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Evaluation of the Level of Reference Diagnoses in the dosimetric study of the Abdomen Without Preparation (AWP) in the adult at the Regional Hospital of Ngaoundéré, Cameroon

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ABSTRACT

Introduction: Doses delivered in standard radiography surveys are not sufficiently mastered and the working protocols for the same exam given differ for similar morphotypes within the same hospital structure.

Material and Methods: The dose at the entrance of the skin of the Abdomen Without Preparation (mGy) was evaluated on 30 adult patients with a mass of 70 ± 10 kg according to the Davies model from the 75th percentile irradiation. The analysis and processing of the data was carried out by Excel 2010.

Results: The entrance dose of the ASP obtained in mGy was 8.13 ± 0.4 for the AP projection.

Conclusion: This study revealed large variations in doses at the entry of the skin during the explorations of the abdomen without preparation. These variations made it possible to understand that the diagnostic reference levels depend on the delivered doses and integrate above all the notions of quality of the radiographic image, the quality assurance of the radiological equipment and the level of training of the manipulators.

Keywords: standard radiography, Abdomen Without Preparation (AWP), entrance dose, Diagnostic Reference Level (NRD).

INTRODUCTION

The radiodiagnosis answers the sphere of activity which employs the ionizing radiations with goal diagnosis, even interventionnel. This practice engages the exposure to the ionizing radiations constituting the principal artificial source of irradiation to which the man is exposed. The evaluation and the optimization of the amounts received by the patients are very significant tasks for the protection of the patients in radiodiagnosis [1]. The optimization of the amounts delivered during the radiological examinations, by the determination of the Levels of Diagnostic Reference (NRD) and it quality control of the installations and radiological procedure, make it possible to minimize the risk related to these irradiations by reducing the amount received by the patient.The diagnostic medical examinations using ionizing radiations such as radiology, the scanning and the nuclear medicine lead to a variable exposure of the patients according to the procedure implemented, the technology of the installation and the morphotype of the patient [2].

The use of the ionizing radiations at diagnostic or therapeutic ends is indeed incompatible with a lawful limitation of the amounts:the level of irradiation is by need subordinate to the medical objective, and to impose "*a priori* " insuperable thresholds would be a misinterpretation prejudicial with the patients.The protection against radiation of the people exposed for medical reason thus rests exclusively on lesprincipes justification and of optimization [3]. Pursuant to the principle of optimization and without however calling into question the diagnostic quality of the examination, the dosimetry of the patients in standard radiography is thus a function of the operational parameters such high voltage (Kv), the intensity of the current (my), the duration (S), the load or milliampèrage (farmhouse), the morphotype, the incidence carried out (PA/AP), Distance-Hearth-Skin (DFP), Distance-Hearth-Film (DFF), of the field and filtration etc, In order to urge the professionals of the imagery to optimize the amounts which they deliver with their patients, of the levels of reference were defined in _Æ_ Æ_ medical diagnoses current.

The numerical determination of the values of reference is based on the statistical method known as of the 75èmes percentiles of the parameters of distribution of the measured amounts [4,5].The concept of NRD is specific to the medical exposures and does not have to be confused with that of "limit of the personal doses" which is applied dansles fields of the protection against radiation of the workers and the public. In traditional radiology, the dosimetric sizes which answer these criteria are on the one hand the amount at the entry of the patient, on the other hand the product amount-surface (PDS).The amount at the entry of the skin (Of) in conventional radiography can be obtained by calculation starting from the mathematical methods or be measured by a thermoluminescent dosemeter (TLD) [4].These two methods present relatively weak differences.The method of calculation or mathematics appears reliable and constitutes an effective alternative of measurement of the amount to the surface of the skin [6].

MATERIAL AND METHODS

Our study was monocentric and prospective and was carried out with the service of radiology and medical imagery of the Regional Center of Medical imagery of Ngaoundéré during the period active from April at July 2016.Any subject addressed for a ASP and whose age was located between 20 and 60 years, with a body mass ranging between 70 ± 10 kg was concerned in the study. The examinations were carried out on a GENERAL apparatus of mark ELECTRIC, model 5192454 whose maximum tension at the boundaries is 150 Kv. The studied parameters related to the patient (age, sex, explored anatomical area), the parameters related to the procedure (the Distance - Hearth-Film or DFF, Distance-Hearth-Skin or DFP, the incidence), for irradiation (kilovoltage or Kv, milliAmperage, time (séconde) or farmhouse), the dosimetric constants which missed in addition on the console of handling (Amount at the entry or Of, the product proportions surface or PDS).

The first stage of calculation of the amount at the entry of the skin in standard radiography using the ideal models consists in calculating the power, the output (output) of the tube with ray.The power of the tube was estimated within the framework of our study according to the model of Suchart et al.. [7] using the parameters of irradiation directly implied in the achievements of the examinations.

$$\boldsymbol{{}^{O}\!/_{P}}\ \mathbf{(mR) = A \times 6.53{\times}10^{-4}(mR/mAs)(kVp^{2})^{-1} \times kVp^{2} \times mAs}$$

where A was an equal constant of 0,5;0,8 and 1 for the generator single-phase currents tubes, three-phase and high frequency respectively.Within our framework of study the tube with x-ray was three-phase.The outputs obtained were converted of (Mr.) in (mGy. farmhouse $^{-1}$) by multiplication with a factor of 0,00877/mAs [8].

