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Hyperthermia in a Patient with Relapse Malaria: A Case Report

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Abstract: Malaria is an infectious disease that caused by Plasmodium infection in red blood cells. The main clinical manifestations that appear in malaria are fever with shivering, shaking, and sweating and weakness. This condition can cause severe hyperthermia, which is at risk of causing brain damage, seizures, or delirium. This study aims to see the characteristics of fever and implementation in patients with malaria relapse. A 41-year-old man with a history of malaria four months ago. During the first malaria, the patient experienced fever to shivering and sweating as well as muscle pain and fatigue every morning. In malaria relapse, complaints of fever and chills every morning were exacerbated by complaints of dizziness as if being hit and weakness. Laboratory examination results found Plasmodium vivax gametocyte and schizont stages. The patient received paracetamol, cefixime, dexamethasone, and DHP Frimal therapy as well as Tepid Water Sponge therapy. After three days of treatment with a combination of pharmacological therapy and tepid water sponge, there was a decrease in temperature from 38.4°C with warm extremities, sweating, headache and shivering to 37.8°C on the second day and 36.7°C on the third day with warm extremities and no shivering, no headache and more fit. The administration of a combination of pharmacological and non-pharmacological tepid water sponge therapy in patients with malaria relapse was able to reduce hyperthermia. Further researchers are expected to be able to examine more widely the effectiveness of actions to reduce hyperthermia in adult patients with malaria.

Keywords: Hyperthermia, Malaria, Relapse.

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Introduction

Malaria is one of the leading causes of death, particularly in tropical and subtropical regions, ranking third after other diseases such as acute lower respiratory tract infections and diarrhea. Globally, there were 247 million reported malaria cases across 84 countries categorized as endemic regions. Indonesia is among the malaria-endemic countries, with a total of 543,965 cases, approximately 89% of which originated from Papua Province. Of all reported cases, 93% received treatment, while the remainder either did not seek treatment or self-medicated without a doctor's prescription. In 2024, the number of malaria-related deaths reached 178 (Kemenkes RI, 2025). Malaria relapse, particularly caused by Plasmodium vivax, presents a distinct challenge in malaria control. According to WHO, in 2017, approximately 82% of global Plasmodium vivax cases were concentrated in five countries, including

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Indonesia (WHO, 2019). Nascimento et al. (2019) reported that the prevalence of relapse ranged from 17% to 92.85%.

Malaria is a disease that affects red blood cells and is caused by Plasmodium parasites transmitted to humans through the bite of an infected female Anopheles mosquito. There are five known species of Plasmodium that cause malaria in humans: Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae, and Plasmodium knowlesi (Aini et al., 2022). Malaria is an infectious disease that may manifest acutely or chronically, caused by Plasmodium parasites invading red blood cells (erythrocytes). It is characterized by the presence of asexual forms of the parasite in the bloodstream and clinical symptoms such as fever, chills, anemia, and splenomegaly. The infection may affect vital organs including the kidneys, liver, and spleen, and in severe cases, can be life-threatening. In some patients, splenomegaly may reach more than 10 cm. Prior to infecting erythrocytes, the parasite first resides in the liver. Different Plasmodium species exhibit distinct characteristics in terms of symptoms and treatment approaches (Buhungo, 2022).

Plasmodium vivax tends to invade reticulocytes (immature red blood cells), whereas Plasmodium malariae infects mature red blood cells. This specificity limits parasitemia levels for both species to fewer than 20,000 parasites per cubic millimeter of blood (Roach, 2022). The parasite's erythrocytic cycle and the release of metabolic waste trigger an inflammatory response. As Plasmodium develops in erythrocytes, it forms schizonts which eventually rupture, releasing merozoites and waste products such as hemozoin. These substances, along with parasitic antigens, stimulate the immune cells to release pro-inflammatory cytokines like TNF-α and IL-1, which induce fever.

