



Kansas City

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Whole Body Dual X-Ray Absorptiometry (DEXA) to Determine Body Composition

Policy Number: 6.01.40
Origination: 4/2005

Last Review: 4/2014
Next Review: 4/2015

Policy

Blue Cross and Blue Shield of Kansas City (Blue KC) will not provide coverage for DEXA to determine body composition. This is considered investigational.

When Policy Topic is covered

Not Applicable

When Policy Topic is not covered

Dual x-ray absorptiometry (DEXA) body composition studies are considered **investigational**.

Description of Procedure or Service

Using low dose x-rays of two different energy levels, whole body dual x-ray absorptiometry (DEXA) measures lean tissue mass and total and regional body fat, as well as bone density.

Background

Measurements of body composition have been used to study how lean body mass and body fat change during health and disease and have provided a research tool to study the metabolic effects of aging, obesity, and various wasting conditions such as occurs with acquired immune deficiency syndrome (AIDS) or post-bariatric surgery. A variety of techniques has been researched, including most commonly, anthropomorphic measures, bioelectrical impedance, and dual x-ray absorptiometry (DEXA) scans. All of these techniques are based in part on assumptions regarding the distribution of different body compartments and their density, and all rely on formulas to convert the measured parameter into an estimate of body composition. Therefore, all techniques will introduce variation based on how the underlying assumptions and formulas apply to different populations of subjects, i.e., different age groups, ethnicities, or underlying conditions. Anthropomorphic, bioimpedance, and DEXA techniques are briefly reviewed as followed.

Anthropomorphic Techniques

Anthropomorphic techniques for the estimation of body composition include measurements of skin-fold thickness at various sites, bone dimensions, and limb circumference. These measurements are used in various equations to predict body density and body fat. Due to its ease of use, measurement of skin-fold thickness is one of the most commonly used techniques. The technique is based on the assumption that the subcutaneous adipose layer reflects total body fat, but this association may vary with age and gender.

Bioelectrical Impedance

Bioelectrical impedance is based on the relationship between the volume of the conductor (i.e., the human body), the conductor's length (i.e., height), the components of the conductor (i.e., fat and fat-free mass), and its impedance. Estimates of body composition are based on the assumption that the overall conductivity of the human body is closely related to lean tissue. The impedance value is then combined with anthropomorphic data to give body compartment measures. The technique involves

attaching surface electrodes to various locations on the arm and foot. Alternatively, the patient can stand on pad electrodes.

Underwater Weighing

Underwater weighing (UWW) has generally been considered the reference standard for body composition studies. This technique requires the use of a specially constructed tank in which the subject is seated on a suspended chair. The subject is then submerged in the water while exhaling. While valued as a research tool, UWW is obviously not suitable for routine clinical use. UWW is based on the assumption that the body can be divided into 2 compartments with constant densities, i.e., adipose tissue with a density of 0.9g/cm³ and lean body mass (i.e., muscle and bone) with a density of 1.1g/cm³. One limitation of the underlying assumption is the variability in density between muscle and bone; for example, bone has a higher density than muscle, and bone mineral density (BMD) varies with age and other conditions. In addition, the density of body fat may vary, depending on the relative components of its constituents, e.g., glycerides, sterols, and glycolipids.

DEXA

While the cited techniques assume 2 body compartments, DEXA can estimate 3 body compartments consisting of fat mass, lean body mass, and bone mass. DEXA systems use a source that generates x-rays at 2 energies. The differential attenuation of the 2 energies is used to estimate the bone mineral content and the soft tissue composition. When 2 x-ray energies are used, only 2 tissue compartments can be measured; therefore, soft tissue measurements (i.e., fat and lean body mass) can only be measured in areas in which no bone is present. DEXA also has the ability to determine body composition in defined regions, i.e., in the arms, legs, and trunk. DEXA measurements are based in part on the assumption that the hydration of fat-free mass remains constant at 73%. Hydration, however, can vary from 67–85% and can be variable in certain disease states. Other assumptions used to derive body composition estimates are considered proprietary by DEXA manufacturers (i.e., Lunar, Hologic, and Norland.)

