

PURPOSE: The main goal is to demonstrate the effects of varying imaging equipment parameters have upon patient radiation dose in modern cardiac catheterization x-ray systems. The parameters examined include: pulse rate, Field-of-View (FoV), patient thickness, fluoroscopy versus record mode, SID settings and ABC programs.

METHODS & MATERIALS: A Siemens flat panel Axion Artis FC cardiac unit was used. The patient was simulated by sheets of acrylic varying in thickness from 10 cm to 30 cm. The exposure rate was measured at the entrance surface of the acrylic with an ionization chamber.

RESULTS: The entrance exposure rate varied with the $(\text{FoV})^N$ where $-2 < N < -3$. The exposure rate varied directly with pulse rate in both fluoroscopy and record mode; in comparison to continuous or 30 pps, 15 pps reduced the radiation levels by 50%. The plus mode increased radiation levels by 40-50% and the minus mode reduced the levels by 40-50%. One minute of record imaging is equivalent to about 10 minutes of fluoroscopy. For both modes, the radiation levels increase approximately as an exponential function of thickness with an HVL in acrylic of about 2.8 cm. Maximum exposure rates for large patients can be 10 - 20 R/min in fluoroscopy and over 100 R/min in record mode.

SUMMARY: Although typical cardiac catheterization radiation levels are available for image intensifier and cine film systems, these data provide information related to a modern flat panel and digital recording system. Data about the relative effects permit significant dose savings to be realized by judicious selection of settings. In comparison to older equipment without these modern features, utilization of all the dose reduction steps can result in a dose savings of over 90%.

CONFLICT OF INTEREST: Some free software upgrades to equipment were provided during evaluations; no other financial conflicts exist.