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Antibiotic Sensitivity Patterns of the Most Common Bacteria Isolated from Al-Mouwasat University Hospitalin 2015,Syria

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Abstract: Bacterial resistance to antibiotics has become a growing threat facing health care professionals when treating infectious diseases. Therefore, it was important to study the bacterial sensitivity patterns, their periodic and geographic changes.

The current study included the antibiotic sensitivity patterns of the most common bacteria isolated from patients in Al-Mouwasat University Hospital during the period between January and October 2015.A total number of457 isolates of Escherichia coli, Staphylococcus aureus, and Pseudomonas aeruginosa were obtained from various clinical specimens and were confirmed by standard bacteriological procedures. Thereafter, antibiotic sensitivity patterns were defined by disc diffusion method.

Escherichia coli isolates showed high rates of sensitivity to Tigecycline(93%) ,Colisten(89%), Imipenem(86%),and Meropenem (79%). Whereas, Vancomycin, Meropenem, and Linezolid demonstrated maximum sensitivity against Staphylococcus aureus(98%), (91%), and (91%), respectively. Regarding Pseudomonas aeruginosa, the isolates were maximally sensitive to Imipenem (85%) and Colisten (73%).

Comparison of the results with local and international studies demonstrated a decline in sensitivity to most antibiotics in the current study, with the exception of Pseudomonas aeruginosa isolated from otic infections, which showed an increase to some antibiotics when compared to a study from Alqamishli, Syria.

In conclusion, periodic antimicrobial susceptibility studies should be regularly performed to detect the resistance trends of bacteria, and to modify the selection of antibiotics used in sensitivity tests according to their results.

Key wards: Antibiotic sensitivity, Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa.

Introduction

Over the past 60 years, antibiotics played a significant role in limiting the spread of infectious diseases, and consequently, improving their prognosis and reducing mortality. Nevertheless, microbial resistance to antibiotics has increased substantially in the recent years. In fact, about 70% of bacteria that cause hospital-related infections are resistant to at least one of the recommended antibiotics. Moreover, some organisms are resistant to all approved antibiotics and can only be treated with experimental and potentially toxic drugs[1,2].According to The World Health Organization (WHO) Report (No.194,2014), antibiotic resistance is now a serious and public threat that can affect individuals from all ages and ethnic groups, and can become a burden on our health care systems[3].

Acquired resistance can result from chromosomal mutations orgene transmission from one microorganism to another by plasmids or transposons. Bacteria can use several biochemical mechanisms to develop resistance, namely, antibiotic inactivation through interference with cell wall synthesis, target modification by inhibiting protein synthesis, altered permeability that lead to changes in cytoplasmic membrane and "bypass" of metabolic pathways[2,4,5,6].

The indiscriminate use of antibiotics is the most important causal factor of this phenomenon. The improper use of broad-spectrum antibiotics, inaccurate medical diagnosis, prescribing multiple and unnecessary antibiotics, as well as, adding antibiotics as supplementary materials for cattle food are all examples of antibiotics misuse that could lead to bacterial resistance to antibiotics[1].

Antibiotic resistance should be addressed and detected as soon as it emerge, and Measures must be taken immediately to limit it. Without these measures, extinguished diseases could resurface again, which might require the development of new generations of antibiotics to treat them[1,2].

Therefore, it is important to study the patterns of bacterial sensitivity to antibiotics and to update these studies regularly. Hence, the results of such studies should be compared to determine the differences and similarities amongst the various resistance patterns, and the ability of some antibiotics to prove permanent effectiveness throughout time.

The current study aimed to: 1-Study the antibiotic sensitivity patterns of the most widespread bacterial isolations in Al-Mouwasat University Hospital during the period from January 2015 to October 2015.2-Compare the results with previous studies that reported bacterial resistance to antibiotics in different regions and time periods.

Experimental

This study was carried out in the Department of Bacteriology in Al-Mouwasat University Hospital from January to October 2015.Antibiotic sensitivity tests were applied on a total number of 457 isolates of Escherichia coli(*E.coli*), Staphylococcus aureus (*S.aureus*), and Pseudomonas aeruginosa (*P. aeruginosa*). Antibiotics were chosen according to bacterial strains and the sample source.

Bacteriawas identified depending on the microscopic characteristics using Gram stain and the morphological characteristics of bacterial colonies cultured on Blood Agar and Eosin methylene blue (EMB).

Biochemical tests were also performed, such as coagulase test and catalase test (positive in *S. aureus*), Oxidase test (positive in *P. aeruginosa*), besides Analytical Profile Index (API) when necessary.

