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Original research

Bacterial Contamination of Medical Scissors and Clamps in the Blood Collection Room

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Abstract:
Background: Bacterial contamination in blood products remains a critical concern in healthcare and transfusion services because it can lead to transfusion-transmitted infections and endanger patient safety. Contamination may originate from the donor's skin flora, medical personnel, or the surrounding environment during the blood collection process. Evaluating the sterility of reusable medical instruments such as scissors and clamps is therefore essential to maintain aseptic conditions and prevent microbial transmission in clinical and blood collection facilities. Objective: This study aimed to identify and quantify bacterial growth on medical scissors and clamps used in the blood collection room of the Indonesian Red Cross (PMI) Sleman Regency and to assess their compliance with recognized sterility standards. Method: A descriptive observational study with a cross-sectional design was conducted. Four samples (two scissors and two clamps) were collected aseptically. Each instrument surface was swabbed and cultured on Nutrient Agar (NA) medium, followed by incubation at 37°C for 24–48 hours. Colony growth was enumerated, and sterile, unused instruments served as negative controls. Instruments with <30 colony-forming units (CFU) were considered within acceptable sterility limits. Result: Minimal bacterial growth was observed, with only two colonies found on scissors and two on clamps. These values were below the accepted sterility threshold, indicating satisfactory microbiological cleanliness consistent with previous studies in similar environments. Conclusion: The very low colony counts (<30 CFU) confirm that the medical instruments in the PMI Sleman Regency blood collection room meet sterility standards, demonstrating effective sterilization and infection control practices.
Keywords: Bacteria, Scissors, Clamps, Blood Collection Room

Introduction

Blood is a therapeutic product that must be collected in accordance with a strict quality management system to ensure safety and minimize the risk of bacterial or other microbial contamination (Ministry of Health Regulation No. 91, 2015). Bacterial contamination in blood products poses serious risks, including transfusion-transmitted infections and adverse transfusion reactions. Such contamination may occur at several points along the transfusion chain—ranging from donor collection, component processing, and storage to distribution—and may arise from both internal and external environmental sources.

Airborne microorganisms are among the main contributors to bacterial contamination in healthcare environments. Poor indoor air quality can facilitate the contamination of medical instruments and blood products, potentially causing hospital-acquired infections (HAIs) and increasing infection risk in blood transfusion units (Septiari, 2017). Therefore, maintaining the sterility of rooms and instruments used in blood collection is an essential aspect of infection prevention.

According to the Ministry of Health Regulation (2015) on blood transfusion service standards, rooms and equipment used for blood component handling must comply with the national quality management system to prevent microbial contamination, mix-ups, and disease transmission. However, several environmental and procedural factors—such as open doors, inadequate air circulation, and poor housekeeping—can increase bacterial counts indoors and compromise sterility (Yunita, 2015).

During phlebotomy, bacterial contamination can occur through direct contact between the donor's skin and medical instruments, or indirectly via airborne microorganisms. Hence, both instrument sterility and donor skin disinfection play critical roles in preventing microbial entry into collected blood. Transmission can occur through the healthcare worker's hands, clothing, medical devices, or the environment. Medical instruments are known vectors for bacterial transfer between patients and surfaces (Febyayuningrum, 2021). Common airborne and contact contaminants include *Escherichia coli*, *Staphylococcus spp.*, *Streptococcus spp.*, *Pseudomonas spp.*, and *Bacillus subtilis*, which are often found in indoor healthcare settings.

Previous studies have reported that inadequate sterilization of medical instruments can lead to microbial contamination of blood bags, potentially causing transfusion reactions or even fatal outcomes in recipients (Kaur et al., 2022). Rahman (2021) demonstrated that residual microbial contamination on medical instruments in hospital transfusion services could lead to bacterial proliferation in stored blood components, emphasizing the need for standardized disinfection procedures. Similarly, Kaur et al. (2022)

highlighted that proper sterilization practices significantly reduce contamination risk in clinical instruments and blood storage facilities.

