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E100 Education in Radiologic Technology - From Practice to Profession

2020 Spring Symposium

Abstract

The scope of this paper is to discuss the history of the education of radiologic technologists and how it has evolved since the late 1890's. The world of medicine and diagnosing illness today is very different from that of the late 19th century. A study done by Smith-Bindman, Miglioretti, and Larson (2008) have found that in a 10-year period from 1997-2006, 4.9 million imaging procedures were done in just one large health system. The use of CT (Cat Scan) nearly doubled and MRI (Magnetic Resonance Imaging) exams tripled in this same year period (Jones, Mills, Mogensen, and Lee, 2012). Alarmingly, radiation exposure has also risen with the boom in medical imaging. Presumably competent and licensed professionals completed all of these imaging procedures. Each professional should have completed a rigorous educational course and passed a national test, although historically this was not always the case. The education of radiologic technologists has moved from "on the job training" to a highly specialized profession requiring at least an associates degree that is congruent with the responsibilities that technologists are faced with in today's world.

Keywords: education, x-ray technician, x-ray technologist,

ARRT-American Registry of Radiologic Technologist-licensing body for x-ray technologists; ensures entry-level knowledge for those entering profession

ASRT-American Society of Radiologic Technologists-establishes and supports the life-long learning of imaging technologists; advocate of profession

CT-Cat Scan-imaging exam using radiation to form precise 3D images of human body

MRI-Magnetic Resonance Imaging-imaging exam using magnetic fields and radio waves to form precise 3D images of human body; no radiation used; expensive

FDA-Food and Drug Administration-government agency that protects public health

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Introduction

X-rays were discovered in 1895 in the basement laboratory of Wilhelm Roentgen and within 6 months were considered to be a medical necessity in the treatment of many injuries and illnesses. Those early days of medical imaging are considered to be the birthplace of radiologic technology. Anyone who could afford the equipment in that era could take x-rays so many wealthy businessmen, photographers, and electricians would purchase and use the equipment for more of a curiosity or sales gimmick (History of American Society of Radiologic Technology, 2019). As popularity grew in the medical field, many receptionists and nurses were also shown how to operate the equipment for the doctor without any training of the human body or how to operate the equipment, and by 1910, many physicians were using x-rays in his/her practice. The death toll of these early pioneers was quite high due to the unknown dangers of radiation and poor radiation protection measures, but more importantly, no formal education process to help educate the people using this type of medical equipment. The education of radiologic technologists has moved from "on the job training" to a highly specialized profession requiring at least an associates degree that is congruent with the responsibilities that technologists are faced with in today's world.

Discussion

Current Impact of Medical Imaging

Medical imaging today is a multi-billion dollar industry and as such, impacts healthcare in more than one way. For purposes of this report, it is important to limit the information presented to the area of greatest impact. This area is the ability to diagnose

illness by obtaining a technically sound exam, but at the lowest radiation dose possible. Imaging procedures, especially CT and high-dose fluoroscopic {live action x-ray} studies "account for more than half of the radiation dose that the public receives" (Jones, Mills, Mogensen, and Lee, 2012). A study done by Smith-Bindman, Miglioretti, and Larson (2008) has found that in the 10-year period from 1997-2006, 4.9 million imaging procedures were done in just one large health system alone. The use of CT nearly doubled and MRI exams tripled in this same year period (Jones et.al, 2012). Alarmingly radiation exposure has also risen with the boom in medical imaging. Currently the FDA is sponsoring an initiative to lower radiation dose and there are three main points to this initiative. According to the FDA website, imaging technologists have an active role in this by "promoting safe use of medical imaging devices, supporting informed clinical decision–making and increasing patient awareness" (2019). This mantra is repeated in the ARRT Code of Ethics and is a core belief in medical imaging.

In order for an accurate diagnosis to be made, quality images must be obtained by imaging professionals who are obligated by the ASRT technologists' code of ethics to "assess (clinical) situations; exercise care, discretion and judgment; assume responsibility for professional decisions; act in the best interest of the patient" (ASRT, 2019). Technologists who balance these responsibilities will have a positive impact on the patient's quality of life while those who don't may bring tragic results to the patient. Any imaging procedure ordered by a physician must have a valid reason or physical symptom to justify that exam. It is up to the imaging technologist to verify that the information is complete and accurate. A highly trained technologist will be able to understand the clinical symptoms of the patient and confirm that the exam ordered is appropriate. Once

the procedure begins, if more information is needed such as an extra view or a wider scanning window, a skilled technologist can acquire that information in real time and give the radiologist better information to make a diagnosis.

