Radiation Exposure Reduction during Hysterosalpingography

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PURPOSE

Hysterosalpingography involves radiation exposure using combined fluoroscopy and spot films to the pelvic area of women, many of whom are actively trying to conceive. As part of our department-wide initiative to reduce patient radiation exposure, we assessed the process and workflow of our hysterosalpingography practice to reduce patient and provider exposure without diminishing exam quality.

METHODS

All fluoroscopic exams were performed using a GE Precision MPi System (GE Medical Systems, Milwaukee, WI.) Measurements were performed comparing Air Kerma recordings by the fluoroscopy equipment to independent calibration detectors.

Pulse fluoroscopy was used with radiologist given radiation usage results after every exam as feedback.

Air Kerma measurements were recorded and used to adjust settings during exam. The radiologists were trained in the monitoring of Air Kerma exposure readings.

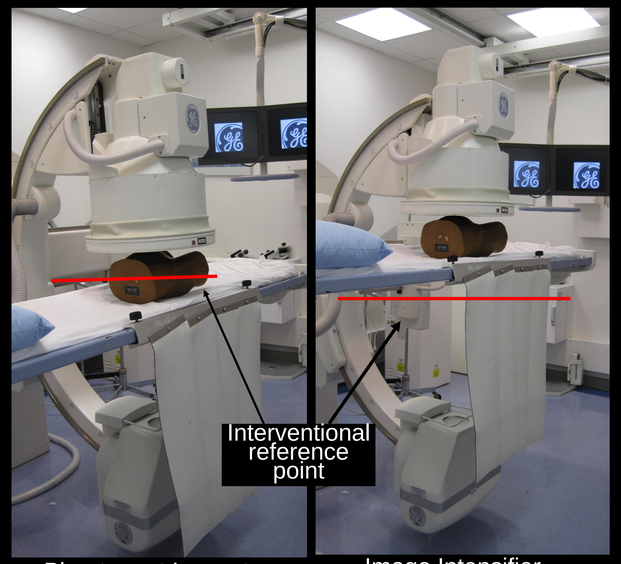
100 hysterosalpingograms exams were performed by two board certified radiologists over a 12 month period. All exams were included in this effort to reduce exposure. This effort was part of a department-wide initiative to reduce patient radiation exposure. Study images were reviewed weekly by both radiologists to assess image quality.

RESULTS

Median fluoroscopy times were reduced to 0.0 minutes (<3 seconds of fluoroscopy time per exam.) Air Kerma recorded levels were reduced from to 0.84 mGy using small focal spot, AEC exposure setting, lowest dose setting (A on this specific unit), Kv 75 and mA 320. No reduction in overall exam quality was noted during this entire process.

Air Kerma values may be linked to a geometric point & not to actual patient dose

Utilizing the geometry of the room may be useful in reducing dose beyond reductions in Air Kerma tabulations



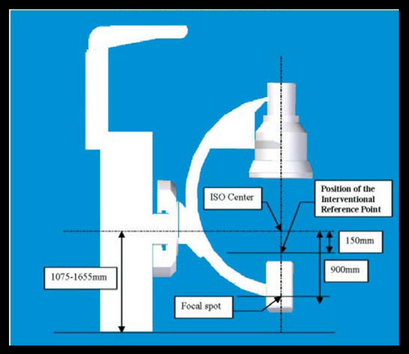
Phantom at Isocenter
Image Intensifier moved closerTo tube
Dose = Air Kerma level (without backscatter)

Image Intensifier raised to highest position
Phantom raised close to Image Intensifier
Entrance Skin Dose To approximately 58% of reported Air Kerma level

Air Kerma values do not always reflect the actual dose received by the patient during the examination.

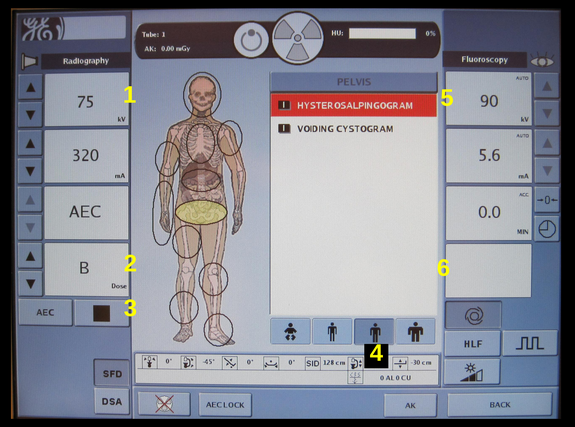
Digital fluoroscopy rooms have been shown to result in lower patient dose during fluoroscopic exams.

