Medical Science

25(113), July, 2021

Intensive treatment of lymphedema and mobilization of liquids in body segments

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To Cite:
Godoy MFG, de Godoy JMP, de Godoy LMP, de Godoy HJP, Ramos RR. Intensive treatment of lymphedema and mobilization of liquids in body segments. *Medical Science*, 2021, 25(113), 1578-1582

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Peer-Review History
Received: 30 May 2021
Reviewed & Revised: 01/June/2021 to 23/June/2021
Accepted: 24 June 2021
Published: July 2021

Peer-review Method
External peer-review was done through double-blind method.

ABSTRACT

Background: Lymphedema is a clinical condition associated with a functional or mechanical deficiency of the lymphatic system, leading to the accumulation of macromolecules in the interstitial space and the consequent retention of liquids. The objective of the study was to determine changes in the extracellular water/total body water ratio in all extremities and the thorax after intensive treatment for lymphedema. *Method*: A clinical crossover study was conducted involving the determination of the extracellular water/total body water ratio in all extremities and the thorax of 86 patients with clinical diagnosis lymphedema, stage II and III at the Clínica Godoy-Sao Jose do Rio Preto-Brazil in January until December 2020. Evaluations were performed with multi-segment bioimpedance analysis before and after intensive treatment for lower limb lymphedema using the Godoy Method. *Results*: Significant reductions were found after treatment using all assessment methods (volumetry, circumference measurements and bioimpedance analysis). *Conclusion*: The intensive treatment of lower limb lymphedema using the Godoy Method results in a reduction in edema throughout the body, as demonstrated by bioimpedance analysis of all extremities and the trunk. Therefore, the method affects the lymphatic system and the response is systemic.

Keywords: Intensive treatment, lymphedema, mobilization of liquids, body segments

1. INTRODUCTION

Lymphedema is a clinical condition associated with a functional or mechanical deficiency of the lymphatic system. This condition may be congenital or acquired. In congenital lymphedema, the individual is born with an abnormal lymphatic system, the can during of life manifest or not the lymphedema. The classification is based on the age at which the condition emerges. This classification, the congenital is presents at birth, while praecox, developing during puberty and the late type occurs after the age of 35 years (Gasparis et al., 2020; Rabe et al., 2017; Pereira de Godoy et al., 2020). Regarding secondary (acquired) lymphedema, one of the causes can be by filaria, which happens in

economically less favored countries and treatment for cancer in developed countries. Venous causes leading to phlebolymphedema and infectious conditions, especially erysipelas, are frequent (Gasparis et al., 2020); (Godoy & Silva, 2007). The diagnosis is made using methods that measure volume, such as the water displacement volumetry, circumference measurements and bioelectrical impedance analysis (bioimpedance) (Dylke &Ward, 2020; de Godoy et al., 2019; Keo et al., 2017; Temur & Kapucu, 2019). Multi-segment bioimpedance analysis enables the assessment of different body parts and the determination of the mobilization of water throughout the body (Pereira de Godoy et al., 2021). Several treatment options have been used in recent years (Pereira de Godoy et al., 2019; Temur & Kapucu, 2019). However, novel conceptions have emerged that propose the clinical normalization of lymphedema in all stages (Pereira de Godoy et al., 2020). For children, cervical lymphatic therapy as monotherapy results in the totally reduce of the edema.

Multi-segment bioimpedance analysis offers an advantage over other volume measures (volumetry and circumference measurement) because it enables separate analyses of the body segments (upper, lower limbs and thorax) as well as the determination of intracellular and extracellular water, thereby furnishing additional information. Other exams, such as lymphoscintigraphy and magnetic resonance lymphography are useful, but offer more anatomic information and do not enable the determination of changes in volume (Mills et al., 2021; Forte et al., 2019).

The objective of the study was to determine changes in the extracellular water/total body water ratio in all extremities and the thorax after intensive treatment for lymphedema.

2. MATERIALS AND METHODS

Patients and setting

Total Participates are 86 patients (86% women and 14% men). Mean age was 40.2 ± 15.6 years (range: 20 to 71 years). Evaluations and treatment were performed at the Clínica Godoy-Sao Jose do Rio Preto-Brazil in January until December 2020.

Design

A clinical crossover study was conducted involving the determination of the extracellular water/total body water ratio in all extremities and the thorax of 86 patients. Evaluations were performed with multi-segment bioimpedance analysis before and after intensive treatment for lower limb lymphedema using the Godoy Method®. Comparisons were performed using the Wilcoxon signed ranks test.

Inclusion criterion

Patients with lower limb lymphedema

Exclusion criteria

Lower limb lymphedema due to other causes of edema detected during the patient history and physical examination, heart disease, kidney disease, active infection.

Statistical analysis

Descriptive statistical analysis of the data was performed. The Wilcoxon signed ranks test paired t-test was used for the comparisons, considering a 5% alpha error.