The clinical manifestations of P. vivax relapse closely resemble those of primary infection, including recurrent fever, chills, sweating, and headache, often accompanied by muscle and joint pain. Mild to moderate anemia commonly occurs due to red blood cell destruction and impaired erythropoiesis. Thrombocytopenia is also frequently observed, leading to easy bruising or minor bleeding. Some patients report non-specific symptoms such as malaise, fatigue, mild abdominal pain, and anorexia. In cases of repeated relapse, general health may deteriorate, with weight loss or mild chronic symptoms affecting quality of life, although not always as severe as the initial episode. Diagnosis of relapse is typically based on a history of previous infection, a pattern of recurrent fever, and blood tests confirming parasitemia after a symptom-free period (Mehra et al., 2024).

Fever in Plasmodium vivax relapse malaria is caused by the reactivation of hypnozoites, the dormant form of the parasite that resides in the liver following primary infection. Upon reactivation, hypnozoites release merozoites into the bloodstream, which subsequently infect red blood cells. This process results in erythrocyte rupture and the release of parasitic antigens and toxic products such as hemozoin, triggering the body's immune response. Immune activation leads to the release of pro-inflammatory cytokines such as IL-1, TNF-α, and IFN-γ, which act on the hypothalamus to raise the body's temperature set-point, causing fever accompanied by chills and sweating. Due to the cyclical nature of the parasite's lifecycle, fever symptoms recur during the relapse phase. This mechanism explains the characteristic periodic fever pattern of P. vivax malaria even without reinfection from an external source (White, 2021).

If malaria-induced fever is not promptly treated, patients are at risk of developing severe complications that may lead to death. Prolonged high fever can cause severe hyperthermia (body temperature >41°C), posing risks of brain damage, seizures, or delirium. One of the deadliest complications is cerebral malaria, marked by impaired consciousness, seizures, and coma due to microcirculatory blockage in the brain by infected erythrocytes. Massive red blood cell destruction can also cause severe anemia and tissue hypoxia. Fever and vomiting-related dehydration may lead to electrolyte imbalance, hypovolemic shock, and an increased risk of acute kidney injury. Another potentially life-threatening complication is non-cardiogenic pulmonary edema caused by increased capillary permeability, which can severely impair breathing. Therefore, timely and appropriate malaria treatment is essential to prevent life-threatening complications (CDC, 2024).

The recommended treatment for malaria currently involves the use of a combination of dihydroartemisinin-piperaquine (DHP). This combination enhances therapeutic efficacy and prevents drug resistance. In uncomplicated malaria cases, treatment is administered orally using DHP and primaquine. Primaquine also serves as a gametocytocidal and hypnozoiticidal agent. In contrast, severe malaria cases must be treated in healthcare facilities such as community health centers, clinics, or hospitals. Upon arrival, patients are given intravenous artesunate, administered via bolus at least three times. Once patients are able to take oral medication, treatment continues with a three-day course of DHP combined with primaquine, adjusted according to the infecting Plasmodium species. Antibiotics may be considered in adult severe malaria cases with hyperparasitemia, acute

kidney injury, acidosis, or malaria with shock (Kemenkes RI, 2023).

Paracetamol can be used to reduce fever (hyperthermia) in malaria patients. Paracetamol is an over-the-counter drug classified as an antipyretic and analgesic. A non-pharmacological intervention that may aid in reducing hyperthermia in malaria patients is the tepid water sponge. Research by Rossa (2019) demonstrated that implementing the tepid water sponge procedure effectively reduced body temperature in patients experiencing hyperthermia. In this case, the patient's temperature dropped from 39.2°C to 36.9°C, within the normal range. The focus of nursing interventions is to address hyperthermia through non-pharmacological measures, such as warm compresses or tepid water sponging. This procedure is performed for 10–15 minutes by wiping various body surfaces with a washcloth soaked in warm water. Body temperature is measured before and after the intervention, showing a temperature reduction of approximately 1°C. Based on these findings, tepid water sponging can be considered an effective independent nursing intervention in managing hyperthermia in adult patients, particularly as an initial treatment before or alongside pharmacological therapy (Aini et al., 2022).

