Efficiency of a minicourse in radiation reducing techniques: a pilot initiative to encourage less irradiating cardiological interventional techniques (ELICIT)

E Kuon, K Empen, D M Robinson, A Pfahlberg, O Gefeller, J B Dahm

METHODS

Before and after the minicourse we analysed the following mean radiation parameters of 10 coronary angiographies, performed by each of the seven participating interventionists at the cardiac centre of Greifswald University, Germany: total DAP, radiographic (DAP\text{R}) and fluoroscopic (DAP\text{F}) fractions of DAP, the number of radiographic frames and runs, and fluoroscopy time. Bypass graft controls, significant valve diseases, emergency catheterisations, and PCI were excluded, since they are inhomogeneous.

We based our oral in-house PowerPoint minicourse in radiation reducing techniques, 90 minutes in length, on the following recommendations\footnote{1}\footnote{2}:

- Restriction to essential radiographic frames
- Consistent systematic use of the low level fluoroscopy mode
- Training of fluoroscopy saving blind positioning to the region of interest
- Restriction to the ostial region of interest during intubation of coronary arteries
- Preference for projections that rotate out the spine
- Adequate, instead of a best possible, image quality
- Full inspiration during radiography if necessary
- Adequately experienced and well rested interventionists.

Images were obtained with a digital, single arm flat panel system (AXIOM Artis dFC; Siemens AG, Erlangen, Germany). With a focus image detector distance of 1.2 m, a 25 mm thick aluminium absorber, and a 20 cm flat panel detector field format, detector entrance dose rates amounted to 0.029 \(\mu\)Gy/pulse (15 pulses/s) for fluoroscopy and to 0.170 \(\mu\)Gy/frame for radiographic documentation (15 frames/s). DAP was measured by a light transparent ionisation chamber (K1-S Axiom; PTW, Freiburg, Germany).

RESULTS

Patients’ mean (SD) overall DAP of all seven interventionists decreased from 30.8 (9.8) to 19.2 (6.8) \(\text{Gy} \times \text{cm}^2\) (\(p < 0.001\)) due to a reduction in radiographic DAP\text{R} from 21.0 (6.6) to 11.7 (3.2) \(\text{Gy} \times \text{cm}^2\) (\(p < 0.001\)).

This was a result of slightly shorter radiographic runs but mainly of the efficient application of radiation reducing tube angulations and a significantly better collimation to the region of interest. DAP\text{F}/frame decreased from 29.2 (6.9) to 18.4 (4.5) \(\text{mGy} \times \text{cm}^2\) (\(p < 0.001\)) and DAP\text{F}/s decreased from 42.5 (11.7) to 26.4 (8.3) \(\text{mGy} \times \text{cm}^2\) (\(p < 0.001\)). However, the latter attempts took time: fluoroscopy time increased slightly from 245 (82) seconds to 266 (101) seconds, so that the reduction of DAP\text{F} missed significance.

For individual interventionists, the reduction of mean total DAP\text{R} and DAP\text{F} was apparently less influenced by the number of radiographic frames and the fluoroscopy time than by the DAP\text{F}/frame and the DAP\text{F}/s. Total DAP seems not to depend on the operator’s interventional experience (fig 1).

DISCUSSION

The presented minicourse in radiation reducing techniques, the first validated course to date, promises considerably less patient radiation exposure and consequently occupational operator dose due to coronary angiography in clinical routine. That dose reduction predominantly resulted from consistent collimation to the region of interest during both radiography and fluoroscopy.

In this pilot study, mean DAP before and after the minicourse did not correlate with fluoroscopy time, which increased slightly. Moreover, the fact that DAP\text{R} significantly exceeded DAP\text{F} raises questions about the widely accepted predominant significance of fluoroscopy time for total patient DAP and the operator’s efforts in reducing radiation.\footnote{1}\footnote{2}

If DAP\text{R} and DAP\text{F} are recorded separately, the ratios of DAP\text{F}/frame to DAP\text{F}/s depends on the flat panel detector.

Abbreviations: DAP, dose–area product; DAP\text{R}, dose–area product radiographic fraction; DAP\text{F}, dose–area product fluoroscopic fraction; PCI, percutaneous coronary intervention
In conclusion, the present study definitively confirms that efforts to reduce patient radiation exposure in clinical routine favour both consistent collimation to the region of interest and less irradiating tube angulations. Regular documentation of DAP⁹ and DAPº and of the number of radiographic frames in addition to fluoroscopy time and total DAP would be well suited to monitor, by self surveillance or by supervisory authorities, each operator’s individual long term efforts towards decreasing radiation exposure.

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**REFERENCES**


**FROM BMJ JOURNALS**

Cost effectiveness of nurse led secondary prevention clinics for coronary heart disease in primary care: follow up of a randomised controlled trial

James P Raftery, Guiqing L Yao, Peter Murchie, Neil C Campbell, Lewis D Ritchie

Objective: To establish the cost effectiveness of nurse led secondary prevention clinics for coronary heart disease based on four years’ follow up of a randomised controlled trial.

Design: Cost effectiveness analysis.

Setting: 19 general practices in north east Scotland.

Participants: 1343 patients (673 in intervention group and 670 in control group, as originally randomised) aged under 80 years with a diagnosis of coronary heart disease but without terminal illness or dementia and not housebound.

Intervention: Nurse led clinics to promote medical and lifestyle components of secondary prevention.

Main outcome measures: Costs of clinics; overall costs to health service; and cost per life year and per quality adjusted life year (QALY) gained, expressed as incremental gain in intervention group compared with control group.

Results: The cost of the intervention (clinics and drugs) was £136 ($254; €195) per patient higher (1998–9 prices) in the intervention group, but the difference in other NHS costs, although lower for the intervention group, was not statistically significant. Overall, 28 fewer deaths occurred in the intervention group leading to a gain in mean life years per patient of 0.110 and of 0.124 QALYs. The incremental cost per life year saved was £1236 and that per QALY was £1097.

Conclusion: Nurse led clinics for the secondary prevention of coronary heart disease in primary care seem to be cost effective compared with most interventions in health care, with the main gains in life years saved.

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