

Ultrasonic surgery is a minimally invasive technique that uses **high-frequency sound waves** to cut, coagulate, or fragment tissue during surgical procedures. This method has gained popularity for its precision, reduced trauma to surrounding tissues, and enhanced safety when working near delicate structures like blood vessels and nerves.

Key Mechanism: An **ultrasonic generator** converts electrical energy into **mechanical vibrations** that are transmitted through an instrument called a **sonotrode**. These vibrations oscillate at ultrasonic frequencies, allowing for various tissue effects: - **Cavitation**: Micro-bubbles are generated in tissues containing fluid, and their implosion helps fragment soft tissues (e.g., liver tumors). - **Mechanical effect**: Direct contact of the vibrating tip with tissue can physically disrupt or remove more solid tissues, like bones or tumors, without harming surrounding healthy structures such as nerves or blood vessels.

Benefits: 1. **Precision**: Ultrasonic surgery allows for selective removal of tissue types, minimizing damage to critical structures. 2. **Minimal bleeding**: Due to the cauterizing effect of ultrasonic waves, bleeding is often reduced. 3. **Versatility**: It is used in a variety of fields, including **neurosurgery, spinal surgery, liver surgery**, and **wound debridement**.

Clinical Applications: - **Neurosurgery**: Ultrasonic aspirators, like those developed by **Söring GmbH**, are used to safely resect brain tumors while preserving vital tissues such as the dura mater and nerves.

- **Liver Surgery**: Devices like **HEPACCS®** are used to remove liver tumors, offering precision in treating delicate tissues

- **Wound Debridement**: Ultrasonic technology helps clean wounds by removing dead or infected tissue, promoting faster healing

This technology has revolutionized various surgical procedures by improving outcomes and enhancing surgeon control during complex operations.

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