International Journal of Environmental Sciences
ISSN: 2229 7359
Vol. 11 No. 18s, 2025
https://www.theaspd.com/ijes.php

The Upcoming Threat Of Nosocomial Endocarditis- A Narrative Review

Dalia Biswas[1], Moushumi Debnath[2], Sharmila Chaudhuri[3], Yukti Gogia[4], Komal Dhull[5], Epshita Kakati[6], Vipin Kumar Chandraker[7]
[1]Professor, Department of Physiology, Varunarjun Medical College and Rohilkhand Hospital, Shahjahanpur (UP)
[2]Professor, Dr. N. Y. Tasgaonkar college of Physiotherapy, karjat, Mumbai
[3]Associate Professor, Department of Physiotherapy, School of Allied Health Sciences, Galgotias University, Greater Noida, India
[4]PhD Scholar, Clinical Demonstrator, K R Mangalam University
[5]Demonstrator, KR. Mangalam University
[6]MPT Orthopaedics, Clinical Demonstrator, KR Mangalam University, Gurgaon, Haryana
[7]Principal, Apollo College of Physiotherapy, Durg (C.G.)

Abstract
Nosocomial endocarditis, also known as healthcare-acquired endocarditis, is an infection of the endocardium or heart valves that is acquired in a hospital. In patients with long hospital stays with or without heart ailments, in patients undergoing invasive interventions, and those admitted to intensive care units (ICUs), it is of significant concern. This review examines the primary aspects of nosocomial endocarditis, concentrating on risk factors, prevalent microorganisms, and patient outcomes.
Keywords: *Nosocomial endocarditis, infection, Microorganism*

INTRODUCTION

Nosocomial means an infection acquired by a patient during their hospital stay or after discharge from the hospital. Nosocomial Endocarditis is a Healthcare-associated infection. Healthcare-associated infections (HAIs) have a significant impact on patient safety and disease burden, making them a serious global public health issue (1-5). The prevalence rate of HAI in hospitalized patients is 10% in developing countries, and below 7% in developed countries, as reported by the World Health Organization (WHO) (6). HAIs are defined as infections acquired by patients after hospitalization for more than 2 days that were not present at the time of admission. HAIs can occur during a hospital stay or after discharge. They also include the infections acquired by health professionals during their work in hospitals (6). HAIs are coupled with a longer length of hospitalization, increased risks of morbidity and mortality, and a greater financial burden. Their risk is 2-20 times higher in developing countries as compared to developed countries (6-10). Reports from the USA indicate that the annual cost ranges from US$28 to US$45 billion due to HAIs from 1990 to 2002 (11). Additionally, HAIs lead to increased rates of antimicrobial resistance (AMR), which complicates the treatment of infections (12,13).

Healthcare-associated infections (HAIs) are usually associated with increased cost of hospital stay, morbidity, and mortality in patients. In the era of hospital value-based care, HAIs cause penalties for hospitals. Less is reported on the incidence of occurrence and outcomes of HAIs among hospitalized patients with common cardiovascular conditions. A study identified 159,021 hospitalizations with≥1 HAI between 2008 and 2015. A national database was used in which adults aged ≥18 years were hospitalized with five common cardiovascular conditions, including heart failure (49.6%), acute myocardial infarction (20.4%), cardiogenic shock (18.6%), atrial fibrillation or flutter (11.9%) and coronary artery bypass grafting (10.5%). They assessed the temporal trends in length of stay (LOS), cost, incidence, and mortality associated with Clostridium difficile infections (75.4%), catheter-associated urinary tract infections (15.1%), ventilator-associated pneumonia (7.9%), and central line-associated bloodstream infection (3.1%). On propensity matching, HAI remained associated with an over duration LOS (4.9 vs 9.6 days, p <0.0001), total hospital bill charges ($79,227 vs $50,699, p <0.0001), and in-hospital deaths

(13% vs 10.4%, p <0.0001) in comparison to patients who did not acquire any infection during their hospital stay. The study concluded that patients with cardiovascular disease who acquired a HAI had markedly higher LOS, costs, and mortality (14).

A rare but serious infection that can occur in hospitalized patients is nosocomial infective endocarditis (NIE), a complication of nosocomial bacteremia (bacterial infection that occurs in a hospital setting). Infective endocarditis (IE) is defined as an infection of the endocardial surfaces of the heart, which bacteria, viruses, or fungi may cause.

