Jurnal Kesehatan Komunitas Indonesia (JKKI)
Volume 4 Issue 2, August 2024, pp 248-256
https://ebsina.or.id/journals/index.php/jkki
eISSN 2503-2801, pISSN 2985-3435

Effectiveness of Compression Therapy on Lower Extremity Oedema in Heart Failure Patients: A Case Study

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Article History
Submitted: 25-06-2024
Revised: 28-07-2024
Accepted: 10-08-2024

doi.org/10.58545/jkki.v4i2.339

Abstract

Background: Heart Failure is a condition that the heart can not pump enough blood to meet the circulatory needs used in the body's metabolic processes. Patients with heart failure disease may experience swelling (oedema) in certain parts of the body, especially the lower extremities. Oedema that is not treated will exacerbate damage to the circulatory system. One of the treatments for lower extremity oedema in heart failure patients can be done by giving compression therapy. **Purpose:** The purpose of this study is to determine the effectiveness of compression therapy on lower extremity oedema in heart failure patients. **Method:** This research is a case study that managed one patient with heart failure disease who has lower extremity oedema. Data collection was carried out by observation, interview and provision of interventions carried out for 4 days using moderate pressure (20-30 mmHg). This research use compression stocking for 18 hours within 24 hours. Compression therapy is given once a day that the stocking is used at 14.00 WIB and removed at 08.00 WIB on the following day. The instrument used in this study was the pitting oedema observation sheet. **Result:** The results of this study were a decrease in the degree of pitting oedema in patients from a value of +3 with a depth of 5 mm in a return time of 65 seconds to a value of +1 with a depth of 1 mm in a return time of 2 seconds. **Conclusion:** Compression therapy is effective in reducing the degree of pitting oedema in patients with heart failure. Compression therapy has optimal effectiveness on the third day of intervention. Therefore, this therapy is highly recommended to be applied in the inpatient room, especially in patients with heart failure who have oedema in lower extremity.

Keywords: Heart Failure, Oedema, Compression Therapy

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How to cite:
Batrisyia, I., Sutawardana, J. H., A'la, M. A. & Setiawan, I. (2024). Effectiveness of Compression Therapy on Lower Extremity Oedema in Heart Failure Patients: A Case Study. Jurnal Kesehatan Komunitas Indonesia, 4(2), 248-256. https://doi.org/10.58545/jkki.v4i2.339

1. BACKGROUND

Heart Failure is a serious disease in the world. Heart failure is when the heart cannot pump enough blood to meet the needs of circulation used in the body's metabolic processes (Dewi et al., 2023).

The most common symptom in patients with heart failure is leg oedema, with the percentage of incidence reaching 80% of total HF patients. In addition, other signs, such as orthopnea, have a percentage of 71%, and dyspnea has a percentage of 52% (Karson & Engkartini, 2018). Based on this percentage, it can be seen that the most common symptom in patients with heart failure is leg oedema.

The prevalence of heart failure disease reaches 26 million sufferers worldwide. According to the World Health Organization (WHO) shows that the prevalence of heart failure in the United States reaches 550,000 cases/ year with a mortality rate of 375,000 people (Lumi et al., 2021). In Indonesia, according to research by the Ministry of Health, there was an increase in the prevalence of heart disease in 2018 (Utami & Pratiwi, 2022). According to Basic Health Research (Riskesdas) data in 2018, the prevalence of heart failure was 229,696 people or 0.13% (Riskesdas, 2018).

Leg edema is an accumulation of fluid in the feet and legs caused by interstitial volume dilation or an increase in extracellular volume (Dewi et al., 2023). Patients with heart failure can experience swelling (oedema) of the lower extremities because the heart disturbs blood pumping. The fluid accumulation in the veins causes the fluid to escape from the veins into the interstitial space, causing oedema.

Management of leg oedema in patients with heart failure is essential. Oedema that is not treated will exacerbate damage to the circulatory system. This is caused by the heart working very hard for a long time. This circulation damage will also increase the work of other organs and cause several other symptoms, such as shortness of breath, chest pain, or even worsening of the patient's condition. One of the treatments for lower extremity oedema in heart failure patients can be done with non-pharmacological therapy, namely by giving compression therapy.

