CT scanning

ICRP Symposium

Oct. 25, 2011

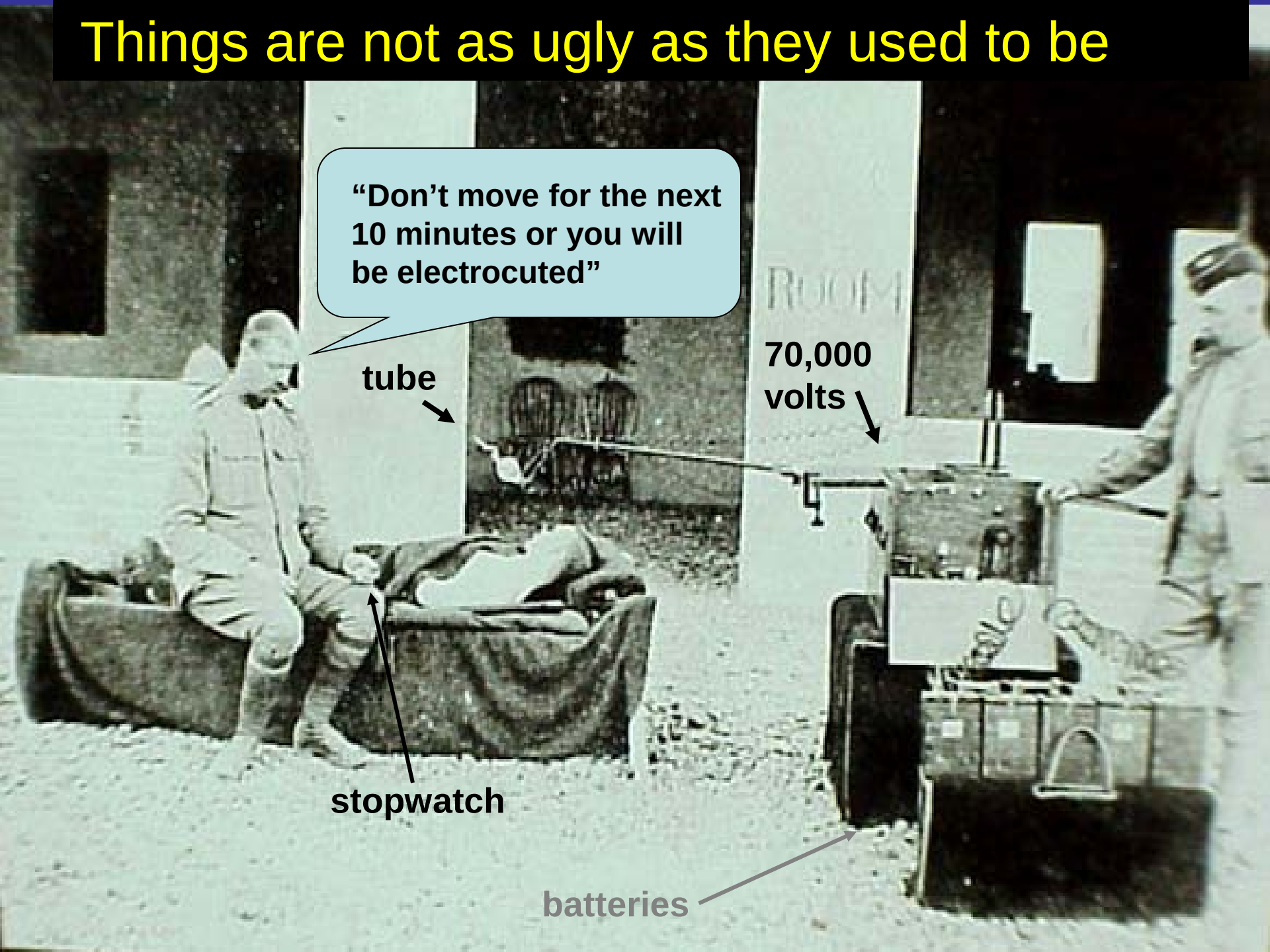
Bethesda, MD

Fred Mettler

NM VAHCS

Albuquerque NM

Things are not as ugly as they used to be

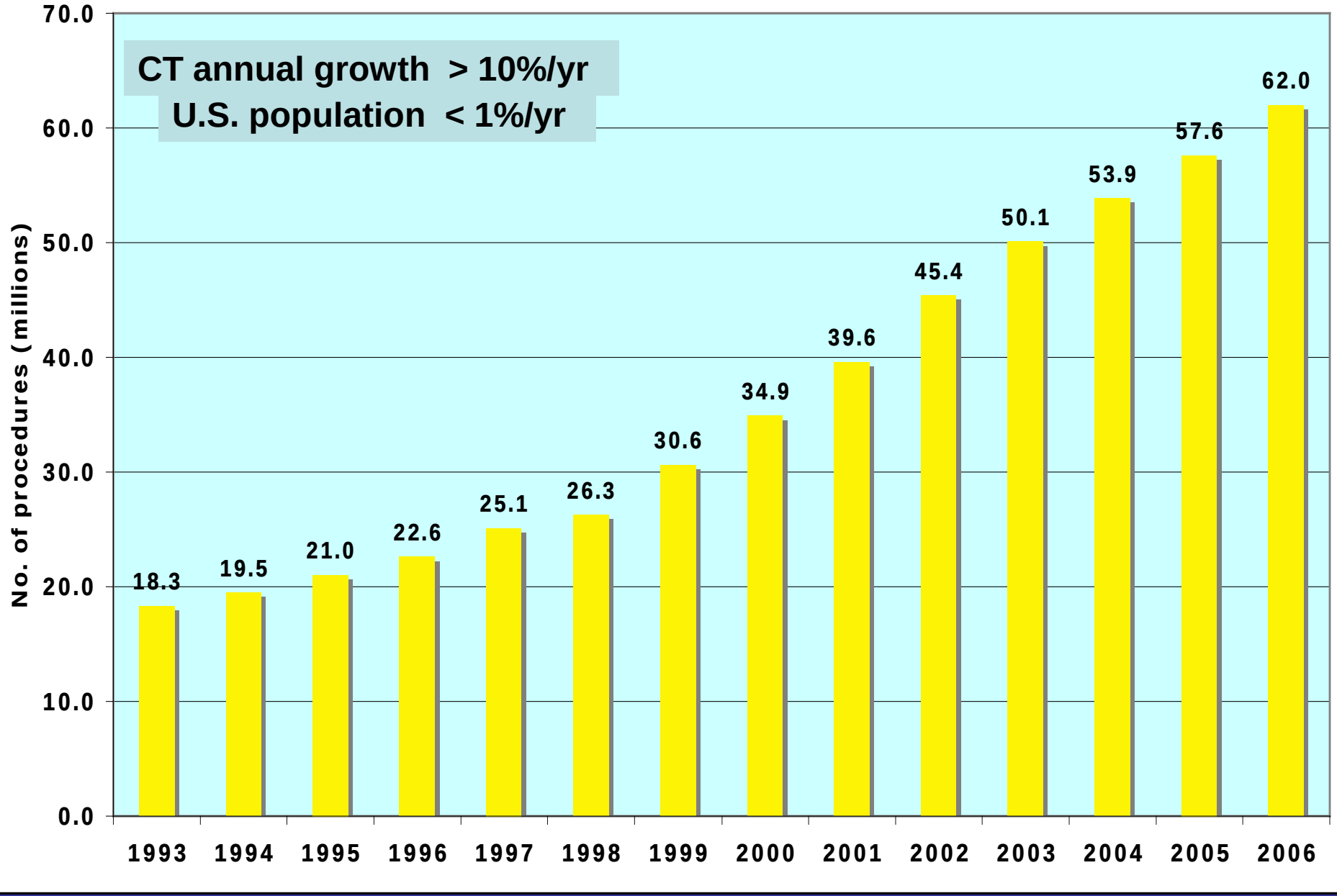


3 million 1982

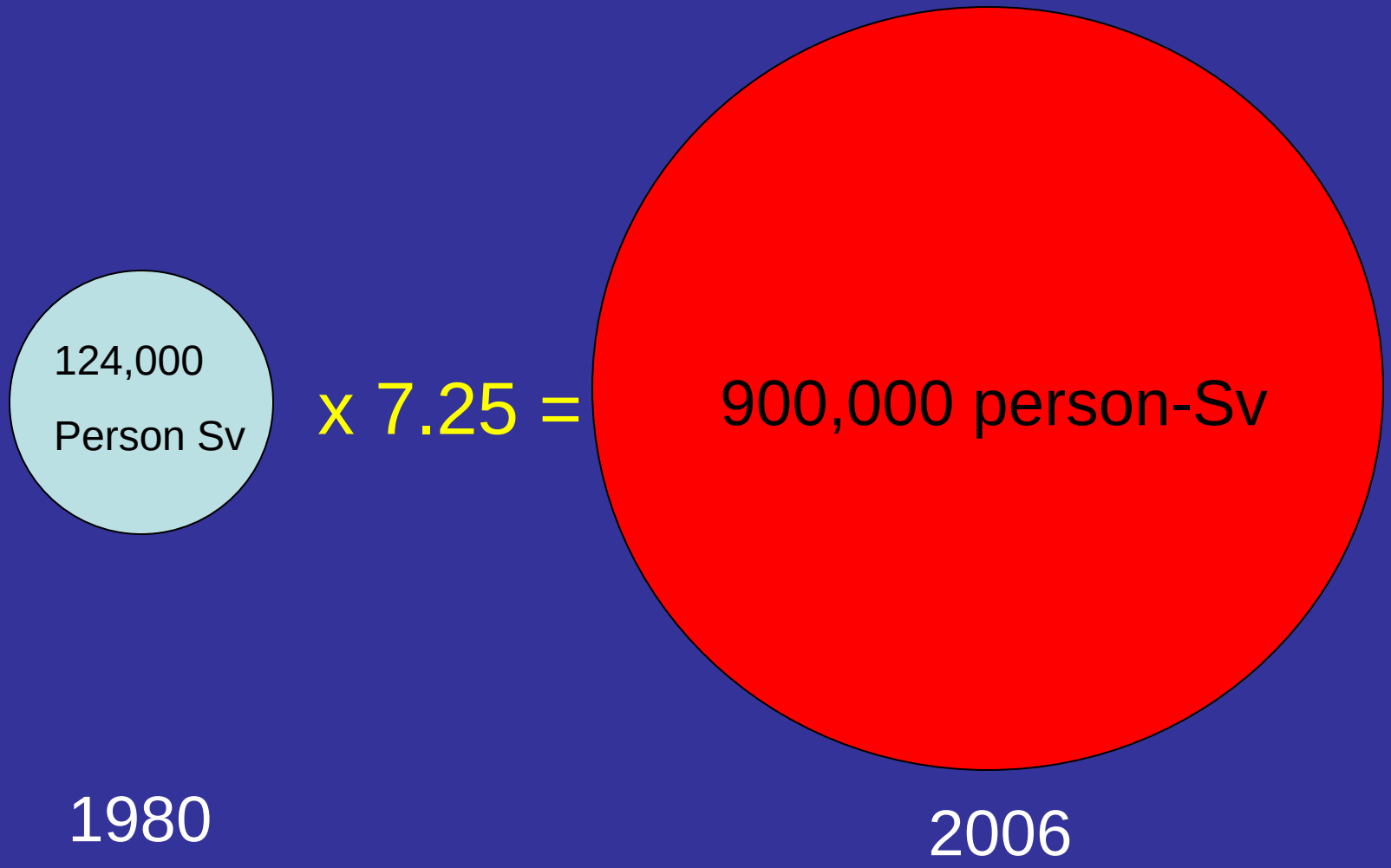
1995 21 million

2007 70 million

CT scans by year in U.S. (millions)



Collective annual population dose from medicine has increased over 700 percent

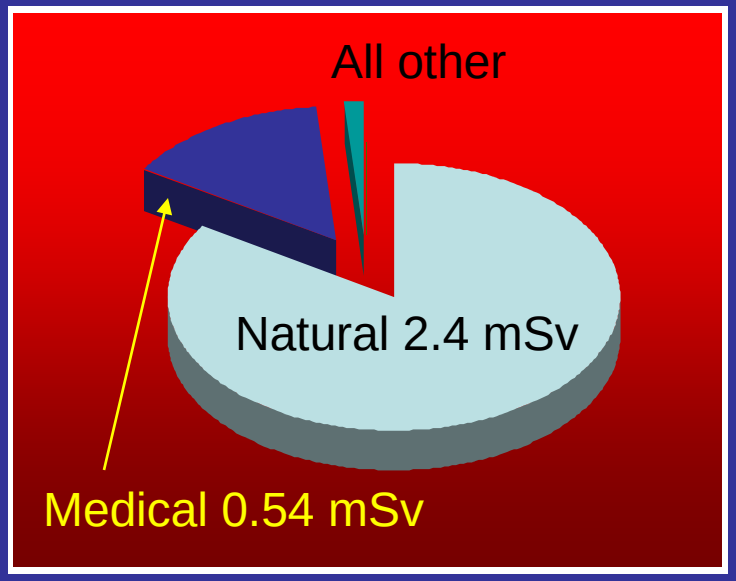


Bad

Regarding dose we were pretty much caught off guard

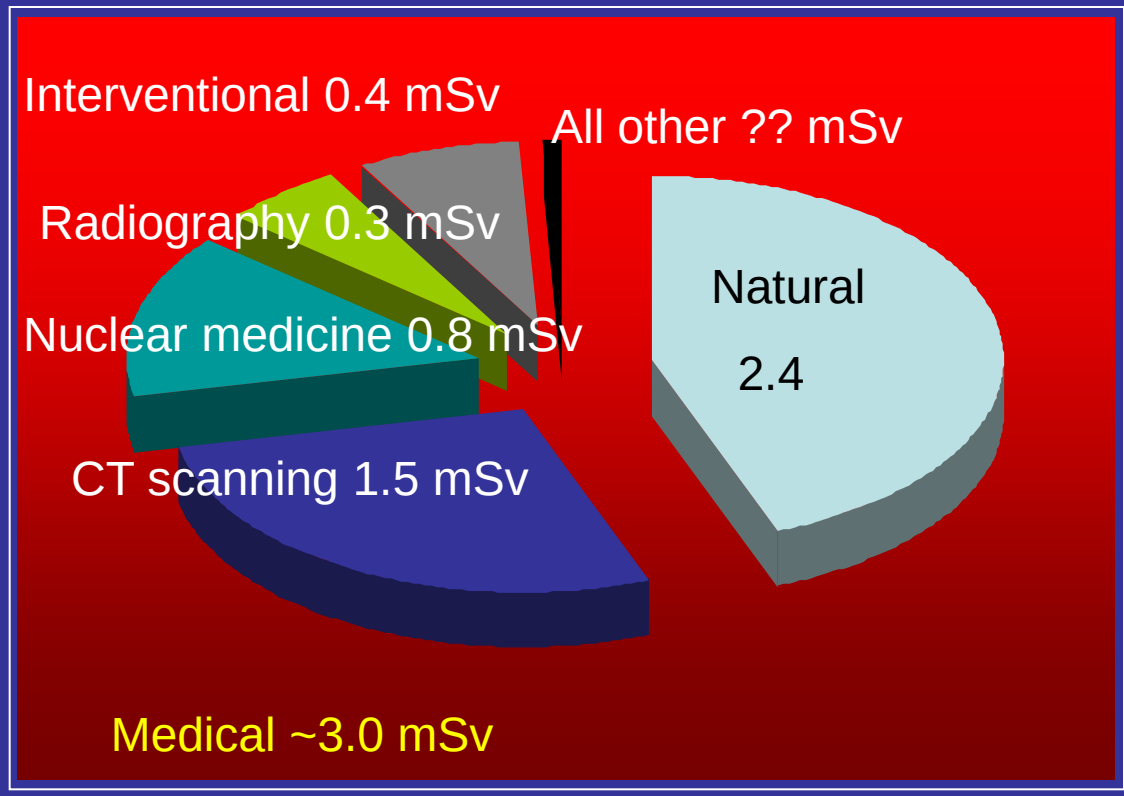
Good or bad ?

