DBS Brain Implant Surgery for Epilepsy Treatment

Source: IE

Why in News?

Recently, a UK-based teenager has become the first person in the world to be fitted with a **brain implant device** to help bring his **epileptic seizures** under control.

- The **Deep Brain Stimulation (DBS)** device was inserted in his skull which reduced his daytime seizures by 80%.

What is Epilepsy Disorder?

- **About Epilepsy:**
  - It is a **central nervous system (neurological) disorder** in which **brain activity becomes abnormal**, causing seizures or periods of unusual behaviour, sensations, and sometimes loss of awareness.
- **Causes:**
  - It is caused by **abnormal electrical activity** in the brain.
  - The disease has **no identifiable cause** in nearly 50% of the cases. However, **head trauma, tumours in the brain**, some infections like **meningitis**, or even **genetics** can lead to epilepsy.
  - It's more common in young children and older adults. It occurs slightly **more in males** than in females.
- **Available Treatment of Epilepsy:**
  - **Anti-seizure Medications:** These are the first line of treatment, aiming to control seizure frequency and severity..
  - **Ketogenic diet:** A **high-fat, low-carbohydrate diet** can be remarkably effective, particularly in children with medication-resistant epilepsy.
  - **Epilepsy Surgery:** Doctors can carry out brain surgery to **remove a portion of the brain** where the seizures originate.
  - **Corpus Callosotomy:** In this surgical procedure doctors remove **the corpus callosum (a part that connects both halves of the brain)** that will **not allow abnormal electrical signals to travel** from one half of the brain to another, preventing abnormal electrical discharges from spreading and causing seizures.

Note

- Epilepsy has been recognised by the **World Health Organisation (WHO) as a neurological disorder.**
- According to a **2022 Lancet study,** the prevalence of epilepsy in India ranges from **3 to 11.9 cases per 1,000 people**.
- Despite the availability of several anti-seizure medications, approximately **30%** of the patients **remain resistant to treatment.**

What is the DBS Brain Implant Technology to Treat Epilepsy?

- **About:**
  - **Deep Brain Stimulation (DBS)** involves **implanting a medical device** with electrodes that **deliver mild electrical currents** to **specific brain regions** linked to seizures.
  - DBS is considered for patients with **medication-resistant epilepsy**, where traditional medications haven't controlled seizures.
  - Unlike surgery that removes brain tissue, DBS offers a **more targeted approach** with potentially **fewer side effects.**

