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IgM antibody profile in patients with typhoid fever at a general hospital

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Abstract
Typhoid fever remains a significant public health problem in endemic areas, so accurate and timely diagnosis is crucial in supporting clinical management. Serological testing for immunoglobulin M antibodies has been widely used to support early diagnosis, especially in health care facilities with limited laboratory resources. This study aimed to describe the immunoglobulin M antibody profile in patients with a clinical diagnosis of typhoid fever who underwent serological testing at a general hospital. This study used a descriptive observational design with a cross-sectional approach. Venous blood samples were taken from 20 patients suspected of having typhoid fever and analyzed using an immunochromatography test. Data analysis was performed descriptively. The results showed that most patients had positive immunoglobulin M test results. It indicates the presence of acute or ongoing infection. Meanwhile, the rest showed negative results, likely because testing was performed early in the infection before optimal antibody levels. These findings confirm the role of immunoglobulin M testing as a relevant diagnostic tool in detecting acute typhoid fever. Interpretation of serology results needs to consider the clinical context and timing of sample collection in order to make clinical decisions more accurate in healthcare practice.

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1. Introduction

Typhoid fever remains a public health problem, especially in developing countries. The World Health Organization reports that every year there are an estimated 16 to 33 million cases of typhoid fever worldwide, with a death toll of 500,000 to 600,000 people. This disease can affect people of all ages, including children and adults, although children are often considered more susceptible to infection due to their immature immune systems. In many endemic areas, typhoid fever cases are most commonly found among 5- to 19-year-olds. This condition makes it an important issue in child and adolescent health (Fitriani & Sukmana M, 2020).

Typhoid fever in Indonesia has long been known as an endemic disease with a sporadic pattern of occurrence. Data from the Indonesian Ministry of Health shows that almost all provinces have reported cases of typhoid. In South Sulawesi Province, in 2014, there were more than 23,000 suspected cases of typhoid, with approximately 16,700 clinically confirmed cases. The distribution of cases shows striking variations across regions, with Bulukumba Regency, Makassar City, and Enrekang Regency reporting the

highest numbers, while several other regencies reported very low or even zero cases (Andayani & Ermawati, 2021). These findings confirm that typhoid remains an uneven but persistent health challenge.

Typhoid fever is caused by infection with Salmonella enterica serovar Typhi, while paratyphoid fever is mainly caused by Salmonella paratyphi A and B. These infections are transmitted through the fecal-oral route and are closely related to environmental sanitation and food hygiene. National hospitalization data show that in 2008, typhoid fever ranked second among hospitalized patients in Indonesia, accounting for more than 31% of all cases. It reflects the significant clinical burden of this disease on health services (Syahfurachman, 1994; Frewin & Ludong, 2020).

Humoral immune responses play an important role in the course of typhoid infection. Increased immunoglobulin levels, particularly IgM and IgG, are biological indicators that appear after exposure to Salmonella typhi or Salmonella paratyphi. IgM is generally detected earlier in the acute phase of infection and declines relatively quickly. Meanwhile, IgG can persist for a long time until the convalescent phase. Therefore, IgM detection is considered more representative for identifying acute infection than IgG, which often reflects prior exposure (Marzalina, 2019).

Conventional serological testing for typhoid still relies heavily on the Widal agglutination test, even though it detects only total agglutinins and is limited in distinguishing between infection phases. A more specific immunological approach, such as the Inhibition Magnetic Binding Immunoassay (IMBI), is considered superior because it can identify IgM antibodies against the O9 lipopolysaccharide antigen of Salmonella typhi. The advantage of this method lies in the use of the α-D-Tyvelosa epitope, which is highly specific to Salmonella group D1 and is not found in other microorganisms, thereby increasing diagnostic accuracy (Ali & Julianti, 2018; Destri et al., 2024).

