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"Typical Values" of Activities Administered to Pedriatics Patients in Renal Exams with ^{99m}Tc-DTPA

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Abstract: ^{99m}Tc-DTPA is a radiopharmaceutical employed for mofological and functional assessment of the renal system. The increase in the number of exams in nuclear medicine (NM) requires that optimization procedures are continually implemented and revised. "Picture Archiving and Communication System" (PACs) file system were utilized to count the number of scintigraphy. Record of pediatric exams from the NM service were used to verify the activities administered (MBq). The objective of this work is to evaluate the number of exams and the activities administered of the ^{99m}Tc-DTPA radiopharmaceutical in pediatric patients for suggest "typical values". Results demonstrated that there are a high percentual difference between the activities administered for all age intervals. Furthermore, the activities administered to younger patients (0 to 1 year old) presented the higher "typical value".

Keywords: typical values, DRL, nuclear medicine, radioprotection

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"Valores típicos" de atividades administradas a pacientes pediátricos em exames renais com ^{99m}Tc-DTPA

Resumo: ^{99m}Tc-DTPA é um radiofármaco utilizado para avaliação mofológica e funcional do sistema renal. O aumento do número de exames em medicina nuclear (MN) exige que procedimentos de otimização sejam continuamente implementados e revisados. O sistema de arquivos "*Picture Archiving and Communication System*" (PACs) foi utilizado para contabilizar o número de exames de cintilografia realizados. Foram utilizados registros de exames pediátricos do serviço de MN para verificação das atividades administradas (MBq). O objetivo deste trabalho é avaliar o número de exames e as atividades administradas do radiofármaco ^{99m}Tc-DTPA em pacientes pediátricos visando sugerir "valores típicos". Os resultados demonstraram que há uma grande diferença percentual entre as atividades administradas para todas as faixas etárias. Além disso, as atividades administradas aos pacientes mais jovens (0 a 1 ano) apresentaram o "valor típico" mais elevado.

Palavras-chave: valores típicos, NRD, medicina nuclear, radioproteção.

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1. INTRODUCTION

Urinary tract infection in children is a problem which presents non-specific symptoms and signs, that can lead to complications such as hypertension and chronic kidney failure [1]. Knowing that nephro-urological diseases also affect children, even newborns, NM exams are recommended, as they are not very invasive, expose the patient to low doses of radiation and are capable of accurately detecting functional changes. Even though it is a safe exam it is always important to review and optimize the procedures involved. At the time it comes to pediatric patients, attention is focused on the values of administered radiopharmaceuticals since children are more radiosensitive and have a longer life expectancy, increasing the probability of experiencing a stochastic effect related to exposures [2].

Currently in Brazil, there are no official Diagnostic Reference Level (DRL) for adult or pediatric exams in NM, although studies have already been carried out to suggest them [3, 4]. For this reason it is important to study and evaluate the activities administered, especially in pediatric patients. This fact is corroborated not only by the greater radiosensitivity of these individuals, but also by the high incidence of kidney diseases in children [5], which leads to an increase in the number of NM exams using the radiopharmaceutical ^{99m}Tc-DTPA.

This study is important for optimizing the activities administered and contributing to reducing patient exposure to radiation, in addition to generating savings in radiopharmaceutical doses and improving the quality of the service. Furthermore, it can contribute to future studies related to the activities administered, the suggestion of DRL and to the radioprotection. In order to bring benefits to patient safety, in addition to raising awareness among the professionals involved. It can also serve to draw attention to the need to apply radioprotection standards effectively and continuously [6]. Therefore, this work

aims to evaluate ^{99m}Tc-DTPA activities administered to pediatric patients at a public hospital in São Paulo with the aim of suggesting "typical values".

2. MATERIALS AND METHODS

MN service has Siemens Symbia E. System gamma camera equipment. The PACs filing system was used to retroactively count the number of pediatric renal dynamic exams performed. The record of exams from the NM service was used to verify the administered activities (MBq and MBq.kg^{-1}) of the radiopharmaceutical ^{99m}Tc-DTPA. Pediatric exams were evaluated at age intervals 0 to 1 year, > 1 to 5 years, >5 to 10 years, >10 to 15 years. Using the values of activities administered for each exam in each age range medians were calculated, as suggested by the International Commission on Radiological Protection - ICRP 135 [6]. It is important to highlight that "typical values" must be estimated when only one installation is being evaluated.

