



# Cancer Detection with Ultrasound

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## Why in News?

Recently, scientists developed an **innovative ultrasound technique for cancer detection**, offering a less invasive, cost-effective alternative to traditional biopsies by releasing biomarkers like RNA, DNA, and proteins from tissue into the bloodstream.

## What is Cancer?

- **About:** Cancer is a condition where certain cells in the body grow uncontrollably and spread to other areas.
- **Cause:** Cancer develops in any part of the body when normal cell growth and cell division malfunction, leading to the formation of abnormal cells that may create tumours, which can be either cancerous or non-cancerous.

### Types of Cancer

| Types of Cancer         |  |
|-------------------------|--|
| <b>Carcinoma</b>        | Originates in epithelial cells (skin, glands). Examples: breast, lung, prostate cancer |
| <b>Sarcoma</b>          | Forms in bone and soft tissues like muscle or fat                                      |
| <b>Leukemia</b>         | Affects blood-forming tissues, resulting in abnormal white blood cell production       |
| <b>Lymphoma</b>         | Begins in immune cells (lymphocytes). Main types: Hodgkin and non-Hodgkin lymphoma.    |
| <b>Multiple Myeloma</b> | Cancer of plasma cells in bone marrow  |
| <b>Melanoma</b>         | Starts in pigment-producing cells, usually affecting the skin.                         |

| Normal Cells   | Cancer Cells   |
|--|--|
| Grow only when they receive growth signals.            | Grow without the need for growth signals.  |
| Follow signals to stop dividing or die when needed.    | Ignore signals for cell death, continue to divide.                                 |
| Immune system identifies and eliminates damaged cells. | Hide from the immune system and evade detection.                                   |
| Maintain a stable chromosome number and structure.     | Accumulate chromosomal abnormalities (duplications, deletions, extra chromosomes). |

## What are the Highlights of the Research Conducted?

- The **gold standard to detect many cancers is a biopsy** where a small piece of tissue or cells is

extracted using a large needle from the part of the body where cancer is suspected to be present.

- **Biopsy is, however, a cumbersome, painful, and potentially injurious process.**
- The study has found that high-energy ultrasound (at frequencies greater than those used in ultrasound scans) can break off a small piece of cancerous tissue into droplets and release their contents into the bloodstream.
  - This method would allow **blood samples to be used to detect cancer types** and the mutations they contain, which is **currently undetectable in blood.**
- The main advantage of this approach is its **non-invasiveness**, which will prevent patient discomfort. However, more studies in a large cohort of patients would be required before this technique can be brought in as a conventional mode of detecting cancer.

### Note:

- Ultrasound (also called sonography or ultrasonography) is a noninvasive imaging test that shows structures inside the body **using high-intensity sound waves.**
  - **Applications in Medical Field:**
    - Pregnancy Monitoring
    - Detecting internal issues such as abnormal growths (e.g., tumors, cysts), gallstones, kidney stones, or blood clots
    - Guidance for Procedures (needle placement for biopsies)
    - Doppler ultrasound evaluates blood flow in arteries and veins

## UPSC Civil Services Examination, Previous Year Questions (PYQs)

### Prelims

**Q. With reference to the treatment of cancerous tumours, a tool called cyberknife has been making the news. In this context, which one of the following statements is not correct? (2010)**

- (a) It is a robotic image guided system
- (b) It delivers an extremely precise dose of radiation
- (c) It has the capability of achieving sub-millimetre accuracy
- (d) It can map the spread of tumour in the body

**Ans: (d)**

**Q. 'RNA interference (RNAi)' technology has gained popularity in the last few years. Why? (2019)**

- (a) It is used in developing gene-silencing therapies.
- (b) It can be used in developing therapies for the treatment of cancer.
- (c) It can be used to develop hormone replacement therapies
- (d) It can be used to produce crop plants that are resistant to viral pathogens

**Q. Select the correct answer using the code given below.**

- (a) 1, 2 and 4
- (b) 2 and 3

(c) 1 and 3

(d) 1 and 4 only

**Ans: (a)**

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