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Effectiveness of warm compresses in reducing fever in children with typhoid fever

Muhammad Khabib Dimyati, Puguh Widiyanto, Sodiq Kamal

Authors information
Department of Nursing, Universitas Muhammadiyah Magelang, Indonesia

Contactable email: khabibdimy@gmail.com / Article DOI: *On process*

Abstract
Typhoid fever is an infectious disease caused by the Salmonella Typhi bacteria, commonly transmitted through fecal contamination and infected food. After entering the digestive system, the bacteria colonize and infect the small intestine. One of the primary symptoms of typhoid fever is a rise in body temperature above 37.5°C, known as hyperthermia. Non-pharmacological nursing interventions, such as applying warm compresses, are often used to help reduce elevated body temperatures. This study aimed to evaluate the effectiveness of warm compresses in lowering hyperthermia in children with typhoid fever at PKU Muhammadiyah Temanggung Hospital. This study utilized a structured case study approach, with interventions administered at regular intervals. Findings showed that the application of warm compresses was effective in reducing hyperthermia. In conclusion, the study suggests that warm compresses are an effective non-pharmacological intervention for lowering body temperature in children experiencing hyperthermia due to typhoid fever.

Keywords: Typhoid fever; hyperthermia; warm compress; complementary therapy; hospital care

Introduction
Typhoid fever is a bacterial infection caused by *Salmonella Typhi*. It can be transmitted through consumption of food or water contaminated by the feces or urine of an infected individual. Symptoms typically emerge 1 to 3 weeks after exposure and include high fever, malaise, headache, nausea, loss of appetite, constipation or diarrhea, pink spots on the chest (known as rose spots), and enlargement of the spleen and liver (Kanj et al., 2020). Common problems in patients with typhoid fever include hyperthermia, nutritional deficits, hypovolemia, acute pain, and constipation. Hyperthermia, or elevated body temperature, is defined as an oral temperature exceeding 37.8°C or a rectal temperature above 38.8°C, often due to external or physiological factors (Pratiwi & Putri, 2022). This condition arises when the body's thermoregulation system fails to effectively control internal temperature. Hyperthermia is usually managed through processes like sweat evaporation, but factors such as high ambient temperatures (above 39°C or 35°C with high humidity) can make cooling less effective. High humidity impedes evaporation, causing heat retention and possible dehydration, which may lead to electrolyte imbalance. Excessively elevated body temperatures pose a risk of damaging the brain and other vital organs (Anisa, 2019).

Applying warm compresses is a non-pharmacological nursing intervention that helps reduce body temperature by stimulating large muscle areas, such as the axilla, neck, and groin folds. In children with hyperthermia, warm compresses encourage the opening of skin pores, promoting heat release from the body. Research by Purwanti & Ambarwati (2021) supports this approach, indicating that warm compresses raise the external skin temperature, signaling the brain to reduce the body's internal heat production. This process results in vasodilation, as peripheral blood vessels in the skin widen, allowing pores to open and heat to escape. Consequently, a decrease in body temperature is observed (Fadil & Hasan, 2018). Warm compresses are a non-pharmacological intervention often used to help reduce fever by facilitating the body's natural cooling processes. When a warm compress is applied to areas with large blood vessels close to the skin's surface, such as the neck, armpits, and groin, it encourages blood flow to these regions and stimulates the dilation of blood vessels (Souza et al., 2022). This vasodilation enables heat to transfer more readily from the blood to the surface of the skin, where it can dissipate into the environment, effectively lowering the core body temperature. The principle is based on thermoregulation: the body senses the external warmth and reduces the brain's internal heating signals, helping bring the overall temperature down. Additionally, the warmth from the compress can soothe muscle tension and provide a comforting sensation, helping to reduce any chills or shivering that may accompany a fever (Krafft et al., 2022). In contrast to cold compresses, which may cause the blood vessels to constrict and retain heat internally, warm compresses support a more gradual and sustained release of heat, which can be more comfortable and effective for reducing fever in children and adults.

Apart from helping reduce fever, warm compresses have added benefits in fever management. They are easy to prepare, cost-effective, and require no specialized equipment, making them a practical option for home care. The gentle warmth is generally well tolerated by patients, including young children, who might otherwise find the sharp cold of ice packs uncomfortable or distressing (Holgersson, Ceric, Sethi, Nielsen, & Jakobsen, 2022). For safe and effective use, the compress should be warm, not hot, to avoid burns or discomfort. It is applied for short intervals, typically 10-15 minutes, with breaks to allow the skin to breathe. Studies have shown that warm compresses not only facilitate temperature reduction but also encourage relaxation, which can help alleviate fever-induced discomfort. However, it's important to note that while warm compresses can help reduce fever, they should be used as a supportive measure rather than as a sole treatment (Krafft, Raak, & Martin, 2023). Persistent high fever requires medical attention to address any underlying infection or condition, as fever often signals the immune system's response to illness. Thus, warm compresses, used alongside other care methods, provide an effective, natural way to help regulate body temperature and improve comfort during fever. Therefore, the study is aimed to use the warm compress in reducing fever in children with thypoid.

Case Description

This research follows a case study approach in which nursing care was provided in a structured manner over a period of 3x24 hours. The nursing process was employed, beginning with a detailed assessment of the patient's condition through data collection via interviews with the patient and their family and information from the Electronic Medical Records (ERM). After data collection, analysis was conducted to identify nursing diagnoses. Based on these diagnoses, nursing interventions were planned, implemented, and evaluated. The focus of this study was a 14-year-old male client presenting with a high fever. Nursing interventions were carried out for three days, with a warm compress applied once daily to reduce the client's body temperature. Following each warm compress application, an evaluation was conducted to observe any changes in body temperature before and after treatment. During the assessment, data indicated that the client had been experiencing a high fever for five days, with temperature spikes particularly noticeable at night. The patient's mother reported that her child was shivering, had not had a bowel movement in 5–6 days, and experienced abdominal discomfort described as a hot sensation. The patient also reported nausea and occasional vomiting, with the mother noting that vomiting occurred approximately six times a day, particularly following food or liquid intake. The client appeared weak and pale, with symptoms including anemic conjunctiva, dry lips, poor skin turgor, and a capillary refill time (CRT) of less than 3 seconds. Other observations included a high body temperature, an anxious appearance, and complaints from the mother about a bitter taste in the client's mouth during eating or drinking. Additionally, the patient's tongue exhibited a white coating.

The client's vital signs were as follows: blood pressure of 105/66 mmHg, pulse rate of 76 beats per minute, temperature of 39.8°C, and respiratory rate of 32 breaths per minute. Abdominal examination findings included: Inspection—brownish skin tone, flat abdomen without lesions; Auscultation—normal bowel sounds; Palpation—no masses, but tenderness present; Percussion—tympanic sounds. Cardiac examination revealed: Inspection—symmetrical chest, brown skin tone, no ictus cordis; Palpation—no heart dilation; Percussion—dull heart sounds; Auscultation—clear "lub-dub" sounds without additional murmurs. Finally, lung assessment findings were as follows: Inspection—chest wall retraction visible; Palpation—no lung dilation; Percussion—no tenderness; Auscultation—sonorous breath sounds. This comprehensive assessment provided a baseline for the application of warm compresses and the evaluation of their effectiveness in managing hyperthermia in the client. Based on the collected data, it can be concluded that the primary nursing diagnosis in this case is hyperthermia. The data aligns with both the major and minor criteria for diagnosing hyperthermia. After establishing this diagnosis, a plan for nursing interventions was developed, focusing on addressing the elevated body temperature. One of the planned interventions included the application of warm compresses, a method supported by theoretical and clinical evidence as effective in reducing hyperthermia. The decision to use warm compresses is well-founded, as it aligns with the reviewed literature, which indicates that warm compresses help lower body temperature by promoting heat dissipation through the skin. This approach is suitable in non-pharmacological management of hyperthermia, providing safe and supportive care to the patient while minimizing dependency on medications. Through this intervention, the nursing care plan seeks to reduce the discomfort associated with high fever and improve overall patient outcomes.

