Scintimammography use in Breast Cancer Diagnosis

By: Kaitlyn Gutmann
What is Breast Cancer?

- Breast Cancer is when a malignant tumor is found in the breast or breasts.
- A malignant tumor is a group of cancer cells that invade surrounding tissues and can further spread throughout the body.
- It is the leading cause of death in women in developed countries.
Detection:

- The main way to screen is a mammogram.
- A mammogram is an x-ray technique that is used to locate small or indistinct lumps on the breast that can’t be or weren’t felt during an exam.
- The test takes 15 minutes.
- Done by placing your breasts inside two plates.
- Early detection and diagnosis is crucial.
Problems with Mammograms:

- Mammograms are the top recommended test for detecting breast cancer, but they do have some flaws:
  - A false positive rate ranging from 2.6% to 15.9%
  - A false negative rate ranging from 12% to 37%
- Clearly mammograms need improvement or additional tests for follow up
What is Scintimammography?

- Also known as nuclear medicine breast imaging
- Specifically designed to detect cancer cells in the breasts
- Uses small amounts of radioactive materials and a special camera
- It is non-invasive and involves the injection of the radiotracer.
- The radiotracer makes its way to the breast where it gives off energy in the form of gamma rays which are detected by a device called the gamma camera.
- The gamma camera works with a computer to produce special images.
Scintimammography:

- 40-60 minutes
- After injection the patient waits approximately 5 minutes before images are taken.
- Each image takes about 10 minutes
- Usually two done per breast.
One Specific Case:

- A 40 year old woman got a clinical breast exam done which revealed a palpable mass in the right breast.
- A mammogram showed her breasts were extremely dense, but had no suspicious masses.
- A scintimammogram showed a focal uptake in the right breast, which is where the physician felt the mass.
- After, a biopsy confirmed that the mass was a form of breast cancer.
- This case shows how significant this test can be in detecting breast cancer.
Mammogram vs. Scintimammogram:
Clinical Study:

- Used radiotracer, technetium-99m methoxyisobutylisonitrile (MIBI) because it has high sensitivity and specificity.
- 78 women ages 35-81.
- All women underwent a biopsy prior to the study to classify them into high, intermediate, or low probability of malignancy.
- High-28; Intermediate-30; Low-20
- Given 740 MBq of the MIBI radiotracer into arm on opposite side of lesion
- Images were taken 10 minutes after injection
- Experts gave an abnormality rating of 0-5
Clinical Study Continued:

- Focused specifically on non-palpable breast lesions.
- Results can be found in the chart below:

<table>
<thead>
<tr>
<th></th>
<th>High (n=28)</th>
<th>Intermediate (n=30)</th>
<th>Low (n=20)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIBI–</td>
<td>MIBI+</td>
<td>MIBI–</td>
<td>MIBI+</td>
</tr>
<tr>
<td>Benign</td>
<td>4</td>
<td>–</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Malignant</td>
<td>2</td>
<td>22</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>22</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>
The top right figure shows a well-defined non-palpable lesion with a low probability of malignancy via mammogram.

The bottom right shows the scintimammogram image revealing a MIBI positive result and the histological diagnosis came back with it being cancer.

The top left mammogram shows a non-palpable lesion with a high probability of malignancy.

The bottom left scintimammogram shows a negative MIBI result corresponding with the histological diagnosis of it being fibrosis and not breast cancer.
Discussion of Study:

- There were 4 false-positives via mammogram in the high probability group and none via scintimammogram. There were however, two false-negatives by the scintimammography.

- There were 17 false-positives from the mammogram which was reduced to 8 false-positives through scintimammograms in the intermediate group. There was only one false-negative in this group.

- In the low group, scintimammography reduced the 16 false-positives to 11. There were no false-negatives.

- Scintimammography would have avoided 14 of the 33 unnecessary biopsies.

- Mammography had a total of 37 false-positives while scintimammography only had 19.

- Limited value in high probability of malignancy but great value in intermediate and low probability of malignancy by reducing unnecessary biopsies by 42%.
Benefits:
- It can reduce unnecessary invasive procedures such as a biopsy by helping physicians “see” a better picture of the breast and/or abnormality specifically targeted.
- The ability for this system to detect breast cancer is not limited by dense breast tissue or even breast implants like a mammogram is.

Risks:
- The radiation risk is higher, but not drastically, than the radiation risk of a mammogram.
- Allergic reactions to radiopharmaceuticals may occur but are very rare and usually mild.
- Injection of the radiotracer may cause slight pain and redness which resolves very shortly after.
Conclusion:

- Scintimammography does not replace mammography just aid the physicians in making better conclusions on breast lesions.
- Definitely helps in reducing unnecessary biopsies.
- More conclusive in lesions that are malignant.
- With some improvement could be extremely helpful, even more so than the mammogram in the future.
Resources: