IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ANALYSIS OF MICROBIAL CONTAMINATION IN HOSPITAL ACQUIRED INFECTIONS

Shyaga. Babu* and Dr. Madan MohanGunda

Department of Microbiology, Government Degree & P.G. College(A), Siddipet, Telangana, India

ABSTRACT

Hospital-acquired infections (HAIs) continue to be a major public health concern due to their impact on patient recovery, healthcare costs, and mortality. Environmental surfaces, medical devices, and patient-contact materials act as reservoirs for microbial contamination and may contribute to the transmission of infectious agents within healthcare settings. The present study was conducted to evaluate microbial contamination associated with selected hospital surfaces and patient-care equipment in a private healthcare facility, Sushrutha Hospital, Siddipet, Telangana, India.

Samples were collected aseptically from nine different sites, including patient bed sheets, cot and bed pillows, patient bed pans, intravenous cannulas, surgical sites, operation theatre floors, urocatheters, food racks, and personnel racks. The samples were cultured on Nutrient Agar (NA), MacConkey Agar (MCA), and Potato Dextrose Agar (PDA) media and incubated under appropriate laboratory conditions. Colony morphology and microbial growth patterns were observed and recorded.

Microbial growth was observed in all sampled locations, with varying levels of contamination. The personnel rack exhibited the highest microbial load, followed by the bed sheet, surgical site, and urocatheter. Lower contamination levels were observed on the food rack and intravenous cannula. The results indicate that hospital environmental surfaces and patient-contact objects can serve as potential reservoirs of microorganisms.

The findings emphasize the importance of routine microbiological surveillance, proper sanitation practices, and strict infection-control measures to minimize the risk of HAIs and improve patient safety.

KEYWORDS

Hospital-acquired infections, microbial contamination, environmental surveillance, infection control, hospital hygiene, healthcare-associated infections.

INTRODUCTION

Hospital-acquired infections (HAIs), also referred to as healthcare-associated infections, are infections acquired by patients during hospitalization or healthcare procedures that were not present at the time of admission. HAIs represent a significant challenge to healthcare systems worldwide due to increased morbidity, mortality, prolonged hospital stays, and elevated healthcare expenditures.

Environmental surfaces within hospitals, including patient beds, medical equipment, operation theatres, and frequently touched objects, may harbor microorganisms capable of causing infection. These contaminated surfaces can facilitate microbial transmission through direct contact or via healthcare workers and visitors.

Several researchers have highlighted the role of hospital environments in the transmission of healthcare-associated infections. De Oliveira and Damasceno (2010) reported that hospital surfaces can serve as reservoirs of resistant bacteria and contribute to the spread of infections. Kramer, Schwebke, and Kampf (2006) demonstrated that nosocomial pathogens can survive on inanimate surfaces for prolonged periods, increasing the risk of cross-contamination. Similarly, Anaissie et al. (2003) emphasized the significance of environmental contamination in healthcare settings and its association with opportunistic infections. According to WHO (2011) and Klevens et al. (2007), HAIs remain a major cause of morbidity and mortality worldwide, highlighting the need for effective infection-control measures and environmental surveillance.

Routine microbiological monitoring of hospital environments is essential for identifying contamination hotspots and implementing appropriate infection-control strategies. The present study was undertaken to evaluate microbial contamination associated with selected hospital surfaces and patient-care equipment in a private healthcare facility located in Siddipet, Telangana.

METHODOLOGY

Study Area

The study was conducted at Sushrutha Hospital, Siddipet, Telangana, India.

Sample Collection

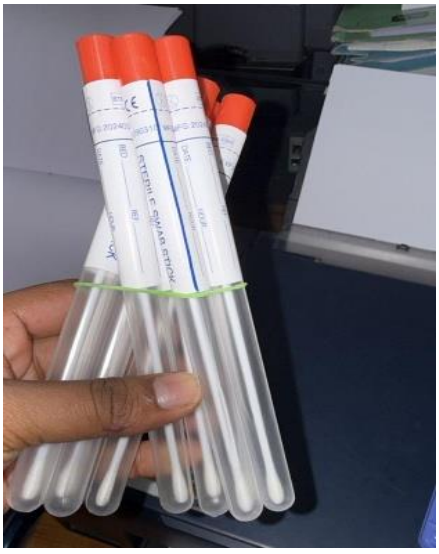

Figure 1. Sterile Sample collections Swabs

Samples were collected aseptically from the following locations:

Patient bed sheet

Cot and bed pillow

Patient bed pan

Patient IV cannula

Surgical site of patient

Operation theatre floor

Patient urocatheter

Patient food rack

Patient personnel rack

Sterile cotton swabs moistened with sterile saline were used to collect samples from the selected surfaces.

Figure 2. Patient's personal Rack

Culture Media

The collected samples were cultured using:

Nutrient Agar (NA)

MacConkey Agar (MCA)

Potato Dextrose Agar (PDA)

Incubation

The inoculated plates were incubated at suitable laboratory conditions for microbial growth and examined after incubation.

RESULTS

Table 1. Observed Microbial Growth on Nutrient Agar

Sample source	Growth levels	Observation
Patient bedsheet	Heavy	Large confluent colonies
Cot & Bed pillow	Moderate	Discrete creamy colonies
Patient bed pan	Moderate	Numerous scattered colonies
Patient IV canula	Low	Few isolated colonies
Surgical site	Heavy	Dense mixed colony growth
Operation theater floor	Low	Few isolated colonies
Patient Urocatheter	Heavy	High colony density
Patient food rack	Low	Limited microbial diversity
Patient personnel rack	Very heavy	Highest colony density

Table 2. Percentage Distribution of Relative Contamination

Sample site	Relative contamination (%)
Personnel rack	25
Bed sheet	18
Surgical site	15
Patient's Urocatheter	14
Patient's bedpan	10
Cot & bed pillow	8
Food Rack	5
Operation theater floor	3
Patient IV canula	3

Figure 3. Isolated Microbial colonies of different site in Hospital

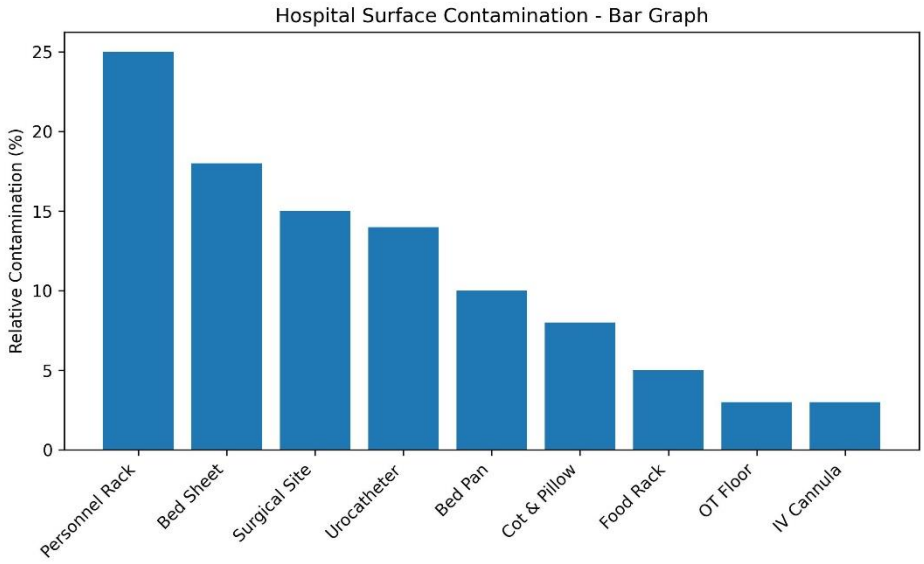

Figure 4. Bar graph-Relative contamination in different sites of hospital

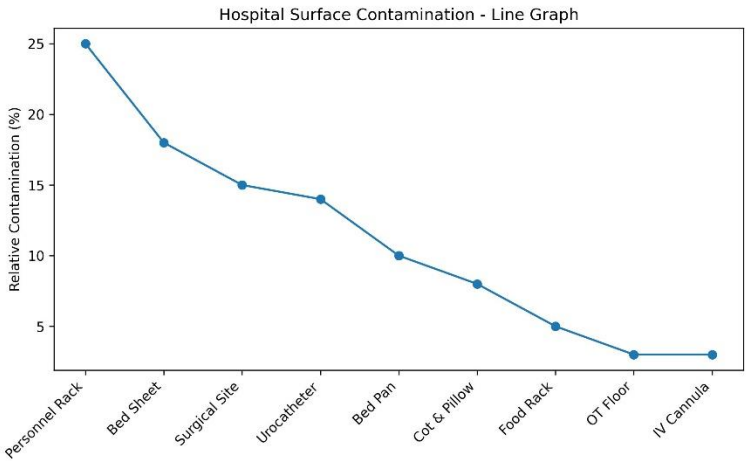

Figure 5. Line graph – Relative Contamination in different sites of hospital

DISCUSSION

The present study demonstrated the occurrence of microbial contamination on various hospital surfaces and patient-care materials. The highest contamination was observed on the personnel rack, indicating frequent human contact and inadequate surface sanitation. Similar findings have been reported in previous studies, where frequently touched hospital surfaces were identified as reservoirs of microbial contamination.

The findings of the present study are in agreement with the observations of De Oliveira and Damasceno (2010), who reported that contaminated hospital surfaces may act as reservoirs of pathogenic and multidrug-resistant microorganisms. Kramer et al. (2006) also found that several nosocomial pathogens can persist on environmental surfaces for extended periods, facilitating transmission within healthcare facilities. Similar observations were made by Bonadonna et al. (2015) and Smith et al. (2013), who highlighted the importance of environmental monitoring in reducing microbial contamination in hospitals. Furthermore, CDC (2003) guidelines emphasize routine cleaning, disinfection, and

surveillance as essential components of infection prevention programs. The present findings therefore support previous reports that frequently touched hospital surfaces require continuous monitoring and strict sanitation practices to reduce the burden of hospital-acquired infections.

