Radiation Protection for Assistant Practitioners in Mammography

by John Saunderson (RPA)

Risks and Large Numbers

If the risk from a mammogram is so small, why worry about patient doses?

Because lots of people are X-rayed, so there is a risk that some will get cancer from the X-ray.

Average dose given for a mammogram = 270 μSv

Number of mammography examinations per year = 1,726,303

So COLLECTIVE DOSE = 1,726,303 x 270 μSv = 466 manSv

Statistically, it can be shown that there is a 90% chance that 466 manSv will cause at least 18 fatal cancers. So we need to ensure that we are definitely saving more lives than that a year to justify a national breast screening programme.

1.3 Special Attention Areas

Pregnancy and potential pregnancy

Deterministic Effects

Age	Minimal dose (Gy) for:		
(weeks)	Lethality	Gross malformation	Mental retardation
0-1	No threshold at day 1?	No threshold at day 1?	
	0.1 thereafter		No effects observed to
2-5	0.25 - 0.5	0.2	about 8 weeks
5-7	0.5	0.5	
7-21	> 0.5	Very few observed	Weeks 8-15: no threshold?
			Weeks 16-25: threshold dose 0.6 - 0.7 Gy
To term	> 1.0	Very few observed	Weeks 25-term: no effects observed

So hundreds of mGy needed to deform or kill fetus. Staff never get such a dose (legal limit to fetus 1 mSv).

Typical breast dose = 2 mGy. Film cassette and breast platform absorb most of X-rays, so dose to fetus from mammography is tiny.

Stochastic Effects

There is an increase risk of childhood cancer associated with fetal exposure to X-rays.

1 in 33,000 chance of fatal cancer per mSv of radiation.

Procedure	Average fetal dose	Hereditary disease	Fatal childhood cancer
Chest	< 0.01 mGy	1 in 4 million	1 in 3 million
Abdomen X-ray	1.4 mGy	1 in 30,000	1 in 24,000
Lumbar spine x-ray	1.7 mGy	1 in 24,000	1 in 20,000
Pelvic X-ray	1.1mGy	1 in 38,000	1 in 30,000
CT Abdomen	8.0 mGy	1 in 5,000	1 in 4,000
CT Pelvis	25 mGy	1 in 1,700	1 in 1,300
Tc-99m bone scan	3.3 mGy	1 in 13,000	1 in 10,000
Natural risk		***1 in 50***	***1 in 1,300***

If pelvic area of patient is in the X-ray beam, or a nuclear medicine scan is being performed then

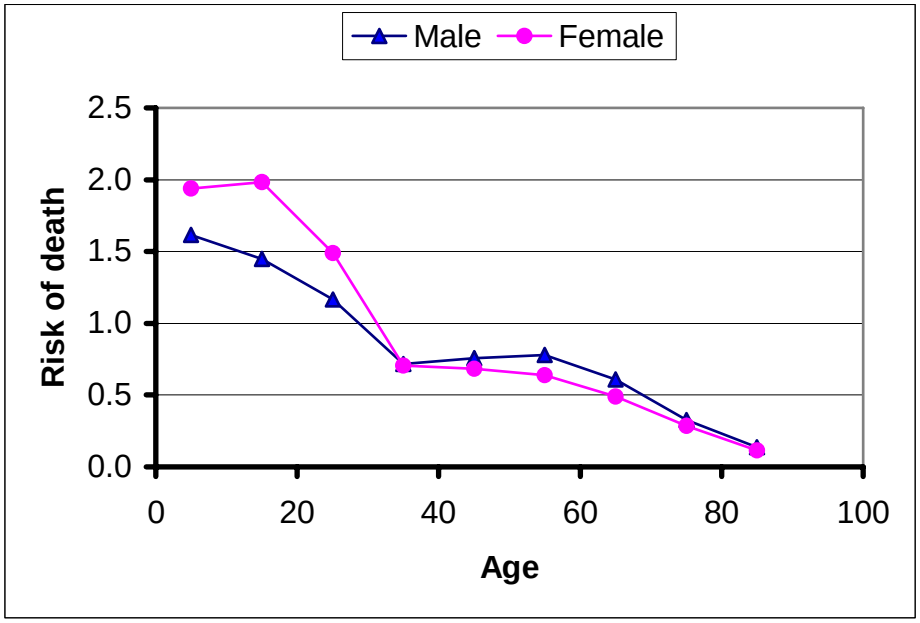
- No possibility of pregnancy - proceed.
- Probably pregnant - radiologist decides
  - delay X-ray until after delivery, or
  - use non-X-ray technique (e.g. ultrasound), or
  - go ahead with X-ray but keep dose low
- Possibly pregnant, low dose procedure - proceed if period is not overdue.
- High dose procedure (10s of mGy, e.g. pelvic CT)
  - X-ray in first 10 days of menstrual cycle .

But "**There is no requirement to enquire about pregnancy prior to mammography as there is no significant dose to the fetus**" - NHBSP Dec 02

For pregnant staff,

- a risk assessment must be performed,
- dose to fetus < 1 mSv for rest of pregnancy.

Infants and children



Children are fast growing, and have longer to develop cancer, so they are more at risk from radiation that older people.

Medical and biomedical research

- Need to take extra care, especially where healthy volunteers involved
- Must be approved by Local Research Ethics Committee
- Must set dose constraints or target levels of dose .

Dose constraints for healthy volunteers are locally set dose limits that must never be exceeded.

Target dose levels are set where the person being X-rayed is gaining a health benefit from the examination, and can be exceeded if it is to the benefit of the patient.

Health screening ***(covered more extensively in other lectures)***

In health screening you are exposing large numbers of healthy individuals, with no symptoms, to the risks of radiation, therefore you must be very sure that the net benefit outweighs the risks. This is one of the reasons why quality assurance and dose surveys are so important in mammography.

High Dose Techniques

Special care should be taken with techniques that can give high doses such as CT and fluoroscopy.

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