Discussion on Hospital-Acquired Infective Endocarditis (HAIE)

1. It has become a growing healthcare problem

Hospital-acquired infective endocarditis (HAIE) is defined as endocarditis occurring 72 hours or more after hospital admission. HAIE can manifest several weeks after a hospital-based invasive procedure. A comparative study examined 87 episodes of endocarditis in patients with a history of recent hospitalization. The incidence rate of endocarditis was found to be 27 cases per 100,000 person-years compared to 1.1 cases per 100,000 person-years in a population with no recent hospitalizations in the 6 months after discharge. The study also noted a higher proportion of typically hospital-acquired pathogens (26% vs. 0%; P = .001) and a lower proportion of viridans streptococci (0% vs. 36%; P < .001) compared to community-acquired episodes. The study concluded that hospital-acquired infective endocarditis is occurring more frequently within 6 months after hospital discharge and has become a rising healthcare problem (15).

2. Hospitalization per se carries with it a definite risk of infection

The increasing incidence of hospital-acquired infections has been reported in numerous medical studies in recent years, pointing to the inherent risk of disease associated with hospital stays. Postoperative staphylococcal wound infections and urinary tract infections caused by Gram-negative microorganisms are frequently reported, but bacterial endocarditis as an outcome of hospital-acquired infections has received less attention. One review found 85 cases of bacterial endocarditis at a Veterans Administration Hospital. Over ten years, 17 veterans acquired hospital-acquired infective endocarditis (HAIE), representing an unusually high incidence that affected clinical outcomes and mortality rates (16).

3. Nosocomial infective endocarditis (NIE) is preventable

Nosocomial infective endocarditis (NIE) is of significant concern due to its high mortality rate as a rare complication of nosocomial bacteremia. However, it is preventable in many cases. The diagnosis of NIE is often missed because many patients admitted to the hospital have coexistent infections. NIE can be prevented through the effective treatment of bacteremia in high-risk patients, the identification of high-risk patients, and careful assessment of positive blood cultures. Prophylactic antimicrobial therapy should be considered for specific invasive procedures in hospitals (17).

4. Nosocomial endocarditis is predominantly due to Staphylococcus aureus

From January 1976 to December 1985, 22 patients discharged from a veterans' hospital and a community hospital were diagnosed with nosocomial endocarditis. Of the 22 cases, 14 (63.6%) occurred in patients aged 60 years or older. Culture reports indicated that Staphylococcus aureus or coagulase-negative staphylococci (77.4%) and streptococci (13.6%) were the predominant causes of nosocomial endocarditis. Intravascular devices were implicated in 10 cases (45.5%). The mortality rate in patients aged over 60 years was 50%. Improved care of intravascular devices or prophylaxis before procedures, such as proper sterilization of intravascular devices and the use of prophylactic antimicrobials, could have potentially prevented these cases of nosocomial endocarditis (18).

5. Nosocomial endocarditis is more pronounced in heart failure patients

One of the common causes of hospitalization in patients with heart failure (HF) is infection. However, the impact of infection on long-term cardiovascular outcomes in HF patients has not been widely studied. A research study compared major adverse cardiovascular events (MACE) in HF patients with or without infection prior to hospitalization. The study, which involved 310,485

patients with their first HF admissions from 2009 to 2015, found that those with readmissions due to illness within one year after HF discharge had worse cardiovascular outcomes (19).

6. Nosocomial endocarditis has worse cardiovascular outcomes

A study conducted between 2009 and 2015 using the Taiwan National Health Insurance Research Database analyzed patients with their first HF admissions. Patients readmitted due to infection within one year after HF discharge had significantly worse outcomes. The infection group had 86.19% of patients experiencing major adverse cardiovascular events (MACE), compared to 63.63% of the control group. The study revealed that patients who experienced infections after HF discharge had a higher risk of MACE (HR 1.760, 95% CI 1.714–1.807), indicating that infections post-discharge are associated with worse cardiovascular outcomes (19-30).

