



Unveiling The Disease Patterns and Infection Categories in MDRO-Infected Patients: Insights from a Comprehensive Study at Dr. Kariadi Hospital, Semarang

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ABSTRACT

Background: Multi-drug resistant organisms (MDRO) pose a significant challenge to healthcare systems worldwide, leading to increased morbidity, mortality, and healthcare costs. Understanding the disease patterns and infection categories associated with MDRO infections is crucial for effective management and prevention strategies. This study aims to unveil the prevalent diseases and infection categories among MDRO-infected patients at Dr. Kariadi Hospital, Semarang in Indonesia.

Methods: A comprehensive retrospective analysis was conducted on medical records of patients diagnosed with MDRO infections. Clinical characteristics were collected and analyzed. The diseases were classified into broader categories based on their organ system or common medical classification.

Result: The study included 100 MDRO-infected patients and they presented with 81 various medical conditions/diseases. The most common diseases associated with MDRO infections were Covid-19, and Bronchopneumonia. Among the infection categories, gastrointestinal disorders, and Neoplastic Diseases were the predominant categories. The study revealed a high prevalence of MDRO infections in patients with these conditions while as the category of Autoimmune and Rheumatic Diseases accounted for the smallest proportion of cases with only one case.

Conclusion : This comprehensive study provides valuable insights into the disease patterns and infection categories in MDRO-infected patients at Dr. Kariadi Hospital, Semarang. The findings highlight the need for targeted surveillance, infection control measures, and antimicrobial stewardship programs to effectively manage MDRO infections. Understanding the most prevalent diseases and infection categories associated with MDROs can aid in early detection, appropriate treatment, and the development of preventive strategies.

Keywords: Multi-drug resistant organisms; disease patterns; infection categories; retrospective analysis

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Introduction

Multi-drug resistant organisms (MDROs) have become a significant threat to global public health, leading to increased morbidity, mortality, and healthcare costs. MDROs, such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), and extended-spectrum beta-lactamase (ESBL)-producing bacteria, exhibit resistance to multiple classes of antibiotics, limiting treatment options and challenging healthcare systems worldwide.^{1,2}

The emergence and spread of MDROs have been fueled by various factors, including the overuse and misuse of antibiotics, inadequate infection control practices, and the global movement of people and goods.^{3,4} As a result, MDRO infections have become increasingly prevalent in healthcare settings, leading to longer hospital stays, increased healthcare expenditures, and a higher risk of complications.⁵

Understanding the specific disease patterns and infection categories associated with MDRO infections is crucial for effective patient management, infection control strategies, and the development of targeted prevention measures. Identifying the most common diseases and infection categories linked to MDROs can provide valuable insights into the epidemiology and clinical characteristics of these infections, enabling healthcare providers to tailor interventions and optimize patient outcomes.

In this study, we aimed to unveil the disease patterns and infection categories in MDRO-infected patients at Dr. Kariadi Hospital, Semarang. By analyzing a comprehensive dataset of MDRO infections, including patient clinical characteristics, we sought to identify the most prevalent diseases and infection categories among MDRO-infected individuals in the hospital setting. The findings of this study will contribute to our understanding of MDRO epidemiology and guide the development of effective prevention and management strategies tailored to our local context.

Methods

This study employed a retrospective analysis of medical records to investigate the disease patterns and infection categories in MDRO-infected patients. The study period spanned from 16 November, 2022 to 16 January, 2023 at Dr. Kariadi Hospital, a tertiary care facility located in Semarang, Indonesia, catering to a diverse patient population.

The inclusion criteria for this study were patients who were diagnosed with MDRO infections during their hospital stay at Dr. Kariadi Hospital within the specified study period. Patients of all ages and genders were included. Exclusion criteria were not applied, ensuring a comprehensive representation of MDRO-infected patients.

Data were obtained from electronic medical records and laboratory databases. Patient information including clinical characteristics were extracted. The diagnoses of diseases were classified into broader categories based on their organ system or common medical classification.

The laboratory employed standard methods for culture, identification, and antimicrobial susceptibility testing following established guidelines.^{6,7}

Descriptive statistics were employed to summarize the clinical characteristics of the MDRO-infected patients. The frequencies and proportions of different diseases and infection categories were calculated.

This study was conducted in accordance with the ethical guidelines and regulations governing retrospective studies at Dr. Kariadi Hospital. Patient data were anonymized and securely stored to maintain confidentiality.

