

# **Drawbacks and Limitations of Computed Tomography**

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When computed tomography (CT) became available in the 1970s, it enabled us to establish diagnoses with unprecedented speed and accuracy.

But it also affected the way we practice and teach medicine, shifting our focus from the bedside to the laboratory and giving rise to a malady that has slowly pervaded our profession. I call this malady “technologic tenesmus”—the uncontrollable urge to rely on sophisticated medical gadgetry for diagnoses.

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## **The drawbacks of this test**

1. Its expense.
2. The high dose of radiation it delivers.
3. The laziness it promotes.
4. The havoc it can wreak when misinterpreted.

# Drawbacks

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## Exorbitantly Expensive

### *How Much Does a CT Examination Cost?*

In a survey of 4 major hospitals in Houston,

- I found that the charge for CT of the head, chest, or abdomen—including contrast, but excluding the radiologist's fee—ranges from \$1,400 to \$2,500.
- The same studies without contrast average \$100 to \$200 less. Scans of the head are slightly cheaper than those of the chest or abdomen. One of the hospitals automatically includes the pelvis in abdominal CTs, which raises the cost to \$4,079 (abdomen, \$2,112; pelvis, \$1,967).

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## *Comment.*

These prices can create a significant financial burden for patients, especially those who undergo multiple CT examinations. And for those without medical insurance, the burden can be devastating.

# Delivers High Dose of Radiation

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## *How Much Radiation Does a Patient Receive from a CT Examination?*

Even the few who know how much CT costs almost invariably are ignorant of how much radiation it delivers.

**Several factors determine the radiation dose** a patient receives from CT.

These include:

- The design of the scanner.
- Size of the patient.
- Anatomic volume scanned.
- Scanning protocol.
- Technique used.
- Quality of the x-ray beam.

**TABLE I.** Effective Radiation Doses from Conventional X-Ray Examinations and Computed Tomography<sup>a</sup>

<b>Diagnostic Procedure</b>	<b>Typical Effective Dose<sup>b</sup> (mSv)<sup>c</sup></b>	<b>Equivalent No. of Single PA Chest Films</b>
<b>Conventional x-ray</b>		
Chest (single PA film)	0.02	1
Pelvis	0.7	35
Abdomen	1.0	50
Lumbar spine	1.3	65
Barium enema	7	350
<b>Computed tomography</b>		
Head	2	100
Chest	8	400
Abdomen	10	500
Pelvis	10	500

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- About 40% of the collective dose of radiation in diagnostic radiology results from CT procedures.
  - 4% of which involve children 0 to 15 years old. Moreover, the radiation dose in children often exceeds the level necessary for diagnostic information.
  - 30% of CTs in children are unnecessary. Given the fact that children are more sensitive to radiation than are middle-aged adults.

# Promotes Laziness

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Physicians order CTs for a variety of reasons (Table II). From my vantage point, the most common reason is “fishing”—scanning the body part thought to be the source of the patient’s complaint or problem.

In such cases, the physician takes a brief medical history, may or may not examine the patient, and, guided by the chief complaint, proceeds directly to CT scanning.

## **This approach has many attractive features.**

- It takes little of the physician’s time.
- Requires no special expertise.
- Demands no discriminate thought.
- Serves as an easy, convenient way to obtain a lot of information quickly.
- The physician need not even see the patient before ordering the test.

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## **Comment.**

- ❑ There appear to be two basic reasons why physicians use CT to fish for diagnoses, convenience and necessity.
- ❑ An easy way to reduce their busy workloads.
- ❑ Using CT over and over again in this manner, they gradually, but unwittingly, become **victims of technologic tenesmus.**

## **TABLE II.** Observed Reasons for Ordering Computed Tomography

### **Common**

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- “Fishing” for a diagnosis (head and abdomen)
- Wanting to see better an already sufficiently visualized lesion (chest)
- Requisite for certain interventions (surgical and radiologic procedures, bronchoscopy, staging of neoplasms, etc.)
- Radiologist’s recommendation.
- Physician’s convenience.

### **Occasional**

- Fear of litigation
- Substantiating—or excluding—a well-constructed clinical impression.

### **Rare**

- Patient’s request
- Lawyer’s request

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## ***Case 1.***

A 53-year-old woman presented with a distended urinary bladder that was mistaken clinically and on CT as a pelvic neoplasm, probably ovarian.

The CT report prompted a host of additional studies, including 2 more CTs. But on the second hospital day, another staff radiologist read the initial CT study as normal. A Foley catheter then unveiled the true nature of the patient's illness.

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## **Case 2.**

A 47-year-old man had a deep venous thrombosis and shortness of breath, findings that prompted a CT angiogram of the chest. The official CT report described bilateral pulmonary thromboemboli, and the patient received an inferior vena caval filter. Shortly thereafter, 2 other staff radiologists read the CT angiogram as normal. When the patient got his hospital bill, his shortness of breath understandably returned.

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### *Case 3.*

A 34-year-old woman underwent cranial CT for dizziness. When the CT report described lytic lesions in the skull suggestive of malignancy, her physician immediately ordered CTs of the chest and abdomen looking for the “primary,” and obtained a slew of tests for multiple myeloma. All produced normal results. After \$23,600 of unnecessary testing, a neuroradiologist interpreted the lytic skull lesions as venous lakes—a benign, normal variant.

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## **TABLE III.** Limitations of Computed Tomography

- ❑ Not always available
- ❑ Cannot replace a pertinent medical history or physical examination
- ❑ Cannot substitute for examining the spinal fluid
- ❑ Cannot provide histologic evidence

# What Should Be Done?

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Computed tomography is a magnificent diagnostic procedure. Its indiscriminate use, however, is rampant and may be doing more harm than good.

## **What, then, should we do about this situation?**

**First,** all health-care professionals should use CT only when no other test or procedure can supply the information needed.

**Second,** all radiologists, particularly those who deal with children, should strive to reduce the radiation dose in each patient to the lowest level capable of yielding acceptable image quality.

**Third,** They should also question the use of CT when the indications do not seem appropriate.

**Forth,** The faculty of every medical school should bring these issues to the attention of students and house officers.

# Coda

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- ❑ The good doctor knows what to do and when to do it.
- ❑ But the very good doctor knows what not to do and when not to do it.
- ❑ In that light, I hope you will think twice before ordering your next CT scan.





*Thanks*

*For Being There*

