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A comparison of CT based measures of skeletal muscle mass and density from the Th4 and L3 levels in patients with advanced non-small cell lung cancer

Bakground: Cachexia and muscle wasting are common in patients with non-small cell lung cancer (NSCLC). Muscle mass and muscle density assessed from routine CT-images at the level of L3 are shown to be prognostic for survival and prediction of treatment toxicity in cancer patients. However, the L3 level is not always included on the routine CT-scans. There is limited knowledge about the agreement between muscle measures at the L3 and at the Th4 level.

Aims: We aimed to investigate whether L3 muscle mass and muscle density might be reliable predicted from Th4 measures.

Methods: Patients from three chemotherapy trials in advanced NSCLC were eligible (n=1305). Skeletal muscle area (cm^2), skeletal muscle index (SMI, cm^2/m^2) and skeletal muscle density (SMD, HU) at the Th4 and L3 levels were assessed from baseline CT-scans by the use of Slice-O-Matic software. SMI and SMD at the Th4 and L3 levels were transformed into z-scores and the agreement between scores was investigated by Bland-Altman plots and estimated by intra-class correlation analyses. Linear regression was used to test if Th4 SMI and SMD z-scores predicted L3 SMI and SMD z-scores.

Results: CT-images from 401 patients were analysable at both levels. There was a moderate agreement between Th4 and L3 SMI z-scores with an intra-class correlation of 0.71 (95% CI 0.64–0.77) for men and 0.53 (95% CI 0.41–0.63) for women. Regression models predicting L3 SMI z-scores from Th4 SMI z-scores showed coefficients of 0.71 (95% CI 0.62-0.80) among men and 0.53 (95% CI 0.40-0.66) among women. R-squares were 0.51 and 0.28 respectively, indicating moderate agreement. A similar, moderate agreement between Th4 and L3 SMD z-scores was observed.

Discussion: The moderate agreement between muscle measures at the Th4 and L3 levels might be related to functional differences between muscle groups at the two levels, but reasons may be more complex. Although there are previous reports on differences in skeletal muscle density between muscle groups, we are not aware of any studies investigating different impact of cancer-related muscular depletion between muscle groups. Whole body CT or MRI scans are the gold standard for measuring lean body mass. However, this was not available for our patients, hence we were not able to investigate whether the Th4 or L3 levels are in best agreement with the whole body muscle mass. We investigated a large sample of patients with similar diagnosis and stage of disease, including a relatively large proportion of elderly and PS 2 patients, and the muscle measures were made using widely accepted methodology.

Conclusion: There was only moderate agreement between muscle measures from Th4 and L3 levels, indicating that missing data from the L3 level cannot be replaced by analyzing images at the Th4 level.

This was a multi-centre study performed together with B.H.Grønberg (PI), T. Wentzel-Larsen, V.E.Baracos, M.J. Hjermstad, N.Aass, R.M.Bremnes, Ø.Fløtten, A.Bye and M.Jordhøy. Article published online in European Journal of Clinical Nutrition, September 2018.