



The Efficacy of Warm and Cold Compresses in Reducing Body Temperature among Hyperthermic Sepsis Patients

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ABSTRACT

Introduction: Clinical manifestations in sepsis patients include high fever (hyperthermia). Interventions to reduce fever can be done through non-pharmacological therapy, including cold and warm compresses. **Objective:** This study was determine the effectiveness of warm and cold compresses on temperature changes in hyperthermic patients in the ICU. **Methods:** This study was a quantitative study with a quasi-experimental pre-post design with a control group. The study was conducted at Sulianti Saroso Infectious Disease Hospital (SSIDH). The sample consisted of sixty (60) patients diagnosed with sepsis in the ICU, with thirty (30) patients receiving warm compress intervention and thirty (30) patients receiving cold compress intervention. The intervention involved a compressing procedure according to the hospital's SOP. **Results:** In the warm compress intervention group, the average body temperature before intervention was 38.74⁰C; after intervention, it was 36.76⁰C. In the cold compress intervention group, the body temperature before intervention was 38.59⁰C; after intervention, it was 36.75⁰C. There was a difference in body temperature before and after intervention for both warm and cold compresses (p-value=0.0001) but the changes in the two interventions were not statistically different (p-value=0.437). **Conclusion:** Both compresses are effective in reducing the body temperature of sepsis patients experiencing hyperthermia. The results of this study can be used as input for nursing interventions in ICU patients with hyperthermia problems with non-pharmacological interventions through warm compresses and cold compresses.

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1. INTRODUCTION

Sepsis remains a significant global health challenge due to its complex and costly treatment, resulting in high mortality rates. Global epidemiological estimates indicate that sepsis affects over 30 million individuals worldwide annually, potentially resulting in 6 million deaths (Hatman et al., 2021). Nearly half of sepsis-related deaths are related to complications arising from trauma and non-communicable diseases (World Health Organization, 2020). Sepsis is a leading reason patients are admitted to the Intensive Care Unit (ICU) (Akbar et al., 2018). Its association with high morbidity and mortality rates results in a significant allocation of ICU budgets (Hatman et al., 2021).

Developing countries experience the highest mortality rates from sepsis (Purba et al., 2020). A multinational study in Southeast Asia revealed that sepsis is linked to increased mortality, ranging from 30% for sepsis to 80% for septic shock (Sidharti et al., 2020). Indonesia, being the most populous country in Southeast Asia and the fourth most populous globally, faces a high incidence of infectious diseases, including sepsis. A retrospective observational study conducted by Purba et al. in four Indonesian health centres found that out of 14,076 sepsis patients, 5,876 (41.7%) survived, while 8,200 (58.3%) died. The national burden of sepsis on 100,000 patients is estimated at US\$130 million. Patients with multifocal infections and single-focal lower respiratory tract infections bear the highest economic burden, estimated at US\$48 million and US\$33 million, respectively, among 100,000 sepsis patients (Purba et al., 2020). Additionally, the health profile of Jakarta Province in 2021 indicates that sepsis is the cause of neonatal death (Dinas Kesehatan Provinsi DKI, 2021).

One of the clinical manifestations observed in sepsis patients is hyperthermia. Fever is most often a symptom of infection, but approximately 25% of hyperthermia in critical care is not due to infection but a tumoral, ischemic, or allergic nature. Fever is a systemic inflammatory response resulting from infection and/or organ disorder, which are underlying conditions associated with sepsis syndrome (Doman et al., 2023).

Temperature is one of the most important vital signs for all patients, including intensive care units (ICU). Fever or hypothermia often necessitates further physical evaluations, investigations, and changes in treatment in the ICU. Hyperthermia, characterised by elevated body temperature, is a component of the host's acute phase response to infectious and non-infectious inflammatory stimuli, making it one of the most prominent symptoms of infection. While fever is often viewed as detrimental due to its potential adverse effects on neurological outcomes, it also offers beneficial effects. These may include reducing bacterial growth, increasing antibody and cytokine synthesis, activating immune cells, and ultimately enhancing survival (Achaiah et al., 2023).

Some studies suggest that treating fever with antipyretic drugs may exacerbate patient outcomes (Wang et al., 2023). The management of fever involves both pharmacological and non-pharmacological therapies. Pharmacological therapy includes antipyretic drugs such as paracetamol and ibuprofen, while non-pharmacological approaches include lightweight clothing, staying hydrated, getting adequate rest, and applying compresses. Various techniques for applying compresses to reduce body temperature include warm compresses and cold compresses. There are different understandings regarding the management of fever, especially in relation to non-

pharmacological measures, with conceptual disparity related to the effectiveness of different methods. Nurses play a unique role in the care of febrile patients and often make use of non-pharmacological technique, based on individual clinical experience with no scientific evidence (Souza et al., 2022).