Risk Factors in the Development of Nosocomial Endocarditis

Several factors contribute to the development of healthcare-associated endocarditis, including:

- Invasive Interventions: Patients undergoing invasive procedures, such as those involving intravascular catheters, are at an increased risk (31). Infected catheters are involved in approximately two-thirds of nosocomial endocarditis cases (32).
- Healthcare-Associated Bloodstream Infections: Bloodstream infections acquired in healthcare settings can lead to endocarditis (31).
- Underlying Conditions: Elderly patients with degenerative valve diseases are more susceptible to nosocomial endocarditis (31).
- Prosthetic Valves and Devices: The presence of prosthetic valves and other implanted devices increases the risk of infection (31, 33).
- Hemodialysis: Patients undergoing hemodialysis are at higher risk for healthcare-associated endocarditis (31).
- Diabetes Mellitus: Diabetes is also identified as a risk factor for nosocomial endocarditis (31).
- Immunosuppressive Therapy: Patients on immunosuppressive therapy are more prone to these infections (31).

Common Microorganisms Associated with Nosocomial Endocarditis

The microorganisms responsible for nosocomial endocarditis often differ from those in community-acquired cases. Common pathogens include:

- Staphylococcus aureus: This is a frequently identified microorganism in healthcare-associated endocarditis (32, 34, 35).
- MRSA (Methicillin-resistant Staphylococcus aureus): The prevalence of MRSA is notably higher in healthcare-associated infections compared to community-acquired infections (34, 35).
- Enterococci: These are also more common in nosocomial endocarditis (32, 34).
- Staphylococcus coagulase-negative: These species are also observed in nosocomial cases (34, 35).
- Fungi: Fungal infections are also a relevant consideration in this setting (32).

Patient Outcomes in Cases of Nosocomial Endocarditis

Nosocomial endocarditis presents significant challenges in diagnosis and management, often leading to poorer outcomes. Factors impacting outcomes include:

- Delayed or Difficult Diagnosis: Nosocomial endocarditis can be challenging to diagnose promptly (35).
- Increased In-Hospital Mortality: Studies indicate a higher in-hospital death rate among patients with nosocomial endocarditis compared to those with community-acquired infections (35).

Diagnostic and Therapeutic Strategies in Nosocomial Endocarditis

Early and accurate diagnosis is critical in managing nosocomial endocarditis. Key strategies include:

- Early Blood Cultures and Serology: Prompt collection of blood cultures is essential for identifying the causative microorganism (3).
- PCR (Polymerase Chain Reaction): PCR can be a valuable tool for rapid pathogen identification (33).
- Early Access to Echocardiography: Echocardiography is crucial for visualizing cardiac structures and detecting vegetations or abscesses (33).
- Optimisation of a Surgical Approach: Identifying high-risk patients and considering the need for surgical intervention is critical (33).
- Multidisciplinary Team Discussion: Each case should be discussed by a team of specialists to determine the best course of action (33).
- Hemodialysis: End-stage renal disease patients on hemodialysis have an increased incidence of endocarditis (33).

Summary

Hospitalization, as it is, carries with it a definite risk of infection. Healthcare-associated infections (HAIs) are primarily caused by postoperative staphylococcal wound infections or post-manipulative urinary tract infections resulting from Gram-negative microorganisms. Other main risk factors include being over 60 years of age, the presence of indwelling urinary catheters and central catheters, and invasive procedures such as intravenous infusion, tracheal cannula, tracheotomy, arteriovenous cannula, deep vein catheterization, ventilator use, and mechanical ventilation. Healthcare-related risk factors also include chemotherapy, hormone therapy, hemodialysis, and immunosuppression. Chronic diseases, coma, diabetes mellitus, long-term bed stay, prolonged antibiotic use, and hospitalizations longer than 15 days have been confirmed as the primary risk factors for HAIs in hospitalized patients compared to those without HAIs in various reports.

The interactions between these risk factors and HAIs show that elderly patients, who often require long-term care, are more likely to have underlying diseases or comorbidities and are frequently treated with immunosuppressive therapies, according to meta-analysis reports. Therefore, preventive and control measures should be implemented to mitigate both the economic burden on patients and the financial burden on hospitals resulting from HAIs.

Nosocomial endocarditis is a less common manifestation of hospital-acquired infection. The unusually high incidence, clinical course, and subsequent mortality associated with nosocomial endocarditis have recently gained significant attention. This review has some limitations. First, the studies included were mostly publications from Chinese journals. Second, most of the included studies were single-center studies. To obtain more robust findings, multicenter studies are required. Third, publication bias in terms of adjusted odds ratios (ORs) for all potential risk factors existed among the included studies, which could have been eliminated by controlling for potential confounders.

