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Effect of cold compression therapy to reduce pain intensity after mild traumatic brain injury: A case study

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Abstract

Background: Brain injury is one of the causes of death and disability worldwide. Headache or pain is the most common somatic complaint after a mild brain injury. If left unchecked, this will become chronic pain which can result in decreased organ function and cause unexpected changes in behavior. Cold compresses are a non-pharmacological technique that can be used to reduce pain.
Purpose: To prove that the application of cold compression therapy to reduce pain intensity after mild traumatic brain injury.
Method: The study using a case study approach method by implementing the results of cold compress intervention research which aims to comprehensively describe the positive effects of applying cold compresses based on standart operational procedure (SOP) by assessing whether or not there is a reduction in pain in patients mild traumatic brain injury using the Numerical Rating Scale pain scale. The samples in this study were patients with mild brain injuries who were given therapy for 5-10 minutes every day for three days
Results: The pain scale in patients after being given cold compress intervention for three days decreased with an average initial pain scale of 5 to 2.
Conclusion: Cold compress intervention can help reduce pain in patients with mild brain injuries.

Keywords: Cold Compress Therapy; Mild Traumatic Brain Injury; Pain Scale.

INTRODUCTION

Brain Injury is one of the causes of death and disability worldwide, and accounts for a large proportion of people living with disabilities (Marques, Antunes, Machado, Ramos, Duarte, Oliveira, & Sousa, 2021). Conditions like this often occur with scattered and non-specific signs and symptoms such as headache, nausea, fatigue, hypersomnolence, difficulty concentrating, photosensitivity and phonosensitivity, irritability and depersonalization. Although these symptoms usually resolve within 3 months, 5%–15% of patients may continue to experience chronic symptoms (Van, Stone, Welch, Davidson, Kerslake, Caesar, & Carson, 2020).

This event is one of the most frequently seen events in emergency units (ER) throughout the world with cases of mild brain injury occurring in patients, namely (80-90%) (Coffeng, Jacobs, Koning, Hageman, Roks, & Naalt, 2020). The incidence of mild brain injury can occur at 200–300/100.000 people per year in hospitalized patients and may be twice as high in non-hospitalized patients. However, several recent population-based studies report much higher rates (>700/100,000) (Lefevre-Dognin, Cogné, Perdrieau, Granger, Heslot, & Azouvi, 2021).

Mild brain injury (MBI) can be defined by a Glasgow Coma Scale score between 13 and 15 at 30 minutes post-injury, and one or more symptoms

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within <30 minutes of loss of consciousness; <24 hours post-traumatic amnesia, mental disorders at the time of the accident (confusion, disorientation, etc.), and/or temporary neurological deficits (Rauchman, Albert, Pinkhasov, & Reiss, 2022). Apart from vomiting and fatigue, headaches or pain are the most common somatic complaints after mild brain injury (Leung, 2020).

Pain is always associated with unpleasant sensations and if left untreated it will become chronic pain which can result in decreased function of organs and cause unexpected changes in behavior. Therefore, immediate treatment is needed to reduce the pain to prevent worsening. Pain management can be done using non-pharmacological interventions (Grassini, 2022). Management after mild traumatic brain injury is challenging for patients who often have co-occurring symptoms and diagnoses (Portanova, Dreesmann, Moore, Buchanan, & Thompson, 2021).

In the pharmacological approach, nonsteroidal anti-inflammatory drugs (NSAIDs) and opioids are usually prescribed. Despite its therapeutic effectiveness, this approach has significant drawbacks. Opioids cause tolerance, dependence, and hyperalgesia(Grassini, 2022). In addition, some analgesics require invasive therapy, such as intrathecal drug administration, which has its own clinical risks and complications (Kambu, Kristinawati, & Shalihien, 2020). Therefore, non-pharmacological approaches can be applied to reduce pain, for example teaching deep breathing relaxation, hypnosis, acupressure, music therapy, biofeedback, massage therapy, aromatherapy, guided imagination techniques, and warm/cold compresses on the area of pain that is felt (Fatonah, Al-murhan, & Bakri, 2023).

Cold compresses can be given so that patients are not dependent on drugs and are safe and easy, with few or no side effects (Portanova et al, 2021). The results of another study showed that all respondents stated that they felt better after receiving a cold compress, with the majority of respondents experiencing some relief (70%) (Lubis, Tanjung & Asrizal, 2021). This technique is considered efficient and economical by using a pain reduction method that can be done easily (Yaban, Álvarez-García, & Bozdemir, 2023). Applying ice can reduce the decrease in skin temperature which can slow down the activity of nerve fibers and receptors, thereby changing the perception of pain (Fadlilah, Rahil, & Amestiasih, 2020).