Result

A total of 100 patients with MDRO (Multidrug-Resistant Organism) infection were included in this comprehensive study conducted at Dr. Kariadi Hospital, Semarang. These patients presented with 81 various medical conditions/diseases providing valuable insights into the disease patterns associated with MDRO infections.

Among the 100 MDRO-infected patients, the most prevalent condition/disease observed was "Covid-19" (n=8), followed by "Bronchopneumonia" (n=5), "Pneumonia" (n=4), and "Post-Laparotomy" (n=4). Other notable conditions included "UTI (Urinary Tract Infection)" (n=4), "Chronic Kidney Disease (CKD)" (n=4), and "Stroke Infarction" (n=3). Based on categories, the category with the highest number of conditions was "Gastrointestinal Disorders" (23.5% of the total

number of conditions), followed by "Neoplastic Diseases" and "Others" both at (17.3%), "Infectious Diseases" (9.9%), "Neurological Disorders" (9.9%), and "Respiratory Disorders" (8.6%). The remaining categories, namely "Renal and Urinary Tract Disorders," "Cardiovascular Diseases," and "Autoimmune and Rheumatic Diseases " accounted for smaller proportions of the total cases, (7.4%), (4.9%) and (1.2%) respectively. Category distribution summary can be seen in Figure 1.

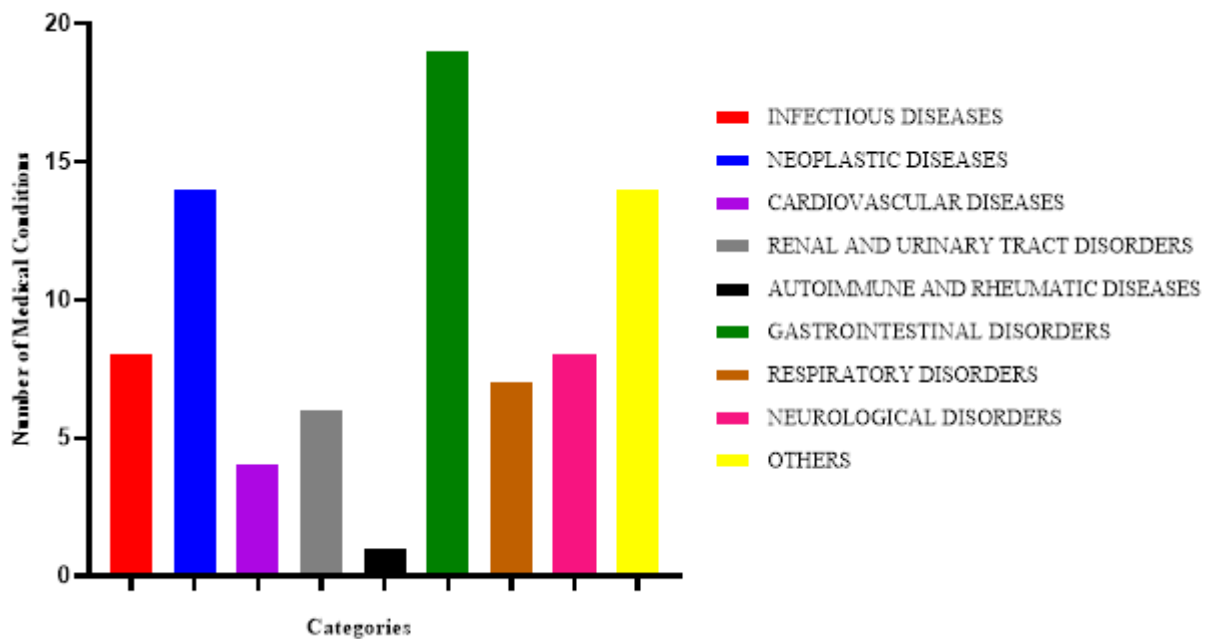


Figure 1: Prevalence of infection categories associated with MDROs

In the category of infectious diseases, our study identified a total of 8 cases of Covid-19, emphasizing the significance of this highly prevalent infectious disease. Additionally, Post-laparotomy cases were reported 4 times, suggesting the relevance of this condition as a potential post-operative complication. The presence of Late-onset hospital-acquired pneumonia (HAP) in 2 cases further highlights the importance of stringent infection control measures in healthcare settings.

Within neoplastic diseases, Carcinoma mammary left (Left breast carcinoma) emerged as a notable disease, with 2 cases identified. This finding underscores the importance of breast cancer screening and early detection efforts in our patient population. Other malignancies,

including Hepatocarcinoma, were also observed, highlighting the ongoing need for advancements in diagnostic and therapeutic approaches for these diseases.

