

## Introduction

Hand grip strength (HGS) and fat free mass index (FFMI) are important indicators of skeletal muscle mass and therefore prognosis in patients with respiratory diseases including cystic fibrosis (CF)<sup>1,2</sup>. CT's have become gold standard in assessing lean body mass (LBM) in cachexia in other diseases including cancer. It provides accurate information regarding muscle mass and adipose tissue allowing for singular or longitudinal assessments over time<sup>2</sup>. This information can be used to improve our understanding of LBM and its correlation with lung function and patient outcome. We propose that calculating muscle volume and density on CT imaging would correlate strongly with FFMI and HGS. This could provide important information to centres where HGS and FFMI testing is lacking and provide prognostic value in CF patients.

## Aims

Identifying a correlation between muscle volume and density on CT images with;

- Lean Body Mass (LBM)
- BMI
- Hand Grip Strength (HGS)
- Lung Function
- Fat Free Mass Index (FFMI)

## Results

61 Patients were identified. 37 Male, 24 female. Mean age was 31 (SD 10.7).

Measurements from T4 showed a significant correlation with

FFMI ( $r=0.59, p<0.001$ ) and HGS ( $r=0.58, p<0.001$ ). T12 level values also showed a strong correlation with FFMI ( $r=0.69, p<0.001$ ) and HGS ( $r=0.71, p<0.001$ ).

Only T12 showed a significant correlation with FEV1 ( $r=0.48, P<0.001$ ) neither T4 nor T12 showed a significant correlation with BMI ( $p>0.05$ ).

CT Calculated Muscle Mass	FFMI	HGS	BMI	FEV1
<b>T4</b>	0.594	0.577	0.069	0.165
<b>T12</b>	0.686	0.705	0.247	0.483

## Methods

### Inclusion Criteria

- All patients of the All Wales Cystic Fibrosis Centre
- CT thorax between 2013 and 2017 within the local health board

The cross-sectional areas and average density of the paraspinal musculature were measured on axial images (Mediastinal window setting, width 350 HU and level 40 HU; slice thickness 0.625 mm.)

Measurements were taken bilaterally at 2 levels

- T4 level (rhomboid major, erector spinae, and trapezius muscles)
- T12 level (erector spinae and trapezius muscles)

