

Patients Dosimetry during the Profile Lumbar Spine X-Ray Examination in Eastern Côte D'ivoire

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Abstract: Our present study aims to evaluate the radiological practices in the largest radiology center in the east of Cote d'Ivoire (Abengourou) to optimize doses during profile lumbar spine X-ray examination. We needed and found on our study site, the high voltage generator associated with the X-ray tube, the desk, the wall stand, the x-ray viewer and the lead aprons. We brought with us the DAP- meter initially calibrated in the Secondary Calibration Laboratory in Freiburg Germany. The examination took place in the radiology room meeting the standards set by Ivorian laws. we took into account 30 adult patients, all of whom came for a profile lumbar spine examination confirmed by the prescription form they had. Before our study, this room was visited by the departments responsible for inspecting the radiology rooms. When the technician triggers the beam that hits the patient, we read on the electrometer, Dair and DAP. We did so for each of the 30 patients. The Diagnostic Reference Level (DRL) of ESD 4.07 mGy and DAP 553.19 cGycm² were calculated by the 75th percentile method on the 30 patients. We also calculated the arithmetic mean of ESD and DAP, we found respectively ESD_m = 3,691 mGy and DAP_m = 520,6 cGycm². Our results allow us to say that for the examination of the profile lumbar spine, the dose received by the patients is optimized but the PDS is not. Corrective measures must then be taken.

Keywords: Entrance Surface Dose, Dose Area Product, Diagnostic Reference Levels, Optimization.

1. INTRODUCTION

The implementation of diagnostic reference levels (DRL) has become in recent years one of the central issues in the management of doses received by patients in radiodiagnosis and interventional radiology [1]. The aim is to obtain good image quality while minimizing the dose received by patients. There is a growing need for harmonization of practices and doses involving standardization of procedures and optimization of parameters influencing the dose delivered to patients [2]. Numerous scientific meetings have shown a growing interest in diagnostic reference levels such as the workshops in Italy in 1993[3], Luxembourg in 1997[4], the IAEA conference in Malaga in 2001 Decisions have also been taken by states such as those of the European community through directive 97/43[5] which is a transposed publication 70 of the International Commission on Radiological Protection (ICRP) to establish the DRLs. In Côte d'Ivoire, a study was conducted by Konate and al which made it possible to establish the DRL for 11 radiology centers [6] for examinations of the thorax, the front lumbar spine and the profile lumbar spine. Our present study aims to evaluate the radiological practices in the largest radiology center in the east of Cote d'Ivoire (Abengourou) to optimize doses during profile lumbar spine X-ray examination.

2. MATERIALS AND METHODS

2.1. Materials

we needed and found on our study site, the high voltage generator associated with the X-ray tube, the desk, the wall stand, the X-ray viewer and the lead aprons. We brought with us the DAP- meter initially calibrated in the Secondary Calibration Laboratory in Freiburg Germany [7]. This device consists of an ionization chamber that is fixed at the exit of the tube on rails and an electrometer that we have placed next to the desk behind the screen. When the beam passes through the ionization chamber, the ions formed move and create a current which is carried through two leads on the electrometer which converts it into a dose in the air (Dair) and Dose-Area Product (DAP) [7].

2.2. Methods

The examination took place in the radiology room meeting the standards set by Ivorian laws [8]. we took into account 30 adult patients[9], all of whom came for a profile lumbar spine examination confirmed by the prescription form they had. Before our study, this room was visited by the departments responsible for inspecting the radiology rooms. When the technician triggers the beam that hits the patient, we read on the electrometer, Dair and DAP We did so for each of the 30 patients. We also noted the high voltage, the charge, the distance between the focus and the detector used, the filtration of the tube.

3. RESULTS

3.1. Determination of the Entrance Surface Dose of patients

We determined the ESD of each patient from Dair by the formula

$$ESD = BSF * Dair$$

BSF backscattering factor equal to 1.35 [10]

3.2. Determination of the DRL and the average of ESD and DAP

The DRL was determined for each patient, for the ESD and the DAP, using the 75th percentile method [11]. We also calculated the mean Entrance Surface-dose ESDm and the mean dose-area product DAPm using the arithmetic mean [12] (table 1). These averages correspond to all the radiological practices for the examination of the lumbar spine in this room.

