Course project
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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»

-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.

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ARTICLE

Body composition, energy expenditure and physical activity

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

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Background

Background, body composition

- Two major compartments;
  - fat mass
  - fat-free mass, often referred to as lean body mass
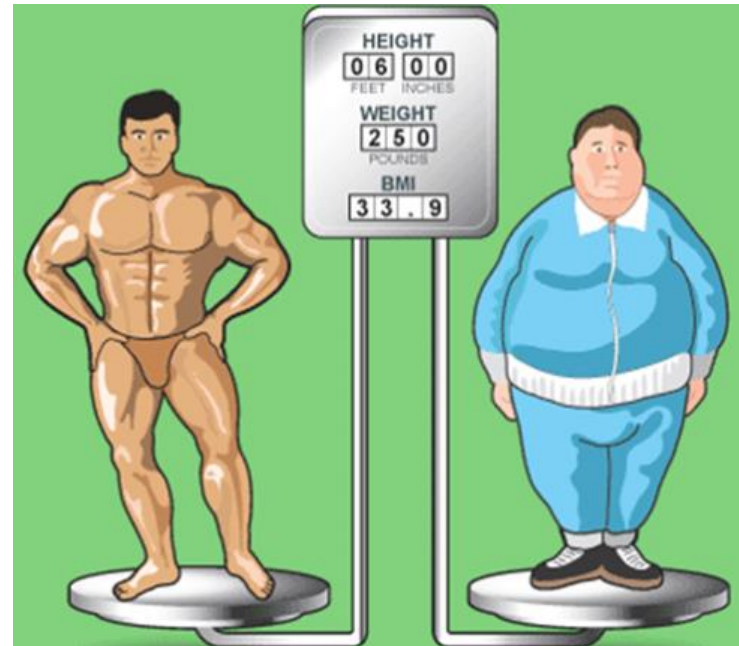   (LBM) where skeletal muscle constitutes a major part
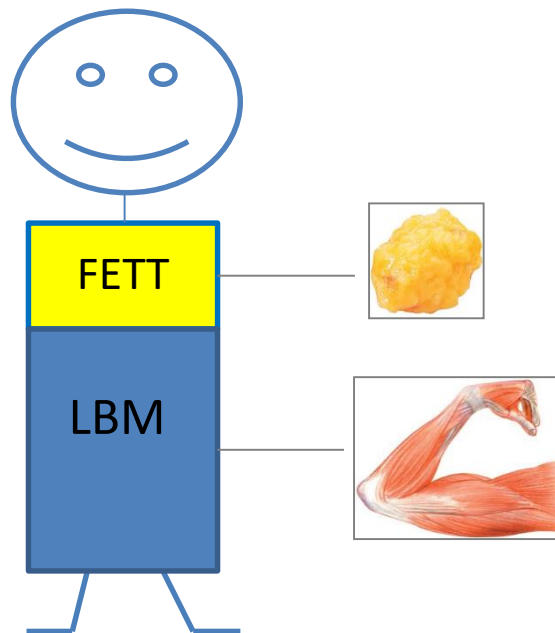
Roubenoff R et al, Am J Clin Nutr 1997
Kyle U G et al, Clin Nutr 2004
Prado CM, Heymsfield SB, JPEN 2014

Background, body composition

- The relative amounts of the different compartments
  - not visible on the outside
  - not reflected by weight or BMI/BSA

Bakground, body composition

- Involuntary weight loss - hallmark of cancer

- Cancer cachexia

  - loss of muscle mass (with or without fat loss)

  - low muscle mass termed sarcopenia

Fearon K et al, Lancet Oncol 2011

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Background, body composition

- Weight loss and sarcopenia in non-small cell lung cancer (NSCLC)

  - common

  - associated with worse prognosis

  - increased risk of treatment toxicity from systemic cancer treatment

Prado CM et al, Lancet Oncol 2008
Martin L et al, J Clin Oncol 2013
Sjøblom B et al, Lung Cancer 2015
Baracos VE et al, Am J Clin Nutr 2010

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Bakground, body composition analyses

