# Bacterial Aetiology And Frequency of Nosocomial Blood-Stream Infection Among Children in Khartoum State: A Pilot Study

Naser Eldin Bilal[1,*], Alnazier Altayeb Ali[2], Fathi Mustafa[3], Alsamani Abdalmahmoud[4]

[1] *General Director of the Central Research Laboratory. University of Khartoum, Sudan*

[2] *Ministry of Health .Khartoum state. Sudan.*

[3] *Omdorman Islamic University. Sudan*

[4] *Ministry of health .Algazera state. Sudan.*

** Central Research Laboratory: University of Khartoum*

***Abstract: Nosocomial bloodstream infection is an important cause of morbidity and mortality. The case- fatality rates for it up to 50% for some microorganisms and represents 5% of hospital infections. The aim of this study was to determine the bacterial aetiology and frequency of nosocomial bloodstream infection among children in Khartoum state.***

***A pilot prospective study was conducted in two major hospitals, from 7 July to 21 August 2015. A blood specimen for bacteriological culture was collected from patients (< 18 years age) who developed fever after 48 hours or more post admission. Blood specimens were investigated using conventional blood culture technique. All blood specimens collected were incubated in ambient air at $37^0$C for 7 days.***

***Of 175 paediatric patients, 64 patients developed fever at hospitals. The frequency rate of nosocomial blood stream infections among 34 fibril patients was 11.7% (7.6 cases per 1000 hospital-days). Four (4/34) isolates (P.aeruginosa (2), S.aureus and S.epidermidis) were recovered with no death observed among infected patients. The frequency of fever development at hospital was 36.5% (64/175). The average hospitalization days were 10 days (n=175) for paediatric patients. And the average days between patient admission and development of fever (n=64) were 9 days, while the average hospital stay for the NCBI cases were 25 days. All patients had implemented intra-venues catheter for average mean of four days.***

***Our findings showed that nosocomial bacteraemia infections had high frequent rate and prolonged hospitalization period for 15 days, despite increased use of broad spectrum antibiotics.***

***Keywords: Nosocomial infection, Blood stream, children.***

## I. INTRODUCTION

The burden of sepsis on health care is significant. Worldwide, 13 million people become septic each year and 4 million die. The mortality rates for severe sepsis are 30 to 50%; for septic shock, even higher than 50% [1]. Healthcare Associated Infections (HCAI) occurs in both developed and developing countries; approximately 1.4 million patients acquire HCAIs each day [2]. Of every 100 hospitalized patients at any given time, 10 in developing countries will acquire at least one health care-associated infection [3]. In Sudan, 41 % of population were <15 years old in 2013, with under-five mortality rate (probability of dying by age 5 per 1000 live births) 76.6 [4].

In addition to an increase in incidence of NBSI, the proportion caused by multidrug resistant pathogens is also rising [5]. Despite advances in antimicrobial treatment, NBSI prolongs hospital stay, increases direct patient care costs and directly causes mortality [6,7,8]. These infections represent a small proportion of nosocomial infections approximately 5%. However with significant impact include indirect cost and increase of multidrug resistant bacteria [6]. But hand washing is the single most important measure in the prevention of healthcare associated infections [7].

The case- fatality rates for nosocomial bloodstream infections are high up to 50% for some microorganisms. NCBI represent 5% of hospital infections [6]. The aim of this study was to determine the bacterial aetiology and frequency of nosocomial bloodstream infection (NBSI) among children in Khartoum state.

## II. METHODS

All patients admitted to the hospitals from 7 July to 21 August 2015 were included except those patients diagnosed at time of admission had sepsis or complain of fever, neonates were not included in this study.

Blood specimens (5 ml) were collected from consented patients with body temperature more than $37C^0$ (on axilla). Inoculated in brain heart infusion broth (20 ml) supplied from Himedia company® India (lot No: LQN302), this batch was validated for sterility and performance test by research team.

The pathogenic bacteria were identified through conventional blood culture technique described by WHO

[9]. All the isolates were subjected to antibacterial susceptibility testing using Kiraby Baur method [10].

## III. RESULTS

Of the 175 (81 males / 94 females) paediatric patients, 64 patients developed fever at hospitals. The frequency of fever development at hospital was 36.5% (64/175). 34 blood specimens were collected from 34 of 64 febrile patients. Four isolates were recovered with no death observed among infected patients. The 4 isolates were *P.aeruginosa* (2), *S.aureus and S.epidermidis*. No multiple episodes of infection were detected. The frequency rate for NBSI among fibril patients (4/34) was 11.7% (7.6 cases per 1000 hospital-days). Three of the infected patients were females and one was male. Two of them were diagnosed had jaundice, one had acute inflammation and the fourth suffer from Sickle cell anaemia.

The average hospitalization days for paediatric patients were 10 days (n=175). The average days between patient admission and development of fever were 9 days (n=64). The laboratory confirmed NCBI had 25 average hospitalization days (n=4), so NCBI prolongs hospitalization days up to 15 days.