The cases in this study were taken from patients diagnosed with heart failure. The patient also had a history of hypertension and diabetes mellitus. Of the several typical signs of heart failure patients, one physical sign appears in this case. Namely, the patient has edema in the lower extremities. The patient was admitted on 16 June 2024 until 24 June 2024. The patient had lower extremity oedema with a value of +3 with a depth of 5 mm in a return time of 65 seconds. The patient received diuretic therapy on 22 June 2024, on the third day of intervention.

Volume 4 Issue 2, August 2024, pp 248-256
https://ebsina.or.id/journals/index.php/jkki
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In addition, a fluid restriction program was also imposed on the patient.

2. METHODS

The method used in this research is a case study on heart failure patients who have lower extremity oedema in the Lavender room of dr. Soebandi Hospital. The sample used in this study was one patient, namely Mrs.E, who had met the research criteria, namely aged› 18 years, class II-III heart failure patients, heart failure patients with stable conditions (blood pressure, pulse, oxygen saturation, respiratory frequency, and average temperature), patients who did not have leg wounds/infections and patients who were not undergoing hemodialysis.

This study was conducted for four days, starting June 20-24, 2024. The intervention used in this study was compression therapy, which is the installation of compression stockings in heart failure patients with leg oedema for 18 hours within 24 hours. Compression therapy is given once a day, and the stocking is used at 14.00 WIB and removed at 08.00 WIB on the following day. The data used in this study were obtained from interviews and direct measurements of patients' condition and degree of pitting oedema. The instruments used in this study were tensimeter, oximeter, and thermometer. Measurement of the patient's vital signs and measurement of the degree of pitting oedema before and after the intervention will be recorded on the observation sheet every day.

Researchers also provide nursing care to solve the patient's problems. Some nursing problems in patients are decreased cardiac output, hypervolemia, activity intolerance, instability of blood glucose levels, impaired skin integrity, and disturbed sleep patterns. From the nursing problems that arise, researchers apply appropriate interventions to achieve the desired nursing outcomes. This case study is one part of the researcher's nursing care actions.

3. RESULTS

One of the nursing problems is that the patient has a decrease in cardiac output, so the patient is diagnosed with heart failure. In addition, the patient also has one of the significant symptoms and signs in the diagnosis of decreased cardiac output, namely oedema. The researcher then conducted a cardiac care intervention, and one of the therapeutic actions of the intervention was to compress the patient's oedema using an elastic stocking. The

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researcher then carried out the intervention for four consecutive days.

After providing compression therapy for 4 days, meticulous observation of the degree of pitting oedema in the patient was conducted. This careful monitoring allowed us to note a decrease in the degree of pitting oedema, indicating the effectiveness of the intervention.

Table 1. Result of Pitting Oedema

Day	Date/Time of Use Stocking	Pitting Oedema Pre	Date/Time of Remove Stocking	Pitting Oedema Post
1	20 June 2024 / 14.00 pm	+3 (5 mm depth in 65 seconds return time)	21 June 2024/ 08.00 am	+3 (4 mm depth in 60 seconds return time)
2	21 June 2024/ 14.00 pm	+3 (4 mm depth in 60 seconds return time)	22 June 2024/ 08.00 am	+2 (3 mm depth in 15 seconds return time)
3	22 June 2024/ 14.00 pm	+2 (3 mm depth in 15 seconds return time)	23 June 2024/ 08.00 am	+1 (1 mm depth in 3 seconds return time)
4	23 June 2024/ 14.00 pm	+1 (1 mm depth in 3 seconds return time)	24 June 2024/ 08.00 am	+1 (1 mm depth in 2 seconds return time)

Table 1 shows that compression therapy was implemented for the Patient for four days with a frequency of 1 time a day with a pressure of 20-30 mmHg (moderate compression). Compression stockings are installed for 18 hours and 6 hours of relaxation within 24 hours. Compression stockings are installed every 14.00 WIB, and removal is done at 08.00 WIB the following day. Before implementation, the procedure for the duration of compression stocking installation was delivered to the patient and family. This ensures that patients or families only remove compression stockings within the specified hours. In addition, pitting oedema measurement was also carried out on the Patient's vital signs, including blood pressure, heart rate, SpO2, respiration rate, and temperature. The following were the results of monitoring the patient's vital signs (TTV) for four days before implementation.

