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**THE TECHNIGRAM**  
JOURNAL OF THE CALIFORNIA SOCIETY OF RADIOLOGIC TECHNOLOGISTS  

**Features**  

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THE TECHNIGRAM
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EDITORIAL

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President’s Message: Strength in Numbers

by David Poon, CRT, RT (R) ARRT

The CSRT was founded on May 26, 1938 and it is one of the oldest professional societies dedicated to Radiologic Technologists in the country. The CSRT’s mission has not changed during that time. The mission of the CSRT is to “provide leadership for the Radiologic science professions, and to promote excellent patient care through quality education and legislation.

Radiologic Technologists (RT’s) demonstrates their commitment to the profession and to their specialty everyday. Whether it is teaching, working in a cath lab, surgery and/or or taking radiographs of patients, the work we do help save lives! The CSRT is the organization that supports your practice as an radiologic technologist. The CSRT is a State affiliate of the ASRT. We are dedicated to assisting you, providing you with information and promoting the causes that support radiologic technologists in the State of California.

I strongly believe in the old saying, “There is strength in numbers.” So it is vitally important that we pursue not only our traditional recruitment channels but also appeal to RT’s in all roles, specialties, settings and generations, including educators and administrators who are well positioned to spread the word about the importance of the CSRT to students, new graduates and their staff. We also need to reach out to more specialty imaging associations to join us and create options for other organizations with RT members to have a relationship with the CSRT. It is a great way to unite RT’s around a common purpose!

Radiologic Technologists are on the frontlines when it comes to imaging in California. Yet, many aren’t aware of the important work of the CSRT. It is important to for us to have a unified voice, and the CSRT represents that voice in California. Thinking about strength in numbers, it’s important for us to be able to accelerate change that is good for patients in California as it relates to medical imaging. We need to have as many RT’s as possible united under the CSRT to be able to do that. Ultimately being a CSRT member allows RT’s to have a voice at the local, regional and state level, which gives us the power to influence positive change for patients!

We are making a number of strides, particularly as we’re working with community leaders to advance the goals of the medical imaging. The CSRT is taking the lead, and we need all of our members to help make changes in our communities, our own professional lives and our work environments if we want to truly achieve a new direction in healthcare and support the CSRT for another 77 years!

Support the CSRT! Invite a colleague, co-worker and/or or supervisor to be a CSRT Member.

Sincerely,

David Poon, CRT, RT (R) ARRT
2015 President & Chairman
California Society of Radiologic Technologists
Help Wanted

For anyone interested in participating with the editorial preparation of the Technigram, an opportunity exists. The Technigram is published quarterly and is the official journal of the California Society of Radiologic Technologists. Interested applicants should have some experience in writing or journalism, and with a working knowledge of English grammar. Graphic arts experience desirable but not mandatory.

Interested applicants for this volunteer position please reply to email@csrt.org

Upcoming Events

- **Fall Seminar**
  “The Latest & The Greatest”
  Saturday, September 26, 2015
  Sutter Cancer Center: Sacramento
  More info coming soon!

- **Venipuncture Course**
  Saturday, September 26, 2015
  Sutter Cancer Center: Sacramento
  More info coming soon!

- **Radiologic Technology Certification Committee Meeting**
  Wednesday, October 28, 2015
  CDPH Headquarters
  1500 Capital Ave., Bldg 172
  Sacramento, CA

- **CSRT Annual Conference**
  Saturday, November 7 - Sunday, November 8, 2015
  South San Francisco Conference Center
CSRT 2014-2015 Board of Directors

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Anjulie Bales
Student Committee Chair
As of late, there has been discussion going on in several California Assembly committees with regard to MRI and the qualifications and safety education of MRI technologists. There has also been discussion on various social media pages among colleagues from the various related organizations. It seems that the words profession, licensure, certification and registration have been misused throughout, so I thought I would research into the history of technologist education and certification, including the area specific to MRI.

Profession as defined by Merriam Webster is “a calling requiring specialized knowledge and often long and intensive academic preparation” and “the whole body of persons engaged in a calling”.

Certification as defined by Merriam Webster is “the act of making something official, the act of certifying something or official approval to do something professionally or legally”.

Registration as defined by Merriam Webster is “the act or process of entering information about something in a book or system of public records, the act or process of entering names on an official list or a document showing that something (such as a vehicle) has been officially registered”.

