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Antibiotics susceptibility testing of Bacterial Species Isolated from UTI Patients in Samarra City-Iraq.

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Abstract:

Background: Urinary tract infection (UTI) is most common universal infectious disease that effects organs concerned with the urinary system i.e. ureter, bladder, urethra along with kidney, the most common pathogens causing UTI are *Escherichia coli, Klebsiella pneumoniae*, *Enterococcus species, Streptococcus agalactiae, Proteus mirabilis, Staphylococcus saprophyticus, Viridans streptococci, Klebsiella oxytoca and Pseudomonas aeruginosa*. Antimicrobial susceptibility testing (AST) is a laboratory procedure performed by medical technologists (clinical laboratory scientists) to identify which antimicrobial regimen is specifically effective for individual patients.

Aim of study: This study aim to isolate and diagnose bacterial types that cause UTI and find the antibiotics susceptibility for bacterial isolates.

Methods: This study including the collection of 114 samples (urine samples) from UTIs suspected patients (women and man) aged between 18 to 45 years and who visited Samarra general hospital and outpatient clinics in Samarra city during the duration from October 2022 to January 2023, patients personal information was recorded including name and age etc., the urine samples were handled in Samarra general hospital, microbiology lab also in college of applied science, microbiology lab, the urine samples were tested by microscopic examination, culturing on Nutrient, Blood, MacConkey and Mannitol media and Gram stain, biochemical test (Catalase, Oxidase, TSI test, Indole, Methyl red, Voges proskaur, Citrate utilization, Urease, Coagulase and Novobiocin) and Kirby-Bauer method for Trimethoprim/Sulphamethoxazole, Cefixime, Nitrofurantoin, Tetracycline, Ciprofloxacin, Vancomycin, Amikacin and Meropenem were tested against bacterial isolates.

Results: of 114 urine samples, 104 had been culture, 60.58% were positive urine culture and 39.43% were negative urine culture, *E.coli* was the most predominant bacteria 31.75% follow by *S. aureus* 19.5%, *K. pneumonia* 17.46%, *S. epidermidis* 12.7%, *P. mirabilis* 6.35%, *P. vulgaris* 4.77%, *S. saprophyticus* 4.77% and *C. freundii* 3.18%.

Conclusion: *P. vulgaris*, *C. freundii*, *S. epidermidis* were the most susceptible bacterial species to antibiotics 25%, whereas S. *saprophyticus* was the most resistance bacteria to antibiotics 62%, in addition, Meropenem was the most effective antibiotic follow by Ciprofloxacin and Vancomycin, also we founded that Vancomycin was the less effective antibiotics used in our study.

Key word: **UTI:** urinary tract infection, **AST**: Antimicrobial susceptibility testing.

اختبار حساسية المضادات الحيوية للانواع البكتيرية المعزولة من مرضى التهاب المسالك البولية في مدينة سامراء

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مستخلص:

التهاب المسالك البولية (UTI) هو أكثر الأمراض المعدية شيوعًا التي تؤثر على الأعضاء المعنية بالجهاز البولي مثل الحالب والمثانة والإحليل بالإضافة إلى الكلى، من اكثر الانواع البكتيرية التي تسبب التهاب المسالك البولية هي الإشريكية القولونية، والكلبسيلا الرئوية، وأنواع المكورات المعوية، والمكورات العقدية القاطعة للدر. ، المتقلبة الرائعة، المكورات العنقودية المترممة، المكورات العقدية Viridans، كليبسيلا أوكسيتوكا والزائفة الزنجارية. اختبار الحساسية لمضادات الميكروبات (AST) هو إجراء مختبري يقوم به تقنيو الطب (علماء المختبرات السريرية) لتحديد نظام مضادات الميكروبات الفعال للمرضى.

هدف الدراسة: تهدف هذه الدراسة إلى عزل وتشخيص الأنواع البكتيرية المسببة لالتهاب المسالك البولية وإيجاد حساسية المضادات الحيوية للعزلات البكتيرية.