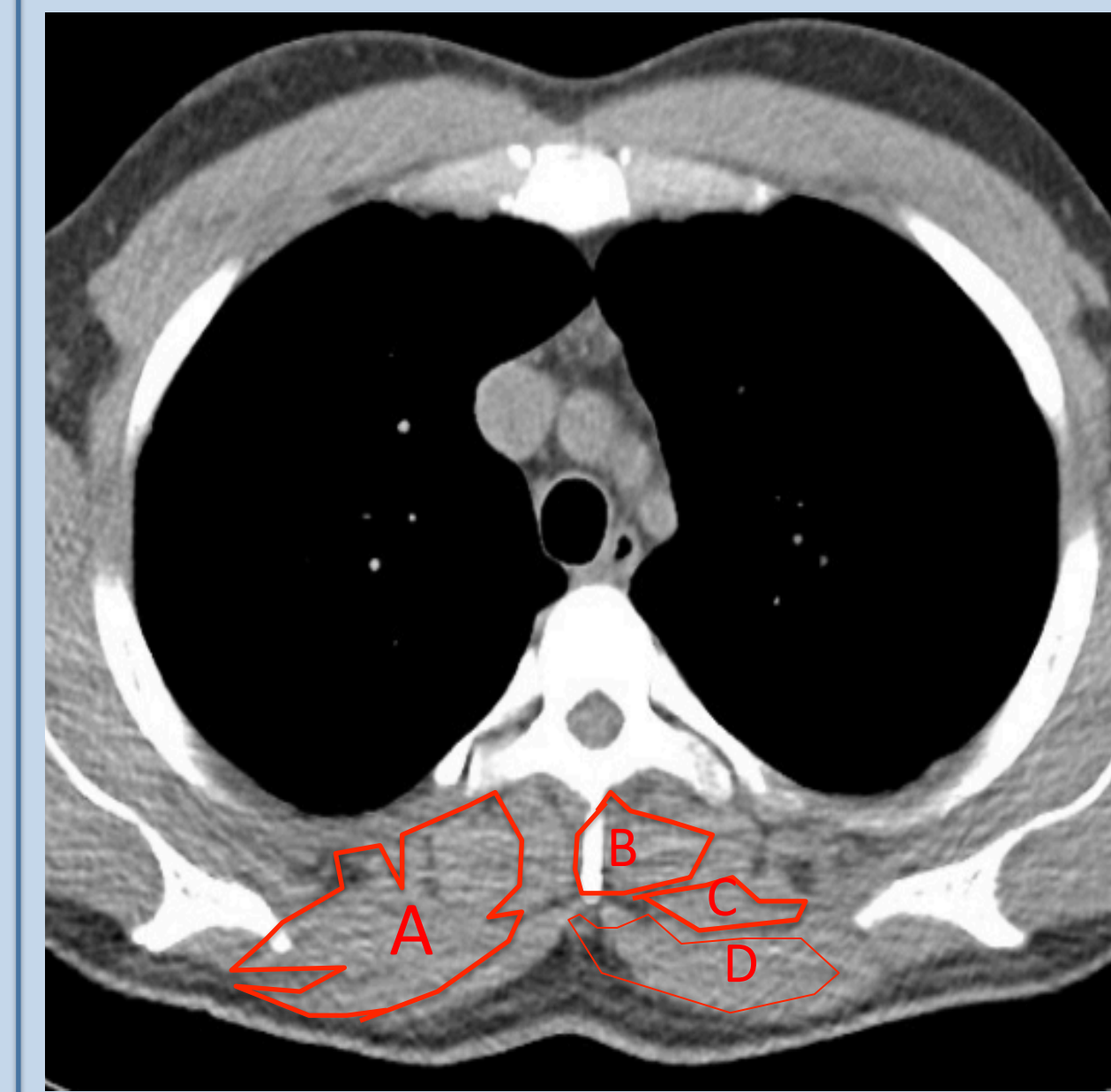
Areas were demarcated by using the 'free mark area' tool as depicted opposite. Careful effort was made to avoid surrounding low or high density structures eg vessels, fat and bone. The surface area and average density were multiplied to calculate muscle mass.

Measurements were compared with FFMI (using the Tanita bc418ma bioelectrical impedance results with the patients height and weight), HGS (using the Takei digital dynamometer 5401), BMI and lung function tests from routine clinic appointments in the same year as imaging.

## Discussion

- This pilot study strongly suggests that CT images can be used to accurately assess skeletal muscle mass.
- This may provide useful information for centres who are unable to obtain HGS or FFMI, as most CF patients receive CT thorax imaging.
- We propose that measurements from T12 are used as they correlate more strongly with FFMI, HGS and FEV1. Measurements from T12 also have the added benefit of being less labour intensive as they only require one area to be demarcated.

A larger study to increase confidence in these findings and to assess reproducibility is currently underway

