

암재활

발표일시 및 장소 : 10 월 27 일(토) 14:30-14:40 Room E(5F)

#### OP4-2-4

### QUANTIFIABLE SUPRA-FASCIAL FIBROSIS IN LYMPHEDEMA USING HOUNSFIELD UNIT FROM COMPUTERIZED TOMOGRAPHY

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#### Purpose

To verify feasibility of computerized tomography (CT)-based quantification of supra-fascial microscopic fibrosis.

#### Method

Retrospective, observational, cross-sectional study had been conducted from January 2017 to March 2018. Patients with only unilateral lymphedema were included. Three types (maximum, mean, minimum) of CT reticulation indexes (CTRIs) were digitally subtracted from the cross-sectional images by narrowing window width of absorptive values (Hounsfield unit [HU]) and then were compared with the measurements used in common for lymphedema: 1KHz-based impedance in affected limb standardized by value in the un-affected one, lymphoscintigraphic stages (I to IV) of Peeking et al., circumference difference between limbs standardized by value in the un-affected limb, and International Society of Lymphedema (ISL) sub-stages.

#### Result

A mean value of cross-sectional images on CT per patients was 127 (7 to 557 scans). Two third of the patients had breast cancers and one third gynecologic cancers except one patient (Table 1). CTRIMEAN was related with months from onset of limb swelling to being taken CT ( $r = 0.52$ ,  $p < 0.01$ ). CTRIMAX also showed the same result ( $r = 0.45$ ,  $p < 0.05$ ). Significant relation with ISL stages was noticed; CTRIMEAN ( $r = 0.86$ ,  $p < 0.01$ ), CTMIN ( $r = 0.79$ ,  $p < 0.01$ ), and CTRIMAX ( $r = 0.68$ ,  $p < 0.01$ ). CTRIMIN showed relation with 1 KHz-based impedance ratio ( $r = -0.46$ ,  $p < 0.05$ ) and with the proximal limb circumference difference ratio ( $r = 0.45$ ,  $p < 0.05$ ) (Figure 1). No significance was notice in the serum albumin level, lymphoscintigraphic stages, or the distal limb circumference differences ratio. Based on receiver operating characteristics curve analysis, CTRIMAX showed the discriminating sensitivity of 0.78 and specificity of 0.60 against lymphoscintigraphic stage IV (no visualization of superficial and deep lymph nodes) and the sensitivity of 0.75 and specificity of 0.56 against lymphoscintigraphic stage III (no visible superficial lymph node, but visualization of deep lymph nodes) with the cut-off value of

17.57 (Figure 2). No significance was found in the contributing factors such as underlying cancers, history of taking radiotherapies, rehabilitative managements, or anti-edemic drugs.

### Conclusion

CTRIs are significantly related with the duration of swelling, the ISL sub-stages, circumference difference ratio in the proximal limb, and 1 KHz-used impedance ratio. CTRIMAX showed reasonable degree of sensitivity and specificity in discriminating deep lymphatic system dysfunction. Considering that information technology has been developed very fast, this innovatory quantification using digital subtraction from CT using HU may lay a foundation on further progress in early screening on inaccessible deep-located fibrosis in persistence of lymphedema and in early intervention from the beginning.

Table 1. Demographic characteristics CTNUMBER, the number of cross-sections on CT scan; OPTOCT, months from operation to CT; LETOCT, months from onset of lymph edema to CT; OPTOLE, months from operation to onset to lymph edema; ISL, International Society of Lymphology