Development

The patients were sent to the specialized clinic for treatment. All had stage II or III lower limb lymphedema. The patient history was taken. General and specific physical examinations were performed and other causes of edema diagnosed clinically as well as heart and kidney diseases were discarded. Volumetric analyses were done using the water displacement method, circumference measurements, weight and multi-segment, multi-frequency bioimpedance analysis (*InBody S10*). After confirmation of the diagnosis, the patients underwent intensive therapy using the Godoy Method® eight hours per day for five consecutive days. Treatment consisted of cervical lymphatic therapy (gentle surface movements of 0.5 cm in the cervical region), eight hours of mechanical lymphatic therapy using the RAGodoy® device, which is an electromechanical device that performs passive dorsiflexion plantar, manual lymphatic therapy adapted to each physiopathological process and a compression mechanism (hand-crafted stocking made of grosgrain [non-elastic] fabric) adjusted daily. After days of treatment, the volumetric evaluations were performed again, but we only describe the bioimpedance results in the present study.

3. RESULTS

Significant reductions were found after treatment using all assessment methods (volumetry, circumference measurements and bioimpedance analysis). However, we are only analyzing the bioimpedance results in the present study. Table 1 displays the descriptive statistics (mean, median, standard deviation) of the data analyzed for each extremity and the thorax. Treatment was effective at reducing the extracellular water/total body water (ECW/TBW) ratio in all segments analyzed (Table 2). Figure 1 displays the box & whisker plot showing the differences in each segment before and after treatment.

Table 1 Descriptive statistics of data for each body segment and thorax

Variables	ECW/ TBW- RA- Before	ECW/ TBW- RA- After	ECW/ TBW- LA- Before	ECW/ TBW- LA- After	ECW/ TBW- TH- Before	ECW/ TBW- TH- After	ECW/ TBW- LL- Before	ECW TBW LL- After	ECW/ TBW- RL- Before	ECW/ TBW- RL- After
Valid data	86	86	86	86	86	86	86	86	86	86
Mean	0.395	0.386	0.394	0.376	0.391	0.379	0.388	0.376	0.385	0.378
Standard deviation	0.013	0.011	0.0232	0.0122	0.011	0.009	0.019	0.007	0.010	0.005
Maximum	0.433	0.42	0.451	0.39	0.417	0.397	0.439	0.39	0.414	0.393
Upper quartile	0.405	0.393	0.409	0.382	0.401	0.384	0.4	0.38	0.392	0.383
Median	0.395	0.387	0.391	0.378	0.391	0.38	0.387	0.377	0.386	0.378
Lower quartile	0.388	0.379	0.381	0.374	0.385	0.375	0.372	0.373	0.378	0.374
Interquartile range	0.017	0.014	0.028	0.008	0.016	0.009	0.028	0.007	0.014	0.009
Minimum	0.347	0.365	0.329	0.284	0.352	0.305	0.35	0.333	0.365	0.364
Range	0.086	0.055	0.122	0.106	0.065	0.092	0.089	0.057	0.049	0.029
Centile 95	0.419	0.406	0.436	0.388	0.41	0.39	0.425	0.385	0.401	0.387
Centile 5	0.374	0.37	0.357	0.368	0.375	0.371	0.363	0.367	0.37	0.369

ECW- extracellular water; TBW- total body water; RA- right arm; LA- left arm; Th- thorax; LL- left leg; RL- right leg

Table 2 Results of Wilcoxon's signed ranks test comparing ECW/TBW ratio before and after treatment

Wilcoxon's test	ECW/TBW-RA	ECW/TBW-LA	ECW/TBW-TH-	ECW/TBW-LL	ECW/TBW-RL
*p-value	0.0001	0.0001	0.0001	0.0001	0.0001

ECW- extracellular water; TBW- total body water; RA- right arm; LA- left arm; Th- thorax; LL- left leg; RL- right leg