Table 2. Observation of Vital Signs (Pre-Intervention)

Date	Vital Signs					
	BP (mmHg)	MAP (mmHg)	HR (Per minutes)	SpO2	RR (Per minutes)	Temperature
20/06/24	130/80	96.6	90	98 %	20	36.5°C
21/06/24	120/70	86.6	83	97 %	22	36.8°C
22/06/24	130/80	96.6	103	98 %	21	36.5°C
23/06/24	110/80	90	87	99 %	20	36.7°C

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Based on Table 2, the vital signs can be seen before compression therapy during the four days. The patient's condition was stable. On the first day before compression therapy, the Patient's blood pressure results were 130/80 mmHg, MAP: 96.6 mmHg, pulse 90 times/min, SpO2 98%, RR 20 times/min, and temperature 36.5º C. On the second day before the intervention, vital signs were measured. The results showed that the Patient's blood pressure was 120/70 mmHg, MAP: 86.6 mmHg, pulse 83 times/min, SpO2 97%, RR 22 times/min and temperature 36.8o C. Before giving compression therapy on the third day, vital signs were measured on Patient's and the results were obtained blood pressure 130/80 mmHg, MAP: 96.6 mmHg, pulse 103 x/min, SpO2 98%, RR 21 times/min and temperature 36.5º C. On the last day of the intervention, the Patient's blood pressure was 110/80 mmHg, MAP: 90 mmHg, pulse 87 x/min, SpO2 99%, RR 20 times/min, and temperature 36.7º C.

Table 3. Observation of Vital Signs (Pre-Intervention)

Date	Vital Signs					
	BP (mmHg)	MAP (mmHg)	HR (Per minutes)	SpO2	RR (Per minutes)	Temperature
20/06/24	120/80	93.3	85	98 %	22	36.6º C
21/06/24	110/70	83.3	97	99 %	21	36.5º C
22/06/24	130/70	90.0	96	98 %	21	36.7º C
23/06/24	120/70	86.6	84	99 %	20	36.6º C

Based on Table 3, it can be seen the vital signs after compression therapy during the four days. On the first day, vital signs were checked again and the results showed that Patient's blood pressure was 120/80 mmHg, MAP: 93.3 mmHg, pulse 85 times/min, SpO2 98%, RR 22 times/min and temperature 36.6º C. After the second day of intervention, vital signs were measured again and the results obtained were blood pressure 110/70 mmHg, MAP: 83.3 mmHg, pulse 97 times/min, SpO2 99%, RR 21 times/min and temperature 36.5º C. On the third day after giving compression therapy, the vital signs were measured again and the results obtained were blood pressure 130/70 mmHg, MAP: 90 mmHg, pulse 96 times/min, SpO2 98%, RR 21 times/min and temperature 36.7º C. On the last day after the therapy was given, vital signs were measured again and the results were obtained that Patient's blood pressure was 120/70 mmHg, MAP: 86.6 mmHg, pulse 84 times/min, SpO2 99%, RR 20 times/min and temperature 36.6º C.

