Journal of
Obesity & Weight Loss Therapy

ISSN: 2165-7904

Short Communication Open Access

Clinically Practical Strategies for Measuring Visceral Adiposity

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Introduction

Age, race, ethnicity, genotype, food, physical activity, hormone levels, and medicine all influence how adipose tissue is distributed anatomically throughout the human body. Women, the elderly, and overweight people have a higher percentage of fat tissue. Subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT) are the two primary compartments of body fat tissue, each with its own metabolic properties (VAT). While all of these tissue types are significant, visceral adiposity has received special attention due to its link to a variety of medical conditions [1].

Despite the fact that fat and adipose tissue have distinct biochemical and metabolic characteristics, these terms will be used interchangeably in this review. Visceral or central obesity refers to abdominal obesity, which is defined by an increase in adipose tissue around the intra-abdominal organs. It has been linked to a number of pathological conditions, including impaired glucose and lipid metabolism, insulin resistance, and an increased risk of colon, breast, and prostate cancers. It has also been linked to longer hospital stays, higher rates of infections and non-infectious complications, and higher hospital mortality.

The amount of obesity is closely related to the prognosis of metabolic syndrome. Visceral obesity is an independent component of metabolic syndrome. VAT buildup also determines a full cardiovascular risk profile and increases the risk of IHD and arterial hypertension. VAT releases bioactive molecules and hormones such as adiponectin, leptin, tumour necrosis factor, resistin, and interleutin 6 as a hormonally active tissue (IL-6). Because of its beneficial antiangiogenic effect, adiponectin is a particularly important hormone among these hormones. Adiponectin concentrations are linked to Type 2 diabetes, high blood sugar, hypertension, cardiovascular disease, and several cancers. As a result, it may be necessary to combine adiponectin measurements with VAT calculations to gain a better understanding of the pathophysiology of obesity-related illnesses in humans. Because visceral obesity is linked to a poor prognosis, metabolic abnormalities, and the severity of pathology in a variety of chronic diseases, it's critical to find methodologies that precisely quantify adipose tissue and can distinguish VAT from total adipose tissue [2].

It is clear that precise and clinically useful methods for estimating VAT are required. However, developing quantitative criteria for identifying visceral obesity in relation to these metabolic abnormalities is also critical. There hasn't been a precise definition of these requirements in any modality to far. Currently, techniques for measuring visceral adiposity range from simple, indirect methods of evaluation, such as body mass index (BMI) (weight divided by height squared) to provide a cross-sectional area of visceral fat as an accurate and reliable equivalent to visceral fat volume measurement, to CT imaging to provide a cross-sectional area of visceral fat as an accurate and reliable equivalent to visceral fat volume measurement. An index of abdominal obesity, on the other hand, cannot be adequately classified and defined without specific measures of visceral obesity [3].

Clinically expedient techniques: To assess visceral fat, a variety of procedures have been developed. Those that can be done quickly, have immediate benefits, and can be done at the bedside without requiring substantial technical knowledge are the most clinically expedient. Anthropometric measurements and bioelectrical impedance analysis (BIA) are intended to offer quick, if crude, measurements of body composition; however, VAT is only an indirect estimate when these methods are used. Only CT and MRI can offer direct cross-sectional area measurements or volumetric VAT measurements.

Dual energy X-ray absorptiometry: DXA and air displacement plethysmography, two whole-body imaging methods, have gotten a lot of interest lately because of their precision and speed. These modalities are increasingly being used by researchers, despite the fact that they are not always clinically accessible. Air displacement plethysmography is a relatively new method that estimates volume and density using pressure–volume correlations. To identify fat, lean, and bone mineral content assessments, DXA examines the attenuation of two energies emitted by the modality. However, because DXA and air displacement plethysmography cannot discriminate between distinct adipose tissue deposits, they can only provide estimates of visceral adiposity.

VAT measures from single-slice CT scans at the fourth and fifth lumbar vertebrae were shown to be erroneous when compared to intra-abdominal fat measured from DXA and anthropometric data in obese women. The "narrow" placement of the WC on the trunk was difficult to distinguish in obese women with a higher proportion of upper body fat distribution. Despite being a bigger number than the waist measurement, the umbilicus circumference, which is easier to discern yet placed inferior to the waist, is often reported in these cases. The validity of the waist measurement in obese women may be harmed as a result of this variation. Inconsistency in sagittal diameter measures is another source of inaccuracy, as there are no standard protocols for measuring sagittal diameter, and any variation in body posture might impact the measurement value [4].

Ultrasound: Another method for assessing subcutaneous and intra-abdominal fat tissue is ultrasound. A single measurement takes extremely little time, but reproducibility and accuracy are low. Because ultrasound assessments of intra-abdominal adipose tissue have a coefficient of variance of 64%, ultrasonography is not recommended for measuring visceral fat. A good association between abdominal ultrasound measurement and the quantity of intra-abdominal adipose tissue on CT, as well as its value in detecting intra-abdominal obesity, has been demonstrated in several investigations.

CT and MRI: CT and MRI are currently the gold standard for assessing intra-abdominal adipose tissue quantitatively. CT provides a direct means of measuring visceral fat deposition in both adult and paediatric populations because to its superior adipose tissue resolution. The primary radiographic metric used to distinguish between different tissues is Hounsfield units (HU); the window width identifying fat

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Received December 03, 2021; **Accepted** December 17, 2021; **Published** December 24, 2021

Citation: Miller D (2021) Clinically Practical Strategies for Measuring Visceral Adiposity. J Obes Weight Loss Ther 11: 478.

tissue varies from −250 HU to −30 HU. Fat volume is measured in voxels and converted to cubic centimetres. Cross-sectional areas can be assessed in single or several slices at predetermined landmarks, resulting in robust fat volume correlations [5].

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