Secondary lymphedema may develop following surgery for breast cancer. Bioelectrical impedance is being studied as a diagnostic test for lymphedema, particularly for subclinical disease.

Related Policies

- Compression Therapy for Lymphedema and Venous Stasis Ulcers

Policy

Devices using bioimpedance (bioelectrical impedance spectroscopy) are considered investigational for use in the diagnosis, surveillance, or treatment of patients with lymphedema, including use in subclinical secondary lymphedema.

Policy Guidelines

There is a category I CPT code for bioelectrical impedance testing:

- 93702: Bioimpedance spectroscopy (BIS), extracellular fluid analysis for lymphedema assessment(s)

Benefit Application

Benefit determinations should be based in all cases on the applicable contract language. To the extent there are any conflicts between these guidelines and the contract language, the contract language will control. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

Some state or federal mandates (e.g., Federal Employee Program (FEP)) prohibit Plans from denying Food and Drug Administration (FDA) - approved technologies as investigational. In these instances, plans may have to consider the coverage eligibility of FDA-approved technologies on the basis of medical necessity alone.

Rationale

BACKGROUND

Secondary lymphedema of the upper extremity may develop following surgical treatment for breast cancer; it has been reported in approximately 25% to 50% of women...
following mastectomy. This can be a chronic, disfiguring condition. It results from lymphatic dysfunction or disruption and can be difficult to accurately diagnose and manage. One challenge is identifying the presence of clinically significant limb swelling through simple noninvasive methods. Many techniques have been used for documenting lymphedema including measuring differences in limb volume (volume displacement) and limb circumference. A number of newer techniques are being evaluated, including bioimpedance with use of bioimpedance spectroscopy (BIS) analysis, which uses resistance to electrical current in comparing the composition of fluid compartments. BIS is based on the theory that the amount of opposition to flow of electric current (impedance) through the body is inversely proportional to the volume of fluid in the tissue. In lymphedema, with the accumulation of excess interstitial fluid, tissue impedance decreases.

The detection of subclinical lymphedema, that is, the early detection of lymphedema before clinical symptoms become apparent, is another area of study. Detection of subclinical lymphedema (referred to as Stage 0 lymphedema) is problematic. Subclinical disease may exist for months or years before overt edema is noted. This approach generally involves comparison of preoperative (i.e., baseline) with postoperative measurements, since existing differences between upper extremities (like the effects of a dominant extremity) may obscure early, subtle differences resulting from the initial accumulation of fluid. Bioimpedance has been proposed as a diagnostic test for this condition. Those who support this approach to diagnose subclinical disease believe that early treatment of subclinical lymphedema should result in less severe chronic disease.

**REGULATORY STATUS**

One of the devices is the ImpediMed L-Dex™ U400 cleared for marketing by the U.S. Food and Drug Administration (FDA) through the 510(k) process in 2007. According to FDA documents, the device is indicated as an aid in the clinical assessment of unilateral lymphedema of the arm in women. It is not intended to diagnose or predict lymphedema.

FDA product code: OBH

**Literature Review**

Assessment of a diagnostic technology typically focuses on 3 parameters: (1) technical performance; (2) diagnostic performance (sensitivity, specificity, and positive and negative predictive value) in appropriate populations of patients; and (3) demonstration that the diagnostic information can be used to improve patient outcomes (clinical utility). While in some cases, tests can be adequately evaluated using technical and diagnostic performance, when a test identifies a new or different group of patients with a disease, randomized controlled trials (RCTs) are needed to demonstrate impact of the test on the net health outcome.

**Technical Performance**

Technical performance of a device is typically assessed with 2 types of studies, those that compare test measurements with a gold standard and those that compare results taken with the same device on different occasions (test-retest). While there is no absolute gold standard for diagnosis of lymphedema, the de facto gold standards are limb volume and/or limb circumference. Studies that address technical performance of bioimpedance devices are described below:
A 2010 publication by Czerniec et al reported on measurement of lymphedema in a small group of patients, 33 with lymphedema and 18 without. This study was to determine the relationship between physical methods of measuring lymphedema and self-reported swelling. Measurement techniques included self-report, bioimpedance spectroscopy, perometer, and the truncated cone method. The authors noted that the physical measurement tools were highly reliable with high concordance (0.89 to 0.99, respectively). In this study, self-report correlated moderately with physical measurements (0.65 to 0.71, respectively) and was moderately reliable. The authors concluded that lymphedema assessment methods are concordant and reliable but not interchangeable.

In a U.S.-based study published in 2007, Warren et al evaluated 15 patients with upper- or lower-extremity secondary lymphedema documented by lymphoscintigraphy, along with 7 healthy controls using bioimpedance spectroscopy (BIS) analysis. In addition, both the affected and unaffected limbs in lymphedema patients were evaluated so patients also served as their own controls. According to BIS in the lymphedema patients, the average ratio of current flow of the affected limb to the unaffected limb (the impedance ratio) was 0.9 (range, 0.67-1.01). In the control group, the average impedance ratio was 0.99 (range, 0.95-1.02). Lower impedance ratio values correlated with higher levels of accumulated fluid.

