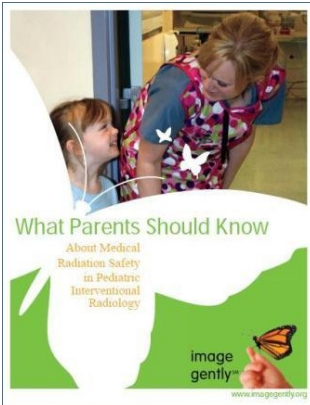


10 Pearls: Radiation protection for **children** in interventional procedures

1. Remember: Some tissues of a growing child are more sensitive to radiation than adult

Children have longer life span to manifest radiation effects



2. Discuss with parents before the procedure

- Ask about previous exposures
- Answer their concerns about radiation safety

image gently

Patient's Name _____ MR# _____ Date of exam _____

Step Lightly Checklist

Review steps below before starting the procedure.

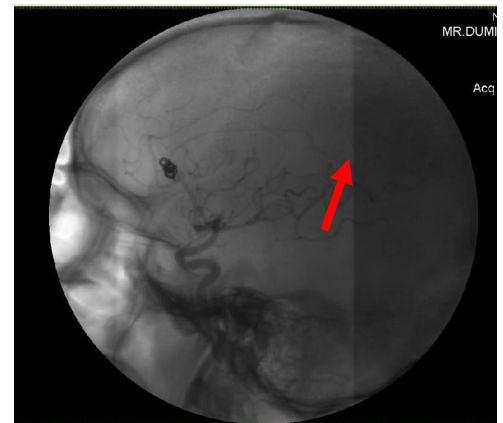
Safety is a team effort: don't be afraid to ask the necessary questions to ensure you are working as a team to keep radiation dose to patients and staff as low as possible.

Reducing radiation dose must be balanced with safe, accurate and effective completion of the procedure. Not all the steps below may be possible in each case, depending on patient size, technical challenge and critical nature of the procedure. Overall patient safety is most important. The goal is to minimize the dose to the patient while providing important and necessary medical care.

- Ask patient or family about previous radiation ([record card downloadable at this link](#)). Answer questions about radiation safety ([patient brochure downloadable here](#)).
- Use ultrasound when possible.
- Position hanging table shields and overhead lead shields prior to procedure with remainder during the case as needed.
- Operators and personnel wear well fitted lead aprons, thyroid shield and leaded eye wear.
- Use pulse rather than continuous fluoroscopy when possible, and with as low pulse as possible.
- Position and collimate with fluoroscopy off, tapping on the pedal to check position.
- Collimate tightly. Enclude eyes, thyroid, breast, gonads when possible.
- Operator and personnel hands out of beam.
- Step lightly; tap on pedal and review anatomy on last image hold rather than with live fluoroscopy when possible; minimize live fluoroscopy time.
- Minimize use of electronic magnification, use digital zoom whenever possible.
- Acknowledge fluoroscopy timing alerts during procedure.
- Use last image hold whenever possible instead of exposures.
- Adjust acquisition parameters to achieve lowest dose necessary to accomplish procedure: use lowest dose protocol possible for patient size, lower frame rate, minimize magnification, reduce length of run.
- Plan and communicate number and timing of acquisitions, contrast parameters, patient positioning and suspension of respiration with radiology and sedation team in advance to minimize improper or unintended runs.
- Move table away from X-ray tube in both planes. Move patient as close to detector in both planes.
- Use a power injector, or extension tubing if injected by hand.
- Move personnel away from table or behind protective shields during acquisitions.
- Minimize overlap of fields on subsequent acquisitions.
- After procedure: record and review dose.

3. Increase awareness among your team members through the use of a pre-procedure safety checklist

4. Plan the procedures in detail and in advance to avoid improper or aborted runs or other repeated exposures



[http://www.pedrad.org/associations/5364/files/ImGen StpLight Chcklst.pdf](http://www.pedrad.org/associations/5364/files/ImGen_StpLight_Chcklst.pdf)



5. Protect the patient's thyroid, breast, eyes and gonads where possible



RPOP Posters webpage!

