

# Role of Antibiotics against Staphylococcus Aureus

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**Abstract:** An increasing antimicrobial resistance has resulted in morbidity and mortality from treatment failure and increased health care costs. The most common method sensitivity test with help of cup agar method to aim of antimicrobial susceptibility testing is to determine the lowest concentration of existing or even new antimicrobial agent which inhibit the growth of organisms. The overuse of antibiotics is accelerating the bacterial resistance, and therefor there is a need to reduce the amount of antibiotics used for treatment. The novel concept light assisted that consist of UV irradiation treatment followed by a different antibiotics treatment can significantly reduce the amount of antibiotics needed for eradicating mature bacterial biofilms. Wound infection or other infections produced by antibiotics-resistant bacterial strain are particularly difficult to manage. This study examined the effectiveness of UV light treatment in killing antibiotic-resistant strain in vitro. Antibiotic resistance strain *S. aureus* is more susceptible to killing effects of UV.

**Keywords:** Staphylococcus aureus, Antibiotics, UV effect, UV light

## 1. Introduction

Staphylococci are approximately 0.8 – 1 µm in diameter, uniformly gram positive, spherical cocci arranged characteristically in grapes like clusters. Clusters form occurs cell division in three planes with daughter cell tend to remain close together and is favored by culturing organisms in solid media. Staphylococci are non-motile, non-sporing, noncapsulated. Staphylococcus aureus is a gram positive cocci bacteria named for its tendency to form clusters. It is a Greek word “staphyle” means “bunch of grapes” and golden pigmentation “aureus” is the Latin word for “golden”. *S. aureus* is some pathogen bacteria with genome consisting of a circular chromosome of approximately 2,800 base pairs and additional prophages. Humans are a natural reservoir of *S. aureus* with 50 % of healthy adults colonized. Staphylococcus aureus is a pathogen organism. its pathogen increasing importance for the antibiotic’s resistance.

## 2. Antibiotics Properties

Antibiotic word has been derived from word “antibiosis” it means survival of fittest which according to biology concept. In process one organisms may destroy another to prevent itself. Introduced term of antibiotic by Vcillemin in 1889 it was defined by Waksman in 1944. “it is a chemical substance produced from or derived from living cells which is capable in small concentration of inhibiting the life process or even destroying the microorganisms. To bring antibiotic action is very low concentration. They are also classified chemotherapeutic agents. The antibiotics are different modes of action or different work or specific antibiotic can be effective against certain types of microorganisms.

## 3. Types Antimicrobial Agents

Drug class and specific Antibiotics: -

1) Bacteriostatic

- Glycylcyclines: tigecycline
- Tetracycline: doxycycline, minocycline
- Lincosamides: clindamycin
- Sulfonamides: sulfamethoxazole

2) Bactericidal

- Beta-lactams (penicillin, cephalosporins, caebapenems): amoxicillin, cefazolin, meropenem
- Fluoroquinolones: ciprofloxacin, levofloxacin, moxifloxacin
- Glycopeptides: vancomycin (19).

Use of antibiotics list: -

Azithromycin	Roxythromycin
Levofloxacin	fluconazole
Doxycycline	dompheridone
Ampicillin	cetirizine
Amoxicillin	levocitrizine
Chloramphenicol	cifxicillin
Levofloxacin	Doxycycline
Ciprofloxacin	

## 4. Ultraviolet effect

Ultraviolet radiation which is potentially killed organisms UV222 or inactivated.

Recent measurement of ozone levels has led to concern that stratospheric ozone layer is being depleted as a result of contamination with mam-made chlorofluorocarbons. Concomitantly the amounts of solar UV-B radiation reaching the Earth’s surface is increasing. UV-B radiation has been shown to be harmful to living organisms, damaging DNA, proteins, lipids and membranes. (Hollosey F.Micron.2002)

Wound infections produced by antibiotic-resistance bacterial strains are particularly difficult to manage. UV light treatment in killing antibiotic-resistance strains of *S. aureus* in vitro. Organisms were prepared on medium and treated

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with UV light. (TA Conner-Kerr, PK Sullivan, J Gaillard, ME Franklin, RM Jones)

UV light induced corneal collagen cross-linking is a therapeutic procedure used in the visual sciences which is based on irradiation of the corneal surface with UV light in combination with the administration of vitB2 to increase.

In some cases, CXL has also been proposed to treat infection keratitis

Since the PS localizes to certain cells, only target cells in the irradiation area are damaged. Drug-resistant bacteria can be effectively eliminated by PDT and there are no reports of microbes becoming resistant to PDT despite numerous attempts to induce resistance by repeated cycle of semilethal PDT and microbial regrowth.

