

# Patient Radiation Dose in Invasive Cardiology

Jerome Clerc, Catherine Le Gac, Bernard Glatt, Thierry Royer, Bernard Chevalier, Philippe Guyon

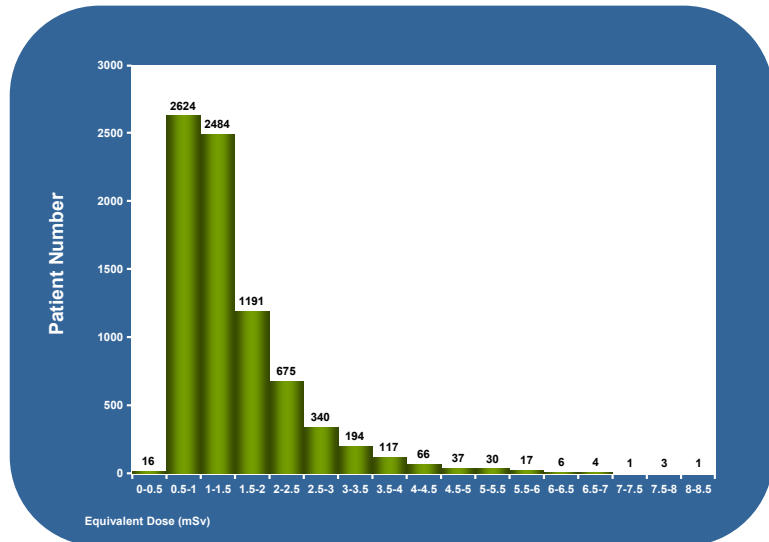
## ABSTRACT

**Background:** Patient radiation protection needs to be promoted. However patient dosimetry audit is not a current practice in Cardiology. The aim of this study is to evaluate the radiation exposure during invasive coronary investigations.

**Methods:** Between 2002 and 2005 skin dose absorption and equivalent dose (biological effect) were measured and analyzed for 7806 consecutive procedures (6704 pts) performed on the same flat panel detector system. Mean age was 64±12 years (4948 men) corresponding to a standard French population investigated for coronary and valvular disease (LM 5%, normal coronary angiogram 25%, one vessel lesion 27%, two 21%, three 29%, valvular disease and others 8%).

**Results:** Equivalent doses were respectively 1.08±0.44 mSv (0.42-5.74) for the coronary angiograms (n=4408), 1.74±1.02 mSv (0.47-7.63) for the PTCA (n=720), 2.05±0.96 mSv (0.48-8.35) if the PTCA was performed just after the diagnostic procedure (n=2678). Male gender, age, body mass index, previous bypass, cardiogenic shock, emergency, left ventriculography, aortography or other vessel angiographies, PTCA site number, chronic total occlusion, frame speed acquisition, junior operators were associated with patient radiation dose increasing. No radiation related complication could be observed during the hospitalization phase.

Figure 1: Equivalent Dose Distribution



**Conclusions:** Using flat panel technology, patient radiation dose are no high in invasive cardiology, suggesting a low determinism and stochastic risks. However reducing dose is a daily goal, and significant gains could be expected.

## BACKGROUND

*Patient Radiation Needs to be Promoted*

- Radioprotection goals are universal:
  - Justification, Optimization, Reduction
- Patient radiation dose increase time after time in cardiology:
  - X Ray exposure : Invasive Cardiology and new modalities as MSCT
  - SPECT investigations
- However patient dosimetry audit in cardiology is not a current practice

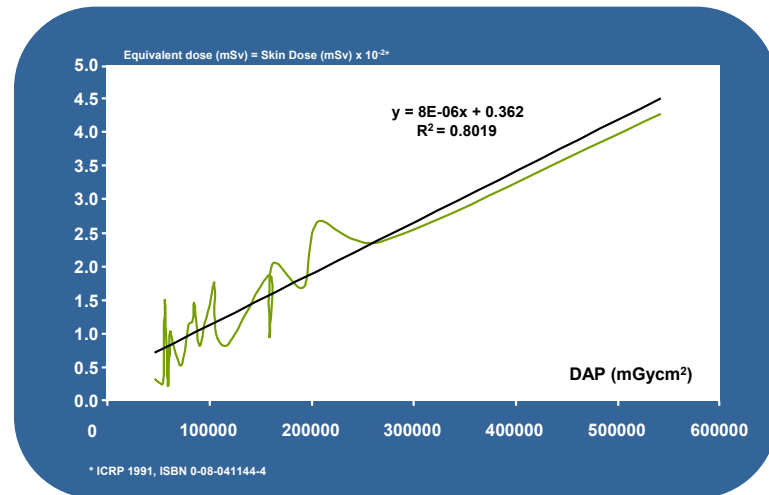
*Study Aim*

- Between 2002 and 2005 skin dose absorption and body equivalent dose (biological effect) were measured and analyzed for 7806 consecutive procedures (6704 pts), on a single X ray cath-lab (flat panel detector: Allura FD 10, Philips medical system™)

*Methods*

- For 100 consecutive pts explored in 2006, skin doses were measured during X ray exposure (PSD-3, Unfors Instruments™)
- 50 pts to calculate the correlation between Skin Dose and Dose Area product (DAP) and the other half for definitive validation