This study aims to explore the characteristics of fever and its management in patients experiencing relapse malaria. A 41-year-old male, working in an endemic area, experienced fever accompanied by chills occurring only in the morning while visiting his hometown. His body temperature reached 38.4°C. The patient had a medical history of malaria and dengue fever. His relapse symptoms were exacerbated by weakness and a pulsating headache sensation.

Method

The research employed a case report design, which is a type of study focused on unexpected or unusual clinical findings and patient prognoses, supported by literature or other case reports. The methodological approach used was descriptive. Data were collected through observation, subjective assessment of the client, and evaluation of physical examination results (Alsaywid & Abdulhaq, 2019). The study was conducted on a patient with relapsing malaria in the Internal Medicine Inpatient Ward of a hospital in West Java from September 17 to 19, 2024. The respondent signed an informed consent form containing an explanation of voluntary participation, research procedures, responsibilities of the respondent, risks and side effects, benefits, and assurances of patient confidentiality.

Pharmacological interventions administered to the patient included oral DHP Frimal (3 times daily), injectable Cefixime (1 gram twice daily), injectable Ranitidine (1 ampoule twice daily), injectable Dexamethasone (1 ampoule three times daily), oral Paracetamol (once daily), intravenous Asering fluid therapy on the first and second days, and Ringer's Lactate on the third day at a rate of 20 drops per minute. Paracetamol, as an antipyretic, was administered at 9:00 AM when the patient's body temperature began to rise. Despite this, the patient experienced chills and warm extremities, after which tepid water sponge therapy was applied for approximately 15 minutes, resulting in a temperature reduction of 1–2 °C. On the first day, Paracetamol was given at 9:00 AM, yet the patient still experienced fever and chills at 10:00 AM. On the second day, Paracetamol was given at 10:00 AM to prevent chills and fever, but symptoms still occurred at 11:00 AM. On the third day, Paracetamol was administered again at 9:00 AM. Evaluation was conducted through body temperature measurement using a thermometer, palpation of extremity temperature, and subjective patient-reported symptoms.

The non-pharmacological interventions implemented in this case study included increased oral fluid intake, the use of blankets, and the application of tepid water sponge therapy to manage hyperthermia in the patient with malaria. Tepid sponge is an independent nursing intervention proven effective in reducing body temperature in patients experiencing fever or hyperthermia. This intervention was performed for 15–20 minutes using water at a temperature of approximately 40–50°C. Its effectiveness was assessed by comparing body temperature reductions and patient comfort levels before and after the intervention (Rossa, 2019). In this study, tepid water sponge therapy was applied when the patient began to experience fever and chills in the morning. The intervention was performed for approximately 15 minutes, targeting the neck, both armpits, and groin areas, using warm water. It was conducted around 10:00 AM, about one hour after Paracetamol administration, when the patient began to show symptoms of fever and chills.

Result and Discussion

Date and Time	Intervention	Temperature	Subjective Complaint
17/09/2024			
09.00	Pharmacology	38.4 °C	Headache, Myalgia
10.00	Tepid Sponge	37.9 °C	Chills, Sweating
10.30	**Evaluate**	36.9 °C	Fatigue
18/09/2024			
10.00	Pharmacology	37.8 °C	Headache, Myalgia
11.00	Tepid Sponge	37.4 °C	Chills, Sweating
11.30	**Evaluate**	36.3 °C	Fatigue

19/09/2024			
09.00	Pharmacology	36.7 °C	Fatigue
10.00	Tepid Sponge	36.3 °C	Sweating
10.30	**Evaluate**	36.2 °C	No complaint

In this case, *Plasmodium vivax* was found in the patient's blood in the gametocyte and schizont stages. The patient had a history of malaria four months prior to hospital admission. During the primary malaria episode, the patient did not seek treatment at a healthcare facility due to distance constraints. He only took one tablet of primaquine per day without a doctor's prescription. Once he felt better, he stopped taking the medication, with a total duration of consumption being approximately one week. In *Plasmodium vivax* infections, some of the liver-stage trophozoites do not immediately develop into schizonts but transform into a dormant form known as hypnozoites. These hypnozoites can persist in liver cells for months or even years. When the immune system weakens, the hypnozoites can reactivate and cause a relapse. Relapse caused by *Plasmodium vivax* typically occurs between 4 to 12 months after the initial (primary) episode (Kemenkes RI, 2016).