The effects on UV radiation on the genetic material of cells and repair mechanisms by which many cells can reverse the damage caused by UV are examined. (Walter-Harm)

The problem of trying to determine the effect of solar UV radiation on aquatic organisms is much more difficult than that of assessing the impact of UVR on terrestrial plants. (Osmund Holm-Hansen, Dan Lubin, E Water Helnling)

UV-B radiation which is the most biologically injurious component of sunlight.

UV LIGHT: - UV light has shorter wavelengths than visible light. Also visible light to the human eyes. This is similar to how a dog can hear the sound of a whistle just outside the hearing range of humans.

UV LIGHT FROM OUR SUN: -the sun is a source of the full spectrum of ultraviolet radiation.

The sun emits all kind of rays: cosmetic rays, X rays, ultraviolet rays, infrared rays, microwaves, short radio waves and long radio waves. The ultraviolet rays produce UV radiation, which has three main components:

**Ultraviolet A**  
**Ultraviolet B**  
**Ultraviolet C**

Most UVC rays filter through the ozone layer and the atmosphere of the Earth, so not much reaches the earth's surface. UVB rays do react the surface, although some of UVB radiation is filtered out. Considerable amount of UVA radiation reaches the earth's surface.

There are two types of ultraviolet solar radiation- A and B. Both types of rays may cause skin damage or possibly skin cancer.

Sun protection factor (SPF) measure the protection that a sunscreen provides against ultraviolet B but not ultraviolet A rays, which penetrate more deeply into the skin, creating wrinkles.

To protect your child against both types of rays, it is importance to look for sunscreens that are labeled "broad

spectrum", or check the ingredients for the four Food and Drug Administration (FDA)- approved UVA blockers: titanium dioxide, zinc oxide, mexoryl.

UVC is extremely dangerous, but fortunately it's absorbed by our atmosphere, so unless you're in the space station, it's of no concern.

UVB is the second most potent. It is responsible for sunburns (remember "B" for burns). It's also responsible for making vitamin D in your skin – so it has both good and bad qualities. It's present during summer and on sunny days.

UVA is the least potent, but most abundant. 95% of the UV light that reaches us is UVA. It does not increase your vitamin D levels. UVA penetrates clouds and car windows.

UV-C rays are the most harmful and almost completely absorbed by our atmosphere.

UV-B rays are the harmful rays that cause sunburn. Also effect increases the risk of DNA and other cellular damage in living organisms.

DISCOVERY OF UV-LIGHT: - in 1801, Johann Ritter conducted an experiment to investigate the existence of energy beyond the violet end of the visible spectrum. Knowing that photographic paper would turn black more rapidly in blue light than in red light, he exposed the paper to light beyond violet. Sure enough, the paper turned black, proving the existence of ultraviolet light.

Some source uses the distinction of "hard UV" and "soft UV"- in the case of astrophysics the boundary may be at the Lyman limit. i.e. wavelength 91.2nm, with "hard UV" being more energetic.

The same terms may also use in other field, such as cosmetology, optoelectronic, etc. – the numerical value of the boundary between hard/soft even within similar scientific do not necessarily coincide; for example, one applied physics publication used a boundary of 190 nm between hard and soft UV regions.

UV light causes the body to produce vitamin D, which is essential for life. The human body needs some UV radiation to maintain adequate vitamin D levels; however, excess exposure produces harmful effects that typically outweigh the benefits (39).