Antibiotic sensitivity tests were performed by Kirby Bauer (Disc Diffusion) method, which depends on measuring diameters(in millimeters)of the inhibition zones of bacterial growth around filter paper disks saturated with designated amount of the antimicrobials (mcg), and comparing them with standard tables prepared in specialized laboratories[3,5,7,8,9,10,11].

Statistical analysis: Chi-square distribution test was employed to measure the statistical difference between studies, STATA 11 program was used for all statistical analysis. P-value < 0.05 was considered to indicate statistically significant differences.

Results and Discussion

Over a period of 10 months, bacteria from a total of 457 samples were isolated. Samples were collected from various specimen including urine (195), pus(90), sputum(37), swabs (wounds, burns, discharge)(81), and other sources (body fluids,blood)(54).

E.coli was found to be the most common isolated organism (49%),followed by *S.aureus* (28%),and *P. aeruginosa* (23%) [Figure 1].The distribution of the bacteria in both genders is demonstrated in Figure 2.

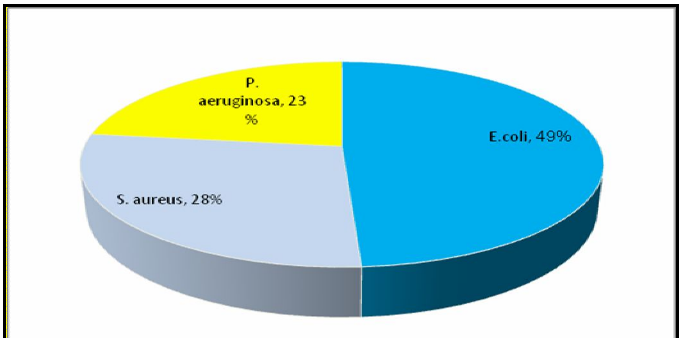

Figure (1) Bacterial distribution in the study

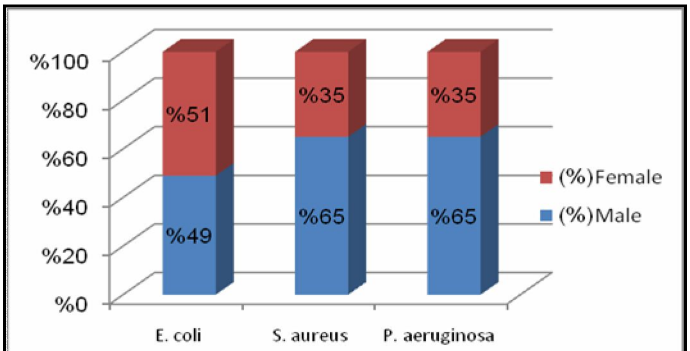

Figure (2) Bacterial distribution in both genders

Sensitivity patterns of *E.coli*:

Urine samples counted the highest frequency sources of *E.coli*: 155 (70%) [Figure 3].The highest rates of *E.coli* sensitivity were seen towards Tigecycline (93%), Colisten (89%), Imipenem (86%), lower rates were recorded in Meropenem (79%) and Amikacin (74%),whereas the lowest rates were reported in Tetracycline, Rifampicin, Nalidixic acid, and Ceftriaxone (10-12%) [Figure 4].

