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## Lymphedema index ratio as Predictive Factor in Patients with Breast Cancer Related Lymphedema

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### Introduction

Bioimpedance analysis (BA) is known to be useful diagnostic and monitoring tool in patients with breast cancer related lymphedema (BCRL). In previous studies, they measured the amount of extracellular fluid (ECF) and bilateral arm circumference before and after treatment in patients with BCRL and found that ECF is useful prognostic factor of treatment in patients with BCRL. The purpose of this study is to determine the useful prognostic factors related BA in patients with BCRL.

### Material and methods

This study was targeted at female patients with BCRL admitted to perform Complex decongestive therapy (CDT) in physical medicine and rehabilitation department of XX Hospital from August 2016 to March 2018. The subjects were older than 18-year-old who underwent surgery because of breast cancer. The patients were diagnosed as BCRL with lymphoscintigraphy. Patients with recent metastasis, conditions such as lymphatic inflammation, trauma, and surgical history of the affected arm were excluded. CDT was performed for 10 days (5 days per week) for 30 minutes a day. CDT consisted of manual lymphatic drainage, compressive bandaging, exercise to promote lymphatic drainage, and patient education. Before and after 2 weeks of CDT, we conducted the BA using Inbody S10ⓡ. The volume of bilateral upper extremities was measured from the fingertips to the proximal portion of 33 cm using the water displacement method.

### Result

A total of 68 patients were enrolled. Lymphedema index ratio (LIR) at pre-CDT and post-CDT were $1.264 \pm 0.234$ and $1.149 \pm 0.156$, respectively. The volume differences between bilateral upper extremities at pre-CDT and post-CDT were $326.27 \pm 275.54$ (ml) and $197.78 \pm 172.72$ (ml). During CDT, the change of LIR and volume differences in bilateral upper extremities were statistically significant with the t-value of 8.399 and 8.535 at the $p < 0.005$ level respectively. The correlation coefficient between the pre-CDT LIR and the volume difference between bilateral upper extremities was 0.731, which was statistically significant at the level of $p < 0.001$(Figure 1). The correlation coefficient between pre-CDT LIR and change of volume difference in bilateral upper extremity before and after CDT was 0.561, which was statistically significant at the level of $p < 0.001$(Figure 2). The pre-CDT LIR and duration of disease were statistically significant at the level of $p < 0.001$ and the ratio of ratio bilateral ECF volume, age, skeletal muscle mass, body mass index, and body fat percentage were not statistically significant in multivariate linear regression (Table 1).

**Conclusion**

In this study, it was found that LIR by BA is useful monitoring tool of treatment outcome and the pre-CDT LIR was statistically significant factor for predicting effects of treatment in patients with BCRL. We suggest continuous BA is required to use the LIR as a follow-up and predictive factor of treatment in patients with BCRL.

Table 1. Factors associated with volume change before and after CDT by multivariate linear regression analysis

| Independent Predictor | Standardized β | $p$-value | Adjusted $R^2$ |
|---|---|---|---|
| LIR at admission | 0.576 | <0.005* | |
| Age | 0.134 | 0.216 | |
| Skeletal muscle mass | 0.213 | 0.242 | 0.510 |
| BMI | - 0.177 | 0.522 | |
| Body fat percentage | 0.245 | 0.245 | |
| Extracellular fluid | -0.182 | 0.787 | |

CDT, Complex decongestive therapy; LIR, Lymphedema index ratio; BMI, Body mass index
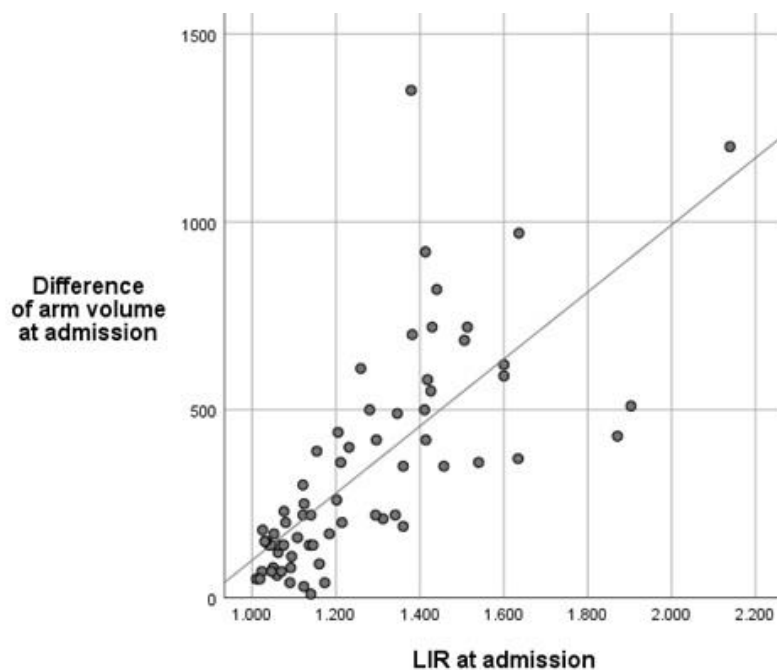


Fig 1. Correlation between LIR and volume difference between both arms at admission
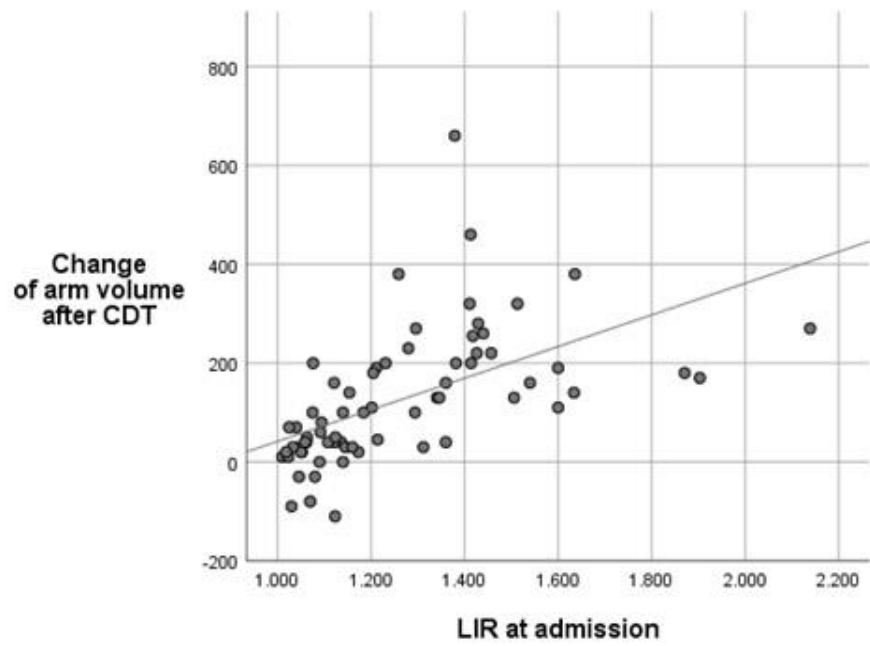
Fig 2. Correlation between LIR at admission and change of affected arm volume after CDT