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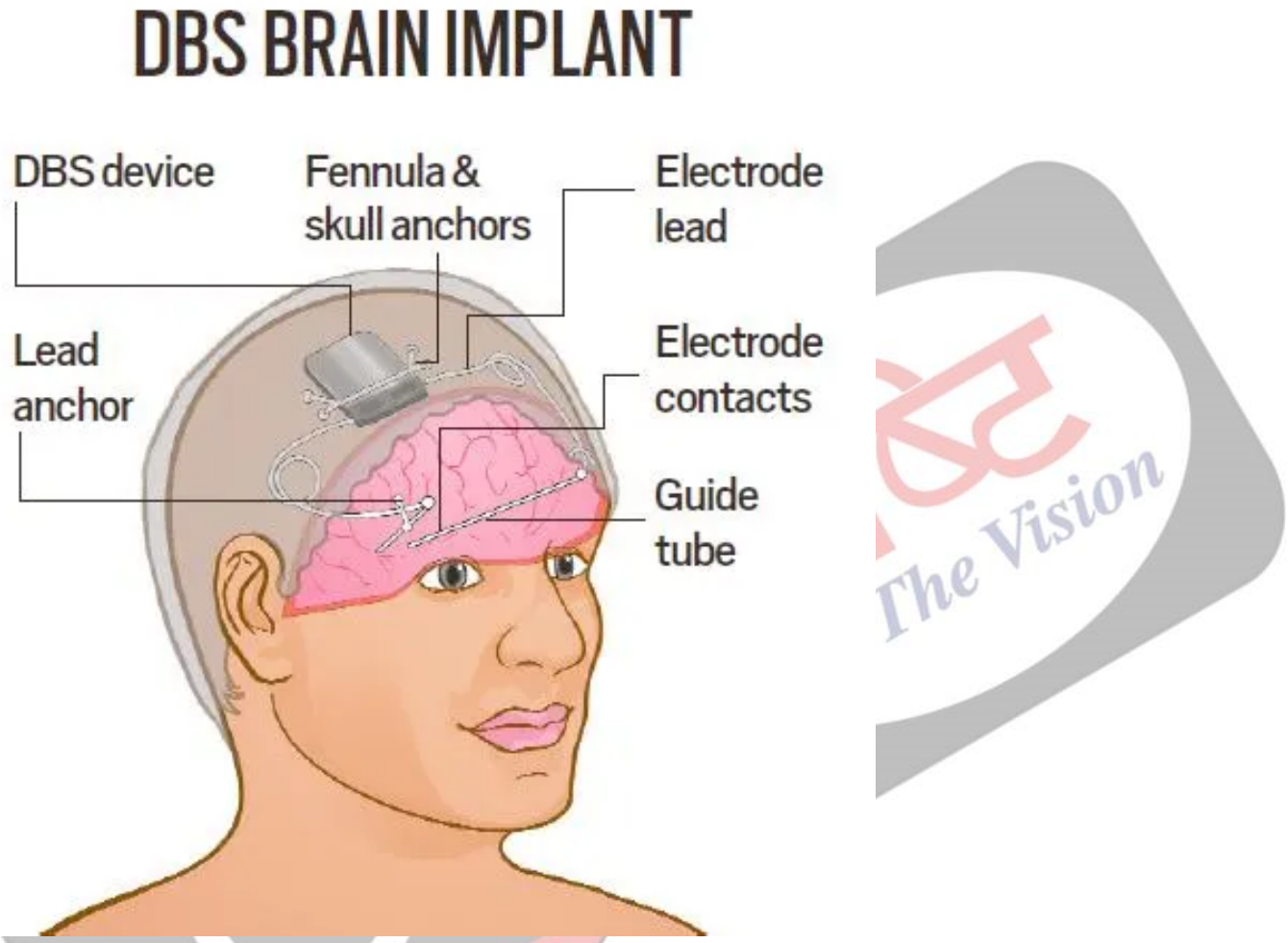

- **Working:**
  - The device is a **neurostimulator** that **delivers constant electrical impulses** to the brain to **disrupt or block abnormal seizure-causing signals** in the brain.
  - **Two electrodes** were inserted deep into the brain, reaching the **thalamus**, a relay station for motor and sensory information. The electrodes are connected to the neurostimulator device.
  - The device can be **recharged wirelessly** using a headphone.
- **Advantages:**
  - **Effective Seizure Control:** It helps **reduce seizure frequency by around 40%** in some patients.
  - **Alternative for Complex Epilepsy:** It offers a viable alternative for patients with epilepsy originating from **multiple brain regions**, where **surgery is difficult or impractical**.
  - **Treatment-Resistant Cases**: It can be a valuable option when **traditional interventions** like medications and dietary modifications **have failed to achieve adequate seizure control.**
- **Limitations:**

    - DBS is **not a guaranteed cure.**
    - It can be expensive with a total cost can reach around Rs 17 lakh.
    - DBS **success rates are lower** compared to well-established surgical approaches. **Brain surgery** can achieve **seizure freedom in nearly 90%** of suitable cases.

- **NeuraLink (American neurotechnology company):** Neuralink's brain implant aims to **help people with traumatic injuries** control computers using only their **thoughts**.
    - It aims to significantly **enhance human abilitie**s by addressing conditions like **Parkinson's Disease.**
- **Brainoware:** It integrates **brain organoids** with **microelectrodes** and can be used to **study human brain development** and **brain-related diseases.**

Read more: Epilepsy.

UPSC Civil Services Examination Previous Year Question

Q. Consider the following statements:

1. Genetic changes can be introduced in the cells that produce eggs or sperms of a prospective parent.
2. A person’s genome can be edited before birth at the early embryonic stage.
3. Human induced pluripotent stem cells can be injected into the embryo of a pig.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 and 3 only
(c) 2 only
(d) 1, 2 and 3

Ans: (d)