The American Registry of Radiologic Technologists (ARRT) defines certification and registration as “the recognition of an individual who satisfies certain standards within a profession. Employers and state licensing agencies, such as our Radiologic Health Branch in California have recognized the ARRT certification for Radiologic Technologists practicing in California. This allows RTs here in California to use the designation CRT.

Also, accrediting organizations such as the American College of Radiology (ACR), Intersocietal Accreditation Commission (IAC), the Joint Commission (JC) and federal regulators, such as the Centers for Medicare and Medicaid Services (CMS), see this credential as proof that technologists have met a recognized national standard.

Medical Licensure as defined by Merriam Webster is “the state or condition of having a license granted by official or legal authority to perform medical acts and procedures not permitted by persons without such a license (an applicant must have RN licensure) or the granting of such licenses (a state board of medical licensure)”.

A History of MR Education and Certification

How to Determine if Someone is “Certified”
by Lorenza Clausen, CRT, RT(R)(CT)(MR)
A license, which first dates back to the 14th century, is defined as “permission granted by competent authority to engage in a business or occupation or in an activity otherwise unlawful (a license to practice medicine).

So what does this all mean?

With respect to MRI licensure and certification, there are only two states that currently license MRI technologists, Oregon and West Virginia. The New Mexico licensure law is still currently under review. They require a specific license to perform MRI in their state. In California, there is no current licensure requirement; therefore certified technologists and noncertified personnel with varying levels of education work in this area.

Certification and the accompanying educational and clinical requirements, depend on the certifying organization, and there are varying pathways to achieve it. Looking at certification alone to confirm technologist competence and safety training is shortsighted. One should review the specific education and clinical competencies and how they were completed for qualification of any certifying exam.

There are two organizations that certify MR personnel, the ARRT and the American Registry of Magnetic Resonance Imaging Technologists (ARMRIT). The ARRT offers both a primary and post primary pathway, while ARMRT is only a primary pathway certification.

The ARRT has a long history of certifying and registering technologists in the various disciplines, beginning with Radiography. In 1920 a group of technicians founded the American Association of Radiologic Technologists (AART). At the Radiological Society of North America (RSNA) annual meeting that year it was recommended that a registry be formed to certify technicians to a certain standard of education and ethics. The other radiologist group, the American Roentgen Ray Society (ARRS), was invited to participate in this process and a distinct and separate certification organization, the ARRT, was formed in 1922.

The American Registry of Radiological Technicians (ARRT) administered the first exam in 1922 to Sister M. Beatrice Merrigan in Oklahoma, consisting of 20 essay questions and a practical exam of prescribed radiographs. It was administered by a radiologist and graded with a required minimum of 60% to pass. A $10 fee for the exam had a $1 annual certification renewal fee. The inaugural board was comprised of radiologists with no technologist representation. The AART voted to accept only registered technicians in 1926. By 1927 there were 432 registrants, of which 18% were men and 82% women. Of those women, 64% were nurses and 43% Catholic sisters. In 1962 the name was changed to the American Registry of Radiologic Technologists (ARRT).

By 1988, the After Summit on Man Power by the Association for Medical Imaging Management (AHRA) conducted a survey on creating advanced certification exams for CT, MR, Mammography and QA. The board approved them for exam development in 1989 and also included the CV certification, based on a separate task force related to that area of practice. CV and Mammography came first and MR and CT exam development followed in 1991.

The first exam was given in March of 1995 with 4600 MR and 5300 CT examinees with a 75% pass rate on their first attempt. Mandatory continuing education requirements also began in 1995. MRI programmatic accreditation was initiated in 2003 by the Joint Review Committee on Education in Radiologic Technology (JRCERT). In 2006 the ARRT MR certification exam became a primary pathway option, thereby allowing technologists to seek out certification without a primary course in Radiography or Nuclear Medicine. In 2008, a unified entry-level MRI education curriculum by the American Society of Radiologic Technologists (ASRT), Association of Educators in Imaging and Radiologic Sciences (AEIRS), Section for Magnetic Resonance Technologists (SMRT) and the International Society for Magnetic Resonance in Medicine (ISMRM) was created.

The ARRT currently registers 325,000 technologists in various disciplines. Specific to MRI, there are 32, 338 RTs MR certified in the USA, American Samoa, Canada, Guam, Puerto Rico and the Virgin Islands. As of June 2015, there are 21,336 ARRT registrants in California. Of those, 2,058 are certified in MR. California has over 22,000 Certified Radiologic Technologists (CRT) under the Radiologic Health Branch of the California Department of Public Health (CDPH), with most holding the ARRT certification.

