

STATISTICAL EVALUATION OF JUSTIFIED MEDICAL EXPOSURES IN RADIOLOGICAL DIAGNOSIS[#]

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Abstract. Worldwide, medical exposures contribute with 20% to the average annual per caput effective dose (0.62 mSv). Our statistical evaluation consists of assessing the frequency and types of procedures underwent by 1134 patients. The most frequent investigation was noticed at lumbar level for 16–40 years group and the highest exposure number at patients over 40 years old. The percentages of justified practices were approximately double than non-justified medical exposures, being correlated with clinical and radiological diagnosis.

Key words: planned exposure, procedures justification, diagnostic radiology.

INTRODUCTION

According to the latest United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) there were reported approximately 3.1 billion diagnostic medical X-ray examinations undertaken annually in the world. Thus, medical exposures contribute to a total annual collective effective dose estimated for 4.0 million manSv to the world population (6446 millions) [5].

In Romania, the legislation regarding radiological protection of persons in medical exposures [4] is based on European Committee Council Directive 96/29 EURATOM [2].

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MATERIALS AND METHODS

Our statistical evaluation consists of assessing the frequency and types of 1999 diagnostic exposures situations (planned, emergency) being underwent by 1134 patients (60.7% females) during four months in winter (2), spring and summer (1) seasons, performed in a radiological unit from Iași general hospital polyclinic.

Data were collected from diagnostic radiology for adult and pediatric patients undergoing 14 most important types (AP, PA, LAT, joints) of conventional X-ray diagnostic (skull and facial bones, chest, cervical, thoracic and lumbar spine lumbo-sacral joint, pelvis and hips, limbs and joints).

In the analysis were taken into account three age groups (up to 15, 16–40, over 40 years old), sex distribution of patients and both presumed clinical and the radiological diagnosis results in respect of justified practice definition as “medical exposure that shall show a sufficient net benefit, weighing the total potential diagnostic or therapeutic benefits it produces, including the direct benefits to health of an individual and the benefits to society, against the individual detriment that the exposure might cause, taking into account the efficacy, benefits and risks of available alternative techniques having the same objective, but involving no or less exposure to ionising radiation” [3].

RESULTS AND DISCUSSION

Table 1 summarizes our data regarding the number of medical exposures for pediatric and adult patients according to age, sex, and types of planned exposure.

Table 1

Distribution of exposures in different types of procedures

Type of planned exposures		Total number of exposures	Number of exposures on age groups (years)			Number of patients (sex)	
			<15	16–40	> 40	M	F
1.	Skull and facial bones (PA, LAT)	73	–	33	40	26	39
2.	Chest (PA/LAT)	567	–	136	431	139	174
3.	Limbs and joints	306	1	89	216	63	96
4.	Cervical spine	176	–	34	142	32	61
5.	Thoracic spine (AP, LAT)	201	1	78	122	27	75
6.	Lumbar spine and lumbo-sacral joint	571	–	230	341	124	184
7.	Pelvis and hip	105	–	21	84	35	59
TOTAL		1999	2	621	1376	446	688

The distribution of examinations according to sex and age was high in female adults (34.4%) and on group over 40 years (68.8%). The most frequent investigation was noticed at spinal column in 47.4% of total exposures, mainly at lumbar level (28.6%) in equal frequency with chest type exposures (28.4%) and followed by limbs (15.3%) and cervical spine (8.8%).

After physician examination the main recommendations for a radiological investigation were for: rheumatic complaints in 41.2% of exposures followed by malignant processes (22.6%), pulmonary and ear-nose-throat acute pathology (19.4%), traumatic injuries (14.4%) and others (0.23%).

For the group of 16–40 years old we noticed that the highest number of exposures was for 37.0 % lumbar spine and lumbosacral joint type, and 21.9% for chest procedures, both procedures explicable due to their active working status.

The patients over 40 years old were the group with the largest number of chest examinations (31.3%), at 25.3% females, followed by 24.8% lumbar spine and lumbo-sacral joint exposures.

