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RSNA 2010 Round-Up

I. Use and Overuse of Exams

» Emergency Departments See Substantial Increase in CT Exams

A new study reports that the use of computed tomography (CT) in U.S. emergency departments is growing exponentially. If the growth trend continues, by 2011, nearly 20 percent of all emergency department (ED) visits may involve a CT exam. The results of this study were presented today at the annual meeting of the Radiological Society of North America (RSNA) and published online and in the journal *Radiology*.

"It is not surprising that CT utilisation has increased," said lead researcher David B. Larson, M.D., M.B.A., director of quality improvement in the department of radiology at Cincinnati Children's Hospital Medical Centre in Ohio. "What's surprising is the sustained high rate of that growth. However, recent developments, such as increased awareness of cost, radiation concerns, national healthcare reform legislation and the economic recession, are likely to inhibit further growth."

Dr. Larson's research team used data collected by the National Hospital Ambulatory Medical Care Survey from 1995 through 2007 to identify nationwide trends associated with CT use in the ED. The researchers performed statistical analysis on a mean of 30,044 ED visits from each year over the 13-year period to estimate overall usage of CT in the ED.

"We have seen a remarkable growth in CT utilisation, not only in the number of ED visits that involve CT imaging but in the percentage of patients walking into the ED that receive a CT," Dr. Larson said.

According to the analysis, the number of ED visits that included a CT exam increased from 2.7 million in 1995 to 16.2 million in 2007, a 5.9-fold increase and an average growth rate of 16 percent per year. The percentage of ED visits involving a CT exam rose from 2.8 percent in 1995 to 13.9 percent in 2007.

"CT is a wonderful technique that is widely available," Dr. Larson said. "Over the 13 years in our study, image resolution improved significantly, making CT a great tool to look for kidney stones, appendicitis and coronary artery disease." For much of the 13-year period studied, headache was the complaint most commonly associated with a CT exam in the ED. But by 2007, headache was surpassed by abdominal pain as the complaint most often associated with CT imaging. In 2007, patients with abdominal pain represented 12.8 percent of all ED visits involving CT.

CT exams to investigate abdominal pain have a higher radiation dose than CT exams used to determine the cause of a headache. The study found that, overall, the use of CT for complaints that are typically related to exams with a higher radiation dose grew faster than those typically related to exams with a lower radiation dose. This suggests that the radiation dose associated with CT in the ED may be growing at a faster rate than the growth in the overall use of CT.

» MRI May Help Determine Time of Stroke Onset

Magnetic resonance imaging (MRI) of the brain could expand the number of stroke patients eligible for a potentially life-saving treatment, according to a new study, published online and in the December issue of the journal *Radiology*.

Some patients who suffer an acute ischaemic stroke — in which a blood clot or other obstruction blocks blood flow in the brain — can be treated with a drug called tissue plasminogen activator, or tPA, that dissolves the clot and restores blood flow. However, the clot-busting drug can only be administered within four and a half hours of the onset of a stroke; when given beyond that window of time, the drug can cause bleeding in the brain.

According to the American Stroke Association, stroke is the third leading cause of death in the United States behind diseases of the heart and cancer. Approximately 795,000 Americans suffer a new or recurrent stroke each year.

"As many as a quarter of all stroke patients cannot be given tPA because they wake up with stroke symptoms or are unable to tell their doctor when their stroke began," said lead researcher Catherine Oppenheim, M.D., Ph.D., professor of radiology at Université Paris Descartes in France. In the study, Dr. Oppenheim and her team of researchers reviewed data from consecutive patients with acute ischemic stroke treated at Sainte-Anne Hospital in Paris between May 2006 and October 2008. The time of stroke onset was well defined in all patients and each underwent MRI within 12 hours.

The 130 patients in the study included 77 men and 53 women (mean age 64.7). Of those, 63 patients underwent MRI within three hours of stroke

onset and 67 were imaged between three and 12 hours after stroke onset. The radiologists analysed different types of MRI data on the patients, including fluid-attenuated inversion recovery (FLAIR), diffusionweighted imaging (DWI) and apparent diffusion coefficient (ADC) ratios.

Using the MRI data alone, the radiologists were able to predict with greater than 90 percent accuracy which patients had experienced stroke symptoms for longer than three hours. "When the time of stroke onset is unknown, MRI could help identify patients who are highly likely to be within the three-hour time window when tPA is proven effective and approved for use," Dr. Oppenheim said. According to Dr. Oppenheim, using MRI to determine the duration of a stroke would change the way stroke is managed in the emergency setting.

» Combined Imaging Technologies May Better Identify Cancerous Breast Lesions

By combining optical and x-ray imaging, radiologists may be better able to distinguish cancer from benign lesions in the breast, according to a new study published in the online edition and January issue of *Radiology*. Researchers at Martinos Center for Biomedical Imaging at Massachusetts General Hospital in Boston helped develop a combined optical/x-ray imaging system capable of obtaining both structural and functional information of the breast.

The two technologies used were digital breast tomosynthesis (DBT), a three-dimensional application of digital mammography, and diffuse optical tomography (DOT), which measures levels of hemoglobin concentration, oxygen saturation and other cellular characteristics, based on how light from a near-infrared laser is absorbed and scattered within tissue. "By co-registering optical and x-ray data, radiologists are able to map suspicious findings and analyse the functional characteristics of those areas," said lead researcher Qianqian Fang, Ph.D., a radiology instructor at Harvard Medical School.

In the study, combined DBT and DOT was performed on 189 breasts from 125 women with an average age of 56 years. To perform the procedure, an optical source and detector probes were attached to a DBT unit and, with the breast compressed, optical data was acquired. The optical probes were then removed without altering the breast compression and a DBT scan was performed.

