



## *Emerging Technology White Paper*

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### **Blood Test for Breast Cancer Could Reduce Biopsies**

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*"It's obviously much easier to take blood as part of one's general annual check-up than to perform a mammogram. A blood test could potentially be cheaper and more patient friendly too; a lot of women don't like having mammograms and they'd probably rather have a blood test."*

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## Executive Summary

Provista Diagnostics has developed a blood test for the early detection of breast cancer. Named the Biomarker Translation Test, or BT Test, it will first be introduced as an adjunct test to mammography to assist health care providers in making earlier and better diagnoses in the detection of breast cancer. Since the test is on the molecular level, there is potential for detection of cancer prior to tumor development, because tumors can grow for two to three years before physical detection is possible.

The benefit of the new BT Test for patients is twofold: first, the test is easy to perform; second, it can be done in just about any clinical setting. The number of women over the age of 40 who are actually getting the National Cancer Institute's recommended screening mammogram every one to two years has dropped 4% in recent years to 45%. There are multiple reasons for women not having a mammogram; most are related to cost, as well as the pain and discomfort associated with the process. The BT Test will help decide how often, or how high risk, each patient is and therefore how many mammograms are really, truly necessary.

Imaging centers will also benefit from a rise in the number of MRIs performed -- because of the BT Test's ability to detect breast cancer years before the cancer would show up on a mammogram, more MRIs will be needed. MRI is primarily used to determine the extent of breast cancer. Since the test will not be dependant on breast characteristics that image well with X-rays, it will also be applicable to a wider range of women, which also means more mammograms will be taken. The result will be more imaging procedures for the provider combined with better earlier detection of cancer for the patient.

Provista Diagnostics stated it is on track for the BT Test to be used as an adjunct by early Q4 2007. As more data is collected, the BT Test will be expanded to become a true diagnostic blood test for breast cancer, eventually becoming a stand-alone test available in a doctor's office, clinic or hospital as a true screening tool.

Early clinical trials of the BT Test reflect a cancer-detection accuracy rate of approximately 95%. Mammography has an accuracy of detection 80% to 85%.

## Economics

Provista Diagnostics has not determined an exact price of the BT Test. The company projects initial costs of less than \$395. As laboratory technology evolves and begins to allow for batch testing, the company projects these costs will decrease. In comparison, the existing cancer biomarker detection test, the Exact Colon Cancer test, costs \$795. With physician costs, screen mammography costs start at \$100, ultrasound costs start at \$209 and MRI costs start at \$859 under Medicare.

There are no existing CPT codes to reflect the BT Test and biomarkers have a wide range of reimbursements; therefore, depending on the laboratory process, reimbursement can range from \$22 to \$53 per marker. Because there are five markers tested, the BT Test has a potential reimbursement range of \$110 to \$265. A large portion of the blood test market will be directed to younger women and thus to private payers. Reimbursement seen from private pay is typically 30% to 50% higher than Medicare. Based on using a vendor-supplied average cost for the test (\$187.50) and a blend of Medicare

(25%) and private pay (75%) the provider could see potential profit margins of \$505,250 over a five-year period.

The bottom line is the margins for providing the test will be dependent on payer reimbursement and the real financial incentives will be an increased number of breast cancer imaging procedures. More women will undergo diagnostic mammograms and MRI. This means good news for providers due the aggressive reimbursement for MRI, as well as good news for payers as breast cancer will be detected early, when the cost of treatment is much lower.

For financial spreadsheets on the BT Test, including cash flow, comparisons to competing technologies and return based on different reimbursement scenarios, [click here](#).

## The Company: Provista Diagnostics

Provista Diagnostics, LLC is a private medical diagnostic development and commercialization company located in Phoenix, AZ. The company is focused on bringing the BT Test to market. First formed in 2004, Provista Diagnostics is the parent company of three biotechnology companies. These companies are centered on acquiring and bringing to market novel medical diagnostic approaches developed by leading researchers.

The company is lead by William Gartner who serves as President and CEO. Gartner has a long history in developing and bringing leading edge products to market. Early in his career, he founded Gartner Research & Development Co., an organization that offered contract product development services and licenses for his own patented products. He holds 21 patents in the environmental and medical fields. Gartner is also the president and CEO of GW Medical Technologies (developing the LymPro Blood test for Alzheimer's) and RCP Diagnostics (developing the RCP-Dx test for estrogen-related cancers, including ovarian, uterine and cervical cancers).

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## The Technology: BT Test

The BT blood test is designed to evaluate known protein biomarkers associated with breast cancer and combine them with a patient's unique personal chemistry and health profile to make a diagnostic determination. The process combines selective biomarker data into a test that looks at the interrelationship between the markers themselves and the patient's personal medical profile. The goal of the BT Test is to detect a cancerous breast tumor or condition either in concert with or prior to detection by mammography. As noted, the test is on the molecular level so there is potential for detection of cancer prior to tumor development, because tumors can grow for two to three years before physical detection is possible.