The ARRT first initially certifies and registers an individual after having satisfies specific standards set forth to include

“The mantra ARRT signifies, “Once certified, forever learning, evolving and developing as a qualified professional”
educational requirements, clinical competencies, ethics and passing an examination. The process also includes graduation from an approved educational program. The above mentioned educational and clinical requirements are contained within the approved program course. All programs must be recognized by an accreditation agency acceptable to ARRT.

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- USDE: United States Department of Education
- CHEA: Council for Higher Education Accreditation
- JRCERT: Joint Review Committee on Education in Radiologic Technology
- JRCNMT: Joint Review Committee on Educational Programs in Nuclear Medicine Technology
- JRCDMS: The Joint Review Committee on Education in Diagnostic Medical Sonography
- CAAHEP: Commission on Accreditation of Allied Health Education programs
  - Or 6 regional accrediting organizations
  - Canada
  - England
  - Australia

There are also processes for Advanced Placement or International education review for qualification. Please refer to this link for more information:

https://www.arrt.org/Educators-Students

Beginning in 2015, any primary or post primary certification applicant, including MRI, must have an academic degree with a minimum of an Associates degree accredited by an ARRT approved agency. The degree does not have to be in the radiologic sciences and can be completed prior to the educational program or following the program within a specific time frame. Prior to 2013 the applicant must be eligible to sit for the exam within 5 years. After 2012 the applicant only has 3 years to gain eligibility.

Clinical experience to qualify for any exam, including MRI, must be completed in the previous 24 months prior to application. In January 2016, applicants must complete 16 hours of structured education that reflects the examination content over several categories. This education must also be completed in the previous 24 months prior to qualification. Education must contain at least one hour of the following content areas for MRI: Patient Care, Imaging Procedures, Sequence Parameters and Options, Data Acquisition and Processing and Physical Principles of Image Formation. ARRT approved academic courses or continuing education programs qualify to meet the standards of structured education.

The subsequent renewal of certification and registration occurs annually after complying with their rules and regulations and standards of ethics. The continuing education requirements are reported biannually and require 24 units of Category A or A+ continuing education. Continuing education is the way to maintain and/or increase a registrant’s knowledge and skillset. With technological advancements and changes in responsibilities such as promotion into other modalities, technologists must constantly update their skills and knowledge to stay current. The continuing education should contain subject matter in their current area of practice. Additional primary and post primary certifications earned during the biennium can also satisfy the 24 CEUs requirement.

Recently added to the requirements is Continuing Qualifications Requirement or CQM. This will be required for all certifications, primary and post primary, acquired on or after January 1, 2011. All certifications will have a 10-year limit. Specific requirements must be reported prior to the end of the 10-year period. CQR has three components that must be completed beginning three years prior to the deadline of requalification. The first group will begin in 2018 and complete the phase by 2021. The Registered Radiologist Assistant (RRA) certification was initiated as a time limited certification and they began the process in 2013.

The three components of CQR will include a personal profile of skills, education and anything else related to one’s professional development over the life of one’s career. The second will be a detailed self-assessment of the registrant’s strengths and weaknesses. Based on this report the technologist will be given a series of targeted continuing education activities designed to strengthen the weaknesses noted and improve their performance in the workplace.

The mantra of the ARRT signifies “Once certified, forever learning, evolving and developing as a qualified professional.”

The American Registry of Magnetic Resonance Imaging Technologists (ARMRIT) was founded in 1991. A New York based not-for-profit corporation, ARMRIT is a certifying organization that began certification of MRI technologists that were trained on the job since 1983, when MRI first became available. It was created to give an alternative pathway to those who did not qualify via a primary ARRT pathway and only had OTJ training. ARMRIT currently has certified technologists in 46 states, as well as, several countries and continents. It has been difficult to determine the current number of ARMRIT certified technologists. Information on their website and social media pages lists 1750 nationwide and internationally with approximately 800 in California.

Applicants for the ARMRIT certification exam can qualify under various pathways. Information from their examination handbook states:

1. Graduates of an MRI program must be from an ARMRIT approved program within 3 years of sitting for the exam and complete at least 1000 hours of documented MRI clinical training.
2. Cross training from an Allied Health field with a minimum of 1,000 hours of clinical MRI experience. A letter of recommendation from the clinical supervisor and a letter from the medical director or interpreting physician declaring the individual competent within the last 12 months. Categories of Allied Health include RNs, Sonographers, PAs and RTs.