- In cancer patients; use of diagnostic CT scans

  - quantified from a single, cross-sectional CT image at the third lumbar level (L3)
  - skeletal muscle measurements; both area and density
  - estimate of whole body LBM

Mourtzakis M et al, Appl Physiol Nutr Met 2008
Shen W et al, J Appl Physiol 2004

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Background, body composition analyses

- Diagnostic CT scans of patients with non-small cell lung cancer is often restricted to thorax and upper abdomen

- L3 level is often not included

Course project

Aim

to investigate whether L3 muscle mass and muscle density might be reliable predicted from Th4 measures
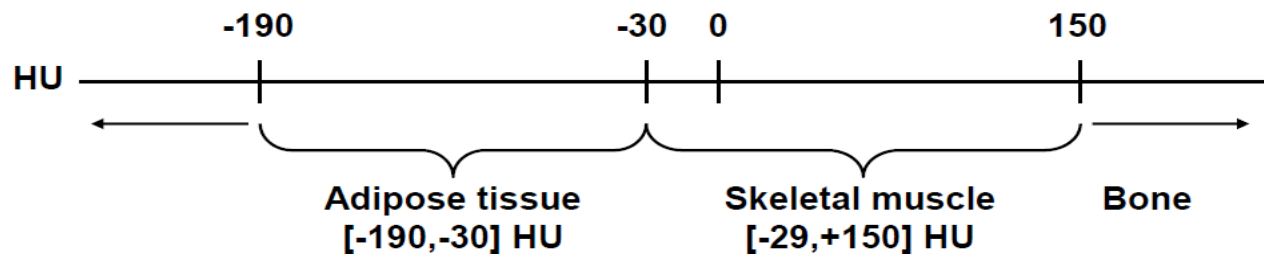
Materials and methods

- Patients from three national chemotherapy trials conducted from 2003 to 2009

- Patients with advanced NSCLC (stage IIIB/IV), ECOG 0-2, no prior chemotherapy

- Diagnostic CT scans at the time of trial inclusion were retrospectively collected

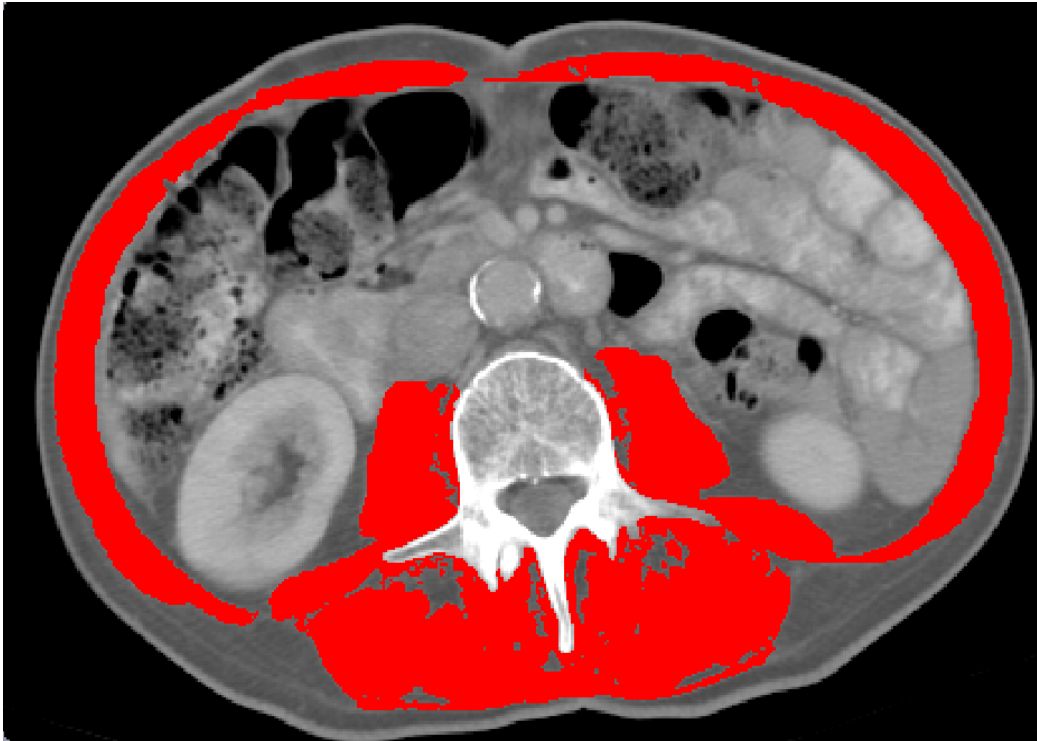- Baseline data; age, gender, ECOG, height/weight