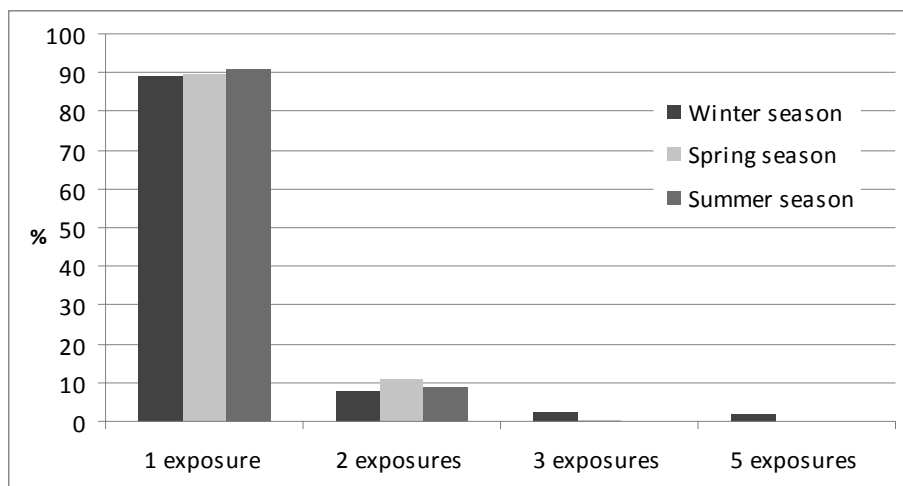


Fig. 1. Distribution of multiple exposures per patient by seasons.

There was an increased number of examinations in winter and spring for season-related diseases such as acute respiratory and chronic degenerative whole spine and skeletal modifications compared with summer time. In 10.5% of cases, patients underwent from 2 (86.4%) to 5 (1.5%) exposures at the same time of radiological examination. The number of exposures varied during seasons: 10.8 % patients with 2–5 exposures in winter time in relation with rheumatic diseases and traumatic injuries, 10.5% in spring season with 2 and 3 exposures per patient and 9% of patients in summer season with 2 concomitant exposures and are illustrated in Figure 1. There were a lot of cases (66%) with multiple exposures at the same person especially in females group and from urban regions (57.5%).

The percentages of justified practices indicated by practitioners, represented in Figure 2, were approximately double than non-justified medical exposures – 64.2% vs.35.8%, revealing that there is an improved and better correlation between clinical diagnostic and the required radiological investigation.

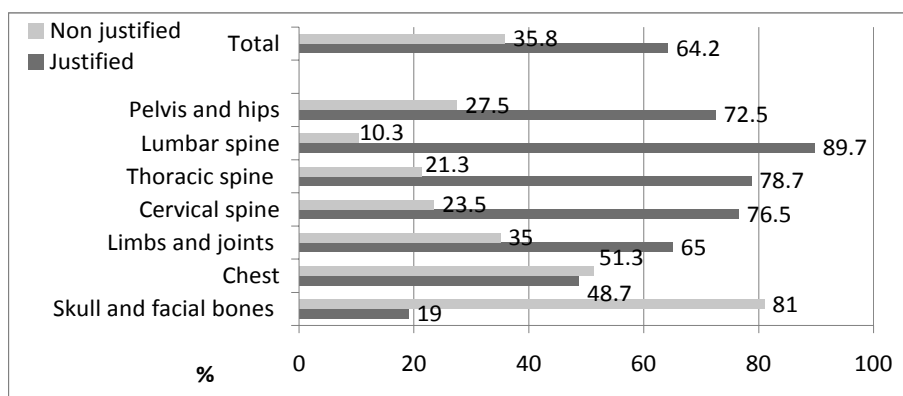


Fig. 2. Percentages of justified practices for various types of X-rays examinations.

This analysis reveals an increased number of justified radiological planned exposures – 64.2% *versus* 58.5% in our previous study [1], possible by the new acquired information in radiological protection of general or other specialist physicians and the rigorous decisions from radiologists.

CONCLUSIONS

The analysis of data concluded an increasing number of justified medical exposures, than previously analyzed data in the same radiological unit.

It is imperative to continue the patients' information about the radiation risk of multiple type exposures at the same radiological examination or shortly carried on future time.

In this analysis we could not estimate the effective per caput and collective dose in the absence of technical parameters of radiological installation, but it will be one of our main objectives in the future studies.

REFERENCES

1. POPESCU, IRINA-ANCA, NICOLETA PERJU, CAMELIA COBZEANU, Studiul practicilor în expunerea medicală planificată în scop diagnostic, In: *Conferința Națională Conceptul „Cultura de Radioprotecție” și rolul său în protecția populației și a mediului*, Ed. Etna, București, 2011, pp. 45–50.

2. ***DIRECTIVA 96/29 EURATOM – basic standards for population radiological protection against natural radiation sources
3. *** *International Basic Safety Standards*, Chapter VII, Medical exposures, 2013.
4. ****Ordinul Ministrului Sănătății și Familiei și al Președintelui Comisiei Naționale pentru Controlul Activităților Nucleare nr. 285/1979/2002* – pentru aprobarea Normelor privind radioprotecția persoanelor în cazul expunerilor medicale la radiații ionizante.
5. ****United Nations Scientific Committee on the Effects of Atomic Radiation*, UNSCEAR 2008 Report, vol. I, Sources: Scientific Annexes A and B, United Nations Ed., New York, 2010, pp. 21–220.