طرق البحث: شملت هذه الدراسة جمع 114 عينة (عينات بول) من المرضى المشتبه بإصابتهم بالتهابات المسالك البولية (النساء والرجال) الذين تتراوح أعمارهم بين 18 إلى 45 سنة والذين زاروا مستشفى سامراء العام والعيادات الخارجية في مدينة سامراء خلال المدة من تشرين الأول 2022 إلى كانون الثاني 2023. تم تسجيل المعلومات الشخصية للمرضى بما في ذلك الاسم والعمر وما إلى ذلك، وتم التعامل مع عينات البول في مستشفى سامراء العام، مختبر الأحياء الدقيقة أيضًا في كلية العلوم التطبيقية، مختبر الأحياء الدقيقة وتم اختبار عينات البول عن طريق الفحص المجهري، والزراعة على الاوساط المغذية ووسائط الدم و ماكونكي والمانيتول، ايضا تم استخدام صبغة جرام، كذلك اجريت الاختبارات الكيموحيوية التالية: (الكاتالاز، أوكسيديز، اختبار TSI، الإندول، ميثيل أحمر، فوج بروسكاور، استخدام السيترات، اليورياز، كواجولاز والنوفوبيوسين)، اجريت طريقة كيربي باور للتريميثوبريم/ السلفاميثوكسازول، السيفيكسيم، النيتروفورانتوين، التتراسيكلين السيبروفلوكساسين والفانكومايسين والأميكاسين والميروبينيم لتحديد حساسية العزلات البكتيرية للمضادات الحيوية.

النتائج: من بين 114 عينة بول، تم زرع 104 منها، وكانت ٪60.58ذو نمو بكتيري ، وكانت ٪39.43 عديمة النمو البكتيري، وكانت بكتيريا الإشريكية القولونية هي البكتيريا السائدة بنسبة ٪31.75 ، تليها بكتيريا s.aureus بنسبة ٪19.5 ، و k.pneumonia بنسبة ٪17.46و s.epidermidis بنسبة ٪12.7و p.mirabilis بنسبة 6.35%و p.vulgaris 4.77% و s.saprophyticus 4.77 % و c.freundii 3.18%.

الاستنتاج: كانت S. epidermidis، C. freundii، P. vulgaris أكثر الأنواع البكتيرية حساسية للمضادات الحيوية بنسبة ٪25، في حين كانت S. saprophyticus أكثر البكتيريا مقاومة للمضادات الحيوية بنسبة ٪62، بالإضافة إلى أن الميروبينيم كان المضاد الحيوي الأكثر فعالية يليه السيبروفلوكساسين. والفانكومايسين، كما وجدنا أن الفانكومايسين هو المضاد الحيوي الأقل فعالية المستخدم في دراستنا.

1. Introduction:

Urinary tract infection (UTI) is most common universal infectious disease that effects organs concerned with the urinary system i.e. ureter, bladder, urethra along with kidney, children, women, elderly, diabetics and individuals with uroliths and urinary catheters are at a higher threat of developing infections (1), however the most common pathogens causing UTI are *Escherichia coli*, *Klebsiella pneumoniae*, *Enterococcus species*, *Streptococcus agalactiae*, *Proteus mirabilis, Staphylococcus saprophyticus, Viridans streptococci*, *Klebsiella oxytoca and Pseudomonas aeruginosa* (2).

Antimicrobial susceptibility testing (AST) is a laboratory procedure performed by medical technologists (clinical laboratory scientists) to identify which antimicrobial regimen is specifically effective for individual patients, on a larger scale, it aids in the evaluation of treatment services provided by hospitals, clinics and national programs for the control and prevention of infectious diseases (3).

According to the formerly stated, our research is projected to find the following:

- isolate and diagnose bacterial types that cause UTI in Samarra city.
- find the antibiotics susceptibility for bacterial isolates.