Despite these known risks, few studies in Indonesia have specifically assessed the microbiological cleanliness of reusable instruments used during blood collection, particularly in regional transfusion units. To address this gap, the present study investigates bacterial growth on medical scissors and clamps in the blood collection room of the Indonesian Red Cross (PMI) Sleman Regency. These instruments are routinely used and frequently exposed to both donor contact and the surrounding air, making them suitable indicators for evaluating sterilization effectiveness and environmental hygiene in blood collection facilities. The findings are expected to support improved infection control measures and reinforce compliance with national quality and sterility standards.

Material and Methods

This study was conducted in two locations: the blood collection room of the Indonesian Red Cross (PMI) Sleman Regency and the Microbiology Laboratory of the Medical Laboratory Technology (TLM) Study Program, STIKES Guna Bangsa Yogyakarta. Data collection was performed in May 2024.

2.1 Study Design and Purpose

A descriptive observational study with a cross-sectional approach was employed to provide an overview of bacterial contamination on reusable medical instruments. The study aimed to identify and quantify bacterial growth on medical scissors and clamps routinely used in the PMI Sleman blood collection room.

2.2 Sample Description and Size

A total of four instruments were analyzed, consisting of two pairs of medical scissors and two clamps. The instruments selected were those routinely used during donor blood collection on the same day of sampling. Before use, these instruments had undergone standard sterilization by autoclaving at 121°C for 15 minutes and were subsequently stored in sterile containers. This ensured that any bacterial presence detected was likely due to post-sterilization environmental exposure.

2.3 Sampling Procedure

Sampling was conducted aseptically using sterile cotton swabs (Deltalab, single-use, rayon-tipped, sterile, 15 cm) moistened with 0.9% sterile saline solution. Each swab was used to wipe the entire inner and outer surfaces of the scissors and clamps. After sampling, the swabs were immediately streaked onto sterile glass Petri dishes containing Nutrient Agar (NA) medium using the streak plate method.

2.4 Control Samples and Transport

To ensure reliability, negative control samples were included. These consisted of sterile, unused scissors and clamps that had not been exposed to the blood collection environment. All inoculated Petri dishes were covered, wrapped with sterile paper, and placed in a cool box (temperature 4–8°C) for transport. Transport to the microbiology laboratory took approximately 30–45 minutes after sampling.

2.5 Culture and Incubation

In the laboratory, all samples were incubated at 37°C for 24–48 hours to allow bacterial growth. Following incubation, bacterial colonies were visually examined and enumerated.

2.6 Colony Counting and Data Analysis

Colony-forming units (CFU) were counted manually using a digital colony counter. Both small and large colonies spreading across the medium were considered as single colonies if they appeared to arise from the same point of inoculation. Colony numbers were compared with the acceptable sterility threshold (<30 CFU per instrument). Data were tabulated descriptively to compare bacterial growth between scissors and clamps.

Results and Discussion

Bacterial swabbing of medical scissors and clamps in the phlebotomy room of the Indonesian Red Cross (PMI) Sleman Regency was conducted on May 22, 2024. A total of five medical instruments—three scissors and two clamps—were sampled from three different tables in the phlebotomy room. The room layout and sampling locations are shown in Figure 1, and the results of bacterial isolation are presented in Table 1.

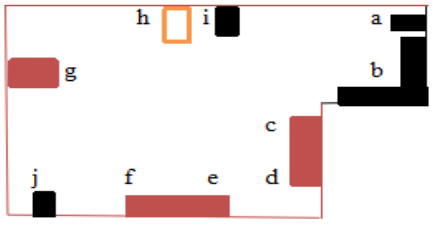

Figure 1. Layout of the Phlebotomy Room at Indonesian Red Cross Sleman Regency
(a: Entrance door; b: Sink; c: Table 1; d: Table 2; e: Table 3; f: Table 4; g: Apheresis table; h: Workbench; i: Door to TTI laboratory; j: Exit door)

Table 1. Results of bacterial isolation on medical scissors and clamps

Location	Medical Instrument	Colony Count (CFU)	Colony Count duplo (CFU)
Table 1	Scissor	0	1
Table 1	Clamp	0	0
Table 2	Clamp	2	0
Table 2	Scissor	0	0
Table 3	Scissor	1	0

The present study demonstrated that medical scissors and clamps used in the phlebotomy room of the Indonesian Red Cross (PMI) Sleman Regency met acceptable microbiological sterility standards, with only four bacterial colonies detected across all five sampled instruments. These results are well below the contamination threshold of <30 CFU per instrument, as outlined by standard microbiological evaluation criteria (Nanggita, 2023). Such minimal bacterial counts indicate effective sterilization practices and adherence to standard operating procedures (SOPs), particularly regular disinfection using alcohol and ultraviolet (UV) light exposure.

