INCIDENCE OF NASAL CARRIERS OF STAPHYLOCOCCUS AUREUS IN AND OUTSIDE HOSPITAL ENVIRONMENT AND ANTIBIOTIC SENSITIVITY OF ISOLATED STAPHYLOCCAL STRAINS

THESIS

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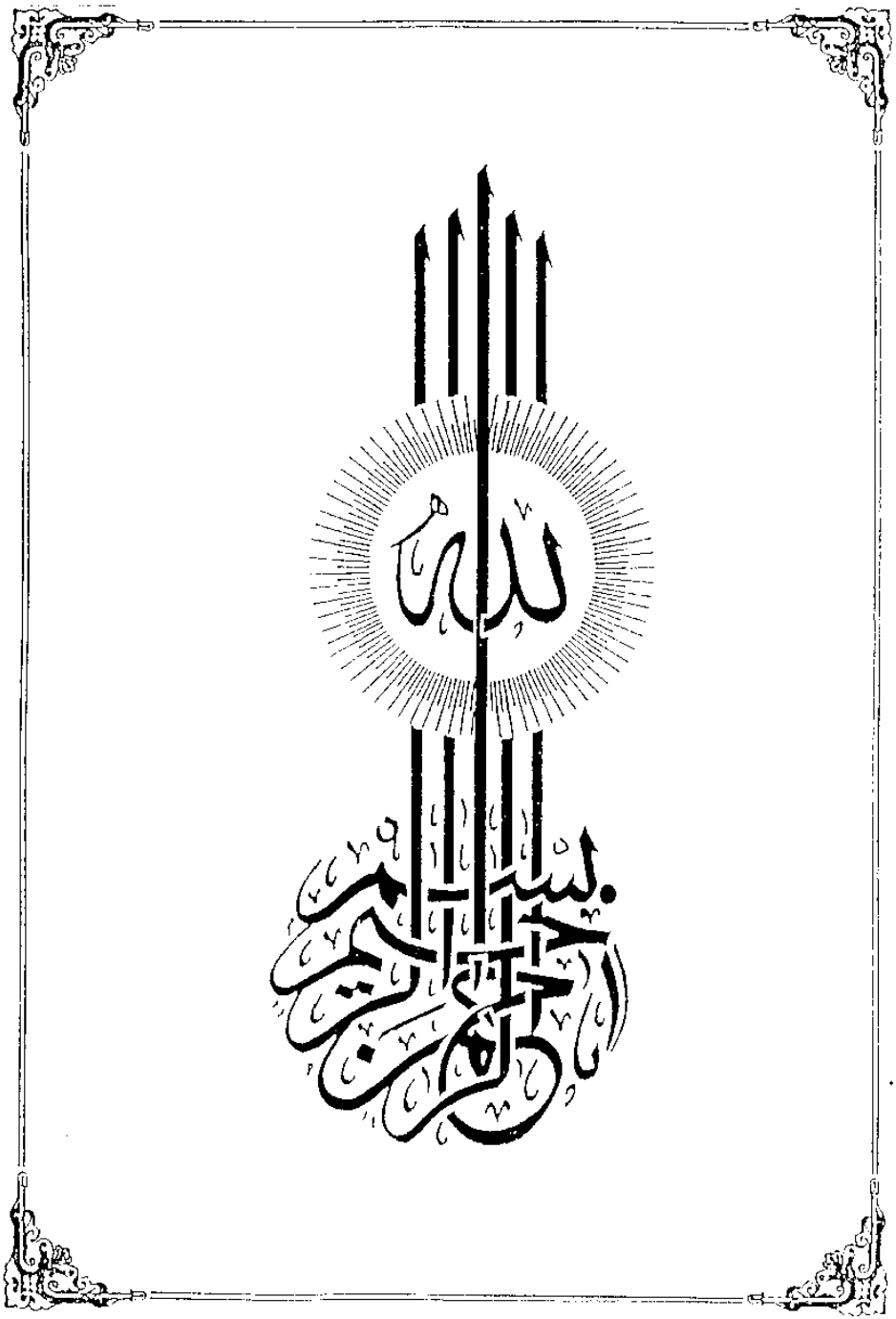

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Staphylococcus is a significant human pathogen , causing a wide spectrum of diseases ranging from superficial cutaneous infections to life-threatening systemic maladies . (**Murray et al . , 1990**)

Several staphylococcal species preferentially colonize specific niches of the human body . **Kloss (1980)**, reported that from 10 % to 40 % of the general human population carry this species in their nares and up to 70 % of hospitalized individuals (patients and medical personnel) carry this organism .