The chemistry of the BT Test is based on a panel of up to five molecular protein biomarkers. These consist of several well known cancer-related biomarkers derived from blood serum. They include a combination of angiogenetic markers for identifying vascular growth, anti-inflammatory markers, and tissue specific markers. Independently tested, these markers will not confirm cancer. However, when combined into a panel and incorporated with a patient's medical profile through a proprietary algorithm, it provides an accurate test for the detection of breast cancer. The algorithm includes patient specific profile information such as age, menopausal state, family history, ethnicity, and the type of medications that have been prescribed.

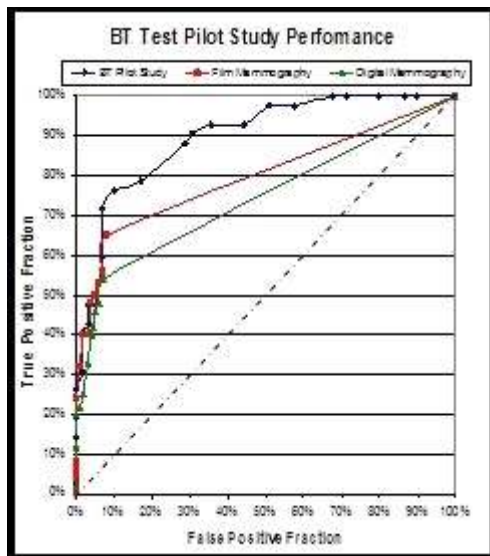


Chart courtesy of Provista Diagnostics, LLC

Early clinical trials of the BT Test reflect 71% sensitivity and 93% specificity, with an overall 88% accuracy rate. Recent clinical trials include the addition of the RCP (Riboflavin Carrier Protein) biomarker. When this new marker is added, the test's projected accuracy rate is expected to rise to 95%. In comparison, mammography has an average accuracy of 80% to 85%.

The BT Test will consist of a blood draw, either at a doctor's office, clinic or hospital. The blood draw can be done during the patient's annual exam. The actual testing will be performed at Provista Diagnostics. In its first marketing phase, ELISA (Enzyme-Linked Immunosorbant Assay) chemistry technology will be used to identify each marker. ELISA chemistry has the ability to measure protein markers in low detectable quantities. Provista Diagnostics is also working towards adopting a multiplex bead assay technology that will allow multiple biomarkers to be identified in one test, which will accelerate the availability of results at lower costs.

The BT Test will offer women a simple, non-invasive blood test for the early detection of breast cancer. Mammography is currently the standard of care for women over 40 and is not recommended for younger women whose breast characteristics make mammography virtually ineffective. Initially, the BT Test is intended for use in conjunction with mammography and is expected to set a new standard for routine breast health care. Ultimately, the company's goals are to expand the utility of this test to the younger segment of women, those in their 20s and 30s.

### BT Test Financials

Provista Diagnostics anticipates the initial cost of the BT Test will be approximately \$395. The company also projects the cost will decrease as the laboratory technology for the test moves from processing each biomarker separately (ELISA) to performing a run (cytometry or beaded assay). In comparison to a \$395 benchmark, Exact Sciences' PreGen-Plus Colorectal Cancer screening biomarker technology test costs approximately \$795. It has 80% to 90% sensitivity depending on how many markers are used.

Along with costs, reimbursement for any technology is an important factor. CMS has focused on aggressively reimbursing leading edge technologies that will improve outcomes and decrease costs. However, historically Medicare reimbursement for advanced diagnostic laboratory technology has not kept up with cost. This is especially significant since molecular diagnostic testing is a relatively new field. According to [www.insightpharmareports.com](http://www.insightpharmareports.com), diagnostic laboratory tests account for less than 2% of all Medicare spending but they influence up to 70% of all health care decisions. In response to this, H.R. 1321 - the Medicare Advanced Laboratory Diagnostics Act of 2007 was introduced. Its goal is to reform

and update Medicare policies to encourage the development and adoption of new clinical diagnostic laboratory tests. By providing accurate early detection and with its ability to influence the breast cancer diagnostic treatment process, the BT Test will fall into this category. As improved outcomes result, this should mean more aggressive reimbursement for the BT Test in the future.

Reimbursement for diagnostic biomarker laboratory testing is based on the process and how many markers are being identified. The BT Test is so unique there are no exact CPT codes to reflect the technology. As a guide, reimbursement for protein biomarker assays range from \$22 (CPT 85307, Assay Activated Protein C, \$22 to \$30) to \$32 (CPT 83873, Assay of CSF Protein, \$24 to \$32) using ELISA technology. The more advanced technology, such as radio immunoassay, is reimbursed between \$40 and \$53 (CPT 84207) per marker. Because the BT Test will test five markers, the potential reimbursement is \$110 to \$265. In a worst case scenario using a low Medicare payment of \$135 and a cost of \$200 per test, the provider would lose almost \$987,000 over a five-year period. In a best case scenario based on a low cost of \$175 and high Medicare payment of \$263, a facility would see approximately \$1 million in profits over the same period (blood drawing costs included).

