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Research Paper

Estimation Risk of X-Ray Machines From Medical Procedures

Medical Science

KEYWORDS : Risk, dose, x-ray machines, para-medical

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ABSTRACT

The purpose of the paper was to determine estimation of risk dose from x-ray machines due to medical procedures from radiography examinations in the diagnosis radiology. The radiation from x-ray machine was measured, when diagnostic techniques of head - neck, chest, cerebral, abdominal part of stomach were acted. The patient data and characteristics of radiography techniques in radiological department were provided. Average genetically significant dose (GSD) and annual effective dose (AED) for persons in south-east of Iran were 4.6±0.1mSv/y and 3.07±0.3mGy/y respectively. Genetically significant dose (GSD) and annual effective dose (AED) in south-east in Iran were variable in comparison to Western and European countries and did not cause risk for patient. X-ray machines were needed surveillance permanently.

Introduction:

The radiation absorbed dose [1]. entrance surface in dose individual radiographic techniques, dose area product in complete x-ray examinations and significant organ dose were recommended to be measured [2]. Individual genetic significant dose per year was a radiation to individual productive organ with any characteristic confronted to radiation [3]. Radiation risk definition was applied for safety in techniques in different part of world at this present. Formulae for radiation during radiography techniques, estimations of organ radiation in radiology examination with individual's data and rate of fertility in the region were suggested by ICRP [4]. Genetic dose was a significant index according to UNSCEAR [5]. The equivalent annual effective dose (AED) and genetic significant dose (GSD) were not studied in South- east of Iran country. The purpose of this study was to estimate the risk dose from x-ray machines due to medical procedures

Material & Method

This work were undertaken with questionnaire and especial detector by health center authority radiological section in radiological centers in city of this province as Zahedan, khash, Iranshahr, Nickshahr, Saravan, Chahbahar, and Zaboul cities since September 2012-2013. The data was condition and model type of x-ray machine. Data of individual frequency in each city, frequency of sex (male or female), < 15 years, 15-49 years, > 49 years and total fertility rate were provided. Data of radiographic per year, population with sex male or female, and frequency of female 15-49 years and total percentage of frequency rate were provided. Type of radiological examinations, age and sex of patients and values of main technical parameters were provided. The study in organ doses, effective dose equivalents and risk estimates were for four given selected examinations during radiography techniques. The AED and the GSD could not be derived directly. Effective doses were needed in order to assess the population's collective dose arising from medical use of radiation. Organ doses and/or the effective dose could not be measured, but could be estimated on the basis of measured entrance surface dose.

Calculation formulae for Annual effective dose and significant dose were AED= $\Sigma_k \Sigma_I N_{KI} H_{KI} / \Sigma_K N_K$ and GSD= $\Sigma_K \Sigma_I N_{KI} P_{KI} \partial_{KI} / \Sigma_K N_K P_K$ respectively,in which N_{IK} frequency of patients, P_{IK} frequency of expected children, ∂ mean gonad and H_{KI} average effective dose and organ significant dose of patients in kth in sex and age group who underwent an examination of type I. N_k was frequency of population per sex and age in Kth of the each city of the year group and P_k was child expectancy. The correction of data was done before using the above mentioned formulae. Most of calculation was undertaken by Excels programmed of computer. The radiographic techniques were head - neck, chest, extreme and cerebral which were assumed to be almost similar in gonad absorbed dose. Distribution of patient examination were <15 year, 15-49 years for male or female. Average of Kvp, mAs, thickness of patients, field size, filtration type and type of techniques was supposed to radiologic section in Zahedan center. The radiation of x-ray machine, absorbed dose for diagnosis equipments in radiography departments were measured in air around by moveable detector ray spectrometric system MGP-MULTI RAD LLR immediately after operation of x-ray machine. This detector was used to measure air kerma at the entrance skin of patients. The organ and effective dose in any radiography were estimated according to factors sex, kvp, mAs, field size, air, weight, height, age and radiography type. Average data of that county were applied for calculating AED and GSD of patients in any examination group, sex and county. Genetically significant dose of an extremity was not calculated. Hajizadeh et al method was used to evaluate AED and GSD. The methods of calculating AED and GSD were based on the amount of shield, distance from center of examination field, and radiography condition. As there were not any data related to child expectancy of the population, the three groups of ages <15, 15-49 and >15 years were supposed. Firstly AED and GED were considered for all ages (table 3), and secondly, maximum of expected fertility rate as child expectancy was true for <15 years and it was reduced to zero, for female at 49 and male at the end of life. MCE (maximum child expectancy) of female was derived from general fertility rate (GFR) by 34x GFR/1000, and male by using their population factor. Maximum time of fertility of female was derived from frequency of delivery. In other words, it was shown by GFR and was calculated by delivery time 34 divided by 1000 and for male was gained by relative population factor.

