

Objective

The purpose of this study is to investigate the importance of testing phase angle in elderly breast cancer patients.

Method

This study was conducted on patients under outpatient follow-up with the Rehabilitation medicine department for breast cancer rehabilitation treatment, lymphedema prevention, and treatment from February 2019 to November 2022. A total of 50 patients (over the age of 60) were registered, and Bioelectrical impedance analysis (BIA) was performed in outpatient follow-up after breast cancer surgery. (Figure 1) BIA test was used to help evaluate body composition and body fluid level, and phase angle also can be obtained using BIA. Phase angle is a parameter that is calculated from resistance (R) and reactance (Xc) raw data. Phase angle reflects the electrical function of cell membrane and cellular integrity. We used the inter-limb phase angle ratio, which defined as the value obtained by dividing the phase angle of the affected arm by the phase angle of the unaffected arm. Also, the Extracellular water / Total body water ratio (ECW/TBW) can be obtained through BIA, and the value means reflects the degree of edema. We used the inter-limb ECW/TBW ratio, which defined as the value obtained by dividing the ECW/TBW of the affected arm by the ECW/TBW of the unaffected arm. In addition, a dynamometer was used to measure the maximal hand grip power.

Result

50 breast cancer patients participated in the study. (Table 1) They received various treatments such as radiation therapy, chemotherapy, and endocrine therapy in addition to surgical treatment.

In this study, a simple regression analysis was conducted to investigate whether phase angle was associated with maximal hand grip power. (Table 2) As a result of regression analysis, the regression model was statistically significant ($F=6.192$, $p=0.016$), and phase angle explained $\sim 11.4\%$ of maximal hand grip power strength variance.

In addition, we used Pearson correlation analysis to confirm the relationship between the inter-limb phase angle ratio and the inter-limb ECW/TBW ratio, and they showed a significant negative correlation ($r=-0.919$, $p<0.000$). (Table 3) As the inter-limb ECW/TBW ratio increases, the inter-limb phase angle ratio decreases. Since the inter-limb ECW/TBW ratio can be used as a parameter showing the severity of lymphedema, it can be seen that the inter-limb phase angle ratio changes according to the severity of lymphedema.

Table 1. Participant characteristics (N=50)

Dermographic factor		Value
Age (years), mean \pm SD		66.50 \pm 5.00
Operation	BCS	40
	Mastectomy	10
Axillary lymph node dissection	(+)	30
	(-)	20
Chemotherapy	(+)	28
	(-)	22
Radiotherapy	(+)	43
	(-)	7
Endocrine therapy	(+)	38
	(-)	12

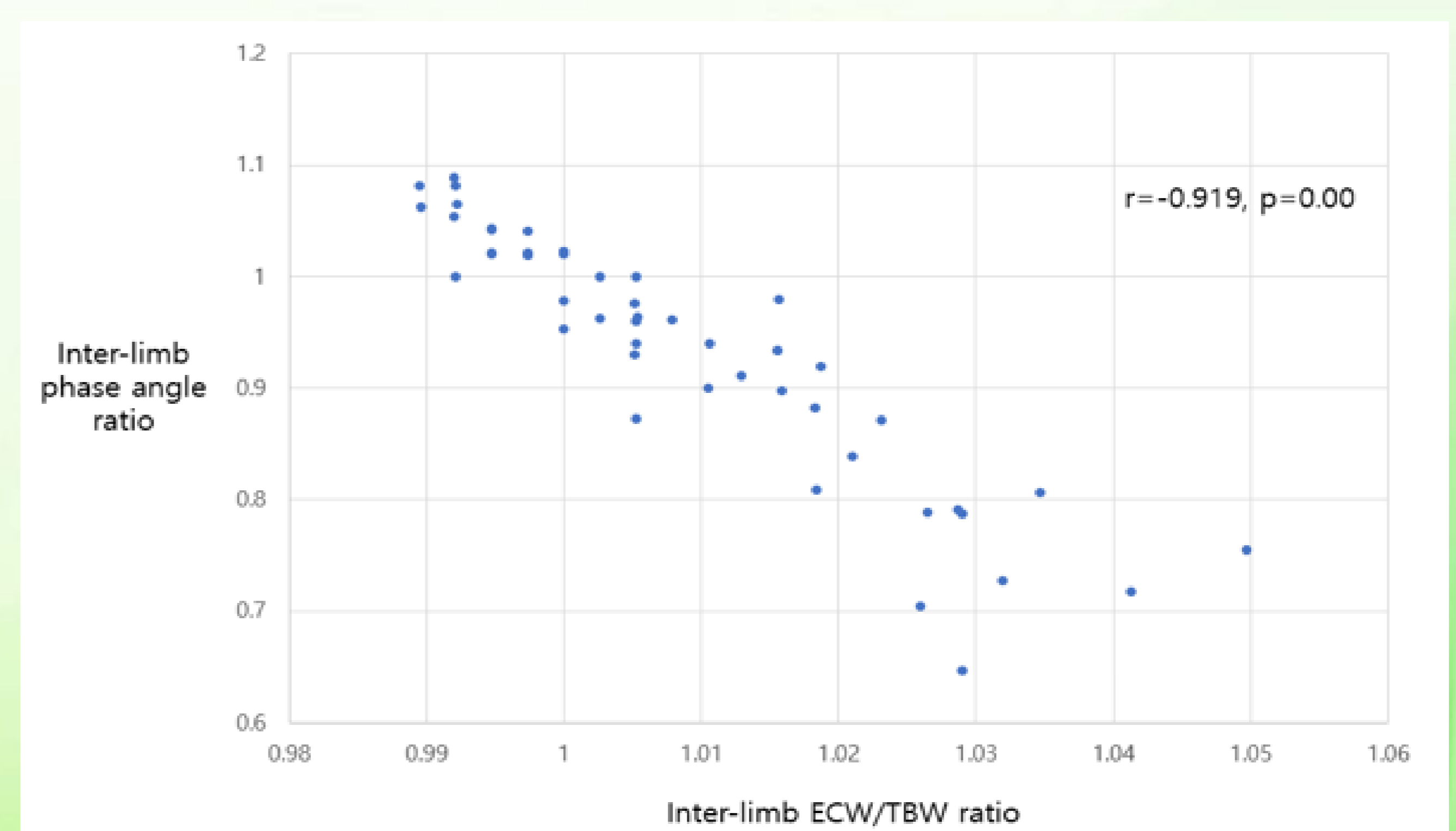
Values are presented as number (%)

Table 2. Relationship between the phase angle and the maximal hand grip power

		Unstandardized coefficient		Standardized coefficient	p-value
		β	Std. Error	β	
Model 1	(constant)	1.722	6.725		0.799
	($R^2=0.114$)	3.350	1.346	0.338	*0.016

* Denotes significant difference (* $p<0.05$)

Table 3. Pearson correlation coefficients (r) of inter-limb phase angle ratio and inter-limb ECW/TBW ratio



* Denotes significant difference (* $p<0.05$)



Figure 1. Bioelectrical impedance analysis

Conclusion

In this study, the phase angle showed a significant relationship with the variance of hand grip power in elderly breast cancer patients, and showed a significant strong negative correlation with the inter-limb ECW/TBW ratio, which shows the severity of lymphedema. Therefore, it suggests that the measurement of phase angle can be used as a good way to identify changes in muscle strength and the severity of lymphedema in elderly breast cancer patients.