Imagine looking inside the body and seeing everything in precise, three-dimensional detail — the lobe of a brain, the twisting passageways of nasal cavities, the structure of vertebrae in the spine. That’s the intricate view more and more surgeons are seeing with the next-generation of image-guided surgery technology.

Image-guided surgery technology has revolutionized traditional surgical techniques by providing surgeons with a way to navigate through the body using three-dimensional (3D) images as their guide. Furthermore, those images can be changed, manipulated and merged to provide a level of detail not seen before in the operating room. The technology is similar to that used by today’s global positioning satellite systems, which can track the exact location and direction of vehicles at any point on the globe. Because the view is so precise and so controllable, a surgeon can actually see where healthy tissue ends and a brain tumor begins, or precisely where on the spine to place a pedicle screw to maximize patient mobility.

What are the advantages of image-guided surgery?
Because of the precision that image-guided surgery technology provides, surgeons are able to create an exact, detailed plan for the surgery — where the best spot is to make the incision, the optimal path to the targeted area, and what critical structures must be avoided. The technology allows surgeons to view the human body — a dynamic, three-dimensional structure itself — in real-time 3D.

The technology creates images that allow surgeons to see the abnormality, such as a brain tumor, and distinguish it from surrounding healthy tissue. It also enables them to manipulate the 3D view in real-time during surgery. The constant flow of information helps surgeons make minute adjustments to ensure they are treating the exact areas they need to treat.

How does it benefit patients?
The technology aids in shortening operating times, decreasing the size of the patient’s incision, reducing the procedure’s invasiveness — all of which can lead to better patient outcomes and faster recoveries.

Real life applications
Before the advent of this technology, surgeons would have to study two-dimensional diagnostic scans, such as X-rays, and then determine how those images corresponded to the patient’s actual body.

Brain applications
The brain is the most complicated structure in the universe, making it necessary to approach surgery carefully and with extreme planning to minimize the risk to patients. The StealthStation® System can be used for:
• Tumor biopsies
• Visualization of critical brain structures
• Tumor resection
Image-guided surgery also provides new alternatives for patients with multiple medical problems, patients who may not be able to tolerate large, invasive surgeries, and patients whose conditions in the past would have been considered inoperable.

How does the technology work?
Medtronic, the world’s leading medical technology company, has developed several revolutionary image-guided surgical systems that are used in brain, spinal, ear/nose/throat and orthopedic surgeries. As of July 2001, there are more than 650 StealthStation® treatment guidance systems in use around the world.

Each system involves the same basic principles:

Prior to an image-guided operation, the patient undergoes diagnostic testing such as a CT (computed tomography) scan or MRI (magnetic resonance imaging). These images are then converted into 3D images showing the patient’s organs, muscles, tissue and nerves. This is the information surgeons use to plan the operation.

When surgery begins, the 3D images are synchronized with real-time information provided by light emitting diode (LED) cameras within the operating room. By matching the pre-surgery information to the patient’s real anatomy, surgeons can manipulate the view to see precisely what they need to see. It also allows them to track instruments during the surgery, including the position of the instrument and the angle at which it is entering the body — side to side, up and down and back and forth — with tremendous precision.

Image-guided surgery has revolutionized traditional surgical techniques by providing a precise treatment guidance system that can help ensure the safety of vital structures, while providing the best outcome for patients.

Spinal applications
The complex construction of the spine — interconnecting bones and nerve bundles — requires extreme surgical finesse. Spine surgeons often have to calculate within millimeters to ensure the success of the procedure and optimal results for the patient. The StealthStation® system can be used for:
- Repairing traumatic spinal injury
- Decompressing nerve roots

Orthopedic applications
Using image-guided surgery for traditional orthopedic applications offers several benefits. It provides a less-invasive surgical option and, in turn, allows the patient to begin rehabilitation sooner. The StealthStation® system can be used for:
- Reconstructive surgery
- Traumatic bone repair

Ear/nose/throat applications
As with cranial surgery, extreme finesse is required to navigate the many small passages and cavities involved in ENT surgery. The StealthStation® system can be used for:
- Sinus surgery
- Cyst and polyp removal
- Optic decompression

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