3. On The Job Trained-Equivalency Clause. A Bachelor degree and documented 1700 hours of MRI clinical experience or four years (6240 hours) of MRI clinical experience with a letter of recommendation from the clinical supervisor and a letter from the medical director or interpreting physician declaring the individual competent within the last 12 months.

ARMRIT is also recognized by the ACR, IAC, JC and more recently, Radsite. These accrediting organizations, as mentioned previously, are recognized by the Centers for Medicare and Medicaid Services (CMS).

Certification is for 3 years and requires 6 CEUs per year for renewal. The ARMRTIT examination is divided into three sections, with a 70% pass rate required for all three sections. Single sections not passed may be retaken individually.

The ARMRIT Commission on Accreditation reviews and accepts programs for eligibility to sit for their exam.

The issues affecting the future of MRI education and certification in the United States were discussed in 2014. A survey was conducted of several directors from MRI programs across the country and led to a consensus report on various issues. Questions on 10 key issues were sent out to the 25 respondents. There was a 60% response from the initial 42 program directors that were contacted.

The opinions collected in the survey included MR certification for all technologists, bachelor’s degree minimum for MR education clinical coordinators, master’s degree minimum for MR program directors, removing radiography from MR technologist job descriptions, abolishing the ARRT MR post-primary pathway and opposing recognition of the ARMRTIT magnetic resonance certification.

As a result of the study, the Consensus Report of MRI Program Directors on Issues Affecting the Future of MRI Education in the United States was submitted and published in the AEIRS Radiologic Science & Education, Volume 19 Number 1 in June 2014. The results of the study were an attempt to provide guidance on the future of education in MRI and assist educators and students in their profession.

From this study it was suggested that there was a need for MR certification of all MRI technologists, high professional and educational standards for education faculty and further recognition by organizations that MRI should be a distinct modality with specific formal training for technologists.

While the specific events in MRI education history happened more than a decade ago, there are still only 25 MRI primary pathway professional education programs in the U.S. recognized by the ARRT. Only 6 of these are programmatically accredited by the JRCERT. With respect to facility accreditation, organizations to include the ACR, IAC and the JC, more recently, still only recommend MRI certification for technologists.

ARMRIT lists 17 approved MRI programs in the U.S. Of those, 7 are in California. These are recognized and approved by the Commission on Accreditation by ARMRTIT.

There are also several non accredited MRI schools throughout the country, including here in California.

To clarify what is programmatic accreditation vs. institutional accreditation, one needs to understand accreditation. Accreditation is “a process that assures that an institution or program provides a quality education.” It guarantees that the students have quality skills and have met a certain standard. Accreditation is voluntary, but it shows that the institution wants external peer review. Institutional accreditation reviews the overall school, institution or college. Programmatic accreditation evaluates the individual program, such as an MRI program. Site visitors are also usually credentialed in the field of study and evaluate the entire curriculum, both didactic and clinical.

Institutional accreditation may or may not have the same level of quality found with an external review.

The above information gleaned from the issues surveyed in the consensus report and other historical information, clearly point to the appropriate direction that MR education and certification should take in the future. For more information the complete report can be seen at the following link:

http://goo.gl/Jeolf

As can be seen by the above history with regard to education and certification specific to MRI, it seems logical that we can learn from the American Nursing Association by the following quote:

The public has a right to expect registered nurses to demonstrate professional competence throughout their careers. ANA believes the registered nurse is individually responsible and accountable for maintaining professional competence. The ANA further believes that it is the nursing profession’s responsibility to shape and guide any process for assuring nurse competence. Regulatory agencies define minimal standards for regulation of practice to protect the public. The employer is responsible and accountable to provide an environment conducive to competent practice. Assurance of competence is the shared responsibility of the profession, individual nurses, professional organizations, credentialing and certification entities, regulatory agencies, employers, and other key stakeholders.

This can be applied to the medical imaging profession and what we as technologists should expect from ourselves, regardless of what minimum standards are
set by other organizations and currently requiring or recommending. Varying pathways and shortcuts do not translate into what is ultimately important, the safety of the patient and the diagnostic quality that we provide thru high standards of education and clinical competency.

A uniform, high-level set of standards for MRI technologist credentialing would be of benefit to the magnetic resonance field. It was also suggested in the Consensus Report that a collaborative standardized examination, or at the very least require equivalent standards in both examinations would benefit the profession and technologists.

Organizations such as the SMRT, AEIRS, and ASRT could also collaborate with the ARRT and ARMRIT in reaching this goal, as those groups had done with developing the MR curriculum.

If the requirements for curriculum and clinical competencies were equivalent, the same recognition as given for the ARRT certification could be possible.