**Harmful Effects on Human:**

- Skin Condition
- Skin damage
- Eye damage
- DNA RNA damage

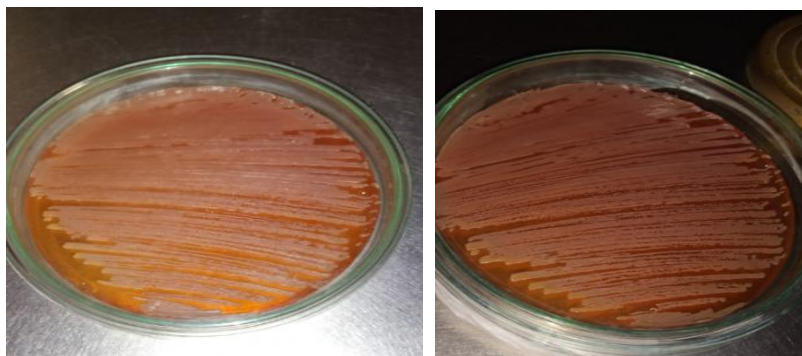


Figure 1: Yellow colonies of *Staphylococcus aureus*

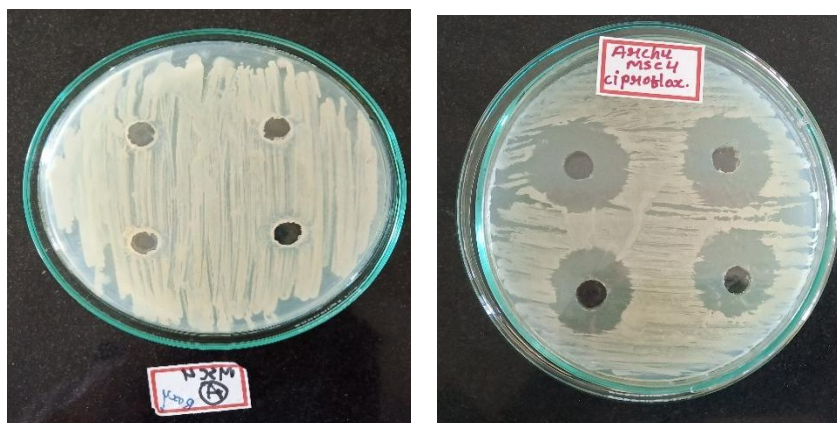


Figure 2: Colonies of Roxithromycin and Ciprofloxacin

Table 1: Gram's reaction results

ORGANISMS NAME	GRAM'S REACTION	SHAPE	Arrangement
<i>Staphylococcus aureus</i>	Gram positive Purple color bacteria	Small round, coccus	Some are bunch and graphs like structure

### 3.1 Materials and Methods

Sample collection:

Sample collected by a direct pus (pimple) in a human body.

#### Media

Organisms for growth used media- Nutrient agar

Mannitol salt agar (MSA)

Nutrient broth

Mannitol salt agar media is a specialized media for *Staphylococcus aureus* organisms.

Nutrient agar and broth are normal or effective media for all organisms.

Cultivation: - (Isolation of organisms)

- First take a sample from a collection
- Then made a media (N-agar or MSA)
- Then sample of pus streak on a plates
- Then plates are put into an incubator for incubation at 37°C for 24 hours.
- Next day show a plates
- On plates organisms are grow and its pigmentation color are pale golden yellow it to defiantly pure plates of *S. aureus*

- For perfection test of organisms perform gram's staining and colony characteristics of organism.

#### Ditch Plate Method

Principle– When an antibiotic is added in agar cup, the radial diffusion of an antibiotic through the agar, produces a concentration gradient. Test organism is inhibited at the minimum inhibitory concentration(MIC), giving rise to a clear zone of inhibition. Greater the MIC, larger is the zone of inhibition.

#### Procedure

- 1) Made a nutrient agar and allow it to solidify.
- 2) Sterilize the cup-borer by dipping it in alcohol followed by flaming it.
- 3) With the help of cup-borer make cups.
- 4) With the help of sterile pipette fill cups each with definite quantity of different antibiotics to be tested. Take precautions not to overflow cups.
- 5) Incubate the plate in refrigerator for 30 minutes so as to allow diffusion of antibiotics.
- 6) Incubate the plate in upright position at 37°C for 24 hours.
- 7) Next day observed the plates for the zone of inhibition and measure the zone size.
- 8) Interpret the results of antibiotics sensitivity as sensitive, moderate sensitive, or resistant on the basis of zone size.

Treatment: - (ANTIBIOTICS)

*Staphylococcus aureus* treatment by a different antibiotic. These antibiotics are different concentration and applied on organisms.

Treat by an antibiotics and show a resistance of a organisms and check the zone of inhibition.

## 5. Method

Treatment by antibiotics with the help of ditch method to check the resistance and check the zone of inhibition.

- Take a N-agar plates.
- Streak an organism on it.
- With the help of ditch method, so use of a sterile cupboard. For a ditch on a plates.
- After made a ditch into plates, wells are creating.
- Then put antibiotics into wells.
- Antibiotics are not directly added it to a different concentration and help of micropipette.
- Then plates are put into incubator for incubation time at 37°C for 24 hours.
- Next day show a result.
- Antibiotics are creating zone or some antibiotics are resistance of an organisms.

## 6. Discussion

A sensitivity analysis is a test that determines the “sensitivity of bacteria to an antibiotic. It also determines the ability of the drug to kill the bacteria.

Doctors use sensitivity testing to determine the right antibiotic treatment for an infection and to monitor changes in bacterial resistance to antibiotics.

Antimicrobial susceptibility tests are used to determine which specific antibiotics a particular bacteria of fungus are sensitive to.

Results are commonly reported as the minimal inhibitory concentration, which is the lowest concentration of drug that inhibits the growth of the organism.

I performed cup agar method to show a sensitivity of organisms against different types of antibiotics. All antibiotics are different concentrations so results are also different

Some are inhibiting the zone or some antibiotics are sensitive against organisms.

When I am talking about the dangerous component of sunlight, I am really talking UV light. UV light is ionizing radiation, meaning that it frees electrons from atoms or molecules, causing chemical reactions. Performed UV effect on organisms which were treated with antibiotics.

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