Bacteriological profile of Indian currency circulating in a tertiary care hospital in rural Bengal

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ABSTRACT

Background: Everyone has to handle currency notes every day and during transaction different kinds of microorganisms contaminate the currency notes, which include normal saprophytic microflora to pathogenic microorganisms.
Aim: To find out the likelihood of bacterial contamination of currency circulating in a tertiary care hospital of rural West Bengal, the bacteriological profile and antibiotic resistance pattern of the isolates.
Methods: Total 100 currencies of 6 different denominations were collected from the hospital premises in sterile polythene bags. Pure isolates were identified by colony characteristics, Gram staining, motility and different biochemical tests. Antibiotic sensitivity tests were done by Kirby Bauer disc diffusion technique.
Results: 91% of currencies were contaminated with pathogenic organisms. 116 isolates of 11 different bacterial species were identified. Enterococcus sp (25%) was the most frequently isolated bacteria followed by Coagulase negative Staphylococcus (20.68%), Staphylococcus aureus (12.06%), Bacillus sp (12.06%), Escherichia coli (9.48%), Klebsiella sp (5.17%), Micrococcus sp(5.17%), Diphtheroids(4.31%). 35.71% of S.aureus were MRSA, whereas 12.5% coagulase negative staphylococci were methicillin resistant. Piperacillin –Tazobactum showed good efficacy against E.coli and Klebsiella sp resulting in only 36.36% and 16.66% resistance respectively.
Conclusions: This study revealed that currency circulating in this hospital premises were contaminated with different pathogenic and potential pathogenic bacteria including multi drug resistant strains. So the need to improve health consciousness among people while handling currency is an urgent issue.

Key words: bacterial contamination, currency, hospital

INTRODUCTION

Currency is handled by all categories of people and may be contaminated during coughing, sneezing, touching with hands and placement on dirty surfaces.[1] Many people tongue-wet their fingers when counting money thereby, contaminating their fingers as well as currency notes. So, it is obvious that anything that gets on hands may be transferred to money and vice-versa.

Search for contaminated currency started in early 1970s, reported potential pathogens on 13% of coins and 42% of paper currency collected from laboratory personnel.[2]

Studies in different parts of India show that predominant organisms isolated from contaminated currency are Bacillus sp followed by Coagulase negative Staphylococci (CNS) and Micrococcus sp. Other pathogenic bacteria present in the currency are Klebsiella pneumoniae, Escherichia coli, Staphylococcus aureus, Pseudomonas sp, Salmonella sp, Proteus sp.[3,4] But in a recent study conducted in Nagpur, Escherichia coli was found to be the most common organism.[5] This finding resembles the data collected from the study in Bangladesh.[1] So, pattern of contamination varies from one place to another.

Therefore, the present study was focused on the bacteriological niche of circulating currency in a tertiary care hospital in rural Bengal. To the best of our knowledge this study is first of its kind conducted in a hospital setting in India.

MATERIALS AND METHODS

Type of study: Hospital based Cross sectional study. Study area: Study was conducted in College of medicine and JNM Hospital, Kalyani, Nadia, West Bengal. Study period: Two months- June 2012 to August 2012. Study population: Currency was collected from OPD ticket registration counters, hospital pharmacy, laboratory

Pal K et al. Bacteriological profile of Indian currency circulating in a tertiary care hospital in rural Bengal

IJRRMS 2013;3(2)

technicians, ward boys, Group D staff, nurses, doctors working in the hospital, patients as well as companions of patients, whoever present in the hospital premises. Currency of Rs. 2, 5, 10, 20, 50, and 100 according to availability were collected randomly without any special selection criteria. Sample size: Total hundred currencies of different denominations were investigated.

Collection of samples: Persons handling the money were asked to deposit the currency in a sterile polythene bag; after being compensated with other currency of same value. Samples thus collected were sealed, tagged (serial number, source, date of collection) and taken to the bacteriology laboratory for analysis. From the local bank, five new currency notes of each denomination were obtained and used as control.

Isolation of bacteria: A sterile cotton swab soaked in sterile normal saline was rubbed thoroughly on both surfaces of currency notes. Then swab was inoculated on a plate of blood agar media and MacConkey's agar media. The plates were incubated aerobically at 37^0C for 24 hrs. Plates were observed for growth of bacteria, mixed growth was further subcultured to obtain pure colony. The colony was identified phenotypically by colony characteristics, Gram staining, motility, biochemical tests as per standard protocol. The media used were prepared in the laboratory from

commercially available dehydrated media, procured from Hi-Media Laboratories.