Rationale

This policy was originally created in 2003 and was updated regularly with searches of the MEDLINE database. The most recent literature search was performed for the period October 2012 through October 24, 2013. The key literature is described below.

Several different clinical roles for whole body dual x-ray absorptiometry (DEXA) scans to assess body composition have been suggested. Each clinical application requires different data for analysis.

DEXA as Reference Standard for Body Composition Assessment

In general, reference standards for diagnostic tests, often used primarily in research settings, serve to evaluate and verify the use of simpler and more convenient alternative tests that measure the same diagnostic parameter. For body composition studies, underwater weighing (UWW) has been historically considered the reference standard. The emergence of DEXA as a potential new reference standard reflects its ease of use and the fact that it provides a 3-compartment model of body density, ie, lean body mass, bone mass, and fat mass, compared to the 2-compartment model of UWW. More recently, a 4-compartment model has been suggested as the reference standard, consisting of measurements of bone/mineral, protein, water, and fat. Studies to evaluate different techniques of measuring the same parameter typically consist of correlation studies that compare values between the 2 techniques. However, correlation studies do not provide information on which diagnostic technique more closely represents the true value. For example, a lack of correlation between DEXA and UWW may reflect the lack of accuracy of UWW, as opposed to any deficiency in the DEXA technique. Furthermore, two diagnostic techniques may be highly correlated but produce different values of body composition, ie, compared to UWW, DEXA may identify different groups of patients as abnormal and normal.

There is extensive literature comparing DEXA to other techniques for assessing body composition, most commonly UWW, bioelectrical impedance, or skinfold thickness in different populations of

patients, ie, different age groups, ethnicities, and underlying disorders.(1-4) In general, these studies have shown that DEXA is highly correlated to various methods of body composition assessment. Detailed review of this literature is beyond the scope of the present discussion; however, it is apparent that many authors would consider a DEXA body composition study the reference standard. For example, in various research studies, the results of DEXA body composition have been included as an intermediate outcome in studies of nutrition and various metabolic disorders.(5-9) Regardless of whether a DEXA scan is considered the reference standard, the key consideration regarding its routine clinical use is if the results of the scan can be used in the management of the patient to improve health outcomes.

DEXA as a Diagnostic Test to Detect Abnormal Body Composition

As a single diagnostic measure, it is important to establish diagnostic cut-off points for normal and abnormal values. This is problematic, since normal values will require the development of normative databases for the different components of body composition (ie, bone, fat, and lean mass) for different populations of patients at different ages. In terms of measuring bone mineral density (BMD), normative databases have largely focused on postmenopausal white women, and these values cannot necessarily be extrapolated to either men or to different races. DEXA determinations of BMD are primarily used for fracture risk assessment in postmenopausal women and to select candidates for various pharmacologic therapies to reduce fracture risk. In addition to the uncertainties of establishing normal values for other components of body composition, it also is unclear how a single measure of body composition would be used in the management of the patient.

DEXA as a Technique to Monitor Changes in Body Composition

Changes in body composition over time may provide useful information. The ability to detect changes is related in part to the precision of the technique, defined as the degree to which repeated measurements of the same variable give the same value. For example, DEXA measurements of bone mass are thought to have a precision error of 1% to 3%, and given the slow rate of change in BMD in postmenopausal women treated for osteoporosis, it is likely that DEXA scans would only be able to detect a significant change in BMD in the typical patient after 2 years of therapy. Of course, changes in body composition are anticipated to be larger and more rapid than changes in BMD in postmenopausal women; therefore, precision errors in DEXA scans become less critical in interpreting results. Many studies have used DEXA to monitor changes in body composition, and the precision is similar to that estimated for DEXA measurements of BMD. While measuring changes in body composition is widely used in athletes for training purposes, it is still unclear how monitoring changes in body composition could be used in the medical management of the patient.