<https://rpop.iaea.org/RPOP/RPoP/Content/AdditionalResources/Posters/index.htm>

10 Pearls: Radiation protection for **children** in interventional procedures

6. Use optimal technique:

- Lower frame rates. Decrease from 7.5 to 3 pulses per second when possible
- Remove grids from machine if possible for infants under 20 kg
- Use air-gap technique instead
- Minimize imaging time
- Minimize field overlap in repeated acquisitions
- Use tighter collimation
- Minimize magnification usage

10 Pearls: Radiation protection of patients in fluoroscopy

1. Maximize distance between the X ray tube and the patient to the extent possible
2. Minimize distance between the patient and the image receptor
3. Minimize fluoroscopy time
Keep records of fluoroscopy time and DAPIKAP (if available) for every patient
4. Use pulsed fluoroscopy with the lowest frame rate possible to obtain images of acceptable quality
5. Avoid exposing the same area of the skin in different projections
Vary the beam entrance port by rotating the tube around the patient

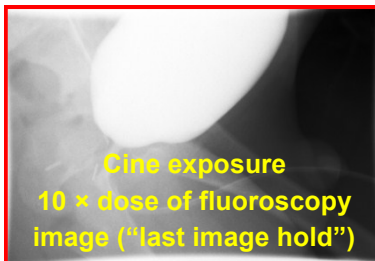
Figure adapted from L. K. Wagner

IAEA RPOP <http://rpop.iaea.org>

10 Pearls: Radiation protection of patients in fluoroscopy

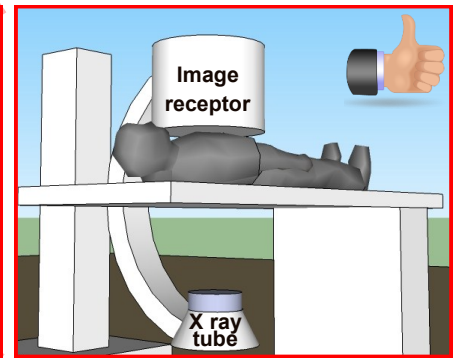
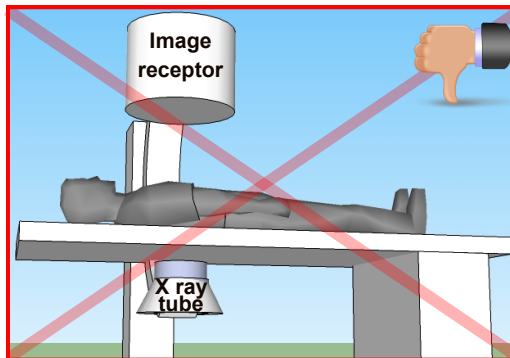
6. Larger patients or thicker body parts trigger an increase in entrance surface dose (ESD)
7. Oblique projections also increase ESD
Be aware that increased ESD increases the probability of skin injury
8. Avoid the use of magnification
Decreasing the field of view by a factor of two increases dose rate by a factor of four
9. Minimize number of frames and cine runs to clinically acceptable level
Avoid using the acquisition mode for fluoroscopy
Cine dose rate $\approx (10-40) \times$ normal fluoroscopy dose rate
10. Use collimation
Collimate the X ray beam to the area of interest

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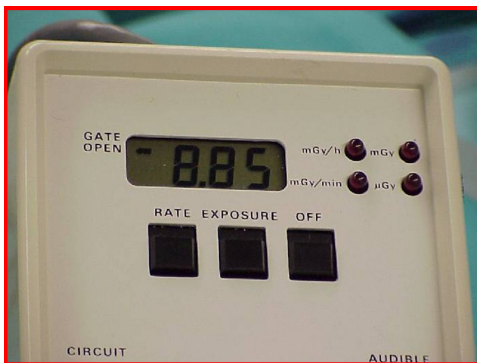


7. Use "last image hold" rather than additional exposures, where appropriate

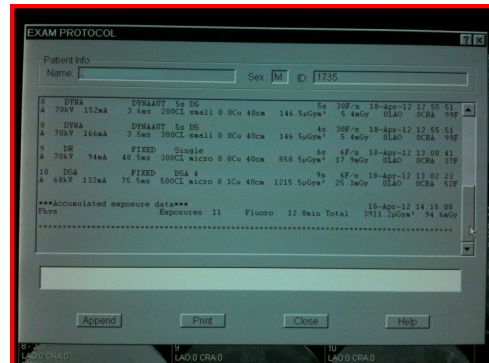
8. Increase distance between patient and the X ray tube and decrease distance between patient and image receptor



9. Use dose recording and dose reduction technologies in equipment



10. Review and record radiation dose after the procedure



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