The bed sheet, surgical site, and urocatheter samples also showed substantial microbial growth. These locations are closely associated with patient care and may contribute to the transmission of opportunistic pathogens if proper infection-control measures are not maintained.

Lower contamination levels observed on the food rack and intravenous cannula may reflect routine cleaning and disinfection practices. However, the presence of microbial growth on all sampled sites highlights the importance of continuous environmental monitoring.

The study findings support the need for strict cleaning protocols, regular microbial surveillance, hand hygiene compliance, and proper sterilization procedures to reduce the risk of HAIs.

CONCLUSION

The study revealed varying degrees of microbial contamination across different hospital surfaces and patient-care equipment. The personnel rack, bed sheet, surgical site, and urocatheter demonstrated relatively higher microbial loads compared with other sampling locations.

The findings emphasize that environmental surfaces within healthcare settings can act as reservoirs for microorganisms and may contribute to hospital-acquired infections. Routine microbiological monitoring, effective sanitation practices, and adherence to infection-control guidelines are essential for minimizing contamination and ensuring patient safety.

ACKNOWLEDGEMENT

The authors express their sincere gratitude to the faculty members and laboratory staff of the Department of Microbiology for their valuable support, guidance, and cooperation throughout this work. We are especially thankful to Prof. G. Sunitha, Principal, for providing laboratory facilities, institutional support, and constant encouragement for the successful completion of this study.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Alfonsi E, Capolongo S, Buffoli M. Evidence based design and healthcare: an unconventional approach to hospital design. Ann Ig. 2014;26(2):137–143. Doi: 10.7416/ai.2014.1968. [DOI] [PubMed] [Google Scholar]
2. Anaissie EJ, Stratton SL, Dignani MC, Lee CK, Summerbell RC, Rex JH, et al. Pathogenic molds (including Aspergillus species) in hospital water distribution systems-a 3-year prospective study and clinical implication for patients with hematologic malignancies. Blood. 2003;101:2542–2546. Doi: 10.1182/blood-2002-02-0530. [DOI] [PubMed] [Google Scholar]
3. ANSI/ASHRAE Standards. Legionellosis: risk management for building water systems. Atlanta: ANSI; 2015. No. 188.
4. ANSI/ASHRAE Standards. Ventilation for acceptable indoor air quality. Atlanta: ANSI; 2016. No. 62.1.