During survey period the patient prophylaxis included broad spectrum antibiotics; ciprofloxacin, cefoxitin, vancomycin and ceftriaxone. The antibacterial susceptibility testing of the isolates is shown in table 1. None of the isolates was susceptible to cotrimethaxazole. The isolated *Pseudomonas* was resistant to amoxicillin and sensitive to pipracillin. None of the Gram positive was resistant to vancomycin.

The table shows the patterns of antibacterial susceptibility testing of the isolates.

The most frequent underlying conditions for NCBI were gastrointestinal tract illness, haematological diseases and central nervous system problems. 82% of patients (n=34) had low hygienic practice. All patients had implemented intra-venues catheter for average mean of four days.

## IV. DISCUSSION

Sudan is classified as low middle income country by world health organization. Sudan provides 2.8 physicians per 10 000 population and 1.3 hospitals per 100 000 population and 6.7 total expenditure on health as % of gross domestic product. In Sudan 41 % of population were less than 15 years old in 2013, with under-five mortality rate (probability of dying by age 5 per 1000 live births) is 76.6 [4]. This let children sepsis as a main issue. In this study 175 children were monitored, for a rise of nosocomial bloodstream infection, for 48 days in two paediatric specialist hospitals from 7 July to 21 August 2015.

The frequency of infection rate found to be very high despite, broad spectrum antibacterial prophylaxis. This indicates increased development of multi-drug resistant bacteria, which convey another risk to treatment of infectious diseases in this country.

This rate is higher than the incidence reported by Aiken *etal* in Kenya from 2002 to 2009 the incidence was 1·0/1000 days in hospital [11]. This might be due to increase in sample size and surveillance period. The increased frequency rate of this study may contribute to prolong average days of IV implantation (4 days) and admission with haematological diseases because of necessary or unnecessary blood transfusion [11]. The frequency rate of this study is lower than the study reported by Vaquero, 2011 in which the infection rate was 37.8/1000 days. However, Vaquero investigated children received parenteral nutrition that was not including as main criteria for this study [10]. It is lower than the frequency rate of 24.5 per 100 hospital-days reported by Asembergiene [12].

In this study all patients were infected with single bacterium. This is in agreement with Marra *etal* 2011 where 95% of bloodstream infection was single bacterium [13,14,15]. Isolation of *S.epidermidis* as in most blood culture interpretation reported as contaminant isolate but it remains the most common isolate from noscomial bloodstream infection as reported by Wisplinghoff *etal*, 2004 (32% of isolates) [15]. Other studies reported that coagulase-negative *Staphylococcus* was most frequent isolate [14,15,16]. In this study population, fever developed faster than that reported by Wisplinghoff, which at least 13days for *E.coli* infections [15].

The isolated *S.aureus* was not resistant to vancomcin, as other studies in Sudan indicate low prevalence of VRSA among clinical isolates. (Prevalence of VRSA was 2.3% [17] and VSSA was 12% [18]) and most VRSA emerged among MRSA. (6.5% of MRSA were VRSA) [19]}, the resistance to co-trimexazole required further studies and alert emergence resistance among clinical isolates. Despite emergence resistance of *pseudomonas aeuroginosa* reported worldwide [20]. The isolated *pseudomonas* was not multidrug resistant one.

Hand washing remains the most single effective measure to prevent nosocomial infections. Aseptic insertion and care of IV catheter may also prevent BSIs.

## V. CONCLUSION

Although nosocomial bacteraemia is rare, it has high frequent rate and prolonged hospital stay. Increased use of broad spectrum antibiotics was observed.

**What is already know on this topic**

- The burden of sepsis on health care is significant. Worldwide, 13 million people become septic each year and 4 million die.
- The case- fatality rates for nosocomial bloodstream infections are high up to 50% for some microorganisms.
- NCBI represent 5% of hospital infections.

**What this study adds**

- The frequency rate for NBSI among fibril patients was 11.7%.
- The frequency of fever development at paediatric hospitals was 36.5%.
- NCBI prolongs hospitalization days up to 15 days.

## VI. COMPETING INTERESTS

The authors declare no competing interest.

## VII. AUTHORS' CONTRIBUTIONS

(Alnazier, Fathi, Alsamani) were team work who designed the study, participated in blood samples collection, bacteria identification, data analysis and writing the manuscript (Naser) approved and revised the study proposal, supervised the study and helped drafting the manuscript.

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**Tables**

**Table 1** Patterns of antibacterial susceptibility testing of the isolates.

| Isolates | Antimicrobial agent | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | VA | GE | CIP | E | P | PI | CTR | C | AMC | COT | TE |
| *P.aeruginosa*(2) | - | S | S | - | - | S | S | S | R | R | R |
| *S.epidermidis* | S | S | S | R | R | - | - | - | - | R | - |
| *S.aureus* | S | S | S | R | R | - | - | - | - | R | - |

VA: vancomycin 30mcg. GE: gentamicin 10mcg. CIP: ciprofloxacin 5 mcg. E: erythromycin 15mcg. P: penicillin 10mcg. PI: pipracillin 30mcg. CTR: ceftriaxone 30mcg. C: chloramphenicol 30 mcg. AMC: amoxyclav 30 mcg (2:1). COT: co-trimethexazole 25 mcg (1.25:23.75). TE: tetracycline 30 mcg. R: resistant. S: sensitive.

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