U.S. 1980



Total 3.0 mSv per capita

U.S. 2006

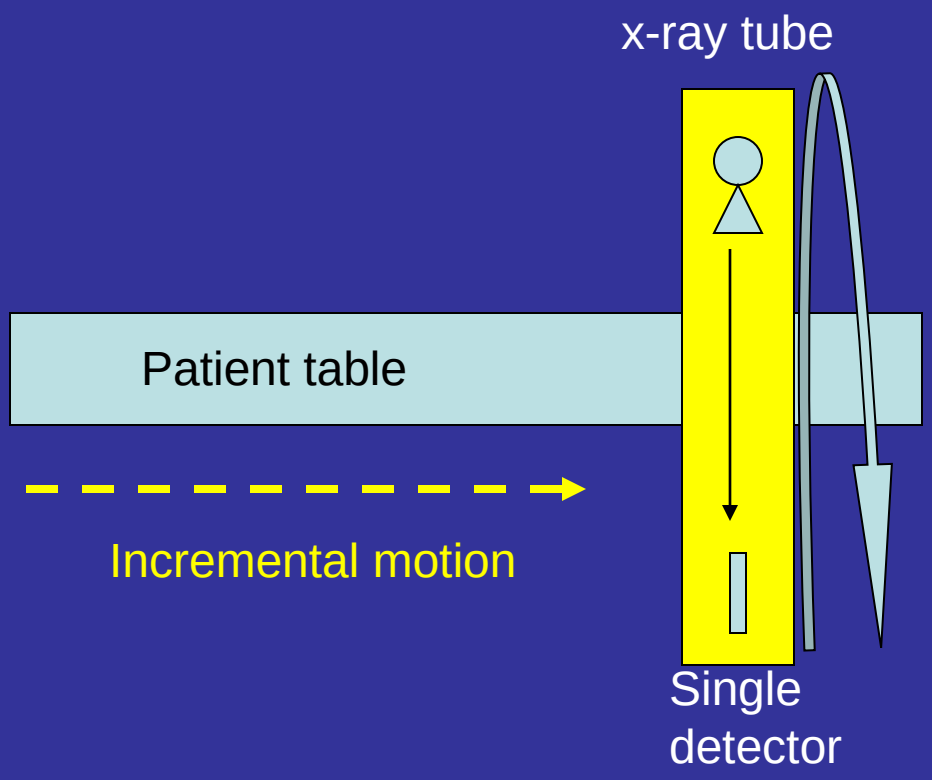


Total ~ 5.4

Computed tomography (CT scan)

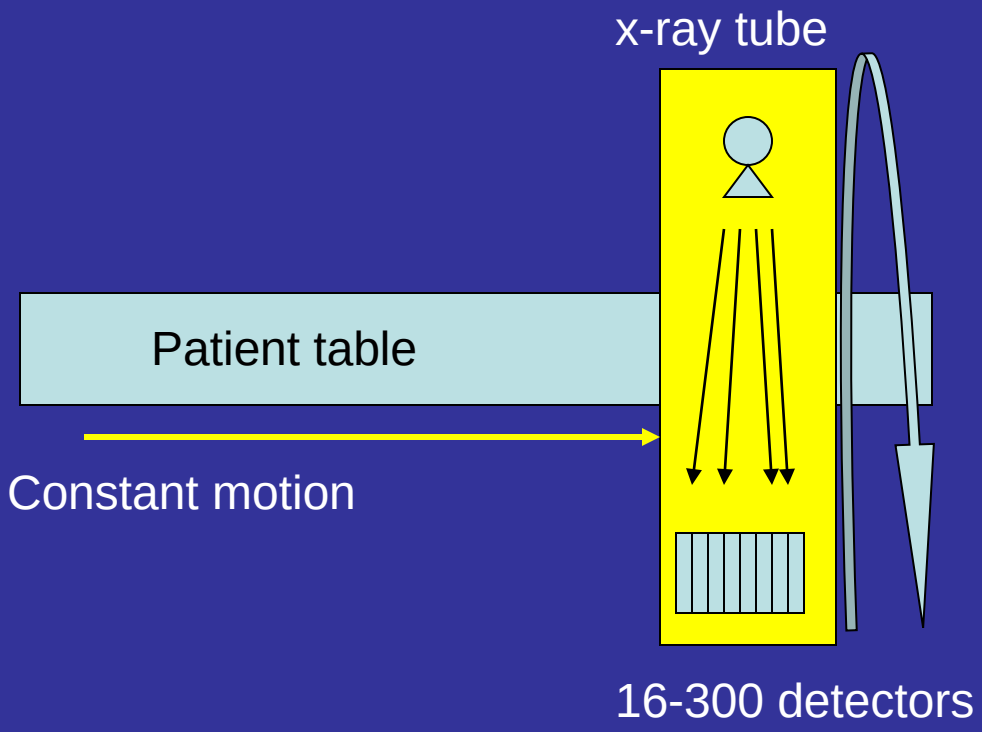
Recent advances in machine technology have led to more applications and markedly increased usage

Single slice CT scanner



Scan time ~ 10-20 minutes

Multislice multidetector helical CT scanner
(new scanners are 1000x faster)



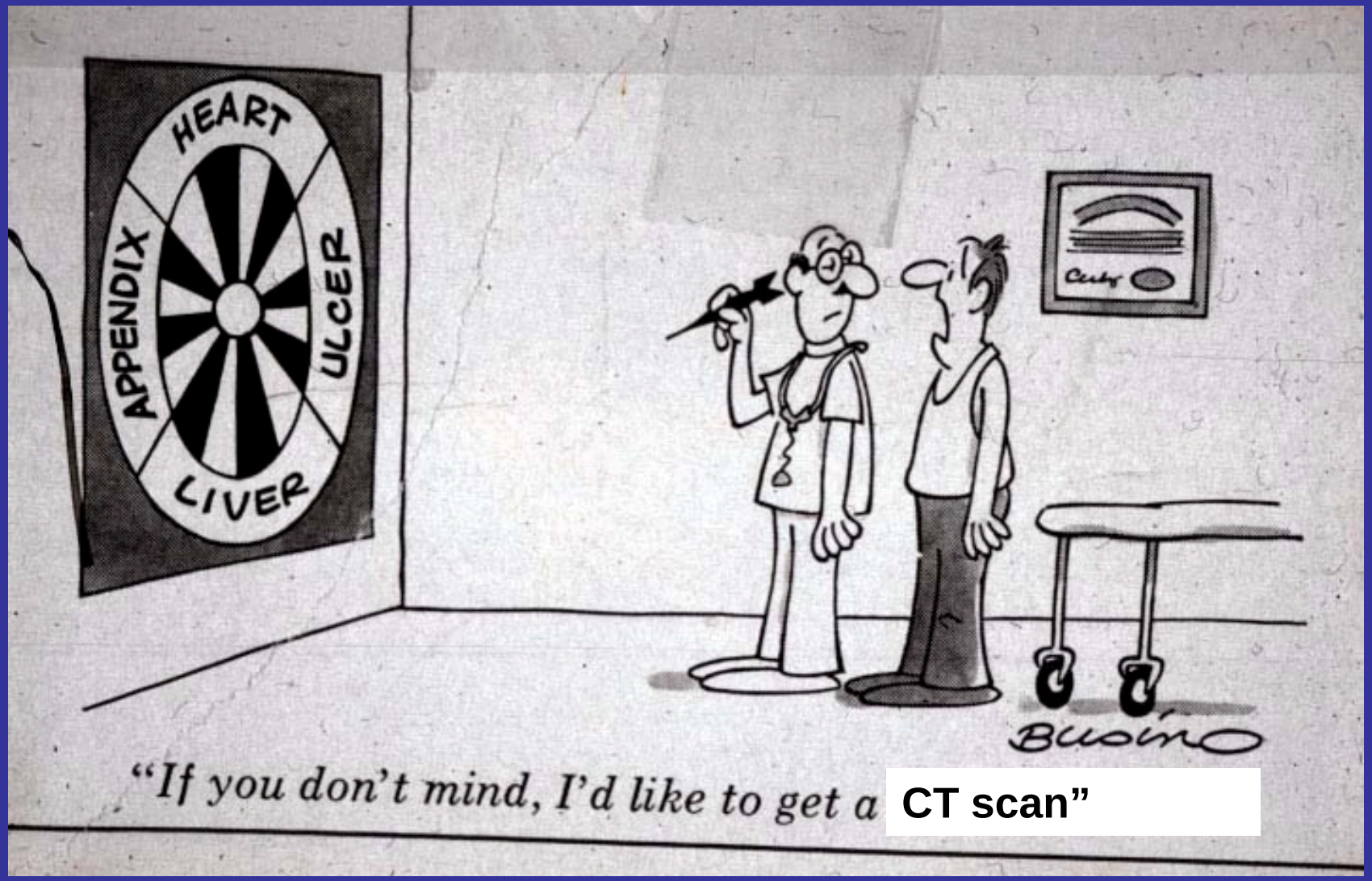
Now 300 slices/images in 0.3 second

Good

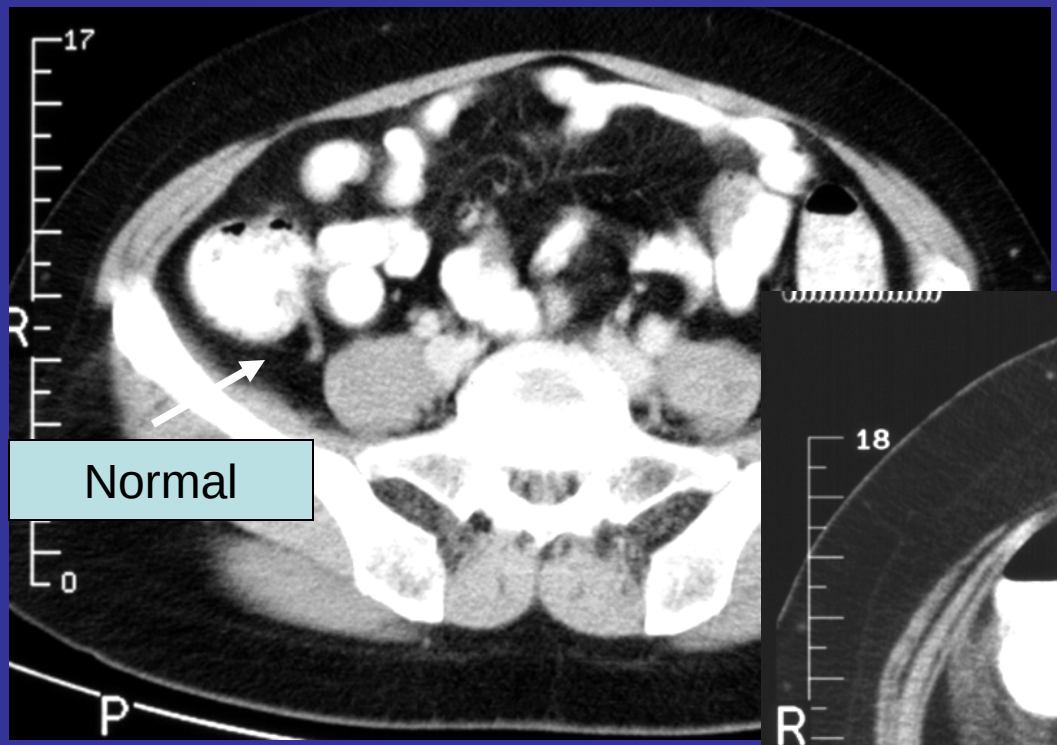
Uncertainty reduced for patient and physician

Good

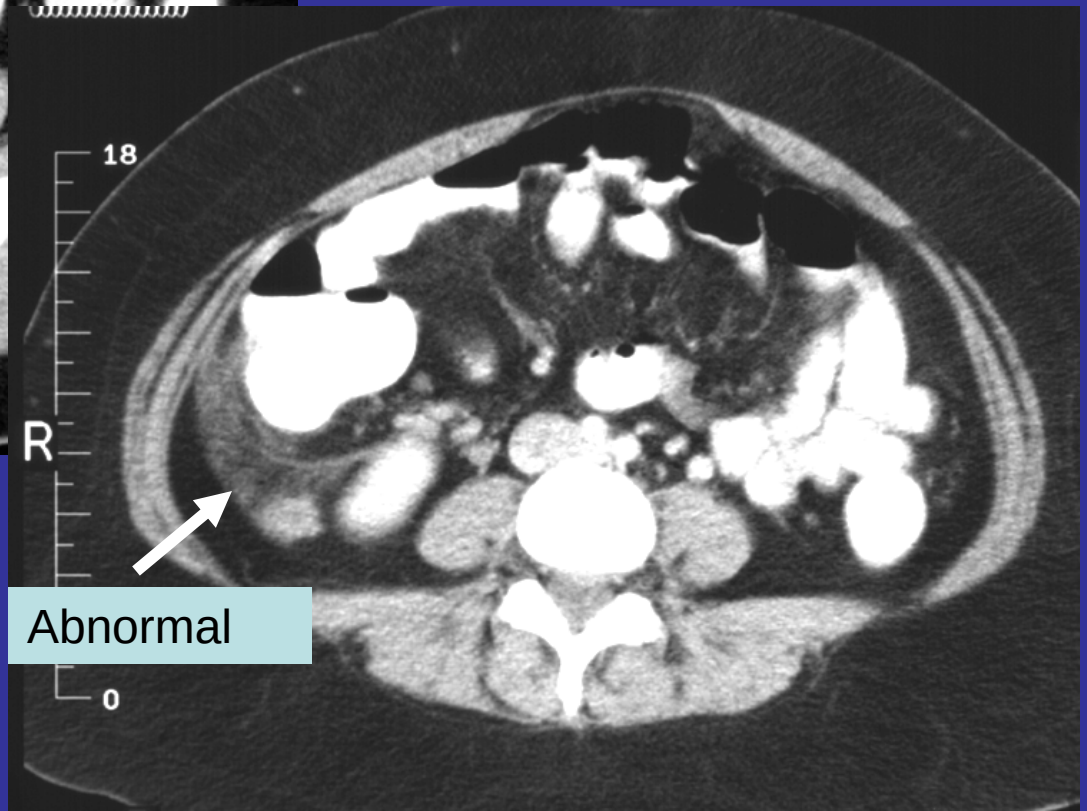
Uncertainty reduced for patient and physician



Good Appendicitis



Normal



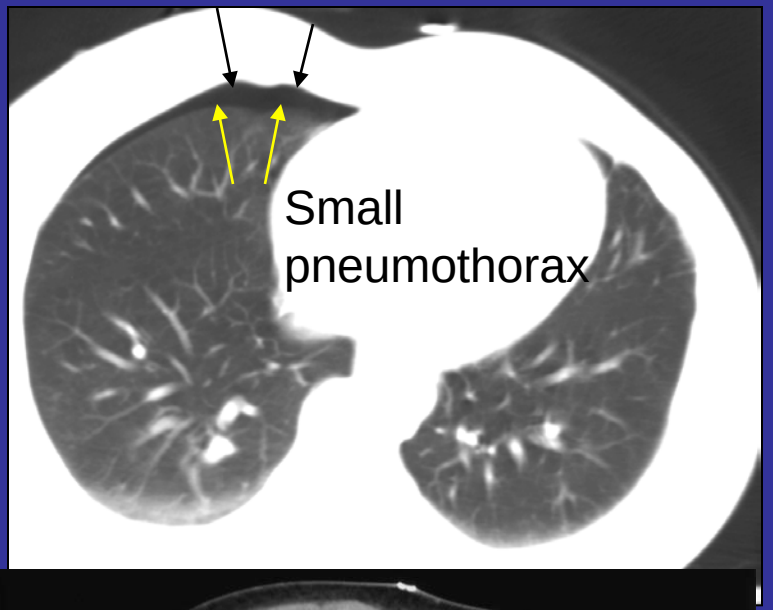
Abnormal

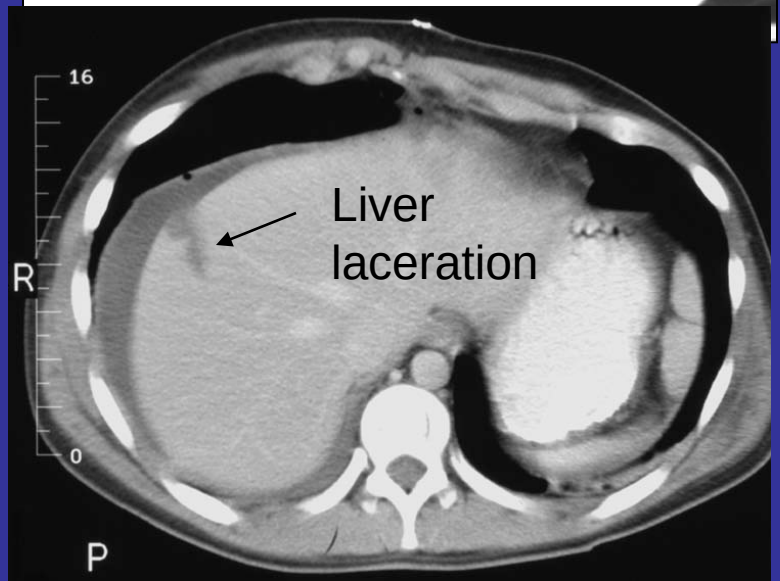
Good Trauma

CT scan of head, neck, chest, abdomen and pelvis

10-30 seconds

Many significant findings are seen such as brain hemorrhage, liver lacerations which are difficult or impossible to see on plain x-rays