Several studies have demonstrated the effectiveness of both warm and cold compresses. Research by Ilhamsyah, (2022) indicates that warm compress intervention effectively reduces body temperature in post-craniotomy traumatic brain injury patients with hyperthermia. Additionally, Research by Rahmawati & Purwanto (2020) found that warm and cold compresses effectively lower body temperature in children in Dr. M. Yunus Hospital Bengkulu, with warm compresses being more effective. Research (Kurniawan, 2018) demonstrated that airflow and cold compresses effectively decrease the body temperature in sepsis patients with hyperthermia in the ICU Room of Dr Kariadi Hospital Semarang. (Rahayu et al., 2019) They concluded that warm compresses are more effective than cold compresses in reducing pain in fracture patients.

The cold or warm compress method has been established as a standard operating procedure (SOP) for compress application in the ICU ward of Sulianti Saroso Infectious Disease Hospital (SSIDH). However, the lack of prior research on the effectiveness of this method prompted researchers to investigate the efficacy of using warm and cold compresses in managing temperature.

The dissemination of warm and cold compresses without their effectiveness proven in the prior international literature is a phenomenon of potential investigation. We intervene in hyperthermic patients due to infectious diseases with cold and warm compresses. This non-pharmacological therapy was expected to accelerate hyperthermia management, particularly in sepsis patients.

2. METHODS

Research Design

We conducted a quasi-experiment with a two-group pretest-posttest design in the ICU ward of Sulianti Saroso Infectious Disease Hospital, North Jakarta, from December 2023 to January 2024. We investigated warm and cold compresses as an intervention to decrease body temperature in hyperthermia patients. The observation was done twice, before and after the intervention.

Population and Sample

The targeted population was all patients admitted to the ICU ward of SSIDH with mechanical ventilation. The average number of patients per month was 40 people. We examined 60 ICU patients who met the inclusion and exclusion criteria. Inclusion criteria included patients diagnosed with sepsis-caused pneumonia with mechanical ventilation, absence of agitation, presence of hyperthermia, and no use of opium analgesic or sedation drugs (morphine). Exclusion criteria encompassed patients lacking consent from their families, those undergoing cardiopulmonary resuscitation (CPR), and patients with unstable hemodynamic status.

Instrument

We examined 60 patients, where 30 underwent the warm compress procedure, and the remaining 30 received the cold compress procedure. Each intervention lasted for 30 minutes. Data were collected from the respondents' characteristic sheets, thermometers, and body temperature observation sheets.

Data Analysis

A descriptive statistic using mean, standard deviation, and proportion was used to describe the demographic characteristics of the respondents. Pre and post-test data were evaluated using an independent T-test. The significance level was set at 0.05. All analyses were performed using Statistical Product and Service Solutions version 22 for Windows.

Ethical Clearance

The study has obtained ethical approval from the ethics committee of Sulianti Saroso Infectious Disease Hospital number PP.07.01/D.XXXIX.14/5/2024.

3. RESULTS

The results revealed that among the 60 respondents, the highest proportion is the late elderly is representing 43,3% of the sample. Regarding gender distribution, the majority were male, accounting for 36 individuals, representing 60% of the sample (Table 1).

Table 1. Frequency Distribution Characteristics of Hyperthermia Patients in the ICU

Variables	n	%
Age (Year)		
26-35	1	1,7
36-45	6	10
46-55	9	15
56-65	26	43,3
> 65	18	30
Gender		
Male	36	60
Female	24	40

The analysis revealed that the average body temperature before the warm compress intervention was 38.74°C, and after the intervention, it decreased to 36.76°C. The results of the Dependent T-test yielded a P-value of 0.000, which is less than the significance level α (0.05). Therefore, the null hypothesis (H0) was rejected, indicating a significant difference in body temperature before and after the warm compress intervention. Similarly, in the cold compress intervention group, the average body temperature before the intervention was 38.59°C; after the intervention, it was 36.75°C. The Dependent T-test resulted in a P-value of 0.000, less than α (0.05), suggesting a significant difference in body temperature before and after the cold compress intervention. Therefore, it can be concluded that the cold compress intervention effectively lowers body temperature in patients with hyperthermia in the ICU Room of RSPI Sulianti Saroso (Table 3).

Table 2. Effectivity of Warm and Cold Compress in Hyperthermia

Group	Body Temperature	Mean	Standard Deviation	Delta of Temperature	T Count	P Value
Warm Compress	Before intervention	38.74	0.480	1.980	13.885	0.0001*
	After intervention	36.76	0.407			
Cold Compress	Before intervention	38.59	0.456	1.843	18.356	0.0001*
	After intervention	36.75	0.327			

*Dependent T-Test

Later, we compared warm and cold compress procedures and found that neither procedure was no significantly different. This means that both interventions are equally effective in reducing body temperature (Table 4).

Table 4. Difference between Warm and Cold Compress in Hyperthermia

Group	Independent T-Test				
	N	Delta of Temperature	Standard Deviation	T Count	P Value
Warm Compress	30	1.980	0.783	0.782	0.437*
Cold Compress	30	1.843	0.550		

*Independent T-Test

4. DISCUSSION

Before the intervention in both treatment groups, the body temperature exceeded 38°C. This condition indicates the presence of hyperthermia, which is commonly associated with sepsis. According to Schortgen (Kurniawan, 2018), 30-60% of patients treated in the ICU room experience hyperthermia and sepsis.