Cardiovascular diseases revealed a total of 3 cases of Stroke Infarction, emphasizing the burden of cerebrovascular events and the criticality of preventive strategies. Edema with congenital heart disease was documented in 2 cases, indicating the impact of cardiac conditions on fluid balance and overall patient well-being.

Among renal and urinary tract disorders, uTI (urinary tract infection) was the most prevalent condition, with 4 cases identified. This underscores the importance of robust infection control measures and appropriate management

of urinary tract infections in our patient cohort. Chronic kidney disease (CKD) was also observed in 4 cases, emphasizing the need for improved strategies for early detection and comprehensive disease management.

In autoimmune and rheumatic diseases, our study identified 2 cases of Systemic lupus erythematosus (SLE), highlighting the ongoing challenges associated with autoimmune disorders and the importance of multidisciplinary care for affected individuals.

Gastrointestinal disorders encompassed various conditions such as severe ulcerative colitis, volvulus, and mesenteric injury, each occurring once. These findings underline the complexity of gastrointestinal disorders and emphasize the need for specialized management approaches.

Respiratory disorders demonstrated the presence of Pneumonia and Bronchopneumonia, with 4 and 5 patients, respectively. These findings highlight the burden of respiratory infections and underscore the importance of preventive measures, early diagnosis, and appropriate treatment.

Neurological disorders exhibited 3 cases of Decreased consciousness with intracranial hemorrhage (ICH), emphasizing the impact of traumatic brain injuries and the critical need for prompt medical attention. Hydrocephalus was observed twice, underscoring the challenges associated with this condition and the importance of effective management strategies. Lastly, the others category included multiple presence of various diseases such as Post amputation, Anemia, and Obs Febris. These findings reflect the diverse health conditions and comorbidities present in our MDRO-infected patient population.

Overall, our comprehensive study provides valuable insights into the disease patterns and infection categories among MDRO-infected patients at Dr. Kariadi Hospital, Semarang. These findings contribute to our understanding of the prevalence and significance of various diseases, emphasizing the importance of tailored management strategies and multidisciplinary care for improved patient outcomes.

Discussion

Among the identified categories, Infectious Diseases emerged as a significant contributor, with notable cases such as Covid-19 (n=8). The high prevalence of MDRO infections in patients with Covid-19 can be attributed to several factors. Firstly, patients with severe respiratory infections often require prolonged hospital stays and intensive care, increasing their risk of acquiring MDROs through exposure to contaminated healthcare settings⁸. Additionally, the frequent use of broad-spectrum antibiotics in the management of critically ill Covid-19 patients may contribute to the selection and proliferation of MDROs⁹. It is imperative to implement strict infection control measures, including proper hand hygiene, environmental cleaning, and judicious antibiotic use, to prevent the spread of MDROs in this vulnerable patient population.

Neoplastic diseases also showed a notable presence among MDRO-infected patients, with breast carcinoma (n=2) being the most prevalent. The association between cancer and MDRO infections can be explained by various factors. Cancer patients often undergo invasive procedures, receive immunosuppressive therapies, and have compromised immune systems, making them susceptible to MDRO colonization and infection¹⁰. The use of indwelling medical devices, such as central venous catheters, further increases the risk of MDRO acquisition¹¹. Early identification of MDRO colonization in cancer patients, coupled with targeted infection control measures and appropriate antibiotic therapy, is crucial to prevent treatment delays and improve patient outcomes¹².

The category of renal and urinary tract disorders demonstrated a significant number of UTI cases (n=4) among MDRO-infected patients. UTIs are a common source of MDRO infections, particularly in healthcare settings. Factors such as urinary catheterization, frequent antibiotic exposure, and the presence of comorbidities contribute to the increased risk of MDRO colonization and subsequent UTI development¹³. Implementing strategies such as catheter-associated UTI prevention bundles, antimicrobial stewardship programs, and

regular surveillance of MDRO colonization can help mitigate the spread of MDROs in this patient population¹⁴.

Interestingly, gastrointestinal disorders emerged as the category with the highest number of conditions among MDRO-infected patients (23.5%). This finding suggests a potential association between gastrointestinal diseases and MDRO infections. Several factors may contribute to this observation. Gastrointestinal disorders often require prolonged hospitalization and exposure to invasive procedures, increasing the likelihood of MDRO acquisition¹⁵. Additionally, alterations in gut microbiota and impaired mucosal integrity in these patients can facilitate the colonization and dissemination of MDROs¹⁶. Further research is needed to explore the specific mechanisms underlying the association between gastrointestinal disorders and MDRO infections and to develop targeted prevention and management strategies.

Cardiovascular Diseases category had cases of stroke infarction probably because these individuals often require prolonged hospital stays and invasive procedures, which increase their exposure to healthcare-associated pathogens, including MDROs¹⁷. The compromised immune status and disrupted barrier function in cardiovascular patients may further contribute to the colonization and infection by MDROs¹⁸.

Under autoimmune and rheumatic diseases, the observation of Systemic lupus erythematosus (SLE) is so because these individuals frequently receive immunosuppressive therapies, which compromise their immune response and increase their vulnerability to MDRO colonization and subsequent infections¹⁹. The complex treatment regimens and the involvement of multiple healthcare providers in the care of these patients can also contribute to the risk of MDRO acquisition²⁰.

In the category of respiratory disorders the presence of pneumonia and bronchopneumonia is understandable because patients with respiratory conditions often require prolonged hospitalization and mechanical ventilation, which are known risk factors for MDRO acquisition²¹. The frequent use of broad-

spectrum antibiotics in the management of these patients further contributes to the selection and proliferation of MDROs²². Strict adherence to infection control measures, including appropriate antimicrobial stewardship, is crucial in minimizing the spread of MDROs among respiratory patients²¹.

For neurological disorders, the observation of decreased consciousness with intracranial hemorrhage (ICH) and Hydrocephalus in our study population emphasizes the vulnerability of neurological patients to MDRO infections. Neurological conditions may necessitate invasive procedures, prolonged hospital stays, and the use of indwelling devices, increasing the risk of MDRO colonization and subsequent infections²³. The compromised immune status and impaired mucosal integrity in these patients further facilitate the dissemination of MDROs²⁴. In the others category, although specific studies directly linking the diseases in the "Others" category, such as post amputation, anemia, and obs febris, to MDRO infections may be limited, the underlying factors contributing to MDRO acquisition in these patients are noteworthy. Prolonged hospitalization, invasive procedures, and compromised immune status can increase the susceptibility of these individuals to MDRO colonization and subsequent infections²⁵.

By understanding the associations between these medical conditions and MDRO infections, healthcare providers can implement targeted infection control measures, such as strict hand hygiene, appropriate antimicrobial use, and surveillance programs, to mitigate the spread of MDROs in these vulnerable patient populations²⁶.

Study limitations

Sample size: One of the limitations of this study is the relatively small sample size. Although the study included 100 MDRO-infected patients, a larger sample size would have provided more robust and generalizable findings.

Single-center study: Another limitation is that the study was conducted at a single center, Dr. Kariadi Hospital in Semarang. This may limit the generalizability of the findings to other healthcare settings or patient populations.

Retrospective design: The study utilized a retrospective design, relying on medical records and data collected for clinical purposes. This design limitation may introduce inherent biases and incomplete information, potentially impacting the accuracy and completeness of the data.

Data availability: The study relied on the availability and accuracy of medical records, which may vary in completeness and consistency. Missing or incomplete data could have affected the analysis and interpretation of the results.

Conclusions

In this comprehensive study conducted at Dr. Kariadi Hospital, Semarang, we gained valuable insights into the disease patterns associated with MDRO infections. The findings revealed the prevalence of various infectious diseases, neoplastic diseases, cardiovascular diseases, renal and urinary tract disorders, autoimmune and rheumatic diseases, gastrointestinal disorders, respiratory disorders, neurological disorders, and other conditions in MDRO-infected patients.

The results underscored the significance of certain diseases, such as Covid-19, bronchopneumonia, and UTIs, in relation to MDRO infections. Factors contributing to the presence of MDROs in specific disease categories, such as prolonged hospitalization, invasive procedures, compromised immune systems, and antibiotic use, were highlighted. Despite the limitations of the study, including the sample size and single-center design, these findings provide important insights into the disease patterns and infection categories in MDRO-infected patients. The study emphasizes the need for vigilant infection control measures, targeted antimicrobial stewardship programs, and improved diagnostic and therapeutic approaches to effectively manage and prevent MDRO infections.

Future research should focus on larger multi-center studies, prospective designs, and comprehensive molecular analysis to further elucidate the underlying mechanisms of MDRO acquisition and develop evidence-based strategies for prevention and control.

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