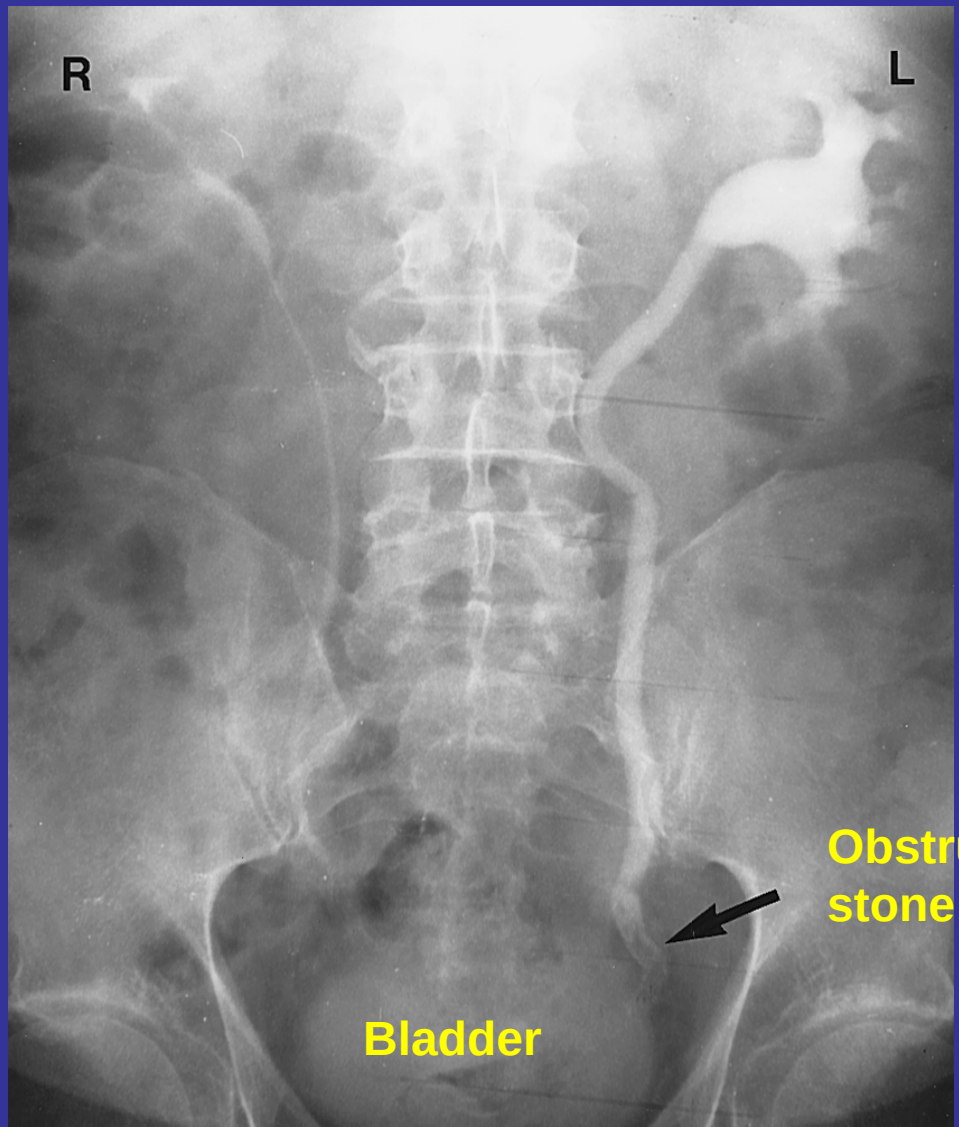
Good replacement of IVPs

Intravenous urogram (IVP)

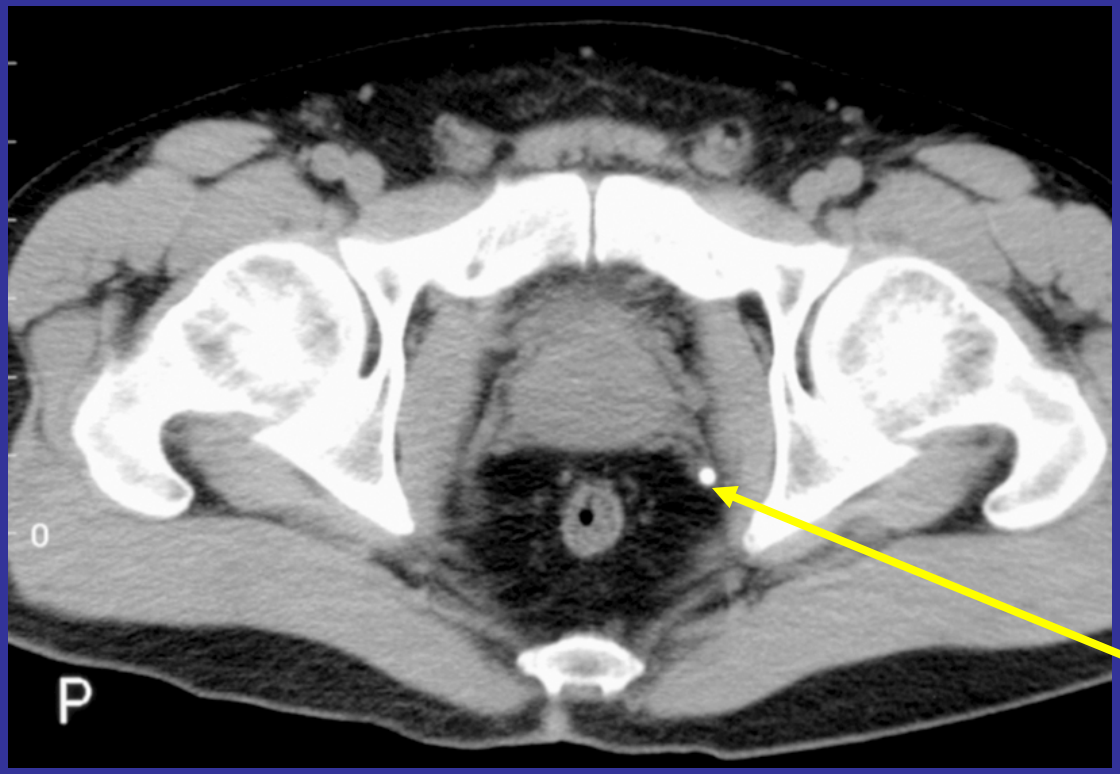
Requires injection of intravenous contrast

Contrast reactions in 5% of patients

30 minutes

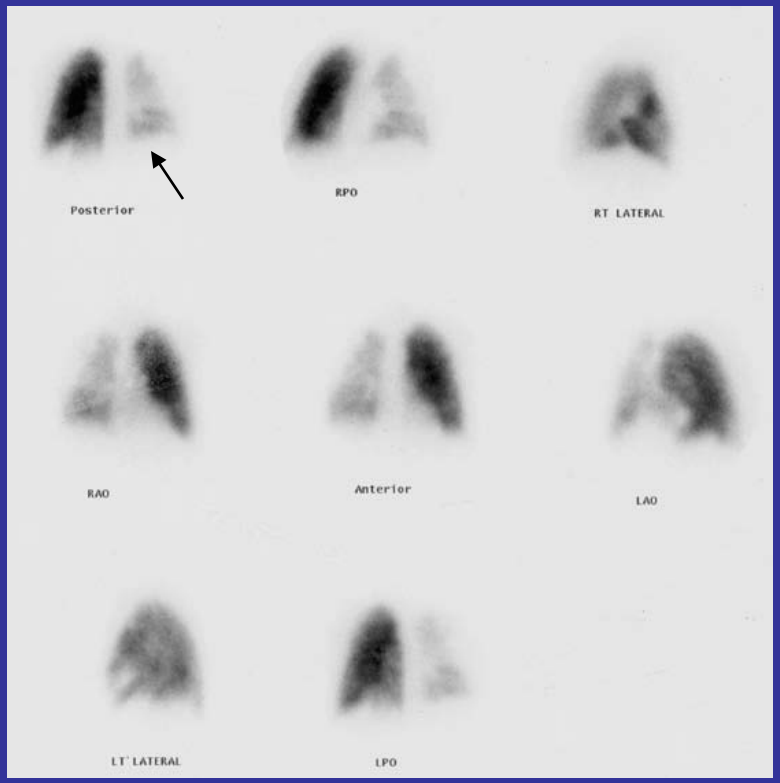


CT scan 30 seconds.
No intravenous contrast

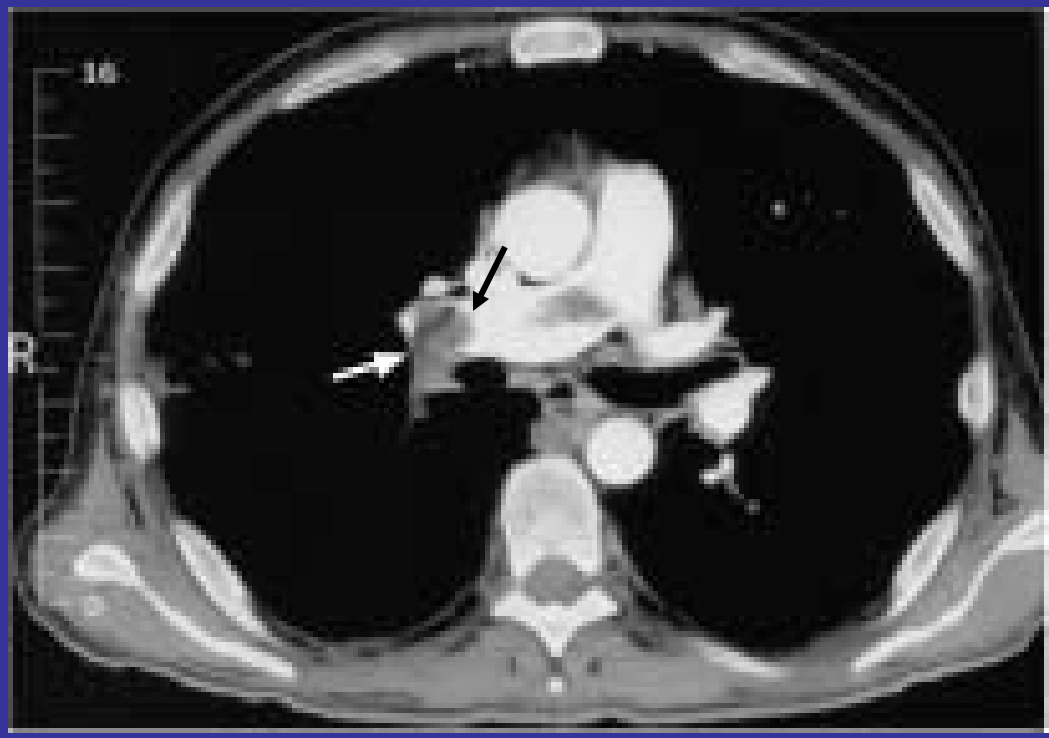


4mm stone in
distal ureter

Good replacement of other techniques with improved accuracy

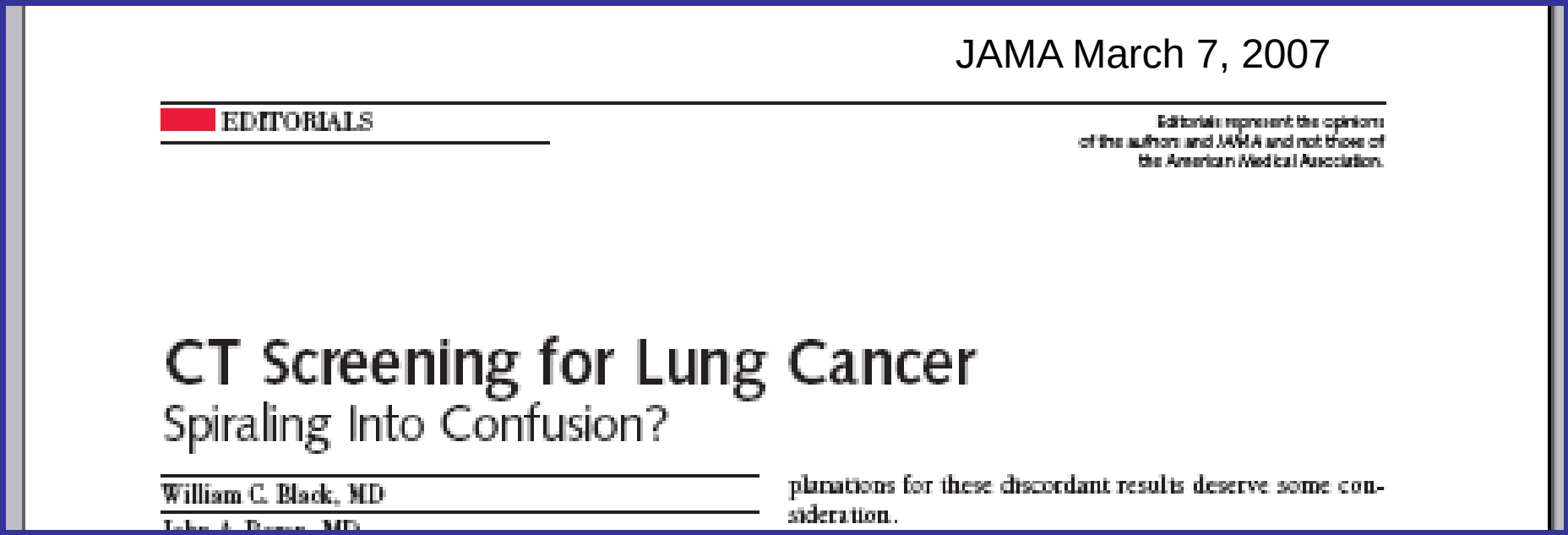


Reduced blood flow to one lung- nonspecific



Large clot in right main pulmonary artery – clear diagnosis

Bad confusion in the literature



JAMA March 7, 2007

EDITORIALS

Editorials represent the opinions of the authors and JAMA and not those of the American Medical Association.

CT Screening for Lung Cancer
Spiraling Into Confusion?

William C. Black, MD

planations for these discordant results deserve some consideration.