Figure 2: DAP and Equivalent Dose Correlation



## RESULTS

Table 1: Equivalent Dose According Examination Type

	n	Mean (mSv)	SD (mSv)	95% CI (mSv)	Min (mSv)	Max (mSv)
Coronary angiogram	4408	1.08	0.44	1.07-1.09	0.418	5.740
Angioplasty	720	1.74	1.02	1.66-1.81	0.466	7.632
Coronarography + Angioplasty	2678	2.05	0.96	2.01-2.09	0.482	8.354

Figure 3: Body Radiation in Invasive Cardiology

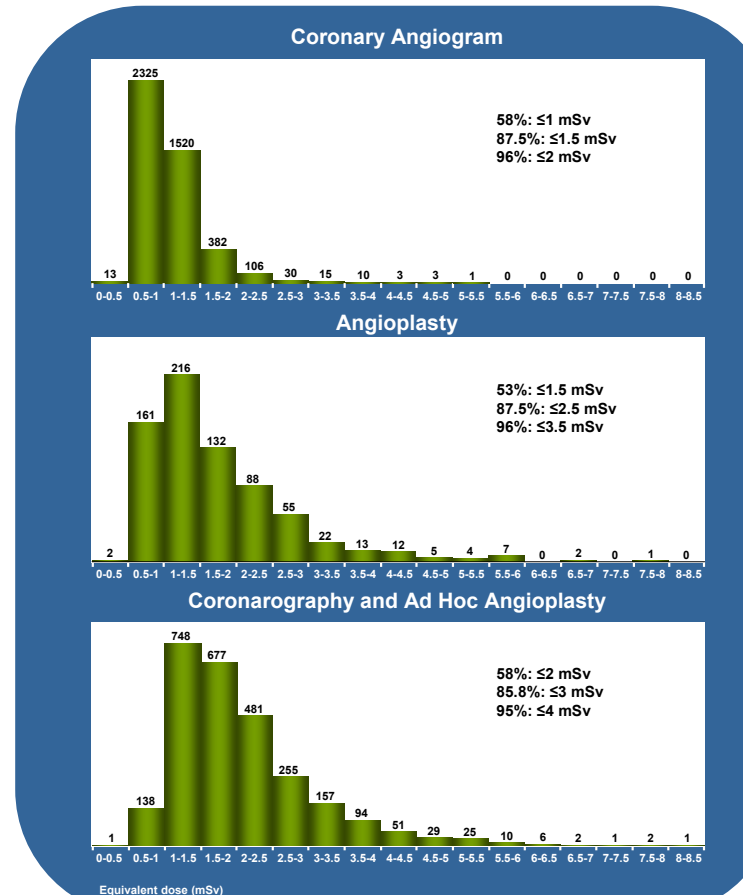
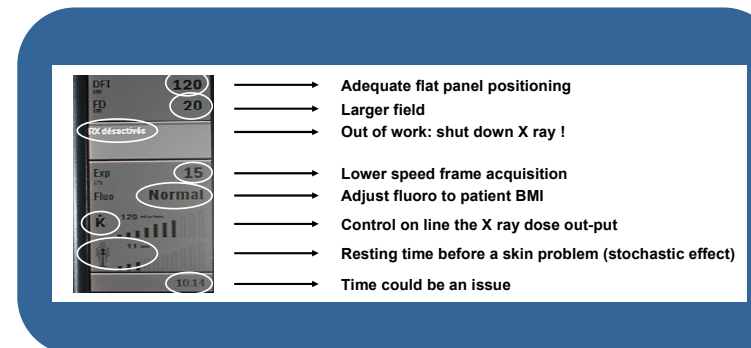


Table 2: Increasing Dose Factors

	Mean Raising Dose (mSv)	95% CI	p
<b>CORONARY ANGIOGRAM</b>			
Age (increasing with age)	0.05	0.36-0.64	0.000
Ventriculography	0.1	0.08-0.11	0.000
Aortography	0.17	0.08-0.26	0.000
Sexe (male)	0.19	0.18-0.20	0.000
BMI (increasing with BMI)	0.27	0.23-0.31	0.000
CABG opacification	0.52	0.36-0.67	0.000
<b>ANGIOPLASTY</b>			
Emergency/shock	0.49	0.35-0.42	0.000
CTO	0.53	0.06-0.99	0.000
PTCA site number (1 versus 2 or more)	0.59	0.5-0.68	0.000
<b>CORONARY ANGIOGRAM or ANGIOPLASTY</b>			
Junior operator	0.14	0.1-0.18	0.000
Acquisition speed (15 versus 30 f/s)	0.7	0.6-0.75	0.000

Figure 4: Reducing the X Ray Dose in Daily Practice?



## CONCLUSIONS

- Using a flat panel detector, patient radiation doses are pretty low in invasive cardiology. Not following a gaussian curve, Equivalent Dose is below 3 mSv in 94% of the procedures
- Suggesting a low determinist and stochastic effect
- Reducing dose is a daily goal and significant gains could be expected, in adapting practices and in improving synergy between non invasive and invasive explorations. In this purpose the couple MRI/Angio is very promising