*International Journal of Research and Review*
*Volume 11; Issue: 9; September 2024*
*Website: www.ijrrjournal.com*
*Audit Report* *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

# Blood Culture Contamination in a Busy Emergency Ward of a Tertiary Care Hospital in Kolkata

**Syamasis Bandyopadhyay[1], Aheli Ghosh Dastidar[2], Sandip Kumar Chandra[3], Aloke Dutta[2], Soma Dutta[4], Ujjwayini Ray[4]**

[1]Senior Consultant, Department of Internal Medicine, Apollo Multispecialty Hospital Kolkata
[2]Post Graduate Trainee, Department of Internal Medicine, Apollo Multispecialty Hospital Kolkata
[3]Consultant, Department of Internal Medicine, Apollo Multispecialty Hospital Kolkata
[4]Consultant Microbiologist, Department of Microbiology, Apollo Multispecialty Hospital Kolkata

Corresponding Author: Aheli Ghosh Dastidar

**DOI: https://doi.org/10.52403/ijrr.20240913**

## ABSTRACT

**Introduction:** Blood culture contamination (BCC) is a serious clinical problem which leads to consequences like initiation or prolongation of antibiotic therapy, complications associated with antibiotic use and prolongation of hospital stay adding to healthcare expenses etc. BCC occurs mostly during sample collection. A Survey of blood collection technique in hospital showed that blood culture sample collection into BACT ALERT bottles by plain syringes results in multiple surface contact thereby increasing contamination rate. To overcome this problem a set of new blood culture vacutainer holder was introduced so that blood could directly be collected into blood culture bottles without any intermediate contact. This audit was done to objectively evaluate whether introduction of this device reduces BCC rates in a hospital.
**Methods:** Data of BCC rate in blood culture samples collected in emergency was assessed for 1 month period before and after introduction of new blood culture holders.
**Results:** BCC rate before and after introduction of new holders were 25.33% and 9.57% respectively. The results thus demonstrated a 62.21% reduction in blood culture contamination rate. Chi Square test showed a significant reduction of BCC rate after this improvisation of sample collection technique. (p value 0.001)
**Conclusion:** Introduction of the improvised blood culture collection technique with special holder objectively reduced BCC rates without any significant increase in cost. Findings of this clinical audit instils hope that the wider usage of this device can bring down BCC rates significantly, while at the same time ensuring convenience of collection and increasing needle safety.

***Keywords:*** Blood Culture Contamination, contaminants, Vacutainer holder

## INTRODUCTION

Blood culture contamination (BCC) is defined as presence of commensal or environmental organisms grown from blood culture bottle probably not representative of true bacteremia. [1]
Blood culture contamination is a significant problem as it increases false positive rates leading to unnecessary and avoidable antibiotic exposure which has a number of serious consequences like promoting resistance patterns, increased susceptibility to C diff infection, increasing cost etc. False positive cultures may lead to other avoidable consequences like unnecessary removal of uninfected indwelling catheters and devices, prolongation of hospital stay

including increased morbidity and mortality and burden on healthcare facilities and finances.

Hospital infection control team is set up for regulation of BCC rates by data collection, conduction of clinical audits and implementation of recommendations.

Observation programmes worldwide have shown that almost all of BCC occurs during sample collection process linked with poor collection technique and inadequate skin disinfection. The contaminants found are mostly skin flora like coagulase negative staphylococci (CONS). Hence it is important to maintain proper standard and technique of blood culture sample collection.

In our hospital, thorough review of blood culture sample collection technique by team survey showed that there was considerable amount of difficulty faced by nursing and paramedical staff in maintaining sterility while collecting the samples using available blood culture bottle and vacutainer holder ultimately resulting in multiple surface contact and thus increasing contamination rates. The main reason was that the current practice of blood culture sample collection involved collecting blood from venipuncture sites by syringes and then pouring the blood into BACT ALERT blood culture bottles. This practice not only increases number of pricks but also increases chances of needle stick injury during sample collection. Needle stick injury in phlebotomy practice is a common occurrence and has serious consequences. [2] [3] To overcome this problem, blood culture vacutainer holders (VACUETTE) which facilitates collection of blood directly from venipuncture site into BACT ALERT bottles were introduced. (Figure 3) This simple improvisation was meant to reduce surface contact, reduce chances of contamination and ensuring safe and the purpose of this audit was to evaluate whether usage of this bigger sized blood culture holder of could bring down BCC rates.

