Modalities to Evaluate Adiposity

Excess adipose tissue can be measured in many ways, and each method has pros and cons. The primary methods are:

Waist Circumference

Waist circumference is a simple, inexpensive way to assess central adiposity.

Central adiposity, or abdominal adiposity, is the accumulation of fat around the abdominal area. Central adiposity includes both subcutaneous fat (fat underneath the skin) and visceral fat (fat that surrounds the internal organs of the peritoneal cavity). People with central adiposity have what is called the "apple shape." High levels of central adiposity are associated with cardiometabolic diseases such as type 2 diabetes, cardiovascular disease, dyslipidemia, and hypertension, as well as overall mortality.[1]

There are no standardized guidelines for the measurement site when measuring waist circumference. The National Heart, Lung, and Blood Institute recommends measuring at the iliac crest.[1,2]

Patients should be standing, with their arms hanging at their sides. The measurement should be taken on bare skin with a measuring tape that doesn't easily stretch.[2]

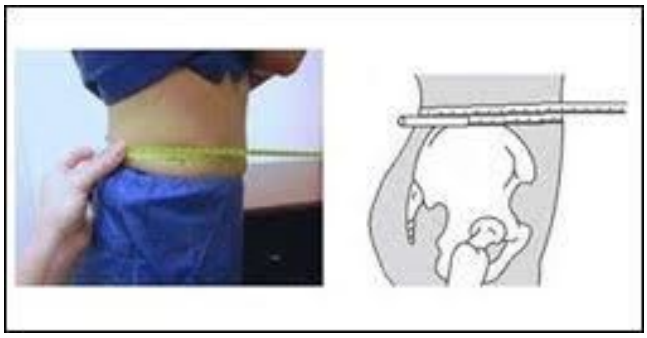

Image courtesy of the National Heart, Lung, and Blood Institute.

- Locate the upper hip bone and the top of the right iliac crest
- Place the measuring tape in a horizontal plane around the abdomen at the level of the iliac crest

- Make sure that the measuring tape is parallel to the floor
- Make sure that the tape is snug but doesn't compress the skin
- Take the measurement at the end of the patient's normal expiration

The American Heart Association and the National Heart, Lung, and Blood Institute cut points for high-risk waist circumference are ≥40 inches in men and ≥35 inches in women.[2]

The Joslin Diabetes Center Asian American Diabetes Initiative recommends high-risk cut points of ≥35.5 inches in Asian American men and ≥31.5 inches in Asian American women.[3] Waist circumference above these cut points is considered a cardiometabolic risk factor.

Patients can have a normal BMI and an elevated waist circumference. In an analysis of data from the Nurses' Health Study, normal-weight women (determined by BMI) with a waist circumference of 35 inches or higher had three times the risk of death from heart disease compared with normal-weight women whose waists were smaller than 35 inches.[4]

Waist-to-Hip Ratio

Waist-to-hip ratio also assesses central adiposity.[1] It is calculated by measuring the waist and the hip (at the widest diameter of the buttocks) and then dividing the waist measurement by the hip measurement.

The World Health Organization (WHO) has determined that a waist-to-hip ratio of ≥0.90 cm in men and ≥0.85 cm in women substantially increases the risk of metabolic complications. [5]

Waist-to-hip ratio is more prone to error than waist circumference because two measurements are required, and the hip is more difficult to measure than the waist.

Imaging

Imaging techniques are primarily used by researchers to assess adiposity. Methods include computed tomography (CT), magnetic resonance imaging (MRI), and dual-energy x-ray absorptiometry (DXA).[1]

CT and MRI are sophisticated imaging tools that can distinguish subcutaneous adipose tissue from visceral adipose tissue. Even though CT and MRI are considered the current "gold standards" for assessing body fat percentage and adipose tissue distribution, these modalities are generally used only in research settings because the equipment is expensive and not portable.

DXA has been used extensively to determine bone density in patients at risk for osteoporosis. Recently it has been used to assess body fat. DXA uses two low-level x-ray beams to estimate fat-free mass, fat mass, and bone mineral density. It is highly accurate, and the equipment is less expensive than CT and MRI. Assessment of body fat by DXA requires very little radiation, which makes it appropriate for repeated measures of weight loss progress. However, not all

DXA machines can distinguish between subcutaneous and visceral fat or accommodate patients with a very high BMI.[6]

Obesity specialists may use DXA. DXA testing also is available in some high-end fitness centers and academic-based exercise science centers. DXA testing for adiposity is not usually covered by insurance.

Body Composition Analysis (BCA)

Body composition analysis (BCA) is occasionally referred to as bioelectrical impedance (BIA). BCA equipment sends small, imperceptible levels of electric current through the body and measures resistance.[1] The current faces more resistance passing through adipose tissue than it does passing through lean body mass and water. Equations then estimate body fat percentage. The equipment required for BCA is easy to use and may be portable. Machines are available for clinical use, and are often used in obesity specialists' offices. These machines can also be found in gyms and fitness centers. Readings are affected by the patient's hydration level, time since the last meal, and phase in the menstrual cycle.

Skinfold Thickness

Skinfold thickness measures subcutaneous fat thickness by using special calipers.[1] Although not often performed by NPs in primary practice, patients may have had this procedure performed at fitness centers.

In this method, the skin is pinched between the thumb and forefinger. Then the skin is pulled away from the body and the calipers are placed on the fold. Measurements are taken at multiple specific sites, such as the trunk, thighs, front and back of the upper arm, and under the shoulder blade. Equations are used to predict the percentage of body fat based on these measurements.

Skinfold thickness is not as accurate or reproducible as other methods for measuring adiposity. Other limitations include the difficulty of obtaining accurate readings in older people, who have loose connective tissue. Patients with obesity and large body folds also can be difficult to measure. The patient's hydration status also affects the measurement. Another disadvantage is a high inter-technician variability of 3% to 9%.[7]

References

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