Bach PB et.al. JAMA 2007

144 cancers found 44 expected

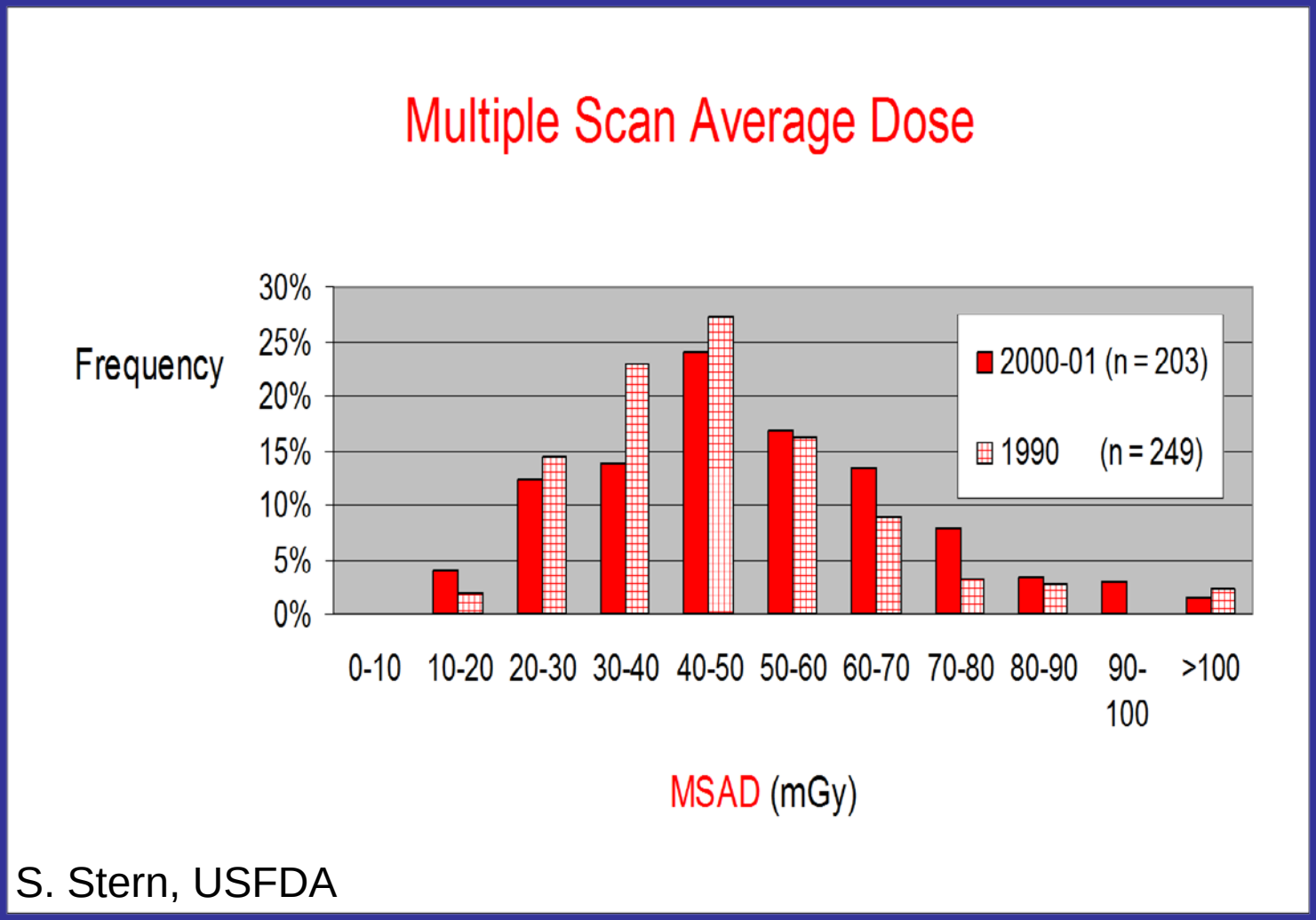
No reduction in mortality

38 deaths vs 38.8 expected

Henschke et.al. NEJM 2006

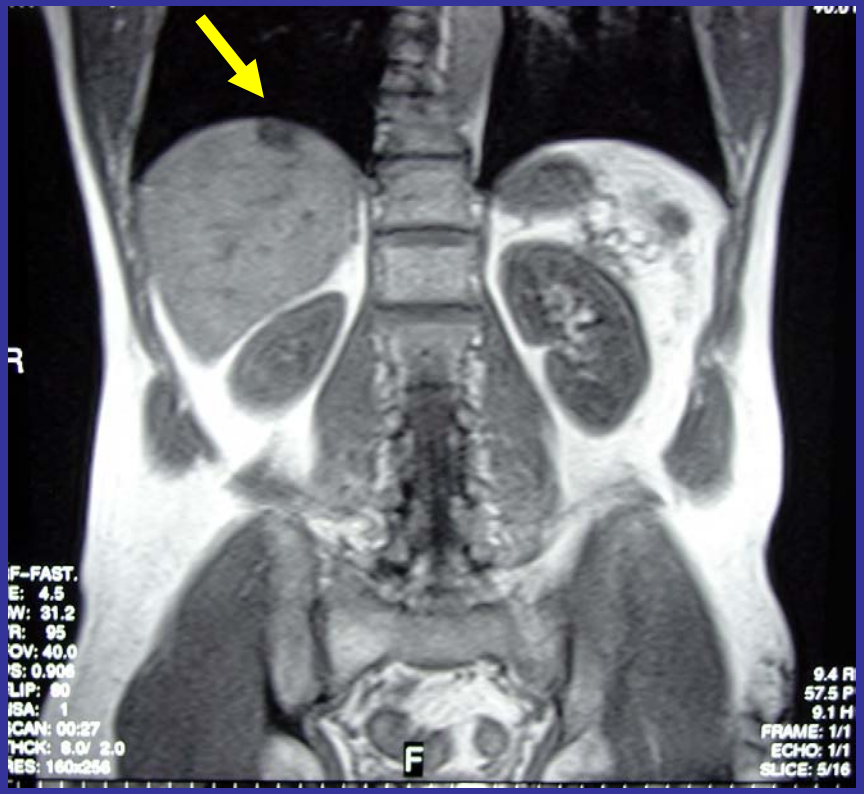
CT scanning can prevent 80% of lung cancer deaths

Ugly Variation in CT scan doses among institutions and by scanner model



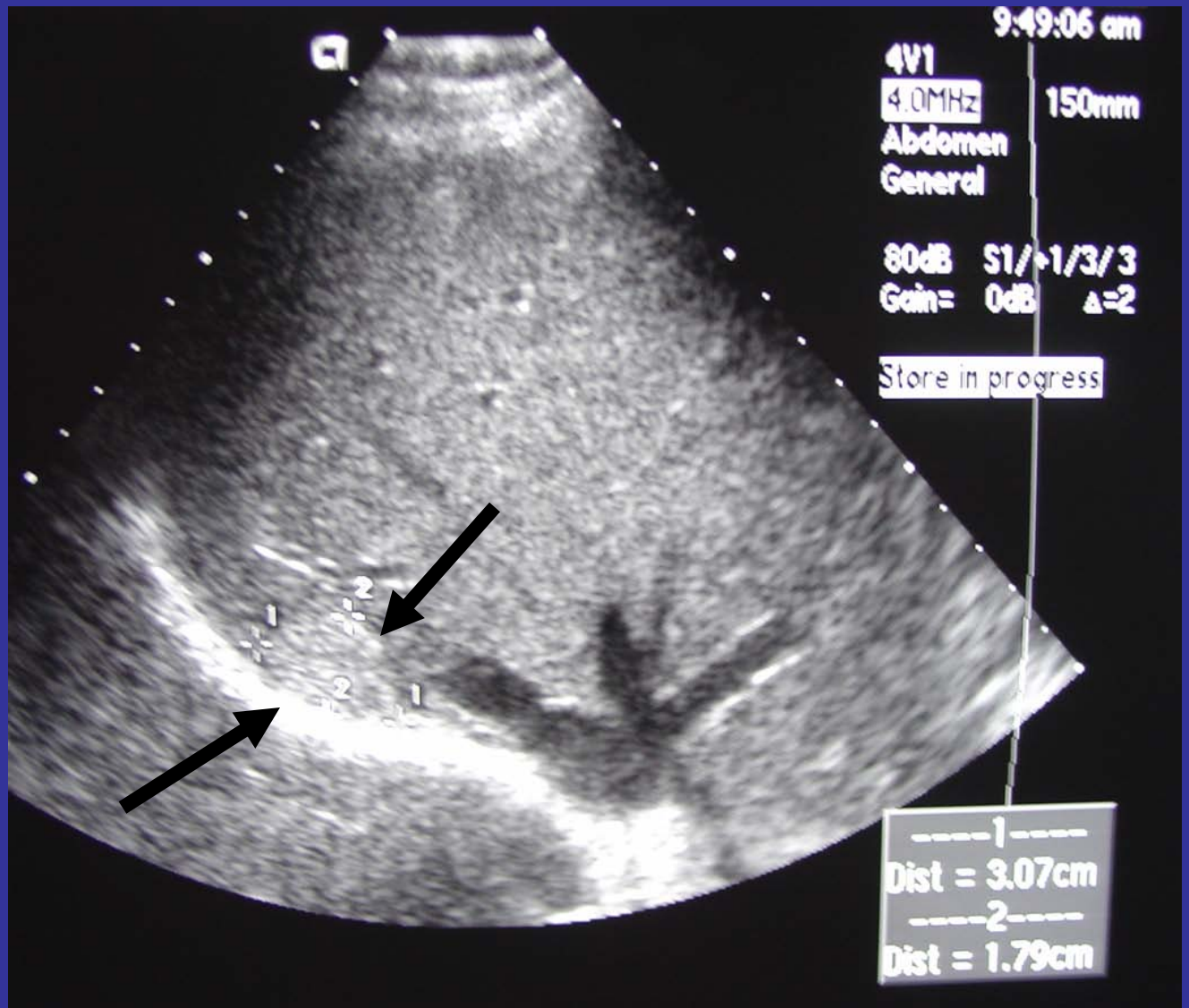
S. Stern, USFDA

Bad Radiologist's repetitive hedging

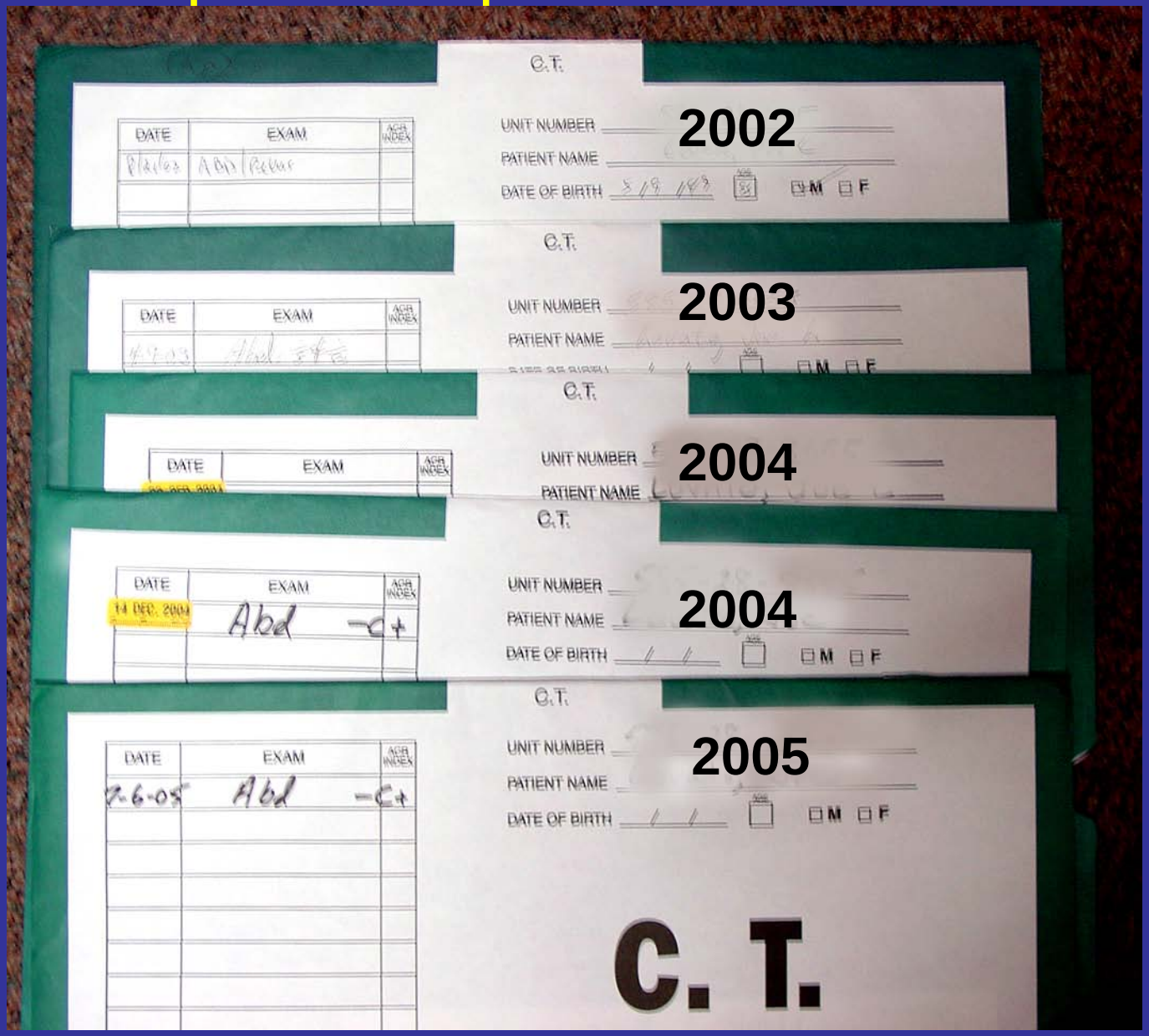


2005 MRI to "evaluate liver lesion"

2004 Ultrasound shows characteristic hemangioma

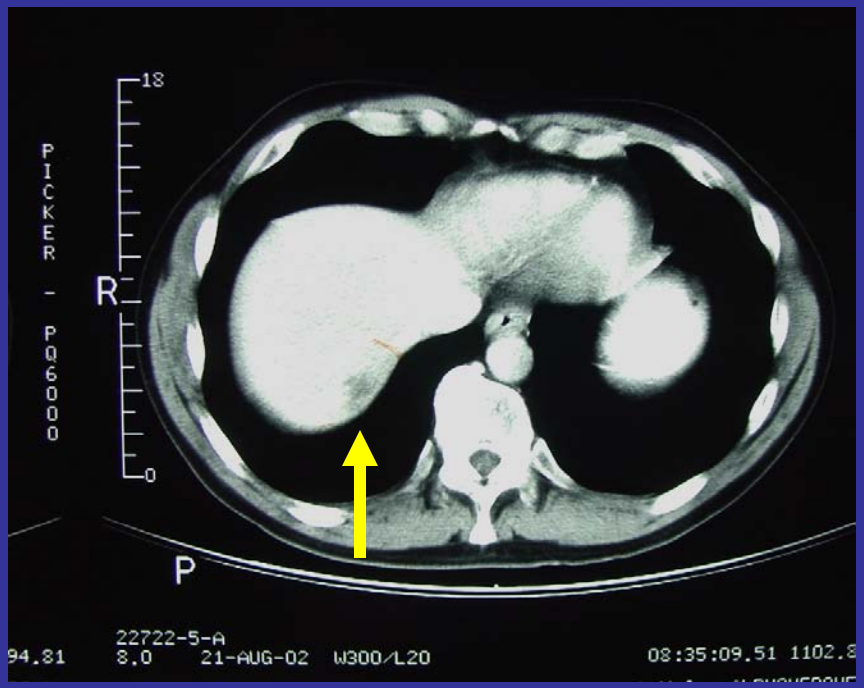


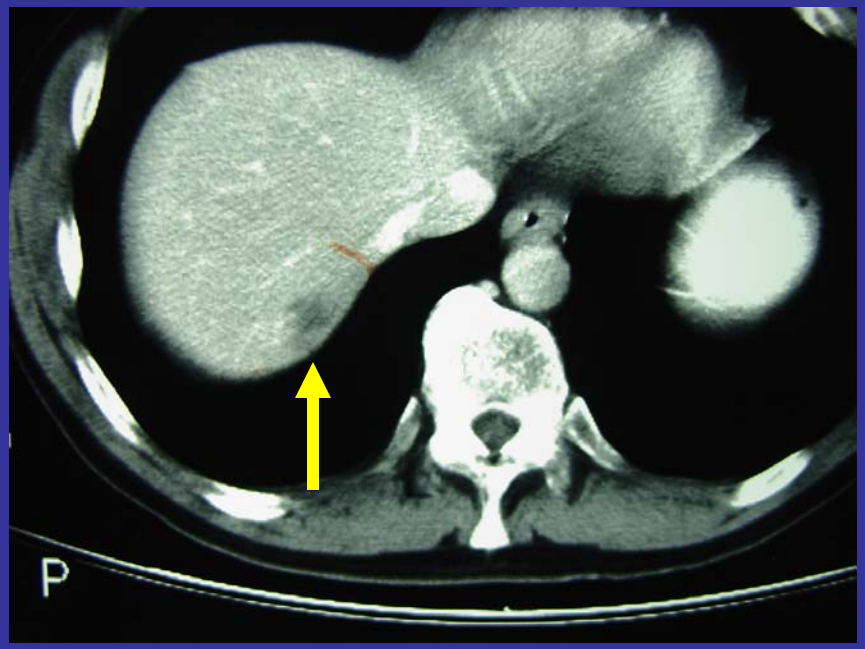
Surprise 4 prior CT studies



CT scan 2002

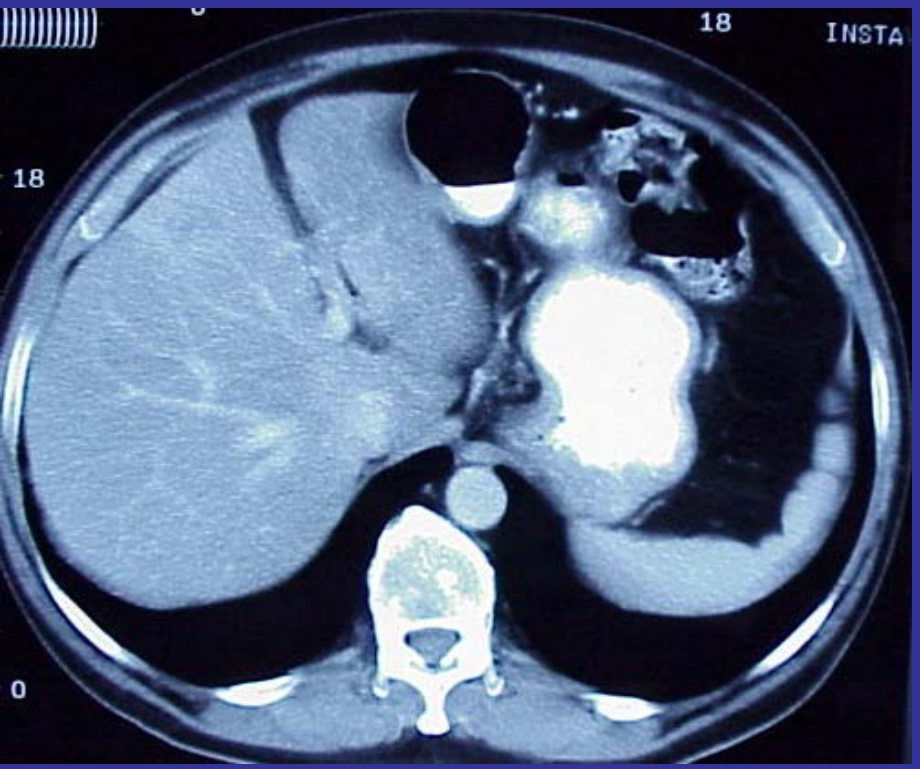
No change over any scans in prior 3 years but "cannot entirely r/o neoplasm"

