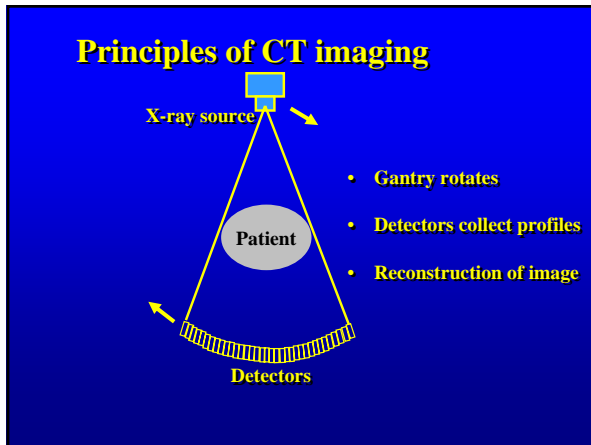


How new medical imaging technology is increasing radiation exposure - should we be concerned?

Richard Fox
Associate Professor,
University of Western Australia
Emeritus Consultant, Royal Perth Hospital



Early CT scanners

For first 15 years

- Image of single slice taken

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- Image of single slice taken
- Then patient moved for next slice

Early CT scanners

For first 15 years

- Image of single slice taken
- Then patient moved for next slice
- Slices generally about 1 cm apart

Problems with Early CT scanners

- Imaging was slow

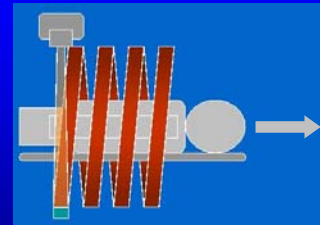
Problems with Early CT scanners

- Imaging was slow
- Only transaxial imaging possible

Problems with Early CT scanners

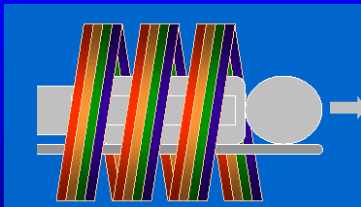
- Imaging was slow
- Only transaxial imaging possible
- Easy to miss lesions between slices

Helical (spiral) CT



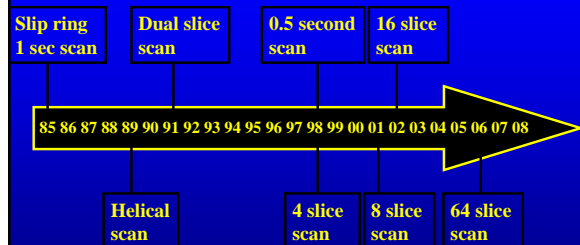
- X-ray beam rotates continuously
- Patient moves through the gantry

Multi-slice CT



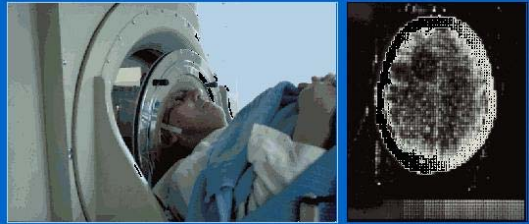
- Simultaneous multiple slices

Progress in CT development



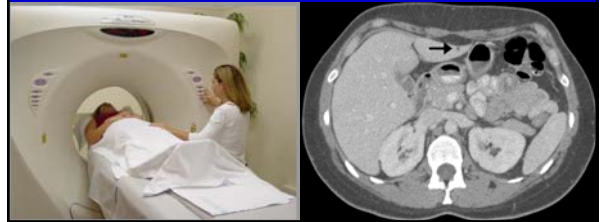
First Clinical Scan – 1972

One slice in 4 minutes
Overnight image reconstruction
Only head imaging



Modern Scanning - 2008

64 slices in 0.4 seconds
Immediate image reconstruction
Any part of the body



Improvements due to multi-slice helical CT

- Imaging is quicker

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Improvements due to multi-slice helical CT

- Imaging is quicker
- Spatial resolution equal in all directions
- Can image in any plane
- Can produce three dimensional images

Image reconstructed in sagittal plane



Rendered image



Sequential rendered images



Effect of imaging improvements

- Much more of the patient can be imaged

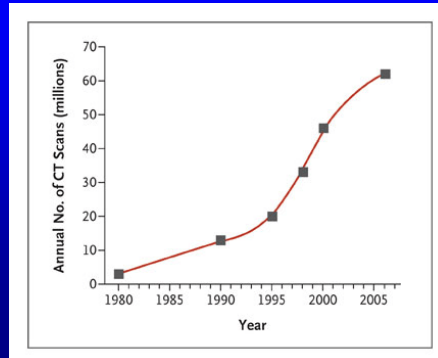
Effect of imaging improvements

- Much more of the patient can be imaged
- Children do not need to be sedated

Effect of imaging improvements

- Much more of the patient can be imaged
- Children do not need to be sedated
- **Better imaging allows wider application**

Increased CT scan use in USA



Is increasing use of CT a problem?

Is increasing use of CT a problem?

