Radiation dose and image quality for adult interventional cardiology in Chile. A national survey.

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INTRODUCTION

• Today no one would doubt that Interventional cardiology (IC) procedures plays an important role in the diagnosis and treatment of cardiac vascular diseases. However, they represent a main artificial sources of ionizing radiation to the population, generating high levels of radiation dose to patients and staff.

• In Chile, since 2008 was adopted the European protocols DIMOND and SENTINEL for commissioning (characterize) X-ray fluoroscopy systems, because their radiation protection legislation does not consider this type of measurements. Evaluation of dose settings and image quality of any X-ray system, are the first quality controls to consider in any patient dose survey, altogether with the accuracy of the dose indications.
PURPOSE

• Investigate at a national level, the differences in dose settings and image quality among X-ray systems used in adult IC procedures, when used in the same geometrical setup simulating the clinical practice.

The study was part of the International Atomic Energy Agency (IAEA) program ‘Strengthening Radiological Protection of Patients in Medical Exposures (TSA3), RLA/9/057’.
# MATERIAL AND METHODS

<table>
<thead>
<tr>
<th>ID no.</th>
<th>Manufacturer</th>
<th>Model Description</th>
<th>Image detector</th>
<th>Year of installation</th>
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<td>1997</td>
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*Manufacturer unavailable*
MATERIALS AND METHODS

Test objects (Leeds TOR FG-18) at isocenter, to evaluate the image quality.

Measurement ESAK, with solid-state detector Unfors Xi.

Numerical parameters used to evaluate the image quality

(Signal-to-noise ratio)

\[
SNR = \frac{[BG - ROI]}{\sqrt{\frac{(STD_{ROI}^2 + STD_{BG}^2)}{2}}}
\]

(High contrast spatial resolution)

\[
HCSR = STD_1 - STD_2
\]

(Figure of merit)

\[
FOM = \frac{SNR^2}{ESAK}
\]

20 cm of PMMA
RESULTS AND DISCUSSION

The ratios of maximum to minimum values measured for 20 cm PMMA were 15.1 for MF and 6.8 for CI modes.
RESULTS AND DISCUSSION

These results should have a direct relation with the ESAK per frame values, type of technology and years of functioning, nevertheless, this condition is not clearly revealed in the present paper.

The X-ray system no. 2 (Phillips Allura Xper FD20) is the one which presents the best results for both image quality parameters evaluated (SNR and HCSR).
The parameter figure of merit FOM has previously been used by other authors for the optimization of signal detectability in digital imaging, relating the image quality and dose per frame needed to obtain such an image. On our research we found maximum and minimum FOM values from 125.4 to 6.9. The FOM proposed does not evaluate the cost in terms of image quality for the HCSR parameter versus doses.
RESULTS AND DISCUSSION

ID.no. 2

Better image

HCSR = 10
CONCLUSIONS

• The results derived from of the dose values and image quality parameters of the X-ray systems involved in the present national survey, show important differences and points out to need to launch an optimization program.