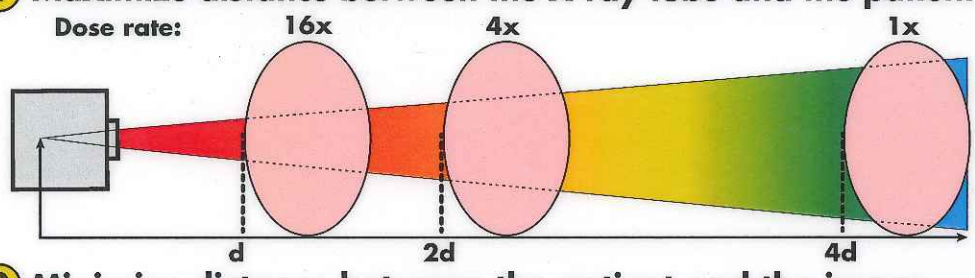
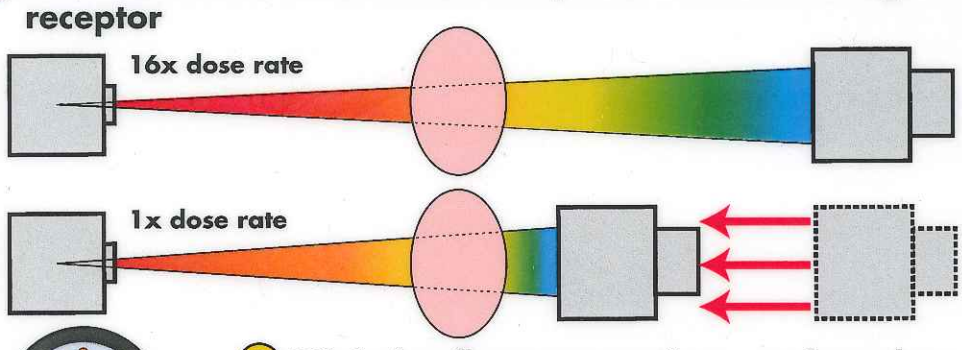
Dose Reduction in Fluoroscopy

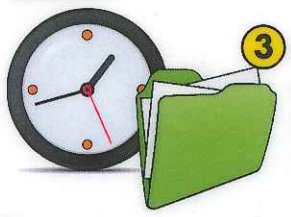
Patient Safety

1 Maximize distance between the X-ray tube and the patient



2 Minimize distance between the patient and the image receptor



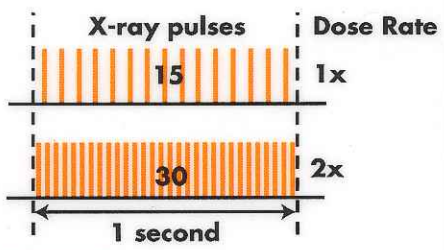


3 Minimize fluoroscopy time, and use last seen fluoro-loop whenever possible

Keep records of fluoroscopy time, DAP/KAP, and air KERMA (if available), for every patient

4 Use pulsed fluoroscopy with the lowest acceptable frame rate

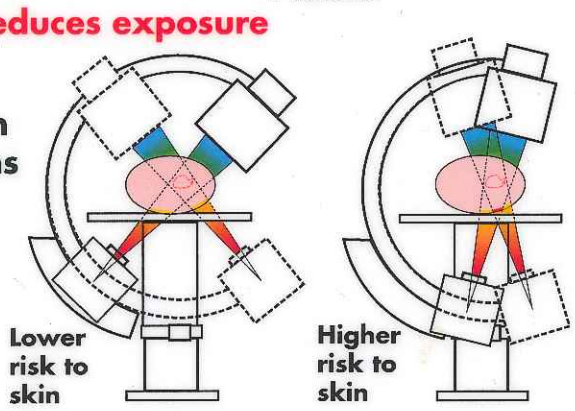
The dose rate is proportional to the frame rate. For instance, 15 frames-per-second (FPS) typically results in **one-half the dose rate** of 30 FPS



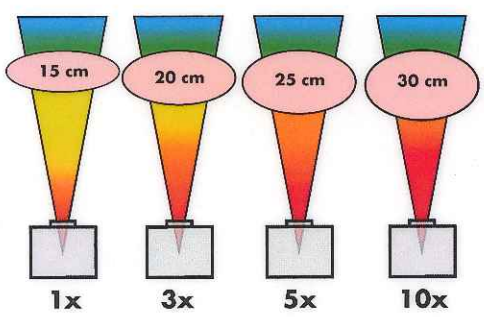
Pulsed fluoroscopy reduces exposure

5 Avoid exposing the same area of the skin in different projections by rotating the tube around the patient

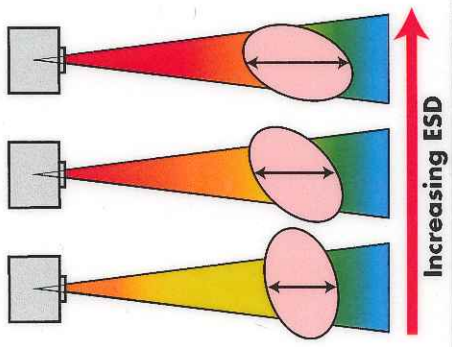
Make sure patient's arm is not in the beam