In 2000, CT represented 11% of procedures, but 67% of radiation dose in USA

TYPICAL X-RAY DOSES

<u>PROCEDURE</u>	<u>EFFECTIVE DOSE (mSv)</u>
Chest x-ray	0.05
Thoracic spine	0.9
Abdomen	1.4
IVP	4.4
CT Scan	
Head	3
Upper abdomen	17

CT Radiation Dose

Already higher than most other procedures

Further increased due to

- Increased usage (esp. in children)

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- Larger irradiation volumes

CT Radiation Dose

Already higher than most other procedures

Further increased due to

- Increased usage (esp. in children)
- Larger irradiation volumes
- Wider application

Is increasing radiation dose a problem?

FIRST X-RAY

Roentgen x-rayed his wife's hand shortly after his discovery of x-rays.



MOBILE X-RAY UNIT (~1900)



EARLY X-RAY

Early radiologists received significant radiation doses

Result = cancer!!

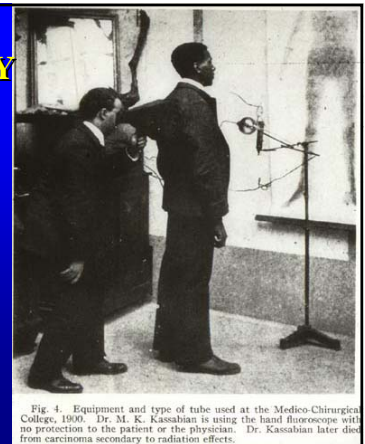
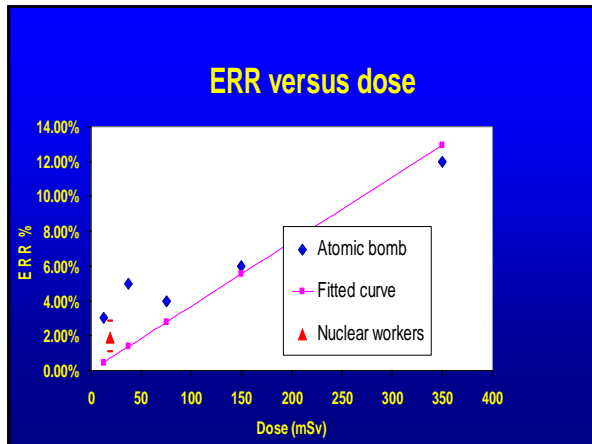


Fig. 4. Equipment and type of tube used at the Medico-Chirurgia College, 1900. Dr. M. K. Kassabian is using the hand fluoroscope with no protection to the patient or the physician. Dr. Kassabian later died from carcinoma secondary to radiation effects.



RADIATION RISK

Estimated risk of death from radiation is:
 (Note there is a 5-10 year latency period)

5% per Sv on average

3% per Sv for a 60 year old

10%-15% per Sv for younger subjects

CONCLUSION

We are killing a significant number of people each year as a result of CT scans
 (estimated to be several hundred in Australia)

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We are killing a significant number of people each year as a result of CT scans
 (estimated to be several hundred in Australia)

AND

that number is growing.

So should CT use be banned?

ONE IN A MILLION RISK OF DEATH

From each of:

- 1000 km by air
- 150 km by car
- smoking 3/4 of a cigarette
- 2 minutes rock climbing
- 1 week at low risk work
- 20 minutes being a 60 year old
- a dose of 20 μ Sv

**US FATAL OCCUPATIONAL
ACCIDENT RATES (1975)**

INDUSTRY	DEATHS/YEAR x10⁻⁶
Trade	60
Manufacturing	80
Service and Government	115
Transport	330
Agriculture	580
Construction	610
Mining and quarrying	630

SO, SHOULD WE BE CONCERNED?

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We should be concerned if CT scanning is being undertaken unnecessarily or if doses are higher than required

SO, SHOULD WE BE CONCERNED?

We should be concerned if CT scanning is being undertaken unnecessarily or if doses are higher than required

However, if you can benefit from a CT scan, there is no doubt that you should have one

Potential for CT doses to be too high

- **Patient pressure on GPs for CT scans**

Potential for CT doses to be too high

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- **Litigation pressure on GPs**

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- Lack of knowledge by some GPs

Potential for CT doses to be too high

- Patient pressure on GPs for CT scans
- Litigation pressure on GPs
- Lack of knowledge by some GPs
- Some radiologists not using optimum techniques

TAKE HOME MESSAGE


- If you need a CT scan there is no doubt that the benefit will outweigh the risk

TAKE HOME MESSAGE

- If you need a CT scan there is no doubt that the benefit will outweigh the risk
- Do NOT have CT scans unnecessarily

TAKE HOME MESSAGE


- If you need a CT scan there is no doubt that the benefit will outweigh the risk
- Do NOT have CT scans unnecessarily
- If concerned discuss with your GP
(GPs should make sure that they understand the risks and the benefits of CT scanning)



Next week's lecture

"Why didn't you tell me"
**- improving communication in the
cancer setting**

Associate Professor Michael Jefford
Peter MacCallum Cancer Centre, VIC



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