Additional Studies

The literature reflects extensive use of whole body DEXA to determine body composition in research. Active research areas are comparison of established clinical measures of body composition (body mass index or BMI, anthropomorphic measurements, and bioelectrical impedance analysis) with results using DEXA, and improvement of equations for more accurate clinical assessment of lean and fat body mass. Although refinement of equations may lead to closer agreement with DEXA estimates of fat mass and fat-free mass, for routine clinical use, BMI is considered to provide satisfactory accuracy for screening adults for obesity.(10)

For many clinical indications, DEXA is being used as the reference standard for the development of simpler methods of determining body composition.(11-14) For example, one study found that the Slaughter equation with skinfold measurements was the closest to DEXA for assessing the body composition of children with cystic fibrosis. (15) In another study, bioelectrical impedance was considered to be a valid diagnostic alternative to DEXA in women with amenorrhea.(16) In patients with human immunodeficiency virus (HIV)–associated lipodystrophy, bioelectrical impedance was found to measure body composition with good precision in comparison with DEXA.(17) Another study reported

that a linear regression model incorporating age, weight, height, waistline, and hipline, predicted DEXA body composition with good accuracy and might be developed as a screening method to identify individuals with metabolic dysfunction.(18)

DEXA measurements of body mass continue to be included as outcome measures in various trials. A few reports suggest that DEXA may have clinical utility for diagnosis of lipodystrophy in patients with HIV, for predicting metabolic insulin sensitivity in older men and women, for predicting glomerular filtration rate in dialysis patients and for characterizing changes in body composition during chemotherapy for head and neck cancer.(19-25) In another study, investigators hypothesized that DEXA would provide more accurate measurement than other methods in conditions, such as chronic obstructive pulmonary disease, with altered fluid balance.(26) Research in these specific clinical applications of DEXA is at an early stage, and studies have not shown if use of this test in clinical care improves outcomes.

Summary

Dual x-ray absorptiometry (DEXA) has emerged as a new reference standard for body composition studies, replacing underwater weighing. While DEXA scans have become a valued research tool, it is unclear how information regarding body composition could be used in the active medical management of the patient to improve health outcomes. Periodic literature searches have not identified any controlled studies in which DEXA body composition measurements were actively used in patient management, nor has the utility of DEXA been compared to the use of other simpler techniques of body composition assessment, ie, bioelectrical impedance or skinfold thickness, in a clinical setting. None of the studies reported data demonstrating the impact of body composition measurement on health outcomes. The technique is considered investigational.

Technology Assessments, Guidelines and Position Statements

In 2013, the International Society for Clinical Densitometry (ISCD) issued a statement on use of DEXA for body composition.(27) The statement included the following ISCD official positions regarding use of DEXA total body composition with regional analysis:

- To assess fat distribution in patients with HIV who are using antiretroviral agents known to increase the risk of lipoatrophy. The statement noted that, although most patients who were taking medications known to be associated with lipoatrophy switched to other medications, some remain on these medications and DEXA may be useful in this population to detect changes in peripheral fat before they become clinically evident.
- To assess fat and lean mass changes in obese patients undergoing bariatric surgery when weight loss exceeds approximately 10%. The statement noted that the impact of DEXA studies on clinical outcomes in these patients is uncertain
- To assess fat and lean mass in patients with risk factors associated with sarcopenia, ie, with muscle weakness or poor physical functioning .

Medicare National Coverage

There is no national coverage determination (NCD). In the absence of an NCD, coverage decisions are left to the discretion of local Medicare carriers.

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Billing Coding/Physician Documentation Information

76499 Unlisted diagnostic radiographic procedure

Category III code, 0028T (Dual energy x-ray absorptiometry (DEXA) body composition study, one or more sites), was deleted effective 12/31/2008.

Additional Policy Key Words

N/A

Policy Implementation/Update Information

4/1/05	New policy, considered investigational.
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