CONCLUSION

Hospitalized patients are predisposed to healthcare-associated infections (HAIs) due to prolonged hospitalization. The longer a patient stays in the hospital, the more susceptible they become to acquiring infections. Therefore, patients with extended hospital stays should be placed under close surveillance to minimize the risk of HAIs. Health management systems should prioritize ensuring safe and brief hospital stays for patients whenever possible. Implementing relevant, cost-effective prevention and control strategies is essential. These strategies can form an evidence base that provides valuable information to reduce the occurrence of HAIs.

Multicentric research is warranted to confirm additional risk factors and issues associated with HAIs. Such studies will provide a broader understanding and further evidence to refine prevention measures and improve patient outcomes.

REFERENCES

1. B. Allegranzi, S.B. Nejad, C. Combescure, W. Graafmans, H. Attar, L. Donaldson, et al.Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis.Lancet, 377 (9761) (2011), pp. 228-241
2. S. Bagheri Nejad, B. Allegranzi, S.B. Syed, B. Ellis, D. Pittet.
Health-care-associated infection in Africa: a systematic review.
Bull World Health Organ, 89 (10) (2011), pp. 757-765
3. A. Cassini, D. Plachouras, T. Eckmanns, M. Abu Sin, H.P. Blank, T. Ducomble, et al.
Burden of six healthcare-associated infections on European population health: estimating incidence-based disability-adjusted life years through a population prevalence-based modelling study. PLoS Med, 13 (10) (2016), Article e1002150
4. E.O. Irek, A.A. Amupitan, T.O. Obadare, A.O. Aboderin.
A systematic review of healthcare-associated infections in Africa: An antimicrobial resistance perspective.Afr J Lab Med, 7 (2) (2018), p. 796
5. E. Zimlichman, D. Henderson, O. Tamir, C. Franz, P. Song, C.K. Yamin, et al.
Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system. JAMA Intern Med, 173 (22) (2013), pp. 2039-2046
6. World Health Organization. Health care-associated infections FACT SHEET
2011. https://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf. [last accessed June 2021].
7.Y. Cai, I. Venkatachalam, N.W. Tee, T.Y. Tan, A. Kurup, S.Y. Wong, et al.
Prevalence of healthcare-associated infections and antimicrobial use among adult inpatients in Singapore acute-care hospitals: results from the first national point prevalence survey.Clin Infect Dis, 64 (suppl_2) (2017), pp. S61-S67.
8.H. Li, X. Liu, D. Cui, Q. Wang, Z. Mao, L. Fang, et al.
Estimating the direct medical economic burden of health care-associated infections in public tertiary hospitals in Hubei Province, China.Asia Pac J Public Health, 29 (5) (2017), pp. 440-450.
9.Y. Lv, L. Chen, J.W. Yu, Q. Xiang, Q.S. Tang, F.D. Wang, et al.
Hospitalization costs due to healthcare-associated infections: an analysis of propensity score matching. J Infect Public Health, 12 (4) (2019), pp. 568-575
10. Ashwitha A. Shetty, Anurag Rawat, Nagashree KS, Ritik Kashwani, Anukriti Kumari, Sumana Kumar, & S.V. Dharrshne. (2023). REVITALIZING SENIOR SMILES: INVESTIGATING ORAL PROBIOTICS FOR ENHANCED HEALTH. *Journal of Population Therapeutics and Clinical Pharmacology*, *30*(19), 1198-1213. https://doi.org/10.53555/jptcp.v30i19.3760
11. P.W. Stone.Economic Burden of Healthcare-Associated Infections: An American Perspective.Expert Rev Pharmacoecon Outcomes Res, 9 (5) (2009), pp. 417-422
12. S. Hansen, F. Schwab, W. Zingg, P. Gastmeier. Process and outcome indicators for infection control and prevention in European acute care hospitals in 2011 to 2012 – Results of the PROHIBIT study.Eur Surveill, 23 (21) (2018), Article 1700513.
13.X. Liu a, Y. Long b, C. Greenhalgh a, S. Steeg c, J. Wilkinson a, H. Li B, A. Verma A, A. Spencer A. A systematic review and meta-analysis of risk factors associated with healthcare-associated infections among hospitalized patients in Chinese general hospitals from 2001 to 2022.Journal of Hospital Infection.Volume 135, May 2023, Pages 37-49
14. P Elliott Miller , Avirup Guha , Rohan Khera , Fouad Chouairi , Tariq Ahmad , Khurram Nasir , Daniel Addison, Nihar R Desai .
National Trends in Healthcare-Associated Infections for Five Common Cardiovascular Conditions.Am J Cardiol. 2019 Jul 16;124(7):1140–1148.
15.Ronen Ben-Ami, Michael Giladi, Yehuda Carmeli, Ruth Orni-Wasserlauf, Yardena Siegman-Igra.Hospital-Acquired Infective Endocarditis: Should the Definition be Broadened? .Clinical Infectious Diseases, Volume 38, Issue 6, 15 March 2004, Pages 843–850.
16. Lucien B. Guze, md; **Morton l. Pearce, M.D. Hospital-Acquired** Bacterial Endocarditis.Arch Intern Med. 1963;112(1):56-62.
17.A Gilleece f1, L Fenelon.Nosocomial infective endocarditis.Journal of Hospital Infection.Volume 46, Issue 2, October 2000, Pages 83-88.
18. Margaret S. Terpenning, MD; Brian P. Buggy, MD; Carol A. Kauffman, MD.Hospital-Acquired Infective Endocarditis.*Arch Intern Med* 1988;148:1601-1603.
19. Chao-Yu Chen, Cheng-Han Lee, Hui-Wen Lin, Impact of infection-related admission in patients with heart failure: a 10-year national cohort study. Scientific Reports volume 13, Article number: 6941 (2023).
20. Savarese, G. & Lund, L. H. Global public health burden of heart failure. *Card. Fail. Rev.* . 3, 7–11 (2017).
21. Anusha R, Swati H, Sumana K. *Differentiating Pathogenic Bacteria through Biochemical Markers: A Study for Clinical Applications*. *Oral Sphere J Dent Health* ***Sci.*** (2025); **1**(1): 11-18. https://doi.org/10.5281/zenodo.14254191
22. X. Liu, A. Spencer, Y. Long, C. Greenhalgh, S. Steeg, A. Verma.
A systematic review and meta-analysis of disease burden of healthcare-associated infections in China: an economic burden perspective from general hospitals.
J Hosp Infect, 123 (2022), pp. 1-11.
23.Y. Zhang, J. Zhang, D. Wei, Z. Yang, Y. Wang, Z. Yao.