Data of patient in relation to demographics, date of initial collection, date of growth flagged by the BACT Alert system (if any), contaminant detection, common contaminant flora, true positive blood culture and pathogens grown were collected for a period of 1 month before and after introduction of new blood collection regimen in an anonymous tabular format.

convenient sample collection. The chances of needle stick injury can also be effectively curtailed. This audit was done to objectively evaluate whether introduction of this device actually brings down the blood culture contamination rate.

## MATERIALS & METHODS

Generally, blood cultures are drawn by performing venipuncture using syringe and pouring the blood into BACT ALERT blood culture bottle. This is because the plastic vacutainer holder (BD vacutainer holder), currently in use, is too small for direct attachment of the BACT ALERT bottle into the holder. (Figure 1) Hence blood for culture had to be collected from venipuncture site separately by syringes. This increases the chance of surface contamination and needle stick injury.

Figure 1

There is availability of plastic vacutainer holder (VACUETTE) with a bigger surface area and volume to accommodate the BACT ALERT bottles without any significant additional cost involvement which also can be used for other blood sample collection using vacutainers. (Figure 2) As the system

was on same principle of blood drawing, no further additional training was needed. This device was introduced in the emergency department where the initial set of blood cultures are usually collected before initiation of antibiotic therapy.

Figure 1

Data collection was done from sample of those patients who fulfilled the following **Inclusion Criteria:**

- Age >18 years
- History of fever (more than 100F and duration greater than 48 hours)
- No history of hospital admission in the last 3 months
- Not on any antibiotic in preceding 7 days
- Sample collected directly by venepuncture
- Sample sent from the emergency department to the laboratory directly

**Exclusion criteria were:**

- Patients with a known diagnosis like malaria, dengue, COVID, Influenza etc
- Patients whose samples were collected from central lines

Data collected was tabulated and analysed in Microsoft excel. Chi Square test was used to compare the blood culture contamination rate before and after introduction of blood culture bottles.

Figure 3

## RESULT

The mean age of the patients was 46 years. 55.23% were females. Before the intervention, 47 out of 150 samples showed a subculture after initial inoculation. 38 out of them (25.33% of total samples) were contaminants as confirmed by growth in only one set of blood culture. Among the contaminants the commonest organism was coagulase negative staphylococcus (CONS). 6 % of samples showed growth of pathogenic bacteria and were true positive blood cultures. The commonest organisms causing septicaemia were found to be *Klebsiella pneumoniae, Pseudomonas aeruginosa, and Salmonella* sp.

After this intervention, post intervention data for a period of one month showed positive subcultures in 38 out of 209 samples (18.18%). Out of them 20 were contaminants (9.57% of total samples). Commonest organisms among contaminants remained coagulase negative staphylococci. 8.61% of samples yielded pathogenic bacteria. The commonest ones were E coli and Salmonella typhi.

The results thus demonstrated a 62.21% reduction in blood culture contamination rate.

Chi square test was performed to evaluate whether usage of holders had any effect on the blood contamination rate. Chi square statistic with Yale correction was found to be 14.87 and p value was evaluated as 0.0001 (<0.05). Hence blood culture

contamination rate significantly reduced after usage of blood culture vacutainer holder.

**Table 1: Table showing Blood Culture Contamination Rate before and after introduction of holders**

| | **Total number of blood culture samples** | **Number of samples showing growth of contaminant flora** | **Number of samples showing growth of pathogenic bacteria** | **Rate of Blood Culture Contamination** |
|---|---|---|---|---|
| **Before usage of holder** | **150** | **38** | **9** | **25.33%** |
| **After usage of holder** | 209 | 20 | 18 | 9.57% |

## DISCUSSION

BCC is a frustrating problem for microbiologists and clinicians alike. The American Society for Microbiology (ASM) and the Clinical Laboratory Standards Institute (CLSI) have recommended to keep the blood culture contamination rate to a maximum of 3%. [4]

However, the blood culture contamination rate varies widely among different countries worldwide and also within institutes. [5-8]

BCC has a lot of downstream consequences ranging from potential adverse effect of unnecessary exposure to antibiotics and associated side effects, increased length of stay and avoidable healthcare expense. [4]

A study by Souvenier et al showed that 41% of blood culture contamination cases by CONS were treated with antibiotics with 34% of the cases receiving vancomycin [9]

Patients who are started on antibiotics often receive a prolonged course. Mean duration of antibiotic therapy among patients whose blood samples showed growth of contaminants was found to be 7 days by van der Heijden et al. [10]

Another study calculated that the average length of stay among hospitalized patients whose blood cultures grew contaminants was prolonged by 5.4 days when compared with hospital controls. [11]

Hence BCC reduction is a global target. Continuous review, training and improvisation of sampling techniques are required to ensure low rates of contamination. The present audit was done to validate whether the introduction of blood collection holder designed to reduce surface contact, could actually bring down BCC rates in real life and showed some hopeful results in terms of reduction in BCC rate.