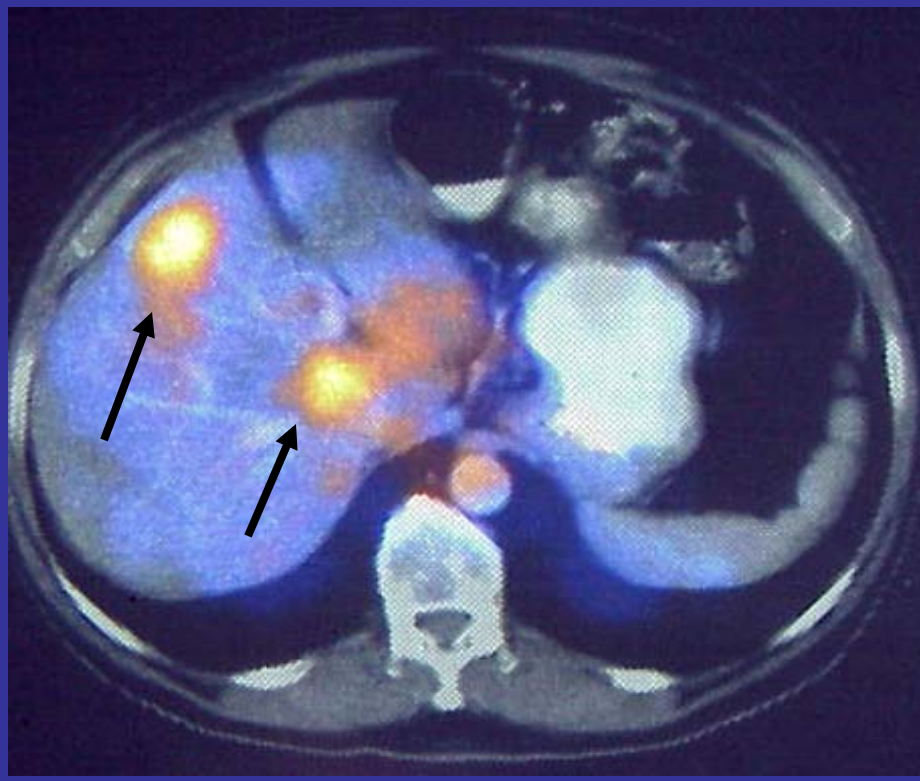




"Judging by your X-rays, I'd say you've been exposed to too much radiation."

Good Hybrid imaging





Bad Self-referral financial incentives

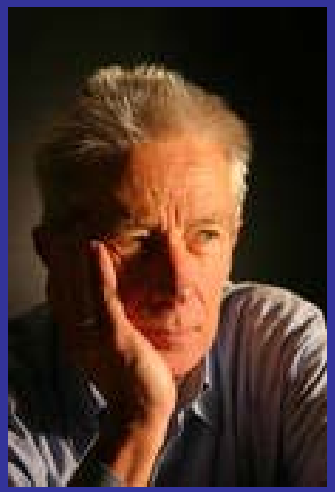
Imaging Opportunities for Urology Physician Pra
Affordable In-Office Computed Tomography Soluti

Procedures Per Day	Days Per Month	Average CPT	Income	FMVL Cost	ROI* Per Month	ROI for 5 Years
1.8	20	$220	$7,950	$7,950	Break Even	Break Even
5	20	$220	$22,000	$7,950	$14,050	$843,000
10	20	$220	$44,000	$7,950	$36,050	$2,163,000

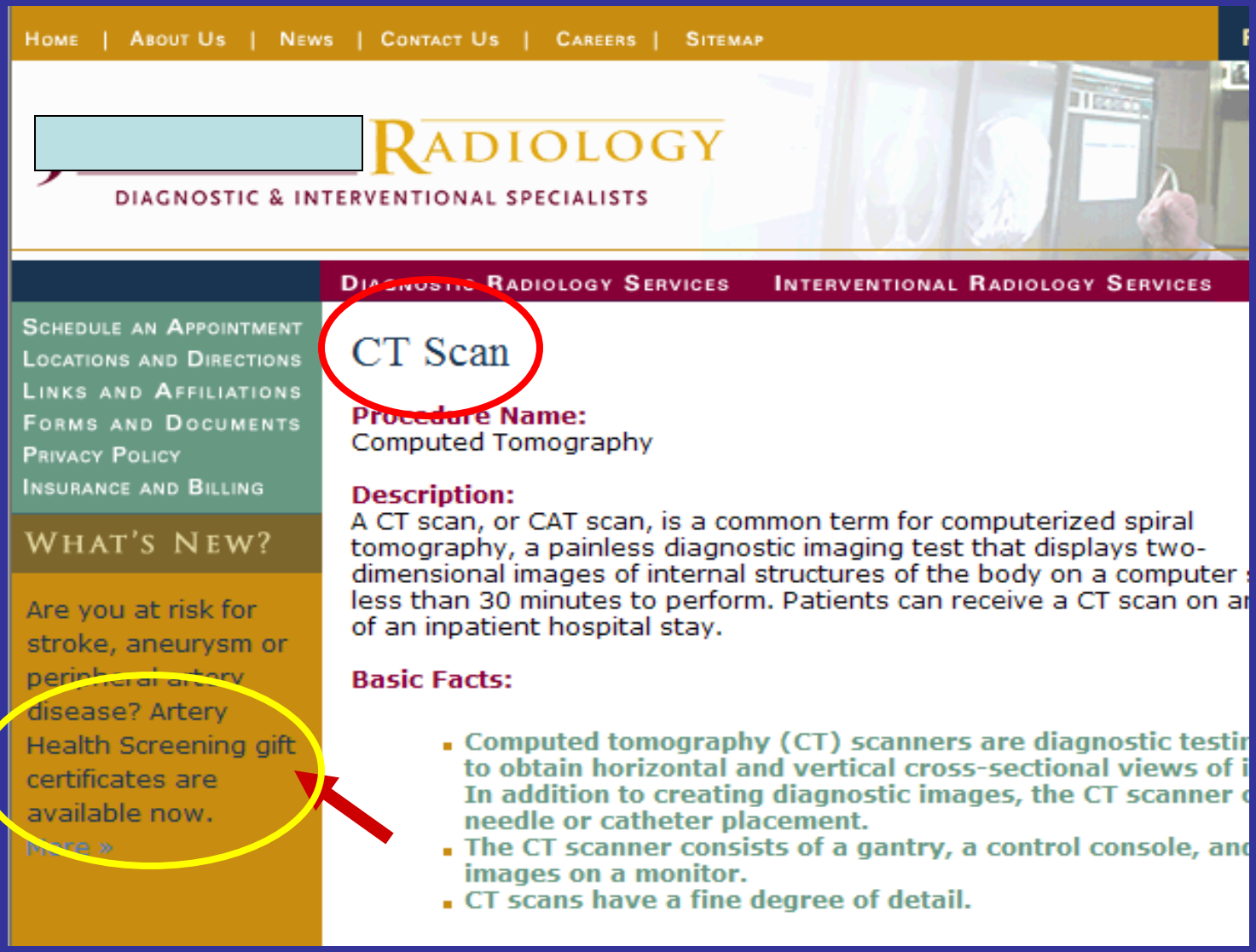
Sample computation – Basic SOMATOM Spirit configuration, based on a 5-year Fair Market Value Lease (FMVL). Prices will vary with additional options. Please consult your Siemens Account Executive for details.
**Return on Investment.*

Ugly

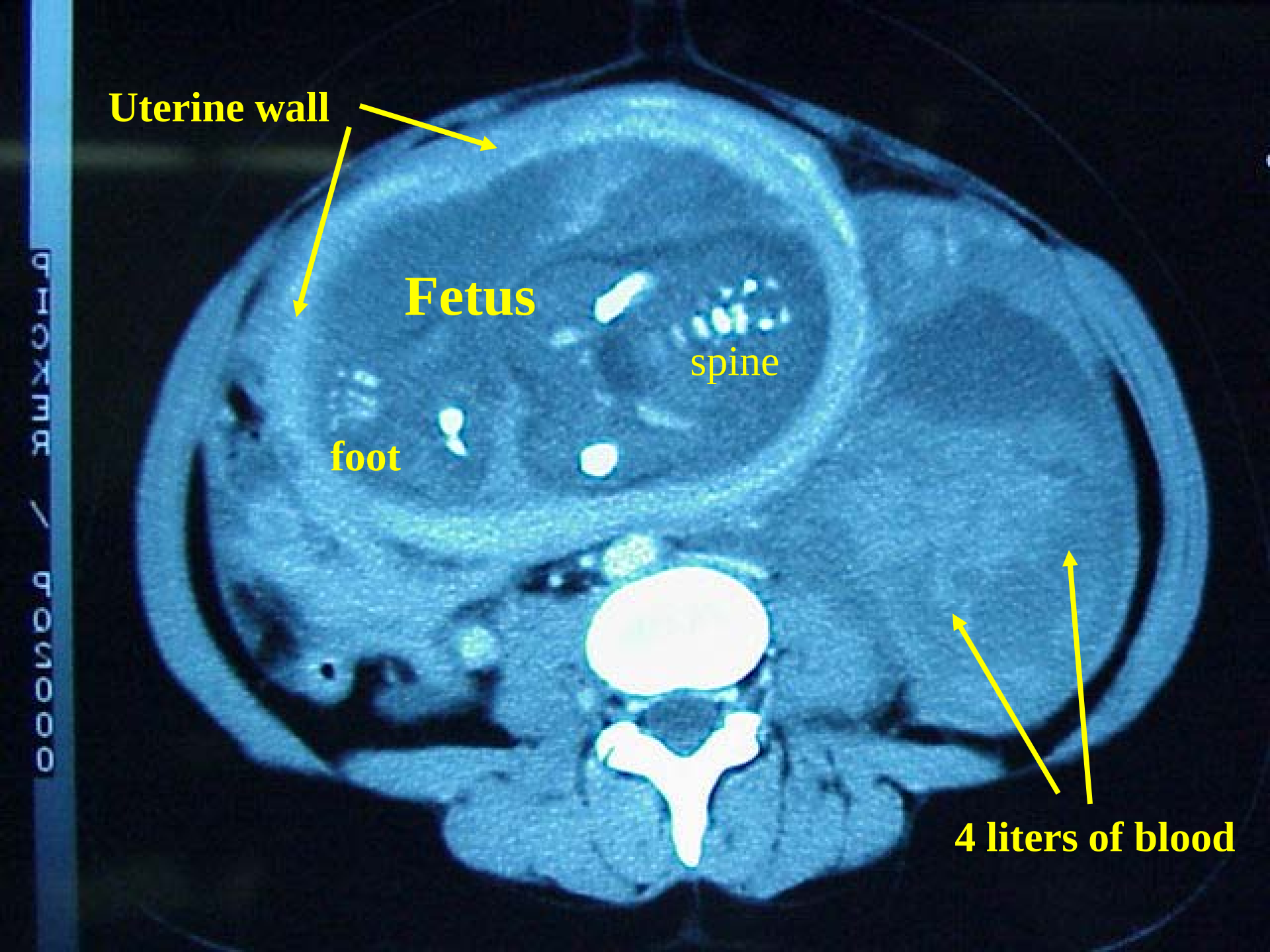
Uncertainty over Obamacare, taxes and the Federal budget has stifled investment and planning



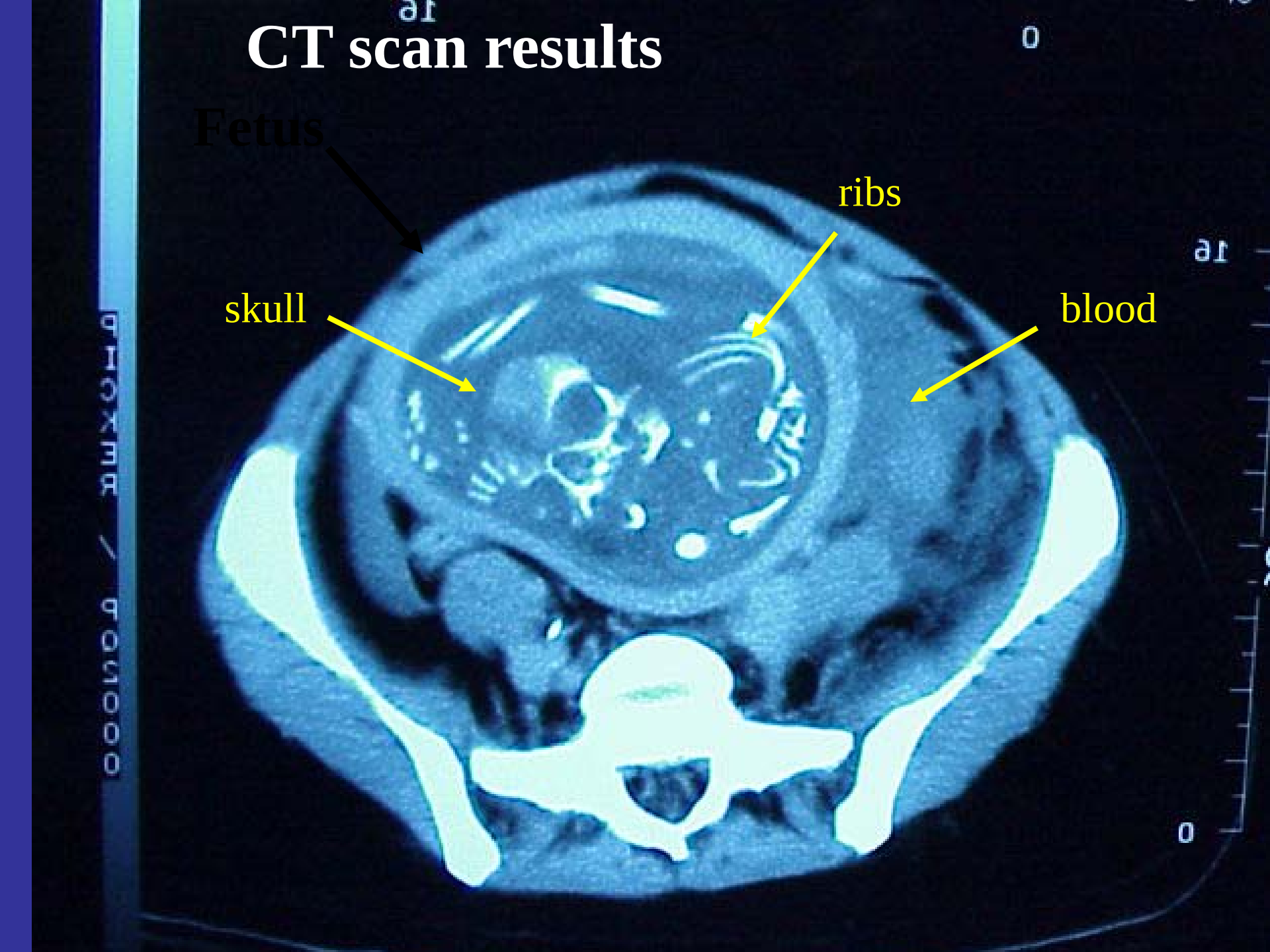
Bad Gift certificates for screening CT scans