The low level of contamination observed aligns with findings from previous research emphasizing that proper sterilization and disinfection methods play a crucial role in preventing healthcare-associated infections. Ramirez-Arcos (2023) reported that variability in sterilization and environmental monitoring practices across blood supply centers directly affects microbial contamination risks. Likewise, Tsegaye (2022) observed a 4.5% contamination rate in blood and blood components in Ethiopia, reinforcing the need for consistent adherence to aseptic protocols in transfusion services. The near absence of bacterial growth in the present study suggests that the disinfection protocols applied in PMI Sleman—particularly the combined use of alcohol wiping and UV irradiation—are effective in reducing both surface and airborne microbial loads (Berliana et al.,2023; Betty & Jenie, 2019).

Comparatively, other studies have reported higher contamination levels on reusable medical instruments. Marselina et al. (2023) identified bacterial and fungal growth on 22 of 35 sterilized minor surgical tools in community health centers, while Dewi (2023) documented the presence of *Staphylococcus aureus* and *Streptococcus* spp. on reusable instruments before sterilization in a hospital emergency unit. Similarly, Szymczyk (2023) found multidrug-resistant bacteria on reusable tourniquets used during blood collection, suggesting that even non-critical medical devices can serve as reservoirs for pathogens if not properly disinfected. An MDPI study in 2022 further reported persistent contamination by *Bacillus cereus* and *Citrobacter freundii* on sterilized surgical instruments, highlighting how environmental factors and procedural inconsistencies can compromise instrument sterility (Zhou, 2022).

In contrast to those findings, the negligible bacterial presence in the present study reflects the consistent implementation of sterilization practices and strong infection control measures in the PMI Sleman phlebotomy room. Regular alcohol disinfection combined with UV exposure appears to contribute significantly to maintaining a sterile environment. UV radiation is known to inactivate a broad spectrum of microorganisms through nucleic acid damage, and its integration with chemical disinfection can enhance decontamination effectiveness (Pigeot-Rémy, 2017; Kowalski, 2020).

Nevertheless, several limitations should be acknowledged. The small sample size (three scissors and two clamps) limits the generalizability of these results, and the absence of bacterial identification beyond colony counting restricts interpretation of the isolates' potential pathogenicity. Future studies should employ Gram staining, selective and differential media, and molecular identification techniques such as PCR to determine the bacterial species involved and their relevance to clinical infection risks. Expanding sampling to include more instruments, multiple collection days, and environmental air or surface swabs would provide a more comprehensive evaluation of microbiological safety in blood collection facilities.

Despite these limitations, the findings of this study contribute valuable preliminary evidence that the sterilization and disinfection protocols currently applied at PMI Sleman Regency are effective in minimizing bacterial contamination risks. Continued compliance with national transfusion service standards (Ministry of Health, Indonesia, 2020) and periodic microbiological monitoring remain critical for maintaining instrument sterility and preventing transfusion-related infections. Furthermore, these results reinforce the importance of ongoing staff training and quality assurance programs to ensure consistent sterilization efficacy in all healthcare settings.

Conclusion

Based on the results of the study, two bacterial colonies were found on medical scissors and two bacterial colonies were found on clamps in the phlebotomy room of Indonesian Red Cross Sleman Regency.

Author Contribution

According to the CRediT (Contributor Roles Taxonomy) author statement, the contributions of each author in this study are as follows. The conceptualization and design of the study were carried out by Gravinda Widyaswara. Methodology development, data collection, and investigation were conducted by Maria Selviana Tulit Ina. Data curation, formal analysis, and visualization were performed by Maria Selviana Tulit Ina. The original draft of the manuscript was prepared by Gravinda Widyaswara, while review and editing were supervised by Arif Tirtana. Supervision, validation, and project administration were provided by Kumara Rahmawati Zain. All authors have read and approved the final version of the manuscript.

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Conflict of Interest

The authors have no conflicts of interest to declare.

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