5. Astley P, Capolongo S, Gola M, Tartaglia A. Operative and design adaptability in healthcare facilities. Technè. 2015;9:162–170. [Google Scholar]
6. Baglioni A, Capolongo S. Ergonomics in planning and reconstruction. G Ital Med Lav Ergon. 2002;24(4):405–409. [PubMed] [Google Scholar]
7. Bonadonna L, Briancesco R, Coccia AM, Di Napoli I, Ferrante I, Forgia C, et al. Indaginisullapresenza di microrganismi in ambienteospedaliero e rischicorrelati. In: SantarsieroA, Musmeci L, Fuselli S, Gruppo di Studio Nazionalesull'Inquinamento Indoor, ed. Workshop La qualitàdell'aria indoor: attualesituazionenazionale e comunitaria. L'esperienza del Gruppo di Studio Nazionalesull'Inquinamento Indoor. IstitutoSuperiore di Sanità. Roma, 28 maggio 2014. Atti. Roma: IstitutoSuperiore di Sanità. 2015. Rapporti ISTISAN 15/4:102-8.
8. Bottero MC, Buffoli M, Capolongo S, Cavagliato E, di Noia M, Gola M, et al. A multidisciplinary sustainability evaluation system for operative and in-design hospitals. In: Capolongo S, Bottero MC, Buffoli M, Lettieri E, editors. Improving sustainability during hospital design and operation: a multidisciplinary evaluation tool. Cham: Springer; 2015. P. 31–114. Doi:10.1007/978-3-319-14036-0_4.
9. Briancesco R, Semproni M, Paradiso R, Bonadonna L. Nontuberculous mycobacteria: an emerging risk in engineered environmental habitats. Ann microbial. 2014;64:735–740. Doi: 10.1007/s13213-013-0708-8. [DOI] [Google Scholar]
10. Buffoli M, Capolongo S, Cattaneo M, Signorelli C. Project, natural lighting and comfort indoor. Ann Ig. 2007;19(5):429–441. [PubMed] [Google Scholar]
11. Capolongo S, Buffoli M, di Noia M, Gola M, Rostagno M. Current scenario analysis. In: Capolongo S, Bottero MC, Buffoli M, Lettieri E, editors. Improving sustainability during hospital design and operation: a multidisciplinary evaluation tool. Cham: Springer; 2015a. p. 11–22. Doi:10.1007/978-3-319-14036-0_2.
12. Capolongo S, Bottero MC, Lettieri E, Buffoli M, Bellagarda A., Birocchi M, et al. Healthcare sustainability challenge. In: Capolongo S, Bottero MC, Buffoli M, Lettieri E, editors. Improving sustainability during hospital design and operation: a multidisciplinary evaluation tool. Cham: Springer; 2015b. 1–10. Doi:10.1007/978-3-319-14036-0_1.
13. Capolongo S, Buffoli M, Oppio A, Rizzitiello S. Measuring hygiene and health performance of buildings: a multidimensional approach. Ann Ig. 2013;25(2):151–157. Doi: 10.7416/ai.2013.1917. [DOI] [PubMed] [Google Scholar]
14. Capolongo S, Gola M, di Noia M, Nickolova M, Nachiero D, Rebecchi A, et al. Social sustainability in healthcare facilities: a rating tool for analyzing and improving social aspects in environments of care. Ann Ist Super Sanità. 2016;52(1):15–23. Doi: 10.4415/ANN_16_01_06. [DOI] [PubMed] [Google Scholar]
15. Caselli E, D' Accolti M, Vandini A, Lanzoni L, Camerada MT, Coccagna M, et al. Impact of a probiotic-based cleaning intervention on the microbiota ecosystem of the hospital surfaces: focus on the resistomeremodulation. PLOS ONE 2016;11(2):1–19. Doi:10.1371/journal.pone.01488572016. [DOI] [PMC free article] [PubMed]
16. CDC (Centers for Disease Control). Guidelines for environmental infection control in health-care facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Atlanta: U.S. Department of Health and Human Services (HHS) for CDC; 2003. P. 52, No. RR-10. [PubMed]
17. D'Alessandro D, Tedesco P, Rebecchi A, Capolongo S. Water use and water saving in Italian hospitals. A preliminary investigation. Ann Ist Super Sanità. 2016;52(1):56–62. Doi:10.4415/ANN_16_01_11. [DOI] [PubMed].