Just about every patient admitted to a hospital will have some type of imaging procedure, whether it is before, during or after the admission. In fact, a study done by Batlle, Hahn, Thrall, and Lee looked at hospital admissions at a large Boston hospital to see if there was a correlation between higher end imaging studies done (CT or MRI) one day prior to hospital admission and length of hospital stay. The study showed that out of the 33,226 hospital admissions, 10,005 patients, or roughly 30% had a higher end imaging procedure done one day prior to admission. Those admissions also ended up with "significantly shorter length(s) of stay" (Batlle, Hahn, Thrall, & Lee, 2010). Having the imaging information available prior to admission can speed up the treatment process. If the images taken are of low quality it could negatively impact the patients treatment and recovery.

Historical Analysis of Medical Imaging

In those early years of radiography, it was not necessary for technologists to do anything more than produce a shadow within the image. This was done by more of a "hunch" rather than hard science as there were no textbooks available and the equipment was still primitive. The technologist taking the image would often count "one Mississippi, two Mississippi" as a way to control the timing of a picture and how long the x-ray beam was on (Young and McElveny, 2019). It was not uncommon for patients to have skin redness after an exam (Young and McElveny, 2019). In fact, many of those

early technologists were electrocuted as he/she had to physically attach the high voltage cables to the units in order to taking the picture (Zobel, 2012).

These early pioneers of the radiologic profession certainly served a specific purpose but there was no formal education. Any skills learned were a result of success but most often, failure. There were no written rules or even textbooks available to help explain how x-rays were created, how they affected the patient or the image receptor. In fact, the x-ray technician's creed, written in the 1920's, adamantly refused any formal schooling (Hoing, 1952).

It wasn't until 1928 that the first book on "X-ray Production and Technic" {original spelling} was published by Eddy C. Jerman (Hoing, 1952). Jerman worked for the Victory X-ray Corporation, which would later join General Electric Company to become one of the premier x-ray equipment manufacturers. Jerman was also considered to be the "Master Radiological Technician" because of his deep understanding of how x-rays are formed (Young and McElveny, 2019). It was through his tireless efforts that those early pioneers assembled themselves and began to set the groundwork for what is known today as the American Registry of Radiologic Technologists, the American Society of Radiologic Technologists and the Association of Educators in Imaging and Radiologic Sciences.

By June of 1933 the Council of Education and Registration had formed to standardize the education and training of x-ray technicians. However, it wasn't until 1956 that there was a uniform training practice in place for all x-ray training centers where a specific number of classroom and clinical hours had to be reached, teacher syllabi were established to have universal course objectives and a strict student to

technologist ratio was observed in the clinical area (Hoing, 1952). Amazingly, these rules are still in effect today.

By 1960 there were 650 approved and accredited x-ray training programs in the United States, most of which were hospital–based (Hoing, 1952). Currently in the State of Wisconsin, there are 15 college and university-based radiologic programs and only 7 hospital-based programs left. This represents a huge shift away from the traditional hospital-based education.

Current Education of Radiologic Technologists

The American Registry of Radiologic Technologists has mandated that all persons taking the national radiography boards in 2015 must have an associate degree prior to taking this test (ARRT, 2009). This ruling has affected hospital-based programs from the standpoint that they must affiliate with some college or university in order to allow for degree completion. Many universities are developing Bachelor of Science in Radiologic Technology degrees in order to capture this market-share. Having this profession move to an undergraduate level will help elevate the status and profession of a registered Radiologic Technologist.

The world of imaging today demands that each technologist not only produce a satisfactory image, but do so by relying on a firm understanding of scientific principles. A "hunch" about how much radiation to use to form an image is no longer ethical nor acceptable. The dangers of radiation are well known and every attempt to reduce patient and occupational dose must be made. Being able to exercise sound judgment and make life altering decisions on behalf of the patient are not to be taken lightly. The equipment used today is infinitely more complicated compared to the early years, but more

automated to use and the risk of electrocution is almost zero. Still, a firm grasp on how the equipment works is needed along with a technologist's ability to use the lowest dose possible to form an image.

Conclusion

The world of radiologic imaging has changed drastically since its discovery and if Wilhelm Roentgen were here to see the images we produce today, he would be in awe. The early pioneers of our profession paved the way through personal sacrifice to show us the importance of learning how to create, control and use x-rays to help people get better. The responsibilities of radiologic technologists has moved from just being lucky enough to produce a shadow on a film to being able to show intricate anatomy in a three-dimensional image.

Technologists have a direct impact on each patient and the proper education is needed to give each technologist the tools needed to work morally and ethically. Moving radiologic technologists' training into a college setting and undergraduate degree to balance the didactic material and the clinical skills needed is good for the profession of radiologic technology and more importantly, good for the patient. It helps elevate the practice of radiologic technology to the same level as other healthcare professionals.

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