One major reimbursement consideration is that the BT Test will also target those women considered to be at risk for breast cancer due to hereditary reasons and/or those who have breast characteristics that do not image well with mammography. The majority of these cases fall under private insurance and are not included under Medicare. Private pay is typically 30% to 50% higher than Medicare. With this in mind, the payment range would be \$130 to \$397 (using the 30 to 50% mark-up). In a best case scenario using an average private payment of \$263 and a low cost of \$175 per test, the provider would see over \$1 million in profits over a five-year period. Based on an average cost for the test (\$187.50) and a blend of Medicare (25%) and private pay (75%), a provider would see profit margins of \$505,250 over a five-year period.

In comparison, screening film mammography's total cost to the payer starts at \$185 (including professional fees). Digital mammography starts at \$135 and can reach \$150 plus for private pay. Because of low reimbursement and high costs, a facility would see profit margins of \$115,000 over a five-year period (based on 2,000 procedures per year) for mammography. In addition to these costs, approximately 10% of screening mammograms reflect false positives. These patients must undergo additional procedures such as diagnostic mammography, then ultrasound, MRI, and finally a biopsy. Diagnostic mammography and ultrasound have similar profit margins of \$82,000 and \$115,000, respectively. MRI costs a payer at least \$700 (physician cost included) and can go as high as \$2,000. Due to very aggressive Medicare reimbursement, the use of MRI equals a profit margin of \$1 million based on 2,000 procedures per year over a five-year period.

The bottom line is, as with any unique new technology, reimbursement in its initial stages can be limited. Still, based on a combination of private pay and Medicare, providers should at least break even when prescribing the BT Test. Along with a new billable test, women's centers should see additional revenue from an increase in breast imaging services. This should be especially evident for MRI providers, a technology that has excellent financial incentives. And as a plus, hospitals and physicians may also see benefit from the financial incentives of a lower rate of lawsuits resulting from the misdiagnosis or late detection of breast cancer (see, e.g., "[Breast Cancer Lawsuit Outcomes](#)," by Richard E. Anderson, M.D., F.A.C.P., Chairman The Doctors Company Board of Governors). These are excellent incentives for providers to prescribe the BT Test.

#### Costs:

- Lab: \$200 to \$175.
- Labor: \$10 (phlebotomist).
- Consumables: \$1 (blood drawing supplies).

#### Reimbursement:

- CPT 85307 (Assay Activated Protein C): \$22-\$30 (technical); \$114 (professional).

- CPT 83950 (HER-2/neu): \$90-\$121 (technical); \$84 (professional).
- CPT 83873 (Assay of CSF Protein): \$24-\$32 (technical); \$80 (professional).
- CPT 84207 (Radio Immunoassay): \$40-\$53 (technical); \$109 (professional).

## The Market

Cancer is responsible for 22.8% of all deaths in the U.S., second only to heart disease (with a rate of 28.5% of all U.S. deaths). Of this number, breast cancer represents 15% of all the cancer deaths in women. This is second only to lung and bronchus cancers (27%). One in eight women will develop breast cancer in their lifetime, accounting for over 240,000 new cases of breast cancer that will be diagnosed in the U.S. in 2007. Early detection is key to surviving breast cancer; when breast cancer is found early (Stage I), the five-year survival rate is 96%. If identified in the more advanced stages (Stage IV) the five-year survival rate drops to 16%. Even Congress understands the importance of early detection, demonstrated by its approval of the "Breast and Cervical Cancer Prevention and Treatment Act of 2000," which pays for the annual screening of women that qualify for Medicaid.

There were approximately 44 million mammography procedures performed each year in over 9,000 certified screening centers in the U.S., down 4% from 2000 (see "[Recent Drop in Mammography Rates Causes Concern](#)," NCI Cancer Bulletin, May 15, 2007, Vol. 4, No. 17). Many patients who have a mammogram will require a follow-up biopsy in order to confirm or rule out cancer. Out of the one million biopsies performed each year, 80% turn out to be benign. This accounts for 800,000 unneeded invasive breast biopsies performed each year.

Fifteen to twenty percent of all tumors do not show up on mammography and at least 10% of identified masses turn out negative for cancer. Because so many biopsies are benign, there is a large market for new technologies that can help reduce the number of women who have to undergo the trauma of a breast biopsy. Cost savings is another factor; a minimally invasive breast biopsy can cost \$500 to \$1,000 to perform excluding professional fees. Open surgical procedures start at \$2,000. This translates to an estimated breast biopsy market of \$750 million to \$1 billion per year out of the \$7 billion spent each year in the U.S. to treat breast cancer.

In recent years several existing technologies such as digital mammography, MRI, ultrasound, and CT have evolved to increase the accuracy of diagnostic breast imaging. These technologies combined are used to perform approximately 2.3 million diagnostic procedures per year, which accounts for another \$230 million dollars a year for the diagnostic portion of the market. Again, the large number of negative biopsies performed creates a large market potential for new technologies that can reduce the number of biopsies and decrease the cost of diagnosing the disease.

## Screening and the Diagnostic Process of Detecting Breast Cancer

### **Screening Mammogram**

A screening mammogram is the first step in identifying a cancerous tumor. However, the drawback of mammography is that it can miss 15% to 20% of tumors.