The interpretation of IgM and IgG antibody profiles has important clinical implications. The detection of IgM without IgG generally indicates an acute infection, whereas the presence of IgG alone is often associated with a history of prior infection or reinfection. Under certain conditions, the combination of IgM and IgG may reflect a moderate to severe phase of infection. Additionally, individuals with asymptomatic typhoid carrier status remain a potential source of transmission, adding to the complexity of controlling this disease (Frewin & Ludong, 2020).

In line with advances in serological diagnostics, Salmonella dipstick tests that detect specific IgM binding to lipopolysaccharide antigens of S. typhi and S. paratyphi are increasingly used as practical, reliable screening methods. This test provides a relatively quick alternative for identifying acute typhoid infection, especially in healthcare facilities with limited resources (Andrio, 2018). Therefore, the IgM antibody profile in typhoid fever patients should be examined in relation to population characteristics, endemicity levels, and patterns of re-exposure that may affect the immune response and the interpretation of serological test results. This study aims to describe the IgM antibody profile in patients with typhoid fever undergoing serological testing at a general hospital. The results of this study are expected to strengthen the understanding of the pattern of humoral immune response in acute typhoid infection. The findings have the potential to serve as a reference for health workers in interpreting typhoid IgM test results and supporting more accurate clinical decision-making in patient management.

2. Method

2.1 Research Design and Participants

The study used a descriptive observational design with a cross-sectional approach. The study aimed to describe the IgM antibody profile in patients with typhoid fever without analyzing the cause-and-effect relationship. The study population consisted of all patients clinically diagnosed with typhoid fever who underwent serological testing at Sari Mutiara Lumbuk Pakam General Hospital. Blood samples of 3-5 mL were collected using a syringe. The blood was allowed to clot, then centrifuged to obtain serum for IgM antibody testing.

2.2 Instruments and Data Collection

Laboratory instruments include tools and materials used to support IgM antibody testing in patients with typhoid fever. The tools used include sterile syringes or vacutainers, blood tubes without anticoagulants, centrifuges, micropipettes and tips, tube racks, and timers. The research materials consist of patient blood serum and reagents for IgM anti-Salmonella tuphi antibody testing using the immunochromatographic test (ICT) method. Data collection began with the aseptic collection of 3-5 mL of

venous blood from patients and its placement in anticoagulant-free tubes. The blood samples were allowed to clot at room temperature and centrifuged to obtain serum, which was used for IgM antibody testing.

2.3 Data Analysis

The IgM antibody test results and patient demographic data were first checked for completeness and consistency. Next, the data were coded and organized into tables to facilitate analysis. Data analysis was performed descriptively in accordance with the research objectives. The IgM antibody test results were classified into positive and negative categories, and then the frequency and percentage were calculated to describe the IgM antibody profile in patients with typhoid fever. The data were presented in a frequency distribution table.

2.4 Ethical Considerations

The Health Research Ethics Committee has approved this study. The research data were obtained from laboratory tests and patient medical records without posing any additional risk to the research subjects. Patient confidentiality was maintained through the use of codes, and the data were used solely for research purposes. All research procedures were carried out in accordance with laboratory standard operating procedures.

3. Results and Discussion

3.1 Results

This section presents the results of IgM antibody tests in typhoid fever patients who were the subjects of the study. Table 1 presents IgM antibody test results for 20 patients with typhoid fever who underwent serological testing at Sari Mutiara Lubuk Pakam General Hospital.

