



Impact of the collective effective dose of the population of the Vale do Aço region on computed tomography scans during the COVID-19 pandemic.

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1. Introduction

With technological advances in development and the growing use of nuclear medicine and diagnostic radiology, the increase in the collective effective dose in populations around the world is a reason for concern. Diagnostic tests using ionizing radiation (X-Rays) can cause unwelcome biological effects when interacting with the human body¹.

In 2005, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR²), a UN body, that periodically estimates the collective dose to the world population from all sources, natural or anthropogenic, increased the annual global dose from radiological examinations from 0.4 mSv to 1 mSv, mainly from CT scan. Factors related to the repetition of radiological examinations can interfere with this dose estimate. The need for repetition of radiological exams by patients may occur and studies have shown that the patient's movement is a prevalent reason for repetition of exams, the incorrect positioning of the patient and other causes with latent characteristics at the workstations may contribute to the occurrence of the error, such as problems in the Software, equipment, facilities, furniture or PPE, for example³.

In 2010, UNSCEAR implemented a long-term strategy to improve the collection, analysis and dissemination of data on radiation doses received by medical radiology patients. In its report submitted in 2017, the Committee shows the contribution of only 27 countries (UN Member States). Africa, Latin America and Asia have failed to fulfill their mission of reporting their data to the Committee⁴.

UNSCAR, in 2011 already showed concerned about the more than 100% increase in radiation dose to the world population and radiology examinations have become the main source of anthropogenic exposure. The largest contribution to population dose from man-made sources of ionizing radiation comes from medical exposure. Several studies conducted in Europe and the USA demonstrate the increase in medical procedures in the population with diagnostic examination, interventional radiology activities and dental radiological procedures¹.

Nuclear technology provides significant advances in the areas of diagnostics in medicine and computed tomography (CT) plays an important role in the detection and monitoring of various diseases. It is a sectional technology that is widely available, easily accessible to patients, and familiar to both radiologists and requesting physicians, in addition to being a quick test and widely used in medical emergencies. Literature data show an important increase in the number of CT scans worldwide in recent years, and consequently, in the risks related to exposure to ionizing radiation. In Brazil, ANS data show a significant increase in the number of CT scans in recent years. In 2014 there were 5,981,432 exams and in 2018, 7,386,876 CT exams^{5,6,7,8}

The exposure of the population to increasingly high doses of ionizing radiation represents a potential public health problem. The indiscriminate use of this diagnostic method can contribute to increasing the radiation dose, which are categorized into three main areas: medical exposure doses, occupational exposure doses and public doses. Another important discussion is about the challenges for the practice of CT exams in optimizing protocols to minimize the risks of exposure to ionizing radiation^{7,9}.

Among the COVID-19 pandemic and the urgency to detect the new coronavirus infection, chest CT is being used more widely for diagnosis, especially when the patient has a false negative PCR diagnosis, in hospitalized patients, patients with severe complications, and for follow-up, including cases with post-COVID complications, so it can be inferred that the number of CT scans performed in this pandemic period may reflect an increase in the collective effective dose in the coming years.

Although national and international agencies have monitored the medical uses of radiation over the years, in Brazil this type of research is still incipient, and the expansion of data involving a greater number of medical services and professionals involved in this collection is necessary.

The estimation of the collective effective dose due to exposure and the risk that these doses may mean to the population depends on associating to each type of exam the entrance dose, the effective dose, the sex, the patient's age and the number of exams performed, among other factors.

This study has the overall objective of estimating the collective effective dose to the population attached to the Steel Valley region from medical exposure of patients who underwent the diagnostic Tomography (CT Chest) in 2018 compared to the pandemic period of COVID-19. The specific objectives are to calculate the effective dose of the most frequent protocols in CT scans to describe information about the technical staff and medical equipment of the investigated services; to verify the frequency of execution of each protocol in chest CT scans with the age, sex and number of scans of the sample in the investigated service in the reported period.

2. Methodology

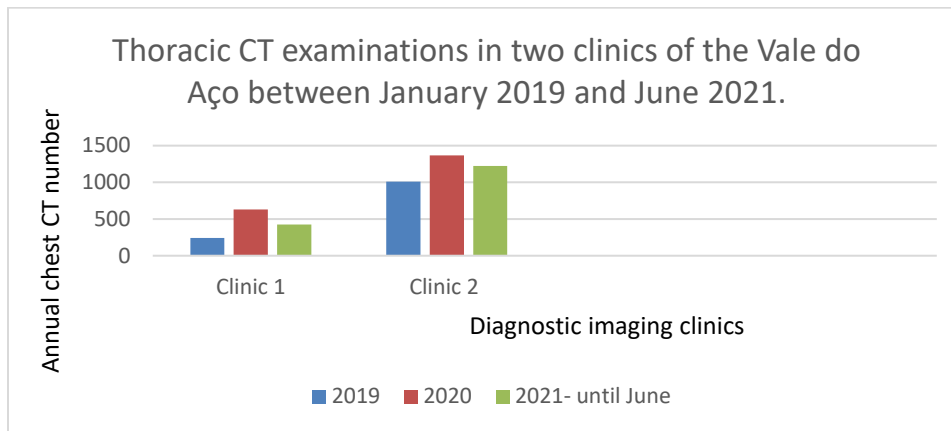
This is a documental and cross-sectional descriptive study because the data are analyzed objectively. The sample is composed of all patients seen in radiology services for chest CT in 2019 compared to patients seen between June 2020 and June 2021, considered the highest number of cases of the disease during the pandemic.

The information is collected from queries to the RIS (Radiology Information System) database and PACS (Picture Archiving and Communication System) in a room with a computer with access to the service's network. During the study, there is no contact with the patients or their radiological reports.

3. Results and Discussion

Taking into consideration that the present report is a communication of work in progress, that data collection is currently under way, and also considering that the investigation of the CT protocols and of the doses incurred by patients during CT examinations is heavily time consuming, the results of this Project that can be present here are still very limited. However, it is already possible to state that the collective effective dose received by the population of the Vale do Aço, in Minas Gerais State, as a result of thoracic CT examinations increased significantly during the Covid Pandemic.

The figure below shows the number of thoracic CT examinations in two image diagnostic clinics in the geographic region of the Project, pre- and during the Covid pandemic. It is possible to observe that there is a remarkable increase in the number of examinations from 2019 to 2020 and that the numbers of the first semester of 2021 can possibly imply an even large number for the whole year.



Source: author himself.

4. Conclusions

According to UNSCEAR Report 2010, the collective effective dose of the world population due to radiologic medical examinations jumped from 1.800.000 men.sievert in 1988 to more than 4.000.000 men.Svt in 2007, corresponding to an individual dose of 0.6 mSv per year.

The Covid pandemics, as could be expected, have the potential to contribute significantly to an even greater increase in the global irradiation of people in medical examinations, which is already the major contributor to the individual doses from all sources, at least in part of the world.

In Brazil, data about the collective effective dose from all sources is still very limited and this study in the Vale do Aço, Minas Gerais State can be a start and contribute to the national effort to assess the radiation doses received by the Brazilian population

Key-words: Collective Effective Dose; Computed Tomography; COVID-19 pandemics.

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