RESEARCH METHOD

The method in this research uses a case study approach by implementing the results of cold compress intervention research which aims to comprehensively describe the positive effects of applying cold compresses based on SOPs by assessing whether or not there is a reduction in pain in Mild Brain Injury patients using the Numerical Rating Scale pain scale. (0 - 10) with interpretation 0: No pain, 1-3: Mild pain, 4-6: Moderate pain 7-10: Severe pain.

The research subjects used in this study were patients diagnosed with mild brain injury with a GCS of 14-15 and complaining of pain in the Teratai room at the Regional General Hospital, dr. Soehadi Prinjonegoro Sragen. The intervention is carried out for 5-10 minutes. To determine the effectiveness of cold compresses, respondents were previously asked what pain number was appropriate to describe the pain felt by the respondent before the intervention was carried out. Cold compress therapy was given for three days.

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RESEARCH RESULTS

Table Pain Score 0-10 Numerical Rating

Variables	Day	Pain Scale	
		Pre-test	Post-test
Patient (1)			
	First	5	3
	Second	3	2
	Third	2	1
Patient (2)			
	First	4	4
	Second	4	3
	Third	3	2
Patient (3)			
	First	5	4
	Second	4	3
	Third	3	2
Patient (4)			
	First	4	4
	Second	4	3
	Third	3	2
Patien (5)			
	First	5	4
	Second	4	3
	Third	3	2

In table 1. The patient is female, 38 years old, with a diagnosis of MBI, GCS E4 V5 M6, post-traffic accident without head injury, complaining of pain in the head when facing to the right with a pain scale of 5, sensitivity to light, nausea, vomiting and body feeling weak. An MSCT examination of the head showed that there were no fractures, trauma or hernias in the head. The patient has a history of diabetes mellitus since 1 month ago and does not routinely control medication. Received drug therapy, namely ranitidine injection 50 mg/12 hours, ketorolac 30 mg/8 hours, dexamethasone 1 ampoule/8 hours, piracetam 1 gr/8 hours and Tranex acid 500 mg/8 hours. Vital signs examination results showed that: BP:120/80 mmHg, RR: 21 x/min, P: 71 x/min, T: 36.4°C and Spo2 100%.

The patient is a 74 year old male with a diagnosis of MBI, GCS E4 V5 M6, post traffic accident, there was a wound on his eyebrow, he complained of pain in the head that came and went with a pain scale of 4, his body felt weak, there were abrasions on his right arm and knee. my right leg was swollen and my stomach felt nauseous. Has a history of hypertension and diabetes mellitus. An MSCT examination of the head showed that there were no fractures, trauma or hernias in the head. The treatment therapy obtained was ranitidine 50 mg/ 12 hours, ketorolac 30 mg/ 8 hours, bactecyin 1.5 gr/ 8 hours and piracetam 1 gr/ 8 hours. Vital signs examination showed the following results: BP: 31/71 mmHg, RR: 20x/min, P: 90 x/min, T: 36.2°C and Spo2 98%.

The patient is female, 67 years old, with a diagnosis of MBI, GCS E4 V5 M6, complaining of pain in the head when moving and hands with a pain scale of 5, nausea, vomiting and body feeling weak. Denies having a history of any disease. An MSCT examination of the head showed that there were no fractures, trauma or hernias in the head. The

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treatment therapy obtained was ranitidine 50 mg/ 12 hours, ketorolac 30 mg/ 8 hours, bactecyin 1.5 gr/ 8 hours and piracetam 1 gr/ 8 hours. and VITAL SIGNS examination. The results obtained were BP: 134/76 mmHg, RR: 21 x/min, P: 78 x/min, T: 36.7°C and Spo2 96%.

The patient is female, 73 years old, with a diagnosis of MBI, GCS E4 V5 M5, complaining of intermittent pain in the head with a pain scale of 4, the body feels weak. Has a history of DM since 10 years ago. An MSCT examination of the head showed that there were no fractures, trauma or hernias in the head. The treatment therapy obtained was ranitidine 50 mg/12 hours, ketorolac 30 mg/8 hours, Humalog 5 x 7 ui vital signs examination results showed that: BP 137/75 mmHg, RR: 21 x/min, N: 66 x/min, T: 36,1°C and Spo2 99%.

