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Research Article

Cesium CS^{137} ,Coblit CO^{60} radiosource emit Beta, Gamma rays effected on Staphylococcus aureus

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ABSTRACT
The goal of this study effect radiation on a number of Staphylococcus aureus bacterial isolates collected from Hilla Teaching Hospital and Imam Ali Hospital in Babil Governorate and Baghdad hospitals different patients randomly from from burns, wounds, urinary tract infections and skin with burn and wounds infections. Identification by $VITECK_2$-GP, S.aureus were implanted on Nutrient broth and Nutrient agar , then placed within test tube containing distilled water 5ml, then exposing to an different radiosources including CS^{137} and CO^{60}, with activity 1-10 µc with different radiation doses for different peroids 1-2-3 hrs.; implanted on Petridishes plates of Nuterinat agar incubated in the incubator for 24 hrs. at 37 ° C . The results of exposure to beta and gamma rays emitted by CS^{137} and CO^{60} radiosources with activity 10 µci and 1 µci. for 1hrs.,2hrs. 3hrs, with different doses including Cs (10 µci) Beta $3.160*10^{-1}$ (1hrs.), $6.32*10^{-1}$ (2hrs.), $9.48*10^{-1}$ (3hrs.) 98.3%, 99.5%, 99.5% respectively ; Cs (10 µci) Gamma$5.815*10^{-1}$ (1hrs.), $11.63*10^{-1}$ (2hrs.), $17.445*10^{-1}$ (3hrs.) 98.9%, 99.6%, 99.5% respectively; Cs (1 µci) Beta $3.417*10^{-1}$ (1hrs.) , $6.835*10^{-1}$ (2hrs.), $9.253*10^{-1}$ (3hrs.), 99.3%, 99.5%, 99.9% respectively ; Cs (1 µci) Gamma $6.289*10^{-1}$ (1hrs.), $12.678*10^{-1}$ (2hrs.), $18.867*10^{-1}$ (3hrs.) 99.2%, 99.6%, 99.8% respectively; Coblit with Co(1 µci) Beta $1.2*10^{-1}$ (1hrs.), $2.4*10^{-1}$ (2hrs.), $3.6*10^{-1}$ (3hrs.) 99.4%, 99.2%, 99.8%; Co(10 µci) Beta, $1.86*10^{-1}$ (1hrs.), $3.7*10^{-1}$ (2hrs.), $5.5*10^{-1}$ (3hrs.) 99.6%, 99.8%, 99.9% respectively ; Co(10 µci) Gamma, $2.33*10^{-6}$ (1hrs.), $4.66*10^{-6}$ (2hrs.), $6.99*10^{-6}$ (3hrs.), 95.2%, 99.8%, 99.8% respectively. Calculate number of colonies with percentage of killing.

Keywords :, Irradiation, Gamma rays, Beta rays, Bacteria.

INTRODUCTION

Staphylococcus aureus is cocci, Gram positive, anaerobic live without oxygen. grape-like clusters and irregular able to cause a specific defect in any tissue, organ and any part of the body, it cause most of diseases with pus, immobile [1].

S.aureus called golden staphylococci because when they grow on a solid medium they are golden yellow, most of strains are a mucous nature because they contain capsule composed of polysaccharides [6]have cell wall is an amorphous protective layer with a thickness of about (204 nm) [7]. The peptidoglycan is the important and basic component of the cell wall and forms about approximately 50% of the mass of the cell wall [2, 3].

It is an opportunistic pathogen that affects on human body such as the skin and in the nose. These bacteria first pass through the tissues, then in the bloodstream, the lymph and multiply [4]cause infections include Such as pneumonia, blood poisoning, bone and joint inflammation and inflammation for the heart and food poisoning [5] a high ability to invade the host tissue and spread very quickly because production of enzymes and toxins that act to stimulate the infections [6,7,8,9,10].

Most of this strain possesses capsular that reduces phagocytosis and forms biofilm [11,12]. Penicillin was the most effective antibiotic on S. aureus but in last peroids emergence strains possess gene responsible for resistance to penicillins known as Methicillin -Resistant Staphylococcus (MRSA)[13]. The study of the biological effect of radiation is important, complex and extremely difficult for two main reasons firstly, the human body is a very complex entity with many organs of different sizes, functions, sensitivities; Secondly, related experiments practically impossible with humans. In the direct method, the bonds between the atoms that make up the particles of living matter are broken as a result of ionization especially in the nucleus of the cell that causing its death or genetic change, the damaged of the radiation in genetic material result breaking the bonds

between the molecules of the same material and cause death or change in the genetic code, then cause a mutation that leading to cancerous or cause an imbalance. The indirect effect of radiations results decomposition of water whose impurities (70-80)% make up the body because produces toxic chemicals that affect on the cell leading to emergences clinical symptoms such as disease or cancer[14].

METHODOLOGY

Bacterial isolates

A total of 100 S.aureus isolates were collected from different samples from patients with burns, wounds and urinary tract infections who were admitted to Hilla Teaching Hospital, Imam Ali Hospital in Babil Governorate and Baghdad hospitals in 2019/2020.These isolates were identified by conventional biochemical reactions.

