Effects of Lower Limb and Dorsolumbar Massages on Edema in Postpartum Women

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Abstract: Edema may occur on hands, face, and lower limbs in 20–40% of postpartum women during the early puerperal period. The elevation of lower limbs is the most effective way to treat lower limb edema in postpartum women. New methods have been recently introduced for the care of the lower limb edema, such as footbaths, after-birth exercises, and aromatic oil massage for the lower limbs. However, the effect of massage on reducing lower limb edema is not completely accepted. The objective of this study is to evaluate the change in the lower limb edema after lower limb or dorsolumbar massage with 30-min elevation of the lower limbs. Nineteen postpartum women were divided into two groups, the lower limb massage group (n=9) and the dorsolumbar massage group (n=10). Both groups showed reduction in the lower limb volume as well as the circumference of the lower leg and the big toe, and an increase in the cutaneous blood flow in the tibialis anterior muscle. These results suggest that lower limb or dorsolumbar massage with elevation of the lower limbs reduces lower limb edema.

Keywords Lower Limb, Massages, Dorsolumbar Massages, Postpartum Women

1. Introduction

In 20–40% of postpartum women, edema appears on the hands, face, lower limbs, and feet, 2–3 days after delivery. Although the edema naturally disappears in the due course of time, postpartum women with the edema experience significantly more fatigue and lack of sleep than those without edema.1,2 At the authors' institution, most of the postpartum women with lower limb edema have also complained of lower back pain. No useful treatment other than elevation of the legs has been reported for lower limb edema. New treatments have recently been introduced for lower limb edema, such as footbath, after-birth exercises, and aromatic oil massage for the lower limbs.3–5 However, the effects of massage on reduction of lower limb edema is not completely accepted.

In this study, the effects of lower limb massage are compared with those of the dorsolumbar massage. The lower limb volume and the circumference of the lower leg and the big toe, as well as the cutaneous blood flow in the big toe and lower limb were measured be-
fore and after the lower limb or dorsolumbar massage with 30-min elevation of the lower limb. Both the lower limb and dorsolumbar massages enabled a reduction in the lower limb volume and circumference of the lower leg and big toe, and an increase in the cutaneous blood flow in the lower limb.

2. Materials and Methods

2.1. Participants

This study was conducted from September to December 2004. Nineteen voluntary participants, all postpartum women within 2–5 days after natural deliveries in obstetric clinics in Kumamoto City, Japan, took part in this study. All the participants showed lower limb edema and were randomly divided into two groups: one group received lower limb massage with 30-min elevation of the lower limbs (n=9) and the other group received dorsolumbar massage with 30-min elevation of the lower limbs (n=10). Postpartum women with complications, such as lower limb varices or an excess amount of blood loss (>500 ml) were excluded. The mean age of the participants was 29.8 years (the age range was 18–39 years), and the mean number of days after giving birth was 3.5 days.

2.2. Measurement

Before applying the lower limb massage or dorsolumbar massage, the parameters for evaluation of the lower limb edema were measured, including the circumference of the right big toe and the right lower limb, the cutaneous blood flow in the right big toe and right lower limb (in the skin on the tibialis anterior muscle), and the volume of the right lower limb of the participants. After the massage, the lower limbs were elevated for 30 min, and subsequently, the parameters were measured again.

The circumference of the right lower limb was measured at 20 cm from the floor. To measure the volume of the right lower limb, a 30-cm high container was filled with warm water, and then the right foot and limb of the participant was submerged in this container. The water that overflowed from the container was weighed to determine the volume of the right lower limb.

2.3. Instructions of massage

The process for lower limb massage followed the protocols used in earlier reports. The massage was given in prone and supine positions with the following instruction:

1. Stroking: lower limbs (10 times)
2. Stroking: lower limbs and popliteal fossae (5 times)
3. Friction: sural and femoral regions (5 times)
4. Stroking (thrice)
5. Kneading: lower limbs (twice)
6. Stroking (5 times)
7. Stroking: heel, lateral surface of the heel, and heel as a whole (10 times each)
8. Foot press
9. Toe press
10. Warming: foot (ankle, plantar arch, and toes)
11. Stroking (thrice)

In the original instructions for lower limb massage introduced by Yanai (Tokyo Medical School), the massage was performed with aromatic vegetable oils in the prone position. In this study, the lower limbs of the participant were covered by an ordinary soft bath towel, and the lower limb massage was subsequently performed in the prone and supine positions without aromatic oils.