Annual surveys for point-prevalence of healthcare-associated infection in a tertiary hospital in Beijing, China, 2012-2014.BMC Infect Dis, 16 (1) (2016), p. 161
24. W.W. Yallew, A. Kumie, F.M. Yehuala.Risk factors for hospital-acquired infections in teaching hospitals of Amhara regional state, Ethiopia: A matched-case control study.PLoS One, 12 (7) (2017), Article e0181145.
25.J. Wang, F. Liu, E. Tartari, J. Huang, S. Harbarth, D. Pittet, et al.
The prevalence of healthcare-associated infections in mainland China: a systematic review and meta-analysis.Infect Contr Hosp Epidemiol, 39 (6) (2018), pp. 701-709
26. Population, China. 2018. Available at: https://data.worldbank.org/indicator/SP.POP.TOTL?intcid=ecr_hp_BeltD_en_ext&locations=CN. [last accessed December 2022].
27. National Health Commission of the People's Republic of China. 2019 China health statistics yearbook.Peking Union College Press, Peking (2019), p. 424.
28.P.W. Schreiber, H. Sax, A. Wolfensberger, L. Clack, S.P. Kuster.
The preventable proportion of healthcare-associated infections 2005-2016: Systematic review and meta-analysis.Infect Contr Hosp Epidemiol, 39 (11) (2018), pp. 1277-1295
29. X.L. Liu, N.L. Ren, Z.F. Ma, M.L. Zhong, H. Li.Risk factors for healthcare-associated infections among tuberculosis hospitalized patients in China from 2001 to 2020: a systematic review and meta-analysis.
30 AM Emmerson et al.The second National Prevalence Survey of Infection in Hospitals–overview of the results. J Hosp Inf(1996).
31. Martin-Davila P, Fowler VG. Chest 2005;128;772.
32.Benito N. Ann Intern Med. 2009;150:586-594.
33. RIEI 682 Cases (90 excluded)
34.Fernandez-Guerrero ML. Clin Infect Dis 1995;20: 16-23
35. CE. Athan E. JAMA 2012; 307: 1727-35.