Diagnostic Performance

A technology assessment on the diagnosis and treatment of secondary lymphedema, performed under contract from Agency for Healthcare Research and Quality (AHRQ) by the McMaster University Evidence-based Practice Center, was released in May 2010. As of October 2014, this assessment has not been updated. The AHRQ assessment identified 8 studies that reported the sensitivity and specificity of tests to diagnose secondary lymphedema. The investigators noted that there is no true “gold standard” to grade severity of lymphedema and that limb volume and circumference are used as a de facto “gold standards”. Two of the 8 studies on diagnostic performance of devices to detect secondary lymphedema evaluated bioimpedance devices. Overall, the investigators concluded that, due largely to heterogeneity among studies, the evidence does not permit conclusions on the optimal diagnostic test for detection of secondary lymphedema. The 2 studies on bioimpedance devices briefly described below:

Cornish et al. in Australia followed 102 patients after treatment for breast cancer. Twenty patients developed lymphedema in the 24-months follow-up period, and in these 20 cases, multifrequency bioelectrical impedance analysis (MFBIA) predicted the onset of the condition up to 10 months before the condition was diagnosed clinically. Estimates of the sensitivity and specificity were both approximately 100%. At the time of detection by MFBIA, only one of the patients had a positive test result from the total limb volume determined from the circumferential measures.

In another study from Australia, Hayes et al noted that the point prevalence of lymphedema varies according to the approach to diagnosis. In this study, lymphedema status was assessed at 3-month intervals between 6 and 18 months postsurgery in a sample of Australian women with unilateral, invasive breast cancer, using 3 methods: bioimpedance spectroscopy, difference between sum of arm circumferences, and self-report. Depending on the method, point prevalence ranged between 8% and 28%, with 1 in 5 to 2 in 5 women experiencing lymphedema at some point in time. According to the technology assessment, the sensitivity and specificity of bioimpedance compared to
arm circumference measurement was 42% and 88%, respectively and the sensitivity and specificity of bioimpedance compared to self-report was 61% and 59%, respectively. Subsequent to the AHRQ review, several additional studies have been published on the diagnostic performance of bioimpedance devices for detecting lymphedema. These studies tended to have relatively small sample sizes and varied in their assessment protocols, outcome measures and reference standards. Representative studies are described next.

In 2013, Berlit et al reported on 60 women who were evaluated for secondary lymphedema following breast cancer surgery using whole-body bioimpedance analysis. The study was conducted in Germany and used a device available in that country. Fourteen women were lost to follow-up and 7 of the remaining 42 women (14%) developed upper limb lymphedema. Compared with circumferential limb measurements and patient baseline impedance values prior to surgery, bioimpedance analysis had a sensitivity of 85.7% and specificity of 97.4% for detection of arm lymphedema. The negative predictive value was 97.4%, indicating that a negative test rules out lymphedema with a high degree of certainty. However, the positive predictive value was relatively low at 54.6%, indicating that a positive test does not rule in lymphedema with certainty.

In 2012, Vicini et al published a retrospective analysis of data from 64 women who underwent surgery for breast cancer and had pre- and postsurgical measurements of bioelectrical impedance assessment using an ImpediMed L-Dex device. Postsurgical measurement occurred within 90 days of surgery and before radiation therapy or chemotherapy. Change in the lymphedema index ratios (LIR) pre- and postprocedure was compared. LIR was defined as the difference in volume or impedance between the affected and nonaffected arm. For the group as a whole, median LIR was 0.5 at baseline and the median change in LIR after surgery was 1.1. The authors noted that, although differences between groups were not statistically significant, there appeared to be a greater change in LIR pre- and postsurgery in patients who received more aggressive treatment, e.g., larger numbers of nodes removed or dissection of axillary nodes compared to sentinel node only. The study did not report use of a reference standard test and did not report sensitivity and specificity of bioelectrical impedance analysis.

Clinical Utility

The ideal study design is an RCT comparing health outcomes in patients who were managed with and without the use of bioimpedance devices; no studies of this type were identified.

A related question is whether early detection and treatment of subclinical lymphedema, using a bioimpedance device or another detection method, improves health outcomes. The literature on treatment shows variability among studies regarding response to therapy for secondary lymphedema. Some studies found that mild disease was more responsive to treatment; other studies did not. Similarly, when duration of symptoms was reported, there was no clear relationship between duration of the edema and response to treatment.