The National Cancer Institute recommends breast cancer screenings once every 12 months for women over 40 with no existing problems with their breasts. Screening mammography consists of two views of each breast (bilateral) and the procedure takes 10 to 15 minutes. During the procedure, the breast is compressed and X-ray beams pass through the breast and expose the film. The film is then processed and evaluated by a radiologist.

If a suspicious tumor is found, a diagnostic mammogram is ordered by the physician to identify further abnormalities. A diagnostic mammogram can be performed with several different technologies including

the use of either one or a combination of ultrasound, diagnostic X-ray or an MRI in order to determine what type of lesion is present.

If these forms of diagnosis detect a suspicious lesion the final step is to confirm whether or not the lesion is cancerous by obtaining a biopsy sample of the tumor. This allows a pathologist to inspect the tumor at a cellular level with a microscope. Breast biopsies can be performed through either an open surgical procedure or by several minimally invasive techniques that utilize a hollow needle to obtain a sample. Open surgical procedures have traditionally been the most common, although minimally invasive stereotactic core breast biopsy has been rapidly gaining acceptance because it involves no surgery or anesthesia and only a small incision is made.

Film-based mammography historically has been used as a screening technology because of its low cost per patient. Based on 8,000 bilateral procedures per year, a facility would see a cost of \$26.28 per patient. This translates to a profit margin of over \$525,000 over a five-year period.

### Screening Financials

Costs:

- Capital: \$83,000.
- Consumables (film/processing): \$15.
- Labor: \$8.
- Service: \$4,500.
- Total cost per procedure (based on 8,000 bilateral screens per year): \$26.28.

Reimbursement:

- CPT 76092: \$36 (professional component).
- APC 0271 \$49 (technical component; bilateral plain film).
- CPT 76082 (CAD add-on payment): \$19.

## Competing Diagnostic Technologies

The ultimate confirmation of breast cancer is examining a tissue sample under a microscope but this requires an invasive biopsy. Before a breast biopsy is performed an ultrasound, diagnostic X-ray or an MRI (or some combination of these imaging technologies) is performed to help rule out the need for a breast biopsy.

### **Breast Ultrasound**

Breast ultrasound (or sonography) is an adjunctive imaging technique for diagnosing breast cancer. It uses harmless, high frequency sound waves to form an image (sonogram); ultrasound is not invasive and involves no radiation. The procedure is performed after a screening mammogram has identified a lesion, which indicates further diagnostic tests are required. The procedure takes about 30 to 60 minutes. A high end, dedicated, color Doppler machine and a 7 MHz transducer is recommended for the procedure in order to obtain the image detail required to evaluate the lesion.

Although breast ultrasound can be used to guide large core needle biopsy, as well as needle localization before a surgical breast biopsy, it is most commonly used to image the specific area of the breast where a lesion was identified by a mammogram. It is often the first study performed to evaluate masses in women under 35, whose mammograms can be difficult to interpret. The ultrasound image is used to determine whether the lesion is a fluid-filled cyst or a solid mass. Five percent of women who undergo breast ultrasound have false negatives and the cancer is missed.

One advantage of ultrasound is the lack of radiation, which makes it ideal for studying breast abnormalities in women who are pregnant. The disadvantage is that the diagnosis of solid masses may be difficult as the process requires good technique. However, in most cases normal tissue can be differentiated from possibly malignant tissue with ultrasound. The diagnosis of a simple cyst (anechoic mass with smooth margins) is 96% to 100% accurate. Older women, who have both dense breast tissue and a dense lesion, have a much lower accuracy rate.

Diagnostic breast imaging offers the lowest capital and start-up costs in comparison to competing technologies. Based on 2,000 patients per year over a five-year period, a facility would see over \$82,000 in profits at the end of a five-year term. Ultrasound can also be used for other imaging procedures, such as OB/GYN applications, which means it can also generate revenue from outpatient procedures typically seen in women's centers.

### Breast Ultrasound Financials

#### Costs:

- Capital: \$200,000.
- Consumables: \$1.
- Labor: \$21.
- Service: \$16,000.
- Total cost per test (based on 2,000 tests per year): \$46.40.

#### Reimbursement:

- CPT 76645: \$150 (professional component).
- APC 265: \$59 (technical component).

## **Digital Diagnostic X-Ray (Full Field Digital Mammography)**

Digital mammography is a very similar procedure to a conventional screening X-ray. Eleven percent of all mammography procedures are performed with full field digital mammography (FFDM) technology. The compression of the breast is the same, although it occurs for a shorter period of time. Total time for the procedure is 10 to 15 minutes. The X-ray passes through the breast and a digital detector converts the X-ray to a digital image. The image can be stored in a computer and viewed on a high-resolution monitor.