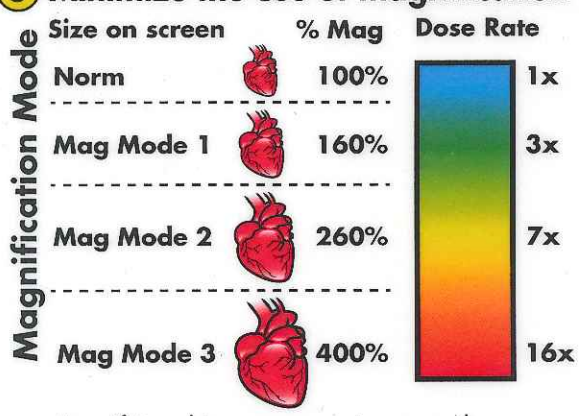
6 Larger patients or thicker body parts increase Entrance Skin Dose (ESD) rate



7 Oblique projections also increase ESD



8 Minimize the use of magnification



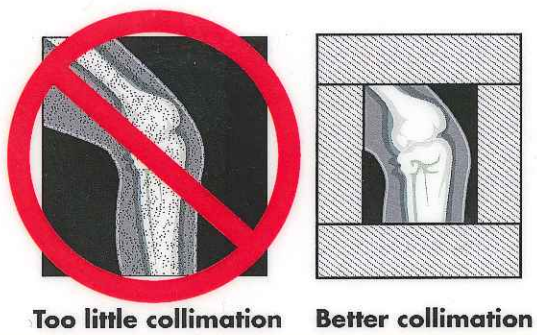
- Magnifying objects on screen increases dose
- Magnification by a factor of 400% increases ESD up to a **factor of sixteen**

9 Minimize number and length of DSA and cine runs, and use lowest acceptable frame rate

Cine dose rates range from **10 to 60 times greater** than normal fluoroscopy

10 Use appropriate collimation techniques

Collimation of the X-ray beam to the area of interest reduces dose and increases image quality



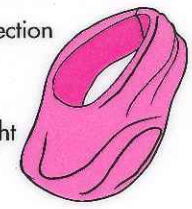
Staff Safety

1 Use personal protective devices

0.25 mm lead equivalence aprons. Appropriately sized to overlap on the front to make 0.5 mm on the front and 0.25 mm on the back