Relapse refers to the condition in which malaria parasites reappear after 28 days post-treatment. This is usually due to incomplete primaquine therapy over 14 days or suboptimal drug effectiveness (Kemenkes RI, 2025). In this patient, the malaria relapse was caused by incomplete antimalarial treatment. Other factors contributing to malaria relapse include the hypnozoite parasite form *Plasmodium vivax* has a dormant liver form called hypnozoites that can reactivate and cause relapse. The number and proportion of hypnozoites in the initial infection influence the relapse frequency. Males are more at risk for relapse, possibly due to immunological and environmental exposure factors. Bites from infected *Anopheles* mosquitoes may trigger reactivation of dormant hypnozoites. Rainy seasons, high humidity, and warm temperatures increase mosquito populations and the risk of transmission, which may contribute to relapse. The effectiveness of primaquine is highly dependent on the total dose administered. Low doses or doses not adjusted to body weight can lead to relapse. Individuals who work outdoors or live in endemic areas are at higher risk of mosquito bites and, consequently, relapse. Limited access to healthcare and treatment can affect adherence to therapy and increase the risk of relapse (He et al., 2019).

The clinical manifestations experienced by the patient during the primary malaria episode included morning fever, muscle pain, sweating, and fatigue. In the relapse episode, the patient felt the symptoms were more severe compared to the primary episode. The fever still occurred in the morning but was worsened by a pounding headache and chills whenever the body temperature rose. The chills caused fatigue after the fever gradually subsided due to muscle tension during the chills.

The patient's headache was caused not only by red blood cell lysis due to the parasite but also influenced by the fever. Hyperthermia or increased body temperature due to excessive heat exposure can trigger or worsen headaches through several physiological mechanisms. Heat causes dehydration, which reduces blood volume and causes brain tissue to contract, triggering nerve pain. High temperatures stimulate the release of neurogenic inflammatory mediators such as substance P and CGRP from afferent nerves, causing local inflammation and vasodilation of the head's blood vessels—conditions often associated with migraines and tension-type headaches. Additionally, disturbed electrolyte balance may cause muscle weakness or cramps, exacerbating neck and head muscle tension, thus increasing the sensation of pain. Clinically, patients with hyperthermia often report dull or throbbing headaches, dizziness, and pressure in the temples, which intensify after physical activity or direct sun exposure (Foster et al., 2020).

The clinical manifestations of relapse malaria generally resemble those of primary infection, but the symptoms are often milder. Main symptoms include intermittent fever (usually every 48 hours), chills, sweating, headache, muscle and joint pain, nausea, vomiting, and general weakness and fatigue. In some cases, mild anemia and splenomegaly may be observed. Unlike primary infection, relapse malaria rarely causes severe complications. However, repeated relapses can have a significant impact on the patient's overall health, especially if not treated with hypnozoite eradication therapy such as primaquine (Ministry of Health RI, 2016). White (2021) states that relapse symptoms are usually milder than the initial infection due to lower levels of parasitemia. Meanwhile, the CDC (2024) also mentions that relapse can occur weeks to months after the initial infection has resolved, with similar clinical features that are generally less severe than the primary episode. The severity experienced by the patient in this relapse episode was influenced by inadequate primaquine dosing and the number of reactivated parasites in the blood.

A study by Mehdipour et al. (2023) showed that patient adherence to primaquine therapy greatly influences the risk of *P. vivax* malaria relapse. A meta-analysis of individual patient data from various countries found that patients who did not complete the full course of primaquine therapy had a significantly higher risk of relapse. This study underscores the importance of education and monitoring in relapse

prevention therapy. Meanwhile, Schäfer et al. (2021) highlighted the role of hypnozoites (the latent liver stage) in causing relapse. New findings related to the biological mechanisms of hypnozoites and the challenges in developing effective therapies are due to the fact that these forms can remain dormant for weeks to months before reactivating.

