Sentinel Lymph Node Biopsy (SLN)

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What is Sentinel Lymph Node Biopsy?

After a lesion is diagnosed as cancerous, it is important to know if the cancer has spread to other areas of the body (metastasized). One of the methods used to determine metastasis is *sentinel lymph node biopsy,* the removal of some lymph nodes. The rationale for sentinel lymph node biopsy is based on the idea that the spread of cancer is not a random event. Migration of cancer cells to distant parts of the body often occurs via blood vessels (veins/arteries) and the lymphatic system.

The lymphatic system is part of the immune system, the body's defense against infection. It includes an extensive network of vessels and some grape-like clusters of lymph nodes (regional collection centers). If a cancer cell leaves the site from which it originated (the primary tumor) via the lymphatic system, it floats through the vessels until it reaches the next group of lymph nodes.

Learn more about the lymphatic system

Learn about other kinds of biopsies

For any region of the body, it is possible to predict which lymph node(s) are most likely to have been reached by a migrating cancer cell. These are known as sentinel lymph nodes (SLN). The sentinel node is the first node to receive drainage from the tumor area, metastasizing cancer cells leaving the tumor are most likely to collect in the SLN. If no cancer cells are found in the SLN it is much less likely that cancer cells have invaded the lymphatic system and moved to other parts of the body.

Watch a documentary on sentinel lymph node biopsy.

The following sections on this page describe the process of SLN biopsy in detail:

- Methods
- Conventions
- Before and After
- Frequently Asked Questions (FAQ)
- Interactive Game: Know the Flow

Methods

There are two methods used to identify and remove the sentinel node and they differ in the way the sentinel node is located. One method uses an injection of a blue dye and the other uses radioactive material and a gamma counter. The methods are often used in combination, a recent survey by Lucci, et al. polled 410 surgeons in the American College of Surgeons and found that 90% use a combination method of blue dye and radioactive colloid. 1 The two methods are described in more detail below.

Blue dye

A small amount of blue dye (often isosulfan blue or methylene blue) is injected into the functional elements of the breast (lobules, ducts, etc.). The dye rapidly spreads throughout the region and within 5-10 minutes lymph nodes

and vessels can be identified. An angled incision is made in the armpit and the lymphatic vessel marked by the blue dye is located and traced until the lymph nodes are reached. The marked node closest to the tumor is the sentinel lymph node.2, 3 Allergic reactions have occurred from the injection of the blue dye, but this is very rare (less than 2% of the time) and seldom severe. 4

Radioactive Colloid

The radioactive tracer material (sulfur colloid) needs to be injected 4 to 6 hours before surgery for it to properly spread throughout the local lymphatic region. After sufficient time has elapsed, a hand-held gamma ray detector is used to detect increased levels of gamma rays given off by the tracer. The gamma detector will indicate the area of the sentinel node when it shows an increase in count numbers; nodes with high levels of radiation are called "hot nodes". This provides the surgeon the precise location of the sentinel node, preventing the extra tissue disturbance that goes along with the blue dye method. After the sentinel node is removed, the surrounding area is checked for other nodes that are considered hot. Individual surgeon preferences dictate the number of lymph nodes that will be removed. Surgeons typically use one of four criteria to identify sentinel nodes:

- radioactivity greater than 3-4 times than the surrounding area
- radioactivity 10-times higher than a non-sentinel node
- radioactivity 10 times the background count
- radioactivity greater than 25 to 30 per second2, 3

Magnetic Particles

In 2018, the Food and Drug Administration (FDA) approved the use of a magnetic system to located sentinel lymph nodes. The Magtrace and Sentimag Magnetic Localization System (Sentimag System) uses injected magnetic particles and a powerful detector magnet to detect sentinel lymph nodes. The particles flow into the sentinel lymph node(s) and are trapped. They can then be detected with a handheld wand. The system was shown in a clinical trial to be as effective as dye and radioactive materials at identifying sentinel lymph nodes. The magnetic particles can cause breast discoloration and allergic reactions are possible. Other side effects are possible, and the test is not for people with metal implants in their armpits (axilla) or for people with conditions affecting their blood iron levels.5, 6

Conventions

How Many Nodes?
The number of nodes that should be removed in a sentinel node dissection is controversial, but research by Wong, et al. on 1,436 patients, involving 148 surgeons from around the United States indicate that when a single sentinel node is removed the false-negative rate is 14.3% and when multiple nodes are removed the false-negative rate drops to 4.3%.7 Regardless of dye staining, gamma radioactivity, or any other procedure, a clinically suspicious node should be removed and examined.
Learn more about false-negative test results.

Value of SLN Biopsy
Sentinel node biopsy is used to detect metastasis. It is generally very effective and is less invasive than an older method known as axillary node dissection. Axillary node dissection involves the removal of larger numbers of lymph nodes than SLN biopsy and is associated with more lymphatic and neurologic side effects (lymphedema and numbness, respectively).8 Studies show that sentinel node biopsy can correctly identify the sentinel node 90% of the time, with a false negative rate of 7.5% and an accuracy of 97%.2
Learn more about lymphedema.

Before and After

Preparation
Preparation for sentinel lymph node biopsy will vary and will be based on surgeon preference. It can be done on an outpatient basis or may require a short hospital stay. Inform your doctor if you are pregnant, think you may be pregnant, or breast feeding. Talk to your doctor about any medications or supplements you are taking, especially those that thin the blood. Blood thinning medications may need to be stopped days or weeks before the procedure, because they can lead to excessive bleeding. If you are going to have general anethesia, do not eat or drink anything for 8 hours before the procedure. You should prepare to have someone drive you home after the procedure, because you may be groggy. In any case speak to your doctor about the exact preparation routine because with each case.