Sepsis is organ dysfunction due to dysregulation of the infectious response. Sepsis is linked to elevated morbidity and mortality rates, and it significantly impacts ICU budgets. High fever, or hyperthermia, is a common clinical manifestation in sepsis patients. Prompt resolution of hyperthermia through appropriate therapy and treatment is crucial. Compresses are among the independent nursing techniques that can effectively address hyperthermia. They represent a physical method to lower body temperature and can be employed in comprehensive care for sepsis patients.

The effectiveness of warm compress intervention in lowering body temperature among hyperthermic patients in the ICU Room aligns with previous research conducted by various scholars. A research by Maharningtyas & Setyawati (2022) supported the effectiveness of warm compresses in reducing body temperature. They propose that warm signals induce vasodilation of blood vessels and stimulate heat dissipation responses through sweat, thereby contributing to a decrease in body temperature. Similarly, (Sumakul & Lariwu, (2022) conducted research on children with fever, demonstrating the impact of warm water compresses on changes in body temperature in a hospital setting. These studies provide additional evidence of the efficacy of warm compresses in managing hyperthermia.

Warm compresses involve applying a warm towel or cloth to the skin's surface. The warmth triggers thermoreceptors in the skin, which send signals to the brain. In response, the hypothalamus in the brain initiates vasodilation, causing the blood vessels to dilate, leading to improved blood

flow and faster temperature increase. This process facilitates muscle relaxation, while the brain restores body temperature to normal (Andari, 2021).

In the warm compress, heat is released through evaporation. This is achieved by applying a warm compress to dilate the blood vessels on the skin's surface, allowing the pores to open. This dilation facilitates heat release from the body, promoting heat dissipation and lowering body temperature. Warm compresses increase blood flow to a specific area. This increased blood flow can aid in reducing body temperature for individuals experiencing hyperthermia. Additionally, warm compresses may accelerate the healing process. The water temperature used in warm compresses is typically warm, facilitating the dilation of blood vessels and promoting heat release from the body (Smeltzer & Bare, 2018).

Cold compress intervention effectively lowers body temperature in patients with hyperthermia in the ICU Room of SSIDH. In line with the results of the study that there was a difference in body temperature in sepsis patients with hyperthermia in the ICU Room of Dr. Kariadi Hospital Semarang before and after being given cold compresses and cold air flow (Z-score = -2.685, P-value = 0.007) (Kurniawan, 2018). Another research proves that giving cold compresses in research is quite effective in reducing body temperature with an average body temperature of 38,38°C, initially before a cold compress was done with an average of 38,87°C (Rahmawati & Purwanto, 2020).

Cold compresses stimulate vasoconstriction and shivering, causing blood vessels to narrow and aiding in the normalisation of body temperature. Furthermore, administering cold compresses triggers the normal process of body temperature regulation through signals captured by the hypothalamus, ultimately restoring average body temperature (Rahmawati & Purwanto, 2020).

Cold compresses lower skin temperature more rapidly than core body temperature, leading to vasoconstriction and shivering. Shivering can result in metabolic disturbances, as it elevates oxygen consumption and respiratory volume, increases the proportion of carbon dioxide in exhaled air, and heightens sympathetic nervous system activity. Consequently, cold compresses are less effective in fever management because they provide less comfort, stimulate heat production, and impede the release of body heat (Nurriddo, 2022).

Changes in body temperature refer to the difference in the average temperature of respondents before and after the intervention. While the results indicated no significant difference in the average reduction of body temperature between warm compress and cold compress interventions, it is notable that the decrease observed with warm compress interventions was more significant than that with cold compress. This discrepancy may be attributed to the heat release mechanisms facilitated by each compress type. Warm compresses aid in reducing body temperature in feverish children by enabling the body to release heat through evaporation. In contrast, cold compresses facilitate heat reduction through conduction.

The findings are consistent with the research conducted by Rahmawati & Purwanto which demonstrated the effectiveness of both warm and cold compresses in reducing body temperature among children admitted to Dr. M. Yunus Hospital Bengkulu (Rahmawati & Purwanto, 2020). Moreover, their study indicated that warm compresses were more effective than cold compresses in lowering body temperature. The research conducted by Rahayu supports the notion that warm compresses are more effective than cold compresses in reducing pain among fracture patients

(Rahayu et al., 2019). While cold compresses effectively lower the body temperature of ICU patients, it is essential to note that this method is not commonly used to reduce body temperature in fever patients due to potential complications. When applied to fever patients, cold compresses can trigger migraines if the temperature is too cold and may lead to further complications. Instead, cold compresses are typically utilised to cool internal wounds or burns among healthcare workers. Therefore, to avoid adverse effects, warm compresses are preferred over cold compresses for fever patients (Andari, 2021).

5. CONCLUSION

The intervention of both warm and cold compresses effectively lowers the temperature in hyperthermic patients. However, despite warm compresses inducing a more significant temperature drop than cold compresses, the difference in temperature reduction between the two interventions was not statistically significant.

6. ACKNOWLEDGEMENT

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7. CONFLICT OF INTEREST

The authors state no conflict of interest.

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