Efficacy of Old and New Generation Antibiotics in MDR *Staphylococcus Aureus* Isolated From UTI

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Abstract

The medical problem of acquired antibiotic resistance for clinical *Staphylococcus aureus* is a global concern. Scientist's efforts are to focus light on the alternative antibiotics for treatment of the isolates that exhibited resistance against classical antibiotics. Recurrent UTI is the commonest nosocomial infection caused by MDR *S. aureus* and the antibiotic treatment becomes an important issue. Methods and Materials: a total of (14) *S. aureus* isolates were tested *in vivo* for antibiotic resistance using disc diffusion method, antibiotics used were Methicillin (Me), Cefamandole (MA), Carbencillin (Py), Vancomycin (Van) and Lomofloxacin (Lom). Results: showed that both of the antibiotics Van and Lom had the highest records of sensitive isolates 13 (92.8%), while the antibiotic me recorded the highest number of resistant isolates 8 (57.2%) from the total 14 isolates. Both MA and Py recorded 9 (64.3%) as sensitive isolates. Conclusion: Antibiotics resistance exhibited by S. *aureus* is an obvious problem mainly for critical cases that need an urgent management with no time to loss, antibiotic sensitivity test should be an obligatory procedure before giving antibiotics to avoid acquired resistance. Old generation antibiotics Methicillin, Cefamandole and Carbencillin need to be tested for efficacy on S. *aureus* isolates before use on, new generation antibiotics Vancomycin and Lomofloxacin are very effective in treatment of vigorous S. *aureus* clinical isolates of recurrent UTI.

Keywords: *Multidrug resistance, Staphylococcus aureus, Antibiotic, Antibiotic sensitivity test and recurrent UTI.*

Introduction

Multidrug resistance MDR *Staphylococcus aureus* is considered as a medical problem due to that there is no more efficient drugs of customary, in another word; the antibiotics of choice are not effective any more in treatment of *Staphylococcus aureus* infections as they were before, this growing problem was investigated and attributed to the numerous abilities of *S. aureus* to develop antibiotic resistance mechanisms like genetic transformation represented by plasmids responsible of antibiotic resistance development and ani-anibiotics enzymes; are the major facilities of that acquired antibiotic resistance and so *S. aureus* are called MDR bacteria [1].

The importance of S. *aureus* as a persistent nosocomial and community acquired pathogen has become a global health concern due to the remarkable capability of evolving different mechanisms of resistance to most antimicrobial drugs usually used [2].

The unrestricted use of antibiotics played a major role in that problem progress. Classically; methicillin resistance by MDR *S. aureus* was always a problem associated with long hospital stay and prolonged antibiotic courses treatment, mechanisms of this antibiotic resistance were fully demonstrated and documented by [3].

Scientists usually trying to develop new antibiotics to overcome the problem of classic and acquired antibiotics resistance, they also trying to find best combination between two antibiotics to gate a synergistic effects upon treatment of MDR clinical isolates of S. *aureus* mainly against isolates responsible of recurrent UTI and burns sepsis the most acquired nosocomial infections caused by S. *aureus* [4]. The present study aimed to compare the efficacy of several old and New Generation Antibiotics in MDR *Staphylococcus aureus* that isolated from recurrent Urinary Tract Infections UTI.

Methods and Materials

- Isolates: fourteen isolates were used in the present study obtained from clinical specimens (urine samples) of recurrent UTI outpatients in Al-Hussein Hospital, clinical samples collected between March and June 2017. Isolates were confirmed using standard bacteriological procedures and biochemical tests as [5, 6].

- Antibiotics Sensitivity Test: The method used was disc diffusion method, Muller Hinton agar plates were inoculated for each isolate then several antibiotic discs were plated, incubation was aerobically at 37 º C for overnight. Antiseptic conditions were considered during all steps. Antibiotics used in the present study and their origin of manufacturing are presented in Table (1). The zones of inhibition were measured and estimated according to [6], Figure (1).