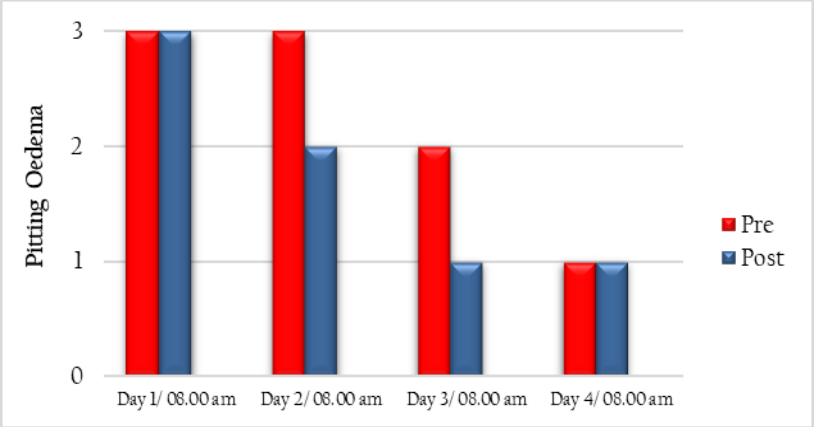

Figure 1. Pitting Oedema Changes

In the pre-test on the first day on June 20, 2024 at 14.00 WIB, the degree of pitting oedema +3 with a depth of 5 mm in a return time of 65 seconds. On the first day post-test on June 21, 2024 at 08.00 WIB, pitting oedema +3 with a depth of 4 mm in a return time of 60 seconds. On the second day pre-test on June 21, 2024 at 2.00 pm pitting oedema +3 with a depth of 4 mm in a return time of 60 seconds. While on the second-day post-test on June 22, 2024 at 08.00 WIB, the degree of pitting oedema +2 with a depth of 3 mm was obtained in a return time of 15 seconds. On the third day pre-test on June 22, 2023 at 14.00 WIB, the results showed that the degree of pitting oedema was +2 with a depth of 3 mm in a return time of 15 seconds. After 18 hours of installation, an evaluation was conducted in the third post-test on June 23, 2024 at 08.00 WIB. The implementation results showed that the degree of pitting oedema was +1 with a depth of 1 mm in a return time of 3 seconds. During the fourth day of installation on June 23, 2024 at 2:00 pm WIB, it was found that the degree of pitting oedema was +1 with a depth of 1 mm in a return time of 3 seconds. At the final evaluation on June 24, 2024 at 08.00 am, it was found that the degree of pitting oedema was +1 with a depth of 1 mm in a return time of 2 seconds.

4. DISCUSSION

Based on the results of the implementation of compression therapy given to the Patient for four days show a decrease in lower limb oedema. The results of this study are also supported by other research conducted by (Fadel et al., 2023) conducted on 29 patients with class II and III heart failure who have lower extremity oedema. The results in this study explain that the provision of compression therapy can reduce the degree of pitting oedema and shorten the use of diuresis therapy in

patients. These results also follow the case study conducted by (Silalahi, 2020), who conducted nursing care for patients at H. Hanafie Muara Bungo Hospital with the patient's nursing diagnoses, namely decreased cardiac output and hypervolemia. The patient has edema of the extremities on both legs, and fluid monitoring interventions and cardiac care are carried out, including intermittent elastic or pneumatic stockings, according to the patient's indications. After intervening for three days, the patient's oedema decreased from a score of 3 (moderate) to 5 (decreased).

Oedema in heart failure patients can be reduced using non-pharmacological treatment, namely by providing compression therapy interventions (Chloranyta et al., 2022). This compression therapy is carried out to press the area where buildup occurs to improve the body's circulation (Atkin & Byrom, 2022). The mechanism or workings of compression therapy are applying constant pressure to the tissue and providing resistance to the calf muscles during ambulation. The constant pressure will cause an increase in interstitial tissue pressure, which fights fluid leakage out of the capillary system. The fluid that comes out will be reabsorbed or reabsorbed into the bloodstream (Webb et al., 2019). This therapy uses compression stockings placed on the feet for 18 hours/day within four days. Compression stockings will produce varying pressure on the foot; the highest pressure is on the lower leg and ankle, and the higher the pressure, the looser. Using the appropriate pressure will help blood in the veins return to the heart optimally so that swelling (oedema) does not occur (Urbanek et al., 2020).

The compression therapy intervention in this study was given to class II heart failure patients who had a stable condition. If there is a decrease in the patient's condition, the provision of compression therapy will be stopped. This is by the procedure (SOP) for providing compression therapy. Based on the measurement of vital signs before and after the intervention, it was found that there was no worsening of the patient's condition. These results also prove that compression therapy does not interfere with other medical treatments or therapies given to patients. Compression therapy can also be used as a supporting therapy for the use of diuretic drugs to accelerate the process of reducing oedema in patients because this therapy does not inhibit the workings of diuresis drugs given to patients.

Compression therapy has been widely used in Indonesia as one of the therapeutic

options to reduce oedema of the lower extremities. Based on the compression therapy intervention that has been given to patient with heart failure disease, there is a change in pitting oedema. Before the intervention, the degree of pitting oedema was at a value of +3 with a depth of 5 mm in a return time of 65 seconds. Meanwhile, after the intervention, the degree of pitting oedema is at a value of +1 with a depth of 1 mm in a return time of 2 seconds.

5. CONCLUSION

Based on the results of the application of compression therapy on Patient with a diagnosis of heart failure for four days, it can be seen that there is a decrease in the degree of pitting oedema in patients. So, it can be concluded that the application of compression therapy is practical for reducing lower extremity oedema in patients with heart failure.

AUTHOR CONTRIBUTIONS

The author contribute all research activity such as conceptualization, data curation, analysis, writing & editing, manuscript revisions.

ACKNOWLEDGMENT

We would like to thank you for the respondents who crontribute the information in research.

CONFLICT OF INTEREST

The authors declare no conflict of interest for this publication.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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