Antibiotic sensitivity testing: Antibiotic sensitivity testing was done by Kirby-Bauer method of disc diffusion susceptibility testing, modified by CLSI (Clinical Laboratory Standard Institute).[6]

RESULTS

Out of the 100 currency notes of six different denominations obtained from the hospital premises, 91 were found to be contaminated; whereas all (30) notes obtained from the bank were sterile. A total of 11 different species of bacteria resulting in 116 isolates were found from those 91 contaminated notes. Among the 116 isolates, 62 (53.44%) were pathogenic to the healthy host and 54 (46.55%) were potential pathogen for immunocompromised host. Dirty and torn currency notes had multiple microbes.

Of the 116 isolates, 95 (81.89%) were Gram positive bacteria. Enterococcus (25%) was the most frequently isolated bacterial species followed by Coagulase negative Staphylococcus (20.68%), Staphylococcus aureus (12.06%) Bacillus sp (12.06%), Micrococcus (5.17%), Diphtheroids (4.31%), and α hemolytic streptococcus (3.45%). Among Gram negative bacilli Escherichia coli (9.48%) was most prevalent followed by Klebsiella sp (5.17%), Enterobacter sp (1.72%) and a nonfermenter Gram negative bacillus (0.86%). (Table-1)

Table 1: Relative occurrence of bacterial species on currency notes of different denominations

Currency denominations	Rs 2	Rs 5	Rs 10	Rs 20	Rs 50	Rs 100	
No. of currency (N)	N= 5	N=15	N= 40	N= 20	N=15	N=5	Number (%)
S.aureus	1	3	8	2	0	0	14(12.06)
CNS	1	3	8	5	6	1	24(20.68)
Enterococcus sp	1	5	12	7	4	0	29(25)
Micrococcus sp	0	2	2	1	1	0	6(5.17)
α hemolytic Streptococcus	0	1	2	1	0	0	4(3.45)
Bacillus sp	1	3	4	3	2	1	14(12.06)
Diphtheroids	0	1	2	2	0	0	5(4.31)
Esch.coli	0	1	6	2	2	0	11(9.48)
Klebsiella sp	1	0	4	0	1	0	6(5.17)
Enterobacter sp	0	0	2	0	0	0	2(1.72)
Non fermenter GNB	0	0	1	0	0	0	1(0.86)
Total organisms isolated	5	19	51	23	16	2	116 (100)
No. of notes Sterile	0	0	3	2	1	3	9
No. of notes contaminated	5	15	37	18	14	2	91
Rate of contamination	100%	100%	92.5%	90%	93.3%	40%	91%

Pal K et al. Bacteriological profile of Indian currency circulating in a tertiary care hospital in rural Bengal

IJRRMS 2013;3(2)

Resistance pattern of all pathogenic Gram positive organisms along with Coagulase negative staphylococcus and Gram negative bacilli were given in table 2 & table 3 respectively. Of the 14 Staphylococcus aureus, 5 were MRSA and of the 24 coagulase negative staphylococci 3 were resistant to cefoxitin though none was resistant to vancomycin, teicoplanin and linezolid. But 3.44% of Enterococci showed resistance even to teicoplanin. S.aureus showed 50% resistance to azithromycin whereas 37.5% of coagulase negative staphylococci and 41.38% enterococci were resistant to azithromycin. Resistance to amikacin was quite similar to all these Gram positive cocci ranging from 29.17% for coagulase negative staphylococci to 35.71% for S.aureus.

Table 2: Resistance pattern of Gram Positive Bacteria

	Antibiotic	S.aureus	CNS	Enterococcus
		N=14(R%)	N=24(R%)	N=29(R%)
1	Ampicillin	9(64.29)	16(66.66)	27(93.1)
2	Cefoxitin	5(35.71)	3(12.5)	--
3	Vancomycin	0(00.00)	0(00.00)	0(00.00)
4	Teicoplanin	0(00.00)	0(00.00)	1(3.44)
5	Linezolid	0(00.00)	0(00.00)	0(00.00)
6	Clindamycin	3(21.43)	2(8.333)	--
7	Gentamicin	7(50.00)	10(41.67)	14(48.28)
8	Amikacin	5(35.71)	7(29.17)	9(31.03)
9	Azithromycin	7(50.00)	9(37.5)	12(41.38)
10	Ciprofloxacin	6(42.86)	6(25)	9(31.03)
11	Gatifloxacin	5(35.71)	7(29.17)	10(34.48)
12	Ofloxacin	6 (42.86)	7(29.17)	12(41.38)
14	Chloramphenicol	4(28.57)	8(33.33)	8(27.59)

All the Gram negative bacilli were resistant to ampicillin, and were universally sensitive to imepenem. Fifty percent of E. coli and Klebsiella were resistant to amoxyclav. These two bacteria were found to be quite sensitive to aztreonam and piperacillin- tazobactum. Resistance of E.coli to fluoroquinolones varied from 36.36% to gatifloxacin to 63.63% to norfloxacin. E.coli were more resistant to gentamicin (54.54%) than amikacin (45.54%). Klebsiella were found equally resistant to both amikacin and gentamicin(33.33%) so as Enterobacter(50%) and Nonfermenter GNB(100%). Resistance of E.coli to different