Table 1: Antibiotic Names and origin of the present study

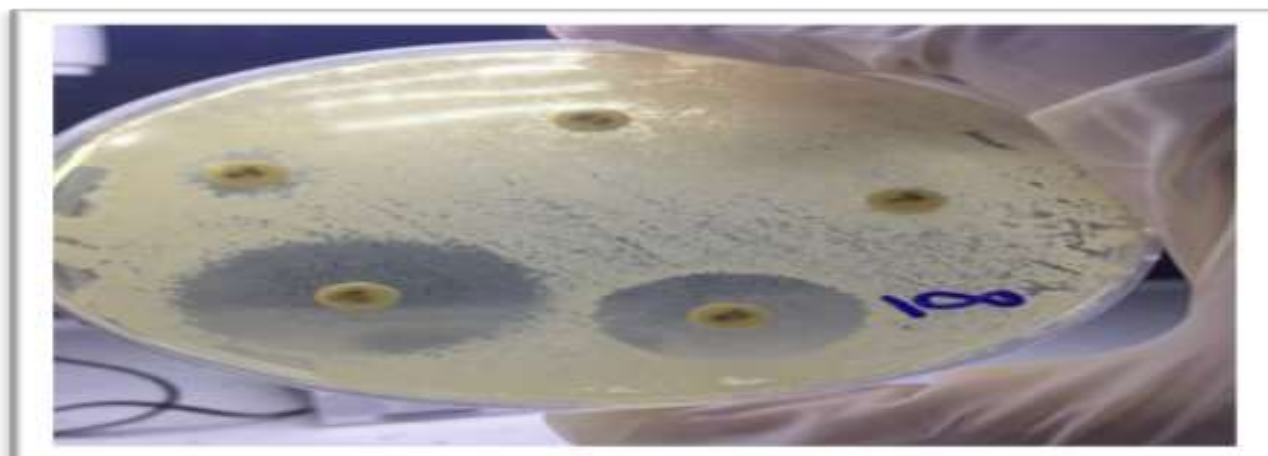| No	Symbol	Antibiotic Name	Concentration (Mcg)	Company/Origin
1	Van	Vancomycin	30	Conda/Spain
2	Me	Methicillin	5	Conda/Spain
3	Lom	Lomofloxacin	10	Conda/Spain
4	MA	Cefamandole	30	Conda/Spain
5	Py	Carbencillin	100	Conda/Spain

Figure 1: Antibiotics Sensitivity Test using Disc Diffusion Method

Statistical Analysis

Results of antibiotic sensitivity were analyzed using simple percentage calculations and columns chart.

Ethical Approval

The authorization and patients' ethical approval for samples were obtained before work starts.

Results

The results of antibiotic sensitivity test for all isolates are shown in table (2), Figure (2). Table (1) showed that the antibiotics Van and Lom had the highest records of sensitive isolates, while the antibiotic me recorded the highest number of resistant isolates. Chart (1) showed the difference in sensitivity response for total isolates involved in the present study (14), Figure (3).

Table 2: Antibiotic Sensitivity Test and Isolates response with Distribution

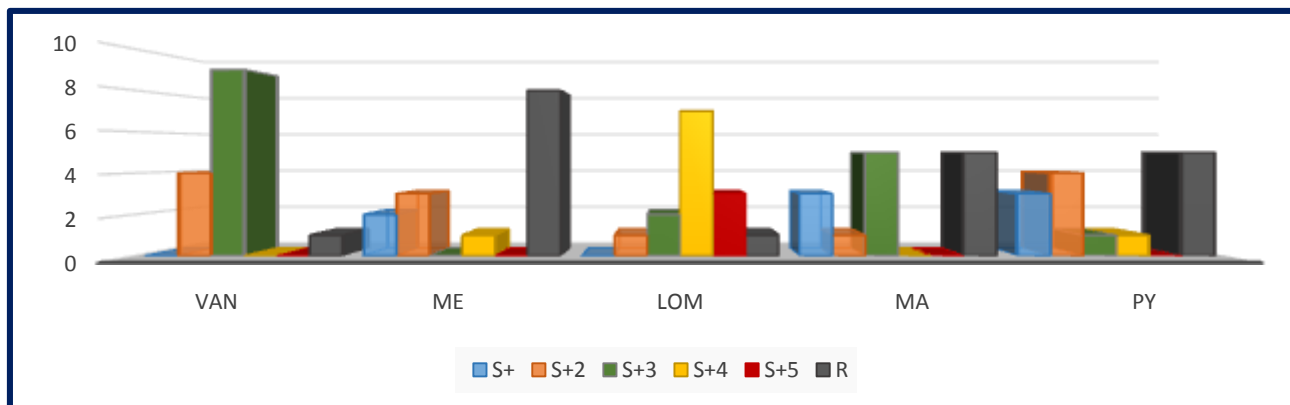| Antibiotic	No. of Sensitive Isolates (%)	No. of Resistance Isolates (%)	Total Isolates Tested
Van	13 (92.8)	1 (7.2)	14
Me	6 (42)	8 (57.2)	14
Lom	13 (92.8)	1 (7.2)	14
MA	9 (64.3)	5 (35.7)	14
Py	9 (64.3)	5 (35.7)	14

