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# Isolation and Antibiotic Resistance Pattern of Staphylococcus Aureus from Paper Currency

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**Conflicts of Interest:** Nil.

**Abstract**

**Context:** *Staphylococcus aureus* is one of the leading causes of human infection worldwide and is endemic in both hospitals and the community. Paper currency has recently been identified as an important mode of spread by which *Staphylococcus aureus* infection may be transmitted since it is frequently transferred from one person to another. Management of severe *Staphylococcus aureus* infection is confounded by the penchant of the pathogen to develop antibiotic resistance.

**Aims:** To study the incidence of presence of *Staphylococcus aureus* on paper currency and to identify the resistance pattern by Kirby-Bauer Disc Diffusion method.

Settings and Design: prospective study carried out in the population of Cuttack city in SCBMCH, Cuttack, India

**Methods and Material:** The study was conducted from feb 2013 to apr 2013. 200 numbers of paper currency was collected from different sources. Each sample was collected into a sterile bag and the currency notes were vortexed individually in a test tube containing 10ml of 0.8%NaCl for 10 minutes and inoculated to blood agar and mannitol salt agar. The isolated bacteria were identified to be S.aureus by standard bacteriological methods. Antibiotic susceptibility testing was determined by Kirby-Bauer disc diffusion method. Methicillin resistant *Staphylococcus aureus* was detected by using Cefoxitin disc(30mcg).

**Statistical analysis used:** None

**Results:** Out of 200 currency *Staphylococcus aureus* was isolated from 44 **(22%)** notes .Maximum number of S.aureus was isolated from hospital staff & patient attendant followed by medicine store within hospital premises.Out of all isolates of *Staphylococcus aureus* . 36.7% was found to be MRSA . Maximum number of MRSA was isolated from hospital staff & patient attendant (62.5%) . Maximum suscepitibility was shown by linezolid followed by vancomycin.

**Conclusions:** Presence of *Staphylococcus aureus* on currency clearly indicate that pathogenic microbe may spread this way. Public education on hand washing, proper handling and care of currency is advocated. Dirty & mutilated notes should be withdrawn from circulation from time to time.

**Keywords:** *Staphylococcus aureus*, Currency notes

## Introduction

*Staphylococcus aureus* is one of the leading cause of human infection worldwide and is endemic in both hospital & community .The ubiquity of *Staphylococcus aureus* is facilitated by it's commensal life style .It is found in anterior nares, skin,axilla,perinum and spreads by direct contact or through fomites. Infection with *Staphylococcus aureus* was initially considered as a

major problem in hospitals, but over the last few decades the incidence of community acquired infection has also increased [1].Researchers have proven in their finding that hospitals are the major source for the spread of pathogenic *Staphylococcus aureus* into the environment, less commonly a colonised or infected health care worker may dessseminate the organisim.The clinical spectrum of *Staphylococcus aureus* infection ranges from relatively benign soft tissue infection to severe and life threatening systemic disease .Management of severe *Staphylococcus aureus* infection is confounded by the penchant of the pathogen to develope antibiotic resistance . After the appearance of multidrug resistant *Staphylococcus aureus* there was fear of returning to preantibiotic era when it was the predominant cause of death due to hospital acquired infection.[2] During past four decade methicillin resistant *Staphylococcus aureus* (MRSA) has evolved from a controllable nuisance to a serious public health concern. Paper currency is an indispensable part of trade after the abolition of barter system and its introduction in China by the Tang Dynasty in A.D( 618-907). It is used repeatedly in exchange for goods & services and circulates in the community from one individual to another and spreads potentially pathogenic microorganisms . Paper currency can act as a fomite for spread of community as well as hospital acquired *Staphylococcus aureus* infection since it is frequently transferred from one person to another[3] . Lower denomination notes have the highest microbe load because they are exchanged more frequently.[4,5,6]

The aim of the study is to determine the incidence of presence of *Staphylococcus aureus* on paper currency and to identify the resistance pattern.