## CONCLUSION

Introduction of the VACUETTE Blood culture holder showed an immediate reduction in blood culture contaminants. This audit done in a single busy department can be used as supportive evidence in introducing these bottles across the entire hospital and beyond. The benefits derived from usage of this relatively inexpensive device in BCC reduction holds a sizeable significance and goes a long way in reducing healthcare expenses. This audit reiterates the fact that constant review and improvisation should be the cornerstone in BCC reduction strategy.

### *Declaration by Authors*

**Acknowledgement:** None

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

## REFERENCES

1. Palavecino EL, Campodónico VL, She RC.2024. Laboratory approaches to determining blood culture contamination rates: an ASM Laboratory Practices Subcommittee report. J Clin Microbiol. 62:e01028-23. https://doi.org/10.1128/jcm.01028-23
2. Gaffney K, Murphy M, Mulcahy F. Phlebotomy practices/needles stick injuries/hepatitis B status/among interns in a

Dublin hospital. Ir Med J. 1992 Sep;85(3):102-4. PMID: 1399472.
3. McGuff J, Popovsky MA. Needlestick injuries in blood collection staff. A retrospective analysis. Transfusion. 1989 Oct;29(8):693-5. doi: 10.1046/j.1537-2995.1989.29890020442.x. PMID: 2799894.
4. Doern GV, Carroll KC, Diekema DJ, Garey KW, Rupp ME, Weinstein MP, et al. 2020. A Comprehensive Update on the Problem of Blood Culture Contamination and a Discussion of Methods for Addressing the Problem. Clin Microbiol Rev 33: e00009-19.
5. Mylotte JM, Tayara A. Blood cultures: clinical aspects and controversies. Eur J ClinMicrobiol Infect Dis. 2000;19:157–163. [PubMed] [Google Scholar]
6. . Wilson ML, Clinical and Laboratory Standards Institute. Principles and procedures for blood cultures: approved guideline. Wayne, Pa.: Clinical and Laboratory Standards Institute; 2007.
7. Strand CL, Wajsbort RR, Sturmann K. Effect of iodophor vs iodine tincture skin preparation on blood culture contamination rate. JAMA. 1993;269:1004–1006.
8. Chukwuemeka IK, Samuel Y. Quality assurance in blood culture: A retrospective study of blood culture contamination rate in a tertiary hospital in Nigeria. Niger Med J. 2014;55:201–203. [PMC free article] [PubMed] [Google Scholar]
9. Souvenir D, Anderson DE, Palpant S, Mroch H, Askin S, Anderson J, Claridge J, Eiland J, Malone C, Garrison MW, Watson P, Campbell DM. 1998. Blood cultures positive for coagulase-negative staphylococci: antisepsis, pseudobacteremia, and therapy of patients. J Clin Microbiol 36:1923–1926.
10. van der Heijden YF, Miller G, Wright PW, Shepherd BE, Daniels TL, Talbot TR. 2011. Clinical impact of blood cultures contaminated with coagulase-negative staphylococci at an academic medical center. Infect Control Hosp Epidemiol 32:623–625.
11. Gander RM, Byrd L, DeCrescenzo M, Hirany S, Bowen M, Baughman J. 2009. Impact of blood cultures drawn by phlebotomy on contamination rates and health care costs in a hospital emergency department. J Clin Microbiol 47:1021–1024.

How to cite this article: Syamasis Bandyopadhyay, Aheli Ghosh Dastidar, Sandip Kumar Chandra, Aloke Dutta, Soma Dutta, Ujjwayini Ray. Blood Culture Contamination in a busy Emergency ward of a tertiary care hospital in Kolkata. *International Journal of Research and Review*. 2024; 11(9): 107-111. DOI: *https://doi.org/10.52403/ijrr.20240913*

******