Discussion

According to the literature reviewed, many of the signs and symptoms observed align with those typical of typhoid fever. This study was conducted on December 18, 2023, in the Multazam room at PKU Muhammadiyah Hospital Temanggung, where data was gathered from multiple sources: the patient, the patient's mother, the attending nurse, the patient's medical records, and direct observation. At the time of observation, a 14-year-old patient presented with a confirmed medical diagnosis of typhoid fever. Referencing the study by Santoso et al. (2022), typhoid fever is identified as a bacterial infection caused by Salmonella typhi. This bacterium infects the body through contaminated food or water and typically leads to systemic infection. Symptoms often emerge 1-3 weeks post-exposure and include malaise, high fever, nausea, headache, loss of appetite, and, in some cases, gastrointestinal symptoms like diarrhea

or constipation. Physical signs may also include pink spots on the chest, known as Rose spots, and, in severe cases, liver and spleen enlargement. Imara (2020) further describes typhoid fever as an acute infectious disease caused by Salmonella typhi, marked by prolonged fever and bacteremia. The infection can invade monocular phagocyte cells, particularly in the liver, spleen, intestinal lymph nodes, and Peyer's patches. This gram-negative bacterium is characterized by flagella, lack of a capsule, and its facultative anaerobic nature. Based on an analysis of both the literature and this patient's case, the findings suggest a clear match between the theoretical presentation and the clinical symptoms observed in this case of typhoid fever. The cause and primary symptoms align closely with those described in the literature, affirming the diagnosis and reinforcing the understanding of typhoid fever's presentation and impact on patient health (Mooventhan & Nivethitha, 2014).

From the study's findings, a nursing diagnosis of hyperthermia (D.0130) was established for the patient with typhoid fever due to the Salmonella Typhi infection. This diagnosis addresses the primary complaint and observed symptoms, including the client's high temperature and physical signs such as weakness, dry mucous membranes, pale conjunctiva, and elevated body temperature and respiratory rate (S: 39.8°C, RR: 32x/min). Additional laboratory data, including leukocyte count (14,000), hematocrit (Ht: 32.4), and hemoglobin (Hb: 10.6 g/dL), supported the diagnosis. Interventions were planned based on the SDKI, SLKI, and SIKI frameworks, with clear targets for symptom management. Nursing interventions for hyperthermia included fever treatment (thermoregulation), fluid management, and monitoring of vital signs. The interventions yielded significant improvement, particularly with fluid management and warm compress application, which facilitated heat loss and lowered body temperature by opening pores for heat evaporation. Research by Purwanti and Ambarwati (2021) on the effects of warm compresses for fever reduction in hyperthermic pediatric patients supports this intervention, suggesting that applying compresses to areas with large blood vessels (e.g., neck, axillae) can stimulate the hypothalamus to release heat. The study further corroborated those physical interventions, including warm compresses and increased fluid intake, effectively reduce fever by inducing peripheral vasodilation and promoting sweating. As Fadil & Hasan (2018) and Kusuma, Suryani, & Cahyaningrum (2023) explain, warm compresses convey an external heat signal, encouraging the brain to limit internal temperature increases. With vasodilation, the skin pores open, allowing heat to escape and decrease body temperature. Pangseti et al. (2020) highlight the importance of compressing areas rich in blood vessels (e.g., neck, groin) to optimize heat loss through evaporation. This aligns well with the clinical intervention in this case, where warm compresses to the forehead, axilla, and neck for 15-30 minutes reduced the patient's temperature from 39.8°C to 38.4°C before any fever-reducing medications were administered. To further enhance comfort and facilitate cooling, the patient wore loose clothing during the warm compress therapy (Schulte, Blakeslee, Kandil, Stock-Schröer, & Seifert, 2022).

Based on the cases and studies reviewed, it can be concluded that warm compress therapy significantly reduces hyperthermia and offers valuable insights for families in managing fever symptoms. In addition to warm compress application, it is crucial to monitor the patient's body temperature consistently and to maintain a comfortable environment and position for the patient. These steps support effective fever management and enhance patient comfort. This final stage of nursing care includes setting clear, achievable outcomes over a three-day period (18-20 December 2023), with the goal of resolving the symptoms associated with hyperthermia. At the end of the evaluation, the patient's condition improved: body temperature normalized to 36.7°C, the lips appeared hydrated, and the tongue no longer showed a white coating. These results indicate successful resolution of the hyperthermia problem and a positive response to the applied interventions.

Conclusion

Based on the author's research findings, it can be concluded that warm compresses effectively lower a child's body temperature. When a warm compress is applied, it raises the external skin temperature, which the body perceives as warm. This perception signals the brain's temperature regulator to reduce internal body heat. The warmth from the compress causes peripheral blood vessels to dilate (vasodilation), leading the skin pores to open and allowing heat to escape more easily. This physiological response facilitates the reduction of body temperature, supporting temperature regulation in children experiencing fever.

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