The process for the dorsolumbar massage followed the back massage procedures outlined in earlier reports. In this study, three new procedures (massage for both sides of the ilia, the back, and the abdomen) were added as a part of the dorsolumbar massage. The dorsolumbar massage was given at a decubitus position following these instructions (Figs. 1 and 2):

1. Gently massage by tracing a spiral figure from the 7th cervical vertebra through the 5th lumbar vertebra (10 min, Fig. 1, (1)).
2. Gently massage by tracing a spiral figure on both sides of the spine from the level of 7th cervical vertebra through the level of 5th lumbar vertebra (15 min, Fig. 1, (2)).
3. Gently massage both sides of the ilia (7 min, Fig. 1, (3)).
4. Gently massage both sides of the back, up and down (5 min, Fig. 1, (4))
5. Gently massage the abdomen as a whole (3 min, Fig. 2, (5)).
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2.4. Analysis

The Aspin–Welch t-test was used for the comparison of the volume of the right lower limb before and after the massage. The paired t-test between the two groups was used for comparison of the circumference of the big toe and the lower limb, and the cutaneous blood flow in the big toe and the lower limb before and after the massage. Statistical significance was defined as a value of $p<0.05$, unless indicated otherwise.

3. Results

3.1. Changes in the parameters after the lower limb massage

Figure 3A shows the significant reduction in the circumference of the right big toe after the lower limb massage ($p<0.0001$), while Figure 3B shows the significant reduction in the circumference of the right lower limb after the massage ($p<0.0004$). Figure 4A illustrates the cutaneous blood flow in the right big toe before and after the massage. It can be observed that there was no significant difference in the cutaneous blood flow in the right big toe before and after the massage. Figure 4B shows the significant increase in the cutaneous blood flow in the right lower limb after the massage ($p<0.03$). Figure 5 illustrates the significant decrease in the volume of the right lower limb after the massage ($p<0.02$).

Fig. 3 Changes in the circumference of the right big toe and the right lower limb produced by the lower limb massage.

The filled circle indicates the circumference before the lower limb massage. The open circle indicates the circumference after the lower limb massage.

Fig. 3A Changes in the circumference of the right big toe produced by the lower limb massage.

Fig. 3B Changes in the circumference of the right lower limb produced by the lower limb massage.
Fig. 4 Changes in the cutaneous blood flow in the right big toe and the right lower limb produced by the lower limb massage.

The filled circle indicates the cutaneous blood flow before the lower limb massage, while the open circle indicates the cutaneous blood flow after the lower limb massage.

Fig. 4A Changes in the cutaneous blood flow of the right big toe produced by the lower limb massage.

Fig. 4B Changes in the cutaneous blood flow of the right lower limb produced by the lower limb massage.

Fig. 5 Changes in the volume of the right lower limb

3.2. Changes in the parameters after the dorsolumbar massage

Figures 6A and 6B show the significant reduction in the circumference of the right big toe ($p<0.001$) and the right lower limb ($p<0.003$), respectively, after the dorsolumbar massage. Figure 7A shows the significant decrease in the cutaneous blood flow in the right big toe after the massage ($p<0.03$), while Figure 7B shows the significant increase in the cutaneous blood flow in the right lower limb after the massage ($p<0.04$). Figure 8 shows the significant decrease in the volume of the right lower limb after the massage ($p<0.02$). These results indicate that both the lower limb and dorsolumbar massages are able to reduce the lower limb edema in postpartum women.

Fig. 6 Changes in the circumference of the right big toe and the right lower limb produced by the dorsolumbar massage.

The filled circle indicates the circumference before the dorsolumbar massage, while the open circle indicates the circumference after the dorsolumbar massage.

Fig. 6A Changes in the circumference of the right big toe produced by the dorsolumbar massage.
Fig. 6B Changes in the circumference of the right lower limb produced by the dorsolumbar massage.

Fig. 7 Changes in the cutaneous blood flow in the right big toe and the right lower limb produced by the dorsolumbar massage.

