Patient Dose Research in Interventional Radiology Suites in Rio de Janeiro, Brazil

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INTRODUCTION

The growing use of interventional procedures guided by fluoroscopy, it is because these procedures offer great benefits to patients. However, these procedures contribute significantly patient's radiation exposure. In interventional procedures the patient has many organs irradiated and, particularly, the skin is the organ most at risk of deterministic injuries. In interventional procedures the dose is difficult to assess for the following reasons: different field sizes of X-rays, projections, magnifications, beam quality, focus skin distance, focus image intensifier distance, total time of irradiation, etc. One of the methods used to perform dosimetry in patients is through the use of meters kerma area product . The purpose of this study was to measure the kerma area product and others parameters, such as, number of images and time exposure in some hospitals in Rio de Janeiro (Brazil) during interventional procedures.

MATERIAL AND METHODS

Figure 1: PTW, Diamentor E: electrometer and ionization chamber

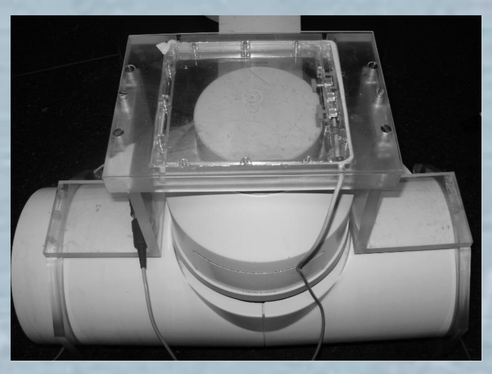

Figure 2: Supports for coupling the chamber to the output of X-ray tube

- Measurements were performed in four cardiac catheterization labs in Rio de Janeiro, Brazil: two public hospitals (A and B) and two private hospitals (C and D).
- Data were obtained from a sample of 339 patients undergoing interventional procedures: 221 Coronary Angiography (CA), 96 Percutaneous Transluminal Coronary Angioplasty (PTCA) and 22 Electrophysiological Procedures (EE).
- The kerma area product measurement was performed using PTW - Diamentor E (Figure 1) and Diamentor M4-KDK meters.
- The X-ray systems do not have a kerma area product (P_{KA}) meter installed, therefore using a special holder, the P_{KA} meter was mounted on the external output of the X-ray tube, being calibrated *in loco* (Figure 2).

RESULTS

Table 1: Results obtained in patients dosimetry

	Irradiation Time (minutes)	Number of images	Total P_{KA} ($cGy.cm^2$)
CORONARY ANGIOGRAPHY [n=221]			
Range	1-35	306-2175	472-60694
3rd Quartile	**8**	**1115**	**7613**
PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY [n=96]			
Range	2-59	209-4813	750-31810
3rd Quartile	**16**	**1400**	**6559**
ELECTROPHYSIOLOGICAL PROCEDURES [n=22]			
Range	5-95	-	1014-108816
3rd Quartile	**30**	**-**	**55838**

