Percentage
E.coli	36	59
Klebsiella. Pneumonia	18	29.5
Pseudomonas. Aureuginosa	5	8.2
Proteus. Mirabilis	2	3.3
Total	61	100

During analysis of antibiotic susceptibility most of the organisms were moderately resistant to Sulphamethoxazole, Cefuroxime, Cefixime and Nitrofurantion. *E. coli* showed 97.2% sucsebtibility to Amikacin (35/36, 97.2%) and resistant to Sulphamethoxazole (19/36, 52.7%). *Klebsiella. Pneumonia* was sucsebtible to Amikacin (18/18, 100%) and resistant to Sulphamethoxazole (11/18, 61.1%). *P. aeuruginosa* was found to show susceptibility to Ciprofloxacin and Amikacin (5/5, 100%) and 100% resistant to Cefuroxime (5/5, 100%). *Proteus. Mirabilis* found to be sucsebtible to Ciprofloxacin, Amikacin and Cefixime (2/2, 100%) and 100% resistant to Cefuroxime and Nitrofurantion (2/2, 100%) (Table 2). Table 2 also showed that no (0/2.0%) *Proteus. Mirabilis* strains were resistant to Ciprofloxacin, Amikacin and Cefixime and 1(1/2, 50%) strains were resistant to Sulphamethoxazole and Amoxycillin Table (3).

Table (3): Antibiotic Susceptibility Profile of Uropathogens Isolated from Patients.

Uroisolated	***E. coli* n=36**			***Klebsiella.pneumonia* n=18**			***P.aureuginosa* n=5**			***Proteus.mirabilis* n=2**		
Antibiotics	S	I	R	S	I	R	S	I	R	S	I	R
Sulphamethoxazole	17	0	19	7	0	11	2	0	3	1	0	1
Amoxicillin	31	1	4	16	1	1	1	0	4	1	0	1
Ciprofloxacin	30	0	6	16	1	1	5	0	0	2	0	0
Cefuroxime	24	1	11	16	1	1	0	0	5	2	0	2
Amikacin	35	0	1	18	0	0	5	0	0	2	0	0
Nitrofurantion	28	1	7	17	1	0	3	0	2	0	0	2
Cefixime	21	4	11	9	1	8	3	0	2	2	0	0

Discussion

Urinary tract infection is emerging as an important community acquired and nosocomial bacterial infection. Moreover, antimicrobial resistance to various classes of antimicrobials to uropathogens continues to be a major health problem in different parts of the world (Oliveira *et al*., 2011, Farshad *et al*., 2012). In the present setting, rate of isolation of 30% bacterial growths corroborate well with a few reports from Bangladesh, India and in Pakistan (Qaiser *et al*., 2011, Rani *et al*., 2012).

It is documented that UTI is more common in females than in males and findings of our investigation are also in agreement with this generalization and rightly coincided with a recent study done by Deshpande *et el*. (Deshpande *et al*., 2011). Likewise, regarding prevalence of uropathogens, our observation is in good agreement with several previous reports (Qaiser *et al*., 2011, Deshpande *et al*., 2011, Keah *et al*., 2007).

Increasing drug resistance is a great concern to common bacterial infections including UTI. Still antimicrobial agents like amoxicillin, cotrimoxazole, cephradin, nalidixic acid, ciprofloxacin, azithromycin are in place to treat many gram-positive and gram-negative bacterial infections including UTI in many underdeveloped and developing countries including Bangladesh.

Unfortunately, all these agents were found to have unacceptable range of antimicrobial activity to uropathogens isolated in our setting. This finding is alarming in regards to the choice of effective therapeutic options in the treatment of UTI and obviously a great concern to treating physicians. Sulphamethoxazole was once considered to be the drug of choice for uncomplicated and complicated UTI but due to lack of rational use, this broad spectrum molecule has entirely lost its efficacy not only in UTI but to other common infections too. Similar picture is also noted in case of 1st, 2nd and 3rd generations cephalosporin. It is reasonable to speculate that there were a few cases of ESBL-producing uropathogens especially from Gram-negative isolates that couldn't be separated in the present investigation due to limitation are thought to be responsible for resistance to different generations of cephalosporin. Amikacin was found to be reasonably high efficacious agent among all antimicrobials used to almost all uropathogens in the current setting and similar results were also reported from other studies (Sharifian *et al*., 2006, Sohely *et al*., 2009). This is good news indeed especially for uncomplicated UTI and prophylaxis in the context of gradually decreasing susceptibility of most of the comparatively cheaper oral anti-UTI drugs. Though moderate to high susceptibility was also noted for Ciprofloxacin and Amoxicillin for most of the uropathogens which is comparable to Amikacin but one has to remember that their uses are limited due to parenteral route and patient's noncompliance.

Among gram-negative isolates, *Pseudomonas spp* is most famous for hospital acquired UTI and conventional antimicrobials are usually ineffective against *Pseudomonas* infections. Though nitrofurantoin was found to have high frequency of susceptibility against *Pseudomonas* UTI but it is only indicated in uncomplicated UTI or for prophylaxis. In the recent years, though precious drugs like carbapenems are being used for *Pseudomonas* infections but in order to preserve its long term efficacy, it is highly recommend that its use should be reserved for known or suspected multidrug-resistant bacterial infections.

Conclusion

Urinary tract infection has high prevalence in females than males in the area of study with most commonly bacterial isolates of E. coli and K.pneumonia. Although high percentage of uropathogens isolates developed a resistance against available used antibiotics, it seems that combined use of antibiotics is more effective against a particular uropathogen. Among antibiotics used for treating UTI, Amikacin still holds much optimism in treating uncomplicated UTI due to fast respond of sensitive

organism. Selection of antimicrobials for UTI should be guided by culture and sensitivity and empirical therapy must be considered on the recent antibiogram of a particular geographical area.

Limitation of the Study

We appreciate some shortcomings of our work in the context of lacking of clinical information. This study was based on retrospective laboratory data only so we failed to provide information on categorization of UTI patients whether symptomatic or asymptomatic, complicated or uncomplicated. Furthermore, distribution of patients based on the sources of infection like catheter-associated, community acquired or nosocomial also could not be mentioned.

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