Table1. DRL and mean values for ESD and DAP

DRL				Mean	
ESD Cote d'Ivoire[6] (mGy)	ESD study (mGy)	DAP Cote d'Ivoire[6] (cGy.cm ²)	DAP study (cGy.cm ²)	ESDm (mGy)	DAPm (cGy.cm ²)
4,238	4,07	736,27	553,19	3,691	520,6

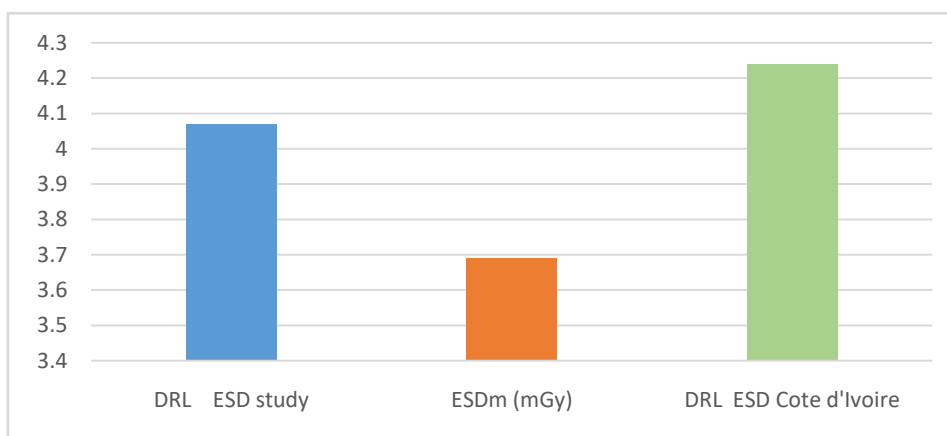


Figure1. Comparison ESDm of Abengourou to the DRL of Abengourou and Cote d'Ivoire

The mean value of the dose received by Abengourou patients is smaller than the DRL of Abengourou and Cote d'Ivoire (see figure 1)

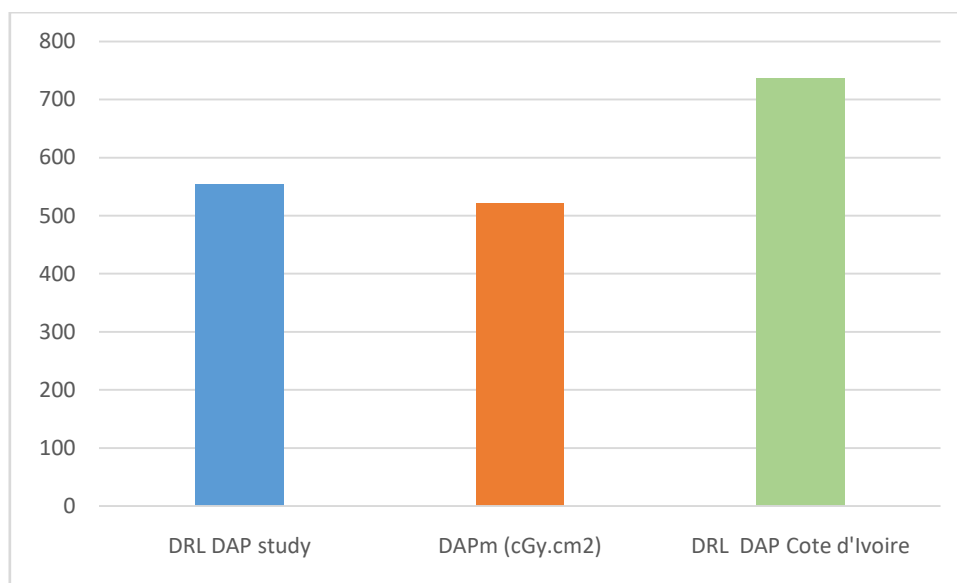


Figure2. Comparison DAPm of Abengourou to the DRL of Abengourou and Cote d'Ivoire

The average value of DAP received by Abengourou patients is lower than the DRL of DAP in Cote d'Ivoire but almost equal to the DRL of DAP in Abengourou (see figure 2)

3-3-Voltage and charge used for our study

From the voltage and charge set by the technician to perform the examination of each patient, we calculated the average voltage and the average charge used in Abengourou to perform the examination of the lumbar spine (see table 2).

Table2. Mean voltage and charge used in Abengourou

Mean voltage (kV)	Mean charge (mAs)
106,9	62,06

4. DISCUSSION

According to table 1 and figure 1, ESDm is lower than DRL of Abengourou and the DRL of Cote d'Ivoire which means that the dose is optimized for the examination of the profile lumbar spine in Abengourou[13]. This can be explained by the existence of good tube filtration 2.5mm Al [14]present in the X-ray tube and by the values of mean voltage and mean charge which are respectively in rank [80-100] kV near 100kV and in rank [70-150] mAs near 70 mAsin accordance with the recommendations of certain learned societies of radiology[15].However, the DAP is not optimized because the DAPm is almost equal to the DRL of DAP; corrective measures must be worn on the exposed surface of the patients. It is necessary to use the diaphragm wisely to cover just the part concerned by the examination [14].

5. CONCLUSION

Our study makes it possible to evaluate the radiological practices at the regional hospital center of Abengourou, the busiest center in the east of Cote d'Ivoire. Our results allows us to say that for the examination of the profile lumbar spine, the dose received by the patients is optimized but that the DAP is not. Corrective measures must then be taken, using the diaphragm properly so as to cover just the part of the patient to be examined.

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