3. RESULTS AND DISCUSSIONS

Over a period of one year, exams were carried out on 88 pediatric patients (0 to 18 years old) with the radiopharmaceutical ^{99m}Tc-DTPA. Of these patients, 30 were female and 53 were male. Because there was a small number of patients over 15 years of age (five patients), the data analyzed were restricted to patients up to 15 years of age.

It is important to highlight that in the exam records it was not possible to access data related to the patients body weight (kg). However, in order to estimate the administered activity normalized in relation to weight (MBq.kg^{-1}), average weight X age values were obtained - from the Brazilian Peadiatric Society [7]. In this way, it was possible to estimate

administered activities normalized in relation to weight, which is one of the ways to estimate "typical values" in nuclear medicine [6]. Table 1 shows the activities administered, percentual difference between them and "typical values".

Table 1 : Administered activities, percentual difference and typical values

0 to 1 year		**> 1 to 5 years**		**> 5 to 10 years**		**> 10 to 15 years**	
ACTIVITY		**ACTIVITY**		**ACTIVITY**		**ACTIVITY**	
MBq	**MBq.kg^{-1}**	**MBq**	**MBq.kg^{-1}**	**MBq**	**MBqkg^{-1}**	**MBq**	**MBq.kg^{-1}**
111	24.67	74	6.07	74	4.03	185	4.39
74	16.44	55.5	4.55	111	5.07	185	5.67
148	18.73	55.5	4.55	185	7.54	203.5	6.24
74	10.57	74	6.07	111	5.07	185	5.25
74	9.87	74	5.06	111	6.04	185	5.25
74	9.37	74	6.07	185	10.07	148	3.87
74	11.56	74	4.48	185	6.79	148	3.87
74	7.87	148	12.13	111	5.07	222	4.07
74	8.04	111	9.1	111	3.7	222	5.26
74	10.57	74	6.07	148	4.94	177.6	4.21
148	18.73	148	14.95	166.5	7.6	259	5.31
129.5	15.60	55.5	4.55	118.4	5.40	185	5.26
18.5	2.23	48.1	3.94	148	6.03	185	5.25
148	16.63	74	6.07	185	6.79	222	5.80
148	21.14	148	8.96	185	10.07		
74	8.31	74	5.07	148	6.75		
74	16.44	111	6.04	136.9	5.02		
74	9.37	74	6.07	148	5.43		
74	10.57	92.5	6.33	185	6.18		
74	8.043	74	5.065	111	5.07		
74	10.57	74	6.07	185	7.54		
74	11.56	148	8.06	148	4.94		
37	4.93	111	7.6	185	6.18		
% difference		**% difference**		**% difference**		**% difference**	
90		73.5		63.4		38	
Typical value	**Typical value**	**Typical value**	**Typical value**	**Typical value**	**Typical value**	**Typical value**	**Typical value**
74	10.6	74	6.07	148	6.03	185	5.4

Adminitered activities values showed high percentage differences between the age ranges. It was possible to verify that the greatest difference were for patients up to 1 year of

age (90%). Simple percentage difference was calculated taking into account the lowest value of administered activity (MBq or MBq.kg^{-1}) as reference. It is also observed that this difference decreases with increasing age range. Consequently, the "typical values" calculated too. In some cases, for this age range, even lower values were administered (2.23 MBq.kg^{-1}), which did not compromise image quality. This fact shows that the values administered activities can be optimized.

4. CONCLUSIONS

By collecting data from pediatric dynamic exams performed with ^{99m}Tc-DTPA, it was possible to assess that there is a significant difference in the activities administered to pediatric patients, especially for younger and radiosensitive patients (0 to 1 year). Furthermore, the fractionation of activities to be administered to pediatric patients is not simple, as the specific activity (MBq.mL^{-1}) of the radiopharmaceutical is very high and the quantity to be fractionated is very small. The evaluation of activities administered to patients could be better evaluated if data related to weight were added to the records archived in the NM service.

Suggestion of "typical values" is a simple tool that may contribute to raising awareness among professionals involved in the steps related to NM exams, demonstrating the importance of seeking to optimize protocols and procedures. Furthermore, it draws attention to the importance of following and effectively implementing the principles of radiation protection in the workplace. It is noteworthy that the evaluation of administered activities and the estimation of DRL contribute to the continuous improvement of the service, with the aim of reducing the dose without detriment to image quality, aiming at the patient's well-being. Finally, it is emphasized that the estimated local "typical values" must be continually reviewed to maintain the quality of the NM service.

CONFLICT OF INTEREST

We have no conflicts of interest to disclose.

All authors declare that they have no conflicts of interest.

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