Staphylococcus aureus (*S.* aureus) appears to be consistently adaptable in becoming resistant to drug therapy , and as a result many antibiotics soon become ineffective for the treatment of staphylococcal infections (**Volk et al . , 1991**) .

Penicillin was considered the drug of choice for *S.aureus* infections . (**Sabath , 1982**) but the continued use of this agent caused the selection of resistant strains which produced penicillinase (**B.lactamase**) , that inactivates the antibiotic before it has caused irreversible changes in the bacterial cells (**Brumfitt and Miller , 1989**) . The ability to produce penicillinase is

usually determined by the presence of a plasmid (Sabath,1982)

Methicillin and other B-lactamase-resistant penicillins were available for the treatment of infection caused by penicillin-resistant staphylococci since 1959 (Haley et al. , 1982). However , over the past several years increasing numbers of isolates that are resistant to methicillin have appeared , these isolates are referred to as methicillin resistant S.aureus (MRSA). (Howard and Kloss , 1987) .

The MRSA are actually resistant to all beta-lactam antibiotics , including the third-generation cephalosporins, furthermore , they are usually resistant to streptomycin , tetracycline , and sulfonamides . Methicillin resistance usually is chromosomally mediated . (Sabath , 1982) .

Methicillin-resistant staphylococcus aureus (MRSA) has recently emerged as both a colonizing organism and a pathogen among many hospitalized patients (Smith et al., 1989) .

Vancomycin was shown to be an effective agent in treating serious infections due to MRSA (Piercy et al., 1989) .

Aim Of The Work

The aim of this work was to investigate the :

1-The nasal carriers state of Staphylococcus aureus among individuals in and outside hospital environment particularly in areas at high risk for severe Staphylococcal infections in hospitals as newborn nursery, intensive care units, operating rooms and cancer chemotherapy wards as massive introduction of epidemic pathogenic antibiotic resistance S. aureus into these areas may lead to serious clinical diseases and persons carrier for S. aureus may have to be excluded from these areas .

2-Antibiotic sensitivity of S. aureus isolated from different sources to illustrate the resistant S. aureus and their selection by the wide spread use of antimicrobial drugs.

REVIEW OF LITERATURE

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Normal Flora Of Nose And Nasal carriers

Innumerable bacteria are filtred from the air as it passes through the nasopharynx , trachea and bronchi . The majority of these organisms are trapped in mucous secretions and swallowed . The nasopharynx is the natural habitat of the common pathogenic bacteria and viruses that cause infections in the nose , throat , bronchi and lungs (**Wolfgang et al. , 1984**) .

The respiratory tract is divided into three sections : An upper part , including the anterior and posterior nares and the nasopharynx ; an intermediate zone common to the respiratory and alimentary tracts , including the oropharynx and the tonsils ; and a lower part , including the larynx , trachea , bronchi and lungs . **Wilson and Dick (1984)**, reported that bacterial flora of the nasal passages differs in several respects from that of the nasopharynx .

The diphteroids, staphylococci (including S. aureus) Micrococcus and Bacillus species are found in the nasal cavity (**Tortora et al. , 1989**) . Moreover , diphteroid bacilli and staphylococci (both S.aureus and S.epidermidis) are far more frequent in the nose

than in the nasopharynx , whereas∝- haemolytic, non-haemolytic streptococci and gram-negative cocci of the Neisseria subflava , are far less frequent (Wilson and Dick, 1984). These non haemolytic streptococci and gram-negative cocci appear to constitute the basal normal flora of the nasopharynx in most communities , so far as this revealed by the usual methods of cultivation (Neumann 1902 , Shibley et al., 1926 , Noble et al.1928, personal observation) .