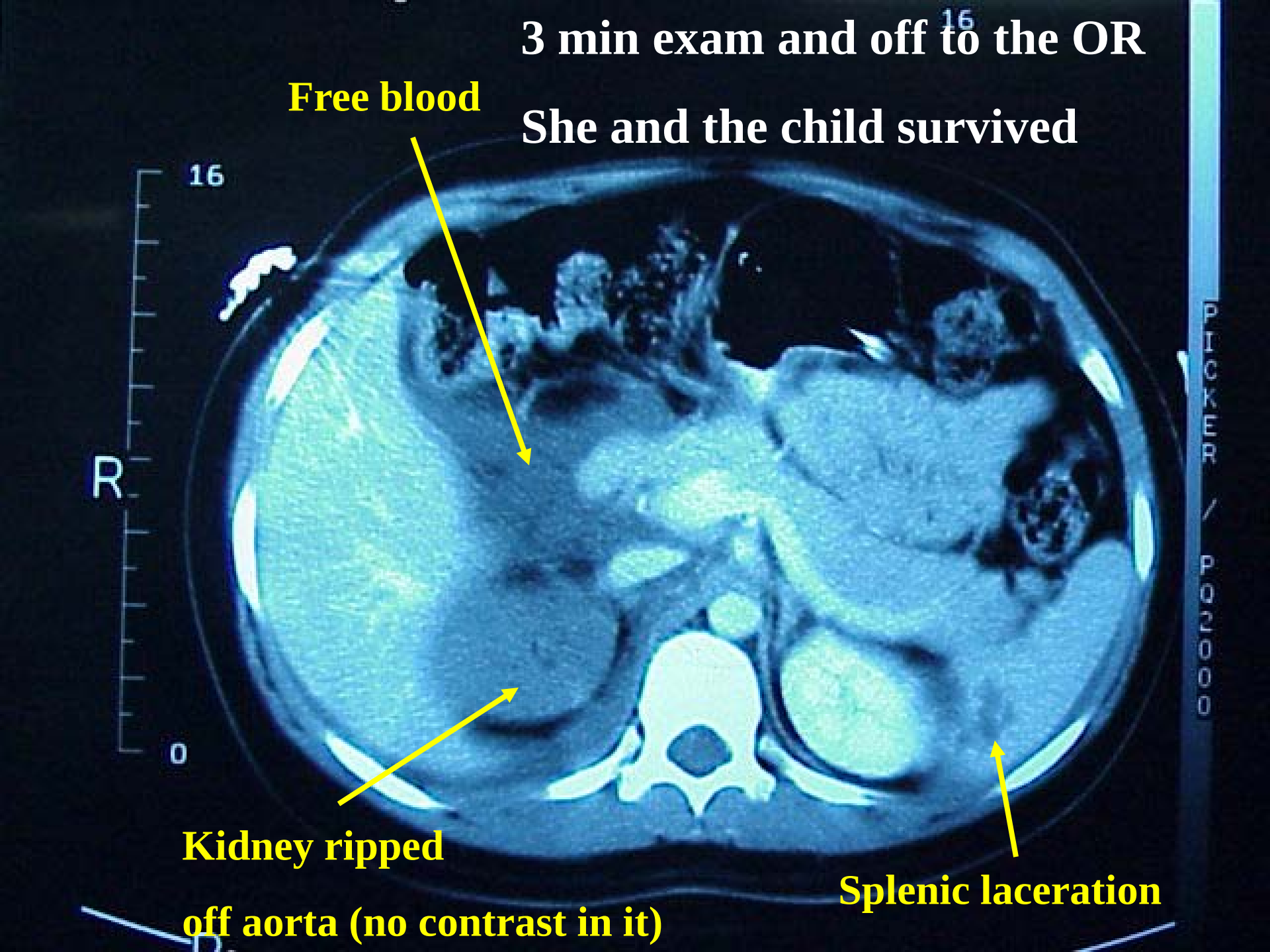


Good Rapid accurate diagnoses especially in the ER


Uterine wall
Fetus
spine
foot
4 liters of blood

CT scan results

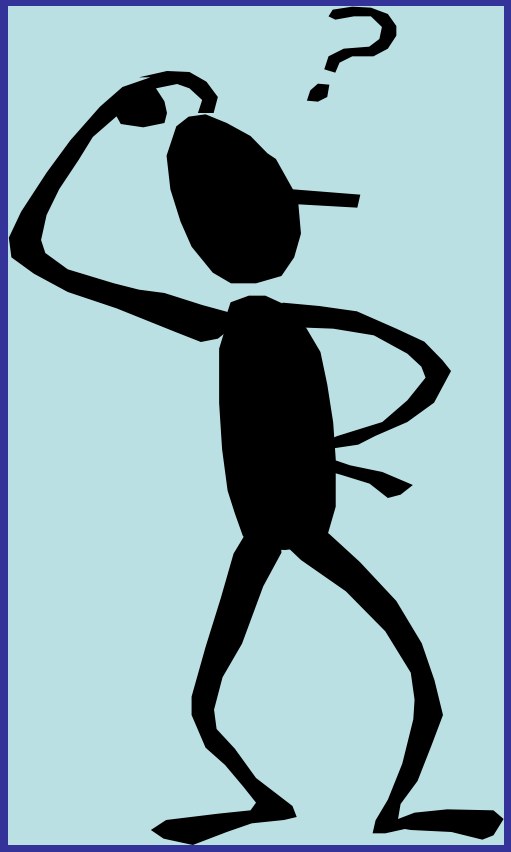



3 min exam and off to the OR
She and the child survived
Free blood
Kidney ripped
off aorta (no contrast in it)
Splenic laceration
16
R
0

Bad

Potential overuse

What does “ABC” stand for

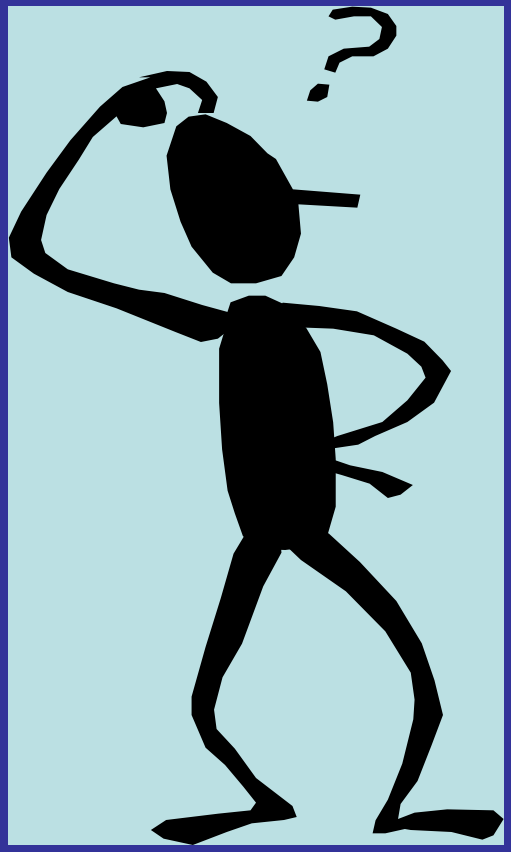


Airway

Breathing

Circulation

What does “ABC” stand for



Airway

Breathing

CT

Ugly

- The urologist or surgeon refuses to come see the renal stone patient until a CT is ordered

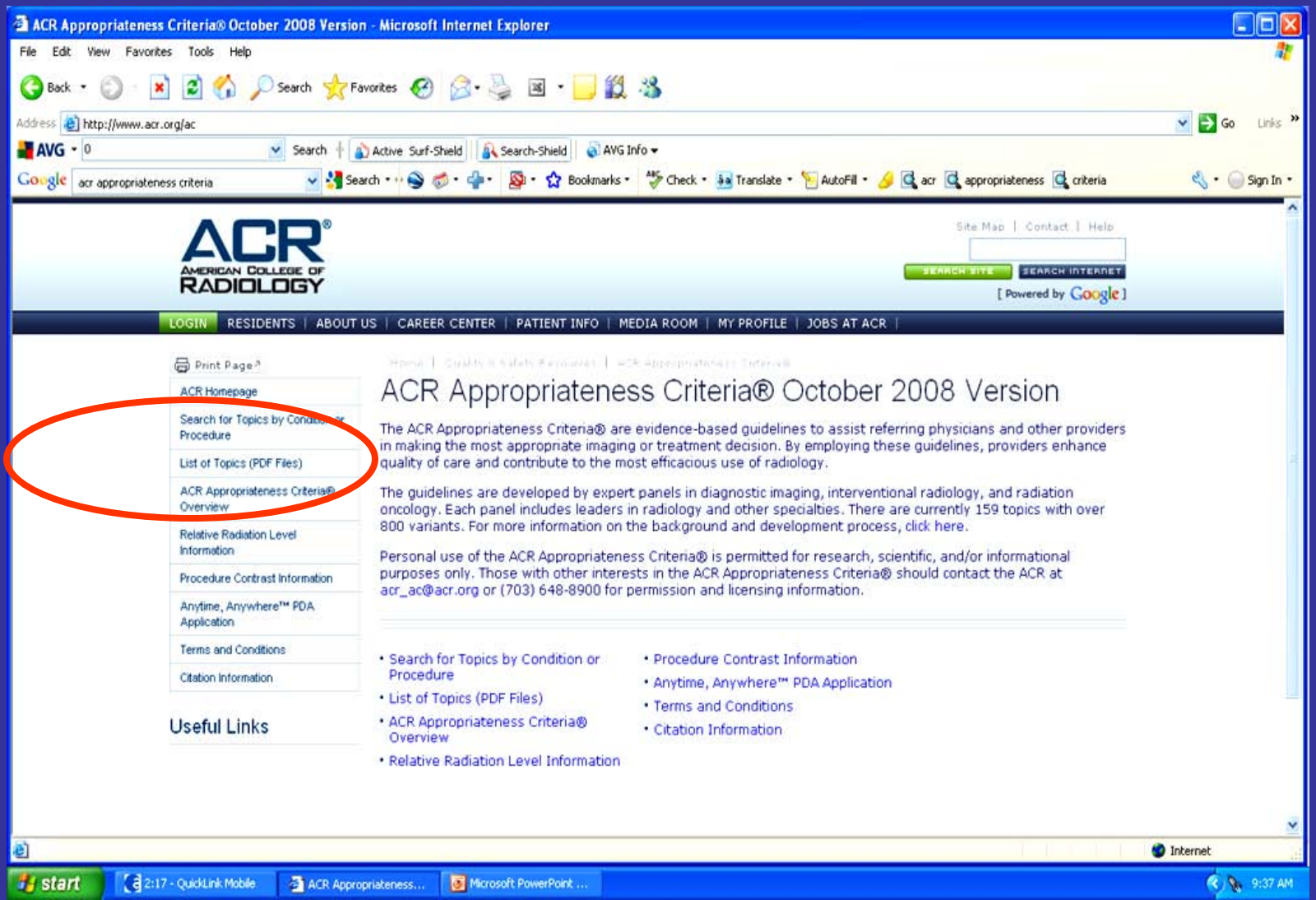
Good and Bad Radiology consultation

- We don’t have time to discuss all CT scans
- A typical department doing 35,000 CT scans per year = 5-6 phone calls per hour *for CT alone*

- Some have 24 hour availability

Good Computer systems

Bad Limited use



Warning - Similar Names

Similar Patients

Please select the correct patient:

Name	DOB	SSN
Vano El Gato	**July 23, 1930**	**144-45-6929**
Vano E	**July 14, 2008**	**144-36-8729**

OK Cancel

Good Computer generated warnings

Attention: Possible radiation issue

Name	DOB	SSN
Cousins Claire	July 14, 1990	144-36-8729

Age 21 6 CT scans done in last 3 months

Continue to order ??

OK Cancel

Machine generated warnings

“ The CT protocol you have chosen has CTDI over the ACR accreditation limit !!”

