

Effect of Nanoparticles against Protuse Mirabilis Bacteria Isolated From Urinary Tract Infections

Hiba Ahmed Mahmoud

University of Samarra...College of Education...Department of Life Sciences

Prof. Dr. Mahmoud Khalaf Saleh

Tikrit University... College of Education for Pure Sciences...Department of Life Sciences

Abstract: The study dealt with the collection of clinical samples from patients with urinary tract infections from the patients and visitors to Samarra General Hospital during the period from October 26/10/2021 until February 3/2/2022, where 130 isolates were collected, isolated and diagnosed, and the results of the culture tests showed The biochemical return of 24 *P. mirabilis* isolates, IMVC tests and sensitivity tests were performed on them against 10 antibiotics by way of disc diffusion on Muller Hinton's medium. *mirabilis* The percentage of resistance of *P. mirabilis* bacteria to β -lactams represented by the antagonist Ampicillin was 87.55%, while for Ciprofloxacin 75%, Cefotaxime 79.16%, Tetracycline recorded the highest resistance by 100%, Genmicin100% and Genmicin70% 83%, and Amikacin by 91.66%, while the anti-quinolines represented by Nalidixic Nalidixic acid with a percentage of 87.5%, while the percentage of chloramphenicol was also high by 95.83%, while imipemen was the lowest by 12.5%. Also, the silver nanomaterial (taken ready) was studied on the growth of isolates and by the method of diffusion by digging. The results showed that there is a clear effect of the nanomaterial on the tested bacterial isolates, and the rate of inhibition diameters was 17-22 mm, and the results of the current study showed the ability of silver nanoparticles (AgNPs) to inhibit Bacterial growth of the tested isolates under study with different diameters depending on the concentration of the substance, as the diameter of the inhibition increased with the increase in concentration.

Key points: antibiotics, nanomaterials, *Proteus mirabilis*.

Introduction

Protuse mirabilis belongs to the genus *Proteus* of the family Enterobacteriaceae and is one of the most important Gram-negative bacteria of the Enterobacter family and its great importance in the spread of hospital-acquired infections Nosocomial infections (Medina and Castillo-Pino, 2019)

They are considered a normal flora in the gastrointestinal tract, but they cause acquird community infections because they are opportunistic bacteria and therefore cause many diseases when they are present in a non-natural environment (Moyaert *et al.*, 2017).

Broad-spectrum beta-lactamases are produced by Gram-negative bacteria, giving the bacteria that produces them an increase in resistance to commonly used antibiotics, including beta-lactams (Girlich *et al.*, 2020).

Nanotechnology has entered the medical products industry, as it has been proven that it is not toxic to human cells, but is effective against cancer cells, viruses, bacteria and in small concentrations. It has also entered many industries such as textiles and food preservation (Qindeel *et al.*, 2021).

Silver has been used as an antibacterial due to its ability to combine with proteins and with bases of DNA, and as a result, it prevents the process of replication (Ahmed *et al.*, 2019).

2- Materials and working methods

1- Collection and identification of bacterial isolates

Clinical samples of 130 isolates of different ages and for both sexes were collected during the period from October 26/10/2021 to February 3/2/2022, from Samarra General Hospital, and the samples were collected in sterile single-use tubes until they are transferred to the laboratory for testing. Biochemistry and diagnosed 24 isolates of *P. mirabilis*.

Tests	<i>P. mirabilis</i>
Gram stain	-
Catalase	+
Oxidase	-
Indol production	-
Methyl red	+
Voges-proskauer	-
Citrate utilization	heterogeneous
Motility	+
Urea se	+

Colonies of *P. mirabilis* were initially identified based on their phenotypic characteristics in terms of the shape, size and color of the colonies. The focus was on the colonies that were characterized by the phenomenon of homing of *P. mirabilis* bacteria on the blood agar medium. It also appeared in pale, non-fermenting colonies of lactose sugar on Macconkey agar medium, as the shapes of the developing colonies, their cultivation characteristics and growth or lack of growth on the differential media were studied.