Results

Average needed radiography machines were 14% by patient population per month. Shortage in equipment, supplies and trained staff was observed and limited available potential benefit to population. Available shortages in equipment related to x-ray machine was 0.11 averagely. Average fertility rate and frequency of fertility (x100) were 11.27 and 0.48 respectively. The range of 15-49 years female per1000 was 0.83-12.85 in Zahedan and Iranshahr respectively. The maximum of query units number was 0.2 in Nickshahr. The maximum of calculated AED and GSD of patients in Kash and Chabahar groups of radiography examination and sex were 9.67±0.002 mSv/y and 7.00±0.7 mGy/y based on the average data for each city. GSD and AED of province. AED and GSD were estimated 5.78±0.7 mSv/y in Chabahar; 7.23±0.002 mSv/y in Khash. AED of Zahedan, 5.35±0.005 mGy/y and in Iranshahr 2.79±0.03 mGy/y and GSD 1.71±0.1 mSv/y in Zahedan, AED of Chahbahar 6.09±0.004 mGy/y respectively. The study shows that the AED is **4.6±0.1** mSv/y and GSD is **3.07±0.3** mGy/y for each person in Sistan and Blouchestan.

Discussion

The younger the age at exposure, risk is higher. The reasons of risk are not understood completely, it is probably due to age of radiography patients. Radiation absorbed dose of infants and children are about a 2-4 fold higher risk for radiation tumors than adult. The x-ray machine per 1000 population of patients in south-east region is averagely 0.11 which is less than one in country with second level health. The number of x-ray machines is more in south-east of Iran than country with second level health. Average fertility rate and number of fertility per

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hundred are 11.27 and 0.48 respectively. Health care, feasibility for services and diagnosis techniques have much less capita [6]. The radiation dose for male is more than female due to extremity radiography of female radiation dose. AED is 10.68 mSv/y in male and 9.14 mSv/y in female and GSD is 7.11 mGy/y in male and 7 mGy/y in south-east regions. The study shows that the average AED is **4.6±0.1** mSv/y and GSD is **3.07±0.3** mGy/y for each person in each city of Sistan and Blouchestan[7]. The results indicate that 14 persons risk induced malignancies and 2.5 persons risk genetic detriment [8]. The technological measures are definitely contributed dose reduction for procedures. The annual effective and average per-capita doses of the Emilia-Romagna region were 5,237person-Sv and 1.2 mSv, from radiation doses to the population in medical exposures respectively [9]. The procedures sometimes supply a high radiation dose, so they should have a greater contribution to population dose and risk than simple examinations [10]. Risk of radiation effects from simple x-ray procedure is the most obvious factor on human health [11]. The more the dose, the higher will be the probability of stochastic effects and the more severe will be the deterministic effects [12]. The type of analysis heavily relies not only on the cooperation of all professionals responsible for patient radiation protection [13], but also on the experience gained during previous surveys because data collection is a very critical process that can invalidate [14]. Imaging procedures can result in high cumulative effective doses of radiation [15]. However, the results of GSD and AED in cities of Sistan and Blouchestan did not cause risk for patient.

Conclusion:

AED and GSD of people in studied region in Iran are lower than European, western country and Middle East city and does not cause risk for patient.

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