2. Materials and Methods:

2.1 Urine samples:

The urine samples (midstream) were observed by microscopic examination, cultivated on routine media (Nutrient, Blood, MacConkey and Mannitol media) for isolation and identification of bacteria causing UTI.

2.2 Identification of bacterial isolates:

The bacterial isolates where identify by biochemical test (Catalase, Oxidase, TSI test, Indole, Methyl red, Voges proskaur, Citrate utilization, Urease, Coagulase and Novobiocin) also Kirby–Bauer method (Trimethoprim/Sulphamethoxazole, Cefixime, Nitrofurantoin, Tetracycline, Ciprofloxacin, Vancomycin, Amikacin and Meropenem) was done to test bacteria for antibiotics susceptibility, and the results interpreted according to CLSI standards and guidelines 2020.

3. Results:

The tables (1-3, 2-3) below represent biochemical tests results of Gram negative and positive bacteria.

Table 1-3: Represent the biochemical tests results of Gram negative bacterial isolates.

NO	BACTERIAL SPECIES	I	M	VI	C	CAT	OXIDASE	TSI	H_2S	UREASE
.1	*E.coli*	+	+	-	-	+	-	A/A ^{G}	-	-
.2	*K. pneumonia*	-	-	+	+	+	-	A/A ^{G}	-	+
.3	*Pro. mirabilis*	-	+	-	+	+	-	K/A ^{G}	+	+
.4	*Pro. vulgaris*	+	+	-	+	+	-	A/A ^{G}	+	+
.5	*Citro. freundii*	-	+	-	+	+	-	A/A ^{G}	+	V
I: Indole, M: Methyl red, VI: Voges proskaur, C: Citrate utilization, CAT: Catalse, TSI: .Triple sugar iron, +: Positive, -: Negative, V: Variable, G: Gas, A: Acidic, K: Alkaline										

Table 2-3: represent biochemical tests results of Gram positive bacterial isolates.

NO	BACTERIAL SPECIES	CAT	COAGULASE	MANNITOL FERMENTION	NOVOBIOCIN RESISTANCE
.1	*S. aureus*	+	+	+	-
.2	*S. saprophyticus*	+	-	-	+
.3	*S. epidermidis*	+	-	-	-
CAT: Catalse, +: Positive, -: Negative.					

3.1 E.coli:

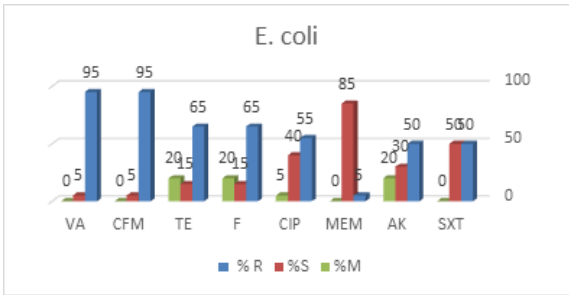

Figure 1-3: Antibiotics susceptibility profile of *E.coli* isolates.

3.2 K. pneumonia:

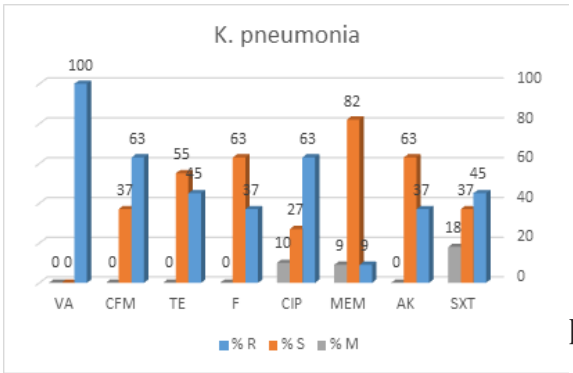

Figure 2-3: Antibiotics susceptibility profile of *K. pneumonia* isolates.