Side Effects
Some of the side effects from SLN biopsy are pain, numbness, limited range of motion, infection, and swelling (lymphedema, seromas-collection of innocuous fluid). These symptoms are usually temporary and decrease in severity over time.8

Learn more about lymphedema

Frequently Asked Questions (FAQ)

When is sentinel lymph node (SLN) biopsy used?

Sentinel lymph node biopsy is used after a lesion is diagnosed as cancerous. It is used to determine if cancer has spread to other areas of the body (metastasized).

What are lymph nodes?

Lymph nodes are part of the lymphatic system. This system filters and transports fluid throughout the body and plays an important role in the immune response. Lymph nodes are small sac-like structures located throughout the body. They store lymphocytes and help control the immune response by allowing lymphocytes to contact foreign materials.

What are sentinel lymph nodes?

The sentinel lymph node is the first node to receive drainage from the tumor area. If cancer cells have left the tumor they will most likely collect in the sentinel lymph node. If there are no cancer cells present in the sentinel lymph node it is much less likely that cancer cells have invaded the lymphatic system and moved to other parts of the body.

What is a sentinel lymph node biopsy?

Sentinel node biopsy is surgical removal of the sentinel lymph node. A surgeon will first identify the sentinel lymph node using the blue dye method, the radioactive colloid method, or both. After the surgeon identifies the node it will be removed and surrounding nodes may also be removed.

What are the benefits of a sentinel lymph node biopsy?

Determining if cancer has spread to other parts of the body is very important for treatment plans. Sentinel lymph node biopsy can do this without removing all regional lymph nodes. This is in contrast to axillary lymph node dissection (ALND) in which all of the lymph nodes in the region are removed. Because removal of lymph nodes may impact the movement of fluids around the body and the immune response, the sentinel lymph node method decreases the risk for side effects, such as lymphedema.

How should I prepare for a SLN biopsy?

Preparation will vary depending on surgeon preference. The procedure may be done on an outpatient basis or may require a short hospital stay. Inform your physician about any medications you are taking, especially blood thinning medications (these may need to be stopped ~5 days prior to surgery). Be sure to ask your physician about any specific preparation they would like you to complete.

How many lymph nodes will be removed?

There is no set or recommended number of lymph nodes that should be removed. It depends on surgeon preference and each individual patient's circumstances. Studies have shown the false negative rate drops when more than one node is removed.

How accurate is SLN biopsy?

Studies have shown SLN biopsy can identify the sentinel node 90% of the time, with a 7.5% false negative rate. SLN has shown an accuracy of 97%.

What is a false negative result?

A false negative is when a medical test is determined to be 'negative' (i.e. no cancer) but the person being tested does have cancer. Watch a video about false negatives.

What is a false positive result?

A false positive is when a medical test mistakenly detects cancer when the person being tested does NOT have cancer. Watch a video about false positives.

Interactive Game: Know the Flow

Know the Flow is an interactive game for you to test your knowledge. To play:

- Drag the appropriate choices from the column on the right and place them in order in the boxes on the left. Note that you will only use five of the six choices to complete the game.
- When done, click on 'Check' to see how many you got correct.
- For incorrect answers, click on 'Description' to review information about the processes.
- To try again, choose 'Reset' and start over.

Know the Flow: Sentinel Lymph Node Biopsy
Processes in order

- 1
- 2
- 3
- 4
- 5

Processes

- Learn more
  diagnosed with breast cancer
- Learn more
  Schedule a Sentinel Lymph Node Biopsy
- Learn more
  Blue dye injected into the breast
- Learn more
  Remove any lymph nodes stained blue
- Learn more
  The removed lymph nodes are sent to a pathologist
- Learn more
  All lymph nodes in the area are removed

Check answers Reset

You did it!
The process is in the correct order!

Play again

This game does not currently fit on this width of screen.
Please visit us on a larger screen to play this game.

1 A Lucci, Jr., PR Kelemen, C Miller III, L Chardkoff, L Wilson. National practice patterns of sentinel lymph node dissection for breast carcinoma. Journal of the American College of Surgeons. 2001; 192: 453-458. [PUBMED]
2 [abc] MC Kelley, N Hanson, KM McMasters. Lymphatic mapping and sentinel lymphandectomy for breast cancer. The American Journal of Surgery. 2004; 188: 49-61. [PUBMED]
3 [ab] G. PEROS and G.H. SAKORAFAS. Sentinel lymph node biopsy in breast cancer: what a physician should know, a decade after its introduction in clinical practice. European Journal of Cancer. 2007; 16: 318-321. [PUBMED]
4 VM Cimmino, AC Brown, JF Szocik, et al. Allergic reactions to isosulfan blue during sentinel node biopsy-a common event. Surgery. 2001; 130: 439-442. [PUBMED]
5 FDA approves magnetic device system for guiding sentinel lymph node biopsies in certain patients with breast cancer. July 24, 2018 FDA News Release. [LINK
6 Information from the manufacturer of the Sentimag System [Mammotome website]
7 SL Wong, MJ Edwards, C Chao, et al. Sentinel Lymph Node Biopsy for Breast Cancer: Impact of the Number of Sentinel Nodes Removed on the False-Negative Rate. American College of Surgeons. 2001; 192: 684-691. [PUBMED]
8 [ab] KK Swenson, MJ Nissen, C Ceronsky, et al. Comparison of side effects between sentinel lymph node and axillary lymph node dissection for breast cancer. Annals of Surgical Oncology. 2002; 9(8): 745-753. [PUBMED]