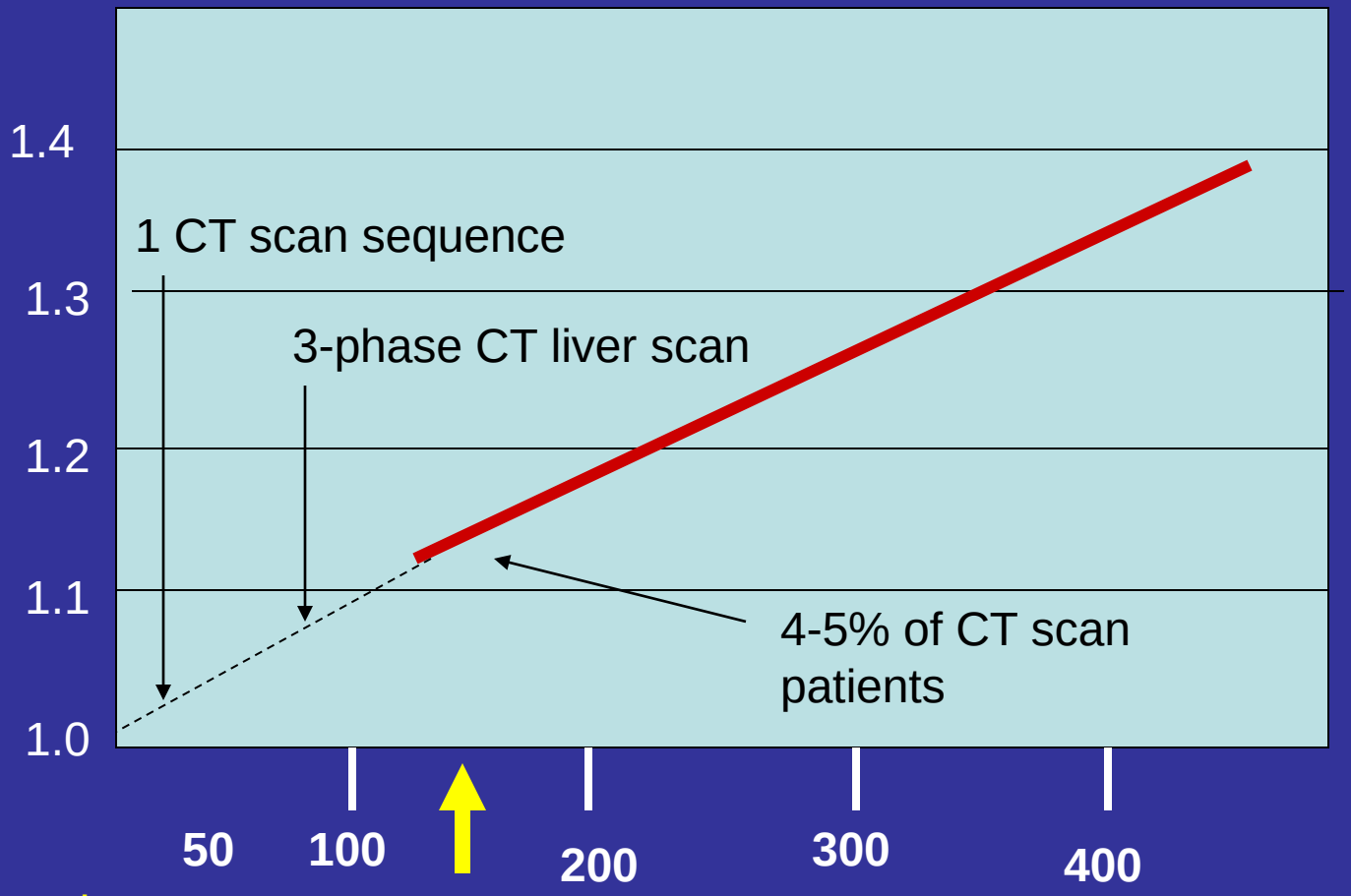
Bad

Inadequate knowledge of dose and risk

Radiology resident

Bad

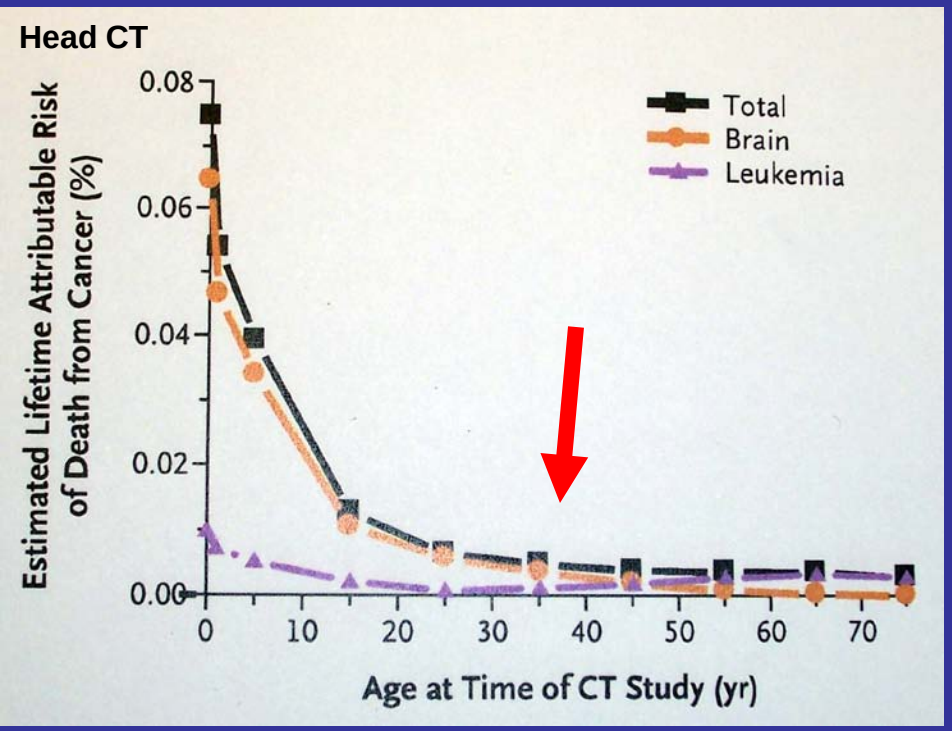
There probably is a cancer risk from CT

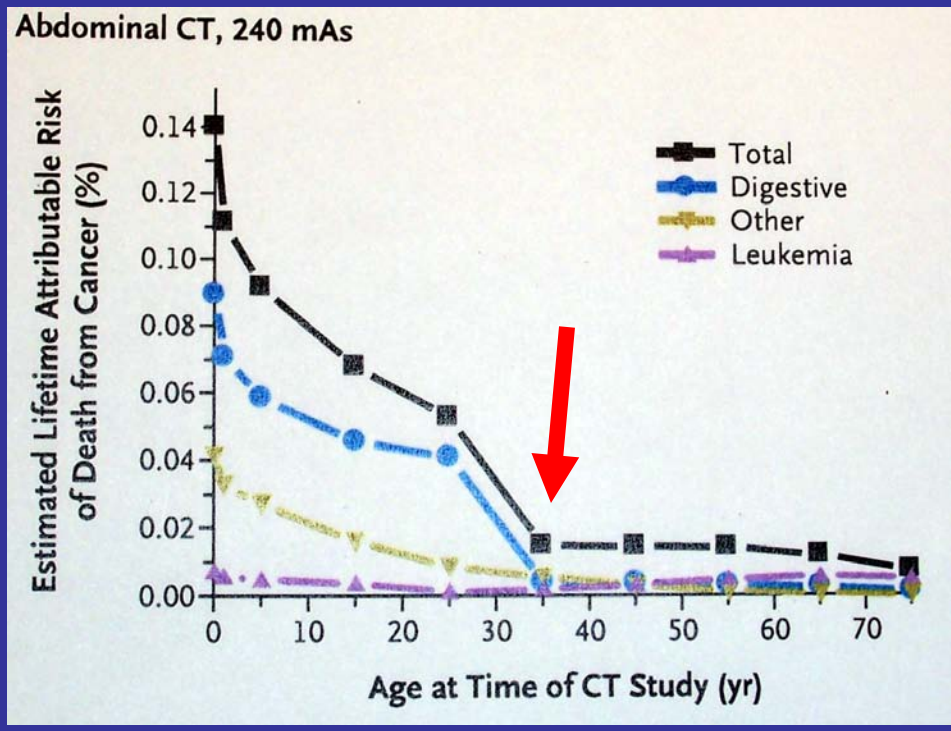


A-bomb data show a statistically significant increase at > 150 mSv

Good and Bad

Age dependence of risk from a CT scan

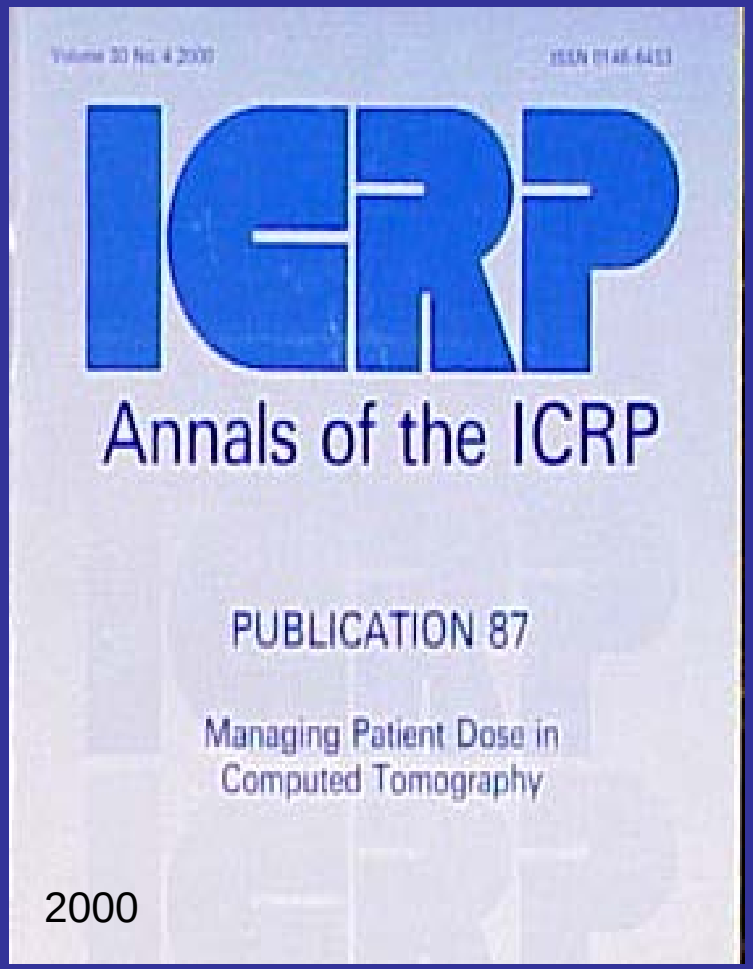




D. Brenner

Good

Some groups noticed the issues in the late 1990's



Bad

It really took media attention to accelerate changes

CT scans for young kids raise concerns

from **PAGE C1**

1930 to 1959.

Because 95 percent of Swedish men ages 18 and 19 are tested before military service, researchers were able to track information about the education and cognitive test results of these former pediatric patients.

The researchers found that the proportion of boys who attended high school decreased in relation to increasing doses of ionizing radiation — the type that penetrates the body — to the front and back of the brain.

The more radiation they were exposed to, the more impaired their learning ability and logical reasoning. Spatial recognition was unaffected. Because the dosages overlap those of CT scans, the findings raise questions about the long-term developmental effects of CT scans, which increasingly are used to assess minor head injuries, Swedish researchers wrote. Although they had data only about radiation exposure before the age of 18 months, they said the findings raised questions about exposure and young children in general.

But Nelson said the types of radiation used then are different from today's CT, and that there are differences in the way various types of radiation are absorbed by the brain.

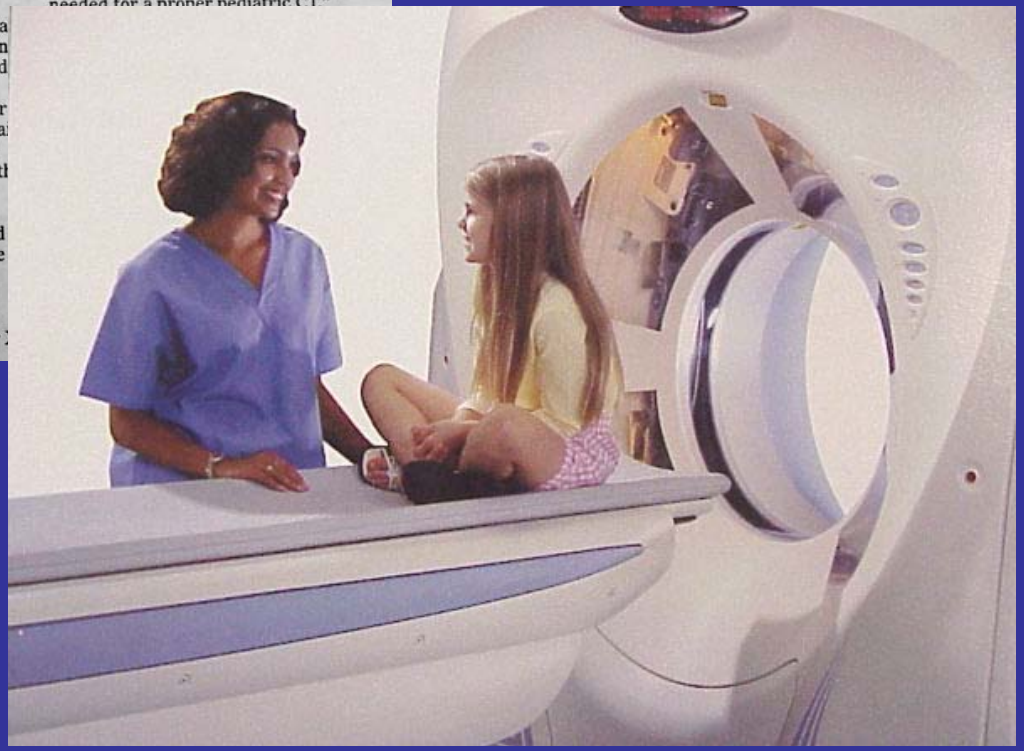
"If the child has significant head trauma as determined by the examining physician would not hesitate to do a CT," Nelson said "The benefits far outweigh the risks."

CT is the preferred test when a doctor suspects that a child has sustained a bra injury. The signs are unequal eye pupil size, weakness or lack of movement in th extremities and abnormal reflexes or unconsciousness for several minutes.

But it's not always required. If a child knocked out briefly, he or she should be observed and usually won't need a CT scan, Nelson said.

If a CT is recommended, Nelson suggests that parents ask the doctor or ray technician "whether the CT facility is using the proper reduced-dose protocols for children based on the size of the child."

He noted that many hospitals and medical facilities use radiation dosing guidelines for adults, which "deliver two to three times more radiation than is needed for a proper pediatric CT."



Good Dialogue

The New York Times

ACR® AMERICAN COLLEGE OF RADIOLOGY

FDA U.S. Food and Drug Administration

Home | Food | Drugs | Medical Devices | Vaccines, Blood & Biolog

Medical Devices

Safety Features Planned for Radiation Machines

By WALT BOGDANICH
Published: June 9, 2010

GAITHERSBURG, Md. — Manufacturers of radiation therapy equipment said at a patient-safety conference here Wednesday that within the next two years their new equipment and the software that runs it would include fail-safe features to help reduce harmful radiation overdoses and other mistakes.

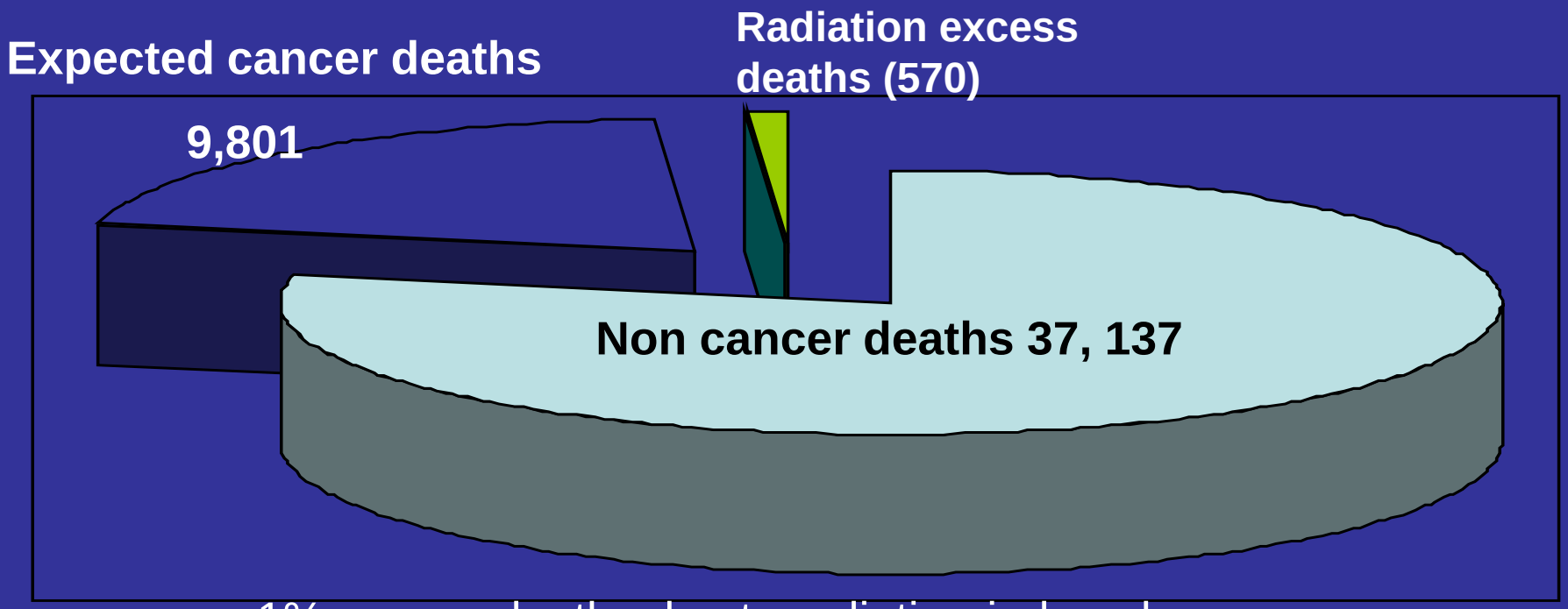
The absence of these fail-safe features contributed to the fatal radiation overdose of a New York City patient, whose death was the centerpiece of a lengthy article in The New York Times early this year that examined radiation accidents and how complex new technology

Good

Radiation is quite a weak carcinogen and the cancers usually take years to arise, if they arise at all

Good Radiation is a weak carcinogen and cancers generally take decades to occur

Causes of death in atomic bomb survivors (2001)



~ 1% excess deaths due to radiation-induced cancer

Preston Rad Res 2004

Bad Even a low risk multiplied by 70 million is a large number

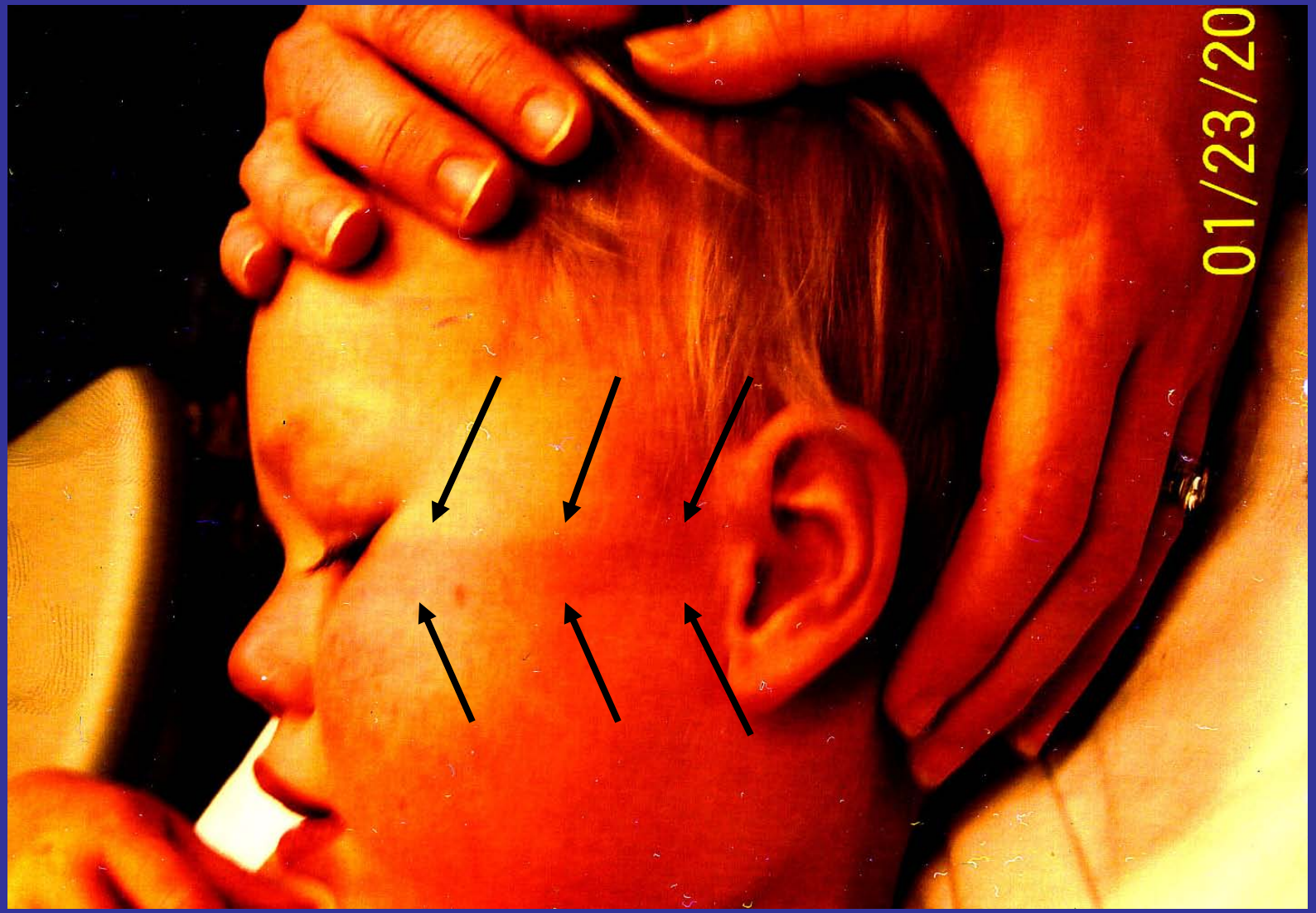
Ugly

CT scanning was reported to cause epilation and erythema over 10 years ago and has continued