3.3 Pro.mirabilis:

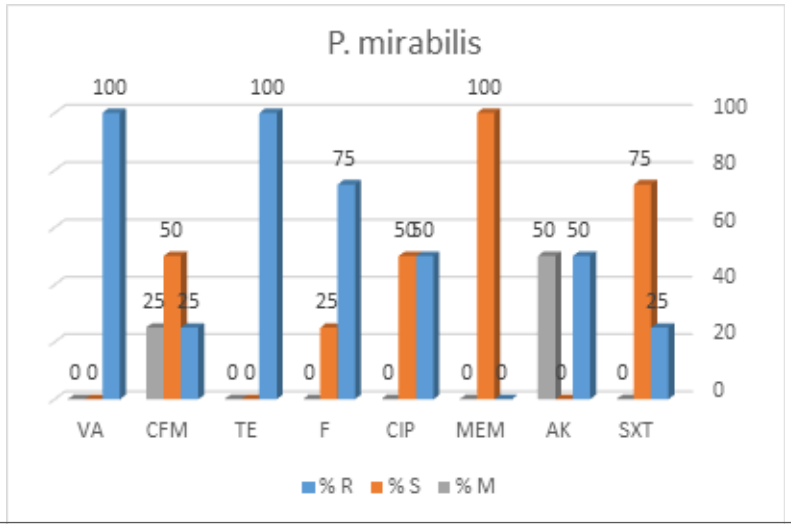

Figure 3-3: Antibiotics susceptibility profile of *Pro.mirabilis* isolates.

3.4 Pro.vulgaris:

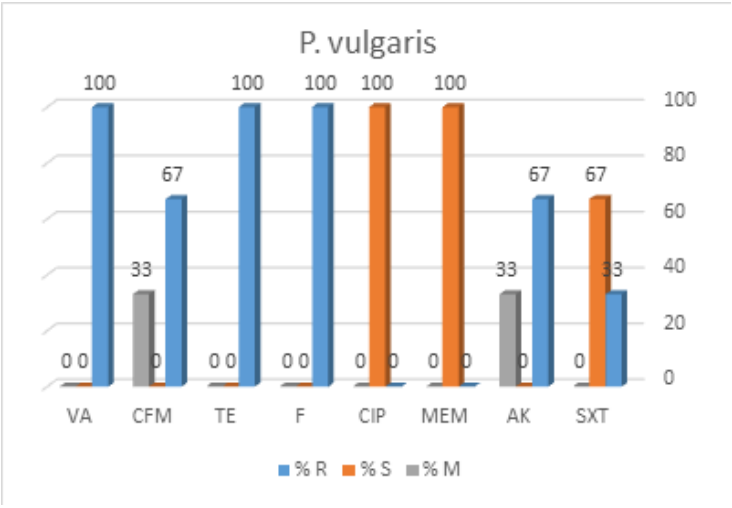

Figure 4-3: Antibiotics susceptibility profile of *Pro.vulgaris* isolates

3.5 Citro.freundii:

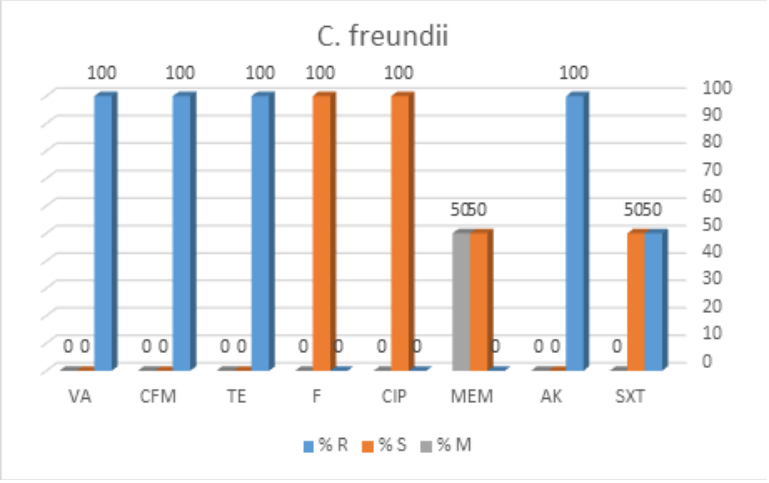

Figure 5-3: Antibiotics susceptibility profile of *Citro.freundii* isolates.

