Cancer Detection and Diagnosis

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One of the key problems in the treatment of cancer is the early detection of the disease. Often, cancer is detected in its later stages, when it has compromised the function of one or more vital organ systems and is widespread throughout the body. Methods for the early detection of cancer are of utmost importance and are an active area of current research.

After the initial detection of a cancerous growth, accurate diagnosis and staging of the disease are essential for the design of a treatment plan. This process is dependent on clinical testing and the observations of physicians. It is important for cancer patients and their families to understand the results given to them so that they can take an active role in the planning of the treatment protocol to be used.

This section includes information on some of the methods used to detect cancer. Also discussed are some possible tests that are still under investigation. You can also find information on the results presented in pathology (path.) reports and a section that describes the process of cancer staging.

Because no test is 100% accurate, **it is important to understand the limitations of medical tests**. The limitations of any particular medical test are described by its **sensitivity and specificity** and **false positive/false negative rates**. Learn more about these important characteristics of every medical test:

- Medical Tests: False Positives and False Negatives
- Medical Tests: Sensitivity and Specificity

Medical Tests: False Positives and False Negatives

When a patient undergoes a medical test the result comes back positive, how sure can they be that they actually have the indicated condition? It turns out to be dependent on the test being done. The same is true for negative results.

When a test is performed to detect a disease, there are four possible outcomes.

- If a test indicates that a patient has a disease that the patient does indeed have, this is called a **true positive**.1
- However, if the test indicates that a patient has a disease when she does not, it is called a **false positive**.1
- If the test indicates the patient is disease-free, and this is indeed the case, it is called a **true negative**.1
- Finally, if the test indicates the patient is healthy when in fact the patient has the disease, we call this a **false negative**.1

Click on the image below to view a video about false positives and negatives.

Medical Tests: Sensitivity and Specificity

Do medical tests find every case of the condition they are designed to detect? Do they ONLY find the things they are designed to find? The short answer is 'No'.

When referring to the accuracy of a medical test, statisticians use the words **sensitivity** and **specificity**. 2 Sensitivity refers to the proportion of the times that a test yields *true positives*. The closer the sensitivity is to 100%, the more likely a positive result actually means that the patient has a disease. Specificity refers to the proportion of the time that a test yields *true negatives*. The closer the specificity is to 100%, the more likely a negative result means that the patient is truly disease-free.

A perfect test gives only true positives and true negatives, and the worst possible test would be the same as guessing. While many medical tests are highly accurate, all tests used in medicine fall somewhere in between these two extremes. This uncertainty raises some difficult issues. A test that yields a positive result will usually lead to the performance of a second, more accurate test. If the second test used is still simple and non-invasive, then a preliminary test that yields a high number of false positives may be acceptable. If the second test is difficult to perform or risky, the initial blood test may lead many people to have unnecessary medical procedures.

If the first test is imperfect it may incorrectly indicate that patients are healthy, when in fact they are not. If the disease is mild and will probably not hurt the patient's health, then the blood test does little harm when it is wrong. If the disease is serious, the blood test may prevent patients from obtaining necessary treatments. The value of any blood test is a balance between the sensitivity and specificity of the test, and the severity of the disease detected. It is important that patients discuss the sensitivity and specificity of tests given with their physician.

Click on the image below to view a documentary on sensitivity and specificity.

If you find the material useful, please consider linking to our website.

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1 [abcd] Segen, Joseph C., Wade, Josie."The Patient's Guide to Medical Tests."Infobase Publishing, 2002.

2 Huda W, Slone R. Review of Radiologic Physics. Lippincott Williams & Wilkins: Philadelphia, 1995.