In the nose , pneumococci and to a slight extent Haemophilus influenzae were found more frequently in cold , damp seasons than in the dry hot periods, a more definite seasonal variation occurred . In the summer monthes the organisms were confined largely to the nasopharynx , but in late winter and early spring they tended to colonize downwards into trachea and forward into nasal cavity (Masters et al. ,1958)

Since the demonstration of high S.aureus carrier rates in hospital patients (Hallman 1937) and healthy adults (Mcfarlan 1938) , it has become clear that potentially pathogenic staphylococci are part of the normal flora of the anterior nares . The subject is fully reviewed by Williams (1963) , who reported that

carrier rates of 20 to 50 percent are recorded for healthy adults and of up to 80 percent for healthy nurses are present . Repeated sampling over long periods indicates that some 10 – 20 percent of persons in a community carry persistently , in many cases probably the same type or types of staphylococcus and some 10 - 20 percent never do so . The remainder are intermittent carriers , often of different phage types of staphylococci in successive periods of carriage , suggesting successive transient colonization by environmental S.aureus (**Wilson and Dick , 1984**). It is note worthy that colonization by one type appears to prevent colonization of the nares by other types **(Rountree and Barbour , 1951)** .

Torry and Reese (1945) found that the nose was usually free from aerobic organisms till after the infants had come into close contact with their mothers for feeding as a rule at about 12 hours after birth . S.albus and streptococci of the viridans and non haemolytic groups were the first to appear ; S.aureus came later .

The carrier rate of pathogens such as S.pyogenes , S.pneumoniae and Haemophilus influenzae may be almost 100 percent in infants and is higher in children than

in adults (**Wolfgang et al. , 1984**) .

Staphylococcal Nasal Carriage

Individuals with no signs or symptoms of disease may be colonized by pathogenic micro organisms and may transmit the pathogens to susceptible hosts who develop clinical disease . There are several types of carriers as described by **Wagner (1990)** :

1- Persistent Carriers are colonized with the pathogen for long periods of time or even perpetually . The pathogen can be isolated every time when a culture is taken from the individual . Treatment with appropriate antimicrobial agent may appear to be effective , but the carrier state usually recurs when treatment is stopped .

2- Transient Carriers occasionally are colonized with a pathogenic microorganism . Most individuals are transient carriers of some microbe at some time . S. aureus and Streptococcal pneumonia frequently can be isolated from a significant percentage of the population .

3- Intermittent Carriers essentially are transient carriers with only one difference : the colonizing micro organism that is isolated from an intermittent carriers

is always the same biotype or phage type .

4- **Non-Carriers** are colonized only by non pathogenic indigenous flora .

Man is the primary host for bacteria found in the nose, and convalescent patients and healthy carriers maintain the reservoir from which others become infected . Certain individuals become nasal carriers for streptococci , staphylococci and discharge these organisms in enormous numbers from the nose into the air . Efforts to eradicate S.aureus from the nares of such individuals by the use of antibiotics have met with only limited success (**Wolfgang and Willett, 1976**).

Colonization of neonates with S.aureus is common on the umblical stump , skin surface and perineal area. Carriage or colonization by S.aureus in older children and adults is more common in the anterior nares . Adherence to the mucosal epithelium is regulated by receptors for staphylococcal teichoic acids. Approximately 15 % of normal healthy adults are persistent nasopharyngeal carriers of S.aureus . A higher incidence of carriage has been reported in hospitalized patients, medical personnel , individuals with eczematous skin disease and individuals who regularly use needles

illicitly (drug abusers) or for medical reasons (eg. insulin-dependent diabetics , patients receiving allergy injections or those undergoing hemodialysis (Murray et al. , 1990)

Patients on chronic hemodialysis tend to have a high carriage rate of S. aureus (Chow and Yu ,1989). Kirmani et al. ,(1978) found that, 62 % of hemodialysis patients carried S.aureus in their nose , throat or skin compared with 21 % of patients with chronic renal failure not on dialysis . Hemodialysis patients who were nasal carriers were significantly more likely than non carriers to also have the organism on the skin (Goldblum et al., 1978). This increased carriage is not merely due to frequent exposure to the hospital environment , because hemodialysis patients are significantly more likely to be carriers than personnel who work in the hemodialysis unit. (Goldblum et al., 1982) .

The acquistion and carriage of S.aureus is a complex problem that is incompletely understood . The infant is colonized with staphylococci within a few days after birth, but because of antibodies passively received through the placenta , the carrier rate drops during the first two years of life, by the age of six the child has acquired