Lead glass eyewear

Thyroid protection

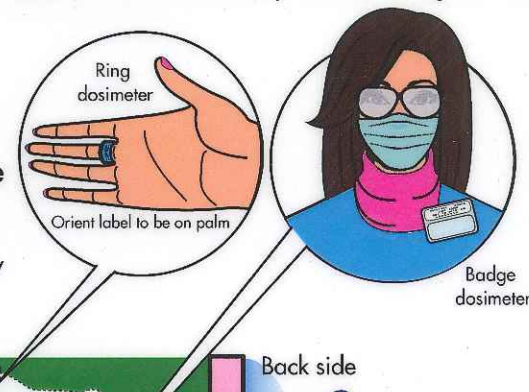


Advisable: skirt type lead apron to distribute weight

Provides > 90% protection

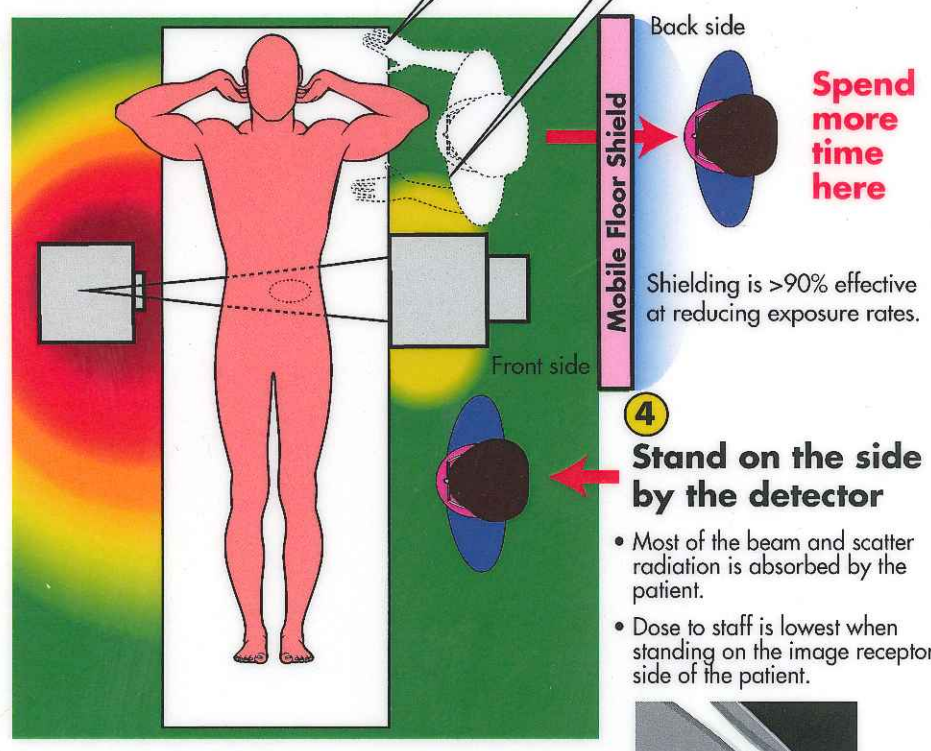
2 Use personal dosimetry

- Wear badge at collar level
- Wear ring dosimeter on hand most likely to receive highest dose



3 Utilize Time-Distance-Shielding principles to reduce your exposure

- Minimize time spent in areas with high exposure rates
- Maximize distance as much as clinically appropriate
- Utilize shielding



Shielding is >90% effective at reducing exposure rates.

4 Stand on the side by the detector

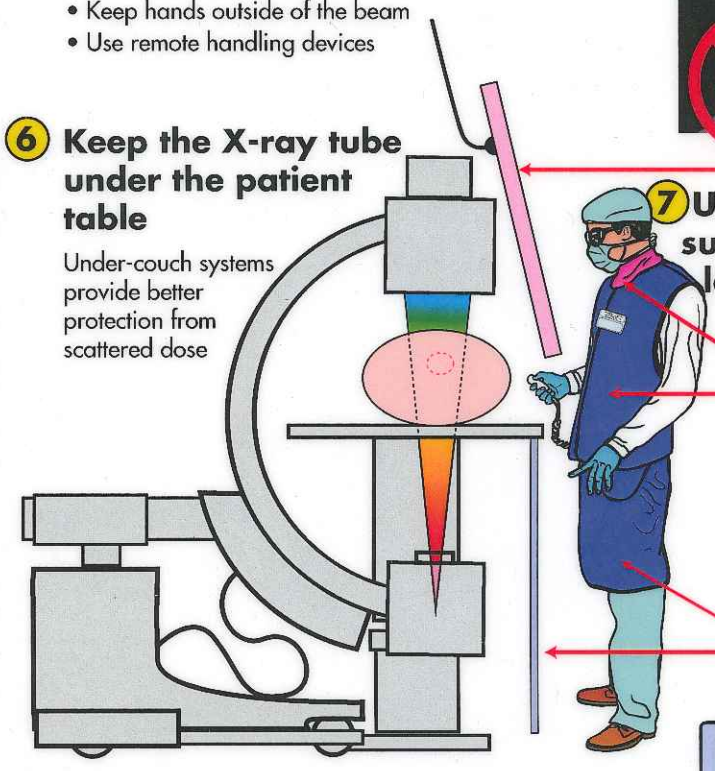
- Most of the beam and scatter radiation is absorbed by the patient.
- Dose to staff is lowest when standing on the image receptor side of the patient.

5 Reduce the dose to your hands:

- Keep hands outside of the beam
- Use remote handling devices

6 Keep the X-ray tube under the patient table

Under-couch systems provide better protection from scattered dose



7 Use ceiling suspended screens, lateral shields, & table curtains

- They provide more than 90% protection from scattered radiation
- Mobile floor shielding is advisable when using cine acquisition

8 Update your knowledge about radiation protection regularly

Questions or concerns about radiation protection?

- Ask your supervisor
- Contact Health Physics (916) 734-3355

9 Other considerations

- Quality control testing of fluoroscopy equipment enables safe and stable performance
- Know your equipment: using the equipment's features effectively will help reduce doses to patients and staff
- Physicians must have a valid State Fluoroscopy Supervisor-Operator Permit
- If necessary, experienced physicians should finish procedures that are more complicated than anticipated to avoid unnecessarily high radiation exposure that may lead to patient skin injury.

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Adapted from: 10 Pearls of Radiation Protection of Staff and Patients in Fluoroscopy https://rpop.iaea.org/RPOP/RPoP/Content/AdditionalResources/Posters/index.htm
and *The Essential Physics of Medical Imaging*, J.T. Bushberg, J.A. Seibert, E.M. Leidholdt., J.M. Boone

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