Materials and methods

- Patients with available CT scans at both the Th4 and L3 level were included

- Skeletal muscle area (cm^2) and mean skeletal muscle density (HU) were assessed from the Th4 and L3 levels by the use of Slice-O-Matic software

Materials and methods

Materials and methods

Manually outlined by the use of software program;

- Amount of muscle mass (area, cm^2)

- Mean density (HU) of the outlined cross sectional muscle area

Materials and methods

Statistics:

- Skeletal muscle measures at both levels were transformed into z-scores

- Agreement between z-scores investigated by Bland-Altman plots and estimated by intra-class correlation analyses

- Linear regression was used to test if Th4 measures could predict L3 levels

- Analyses performed using SPSS

Results

Results

- CT scans retrieved from 1119 patients of the 1305 study participants (87.5%)

- 401 patients (30.7%) had available, analyzable CT scans at both the Th4 and L3 levels and available baseline characteristics (height, weight, age, gender, ECOG)

Results

		All patients (n = 401)		Men (n = 220)		Women (n = 181)	
Age	Mean (range)	66 (37–90)		68 (37–90)		64 (37–85)	
	≥75 years	79	19.7%	48	21.8%	31	21.0%
Histology	Squamous cell carcinoma	92	22.9%	64	29.1%	28	15.5%
	Adenocarcinoma	217	54.1%	104	47.3%	113	62.4%
	Other	92	22.9%	52	23.7%	40	22.1%
Disease stage	IIIB	85	21.2%	47	21.4%	38	21.0%
	IV	316	78.8%	173	78.6%	143	79.0%
Performance status	0	80	20.0%	46	20.9%	34	18.8%
	1	232	57.9%	122	55.5%	110	60.8%
	2	89	22.2%	52	23.6%	37	20.4%
Body weight, kg, mean (SD)		69.0 (13.8)		73.7 (11.9)		65.1 (13.1)	
Body Mass Index, kg/m^2, mean (SD)		23.9 (3.9)		23.8 (3.4)		23.9 (4.5)	
Appetite loss	Yes	211	52.6%	113	51.4%	98	54.1%
	No	190	47.4%	107	48.6%	83	45.9%

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Results

Table 2 Body composition measures at the Th4 and L3 levels

	Measures at the Th4 level						Measures at the L3 level					
	All (n = 401)		Men (n = 220)		Women (n = 181)		p*	All (n = 401)		Men (n = 220)		Women (n = 181)		p*
	Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD	
Measured muscle area, cm^2	176.4	39.6	200.7	31.7	147.0	25.8	<0.001	130.6	29.2	149.0	23.4	108.2	17.5	<0.001
Skeletal muscle index (SMI), cm^2/m^2	60.1	10.9	65.0	10.1	54.1	8.8	<0.001	44.5	8.1	48.3	7.7	39.8	6.0	<0.001
Skeletal muscle radiodensity (SMD), HU	41.5	6.9	42.0	6.8	40.8	6.9	0.107	36.9	8.4	37.2	7.9	36.5	9.0	0.357

*p-value for the comparison between men and women

Both larger muscle area and higher muscle density at
the Th4 level when compared to the L3 level
Men had higher muscle area and density than women

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Results

- Statistical analyses;

- moderate agreement between Th4 and L3 muscle area z-scores

- regression models predicting L3 SMI z-scores from Th4 SMI z-scores indicated a moderate agreement

- similar, moderate agreement between Th4 and L3 SMD z-scores

Conclusion

- There was only moderate agreement between muscle measures from Th4 and L3 levels

- missing data from the L3 level cannot be replaced by analyzing images at the Th4 level

Thank you