The amount at the entry of the skin for each patient was calculated by using the parameters of irradiation of each radiographic exploration according to the model of Davies [9].

$$\boldsymbol{D_e(mGy) = \left({}^{O}\!/_{P}\right)\left(\frac{kV}{80}\right)^2 mAs\left(\frac{100}{DFP}\right)^2 BSF}$$

where

$D_e(mGy)$,the amount at the entry of the skin;

${}^{O}\!/_{P}\, mGy.(mAs)^{-1}$, the power (output) of the tube with x-ray, 80 Kv for a distance fixed at 100 cm for 10 farmhouses;

kV, the tension applied to the tube for the realization of the examination;

mAs, the load passing in the tube;

DFP(cm), Distance-Hearth-Skin;

BSF, the factor of retrodiffusion of radiation.Within the framework of this work, it is equal to 1,35 for the adults according to the IAEA [10].

The anthropometric data and the technical parameters used (Kv, farmhouse, DFF, DFP) were collected at the time of the examination.Only the images of good qualities having been used for the diagnosis were considered.The analysis and the processing the data according to 75èmes percentiles of the parameters of irradiation as well as calculation of the amount at the entry of the skin (Of) of the patients were carried out by Excel 2010.

RESULTS

Examen	Effectif	kV	mAs	DFF	DFP	De	De	ratio De
		Min-Max	Min-Max	Min-Max	Min-Max	Min	Max	Min/Max
ASP : AP	29	70-80	40-60	1,5-1,9	1,3-1,5	4,29	6,9	0,6

Table 1 : Descriptive parameters of the distribution of the amount at the entry of the skin of the abdomen without preparation (ASP) in antéro-posterior incidence

Exam	O	kV	mAs	DFP	75ème percentile
ASP : AP	0,3	72,7 ± 2,0	47,7 ± 5,3	1,4 ± 0,08	8,13 ± 0,4

Table 2 : Descriptive parameters of **the distribution of the 75èmes percentiles** of the amount at the entry of the skin of the abdomen without preparation (ASP) in mGy in antéro-posterior incidence.

The table above presents the whole of the technical and descriptive parameters used for the calculation of the amount at the entry of the skin for the abdomen without preparation in antéro-posterior incidence in mGy. The ratio From (Min/Max) 0,6 indicates a significant variation of the parameters of exploration of the ASP.On the other hand, table 08 above presents the distribution of the 75èmes percentiles of the amount at the entry of the skin in mGy of the abdomen without preparation in antéro-posterior incidence is 8,13 ± 0,4.

Table3 : Parameters of exposure and informative of the patients

Type d'examen	Incidence	Age	Poids	kV	mAs	DFF	DFP
ASP	AP	39, 96	69,08	73,92	48,96	1,72	1,40
		(25-57)	(62-79)	(70-80)	(40-60)	(1,6 -1,8)	(1,3-1,5)

Table 3 presents the distribution of the parameters morphotypes of exposure of the patients (poids, kV, mAs, DFF, DFP).

Tableau 4 : Statistical description of the amount at the entry of the skin (mGy)

Type d'examen	Incidence	Min	Max	Max/Min	3ème quartile	SD
ASP	AP	4,29	6,9	1,6	8,13	0,4

Table 4 presents the statistical distribution of amount at the ASP

Tableau 5 : Comparison of the amount at the entry of the skin (mGy) with those obtained elsewhere and with the NRD

Type of exam	Incidence	Our study	SD	IRSN NRD	Abu et *al.* Soudan 2016 [11]	SD	Khoshdel-Navi et *al.* Iran 2016 [12]	SD
ASP	AP	8,13	0,4	8	3	0,39	2,07	1,17

Le table 5 present the amounts at the entry of the thorax obtained and compared with those estimated by others and at the NRD available for the exploration of the abdomen without preparation in the adult.

DISCUSSION

Table 1 et 2 introduce to the parameters of exposure and informative patients received for the exploration of the thorax to the service of Regional Hôpital radiology of Ngaoundéré.Of these results, we note that diversities of the protocols for same a morphotype are at the origin of the great variations of the parameters of irradiation.

Table 3 shows statistical descriptions of the amount at the entry (mGy) during the radiography of the abdomen without preparation.Of these results, we note that the ratio of the amount at the entry of the Max/Min abdomen is very high (1,6).This report finds its explanations in the great variations of the parameters of irradiation for similar morphotypes as presented in table 4.However, these observations have become very worrying in a context of constant expansion of the medical imagery for one decade and weak documentation as regards the protection against radiation of the patients in spite of the "dangerous" profile of certain manipulators in radiology which does not correspond indeed to their qualification because some was assistance-looking after which do not have is any idea or an approximate idea of the texts and/or practical in favour of protection against radiation but rather converted into manipulators in radiology, and a great rotation of the trainees in radiology who find protocols of work nonavailable but which are often constrained to produce stereotypes able to be exploited.

Besides table 5 presents great variations of the amounts with those and to the international references.These variations with those obtained elsewhere and to the international standards partly explain the absence of the dosimetric values and the protocols of work in the room of examination.Which values which should be well used for control and optimization of the practices.This aspect proves the state embryonic and alarming of the protection against radiation of the patients in the services of radiology in particular to the service of radiology of the Regional Center of Medical imagery of Gaoundéré, however in practice, while posting and by applying the latter, it is possible to avoid an useless irradiation and the periodic evaluation of the delivered amounts should become a routine activity.

CONCLUSION

The evolution of the regulation as regards protection against radiation makes it possible to understand that the development of technologies did not only contribute to the reduction of the exposures but is also at the origin of the blurs in the taking into account of the risks related to these practices of the acts radiodiagnosis.It is advisable to release in a context where the deficit of formation as regards protection against radiation (personnel and patients) is associated the weak knowledge and the non-application of the existing rules of protection against radiation.Much more, force is to note that the qualified staff shortage in protection against radiation and the resource gap constrained with the approximate applications as regards protection against radiation by manipulators in radiology which do not have any qualification and any knowledge on the use of the ionizing radiations.

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