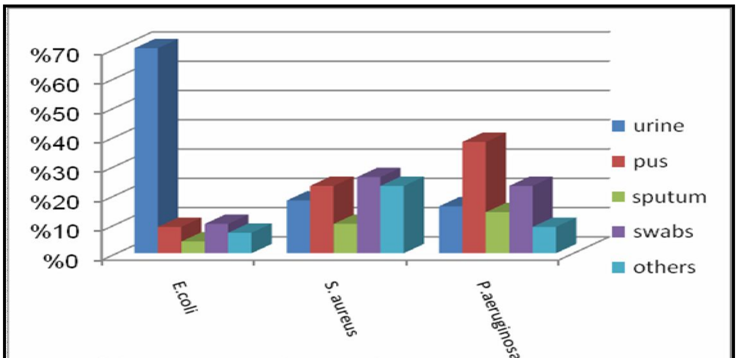

Figure (3) Sources distribution of isolates

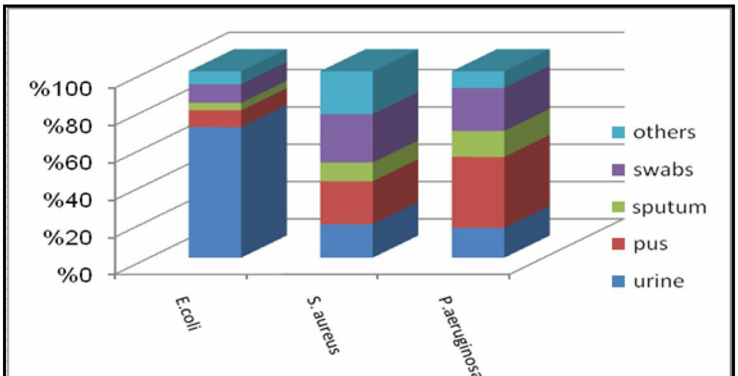

Figure (3) Sources distributions of isolates

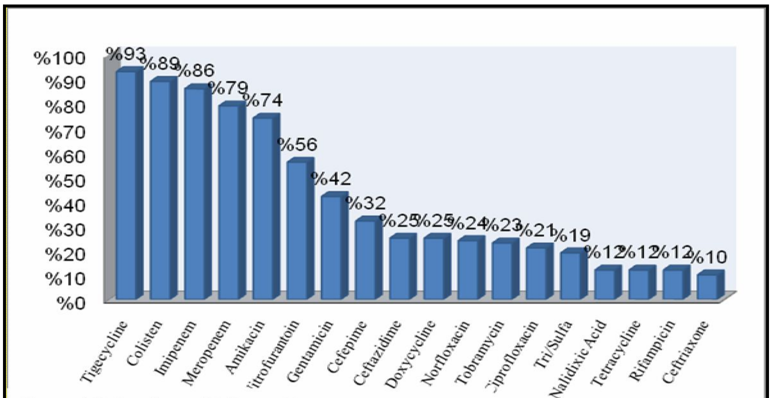

Figure (4) *E.coli* sensitivity patterns

E. coli resistance to commonly used antibiotics **(**Amikacin, Ceftriaxone, Nitrofurantoin, Ciprofloxacin, Nalidixic acid, Tobramycin, and Ceftazidime) was found to be significantly higher in this study when compared withthe susceptibility patterns of *E.coli* in a study conducted by Alshahefon 300 samplesin Al-Mouwasat University Hospitalin 2009[12][Table1].

Table(1)*E.coli* sensitivity patterns compared to local and international studies

P value	Ethiopian study 2003-2010[13]	P value	Local study 2009[12]	Currentstudy2015	Antibiotic
0.000	61.8%	0.0000	35.7%	10%	Ceftriaxone
0.018	23.6%	-	-	12%	Tetracyclin
0.000	96.4%	0.000	72.7%	56%	Nitrofurantoin
0.000	93.5%	-	-	24%	Norfloxacin
0.000	81%	0.055	33%	42%	Gentamycin
0.000	74.7%	0.000	43.7%	21%	Ciprofloxacin
-	-	0.025	34.3%	25%	Ceftazidime
-	-	0.000	92.4%	74%	Amikacin
-	-	0.000	53.7%	23%	Tobramycin
-	-	0.000	29.4%	12%	Nalidixic acid

Comparing the current results with the outcomes of a retrospective review conducted in Ethiopia during the period (2003-2010) and included 446 samples of*E.coli*[13], a significant drop in *E.coli* sensitivity to all commonly used antibiotics (Gentamicin, Ciprofloxacin, Norfloxacin, Nitrofurantoin, Ceftriaxone, and Tetracycline) was also noticed[Table1].

Sensitivity patterns of *S.aureus*:

S. aureus was isolated from 129 (28%) samples. Swabs (26%), pus (23%), and fluids (23%) were its main sources [Figure3].

The results showed high sensitivity of *S.aureus* to Vancomycin (98%) and Linezolid (91%), followed by Nitrofurantoin (82%) and Doxycycline (80%), but low sensitivity to Oxacillin (15%) and Lincomycin (14%) [Figure5].

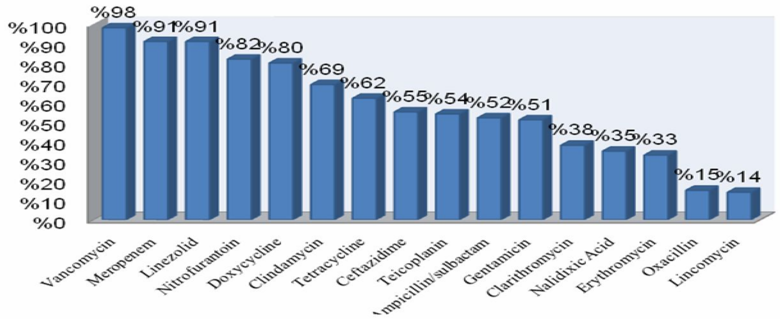

Figure (5): *S. aureus* sensitivity patterns

A significant decrease in *S. aureus* sensitivity to commonly used antibiotics(Erythromycin, Gentamicin, Oxacillin, Teicoplanin, and Co-trimoxazol)was recorded when analyzing the current results in comparison with a study performed in 2007by Abo lateefon64samplesin Al-Mouwasat University Hospital[14]. Similarly, when comparing the 2015 results to a Nigerian study performed in 2009 on 150 samples[15],a significant decline was noticedin the sensitivity to Ciprofloxacin, Erythromycin and Gentamicin, however, sensitivity to Tetracycline was noticed to be increased significantly[Table2].