There are several advantages of digital mammography over conventional X-rays. The digital method decreases the radiation dose per mammogram and can improve detection capabilities, especially for women with denser breasts, which normally require a higher dose of radiation using conventional X-ray. Multiple FDA clinical trials have been performed on digital techniques; 28% to 35% of tumors identified turn out to be positive for cancer when biopsied. Because the image is in a digital format it can be manipulated to achieve a more powerful diagnosis and a computer-aided diagnosis can be performed. Computer aided detection devices will add \$125,000 to the capital cost but improve the rate of detection by 8%.

Digital mammography reimbursement has dropped as the technology has matured. However, the cost savings seen from the elimination of film means it is an attractive revenue-producing technology. Based on 2,000 patients per year over a five-year period, a facility would see over \$115,000 in profits at the end of the five-year term. Adding to the revenue potential, digital technology can also take advantage of several additional reimbursable procedures such as computer aided detection (CAD) and screening mammography.

### Digital Diagnostic X-Ray Financials

#### Costs:

- Capital: \$365,000.
- Consumables: \$0.
- Labor: \$8.
- Service: \$39,000.
- Total cost per test (2,000 diagnostic tests per year): \$62.80.

#### Reimbursement:

- CPT 76090-26 (diagnostic mammography): \$36 (professional component).
- APC 271: \$98 (unilateral; technical component).
- CPT G0206 (diagnostic mammography, direct digital image, add-on): \$3.
- CPT G0236 (computer aided detection): \$19.
- Total digital diagnostic reimbursement: \$82 (unilateral; technical component).

### **Magnetic Resonance Imaging (MRI)**

MRI uses magnetic fields and the magnetic properties of the body to image various molecules in the body. The main function of a MRI is to take images of water and fat molecules. One of the strengths of MRI is its sensitivity in identifying breast cancer. It is used to identify tumors that cannot be identified with other modalities because cancerous tumors have a lot more blood supply (water) than normal breast tissue due to rapid growth. Still, 3.8% of women that undergo an MRI have a false negative.

The total procedure takes 20 to 30 minutes, while the total scan time is approximately three minutes. The patient is given the contrast agent gadolinium, which travels to the blood vessels and allows tumors to be identified because of their high concentration of blood vessels.

The patient is placed into the magnet and protons in water and fat molecules become magnetized. Radio waves from the machine's coils disturb the protons' normal alignment with the magnetic field. This disturbance causes the protons to give off their own radio waves, thus identifying a mass.

MRI is primarily used to determine the extent of breast cancer. The extent of the disease can be very important when determining whether the patient is a candidate for a lumpectomy or how aggressive a mastectomy needs to be performed. The weakness of MRI is it does not consistently find the minute calcium deposits that may indicate small tumors in the diagnostic stage (Stage II).

Compared to competing technologies, MRI is the most costly to perform but it has excellent reimbursement. Based on 2,000 patients per year over a five-year period, a facility would see over \$1,095,000 in profits at the end of the five-year term. The drawback is the high cost may limit its utilization for inpatients under the DRG system because the healthcare provider will not see additional payment.

### MRI Financials

#### Costs:

- Capital: \$895,000.
- Consumables: \$120.
- Labor: \$27.50.
- Service: \$85,000.
- Total cost per test (based on 2,500 tests per year): \$262.

Reimbursement:

- CPT C8903 (MRI breast imaging): \$483 (professional component).
- APC 284: \$376 (technical component).

## Positron Emission Tomography (PET)

Positron emission tomography (PET) is not routinely performed on breast cancer patients. Its primary application for cancer patients is to help determine the stage of the disease and whether treatments are having an effect. This approach may not be the best method for early detection; 7.6% of patients who undergo PET have false negatives.

The technology is based on producing an image by detecting subatomic particles that are emitted by a radioactive substance given to the patient. By imaging the radioactive particles (radioisotope), views of the human body are used to evaluate function. An array of radiation detectors in the scanner locates the radioactivity and produces two-dimensional, color-coded images.

During the PET procedure, the patient lies on a table and receives a radioisotope, which emits positrons or positive electrons. These radioisotopes can easily be incorporated into other chemical compounds, including normal body components (like oxygen) used to image blood flow or a drug used to visualize brain chemical systems, to make a radiopharmaceutical. As the positrons encounter electrons within the body, a reaction occurs that produces gamma rays, which are detected by the PET scanner. A disadvantage of PET is that it exposes the patient to radiation.

In comparison to other high-end technologies such as MRI and CT, PET has very aggressive reimbursement for both the technology and the consumable radioisotopes. The drawback is, with the exception of experimental usage, PET is not reimbursable under Medicare. Based on 2,000 patients per year, PET technology has a cost per patient of \$495. The professional component (physician payment) is approximately \$850. Combined, these two costs reflect a total cost of \$1,345.

### PET Financials

Costs:

- Capital: \$1,600,000.
- Consumables: \$300 (FDG).
- Labor: \$75.
- Service: \$155,000.
- Total cost per test (based on 2,000 tests per year): \$593.

Reimbursement:

- CPT 78811: \$850 (professional component).
- APC 1513: \$1,200 (technical component; new technology, level XIII).
- Pass thru payment for FDG: \$300.

