The use of thoracic CT to determine bone mineral density in adults and children with cystic fibrosis

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Introduction Cystic fibrosis (CF) related bone disease is a common extra-pulmonary complication associated with low bone mineral density (BMD). It is common practice to undertake routine assessment of BMD using dual-energy X-ray absorptiometry (DXA). Andrade et al. Eur Respir J. 2019;53 (6):1900066 showed a significant positive correlation (r 0.74, p<0.001) between the Hounsfield score (HU), an attenuation coefficient measured on standardised computerised tomography (CT), with BMD from DXA in 18 CF children. This could potentially reduce the burden of DXA scanning for patients who have undergone a clinically indicated CT chest. We aimed to confirm this in a larger population of children and adults with CF.

Methods Retrospective cross-sectional study of patients with CF who underwent thoracic CT and lumbar DXA scan within a 12-month interval. HU score was measured in thoracic vertebrae 10–12. Z-scores and BMD (g/cm²) were recorded for patients (37 comparisons between DXA and CT). No significant correlation was observed between these methods in this group (r 0.24, p<0.15). A subgroup analysis of paired scans from 27 patients who all underwent CT using identical parameters (120 kV, automatic mA modulation, CT kernel B70f) showed a moderate but significant, correlation (r 0.55, p<0.003).

Discussion The difference in correlation compared with Andrade et al. may be influenced by discrepancies in patient characteristics, with the pilot study reporting a mean age 16 years and median DXA z-score of 0.65. Andrade et al. set a shorter interval between DXA and CT at 3 months, whilst our study allowed 12 months.

Conclusion The data presented here from an interim analysis of 36 patients does not support the use of HU as a measurement of bone density in CF. However, when standardised CT protocols are examined there is evidence of a moderate correlation. At the time of Congress we expect to share results from a five-year period, including longitudinal data for individual patients.

Radiation exposure among adults with cystic fibrosis: trends and themes

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Introduction Although the average UK dose from medical ionising radiation is 0.44 mSv (PHE-CRCE-026, 2011), people with CF (pwCF) undergo many such investigations for the management of their disease. With improving survival their life-time exposure, a risk factor for the development of malignancy, may be important. We therefore monitored this radiation exposure in our adult CF center and wished to look for any trends over time.

Methods We calculated the estimated effective dose (EED) of ionising radiation using standard reference values (HPA-CRCE-034, 2011; PHE-CRCE-013, 2010), and applied this to all procedures carried out in pwCF at our centre 2017–19, comparing it to that in 2010.

Results There were 2,630 investigations in 327 pwCF 2017–19 and 693 in 253 in 2010 (mean [SD] yearly EED 1.49 ± 3.85 mSv, versus 1.66 ± 3.76 mSv respectively [p=0.56]): 217 pwCF in 2017–19 had an average yearly EED <0.44 mSv.

A similar number of examinations were carried out in each time period (2.7 versus 2.8 per person), predominantly thoracic (76% versus 84%), of which most was CT imaging (89% versus 80% respectively).

In 2017–19, EED was higher in those with chronic Pseudomonas aeruginosa infection (1.56 ± 3.90 mSv versus 1.27 ± 3.68 mSv; p<0.001), non-tuberculous mycobacterium (NTM) (1.52 ± 2.57 mSv versus 1.49 ± 4.05 mSv, p<0.001) and CF-related diabetes (1.56 ± 4.04 mSv versus 1.14±3.65 mSv; p<0.001). Thirteen pwCF (4%) had a yearly average EED of ≥10 mSv (16.33 m ± 13.07Sv in those 7 with malignancy).

Conclusions Although radiation exposure remains high amongst pwCF, in keeping with other published reports (Plant et al), there was no upward trend in EED over time, and a similar number of procedures were performed per person.

As expected, pwCF with more complications had higher radiation exposure, underlining the need to maintain vigilance for comorbidities in this complex chronic disease.