3.6 S.aureus:

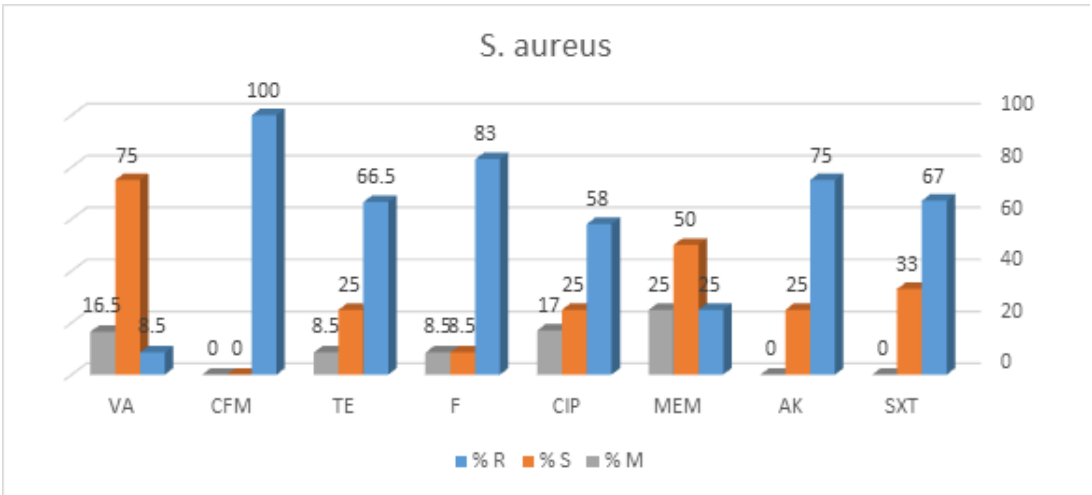

Figure 6-3: Antibiotics susceptibility profile of *S.aureus* isolates.

3.7 S.saprophyticus:

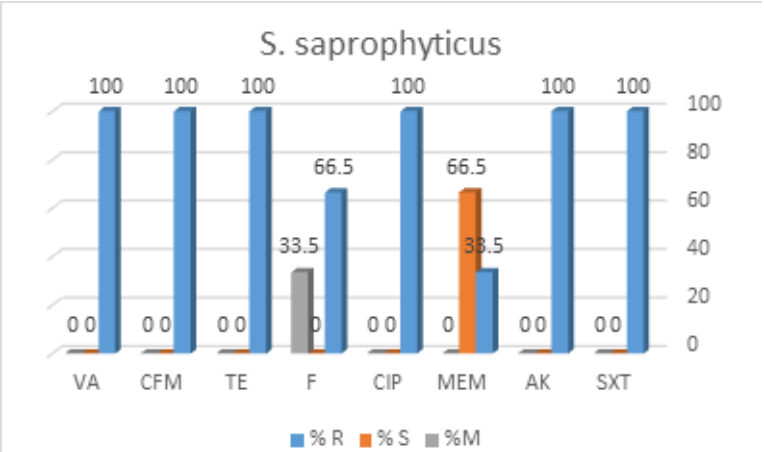

Figure 7-3: Antibiotics susceptibility profile of *S.saprophyticus* isolates.

