Keywords: computed tomography

Problem: What once was a medical luxury is now a necessity of modern-day healthcare. Computed tomography (CT) has come a long way since its initial use in 1973. CT scans continue to evolve and produce better results with less radiation exposure.

Solution: This article provides the following information for physicians:

1. CT's history
2. Current technologies
3. Emerging applications

Computed Tomography: Current Technologies and Emerging Applications

Computed tomography (CT) has become essential to medical practices nationwide. The United States has the second highest CT imaging units per million, making medical scans accessible to most Americans.

Imaging resources and computed tomography have advanced significantly over the years. In fact, CT imaging is often a better predictor of medical conditions than genetics. Providers use CT scans today to diagnose, plan treatment and deliver interventions. Current CT technologies allow physicians to visualize details of internal structures. Keep reading to learn about computed tomography's history, current applications and emerging capabilities.

Key Takeaways

- In the early 1970s, Godfrey Hounsfield and Dr. Allan Cormack invented the CT scanner. Their dedication to science and innovation advanced imaging services indefinitely.
- CT uses X-rays and computer technology to produce detailed, cross-sectional 3D images. The information from these scans helps diagnose diseases, plan therapies and implement treatments.
- Advanced imaging effectively predicts many medical conditions, especially cardiovascular conditions.
- Current capabilities include helical CT, electron beam CT, high-resolution CT, CT angiography, PET and CT combination technology and image-guided interventions.
- Two emerging CT advancements are photon-counting CT detectors and brain imaging reconstruction software. Although these innovations are not commonly used, they are the first FDA-cleared CT technologies in the past decade.

The development of computed tomography

In 1895, Röntgen discovered X-radiation, revolutionizing disease diagnosis. From that point on, X-ray research has continued to evolve. The first X-ray image of an entire skeleton dates back to 1897, only two years after Röntgen's discovery.

Several individuals, like Edison, Thompson and Bocage, significantly advanced X-ray imaging. However, **the development of computational techniques is what launched computed tomography into existence.**

CT imaging relies on tissue density to produce contrasted pictures. Different body tissue absorbs varying levels of X-rays, producing contrasted images. In 1973, the first commercial fan-beam CT scan boasted a 20-second acquisition time with 30 detectors. Biomedical engineer Godfrey Hounsfield and co-inventor Dr. Allan Cormack were awarded the Nobel Prize for inventing the CT scanner.

Over several decades, computed tomography's design, efficiency and imaging have significantly improved. What once was a medical luxury has become an essential tool in modern-day healthcare.

Current CT technologies

CT has come a long way since its origination. This imaging marvel uses X-rays and computer technology to produce detailed images of the following:

- Bones
- Muscles
- Fat
- Organs
- Blood vessels

Unlike a standard X-ray, CTs produce X-ray beams that move around the body. The result is cross-sectional, three-dimensional views of the targeted area. CT scans easily display dense structures, like bones. However, visualizing low-density, or soft tissue, can be challenging. Contrast agents mitigate that problem and improve imaging results. Some current advancements in CT technology are:

- **Spiral CT:** The X-ray beam rotates around the patient and quickly delivers high-resolution images. Multidetector-row helical CT scanners efficiently provide information about coronary artery calcification.
- **Electron beam CT:** This ultrafast CT scan creates a quick movie of moving parts, such as heart chambers and valves.
- **High-resolution CT:** This imaging utilizes very thin slices, less than 0.1 inches. This tool makes it easier for physicians to evaluate conditions like lung disease.

- **Computed tomographic angiography (CTA):** This medical exam combines CT technologies and IV contrast to visualize blood vessels.
- **Combination positron emission tomography (PET) and CT:** By combining PET and CT technology into one machine, clinicians can visualize the anatomy, cellular function and metabolism of specific body parts. This imaging tool helps better assess conditions such as Alzheimer's disease, epilepsy and coronary artery disease.
- **Image-guided robotic surgery:** These innovative surgeries utilize imaging tools, like CT scans, to perform minimally invasive surgeries.

Advancements in CT technologies deliver safe, quick and detailed imaging. It is clear why so many providers depend on these tools in clinical practice.

Two emerging advancements in computed tomography

The Food and Drug Administration (FDA) has cleared two CT technologies for clinical use: the photon-counting CT detector and the brain CT image reconstruction method. These biomedical technologies are the first major CT imaging innovations cleared by the FDA for over a decade.

Photon-counting CT detector (PCD-CT)

PCD-CT utilizes a semiconductor detector to convert X-ray photons into electrical signals. The detector quickly counts and evaluates each photon's energy level. **This process delivers more accurate signaling and more precise results.**

Unlike standard CT detectors, which use a two-step process to produce electrical signals, PCD-CT uses a one-step process. Instead of converting X-rays into light and light into electrical signals, the photon-counting CT detector transforms X-rays directly into electrical signals. The new system decreases the amount of contrast needed and improves spatial resolution.

Brain CT image reconstruction

Providers question whether to use low-dose CT scans and receive an image with less quality or a higher-dose CT for better image quality. Technology like the brain CT image reconstruction software eliminates the debate.

Currently, physicians use computed tomography perfusion (CTP) to evaluate brain damage in stroke patients. However, CTP relies on high radiation doses. Artificial intelligence software will allow providers to use lower radiation doses without compromising processing speed or image quality.

The software reduces radiation dose by 50-75% compared to standard CTPs. These CT technologies are FDA-cleared but are not commonly used at this point. However, these technologies are exciting innovations worth watching for.

Improving patient lives with innovative imaging

Medical imaging, like computed tomography, improves patients' lives. These **advanced imaging tools provide the information to detect and treat problems early.**

We know information is power. It guides decision-making. It improves lives. Our imaging services deliver the information you need to serve your patients. If you want accessible radiology services, we are here to help. We would be honored to be your partner in care. Click the "Refer" button to get started.

Resources

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