18. De Oliveira AC, Damasceno QS. Surfaces of the hospital environment as possible deposits of resistant bacteria: a review. Rev Esc Enferm USP. 2010;44(4):1112–1117. Doi: 10.1590/S0080-62342010000400037. [DOI] [PubMed] [Google Scholar]
19. Exner M, Kramer A, Lajoie L, Gebel J, Engelhart S, Hartemann P. Prevention and control of health care-associated waterborne infections in health care facilities. Am J Infect Control. 2005;26–39. Doi:10.1016/j.ajic.2005.04.002. [DOI] [PubMed]
20. Gião MS, Wilks SA, Keevil CW. Influence of copper surfaces on biofilm formation by Legionella pneumophila in potable water. Biometals. 2015;28:329–339. Doi: 10.1007/s10534-015-9835-y. [DOI] [PubMed] [Google Scholar]
21. Joly JR, Alary M. Occurrence of nosocomial Legionnaires' disease in hospitals with contaminated potable water supply. In: Legionella: current status and emerging perspectives. In: Barbaree JM, Breiman RF, Dufour AP, editors. Washington DC. ASM Press; 1994.
22. Klevens M, Edwards JR, Richards CL, Horan TC, Gaynes RP, Pollock DA, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. Public Health Rep. 2007;122(2):160–166. Doi: 10.1177/003335490712200205. [DOI] [PMC free article] [PubMed] [Google Scholar]
23. Kramer A, Schwebke I, Kampf G. How long do nosocomial pathogens persist on inanimate surfaces? A systematic review. BMC Infect Dis. 2006;6:130. Doi: 10.1186/1471-2334-6-130. [DOI] [PMC free article] [PubMed] [Google Scholar]
24. Mazzacane S, Finzi G, Aparo L, Balboni PG, Vandini A, Antonioli P, et al. The sanification of hospital stays: new strategies for the reduction on HaIs. Health Management 2014. In focus. https://healthmanagement.org/c/healthmanagement/issuearticle/the-sanitation-of-hospital-stays-new-strategies-for-the-reduction-of-hais.
25. Michels HT, Keevil WC, Salgado CD, Schmidt MG. From laboratory research to a clinical trial: copper alloy surfaces kill bacteria and reduce hospital-acquired infections. HERD. 2015;9(1):64–79. Doi: 10.1177/1937586715592650. [DOI] [PMC free article] [PubMed] [Google Scholar]
26. Obbard J, Fang L. Airborne concentrations of bacteria in a hospital environment in Singapore. Water Air Soil Pollut. 2003;144:333–341. Doi: 10.1023/A:1022973402453. [DOI] [Google Scholar]
27. Signorelli C, Capolongo S, Buffoli M, Capasso L, Faggioli A, Moscato U, et al. Italian Society of Hygiene (SItI) recommendations for a healthy, safe and sustainable housing. Epidemiol Prev. 2016;40(3–4):265–270. Doi: 10.19191/EP16.3-4.P265.094. [DOI] [PubMed] [Google Scholar]
28. Smith D, Alverdy J, An G, Coleman M, Garcia-Houchins S, Green J, et al. The hospital microbiome project: meeting report for the 1st hospital microbiome project workshop on sampling design and building science measurements, Chicago, USA, Jun 7th–8th 2012. Stand Genomic Sci. 2013;8:112–117. Doi: 10.4056/sigs.3717348. [DOI] [PMC free article] [PubMed] [Google Scholar]
29. Taccone FS, Van den Abeele AM, Bulpa P, Misset B, MeerssemanW Cardoso T, et al. Epidemiology of invasive aspergillosis in critically ill patients: clinical presentation, underlying conditions and outcomes on behalf of the AspICU Study Investigators. Crit Care Med. 2015;19:7. Doi: 10.1186/s13054-014-0722-7. [DOI] [PMC free article] [PubMed] [Google Scholar]
30. Trautmann M, Lepper PM, Haller M. Ecology of Pseudomonas aeruginosa in the intensive care unit and the evolving role of water outlets as a reservoir of the organism. Am J Infect Control. 2005;33:41–49. Doi: 10.1016/j.ajic.2005.03.006. [DOI] [PubMed] [Google Scholar]
31. WHO. Legionella and the prevention of legionellosis. Copenhagen: WHO; 2007.
32. WHO. Report on the burden of endemic health care-associated infection worldwide. Copenhagen: WHO; 2011. P. 1–34.