Source links researched and for more information:

1. https://www.arrt.org/
17. https://www.arrt.org/Education/Educational-Programs
27. http://www.cdph.ca.gov/Pages/DEFAULT.aspx
Evaluation of the 15% Rule
by Roxanne Munyon, BS, CRT, RT(R)

The purpose of this article is to analyze the 15% rule and its potential for reducing radiation dose to the patient while using Computed Radiography (CR) systems. The 15% rule states that a 15% increase in kVp and halving the mAs will result in a diagnostic image while reducing dose. Students performed exams and applied this rule until a diagnostic image was no longer the result.

Procedure:
Utilizing the GE x-ray equipment, the torso phantom was placed on the table for a routine KUB (Kidney, Ureter, and Bladder) exam. The SID was 40”, centering was at the level of the iliac crest and the collimation was open to include from the bottom of the diaphragm to the pubic symphysis.

Results:
The following table depicts the results that were obtained while continually applying the 15% rule to each exposure. Please note that exposure #1 was the baseline set for this experiment.

<table>
<thead>
<tr>
<th>kVp</th>
<th>mAs</th>
<th>LgM</th>
<th>Dose (mR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>70</td>
<td>2.06</td>
<td>508.3</td>
</tr>
<tr>
<td>2.</td>
<td>81</td>
<td>1.997</td>
<td>336.7</td>
</tr>
<tr>
<td>3.</td>
<td>93</td>
<td>1.917</td>
<td>218.6</td>
</tr>
<tr>
<td>4.</td>
<td>107</td>
<td>1.82</td>
<td>143.4</td>
</tr>
<tr>
<td>5.</td>
<td>123</td>
<td>1.7</td>
<td>29.62</td>
</tr>
<tr>
<td>6.</td>
<td>140</td>
<td>1.58</td>
<td>18.68</td>
</tr>
</tbody>
</table>

Evaluation:
Upon visual inspection it was deemed that image 1 had excellent visibility of detail through spatial resolution. Images 2 and 3 had good visibility of detail, while 4 had fair visibility of detail and images 5 and 6 had poor visibility of detail. Spatial resolution is the ability to distinguish objects that are close in proximity as two distinct objects. While image 1 had visibility of the anatomy of interest as well as the overall highest spatial resolution and visibility of detail, the dose was significantly higher at 508.3 mR. While the other five exposures ranged between 336.7mR to 18.68 mR. The LgM values for images 1 through 4 were within the desired range of 1.8 - 2.2. Images 5 & 6 were below the desired LgM values. The 15% percent rule, in this instance, could be applied four times without sacrificing image quality to the extent of making it an image of non-diagnostic quality. However, as with all aspects of radiology, the clinical indication of the exam is what will determine the diagnostic quality of the image. Image 1 is the typical baseline technique for this kind of exam; it had excellent spatial resolution and the anatomy of interest was visible. However, the dose is high. If the reason for the x-ray exam was for the investigation of either a PICC line or NG tube the technique utilized in image 4 would prove to be acceptable. This would give the diagnostic information necessary, because tube placement would be visible and lowers dose to the patient. The application of this experiment is very useful to students out in the clinic. It shows that technique can be altered and dose lowered to the patient. It is critical that radiographers are aware of the purpose of the exam to aid them in the selection of technique. This is of primary interest, particularly with in-patients who will receive x-ray exams almost on a daily basis.

Recent work has been done by Dennis Bowman RT (R) and the following information is from his lecture at the recent CSRT conference in Los Angeles. He has performed experiments much like the one discussed here and determined that the following techniques will result in a diagnostic image for the abdomen with the CR systems. The LgM values for this chart were at 2.1.

<table>
<thead>
<tr>
<th>Part</th>
<th>View</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs AP</td>
<td></td>
<td>85 8-128</td>
<td>16-20</td>
<td>85 25-35</td>
</tr>
</tbody>
</table>
Welcome to the World of Forensic Radiography
by Melissa Reboja, 2nd year Radiography Student, California State University

According to the American Forensic Association, the term “forensic” pertains to the development of evidence and argument upon usage in the court of law. Therefore, forensic radiography not only has to do with imaging human remains to determine one’s cause of death, but it also relates to the application of radiographic imaging in the development of evidence and argument against legal issues. An article published by the American Society of Radiologic Technologists (ASRT) further states that forensic radiography encompasses a wide range of legal applications because “any diagnostic imaging examination can be considered a forensic examination.” For example, it can be used for investigation of death especially when under suspicion, as documentation for evidence in court or for medical malpractice suits, and diagnosis and/or support for domestic violence. In addition, forensic radiography can be used in the identification of bodies, archaeology, investigation of smuggling and fraud, and can lead to the development of improved technology.