Table 3: Resistance pattern of Gram negative bacteria

	Antibiotic	E.coli	Klebsiella	Enterobacter	Non fermenter GNB
		N=11(R%)	N=6(R%)	N=2(R%)	N=1(R%)
1	Ampicillin	10(90.9)	6(100)	2(100)	1(100)
2	Amoxycillin- clavulanic acid	6(54.54)	3(50)	2(100)	1(100)
3	Amikacin	5(45.54)	2(33.33)	1(50)	1(100)
4	Gentamicin	6(54.54)	2(33.33)	1(50)	1(100)
6	Ofloxacin	5(45.54)	3(50)	0(00.00)	0(00.00)
7	Gatifloxacin	4(36.36)	2(33.33)	2(100)	1(100)
8	Norfloxacin	7(63.63)	3(50)	2(100)	1(100)
9	Cefixime	7(63.63)	4(66.66)	2(100)	1(100)
10	Cetriaxone	4(36.36)	4(66.66)	1(50)	1(100)
11	Ceftazidime	5(45.54)	2(33.33)	1(50)	1(100)
12	Cefotaxime	6(54.54)	3(50)	2(100)	1(100)
14	Aztreonam	4(36.36)	2(33.33)	1(50)	1(100)
15	Imepenem	0(00.00)	0(00.00)	0(00.00)	0(0.00)
16	Piperacillin - Tazobactam	4(36.36)	1(16.66)	2(100)	1(100)
17	Chloramphenicol	6(54.54)	2(33.33)	1(50)	1(100)

cephalosporin groups varied from 36.36% to ceftriaxone to 63.63% to cefixime whereas resistance of Klebsiella sp varied from 33% to ceftazidime to 66% to cefixime and ceftriaxone. Resistance of chloramphenicol was least to Klebsiella (33.33%) and highest to nonfermenter GNB(100%).

DISCUSSION

The results of this study revealed that currency notes are commonly contaminated with various bacteria. We found that 91% of tested currency notes were contaminated with bacteria, which is higher than that previously reported from Nagpur[4] and Nigeria[7] but is lower than the results obtained by some researchers from India,[3,8] Pakistan,[9] and US[10] where almost all the notes were contaminated.

Different species of bacteria isolated in our study are almost similar to the studies done in Saudi Arabia,[11] Pakistan,[9] Ghana,[12] Nigeria,[13] and US[10]. All these studies established gram positive bacteria as the major isolates from the contaminated currency. On the contrary, studies in Assam,[14]

Bangladesh,[1] and Nigeria[7] had shown Gram negative organisms like E.coli, Pseudomonas sp., Klebsiella sp as the predominant one.

We observed Enterococcus sp as the commonest contaminant of the circulating currency, an observation similar to that done in in Africa.[15] However, it was not prominent in any other Indian studies. This discripancy in bacterial pattern may be attributed to regional variation of bacterial profile, habits of the local people and also due to the fact that all the Indian studies done so far involved community set up and were not centered on hospitals. Presence of Enterococci is suggestive of significant fecal contamination of currency, and is a reflection of poor local environmental sanitation and personal hygiene.[16] It also signifies a potential minefield for nosocomial infections.

Present study found relatively more prevalence of bacteria among lower-denomination notes, which was similar to the finding of a study done in Nigeria.[7] The damaged and torn dirty notes were more contaminated than only dirty notes and some contain more than one species of bacteria. These findings may be due to more hand-to-hand exchange.

This study revealed that many multidrug resistant strains of different isolates were prevalent in the currency which included methicillin resistant S.aureus, methicillin resistant coagulase neagative staphylococci, multi drug reristant Escherichia coli and Klebsiella. Though incidence of MRSA in this study was much less than that of a study done in Ghana,[17] its presence is always a threat to hospital patients. There also exists a difference of antibiotic resistance pattern among various other studies,[15,18] that can be explained by the regional variation of prevalent organisms and different antibiotic regimens used for treating those organisms.

CONCLUSION

It can be concluded that currency in this hospital is commonly contaminated with different pathogenic and potential pathogenic bacteria and all the people handling currency are invariably exposed to those microorganisms. So, awareness related to the improvement of personal hygiene and good money handling practice such as washing hands properly with soap and water after handling currency before eating and avoiding using saliva during counting money are strongly recommended as the main pillar to reduce the risk of infection.

AUTHOR NOTE

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Pal K et al. Bacteriological profile of Indian currency circulating in a tertiary care hospital in rural Bengal

IJRRMS 2013;3(2)

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