Increasing the patient distance from the source, raising the imaging intensifier and brining the patient close to the image intensifier reduced the Entrance Skin Dose to approximately 58% of the reported Air Kerma level

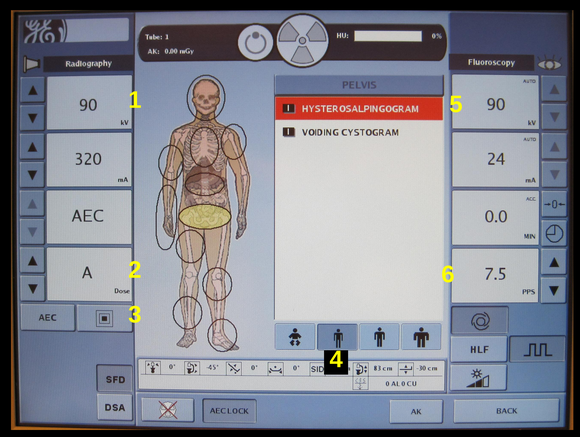


Technical Publication 5148633-100 Revision 4
GE Medical Systems Precision MPi Operator Manual

Vendor Default Hysterosalpingogram Settings



Dose Optimized Settings



Radiography Settings

1. kV 75 → 90
2. Dose setting B → A
3. Focal Spot Large → Small
4. Patient Size Normal → Small

Fluoroscopy Settings

5. kV set at 90
6. Pulse Fluoro is always used

No scout film taken using spot exposure

Single fluoroscopy frame is captured and saved

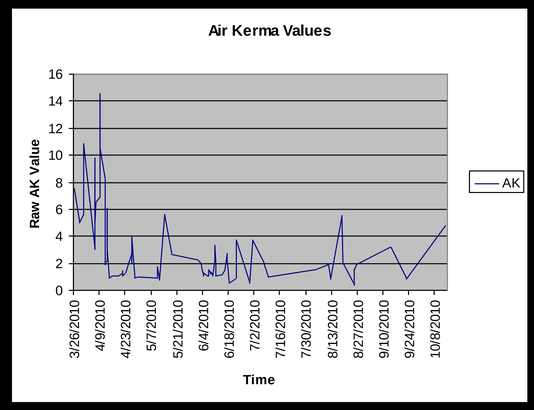
For a thin patient, this single step reduces Air Kerma from 0.3 mGy to 0.04 mGy

Air Kerma Pre-Dose Optimization

Median 7.0, Mean 7.8, Standard Deviation 3.4

Air Kerma Post-Dose Optimization

Median 1.6, Mean 2.0, Standard Deviation 1.5



Air Kerma Readings from Hysteosalpingograms from 26 March 2010 through 22 October 2010

Air Kerma readings, while not an absolute measure of patient exposure, may be effectively utilizied by radiologists as a measure of the level of radiation used during the procedure.

We have found the Air Kerma values for a hysterosalpingogram examination to vary widely depending on the BMI of the patient. Patients with a BMI of 30 may have 4x the Air Kerma readings of a patient with a BMI of 19

Even prior to the initiation of this process improvement effort, we had always used pulse fluoroscopy and rarely utilized more than 3 seconds of fluoroscopy time. This is recorded by the unit as 0.0 min.

CONCLUSION

Training radiologists in radiation reduction strategies and supplying case-by-case feedback on patient dose and fluoroscopy times used is effective in achieving lower patient radiation doses without reduction in exam quality.

SELECTED REFERENCES

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2. Gregan AC, *et al.* Patient dosimetry in hysterosalpingography: a comparative study. *Br J Radiol.* 1998;71(850):1058-61.
3. Kramer R, *et al*. Equivalent dose to organs and tissues in hysterosalpingography calculated with the FAX (Female Adult voXel) phantom. *Br J Radiol.* 2006;79(947):893-9.
4. Meghzifenea A, *et al.* Dosimetry in diagnostic radiology *European Journal of Radiology* 2010; 76:11-14.