In this study, the patient was given oral paracetamol 500 mg. After administration, the patient's body temperature decreased by approximately 0.5°C. In addition to being an antipyretic, paracetamol also functions as an analgesic, so complaints of muscle and headache pain decreased from a scale of 5/10 to 2/10. The fever in malaria patients is caused by the inflammatory response to parasitic infection. Paracetamol inhibits the cyclooxygenase (COX) enzyme, primarily COX-2, which is involved in the synthesis of prostaglandin E_2 (PGE_2) in the brain. PGE_2 is the main mediator that raises the body's temperature set point in the hypothalamus, causing fever. By reducing PGE_2 production, paracetamol helps lower the set point back to normal, thereby reducing fever. Paracetamol shows selective activity against COX-2 under conditions where arachidonic acid and peroxide concentrations are low, such as in the brain (Graham & Scott, 2015). This is consistent with the study by Noor Sofikah et al. (2021), which showed that paracetamol produced a greater and faster reduction in fever than warm compresses. Warm compresses without antipyretics are often used to reduce fever but were only effective for about 30 minutes. Paracetamol proved to be more effective over the next two hours compared to warm compresses in reducing fever in febrile patients in tropical climates. Meta-analysis results showed that warm compresses were less effective than paracetamol in reducing fever two hours after intervention.

The reduction in temperature in hyperthermic patients was also influenced by the use of the antimalarial drug dihydroartemisinin, which functions to reduce the parasite count in the blood, while piperaquine prevents relapse by killing residual parasites and providing post-treatment prophylaxis. The patient was also given cefixime, a third-generation cephalosporin antibiotic, and dexamethasone, which has anti-inflammatory and immunosuppressive effects. Antimalarial drugs work by killing *Plasmodium* parasites that cause malaria. By reducing the parasite load, these drugs help alleviate or eliminate fever and chills caused by the infection (Saeheng & Na-Bangchang, 2022).

Dihydroartemisinin (an artemisinin derivative) works by generating free radicals within the *Plasmodium* parasite, damaging parasite proteins and cell membranes. Piperaquine inhibits heme detoxification within the parasite, leading to its death. Eliminating malaria parasites from the blood removes the pyrogenic stimulus (fever trigger), allowing body temperature to return to normal (Asih et al., 2022). Corticosteroids (anti-inflammatory drugs) can inhibit prostaglandin E_2 synthesis in the hypothalamus by reducing phospholipase A2 activity. They suppress excessive immune responses (e.g., pro-inflammatory cytokines like IL-1, IL-6, and TNF-α), which trigger fever, reduce systemic inflammation, and lower the body's temperature set point (Steen et al., 2020). Cefixime is active against both Gram-positive and Gram-negative bacterial infections and kills bacteria by inhibiting bacterial cell wall synthesis (Ramdhani et al., 2021).

This study found a decrease in body temperature in hyperthermic patients following the tepid water sponge intervention. This is consistent with the findings of Putri et al. (2020), which showed that temperature reduction in patients receiving tepid water sponge occurred significantly faster compared to those who only received antipyretics. Furthermore, the tepid water sponge method was also proven to be more effective in reducing body temperature than standard warm compress techniques. The study revealed that the average temperature drop after tepid water sponge was 0.7°C, while using fever patches only reduced body temperature by 0.1°C. These findings suggest that tepid water sponge is more effective in reducing fever compared to fever patches (Ariyani et al., 2024).

Statistical analysis results showed that red onion rubbing and tepid water sponge therapy were effective in reducing fever in children. The significance value (p-value) for red onion rubbing was 0.000, which meets the criterion of p-value ≤ 0.05, thus proving its effectiveness. The p-value for tepid water sponge therapy was 0.0001, which also meets the criterion, indicating this therapy's effectiveness in lowering fever in children (Syiffani et al., 2023).