**Subjects and Methods**

The study was conducted from Feb 2013 to April 2013. 200 numbers of paper currency of lower denomination i.e 10 rupee note were randomly was collected from different sources including hospital staff, patient attendant, medicine stores, snack corner & stationary shop. Samples of paper notes were collected aseptically by letting the person drop it into separate sterile polythene bags and individual were given a equivalent replacement . Samples were brought to the laboratory and were processed immediately for isolation of*Staphylococcus aureus* . For isolation & characterisation of *Staphylococcus aureus* all paper currency samples were vortexed individually in a test tube containing 10ml of 0.8% Nacl solution for 10 min.The broth was inoculated onto blood agar and mannitol salt agar ,incubated aerobically at 37 degree Celsius for 24-48 hours to select the mannitol fermenting .Gram staining was carried out from the isolated colonies showing characteristic appearence on MSA medium .The isolates were confirmed to be *Staphylococcus aureus* by various standard biochemical tests[7].The antibiotic susceptibility of the isolates were studied by Kirby bauer disc-diffusion method .The susceptibility assay was performed on muller-hinton agar plates using seven different antibiotics (Hi-media Ltd) including cefadroxil (30mcg), clindamycin(2mcg) ,gentamycin(10 mcg), linezolid(30mcg),cefoxitin(30mcg),vancomycin (10/10mcg) ,ampicillin-sulbactum (10/10 mcg) Quality control for susceptibility testing was done using *Staphylococcus aureus* ATCC25293 .Methicillin-resistant staph aureus(MRSA) was detected by using cefoxitin disc (30mcg)

**Results**

From the analysis of 200 paper currency notes collected from different shops & hospitals S.aureus was isolated from 44 (22%) notes.Maximum number of S.aureus was isolated from hospital staff and patient attendant(40%) followed by medicine stores(36%) within the hospitals,medicine store away from hospital(6%) snack corner & groccery shops(5%). Out of all isolates of

*Staphylococcus aureus* 36.7% was found to be MRSA . Maximum number of MRSA was isolated from hospital staff & patient attendant(62.5%) followed by medicine stores within the hospital(26%). No MRSA was detected from medicine stores away from the hospital and snack corners and grocery shops. Maximum suscepitibility was shown by linezolid (100%) followed by vancomycin (90%). Maximum resistance was to 3 rd generation cephalosporin (cefadroxyl).

**Discussion**

Fomites act as very important mode of spread of many pathogenic microorganisms.Paper currency which is used for every type of commerce and exchanged frequently between personells act as a efficient fomite to transmit these microorganisms.

In India paper currency is handled badly by unhygienic practices like using saliva for counting notes,storing them in polythene or leather bags in humid and dark condition like keeping them under their undergarments,socks results in contamination with microorganisms.It is seen that paper currency offers a large surface area as a breeding ground for pathogens.[8] The older the paper note more the accumulation or microbes occur.[9]

S.aureus which is a pathogen can cause significant morbidity and mortality.[10]It is seen that the reservoir for important microorganisms like S. aureus is hospital environment where the MRSA is the major cause of hospital acquired infection.Studies conducted by researchers showed that around S.aureus is the major pathogenic bacteria isolated from currency notes60% by Ghamdi etal and 83.3% by Abdulla SM.[11]Several other studies showed that the major source of spread of pathogenic S.aureus to the environment is from hospitals.[12,13]

Patients themselves infected or colonized,their attendants and the health care worker act as the major reservoir of S. aurus in the hospital setting[14]. A healthy attendant can carry this pathogen to the medicine stores inside the hospital. In this study we have studied the prevalence of S.aureus from different locations including the hospital area and area away from the hospital premices.It is seen that low value notes have more wide spread use and exchanged frequently between people in population.[15] That is why have preffered to choose rupees 10 note for the study.

Staphylococcus aureus which when present in the nose often contaminates hands , fingers can easily become skin carrier.[16]

Out of the 200 samples collected from different sources S. aureus was isolated from 22% of notes where as with other studies isolation rate was 25% and 60%[17,8]Maximum numer of S. aureus was isolated currency collected from people inside the hospital( 76%) proves it's presence in the different reservoir like patient attendants(40%),medicine stores within the hospital premices(36%). Number of pathogenic osmotolerant mannitol fermenting S. aureus is found to be less in the community showing percentage of isolation form snack corners(6%) and gocery shops(5%) out side the hospital .Availability and frequency of isolation of S. aureu varies from place to place but its presenceon the currency notes indicates that pathogen can spread in this way.[3]

Maximum number of MRSA was isolated from hospital staffs and patient attendants (62.5%) where as no MRSA was detected from currency notes collected from outside the hospital in our study.Similar finding was seen in study conducted by Kumar JD etal.[16] where maximum number of S. aureus isolates having different virulence gene from paper currency collected from hospital. All the isolates were found to be sensitive to Linezolide. Varying degree of resistance was showen to different antibiotics and maximum resistance was detected towards

Cefadroxyl ,a third generation cephalosporin. This pattern is similar to theS.aureus isolates of our hospital.

Frequency of *S. aureus* on paper currency collected from different places varies with collection site, the presence of *S. aureus* on currency clearly indicate that pathogenic microbe may spread this way.It is the need of the hour to educate the public on hand washing and proper handling and care of currency . Dirty & mutilated notes should be withdrawn from circulation from time to time.

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