Unfortunately, the United States lacks proper education and the systemic use of radiographic technology in forensics compared to other developed countries, such as Europe, Australia, and Japan. This is because the United States does not formally recognize forensic radiography as a forensic science discipline, which is why it is not commonly heard of in the general public or in the radiology field itself. For example, according to the Forensic Sciences Foundation, the American Academy of Forensic Sciences generally recognize odontology, pathology/biology, physical anthropology, and toxicology as common disciplines in forensic science, but not radiography. Although, this does not mean that its uses are not important in forensic science.

Forensic radiography is a rapidly evolving discipline that plays a vital role in crime investigation, domestic violence diagnosis, medical malpractice, identification and investigation of dead bodies in accident and mass causality events, archaeology, and paleopathology.

Furthermore, this research paper aims to educate and inform its readers about forensic radiography’s uses and importance, in hopes to spark interest amongst radiologic professionals and provide the push it needs to gain full recognition in America’s forensic science. Its history, the different modalities used in the field, educational requirements, and job opportunities are the many sections that will be covered in this research paper. This is important to present because further research and efforts to educate others in forensic radiography would lead to greater possibilities in accuracy regarding many different types of legal decisions and non-diagnostic applications.

Applications of Forensic Radiography

Forensic radiography is not limited to any specific modality and may be applied diversely into both diagnostics and non-diagnostics. Radiography is typically used before performing an autopsy to study the deceased person’s anatomy and pathology. These images are used to help localize fractures, foreign material, and certain poisonous substances which all appear radiopaque on the radiographs. In 2004, Col. H. Theodore Harcke, who is the chief of forensic radiology at the Armed Forces Institute of Pathology, explains in the article, “It’s Not So Elementary,” that his multidetector CT scanner is especially helpful with gunshot wounds because the exact location of the bullet or fragment is easily determined compared to an autopsy. In addition, Harcke states that postmortem imaging research can be used to help the military improve their protective gear by looking at patterns of death. As you will see, forensic radiography encompasses and influences a wide aspect of legal matters and non-diagnostic applications. By educating and informing individuals, forensic radiography can continue to grow and make a lasting impact in America’s world of forensic science.
Crime Investigation

In the case report “Forensic Imaging for Causal Investigation of Death,” David Simons and his investigative crew illustrated how the pre-autopsy CT imaging supported the forensic diagnosis of a 63-year-old man’s cause and manner of death. After being overrun by a car, postmortem CT and autopsy revealed multiple bone fractures without any hemorrhaging, which is ironic because hemorrhaging should have occurred if he had consistent blood flow in his vessels. In the radiographs, a round radiopaque formation was then found in the duodenum and zopiclone tablets were also found in the man’s bag. Investigators thus radiographed these tablets submerged in water and concluded it to be the same substances in the man’s duodenum, due to its similar radiopaque formation on the radiograph. Days later, toxicology reports verified the presence of zopiclone and also measured a 1.39% blood alcohol concentration, whereas autopsy reports were only able to report a “brownish friable mass” in the duodenum. Thus, zopiclone and alcohol intoxication were concluded as the cause of death, followed by an overrun accident.

Non-accidental Injury

Medical imaging examinations and records have served as important legal documentation towards adult and child non-accidental injury. In children, instead of a localized radiograph to one body region, radiographic skeletal surveys are systematic for children under the age of 2-years-old due to the child’s undeveloped communication skills. In order to prevent misdiagnosis, a skeletal scintigraphy (nuclear medicine bone scan) is also recommended, in addition to a skeletal survey, because it can determine metabolic changes within bone tissues that result from trauma. Magnetic resonance imaging (MRI) can also be used in place of skeletal scintigraphy to lower the child’s radiation dose. MRI is also able to provide excellent soft tissue, spine, bone marrow, and intra-articular 2D images in multiple planes, whereas computed tomography (CT) can also be used to identify complex fractures on multiple planes, with better contrast and spatial resolution compared to plain radiographs. With excellent radiographs, proper interpretation can lead to correct forensic conclusions in hopes to protect vulnerable children.