A study by Stout Gergich et al, published in 2008, is frequently cited as support for the early detection and treatment of subclinical lymphedema. In this study, lymphedema was identified in 43 of 196 women who participated in a prospective breast cancer morbidity trial. Limb volume was measured preoperatively and at 3-month intervals after surgery using perimetry (another evolving technique). If an increase of greater than 3% in
upper limb volume developed compared with the preoperative volume, a diagnosis of lymphedema was made and a compression garment intervention was prescribed for 4 weeks. Statistical analysis was a repeated-measures analysis of variance by time and limb (p≤0.001) comparing the lymphedema cohort with an age-matched control group. In this study, the time to onset of lymphedema averaged 6.9 months postoperatively. The mean (SD) affected limb volume increase was 83 mL (119) at lymphedema onset compared with baseline. Of note, clinical lymphedema is generally felt to be apparent when 200 mL of fluid accumulates. After the intervention, a statistically significant mean 48 mL (103) volume decrease was realized. The mean duration of the intervention was 4.4 weeks. Volume reduction was maintained at an average follow-up of 4.8 months after the intervention. The authors concluded that a short trial of compression garments effectively treated subclinical lymphedema. This study does not answer the key question; that is, whether net health outcome was improved by early intervention. In addition, the role of novel diagnostic testing compared to the use of the de facto gold standard tests (limb volume or circumference) also needs to be evaluated.

Another study on whether early detection and treatment of subclinical lymphedema improves health outcomes was published in 2009 by Boccardo et al. The study did not involve the use of bioimpedance devices so it cannot be considered evidence that their use improves outcomes. Fifty-five women were randomly assigned to a preventive intervention or control group. The preventive intervention consisted of volumetric (arm volume) measurements and early management of lymphedema once identified. Among the 49 of 55 women (89%) assessed at 2 years, the incidence of secondary lymphedema was 8% in the preventive group and 33% in controls. This is a relatively small study, and the various interventions used may have each played a role in the outcome for this study. Moreover, as noted earlier, the study did not include use of bioimpedance devices.

Summary of Evidence

Bioimpedance, which uses resistance to electrical current in comparing the composition of fluid compartments, could potentially be used as a tool to diagnose lymphedema. There is minimal information about the technical and diagnostic performance of bioimpedance testing in the diagnosis (surveillance) of secondary lymphedema; especially for subclinical disease. In addition, there are no data from comparative clinical trials that demonstrate the impact of this test (bioimpedance) on clinical outcomes (clinical utility). Thus, based on the current scientific evidence and because the impact on net health outcome is not known, use of this testing in the diagnosis or management of patients with known or suspected lymphedema, or to detect subclinical lymphedema, is considered investigational.

SUPPLEMENTAL INFORMATION

Practice Guidelines and Position Statements


U.S. Preventive Services Task Force Recommendations

The U.S. Preventive Services Task Force has not addressed bioimpedance measurement devices.
**Medicare National Coverage**

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

**REFERENCES**


**Documentation Required for Clinical Review**

- No records required

**Coding**

This Policy relates only to the services or supplies described herein. Benefits may vary according to benefit design; therefore, contract language should be reviewed before applying the terms of the Policy. Inclusion or exclusion of a procedure, diagnosis or device code(s) does not constitute or imply member coverage or provider reimbursement.
Medical Policy

IE

The following services are considered investigational and therefore not covered for any indication.

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<th>Type</th>
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Policy History

This section provides a chronological history of the activities, updates and changes that have occurred with this Medical Policy.

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<tr>
<td>7/2/2010</td>
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<td>8/4/2010</td>
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<td>10/7/2011</td>
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<td>7/24/2013</td>
<td>Policy revision without position change. Policy placed on No Further Routine Literature Review status</td>
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<td>1/30/2015</td>
<td>Policy title change from Bioimpedance for Assessment of Lymphedema Policy revision without position change Coding Update</td>
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Definitions of Decision Determinations

**Medically Necessary:** A treatment, procedure or drug is medically necessary only when it has been established as safe and effective for the particular symptoms or diagnosis, is not investigational or experimental, is not being provided primarily for the convenience of the patient or the provider, and is provided at the most appropriate level to treat the condition.

**Investigational/Experimental:** A treatment, procedure or drug is investigational when it has not been recognized as safe and effective for use in treating the particular condition in accordance with generally accepted professional medical standards. This includes services where approval by the federal or state governmental is required prior to use, but has not yet been granted.
**Split Evaluation:** Blue Shield of California / Blue Shield of California Life & Health Insurance Company (Blue Shield) policy review can result in a Split Evaluation, where a treatment, procedure or drug will be considered to be investigational for certain indications or conditions, but will be deemed safe and effective for other indications or conditions, and therefore potentially medically necessary in those instances.

**Prior Authorization Requirements**

This service (or procedure) is considered **medically necessary** in certain instances and **investigational** in others (refer to policy for details).

For instances when the indication is **medically necessary**, clinical evidence is required to determine **medical necessity**.

For instances when the indication is **investigational**, you may submit additional information to the Prior Authorization Department.

Within five days before the actual date of service, the Provider MUST confirm with Blue Shield that the member's health plan coverage is still in effect. Blue Shield reserves the right to revoke an authorization prior to services being rendered based on cancellation of the member's eligibility. Final determination of benefits will be made after review of the claim for limitations or exclusions.

Questions regarding the applicability of this policy should also be directed to the Prior Authorization Department. Please call 1-800-541-6652 or visit the Provider Portal www.blueshieldca.com/provider.

The materials provided to you are guidelines used by this plan to authorize, modify, or deny care for persons with similar illness or conditions. Specific care and treatment may vary depending on individual need and the benefits covered under your contract. These Policies are subject to change as new information becomes available.