2- Allergy test

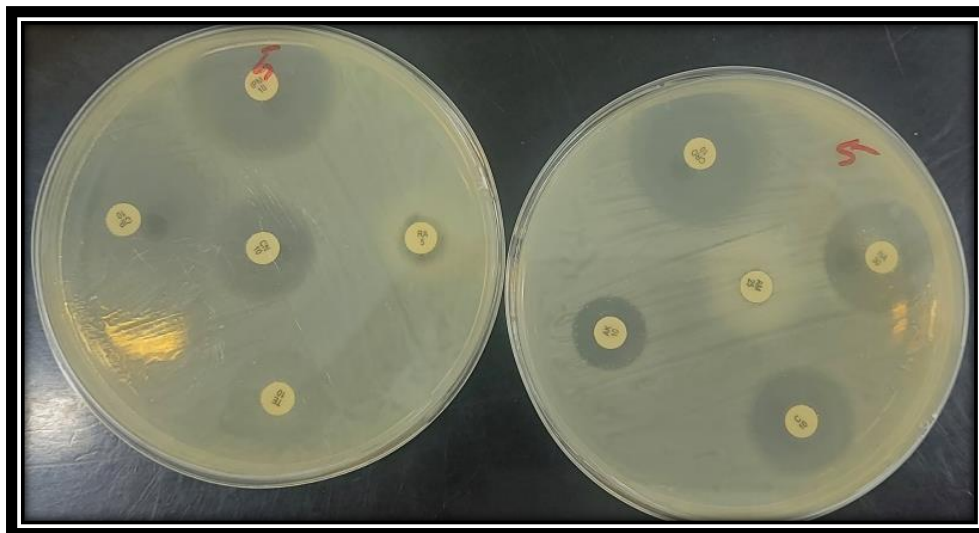
2-4 colonies of *P. mirabilis* were taken. to a test tube containing 5 ml of heart and brain infusion broth and incubated at 37°C for 24 hours. The growth obtained was diluted by using physiological salt solution to obtain a turbidity similar to that of MacFarland 5.0 standard tubes. A cotton swab was dipped in the diluted culture medium, and the bacteria were spread on Muller-Hinton solid medium by streak method more than once and in different directions, and the plates were left for 5 minutes at room temperature. To ensure moisture absorption, then antibiotic tablets were placed, the dishes were incubated at 37°C for 24 hours for all types of antibiotics. The results were read by measuring the diameters of inhibition by taking two perpendicular drops and the results were compared with global measurements (CLSI, 2019).

Results and discussion

Susceptibility for antibiotics

Drug sensitivity was tested on 24 isolates of *P. mirabilis* to 10 antibiotics. The results revealed the sensitivity of *P. mirabilis* to the antibiotics Amikacin, Ciprofloxacin, Imipenem, and Nitrofurantoin at 100%.

Our results converged with researchers Mohammed and Shehab (2018) during their study on isolates of *P. mirabilis*, where the sensitivity to Amikacin, Ciprofloxacin, Imipenem and Nitrofurantoin was 100%, 91.66%, 83.33% and 83.33%, respectively. These results are in agreement with our current results, and our results did not agree with the results of Hussein *et al.* (2017) where the sensitivity to Amikacin, Ciprofloxacin, Imipenem and Nitrofurantoin were 25%, 25%, 10% and 80%, respectively.



The figure shows the response of bacterial isolates to antibiotics

In the past, the majority of *P. mirabilis* isolates were susceptible to common classes of antibiotics, but recent studies in various countries have indicated that antibiotic resistance among *P. mirabilis* isolates is increasing (Magyar *et al.*, 2017). In one study by Fallah *et al.* in Iran (2019), it was reported that resistance to ciprofloxacin, ceftterixon and imipenem was higher than our study average, indicating that antibiotic resistance had increased among *P. mirabilis* isolates in Iran (Fallah *et al.*, 2019).

Similar to our findings, several studies in Iran indicated that most *P. mirabilis* isolates were sensitive to ciprofloxacin (Mirzarazi *et al.*, 2013) and had high resistance to amoxicillin. The resistance rate in our study is also similar to that reported from American and European hospitals. Keyhan *et al.*, 2017; Sader *et al.*, 2011), however the rate was somewhat lower than the rate in a study conducted in Ghana (Feglo *et al.*, 2010). This difference in results may result from the type of antibiotics used and how often they are used in countries.

3- Effect of silver nanoparticles on the growth of *Proteus mirabilis*.

In an attempt to find materials affecting pathological isolates of antibiotic-resistant *P. mirabilis* bacteria, the effect of silver AgNps on the growth of pathogenic isolates and by digging method was tested. The current results showed that there is a clear effect of the nanomaterial on the tested bacterial isolates with different concentrations, including (350, 250, 150, 75). $\mu\text{g/ml}$, and the average inhibition diameters ranged between 81-24 mm, and the MIC value of the nanoparticles ranged between 75-150 $\mu\text{g/ml}$.

The results of the current study showed the ability of silver nanoparticles (AgNPs) to inhibit the bacterial growth of the tested isolates under study as shown in Figure (4-6) with different diameters

depending on the concentration of the substance, as the diameter of inhibition increased with increasing concentration.

The results of this study agree with the findings of Al-Bahrani and Ghafil (2016), when they indicated in their study the effectiveness of nanoparticles (AgNPs) synthesized from the aqueous extract of mushroom Qatar on different bacterial species, including *P. mirabilis* bacteria, as the secondary silver particles (AgNPS) were) Good inhibitory activity and anti-bacterial activity with increasing concentration of nanoparticles.

It also agrees with what was stated in the study of Hemmati and his group (2018) about the anti-bacterial activity of silver nanoparticles (AgNPs) biosynthetic for a group of human pathogenic bacteria, including *P.* This focus is in agreement with the findings of the current study.

The inhibitory effect of silver nanoparticles (AgNPs) is due to its effect on the cell membrane and disrupting its basic functions such as permeability and breathing processes, as well as to the small size of the particles and the large surface area that gives them a lethal effect. Also, secondary silver particles (AgNPs) have the ability to easily enter the cell membrane by Through its interaction with compounds containing sulfur and phosphorous, such as DNA, as well as as a result of releasing silver ions, which have a fatal effect on bacterial cells (Raheem, 2018).



The figure shows the effect of silver nanoparticles on *P. mirabilis* . bacteria

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