The filled circle indicates the cutaneous blood flow before the dorsolumbar massage, while the open circle indicates the cutaneous blood flow after the dorsolumbar massage.

Fig. 7A Changes in the cutaneous blood flow of the right big toe produced by the dorsolumbar massage.

Fig. 7B Changes in the cutaneous blood flow of the right lower limb produced by the dorsolumbar massage.

Fig. 8 Changes in the volume of the right lower limb produced by the dorsolumbar massage.

The filled circle indicates the volume before the dorsolumbar massage, while the open circle indicates the volume after the dorsolumbar massage.

4. Discussion

Edema results from the accumulation of excess interstitial fluids in the tissue. Ohashi defined the term "edema" as follows: Edema is a condition of abnormally large fluid volume in the interstitial spaces, and the swelling in the tissue that can be visually noticed. This condition can be caused by the excess intake of water and sodium, or an impaired body fluid regulation mechanism. Pathophysiological factors for edema include increased capillary hydrostatic pressure, decreased colloidal osmotic pressure of plasma, increased capillary permeability, increased colloidal osmotic pressure of interstitial fluid, and obstruction of lymphatic vessels. Postpartum women with lower limb edema experience some minor symptoms or discomfort, such as numbness, pain during walking, and a sense of exhaustion of the lower limbs. The lower limb edema in postpartum women may result from maintaining the same body position during breast-feeding, pressure from a tight obstetrical binder, and fatigue or anemia during delivery. Nowadays, lower limb massage with aromatic vegetable oil, after-birth exercises, and elevation of the lower limbs are employed to postpartum women with lower limb edema. In earlier studies, the subjective symptoms were found to be improved after the lower limb massage, while the circumference of the lower limb was not significantly changed. This study showed that both the lower
limb and dorsolumbar massages reduced the lower limb edema.

4.1. Effects of the lower limb massage on the lower limb edema

To reduce edema, it is essential to improve the circulation of the blood and lymph. The skeletal muscles contract and compress the blood and lymph vessels to facilitate the smooth flow of blood and lymph toward the heart by means of valves in those vessels, through a mechanism known as the "muscle pump." This "muscle pump" may accelerate the blood and lymph flow.  

Massage may also promote the venous return by the muscle pump, since the muscles are pressed passively. Consequently, the venous pressure of the lower limbs may decrease and the interstitial fluid may flow into the vessel. These supportive effects for the muscle pump through massage may contribute to the reduction of the lower limb edema.

However, we did not observe a significant difference in the cutaneous blood flow in the big toe. During the lower limb massage, the big toe was pressed, but not stroked from the periphery to the heart. Therefore, the venous return was not increased around the big toe.

4.2. Effects of the dorsolumbar massage on the lower limb edema

During the dorsolumbar massage, the back of the postpartum women was stroked (by making big loops) from the 7th cervical vertebra through the 5th lumbar vertebra. This tactile stimulation may pass through the afferent fibers to the thoracic spinal cord, and the 1st and 2nd lumbar spinal cord. Almost all the smooth muscles of the blood vessels are controlled by the sympathetic efferent nerves from the thoracic spinal cord to the 2nd lumbar spinal cord. Therefore, it is possible that dorsolumbar massage may adjust the movement of the smooth muscle in the blood vessels and the blood flow, which may reduce the edema.  

In fact, the cutaneous blood flow in the lower limb increased after the dorsolumbar massage, although the cutaneous blood flow in the big toe decreased afterward.

The reduction of lower limb edema was observed both with the lower limb and the dorsolumbar massage. After both types of massage, the lower limbs of the postpartum women were elevated for 30 min; thus, it is also possible that the elevation of the lower limbs improve the venous return by gravity. In other words, both the massages and elevation of the lower limbs may act to reduce the edema.

5. Conclusion

1. In this study, a new treatment (dorsolumbar massage) for the lower limb edema in postpartum women was proposed.

2. A lower limb or dorsolumbar massage with a 30-min elevation of the lower limbs was observed to reduce lower limb edema.

3. The massage of the lower limbs and dorsolumbar area or the elevation of the lower limbs is therefore considered to independently affect the reduction of the lower limb edema.

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