Victim Identification

Forensic radiography is well known in forensic science for its contribution in victim identification. It provides clues to the victim’s age, sex, and stature. In addition, antemortem and postmortem images can be used for comparison in regards to dental structures, anatomical structures, trauma, and pathological conditions. Kudlas et al. highlights on a 2009 report claiming that correct identification in 100% of cases has occurred when the antemortem and postmortem radiographs of the suspected victim’s frontal sinuses are superimposed to one another. MRI imaging is known to be used in permanent and temporary mortuaries, while CT scanners can be used anywhere, even at the scene of incident with mobile CT scanners. After the 9/11 attacks, radiographic analysis ranging from intact bodies to small body part fragments have helped identify remains. Forensic radiography has made a huge impact in identifying the remains of lost loved ones, hence, continuous support and recognition will allow for a better and improved identification process.
Smuggling and Fraud

Forensic radiography has also been applied non-diagnostically and/or in nonviolent cases, such as smuggling, commercial fraud, and jewel theft. The type of smuggler radiographers have been familiar with are “body packers,” which are individuals who smuggle narcotics by placing them in balloons or condoms and swallowing them. These narcotics travel through the smuggler’s alimentary canal, eventually releasing them by defecating once the destination has been reached. Joel Lichtenstein explains in his article, “Forensic Radiology,” an interesting case that involved a woman accused of swallowing diamonds while at a jewelry store. The radiograph of the woman’s abdomen illustrated a radiopaque diamond-shaped foreign body, although radiologists pointed out that real diamonds are not radiopaque. This then lead to the jeweler being found guilty of fraud. In this example, it is seen that forensic radiography can provide justified information against those who chose to disobey the law.

Archaeology and Paleopathology

Forensic radiography has been growing extensively with archaeology and paleopathology, as researchers seek to learn more and more about the mysteries of past cultures, events, and the evolution of diseases. In the video “Using 3D Visualization to Discover the Secrets of Mummies,” David Hughes, who is a computer visualization specialist, presents at a TEDx conference about the newest invention of a virtual autopsy table called the “Inside Explorer.” This invention combines medical imaging, mainly CT scanning, and 3D computer visualization to recreate a 3D interactive image that allows forensic scientists, archaeologists, doctors, etc. to study almost anything in great detail. Hughes emphasizes on the significance of this new technology by stating that important and sensitive artifacts, such as mummies, can be studied without being touched or disturbed. Hughes then continued on about the “Inside Explorer” by explaining about a naturally mummified man, called the “Gebelein Man,” and how he lived and died. By the data obtained from the “Inside Explorer,” forensic scientists concluded that the “Gebelein Man” was a healthy, strong man between the ages of 18 through 20, who had possibly died from a stabbing wound illustrated by an incision on his back and a broken posterior rib.

The composition of Martian meteorites and rocks that hold fossils of creatures aged over millions of years are also studied by the use of micro CT scanners. Finally, Hughes concluded his presentation by persuading his audience that the involvement of every one of our curious and technically advanced minds, together, can fire the pursuit of amazing future discoveries.
Education and Job Opportunities

Unfortunately, other countries such as Europe, Japan, and Australia are more educated and advanced in forensic technology than the United States, thus, most forensic pathology research takes place in these countries. Kudlas et al. states that the U.S. only has two departments or institutes specific to forensic radiology for physicians, whereas Europe has over 100 institutes. According to the National Institute of Justice, this is mainly due to the shortage of qualified personnel and the lack of funding for proper education. Therefore, most forensic radiographers are trained on the job with varying education from location to location, receive less concerns about proper licensing, and often only have a high school diploma. At Quinnipiac University in Connecticut, a few forensic radiography courses are offered that goes towards a bachelor’s degree in Radiologic Sciences.

Most U.S. postmortem radiography examinations are performed in medical examiner and coroner offices, although according to an ASRT Forensic Radiography Survey conducted in 2008, nearly 70% of respondents do not have access to CT scanners and mainly use radiographic equipment in a dedicated room with a wet processor. Also, 15% of respondents do not have a radiation safety program and 10 % of respondents do not have radiation protection devices, such as lead aprons. Education and proper equipment are all entirely important because examinations need to be of high quality to be considered as convincing evidence. Lastly, in order to strengthen forensic science in the U.S., the National Research Council of the National Academies claim that the “shortage of resources and the lack of consistent educational and training requirements prevent investigators from taking full advantage of tools, such as CT scans and digital x-rays, that the health care system and other scientific disciplines offer”.