## Breast Biopsy

After a suspicious lesion or tumor has been identified through one or more diagnostic techniques, a biopsy of the tissue is performed to allow a pathologist to examine the tissue. There are one million breast biopsies performed each year and options range from an open surgical procedure to minimally

invasive techniques. A biopsy is currently the only accurate method of determining whether a tumor is cancerous. Eighty percent of all biopsies turn out negative.

### Open Surgical Biopsy

Open surgical procedures are the most common method of performing a biopsy; they are performed 78% of the time. This technique is performed in an operating room after a mechanical indicator (needle wire) has been placed in the suspected tumor in the radiology suite. This technique has historically been accepted as the gold standard method of obtaining a specimen of breast tissue. Typically, 5 to 25 grams of tissue are removed through a surgical incision site 3 cm to 6 cm in length. This large amount of tissue permits accuracy of diagnosis and at times can even be therapeutic if the tumor is removed. However, the error rate of correctly diagnosed breast cancer with this method is as high as 20%. This high rate is due to incision error, localization error and tissue selection error. Other drawbacks of the technique include disfigurement and the procedure's high cost.

OR and nursing costs means that open surgical biopsy is the most costly method of biopsy, although it is usually performed in conjunction with a lumpectomy. Based on 1,000 procedures per year, a facility would expect to see a profit of approximately \$129,884 over a five-year period. One thing to keep in mind is that CMS' new DRG rules for 2007-2008 account for costs rather than charges along with complications. This means reimbursement will drop for most facilities.

### Breast Biopsy Financials

Costs:

- Operating room: \$1,350.
- Radiology: \$200.
- Laboratory: \$550.
- Nursing: \$600.
- Total costs: \$2,700.

Reimbursement:

- DRG 262, Breast Biopsy & Local Excision for Non-Malignancy, with a weight of 0.9394 and a length of stay of 2.9 days, and a base rate of \$4,000, equals a reimbursement of \$3,575.
- DRG 260, Subtotal Mastectomy for Malignancy w/o Complications, with a weight of 0.6827 and a length of stay of 1.9 days, and a base rate of \$4,000, equals a reimbursement of \$2,730.

## **Minimally Invasive Breast Biopsy**

Minimally invasive techniques such as stereotactic breast biopsy, ultrasound guided breast biopsy and fine needle breast biopsy account for the remaining 22% of the one million biopsies performed each year. These less invasive biopsy methods are starting to replace open surgical biopsies because of the small 1/4" incision. The image guidance is provided by ultrasound or stereotaxis (two X-ray mammographic views), which are used to accurately target the area of breast tissue when the tumor is found. The stereotactic method is the second most performed technique behind open biopsy, followed by ultrasound guided breast biopsy. Fine needle aspiration is used infrequently due to low accuracy -- insufficient tissue is obtained in 45% of procedures. The advantages of these minimally invasive techniques include minimal scarring instead of a large incision, reduced post-procedural pain, potentially lower hospital costs, shorter recovery time, and immediate resumption of daily activities.

### Stereotactic Guided Breast Biopsy

Stereotactic breast biopsy has been available since 1997. It is a minimally-invasive technique (1/4" incision) that takes approximately one hour and is performed under local anesthesia. The procedure is performed during a diagnostic mammogram. Stereotactic breast biopsy requires that the patient lie facedown on a special table. The table has a hole through which the breast is placed and into the digital mammography unit beneath. The breast is slightly compressed to immobilize it.

Two images at different angles are taken that allow the computer to localize the mass and calculate the coordinates of the tumor. A vacuum-operated needle is advanced to the coordinates that were calculated by the computer. The specimens are sent to a pathologist and the results are usually known in about four days.

The imaging labor and the capital investment mean that stereotactic breast biopsy can be costly, although reimbursement for the procedure is aggressive. Based on 1,000 procedures performed per year, a facility would expect to see a profit of approximately \$216,474 over a five-year period.

### Stereotactic Guided Breast Biopsy Financials

#### Costs:

- Capital: \$375,000.
- Labor: \$65.
- Consumables: \$70.
- Service: \$22,500.
- Total cost per patient (based on 1,000 patients per year): \$433.

#### Reimbursement:

##### Stereotactic Breast Biopsy:

- CPT 76095: \$493.
- APC 0187: \$215 (technical).

##### Percutaneous needle core biopsy device:

- CPT 19103: \$205.
- APC 0658: \$190 (technical).

##### Histochemical stain:

- CPT 88314: \$78.

Total reimbursement: \$483.

### Ultrasound Guided Breast Biopsy

This procedure is similar to stereotactic biopsies in that a hollow needle is used to obtain a biopsy. During an ultrasound guided breast biopsy, the patient lays on her back or side and a local anesthesia is administered. Ultrasound is used to guide the injection of anesthetic along the route to the lesion and about the mass. The radiologist also uses the ultrasound device to guide a hollow core biopsy needle or the handheld Mammotome (Ethicon product) needle directly to the mass. Usually five to 10 samples are taken using the core biopsy method and about 15 are obtained when using the Mammotome. Frequently, the Mammotome will remove the entire mass, a process that can be continuously monitored with the ultrasound probe.

