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Nuclear Medicine Term Paper (BM20812BM)

Submitted to

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Effective Doses in Radiology and Diagnostic Nuclear Medicine

ABSTARCT

The purpose of this review is to provide a compilation of effective doses for radiologic and nuclear medicine procedures. Standard radiographic examinations have average effective doses that vary by over a factor of 1000(0.01–10 mSv). Computed tomographic examinations tend to be in a narrower range but have relatively high average effective doses (approximately 2–20 mSv), and average effective doses for interventional procedures usually range from 5–70 mSv.Average effective dose for most nuclear medicine procedures varies between 0.3 and 20 mSv.These doses can be compared with the average annual effective dose from background radiation of about 3 mSv.

INTRODUCTION

Over the past two decades, there has been marked growth in he absolute number of diagnostic medical procedures that utilize ionizing radiation. In addition, there has been an increasing frequency of relatively high dose procedures including computed tomographic (CT) scanning, interventional procedures, and cardiac nuclear medicine. Although most of these procedures undoubtedly have benefit, there are others for which the benefit is not clear or has not been quantified. It is the duty of the referring clinician and the radiologist, cardiologist and others to assess he potential benefit-risk ratio for various procedures. To do this, one needs to have some idea of the magnitude of the radiation dose associated with the procedures. There are a number of ways in which radiation exposure and dose in medicine are quantitated. Measured quantities include air kerma, entrance surface dose, dose-area product, dose length product, and administered activity. Organ absorbed doses can be estimated by using either clinically validated anthropomorphic phantoms with internal dosimeters or Monte Carlo computer programs. These phantoms and programs represent a “typical patient” and are useful ways to collect data over time. the purpose of this article is to present effective doses from various procedures because effective dose is a measure of potential detriment. It is hoped that this information will be of value to those performing procedures involving ionizing radiation, as wellas to referring physicians and other entities such as institutional research committees.

MATERIALS AND MATHODS

Peer-reviewed scientific literature on radiation dosimetry in radiology and diagnostic nuclear medicine published between 1980 and 2007 was reviewed (4–161). The review included data from the United States, Canada, Japan, Australia and Western Europe. Additionally periodic surveys and literature reviews of the United Nations Scientific Committee on Atomic Radiation and material from Web sites of the U.S. Food and Drug Administration (Nationwide Evaluation of X-ray Trends survey program), several states, and the Conference of Radiation Control Program Directors were also reviewed.Reported values and ranges of effective dose were compiled for common procedures. For some procedures (such as abdominal CT) there were more than 20 publications with the required information. In cases where therewas subtantial material, it was possible to derive an arithmetic mean. This in itself was not very helpful, as it was clear that some of the publications represented large international surveys, others were national surveys, some represented data from a single hospital, and others reported measurements in phantoms. Some of the articles included some new data, but some other portions of the data presented were from previous publications of other authors. The latter were not counted twice. Only a few publications provided detailed data about radiologic techniques or protocols.

DIFFERENT TYPES OF REDIOLOGY

Diagnostic Radiology- Doctors mainly recommend diagnostic radiology for diagnosing and treating diseases. This type of radiology use different imaging process: Ultrasound, X-ray, Electromagnetic radiation.

Interventional radiology- Interventional radiology is mostly used for people with non-cancerous conditions. This system carries out the whole medical imaging process more safely, leading to faster recovery. Intervention radiology also helps in assisting surgical procedures. Moreover, it works on the principle of keyhole surgery. This surgery involves making small cuts rather than larger ones using tiny cameras to look inside the body.

Radiation oncology- Radiation oncology is used for carrying out radiation-based therapy on cancer patients. The high energy radiation used in the treatment damages cancer cells and stops them from spreading any further. Thus, this process can either control the condition or can cure it completely.

RESULTS

Representative values and ranges of effective doses reported in the literature for various examinations and procedures In addition to effective dose, absorbed organ doses are important for some procedures that either involve high doses or include sensitive tissues in the primary radiation beam. For CT scanning, organs in the beam can receive doses that are 10 –100 mGy but are usually in the range of 15–30 mGy per single CT sequence (162–169). Doses to the lens of the eye during CT scanning of the head have been reported to be 30 –50 mGy (170–174). Radiation dose to the breast tissue is of critical importance, especially in girls and young women. Chest CT scanning results in relatively high doses to breast tissue. Doses have been estimated to be 20 – 60 mGy for a CT examination performed for pulmonary embolism, 50 – 80 mGy for a CT coronary angiography examination, and even 10–20 mGy to the inferior part of the breast for an abdominal CT examination (175–177). Even though lower x-ray energies are used, as a comparison, for mammography, the American College of Radiology and the Mammography Quality Standards Act of 1992 regulations require that the mean glandular dose for a single mammogram to a normal-sized breast with 50% granularity be less than 3 mGy.

Adult Effective Doses for Various CT Procedures

Examination	Average Effective Dose (mSv)	Values Reported in Literature (mSv)
Head	2	0.9–4.0
Neck	3	. . .
Chest	7	4.0–18.0
Chest for pulmonary embolism	15	13–40
Abdomen	8	3.5–25
Pelvis	6	3.3–10
Three-phase liver study	15	. . .
Spine	6	1.5–10
Coronary angiography	16	5.0–32
Calcium scoring	3	1.0–12
Virtual colonoscopy	10	4.0–13.2

ADVANTAGES

- Nuclear medicine provides functional and anatomic information.
- It is a useful tool for determining the status of cancer.
- This technology can provide answers for unclear or abnormal lab results.
- Nuclear medicine has the ability to help the heart.
- The amount of radiation distributed to patients in this procedure is minimal.
- The accuracy of the imaging leads to a more accurate diagnosis.
- Nuclear medicine provides a painless way to gather information.
- Most of the radioactivity will pass through the body.

FUTURE SCOPE

Nuclear medicine is a medical specialty that involves the application of radioactive substances to help in the diagnosis or treatment of disease. It records radiation that emits from the body instead of using an external source that generates it, such as an x-ray machine, to help doctors determine what is happening with a person's health. Radiology is also known as diagnostic imaging. The process involves multiples tests, which require projecting and picturing various parts of the body. Radiology is useful in several operations such as CT scan, MRI, X-ray, ultrasound, etc required during diagnosis. Radiology is the principle management process of all the disease. It also contains a variety of tools and techniques for detection, analyzing, and curing. Moreover, it is the way through which the doctor finds out detailed information about disease-related structural changes. We all know early diagnosis can help save much life, and without it, there can be no proper diagnosis, thus no treatment.

CONCLUSION

Nuclear medicine gives doctors and patients more information to help them understand what may be happening with a disease. This impact of this technology is so positive that it can detect problems in some people before they even start to experience symptoms. Although it doesn't provide many solutions to treat the problem, the imaging options that are available make it faster to reach a diagnosis compared to convention methods. Every hour daily, an average of eight people carry out this process in which three of them suffering from cancer. Doctors will not be able to cure a patient without radiology. In most cases, the physicians and doctor rely on the radiology examination result for treating patients. Radiologist helps the physician by guiding them through the reports and treatment options.

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