통증 및 근골격재활

게시일시 및 장소 : 10 월 18 일(금) 08:30-12:20 Room G(3F)

질의응답 일시 및 장소 : 10 월 18 일(금) 10:00-10:45 Room G(3F)

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The Clinical Usefulness of Lymphedema Measurement Technique Using Ultrasound

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Introduction

Various techniques are used for measuring the status of lymphedema, however, no gold standard test is recommended considering structural change with cost efficiency. We previously reported the efficacy of the new ultrasonographic (US) measurement technique to measure the cross-sectional area of the lymphedema on healthy participants and showed a strong correlation with circumference and volumetry. The purpose of this study was to determine whether measurement using US is useful in patients with lymphedema.

Methods

Total 69 female patients admitted to our hospital who had been diagnosed as of unilateral upper limb lymphedema were recruited for the study. The severity of Lymphedema was evaluated with circumference measure, bioimpedance analysis (BIA) and US on the same day. Arm circumference was checked by tape measure at 10 cm above (AE) and below (BE) elbow crease. The BIA was performed by a trained physical therapist, and we used impedance (Z) at 5 Hz of each side of the upper limb. Fully experienced physician measured soft tissue thickness, the distance between skin and the fascia of the muscle, three times each at superior (a), medial (b), inferior (c) and lateral (d) aspect of the bilateral arm using ultrasonography, at 10 cm AE and BE. The amount of soft tissue in the cross-sectional area (ΔCSA) has been calculated by a designed formula using the mean values of the thicknesses on 16 sites. For evaluating inter- and intra-rater reliability, ΔCSA has been measured by two examiners in 29 patients. Statistical analysis was performed for correlations among the parameters, and for intra- and inter-class reliability of ΔCSA.

Results

Demographic data are shown in Table 1. The total reliability at all tissue locations was very strong for both intra- and inter-rater correlation (r ?) (Table 2). In the lesion side, the ΔCSA measured both at 10cm AE and BE showed a strong positive correlation with circumference (rho=0.951, p=0.000 and rho=0.901, p=0.000, respectively). On the other hand, the ΔCSA measured both at 10cm AE and BE revealed moderate negative correlations with Z at 5 Hz of upper limbs (rho=-0.360, p=0.002 and rho=-0.486, p=0.000, respectively). Similar results were seen in the sound side (Table 3).

Conclusion

Compared to other measurements, our newly developed technique measuring the ΔCSA changes has advantages in considering structural change evaluation with cost-effectiveness. Our results showed a moderate to strong correlation of reliability with other conveniently used methods, thus it could be recommended as a useful method in determining the status of lymphedema.

Table 1. Demographics and analyzed data of the subjects

Variables	Values
Age (years)	57.55±9.64
Height (cm)	157.64±5.46
Weight (kg)	61.66±7.32
BMI	24.79±2.46
Circumference (lesion side) (cm)	
AE 10cm	30.32±4.45
BE 10cm	25.66±2.21
Circumference (sound side) (cm)	
AE 10cm	27.06±4.35
BE 10cm	22.25±1.76
Circumference ratio (lesion - sound)	
AE 10cm	1.12±0.05
BE 10cm	1.16±0.07
ΔCSA (lesion side) (cm^2)	
AE 10cm	46.14±9.35
BE 10cm	28.67±8.06
ΔCSA (sound side) (cm^2)	
AE 10cm	33.54±7.82
BE 10cm	14.81±4.32
ΔCSA ratio (lesion : sound)	
AE 10cm	1.40±0.22
BE 10cm	2.01±0.54
Z at 5 Hz (Ω)	
Lesion side	296.82±51.76
Sound side	400.78±47.08
Ratio	0.74±0.10

BMI, body mass index; AE, above elbow; BE, below elbow; Z, impedance

Table 2. Inter- and intra-rater reliability of ΔCSA

Parameters	Sound side				Lesion side			
	AE		BE		AE		BE	
	Inter-rater	Intra-rater	Inter-rater	Intra-rater	Inter-rater	Intra-rater	Inter-rater	Intra-rater
a	0.896	0.885	0.733	0.936	0.671	0.974	0.800	0.936
b	0.834	0.920	0.774	0.959	0.857	0.949	0.864	0.933
c	0.913	0.938	0.623	0.967	0.872	0.960	0.873	0.953
d	0.864	0.936	0.791	0.949	0.784	0.888	0.864	0.944
ΔCSA	0.978	0.989	0.902	0.970	0.989	0.994	0.959	0.990

ΔCSA, cross-sectional area; AE, above elbow; BE, below elbow
All data are statistically significant ($p<0.05$)

Table 3. Correlation between ΔCSA and other parameters

10cm AE		Lesion side		Sound side	
		Circumference	Z at 5 Hz	Circumference	Z at 5 Hz
ΔCSA	rho	0.951	-0.360	0.909	-0.326
	p-value	0.000*	0.002*	0.000*	0.006*
10cm BE		**Lesion side**		**Sound side**	
		Circumference	Z at 5 Hz	Circumference	Z at 5 Hz
ΔCSA	rho	0.901	0.486	0.758	-0.343
	p-value	0.000	0.000	0.000*	0.000*

ΔCSA, cross-sectional area; AE, above elbow; BE, below elbow; Z, impedance
Asterisk (*) means statistically significant