Effect of Gamma,Beta Irradiation on S.aureus isolates.

S.aureus cultivation was done according to Tramps et al., [15] with some modifications as follows:

The irradiation facility used was gamma (γ) irradiation, Beta in different dose and different energy for hr.. The S.aureus isolates was grown in Nutrient broth for 24 h. on shaker (150 rpm) at 30ºC. The well grown bacterial culture was centrifuged at 8000 rpm for 15minutes. The supernatant was decanted and the pellets were suspended in sterile saline.

The suspended cells were collected in a clean sterile flask to form pool. The bacterial suspension of the pool (5ml) was distributed in clean sterile screw cap test tubes and exposed to different doses of Gamma ,Beta radiation using triplicates for each dose. The non-irradiated control and the irradiated cultures were plated on the surface of Trypton soy agar plates, the viable count, percentage of killing was determined according to equation below.

The percentage of killing calculated from equation below :

$$\text{Percentage of Killing} = \frac{\text{Control} - \text{treated} * 100}{\text{Control}}$$

RESULTS AND DISCUSSION

Bacterial isolates

The results of collections 100 S.aureus isolates collected 40 isolates(40%) from burns, 30 isolates(30%) from wounds and 30 isolates (30%) from urinary tract infections. The identification approved all isolates are S.aureus when identification by VITECK2-GP and produce hemolysin when detection on Blood agar medium.

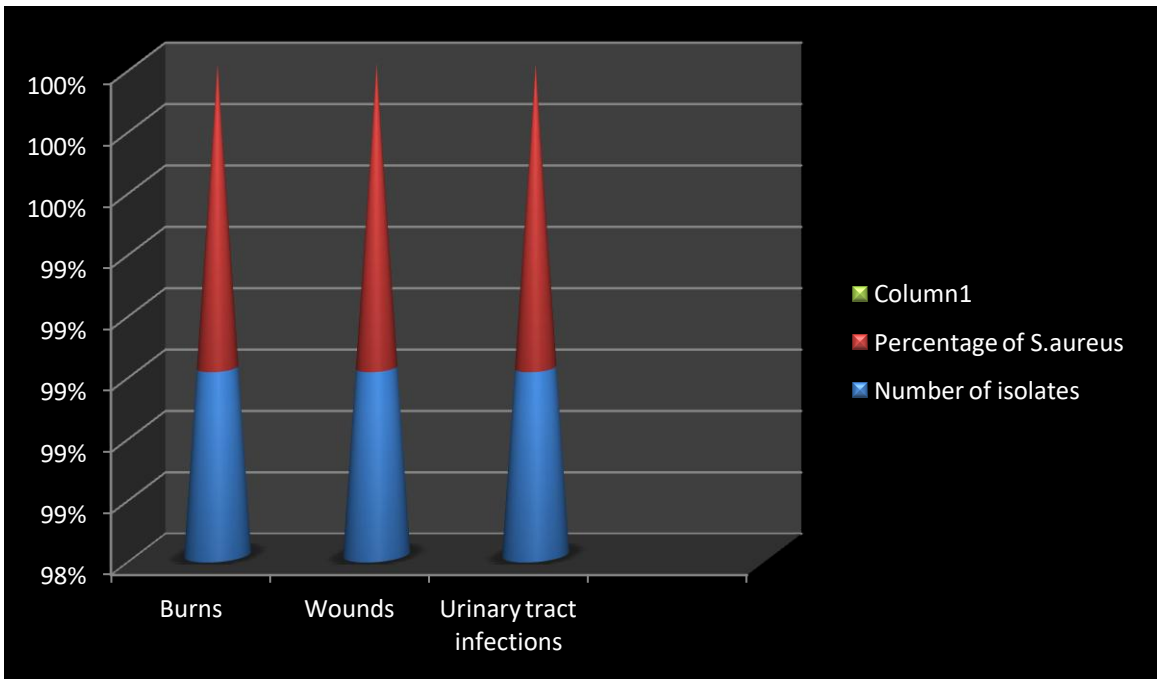

Fig.1: Number of S.aureus isolates with the Percentage.

Fig.2: S.aureus on Nutreint agar and Blood agar.

Effect of Gamma,Beta,Alpha Irradiation on S.aureus isolates

The exposure into radiation results absorption energy, then ionized and electrically excited molecules, direct effect or indirect effect and molecule change that leading to biochemical damage, metabolic transformation and Physiological with genetic damage (mutations) and cause cell death[16].

Table (1): Percentage of killing of S. aureus colony after exposure to Gamma ,Beta irradiation, Dose, Energy and Activity of Isotope.