|                                      |                    | Number (%) or Mean $\pm$ S.D. |
|--------------------------------------|--------------------|-------------------------------|
| Age                                  |                    | 57.46 $\pm$ 13.41             |
| Sex                                  | Male               | 0 (0.0)                       |
|                                      | Female             | 24 (100.0)                    |
| Side                                 | Right              | 11 (45.8)                     |
|                                      | Left               | 13 (54.2)                     |
| Weight (kilograms)                   |                    | 58.52 $\pm$ 10.06             |
| CTNUMBER                             |                    | 127.38 $\pm$ 122.32           |
| OPTOCT (months)                      |                    | 82.65 $\pm$ 50.74             |
| LETOCT (months)                      |                    | 50.21 $\pm$ 42.99             |
| OPTOLE (months)                      |                    | 34.04 $\pm$ 32.29             |
| Albumin level in serum (mg/dl)       |                    | 4.16 $\pm$ 0.36               |
| Cancer                               | Breast cancer      | 16 (69.6)                     |
|                                      | Gynecologic cancer | 7 (30.4)                      |
| History of Radiotherapy              | No                 | 6 (25.0)                      |
|                                      | Yes                | 18 (75.0)                     |
| ISL sub-stage                        | IIA                | 8 (33.3)                      |
|                                      | IIB                | 13 (54.2)                     |
|                                      | IIA                | 3 (12.5)                      |
| History of rehabilitative management | No                 | 7 (29.2)                      |
|                                      | Yes                | 17 (70.8)                     |
| History of drug intake               | No                 | 7 (29.2)                      |
|                                      | Yes                | 17 (70.8)                     |