Although tepid water sponge is commonly applied to pediatric patients, this intervention has also been proven effective in adult patients. In adult patients with dengue fever, tepid water sponge therapy resulted in reduced body temperature. On the first day, body temperature was recorded at 37.8°C and dropped to 36.5°C on the second day after the intervention. Measurements taken before and after the intervention showed a temperature drop of around 1°C, indicating the effectiveness of this intervention in reducing fever in adult patients (Aini et al., 2022).

The mechanism of fever reduction in hyperthermic patients using tepid water sponge is based on the process of evaporation. When the skin is moistened with warm water (around 42–45°C), the water evaporates and absorbs heat from the skin's

surface. Each gram of evaporated water can absorb approximately 0.58 kcal of heat. The compress is applied to specific areas with superficial blood vessels, which can help cool the brain indirectly. Conduction and convection also occur, where warm water applied to the skin absorbs heat through conduction, and cooler surrounding air helps remove heat through convection. Exposure to warm water causes vasodilation of skin blood vessels, increasing blood flow to the surface and facilitating heat release. Thermal receptors in the skin also send signals to the hypothalamus to adjust the body's temperature set point (Agustina et al., 2024).

Nurses play an essential role in preventing malaria relapse by ensuring patient adherence to hypnozoite eradication therapy with anti-relapse medications such as primaquine or tafenoquine following acute phase treatment. Nurses must provide health education on the importance of completing the full medication regimen, even when symptoms resolve, and explain the potential for relapse if treatment is incomplete. In addition, nurses should screen for G6PD deficiency before administering primaquine or tafenoquine, due to the high risk of hemolysis in deficient individuals. Secondary prevention measures also include educating patients about relapse risk factors, such as immune suppression, stress, or other infections. Nurses also have a role in long-term monitoring through home visits or periodic check-ups to ensure relapse does not occur and to detect early symptoms. In endemic areas, nurses may engage in community health promotion programs by encouraging bed net use, vector control, and raising awareness of early malaria symptoms. Implementing this holistic approach aims to reduce relapse rates, improve patient quality of life, and support broader malaria eradication efforts (Rahi et al., 2023).

The results of this study showed that the patient experienced morning fever, chills, fatigue, and a pounding headache. The fever gradually improved after three days of hospitalization and treatment with both non-pharmacological (tepid water sponge) and pharmacological therapies (DHP Frimal, cefixime, and paracetamol). Tepid water sponge therapy aims to induce vasodilation, or the widening of blood vessels, which helps maintain homeostasis. This vasodilation increases blood flow throughout body tissues, reduces blood viscosity, and optimizes local metabolism by enhancing oxygen delivery (Sarayar et al., 2023). Studies show that combining antipyretic therapy with tepid sponge therapy is more effective in controlling hyperthermia than antipyretics alone (Purbandini et al., 2023). However, the effectiveness of this method still depends on proper technique and close monitoring and should not replace antimalarial treatment as the primary therapy (WHO, 2024).

Conclusion

The characteristics of fever observed in this relapse case remained consistent with typical *Plasmodium vivax* relapse patterns, occurring in the morning and lasting approximately one hour. The fever episode began with an increase in body temperature and the onset of muscle pain, followed by chills and headache, and ended with fatigue and sweating. In this relapse episode, clinical manifestations were exacerbated by the presence of more intense headaches. Based on the findings, the combined intervention of tepid water sponge therapy and antipyretic administration (paracetamol) effectively reduced the patient's body temperature during episodes of malaria-induced hyperthermia. The intervention was applied consistently each time the patient exhibited fever symptoms, contributing to its effectiveness. Prior to the intervention, the patient's body temperature was recorded at 38.4°C, accompanied by warm extremities, headache, muscle pain, chills, and fatigue. By the third day, the temperature had decreased to 36.7°C with warm extremities, and all complaints had resolved. Further research with a larger sample size is needed to confirm the generalizability of these findings and to evaluate the long-term effects of this combined intervention in malaria patients with varying degrees of severity.

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Author Contributions

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Conflicts of Interest

The authors declare there are no conflicts of interest related to this study. No financial or personal relationships influenced research design, outcomes, or reporting. The use of red ginger compresses was selected based solely on clinical evidence, with no commercial affiliations.

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