Table(2) *S.aureus* sensitivity patterns compared with local and international studies

P value	Nigerian study 2009[15]	P value	Local study 2007[14]	Current study	Antibiotic
0.002	78.9%	0.133	65%	48%	Ciprofloxacin
0.000	31%	0.801	64%	62%	Tetracyclin
0.000	52.4%	0.017	55%	33	Erythromycin
0.000	92.4%	0.024	69%	51%	Gentamycin
-	-	0.206	60%	69%	Clindamycin
-	-	0.000	26.5%	91%	Meropenem
-	-	0.000	94.3%	54%	Teicoplanin
-	-	0.029	67%	42%	Co-trimoxazol
-	-	0.041	31%	15%	Oxacillin

Sensitivity patterns of *P. aeruginosa*:

Out of 457 samples *P. aeruginosa* was isolated from 106 samples (23%). About 38% of the isolates came from pus, 23% from swabs, and 39% from sputum, urine, and other sources, [Figure3].

P. aeruginosa was found to behighly sensitive, relatively, to Colisten (85%) and imipenem (73%). On the other hand,an extremely low sensitivity to Tetracyclin, Rifampicin, and Nitrofurantoin (4%-6%) was noticed [Figure6].

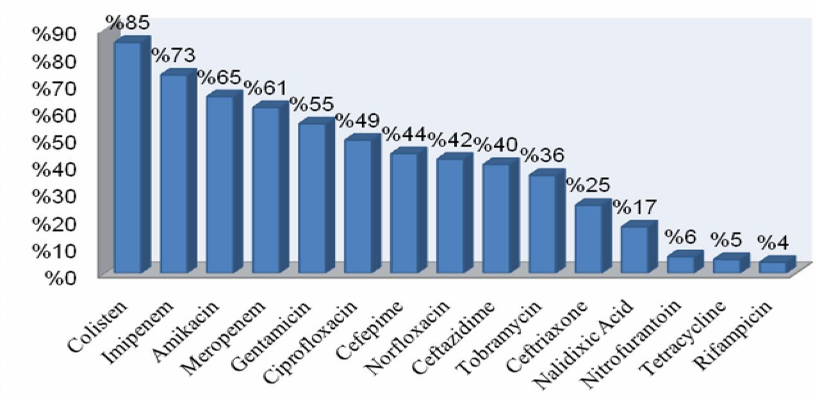

Figure (6): *P. aeruginosa* sensitivity patterns

Due to the fact that all local studies that reported sensitivity of *P. aeruginosa* to antibiotics were stratified by the source of the isolated bacteria, it was necessary to perform two separate comparisons based on the specimen source. Sensitivitypatterns of *P. aeruginosa* associated with ear infections were compared to a study conducted in 2010 by Hussain and Nizam in Qamishly, Syriaon 31 sample of otic infections[2], the current results showed a significant decline in sensitivity to Ciprofloxacin and Imipenem, however, a notable increase in sensitivity to Amikacin and Gentamicin, which might be due to the overuse of Aminoglycoside antibiotics in Qamishly [Table3].

Table (3) Sensitivity patterns of *P. aeruginosa* isolates from otic sources

P value	local study 2010[16] Sensitivity ratio	Current study Sensitivity ratio	Antibiotic
0.010	100%	80%	Imipenem
0.023	31%	65%	Amikacin
0.007	89.8%	59%	Ciprofloxacin
0.016	20.6%	52.9%	Gentamicin

On the other hand, the results of *P. aeruginosa* associated with burns swabs (15 samples)were in line with the findings of a study conducted by Ahmed in 2011 on 24 patients from the same source in Al-Mouwasat University Hospital (data not shown)[16].

The current results were similar to the outcomes reported by an Indian study that tested the sensitivity of 56 samples of *P. Aeruginosa* in 2008 (data not shown)[17].

To sum up, the findings of this study suggested an increased resistance of *E.coli* and *S. aureus* towards most of the commonly used antibiotics over the last 5 years. With regard to *P. aeruginosa*, no important changes were detected in its susceptibility towards the commonly used antibiotics, even the burn- related *P. aeruginosa* isolates over the last 5 years. However, *P. aeruginosa* isolated from otic infections was found to be more sensitivite to Amikacin and Gentamicin, and less susceptibile to Ciprofloxacin and Imipenem.

Based on previous results, periodic studies reporting changes in the antimicrobial susceptibility patterns are recommended. Moreover, antibiotic policy and treatment guidelines should be regularly updated to preserve the effectiveness of antibiotics for better patient management.

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