The disadvantage of this technique is it is dependent on the skill of the physician. The advantage is that it is considerably less costly to perform than a stereotactic breast biopsy. Based on 1,000 procedures

performed per year, a facility would expect to see a profit of approximately \$22,553 over a five-year period.

### Ultrasound Guided Breast Biopsy Financials

#### Costs:

- Capital: \$35,000.
- Labor: \$20.
- Consumables (needle, tubing): \$205.
- Ultrasound: \$35.
- Lab: \$70.
- Service: \$3,000.
- Total cost per patient (based on 1,000 patients per year): \$383.

#### Reimbursement:

##### Ultrasound guidance for breast biopsy:

- CPT 76942: \$90 (professional).
- APC 0268: \$102 (technical).

##### Percutaneous needle core biopsy device (core biopsy):

- CPT 19102: \$262 (professional).
- APC 0005: \$210 (technical).

##### Percutaneous vacuum assisted biopsy device:

- CPT 19103 (mammotome): \$600 (professional).
- APC 0658: \$190 (technical).

##### Histochemical stain:

- CPT 88314: \$78.

Total Reimbursement: \$390.

For financial spreadsheets on the BT Test, including cash flow and return based on different reimbursement scenarios, [click here](#).

## Physician Interviews

*Christa Corn, M.D., General Surgeon and Breast Cancer Surgery Specialist, Phoenix Baptist Hospital, Phoenix, AZ*

"The current problem is a diagnosis can't be formed based on a mammogram or MRI. We can't look at an MRI and say, 'Oh that's benign, don't biopsy it.' MRI also misses 3% of cancers and mammograms miss 10% of cancers, while ultrasound misses about 40% of cancers. Today, we take all three of these images and try to get an idea of whether we need to do a biopsy. Then 70% of the biopsies turn up benign. If there was a simple blood test to perform there would be no need to biopsy all suspicious masses.

"Currently, if a patient's mammogram detects a little vague shape and we don't see the same shape in the other breast we think well, there's a little different asymmetry on this side compared to that side. One physician might think it's normal and another might think it's not. Some will say maybe we need to do an MRI and then maybe an ultrasound. Then, what happens if the ultrasound shows seven little nodules? What do you do with those? Unless they're totally, obviously, negative we typically have to biopsy.

"The blood test isn't going to do away with biopsy but I think it could limit the number of biopsies performed while helping to figure out what to biopsy versus what to simply watch. It may mean in some cases we won't have to do every imaging test and then a biopsy. It will help reduce the trauma some women face when they realize their mammography was abnormal.

"The blood test will affect younger women too because right now we don't recommend starting yearly mammograms until the age of 35. Well, women in their 20s and 30s don't have good screening practices and these are the women we really want to know about for early detection. If we can get a blood test done on these women once a year with negative results that would be great and if we get a positive blood test, even though all the studies were negative, we'd know to watch that patient. A positive blood test means we need to get a mammogram. Then we can add the ultrasound and the MRI and then we can do all the tests again in four months or so. It will help guide what we do.

"I can't wait for this type of technology. I see all kinds of women with vague, bad mammograms and then the ultrasound will show something other than what was on the mammography. We're left to wonder which one to biopsy. Then, after putting needles in these women, they get very concerned and then the MRI doesn't show any of that but shows something in the other breast. This woman is ready to lose both her breasts and for what? The biopsy can still turn out negative but by then she's been convinced something is wrong by four doctors, seven radiologists and four different imaging tests.

"The interesting question is how early and whether the blood test will detect cancer before a mammogram detects it. If the proper biomarkers are used, a blood test could identify the cancer months to years before it would show up on a mammogram. Say, on the best mammogram, we can see a 5 mm lesion. A 5 mm cancer has been growing for five or six years already. If the test can find it two or three years earlier, we'd know to really keep an eye on that particular patient.

"Although an MRI will also detect cancer a year or two earlier, an MRI has to be directed. One has to have said that this particular patient is at risk. Even so I've seen MRI miss detecting a cancer. Everyone seems to think MRI is the new, revolutionary imaging modality but actually it's the \$3,000 test that everyone wants you to get because it's profitable. It is not revolutionary. It shows everything and, for women who are having their menstrual cycles, the MRI must be performed at the right time in the cycle otherwise it's a worthless test. A diagnostic test that requires one be at the right time of their menstrual cycle strikes me as unrealistic. Hormones are also known to screw up the test and then it still misses 3% of cancers. I've seen it miss huge tumors you can feel.

"There seems to be a drive toward determining whether a woman is high-risk based on whether she breast fed her children or whether she's taking hormones. However, women all over the world get cancer. Do breast feeding and hormones really matter? It's hard to say. It certainly doesn't matter in Africa, China or the Middle East; those women get breast cancer too although all or most of these women breast fed because they didn't have a choice and they don't do hormones because they don't really have that choice either. One in eight women in the world gets breast cancer and there's no real way to determine whether one is high risk or not. The blood test could clear this up by saying if you have a positive blood test you are high risk. Period.