Table 1. Data Hasil Pemeriksaan Antibody IgM Pada Pasien Demam Tifoid

Sample Code	Age (years)	Gender	Examination results
A1	13	Female	Positive
A2	59	Female	Negative
A3	49	Male	Negative
A4	24	Female	Positive
A5	18	Female	Positive
A6	42	Female	Positive
A7	9	Female	Negative
A8	20	Male	Positive
A9	31	Male	Positive
A10	7	Male	Positive
A11	12	Female	Negative
A12	65	Female	Negative
A13	24	Female	Positive
A14	13	Female	Negative
A15	14	Male	Negative
A16	47	Male	Positive
A17	8	Female	Positive
A18	49	Male	Negative
A19	24	Female	Positive
A20	17	Male	Positive

Table 1 presents the results of IgM antibody testing, which was positive in 12 samples (60%). Meanwhile, 8 samples (40%) tested negative. These findings indicate that more than half of the patients tested had detectable IgM antibodies at the time of testing. The distribution of positive and negative IgM antibody test results was observed across age groups and genders, with no clear dominance pattern. These results provide an initial overview of the IgM antibody profile in patients with typhoid fever undergoing serological testing.

3.2 Discussion

Research findings indicate that most typhoid fever patients who undergo serological testing have detectable positive IgM antibodies. The results confirm that the humoral immune response in most subjects has entered the acute phase or is ongoing. The presence of detectable IgM indicates the initial activation of the immune system in response to Salmonella typhi infection, a characteristic feature of the primary immune response (Alugupalli et al., 2022; Khan et al., 2023). IgM is the first antibody produced by the body after exposure to bacterial antigens (Barbosa et al., 2021). Positive IgM detection in typhoid fever patients indicates that the infection is still relatively new and that the pathogen-elimination process is ongoing. This pattern aligns with the body's defense mechanism, in which B cells produce IgM before the antibody class switch to IgG occurs (Stavnezer et al., 2014; Kracker et al., 2011). Therefore, IgM testing has important diagnostic value, especially in the early stages of the disease, when clinical manifestations are often not yet specific.

The proportion of negative IgM results, which remains quite significant in this study, underscores the complexity of interpreting typhoid serological tests. Negative results do not always indicate the absence of infection; they may reflect an inappropriate timing of sample collection. Tests performed too early may yield false-negative results (Vimercati et al. al 2021; Andrew et al., 2022). IgM antibodies against Salmonella typhi are generally detectable on the 3rd to 5th day after the onset of fever (Mugi et al., 2022). Therefore, the timing of the test is an important factor in determining the sensitivity of the IgM serological test.

The findings confirm that interpreting IgM results cannot be separated from the patient's clinical context. Symptoms of fever, illness duration, and exposure history need to be considered together to avoid interpreting laboratory results in isolation (Hillerdal et al., 2021; Samuel et al., 2025). IgM serology testing, although practical and relatively rapid, still has biological limitations related to the dynamics of the immune response (Emeribe et al 2021). Therefore, negative IgM results in patients with strong clinical suspicion should prompt further testing or repeat testing at a more appropriate time. These findings reinforce the role of IgM antibody testing as a diagnostic aid in detecting typhoid infection during the acute phase. This test has high clinical value, especially in healthcare facilities with limited access to more complex diagnostic methods. However, laboratory staff and clinicians need to understand that IgM testing is time-dependent and not a standalone test. Integrating laboratory results with clinical evaluation remains the most rational approach to establishing a diagnosis of typhoid fever.

4. Conclusion

Research suggests that most patients with typhoid fever who undergo serological testing in general hospitals have positive IgM antibody results. It reflects the dominance of the acute or ongoing phase of infection. These findings confirm that IgM testing plays an important role as an initial diagnostic tool in detecting typhoid infection, particularly in healthcare settings with limited laboratory facilities. The results of this study reinforce the use of immunochromatographic IgM testing as a rapid, applicable screening method, with interpretation that must take into account the onset of fever and the patient's clinical condition. This study has limitations that need to be considered. The relatively small sample size, descriptive study design, and lack of comparators, such as blood cultures, limit the generalizability of the findings and the comprehensive evaluation of diagnostic accuracy. Therefore, further research should use a longitudinal design, involve a larger sample, and combine serological testing with other diagnostic methods to obtain a more complete picture of the dynamics of the immune response and the accuracy of typhoid fever diagnosis across various healthcare settings.

Conflict of Interest

The authors declare no conflict of interest.

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