The patient is female, 51 years old, with a diagnosis of MBI, GCS E4 V5 M6, complaining of intermittent headaches with a pain scale of 5, dizziness and body feeling weak. The patient said he had a previous history of vertigo but rarely recurred. An MSCT examination of the head showed that there were no fractures, trauma or hernias in the head. The treatment therapy obtained was ketorolac 30 mg/8 hours, bactecyin 1.5 gr/ 8 hours and piracetam 1 gr/8 hours. Vital signs examination is BP:160/91 mmHg, RR: 20 x/min, P: 85 x/min, T: 36.1 °C and Spo2 99%.

DISCUSSION

The results of this study indicate that cold compresses can reduce pain intensity in patients diagnosed with mild brain injury. This is in line with other studies showing that complementary cold compress therapy is effective in reducing pain when applied to patients with aff femoral sheath after percutaneous coronary intervention (Ozkan, & Cavdar, 2021). Mild traumatic injury is categorized as extracranial traumatic injury resulting in a short score ≤ 3 in any domain, no report of confusion surrounding the accident, and GCS 15 (Hume, Mitra, Wright, & Kinsella, 2023). MBI is caused by non-penetrating blunt head trauma that causes brain movement and axonal stretching and tearing, with diffuse axonal injury as the central pathogenic mechanism. This is identical to concussion; both have similar criteria in which the most important elements are acute changes or loss of consciousness and/or post-traumatic amnesia following head trauma and no obvious brain changes on standard neuroimaging (Zetterberg, Winblad, Bernick, Yaffe, Majdan, Johansson, & Blennow, 2019).

The most common categories of MBI cover a wide range of presentations, ranging from patients with a GCS score of 15 and no detectable acute intracranial traumatic injury on computed tomography scan of the brain to patients who have a GCS score of 13 and severe brain injury on CT scan. Although all causes of death from MBIare low, patients remain at great risk for serious sequelae in the first 6 months after injury (Madhok, Rodriguez, Barber, Temkin, Markowitz, & Kreitzer, 2022).

Patients with head injuries can cause permanent damage to brain tissue such as cerebral ischemia (Guedes, Kenney, Shahim, Qu, Lai, & Devoto, 2020). Increased brain metabolism causes the body's consumption of brain oxygen to increase. When the brain's oxygen needs are not met, metabolism will switch from aerobic to anaerobic metabolism. In this condition, lactic acid is produced which stimulates the onset of headaches (Firmada, Kristianti, M & Husain, 2021).

The physiological effects of cold temperatures on tissue can reduce the threshold of arteriole vasoconstriction stimulation, reduce nerve conduction, reduce inflammatory mediator transport, reduce edema, and reduce the local temperature of injured tissue which can provide a pain-reducing response to the tissue (Trisnowiyanto, & Nirwana, M2022). Skin stimulation by administering cold compress therapy to the body can relieve pain by slowing down nerve conduction velocity and inhibiting nerve impulses (Aktaş, Durgun, & Durhan, 2021).

Cold compresses with water temperature of 12°C for 5-10 minutes can reduce pain because ice has an analgesic effect and therefore reduces the intensity of pain in acute injuries such as fractures.(Suryani & Soesanto, 2020). The impact of cold therapy on human skin occurs in four stages. For 1-3 minutes, the patient feels cold. This turns into a burning sensation and pain lasting 2-7 minutes. In the third stage, within 5-12 minutes, the patient feels numbness or reduced pain, nerve transmission decreases, and pain spasms stop. During the 12-15th minute, the metabolic rate increases, and reflex

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vasodilation of deep tissues occurs, allowing proper tissue perfusion (Suwannalert, Chanthasenanont, & Pongrojpaw, 2021).

The mechanism of pain reduction by cold is also explained in the gate control theory consisting of the interaction of cells of the substance gelatinosa, dorsal column fibers, and the first central transmitting cells in the dorsal horn of the spinal cord. Types of sensory nerve fibers consist of large (A-alpha, beta, and gramma) and small (A-delta, B, and C) fibers (Pranowo, Dharma, & Kasron, 2021). Pain sensations are mainly transmitted through small fibers, while cold, touch, or pressure will be transmitted by large fibers which have faster conduction speeds. When a patient is stimulated by cold or pressure along with pain, large non-nociceptive fibers trigger the gate to close (Malorung, Inayati, & Sari, 2021).

CONCLUSION

Providing cold compress therapy intervention can help reduce pain in patients with mild brain injury.

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