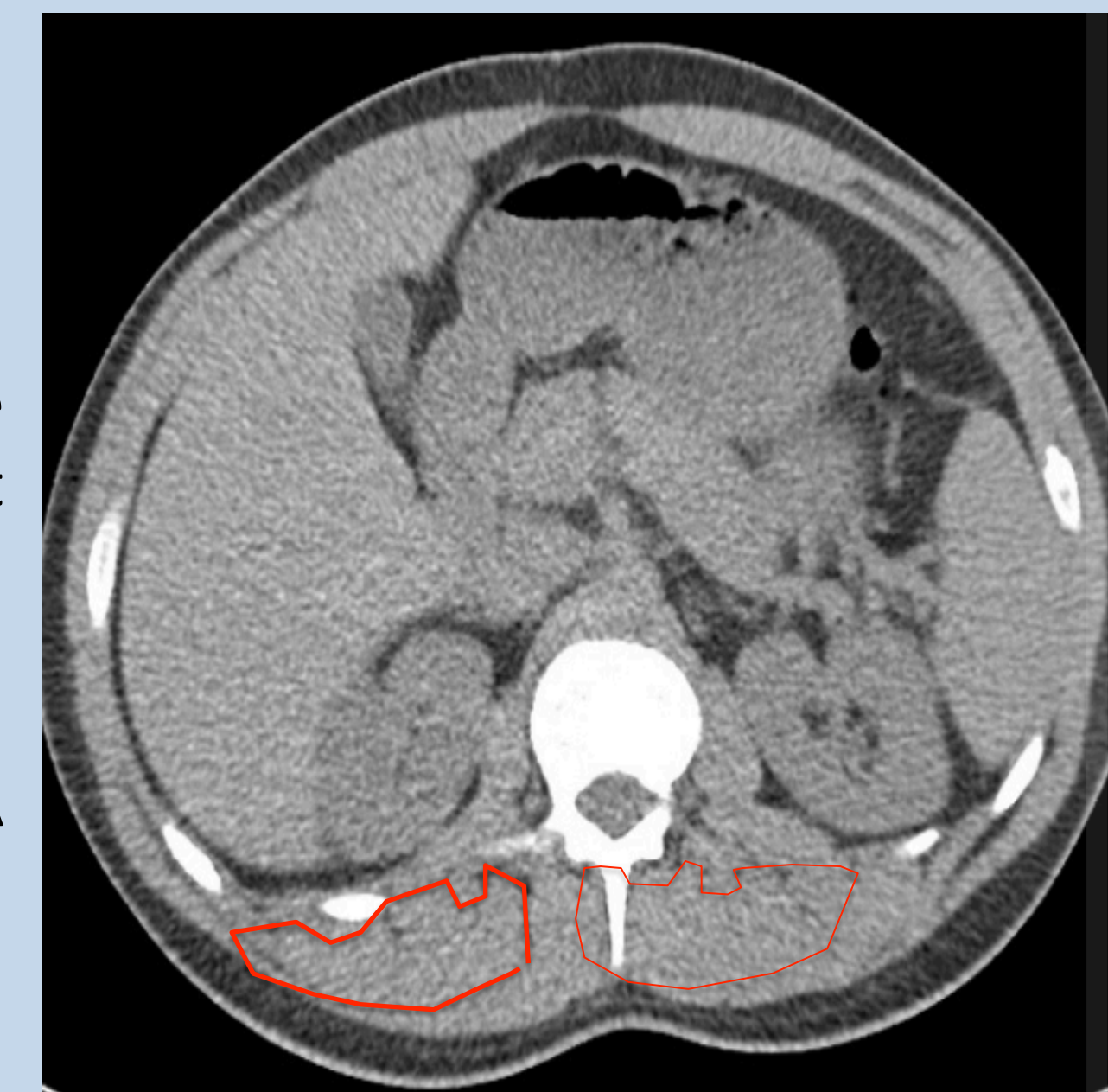


### T4

Measurements from each muscle group were isolated if there was a clear visible fat plane between them as in B (Erector Spinae), C (Rhomboid major) and D (Trapezius). If there was no visible fat plane then they were grouped together as in A

### T12

Muscle groups are harder to isolate at this level, therefore the area was encompassed as a group (as in A above).



## References

1. Bahat G, Turfan A, Ozkaya H et al. Relation between hand grip strength, respiratory muscle strength and spirometric measures in male nursing home residents. *Aging Male*. 2014 Sep;17(3):136-40.
2. Schols AMWJ, Broekhuizen R, Weling-Scheepers CA, Wouters EF. Body composition and mortality in chronic obstructive pulmonary disease. *The American Journal of Clinical Nutrition*. 2005 July;82(1):53-59.