"Every time I see women who have undergone all these tests I just can't wait for the blood test to come out. The problem is getting the right biomarkers and we can't have a bunch of false positives, especially if we're going to depend on it. I believe this could eventually be a stand-alone screening but even if it's always an adjunct screening to mammo at least we will no longer have to do a mammogram, then an ultrasound, then an MRI, then a six-month ultrasound, then a three-month ultrasound, and a six-month MRI and so forth. If the blood test is negative a lot of trauma could be avoided.

"If we get lucky and it becomes a stand-alone test that is better for everyone because radiology is a diagnostic thing. Once radiology starts trying to be predictive it gets lost in the mud. If we can put radiology back where it belongs, which is just diagnoses, it'll be easier for everybody."

*Belinda Barclay-White, M.D., Radiologist, Section Chief of Women's Imaging at St. Joseph's Hospital, Phoenix, AZ; Co-Founder, The Arizona Institute of Breast Health*

"It's obviously much easier to take blood as part of one's general annual check-up than to perform a mammogram. A blood test could potentially be cheaper and more patient friendly too; a lot of women don't like having mammograms and they'd probably rather have a blood test.

"If it is determined that this blood test is an effective screening tool, that is, if it shows a negative result and there is truly no cancer, then we may be able to use it as a screening tool for breast cancer and therefore only have to 'work up' the patients whose blood tests come back positive. In other words, if it comes back positive for breast cancer we'd have to find out in which breast the cancer is located, where it is in the breast, and what sort of cancer it is in order to determine how to treat it.

"After a positive test we would follow up with a mammogram and ultrasound; if these are negative we'd then probably go to an MRI for a positive blood test. The trouble with going straight to an MRI with a positive blood test is that the MRI finds a lot of things that aren't cancer.

"We do know from more than 30 years experience that the smaller the cancer is when we find it the better the patient does. It doesn't matter what grade or what sort of cancer it is. Also, if we were to compare women whose cancer was found on a screening mammogram with women who found their cancer by palpation or other means, the survival rate for the mammographically-discovered cancer is higher. If it's found with a screening mammogram the survival rate is 87% but if it's found by other means the survival rate is only 50%.

"Mammography is still the best screening tool we have. If we know a patient is at a high risk of developing breast cancer due to an abnormal gene or because there are first-degree relatives that developed breast cancer pre-menopausal we would put her in a high-risk screening group and this group is considered for an MRI screen earlier than normal."

*Linda Greer, M.D., Radiologist, SimonMed Imaging, Glendale, AZ*

"My thought is that there are certainly a lot more people who will do a blood test as opposed to a large portion of the population that still won't come in for a mammogram. I also think it's going to be huge in the area of follow-up with patients after a lumpectomy or mastectomy. If we can detect metastatic disease before it becomes widespread and untreatable we'd be saving lots of lives.

"Then, too, it'll be great just for screening. I don't know how good it's going to be; I don't know if it's going to be better than a mammogram although I think they're predicting it will be. If it does come out better than a mammogram it will change my life by eliminating screenings. I'd be able to say, 'Okay, I know there's something there, I have to find it.' Then I'd know I couldn't stop with just a mammogram; I'd have to do an ultrasound or an MRI. I think this will also be a big timesaver. We do 60 to 80 mammograms a day and if we didn't have to do so many and could instead concentrate on the patients that really need a mammogram it'd be great.

"The whole point of a mammogram is there have to be enough cells there to block the X-rays from reaching the film (or whatever detection device) and so the cancer has to form a mass big enough to be seen. This might take one year, it might take 10 years. It depends on how quickly the tumor grows. There is a potential problem with the blood test in that it would find things before you see them and then the question would be, well what do we do? You know you have something but you can't find it. Do you get a bilateral mastectomy or do you just monitor for growth every three months or what? This could be a big dilemma but my guess is that this scenario won't happen very often because MRI is so sensitive and ultrasound is very sensitive."

*Zhen Zhang, Ph.D., Division of Clinical Chemistry, Primary Appointment in Pathology, Department of Pathology, Johns Hopkins University, Baltimore, MD*

"Our lab is developing bioinformatics tools for clinical diagnosis. Combining clinical information with a lab test has the ability to increase the diagnosis of a disease. We are finding what used to be considered a single diagnosis may actually consist of a number of different diseases. Now the physician takes this all into consideration in an informal manner when making the diagnosis. There are a lot of papers that indicate risk with each patient group that includes the probability before you have tests. So if you have a positive test for cancer the risk would be higher. But as a formal product using mathematical and computational algorithms that combine clinical information such as age and family history there are no commercial systems available yet.

"One of the issues has to do with the workflow. When you send a blood sample to a reference laboratory they process the sample and report a number back. This is an automated test. If you include clinical information such as age, someone has to add this from the patient record. This is one of the practical issues that have to be addressed with HIPAA. The information is already available but making it practical and establishing predictive models for the diagnosis and management of diseases will take a lot of considerations of workflow and how to get the information together."

## References

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National Breast Cancer Coalition  
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Scientific American  
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## Questions?

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