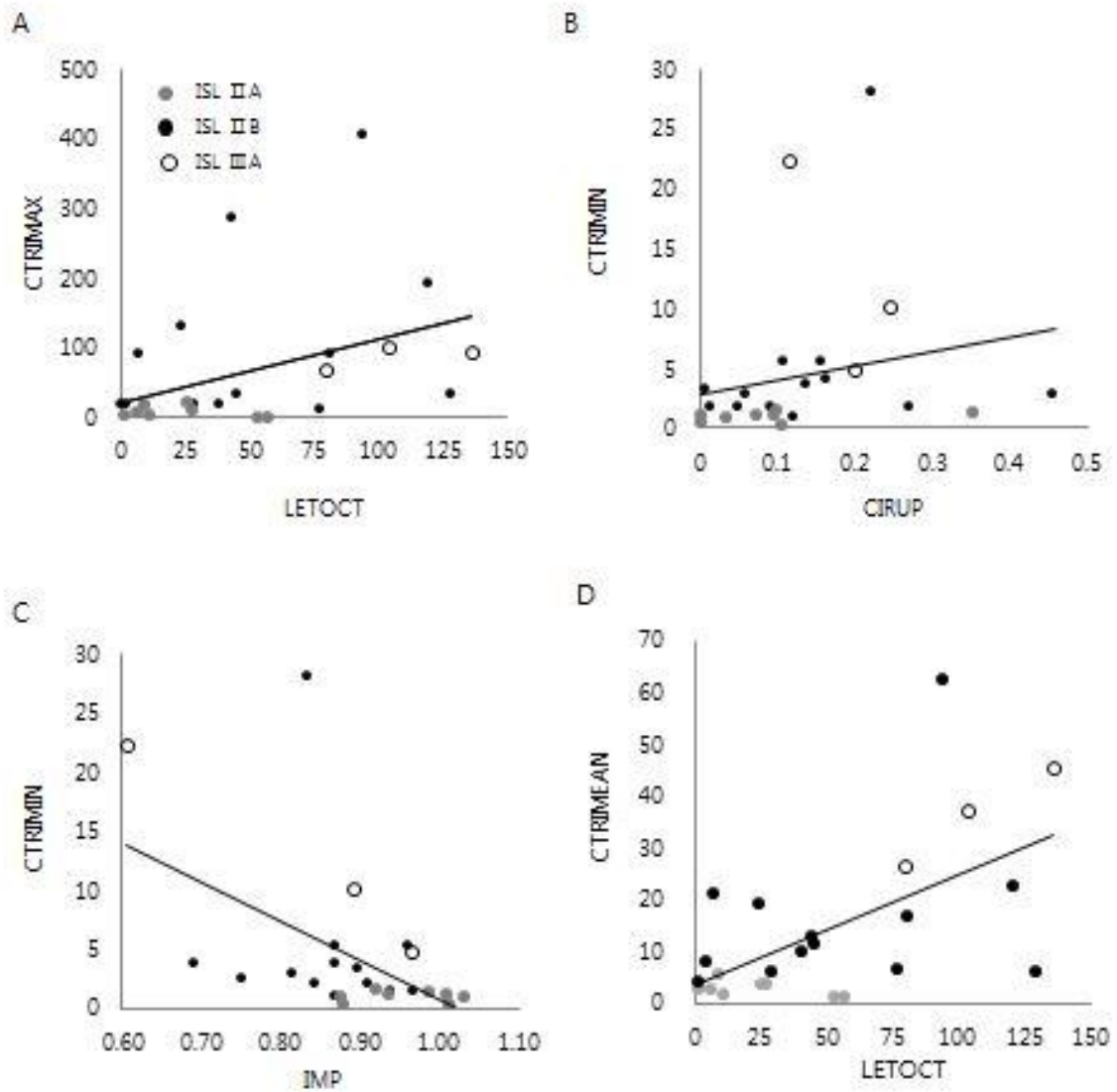


Figure 1. Correlation between the CT reticulation indexes and other clinical measurements A ; B ; C ; D, CTRIMAX, maximal CT reticulation index; LETOCT, months from onset of lymph edema to CT; CTRIMIN, minimal CT reticulation index; CIRUP, circumference difference between affected limb and non-affected limb measured 5 cm proximal to the anatomical landmarks (cm); IMP, 1 KHz-based impedance of affected limb divided by impedance of non-affected limb; CTRIMEAN, mean CT reticulation index; ISL, International Society of Lymphology stage, Spearman correlation analysis.

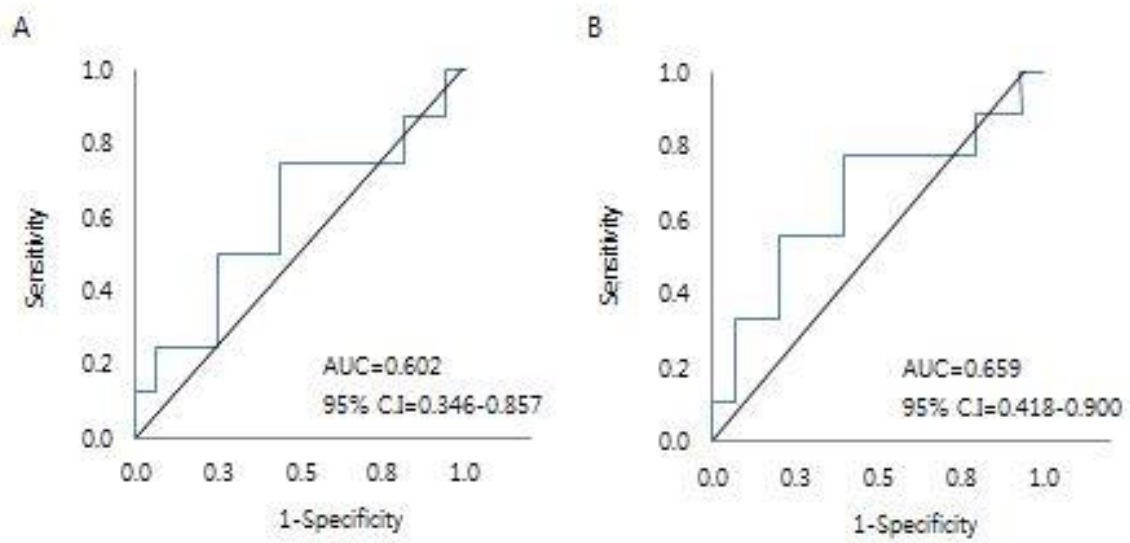


Figure 2. Receiver operating characteristics curve analyses of the CT reticulation indexes on superficial and deep lymphatic system dysfunction A; lymphoscintigraphic stage I, II versus III, IV, B; lymphoscintigraphic stage I, II, III versus IV, AUC, Area under the curve; CI, confidence interval.