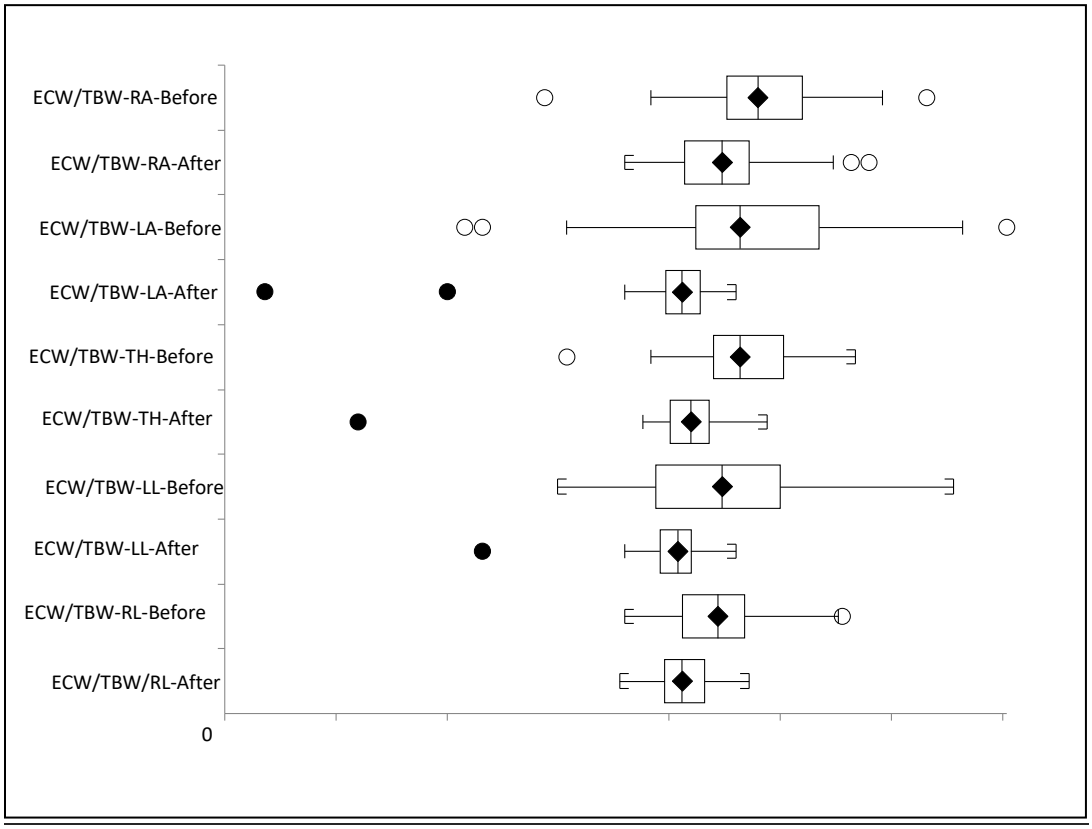

Figure 1 Comparing min, max, median, interquartile range before and after five days of treatment

4. DISCUSSION

The study reports volume reduction in the extracellular water/total body water ratio following intensive treatment for lower limb lymphedema using the Godoy Method®. However, even being the treatment for lower limb lymphedema, analyzing other body segments, it was observed a reduction as well, suggesting a total body reduction. In relation to the literature, no studies with similar of data analyze. Therefore, the present investigation makes a novel, important contribution.

In daily clinical practice, we observe important changes throughout the entire body during intensive treatment for lower limb lymphedema, with reductions in circumference measurements in the abdomen and upper limbs. In a previous study by our research group, we found that intensive treatment for the lower limbs can lead to a systemic reduction, all body parts (de LM Pereira de Godoy et al., 2018). An important bioimpedance finding is that the reduction in the volume of liquid in the lower limbs may be accompanied by an increase in liquid in the upper limbs and trunk, but without causing edema (study in publication phase). However, we have observed a reduction in the extracellular water/total body water ratio, which led us to perform the present analysis. The hypothesis for these changes is that the macromolecules that retain water in the limb with lymphedema are mobilized to other parts of the body but maintain the capacity to retain water without causing edema, and compounds, such as hyaluronic acid, are found within these macromolecules.

The identification of all types of edema and the determination of factors associated with the aggravation of lymphedema, such as obesity, idiopathic cyclic edema, cellulite and lipedema, are fundamental aspects of the final outcome of treatment (de LM Pereira de Godoy et al., 2018; Pereira de Godoy et al., 2020; Jose Maria Pereira de Godoy, 2019; Pereira de Godoy et al., 2017). The method employed is able to mobilize large volumes of liquid with the reduction of approximately 50% or more of the edema in five days and a reduction of one to six kilograms in a single day of treatment (Pereira de Godoy, 2020). The aim the treatment is total reduction of the limb with treatment for all stages of lymphedema. We are currently in the publication phase of studies in which we performed biopsies before and after treatment and detected significant changes in proteins of the extracellular matrix, such as type I, III and IV collagens in basement membranes and an important reduction in the basement membrane. This suggests that treatment for lymphedema results in important changes in the skin and reversal is possible using this method. Each additional piece information regarding small details is fundamental to gaining a better understanding of lymphedema.

5. CONCLUSION

A new form of intensive treatment of lower limb lymphedema using the Godoy Method results in a reduction in edema throughout the body, as demonstrated by bioimpedance analysis of all extremities and the trunk. Therefore, the method results in response systemic, in all body.

Conflict of Interest

The authors declare no conflict of interest.

Funding

This paper received no external funding.

Ethical considerations

This study received approval from the Medical Ethics Committee of Faculdade de Medicina de Sao Jose do Rio Preto # 4.726.181.

Data and materials availability

The data are available upon request from the authors.

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