Figure 2: Antibiotic Sensitivity Test and different response of Isolates
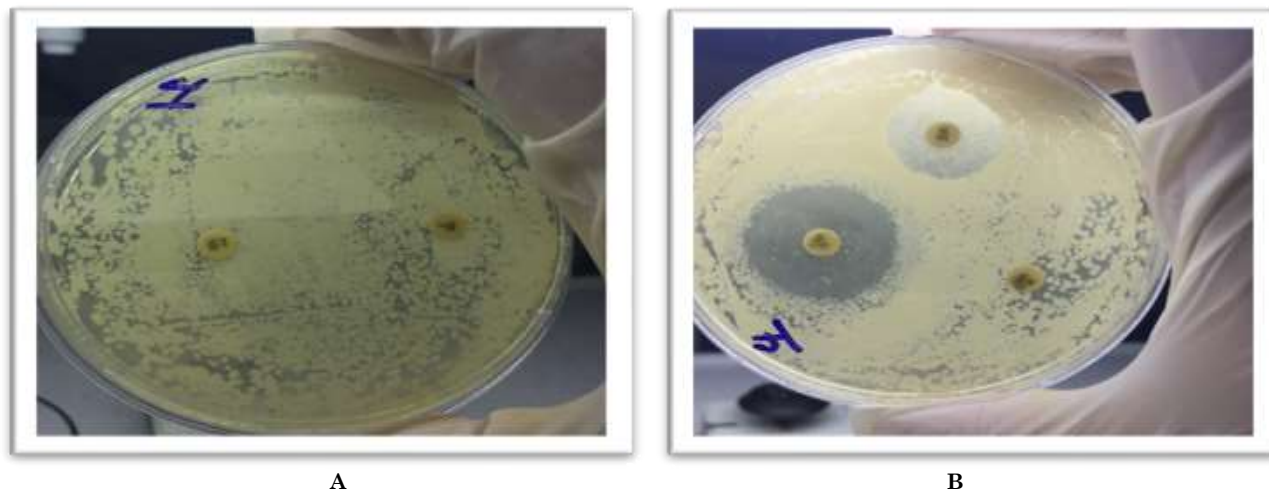

| A | B |

Figure 3: Different responses for antibiotics of the same Isolate. A: resistant with no inhibition zones. B: same isolate with sensitive response and formation of inhibition zones

Discussion

The results exhibited in table (2) and chart (1) showed that the antibiotics Van and Lom used in the present study were the most effective antibiotics among the five antibiotics tested, they both recorded 13(92.8%) sensitive isolates from the total 14 isolates. Vancomycin is one of the modern antibiotics it is a glycopeptide that inhibits cell wall biosynthesis and considered recently as the drug of choice for treatment of MDR *S. aureus* resultant infections despite of the developing molecular resistance against it [7].

A similar opinion is also supported by [8]; they stated that *S. aureus* still susceptible to Vancomycin despite of adapt resistance to antimicrobial drugs. On the same context, Lomofloxacin is one of fluoroquinolones antimicrobial agents usually used for UTI treatment mainly immunocompramized patients and during surgical procedures to avoid UTI, mechanism of action is by interference with critical bacterial enzymes of DNA replication and transcription leading to inhibition of DNA synthesis [9].

The authors [10] stated that despite that Lomofloxacin and other new generation antibiotics are expensive, they are still the antibiotics of choice for management of highly resistant clinical strains of S. *aureus*. In another hand, the antibiotics Me, MA and Py in the present study showed moderate activity against the clinical isolates tested and many isolates were recorded as resistant. The authors [11] recommended that the best management of S. *aureus* infections is by using new generation of wide broad antibiotics as replacement for methicillin (beta lactam) anti-staphylococcal antibiotics against common methicillin-resistant isolates.

And they suggested using them as a combination with old antibiotics because of the growing resistance exhibited by wild S. *aureus* clinical isolates [11]. The research [12] included the most common antibiotics that S. *aureus* isolates were recently recorded as resistant against them, they listed Me, MA and Py among those inefficient any more antibiotics.

The antibiotic MA (Cefamandole) is one of Cephalosporin antibiotics, [13] explained that Cefamandole cannot be used as replacement for ß-lactam antibiotics in treatment of resistant infections because it showed different therapeutic efficacy when tested *in vitro* when compared with *in vivo* trial on methicillin-resistant Staphylococcal strain. The recommendation of [14] was to use both Cefamandole and Vancomycin combination in the treatment of clinical isolates of homogenous methicillin-resistant S. *aureus*.

That because those antibiotics acted synergically against the isolates tested in that research. In the article [4], the authors suggested that there are limits for antistaphylococcal activity of Cephalosporins due to the fact that many relapses were registered post treatment of infections *in vitro*. The author [15] suggested using new drugs depending on nanotechnology as future treatment of more save and fast results, and that may help avoiding excessive drug usage in patients suffering from resistant isolates.

In the other side, improve the medical education and awareness about antibiotics acquired resistance resultant from wrong procedures of usage as stated by [16] is an important issue to overcome this growing problem.

Conclusion

Antibiotics resistance exhibited by S. *aureus* is an obvious problem mainly for critical cases that need an urgent management with no time to loss, antibiotic sensitivity test should be an obligatory procedure before giving antibiotics to avoid acquired resistance.

Old generation antibiotics Methicillin, Cefamandole and Carbencillin need to be tested for efficacy on S. *aureus* isolates before use on, new generation antibiotics Vancomycin and Lomofloxacin are very effective in treatment of vigorous S. *aureus* clinical isolates of recurrent UTI.

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