Radiation doses in a newly founded Interventional Cardiology Department

V. Tsapaki, A. Christou, N. Nikolaou, S. Spanodimos, I. Chinofoti, A. Poulianitou, S. Patsilinakos

Konstantopoulio General Hospital, Nea Ionia, Athens, Greece

Presenting author: V. Tsapaki : virginia@otenet.gr

Introduction

- Interventional cardiology (IC) procedures are a routine around the world due to their successful clinical outcome and improved patient safety.
- They can be difficult and demanding, since the physician must consider simultaneously many technical and clinical aspects. In addition, the patient's condition carries a substantial risk compared to radiation dose.
- Taking the great benefits of interventional procedures for granted, the reports of patient radiation dose studies have raised concern regarding radiation dose levels in IC.

Purpose

The purpose of this study was to investigate the radiation doses in coronary angiography (CA) and percutaneous transluminal coronary angioplasty (PTCA) in the recently founded IC department of Konstantopoulio General Hospital of Nea Ionia in Athens.

Materials and Methods

- The Interventional Cardiology (IC) and Radiology Department was rather recently founded.
- The IC team consists of 3 interventional cardiologists with more than 10 years of experience.
- The remaining staff consists of 4 nurses and 3 technologists with limited experience in interventional procedures in terms of radiation protection.
- Greek Atomic Energy Commission provided a radiation protection course for all the staff of the department before the department start working.
- A medical physicist is available for all radiation protection matters.

X-ray equipment:
Philips Integris Allura Xper FD20
fully digital monoplane machine with flat detector (FD).

Technical parameter	
FD size (cm)	30x40
Field of view (FOV) (cm) (diag)	48, 42, 31, 26, 22, 19, 15
Icocenter to floor (cm)	106.5
Focal spot to icocenter (cm)	81
Generator power (kW)	100
kV range (kV)	40-125
Anode heat capacity (MUH)	2.4
Pulsed fluoroscopy	15
Fluoroscopy mode	L, N, H**
Cu filters	0.2/0.5/1.0
Cine rate (fr/sec)	6, 15, 30
Cumulative Air-Kerma (CAK) (mGy)	Yes
Kerma-Area Product (KAP) ($Gy.cm^2$)	Yes

Patient data:

- *The study was conducted the first year of installation*
- *336 patients were included in the study*
- *177 patients with CA*
- *159 patients with PTCA*
- *Patient data collected: Fluoroscopy time (T) (min), number of images (F), KAP and CAK*

- *Using appropriate conversion factors published in the literature, Peak Skin Dose (PSD) and effective dose (E) were estimated:*
- *PSD = 206+ 0.51*CAK (mGy) for CAK > 500 mGy*
- *E = 0.18 * KAP (mSv)*

Results

CA	F	KAP (Gycm²)	PSD (mGy)	T (min)	E (mSv)
median	570	34	478	211	6.1
min	175	8	284	64	1.4
max	2199	291	2544	2560	52.3

PTCA	F	KAP (Gycm²)	PSD (mGy)	T (min)	E (mSv)
median	932	80	885	612	14.4
min	225	11	290	56	1.9
max	4200	368	3334	3207	66.2

- Median PSD < 2 Gy (dose threshold for first skin effects).
- Only 5 patients (1.5 %) had PSD> 2 Gy (PTCA procedures).
- None of these 5 patients reported any skin effect.

Comparison with median E of other radiological procedures in our hospital:

- CA : 6.1 mSv
- PTCA : 14.1 mSv
- Pelvic CT : 6mSv
- Therapeutic CT guided ablation : 35 mSv
- Repeated CT guided ablation : 114 mSv

Comparison with literature

- This study: CA: 34 Gy cm^2, PTCA: 80 Gy cm^2
- European Reference dose levels:

KAP (CA: 45 Gy cm^2, PTCA: 85 Gy cm^2)

- IAEA Guidance levels

KAP (CA: 50Gy cm^2 , PCI: 125Gy cm^2 *medium complexity*)

- IAEA action levels

CA:15 Gy cm^2 , PCI: 25 Gy cm^2

Conclusion

- The results of the study show that radiation doses are lower than international reference levels, considering the inexperienced staff of the department.
- The percentage of the high risk patients for radiation skin effects is extremely low.
- However, due to the large range of doses, patient dose monitoring will continue for further investigation.