Conclusion

In conclusion, forensic radiography is an important growing discipline that is capable of making lasting impacts in the justice system, unleash mysteries that have been buried for millions of years, and discover the unknown without interrupting its delicacy. Efforts to research and educate others would lead to endless possibilities concerning many different legal decisions and discoveries. The purpose of this research project is to educate and inform its readers about the uses and importance of forensic radiography in the field of forensic science. By doing so, its history, applications in forensic science, educational requirements, and job opportunities have been discussed. Together, we can provide the recognition forensic radiography needs to raise its level of quality, and allow for further amazing discoveries and everlasting changes.

References:
Stereotype Threat, a Reality in Higher Education

by Doris Abrishami, MA, BSRT, CRT(R), ARRT

As a new faculty member at California State University Northridge, I believed it was my responsibility to attend President Dianne Harrison’s annual welcome address in fall of 2014. This was a great gathering of faculty, staff and university administrators which made the occasion more exciting and memorable for me.

The president started addressing the audience and spoke about the university’s priorities and top concerns. During her speech, President Harrison mentioned diversity and its importance in the future of higher education. She emphasized that because our student population is more diverse than ever in so many ways such as: race, ethnicity, religion, age, socioeconomic status and country of origin, it is our responsibility as faculty to be sure each student receives the best and most valuable education at our institution and becomes successful at the end.

President Harrison continued speaking about a book she had recently read that addressed “stereotype threat”. She stated that she was fascinated by this book and she highly recommends it to everyone. As you can imagine, at this point of her speech, we were all on our notepads or electronic devices trying to write down the name of that book and the author. The book is called: “Whistling Vivaldi: How Stereotypes Can Affect Us and What We Can Do (2010)” by Claude Steel.

Needless to say, I ordered “Whistling Vivaldi” the next day and started reading it as soon as it arrived. Whistling Vivaldi is the result of decades of research by Steel and his colleagues on college students. As one may realize, there are many stereotypes existing in our society. “White men can’t jump” was a movie title but it was also depicting that whites are not as athletic as their black peers. Other stereotypes such as: Women are not good in math and science as their male peers may be, men cannot be good cheer leaders, and the list of stereotypes go on…

In the late 1980’s Claude Steel was invited to the University of Michigan to develop a new program for minority students in order to help them improve their college education. Steel noticed minority students and especially black students in the University of Michigan were consistently receiving lower grades, including those black students with highest SAT scores. Steel refused to believe that these low scores reflected black students’ intellectual abilities. As his research continued, Steel found out that many black and minority students feel that they don’t belong in the university. When African American students were given a difficult verbal test, and the researchers said the test was measuring their verbal abilities, students scored much lower than their white peers. On the other hand, when students were told test was a problem-solving exercise and did not measure their intellectual abilities, both black and white students scored the same.

As cited in “Whistling Vivaldi”, similar types of research have been done by many other psychosocial researchers around the country and in the world. Almost every research results the same as Steel and his colleagues achieved. Every time students were under pressure against their stereotype and were threatened by it, they performed lower than their innate abilities. On the other hand, every time students were given encouragement and assurance right before a test, they performed better and their scores were the same as their counterparts without those stereotypes.

You may ask, what does this mean to Radiologic Science educators? What can we as faculty or clinical instructors do to help our students defy these stereotypes?

I believe the first step is to realize and confront our own hidden biases and stereotypes. As educators and technologists, we need to remind ourselves that our biases may be the results of the way we were brought up and the society we live in. One of the methods used to understand our own biases is taking the Implicit Association Test (IAT). This test is available to everyone in online version and has many different categories. You can take the test at: https://implicit.harvard.edu/implicit/. Once you find out what your specific biases are, you can help reducing them in several ways. For example, as an instructor, you should develop a clear and comprehensive syllabus for each course that includes all your expectations in a fair and equitable manner. Use and include rubrics for all assignments so that students know what is expected of them and they will be graded impartially and based on their abilities as individuals and not based on what ethnicity or gender they belong to. If you are teaching a science or math course and your lectures only include the names of male forerunners in that field, you may want to modify your lectures to include female contributors in those fields as well. If you are a clinical instructor at a hospital, interact with students who may seem to be different than you. Try to engage them in your department activates and as they learn from you, make these college students feel they belong there. After all, isn’t this what imaging technologists do when they work with diverse patients?

The next book that I plan to read is about ways to reduce or “outsmart” our biases. That books is written by Banaji and Greenwald (2013) and it is called ‘Blindsight: Hidden biases of good people.’

In conclusion, as educators, reducing or eliminating our biases and stereotypes may not be easy, but realizing that we all have them, is a very important step in the exciting journey of education that we would like to end with “Student Success.”
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