3.8 S.epidermidis*:*

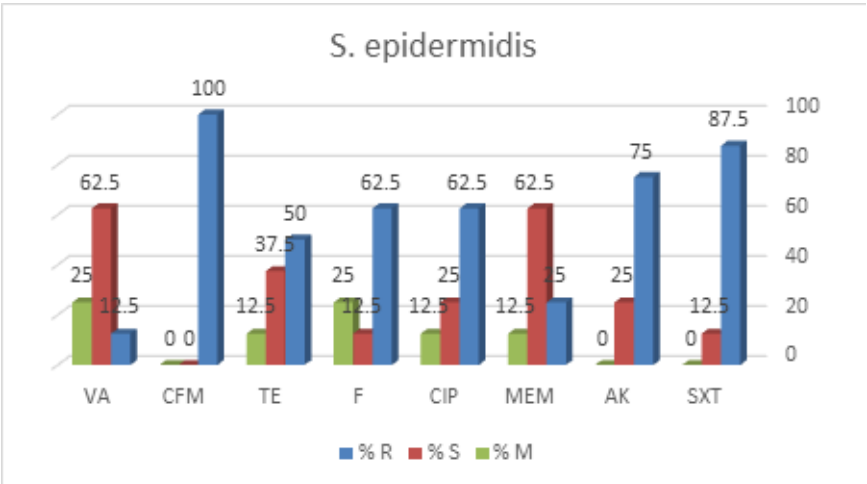

Figure 8-3: Antibiotics susceptibility profile of *S.epidermidis* isolates.

4. Discussion:

Of 114 urine samples, 104 had been culture, the results of the cultivated samples of this study were recorded as follow, positive urine culture were 63 with percentage 60.58% and negative culture were 41 (39.43%), and this in line to **(15), (16), (4),** results, also E.coli was the most predominant bacteria 31.75% follow by S. aureus 19.5%, K. pneumonia 17.46%, S. epidermidis 12.7%, P. mirabilis 6.35%, P. vulgaris 4.77%, S. saprophyticus 4.77% and C. freundii 3.18%, and this compatible to **(5),(17),** findings, Antibiotic resistance considered a global health emergency and there is many factors and mechanisms that promoting the spread of this phenomenon, one of these mechanisms is by producing enzymes, Gram-negative bacteria that are becoming an increasing threat to public health because of their ability to acquire genes located on transferable plasmids that code for extended-spectrum β-lactamases (ESBLs) **(6),** these enzymes are capable of hydrolyzing third-generation cephalosporins and monobactams but not carbapenems (**7**), in addition, ESBLs pose a public health problem because they are encoded on plasmids that usually carry other resistance genes against different classes of antibiotics (e.g., aminoglycosides, sulfonamides, and quinolones) **(8),** also there are a multitude of different resistance mechanisms among uropathogens that are more or less widespread depending on the local epidemiological context **(9),** also Antibiotics resistance is spreads by multiple mechanisms and habits including: misuse and overuse of antibiotics (administering antibiotics without a clear indication, lack of antibiotic policy and standard treatment guidelines frequently seen in developing countries, physicians unnecessarily prescribing lengthy courses of antibiotics or dosing inappropriately) (**10**), increase in Gross Domestic Product (GDP), With the rise in GDP, , there has been substantial improvement in the quality of life of people from low-and middle-income countries (LMICs) that positively correlates with increased antibiotic consumption **(11),** additionally inappropriately prescribed antibiotics which refers to prescription of antibiotics where it is not necessary or selection of inappropriate antibiotics or the wrong dose and duration of an antibiotic, **(12),** moreover agricultural use of Antibiotics (as antibiotics residue

can be found in animal-derived products such as fat, milk and eggs **(13),** finally, easy travel routes, it has been shown that antimicrobial-resistant bacteria may persist for up to 12 months carried in the body after a person has travelled to highly endemic antimicrobial resistance regions, amplifying the risk of transmission among susceptible populations **(14).**

Conclusion:

As a result, this increase in the spread of antibacterial resistance leads to posing a serious threat to society as well as to the medicines available and also causes a negative impact on cancer therapy, transplantation and surgical events.

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