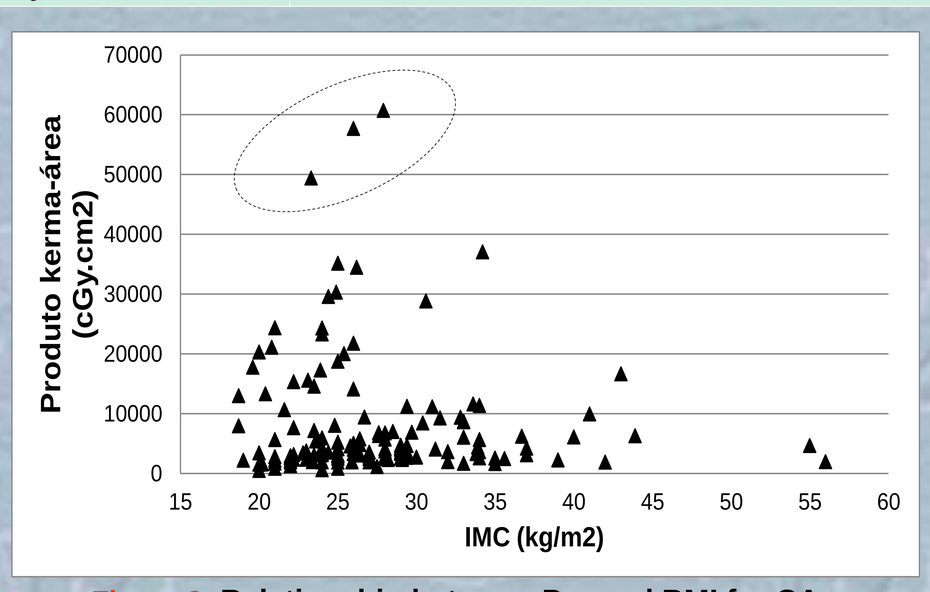

Figure 3: Relationship between P_{KA} and BMI for CA.

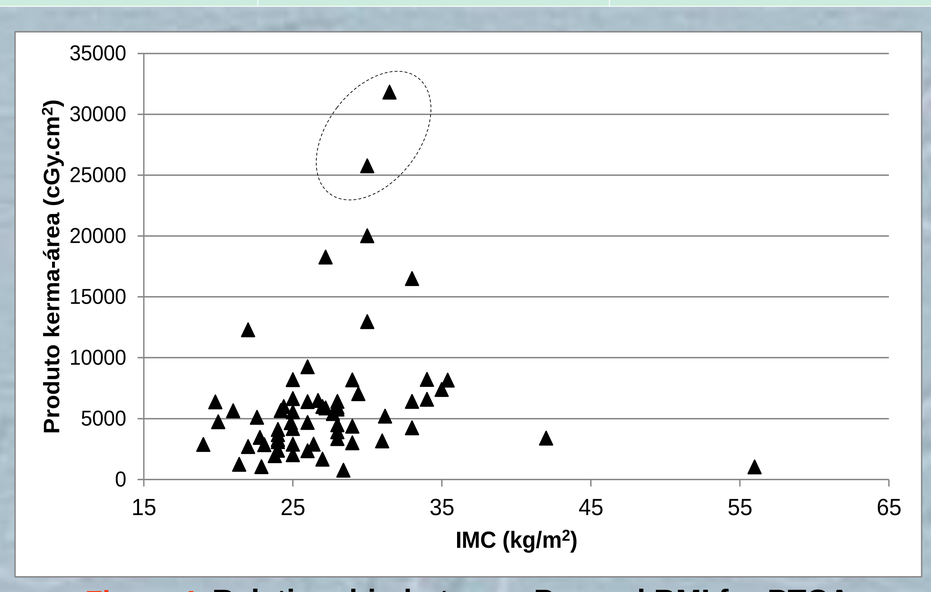

Figure 4: Relationship between P_{KA} and BMI for PTCA.

DISCUSSION

- Table 1 shows that the P_{KA} values for CA are higher if compared with diagnostic reference levels reported by SENTINEL which was 6.5 minutes, and 700 and 4500cGy.cm^2 for irradiation time, number of images and kerma area product, respectively.
- P_{KA} values obtained for CA may be due to the fact that a greater image acquisition during the procedures.
- Table 1 shows that the doses administered to patients (Total P_{KA}) for electrophysiology procedures are larger than during CA and PTCA. These interventions usually require long exposure times of the patient.
- From measurements of quality control, it was found that the equipment where electrophysiological procedures were carried out showed deficiency, resulting in higher P_{KA} values.
- Figures 3 and 4, the points involved by dotted curve represent results of atypical procedures, with the acquisition of a large number of images and long exposure times.

CONCLUSIONS

- A good correlation between P_{KA} and BMI is difficult to achieve, since P_{KA} depends on several factors, in addition the patient's weight and height, as the number of images obtained, pathology type and complexity of the procedure.
- Optimization strategies for practices are proposed owing to improve the radiological protection of patients in interventional procedures. A Technical Cooperation project, BRA9056: "Supporting National Assessment of Quality Control and Radiation Protection in Interventional Cardiology Departments" is being developed involving the interventional cardiology society and health agencies to enhance the effectiveness of the optimization process. We intend to continue the survey in a significant number of hospitals to establish diagnostic reference levels for interventional cardiology.

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