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Editorial Open Access

Computed Tomography (CT) Assessment of Visceral Adiposity

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Editorial

Recognizing that obesity, which is highly prevalent in Western societies, is a leading cause of preventable cardiovascular and cancer-related morbidity and mortality, a more precise and specific definition of obesity is in demand. Radiologists are expected to be recruited for this task.

The traditional and expedient clinical assessment of obesity is based on the measurement of body mass index (BMI), which is defined by the body weight in kilograms divided by the height in meters squared (kg/m2). Most studies linking obesity to cardiovascular and cancer-related morbidity and mortality used BMI to define obesity (>30 kg/m2). Fat tissue is a very active endocrine organ that secretes a variety of hormones and inflammatory cytokines collectively referred as adipokines. Obesity leads to dysregulation of their secretion and consequently to obesity-associated morbidity. Accordingly, BMI should be used cautiously when classifying obesity, as BMI does not distinguish between body fat and lean body mass (in particular muscle tissue). Moreover, to precisely associate fat accumulation with its associated morbidity, specific characterization of the body fat deposition is needed. Body fat is distributed into several compartments with different metabolic characteristics, including the key depots of subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT). Of these, visceral adiposity has demonstrated a stronger association with obesity-related morbidity such as metabolic syndrome, cardiovascular disease and several malignancies including prostate, breast and colorectal cancers [1-4].

While ultrasound is a potential simple imaging modality for estimating subcutaneous and intra-abdominal fat tissue, its reproducibility and accuracy are poor. Bellisari et al [5] demonstrated that ultrasound measurements of intra-abdominal adipose tissue yield a coefficient of variation of 64% and therefore did not recommend ultrasound for the measurement of VAT.

Magnetic resonance imaging (MRI) and CT are generally considered gold standards for visceral fat quantification due to their ability to provide direct measures of VAT cross-sectional areas. However, high cost and limited availability of MRI preclude its widespread use. CT on the other hand is widely available and presents a direct and precise method of assessing VAT deposition in both adult and pediatric population. The limitations of CT include cost, radiation exposure, availability and potential inapplicability for obese patients with weight exceeding limit of CT scanner table [6]. In the clinical setting, both these modalities are commonly used for diagnosis and routine follow-up; these same images that are acquired for clinical purposes can be concurrently used for the quantification of VAT.

Specific ranges of Hounsfield units (HU) are the basic CT measure used to decipher between different tissues; the window width defining fat tissue varies from –190 HU to –30 HU for subcutaneous fat [7] and from -150 HU to -50 HU for visceral fat [8]. Volume of fat can be measured in voxels and translated to cubic centimeters. Cross-sectional areas can be measured in single or multiple slices at predetermined landmarks, which generates strong correlations with fat volume. While single-slice images are often used in research studies, one should keep in mind that they may be less accurate than volumetric analysis. One potential problem in using single-slice analysis for CT is that soft-tissue structures are continuously moving and may adversely affect the reliability of the visceral fat measurement.

Techniques for measuring visceral adiposity vary in accessibility, specificity, accuracy and the ability to quantitatively assess visceral fat. CT images allow clinicians to generate the most accurate, specific and comprehensive data in comparison with other modalities. As the medical community acknowledges the inherited inaccuracy of BMI, CT scans are emerging as the technique of choice for assessment of visceral obesity.

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