Source isotope	Dose (MSV)	Energy(keV)	Type of irradiation	Activity	Killing ration
Cs (10 μci) Beta	$3.160*10^{-1}$ (1hrs.) $6.32*10^{-1}$ (2hrs.) $9.48*10^{-1}$ (3hrs.)	661.66	Beta	10 μci	98.3% 99.5% 99.5%
Cs (10 μci) Gamma	$5.815*10^{-1}$ (1hrs.) $11.63*10^{-1}$ (2hrs.) $17.445*10^{-1}$ (3hrs.)		Gamma	10 μci	98.9% 99.6% 99.5%
Cs (1 μci) Beta	$3.417*10^{-1}$ (1hrs.) $6.835*10^{-1}$ (2hrs.) $9.253*10^{-1}$ (3hrs.)	198.8	Beta	1 μci	99.3% 99.5% 99.9%
Cs (1 μci) Gamma	$6.289*10^{-1}$ (1hrs.) $12.678*10^{-1}$ (2hrs.) $18.867*10^{-1}$ (3hrs.)		Gamma	1 μci	99.2% 99.6% 99.8%
Co(1 μci) Beta	$1.2*10^{-1}$ (1hrs.) $2.4*10^{-1}$ (2hrs.) $3.6*10^{-1}$ (3hrs.)	117324	Beta	1 μci	99.4% 99.2% 99.8%

Co(1 μci) Gamma	$1.56*10^{-7}$ (1hrs.) $3.12*10^{-7}$ (2hrs.) $4.68*10^{-7}$ (3hrs.)	1274.53	**Gamma**	1 μci	99.3% 99.6% 99.7%
Co(10 μci) Beta	$1.86*10^{-1}$ (1hrs.) $3.7*10^{-1}$ (2hrs.) $5.5*10^{-1}$ (3hrs.)	59.54	**Beta**	10 μci	99.6% 99.8% 99.9%
Co(10 μci) Gamma	$2.33*10^{-6}$ (1hrs.) $4.66*10^{-6}$ (2hrs.) $6.99*10^{-6}$ (3hrs.)		**Gamma**	10 μci	95.2% 99.8% 99.8%

The results of exposure to beta and gamma rays emitted by CS ^{137} and CO ^{60} radiosources with activity 10 μci and 1 μci. for 1hrs.,2hrs. 3hrs, with different doses including Cs (10 μci) Beta $3.160*10^{-1}$ (1hrs.), $6.32*10^{-1}$ (2hrs.), $9.48*10^{-1}$ (3hrs.) 98.3%, 99.5%, 99.5% respectively ; Cs (10 μci) Gamma$5.815*10^{-1}$ (1hrs.), $11.63*10^{-1}$ (2hrs.), $17.445*10^{-1}$ (3hrs.) 98.9%, 99.6%, 99.5% respectively; Cs (1 μci) Beta $3.417*10^{-1}$ (1hrs.) , $6.835*10^{-1}$ (2hrs.), $9.253*10^{-1}$ (3hrs.), 99.3%, 99.5%, 99.9% respectively ; Cs (1 μci) Gamma $6.289*10^{-1}$ (1hrs.), $12.678*10^{-1}$ (2hrs.), $18.867*10^{-1}$ (3hrs.) 99.2%, 99.6%, 99.8% respectively; Coblit with Co(1 μci) Beta $1.2*10^{-1}$ (1hrs.), $2.4*10^{-1}$ (2hrs.), $3.6*10^{-1}$ (3hrs.) 99.4%, 99.2%, 99.8%; Co(10 μci) Beta, $1.86*10^{-1}$ (1hrs.), $3.7*10^{-1}$ (2hrs.), $5.5*10^{-1}$ (3hrs.) 99.6%, 99.8%, 99.9% respectively ; Co(10 μci) Gamma, $2.33*10^{-6}$ (1hrs.), $4.66*10^{-6}$ (2hrs.), $6.99*10^{-6}$ (3hrs.), 95.2%, 99.8%, 99.8% respectively.

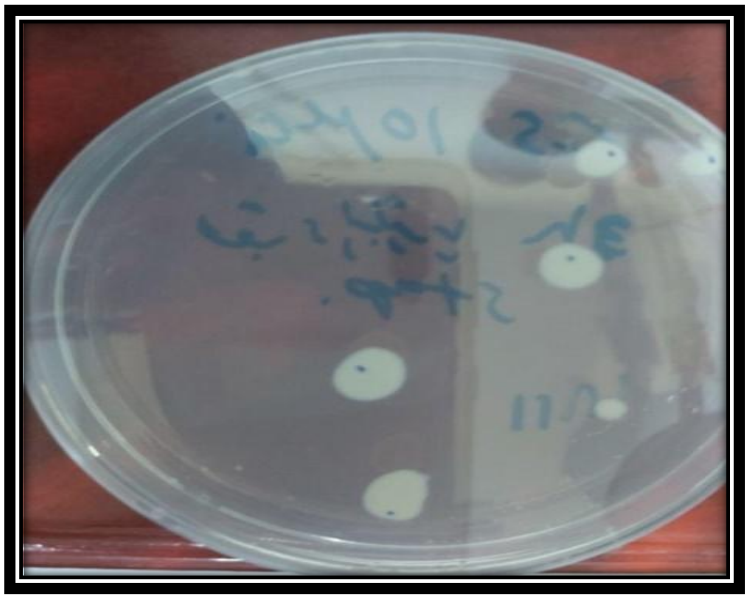

Fig.2: S.aureus after exposure to radiation.

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