Hair loss from excessive dose of a CT angiogram

Ugly

Erythema from recent accidental overexposure



Things that should be in our sights

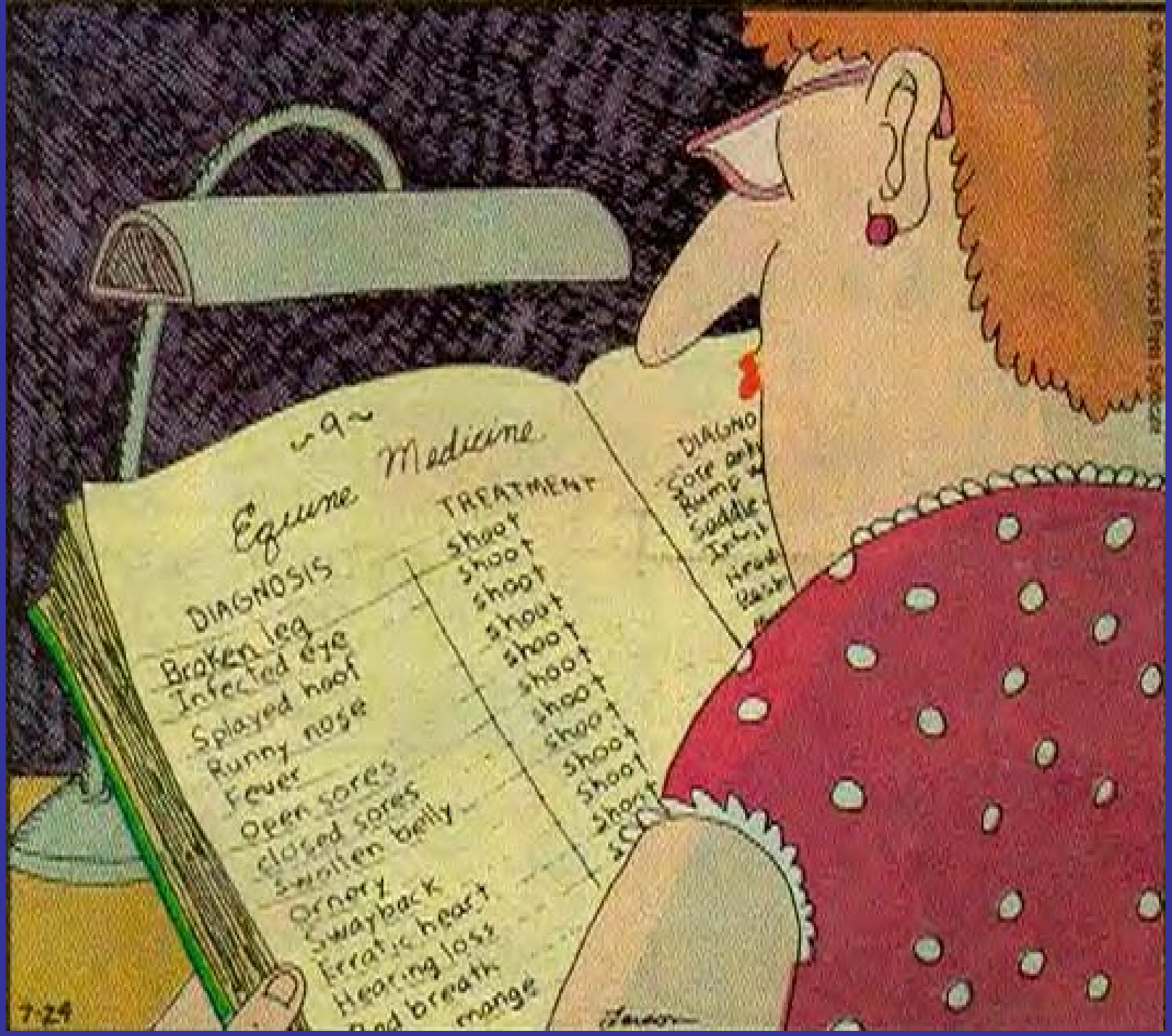
Lower dose, better aim

Good

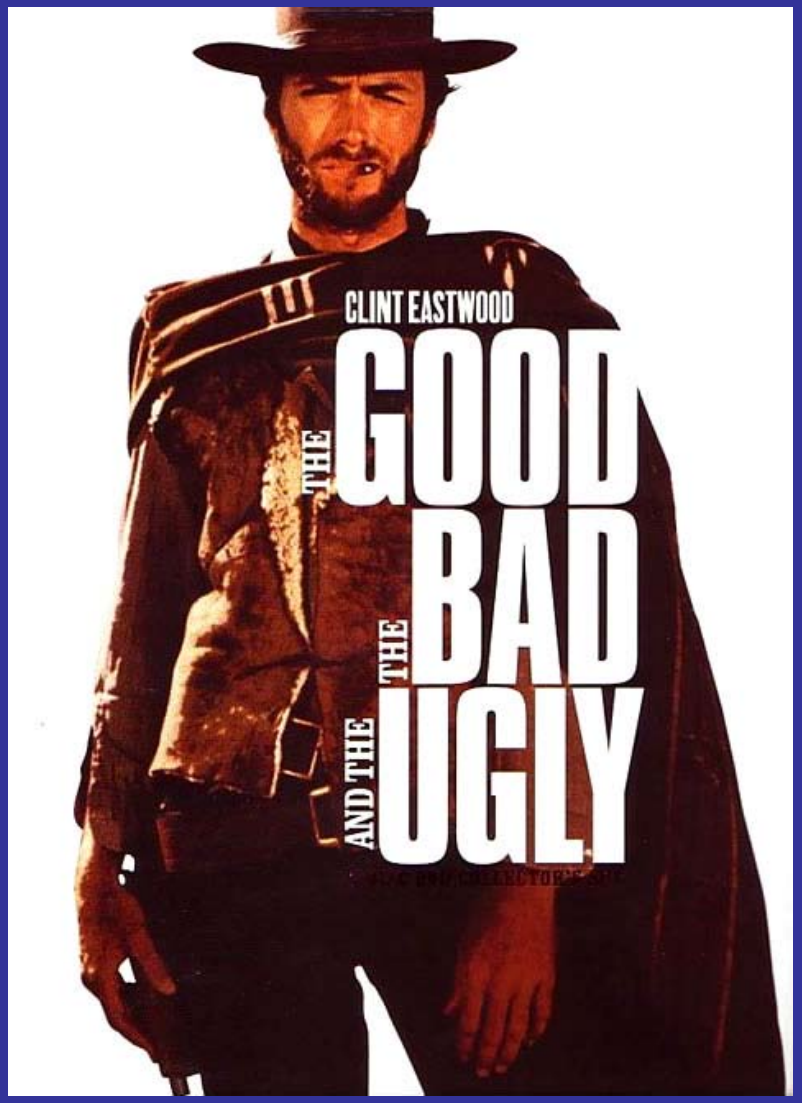
IMAGE WISELY™

Radiation Safety in
Adult Medical Imaging

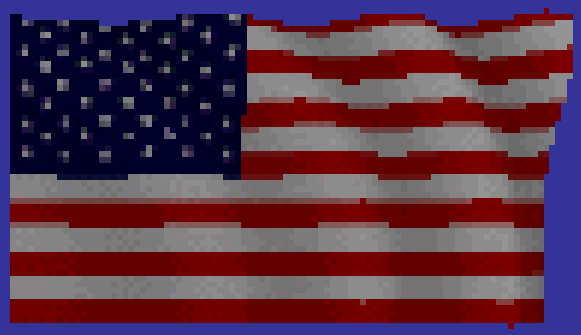
Good translation and outreach


~9~
Equine Medicine
DIAGNOSIS
Broken leg
Infected eye
Splayed hoof
Runny nose
Fever
Open sores
Closed sores
Swollen belly
Ornery
Swayback
Erratic heart
Hearing loss
Bad breath
mange
TREATMENT
shoot
shoot
shoot
shoot
shoot
shoot
shoot
shoot
shoot
shoot
shoot
7-24

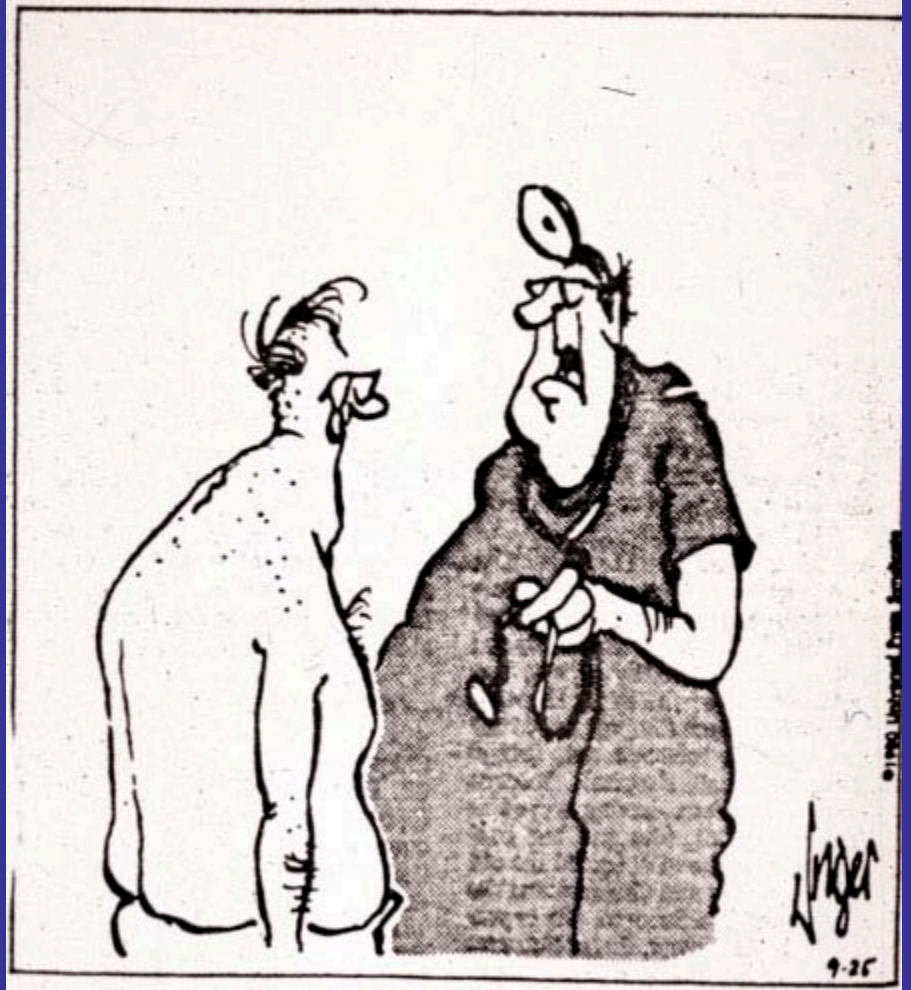
Coming soon…..



Thank you

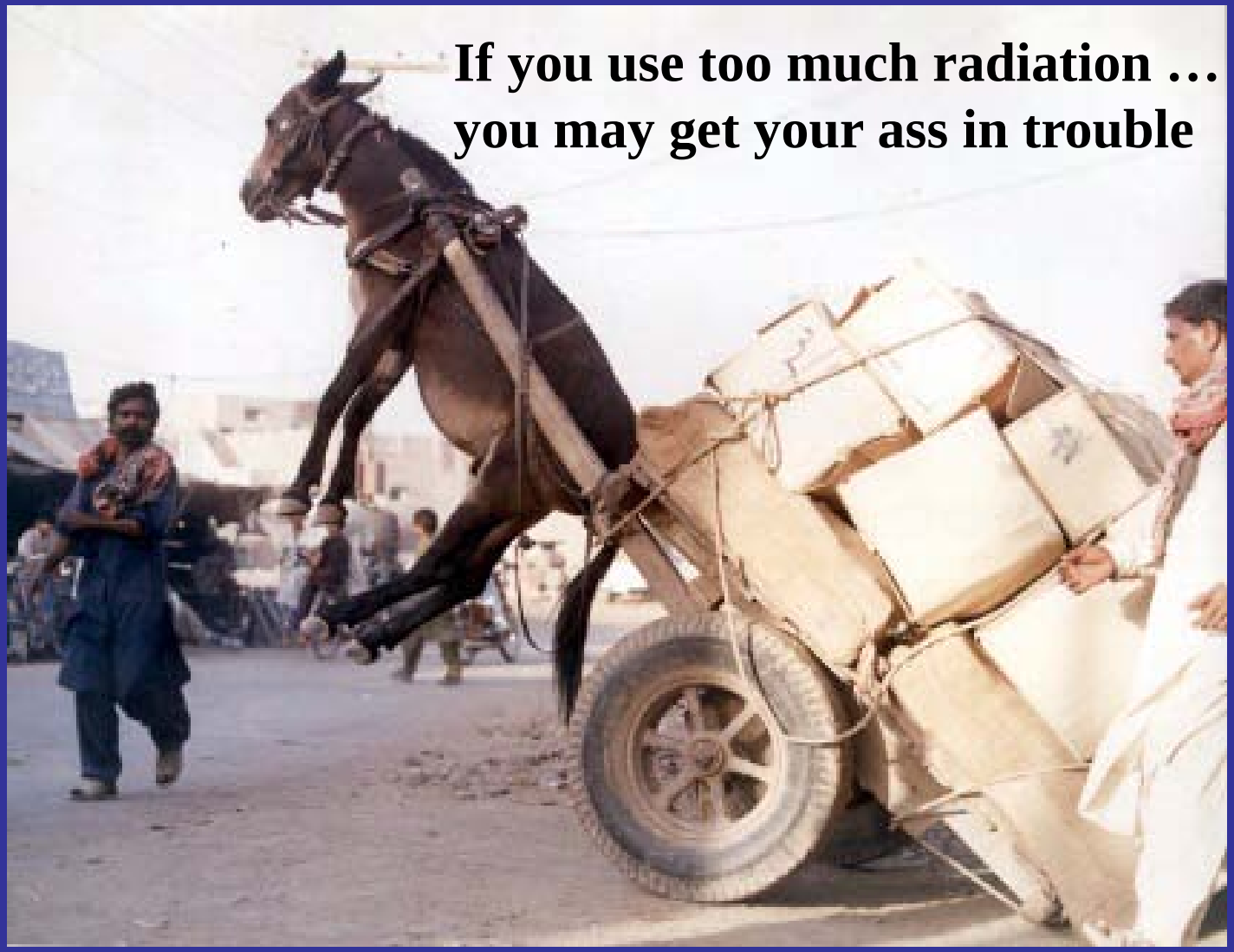


HERMAN



"I'd say it's your gall bladder, but if you insist on a second opinion, I'll say kidneys."

Always remember……



Ugly Going through the learning process