"We are very excited about adding optical imaging to DBT, because it is low-cost, safe, noninvasive and fast," Dr. Fang said.

Of the 189 imaging studies, 138 were negative, and 51 showed evidence of lesions. As determined by breast biopsy, 26 lesions of the 51 lesions were malignant, and 25 were benign. In the 26 malignant tumors, total hemoglobin concentration (HbT) was significantly greater than in the normal glandular tissue of the same breast. Solid benign lesions and cysts had significantly lower HbT contrast compared to the malignant lesions.

In the study, oxygen saturation levels were significantly lower in cysts compared to those in malignant and solid benign lesions and glanest tissue.

II. Design of Imaging Departments

» Imaging Facility Design in an Age of Diminishing Resources

The learning objectives of this course were to discuss making educated decisions about newly constructed or renovated imaging facilities and to understand their impact on both first-costs and life-cycle costs of the facility. It is vital to recognise key design elements in the built environment that support MR imaging safety and support efficient staffing.

Dr Ronald Arenson, an expert in radiology informatics, workforce issues and the effect of managed care on radiology gave a presentation on New Hospital Construction – Architecture and Management of Design in which he used examples from his involvement in the design of the University of California, San Francisco (UCSF) Medical Centre at Mission Bay, due to open in 2014. Dr Arenson is chair and the Alexander R. Margulis Distinguished Professor of Radiology at the UCSF and a member of the RSNA Board of Directors.

According to Dr Arenson, healthcare delivery in the U.S. will change significantly so it necessary to prepare for regular equipment change as technology advances. This is why it is important to be wise about the use of space when designing new radiology departments, as the space available will not change, but the equipment will. Ideally different areas should be separated by specialty but this is not always possible. There are nevertheless numerous important factors to consider such as the number of rooms needed, what procedures are expected, the length of each procedure and variation. Queuing theory also plays a big role as it is important in order to maximise utilisation of all rooms. The workflow of a radiology department is very important, which is why it is necessary to consider the travel routes and times of staff and patients, which influences the design of the waiting areas and dressing rooms. In general, the more open space in the design the better as this helps the flow of a department, however, there are many competing interests so rooms need to be designed in a way that can be multipurpose. Safety is of course the most important factor so there must be at least three clear zones (public zone, transitional and safe zone), however, the comfort of the patient must also be considered, which is why lighting, heating and air conditioning services must be well planned out to avoid waste.

» Smart Design for Imaging

Dr Steven Horii, from the Hospital of the University of Pennsylvania in Philadelphia stressed that the best way to make smart decisions in design and architecture is to consult the people who will be using the facilities. He also agreed that it is not possible to have a successful long-term strategy based on technology possession alone, technology changes so the design needs to be adaptable and flexible. At times of financial difficulties and limited funds planning becomes even more important and designs need to be especially well thought out to cut costs. However, despite the financial crisis there are still critical projects taking place and 60 percent of all U.S. hospitals have projects underway or planned, 19

percent of which include imaging. The priorities of a radiology department have not changed much and customer satisfaction and improving productivity and workflow remain on top, however the challenges faced by facility managers are not solved by design but the impact of design planning, which is vital to the efficient functioning of any department. It is important to learn from others - not only other departments, medical centres or hospitals but also other industries. Evidence practice in radiology can be just as easily applied to design but in order to improve something you must first study it and understand it.

III. Current Issues in Radiation Safety

» Recently Launched – New Project: 'Image Wisely' Campaign

The learning objectives of the session were to understand the goals and action plan of the recently launched 'Image Wisely' initiative, with regards to the radiation exposure from medical imaging; to understand the applicability and limitations of current CT dose metrics for quantifying the radiation exposure delivered to individual patients and to understand current CT equipment features for monitoring and controlling the radiation dose. The aim of the session was also to consider future requirements for CT equipment manufacturers to monitor and control the radiation dose delivered with their CT scanners.

Image Wisely is an awareness programme of the American College of Radiology, the Radiological Society of North America, the American Association of Physicists in Medicine, and the American Society of Radiologic Technologists. Image Wisely, described as a 'wake-up alert' and a 'call-to-action', was launched at RSNA 2010 on Sunday November 28 as a national campaign to promote greater safety in radiology.

Image Wisely's objective is to encourage practitioners to avoid unnecessary ionising radiation scans and to use the lowest optimal radiation dose for necessary studies. Radiologists, medical physicists, technologists, and physicians are encouraged to take the pledge to image wisely for the health and safety of their patients. The Image Wisely website (www.imagewisely.org) provides educational resources and will include vendor microsites, which will offer users easy access to information about dose reduction techniques on specific equipment, dose monitoring, and dose optimisation. The goal is also ACR accreditation of CT scanners, as currently less than 50 percent of the scanners being used in the US are accredited. The key messages of the campaign are - be informed, get accredited and pledge to perform 'the right exam, performed the right way, every time'.

» Radiologists Call for National Strategy to Address Medical Imaging Overuse

Overutilisation of medical imaging services exposes patients to unnecessary radiation and adds to healthcare costs, according to a report appearing online and in the October issue of the journal *Radiology* that calls on radiologists to spearhead a collaborative effort to curb imaging overutilisation. "In most cases, an imaging procedure enhances the accuracy of a diagnosis or guides a medical treatment and is fully justified, because it benefits the patient," said the article's lead author, William R. Hendee, Ph.D., distinguished professor of radiology, radiation oncology, biophysics and bioethics at the Medical College of Wisconsin in Milwaukee. "But some imaging procedures are not justified, because they are unnecessary for the patient's care. These are the uses of imaging that we, as medical physicists, radiologists, radiation oncologists and educators, are trying to identify and eliminate."

The growth in medical imaging over the past two decades has yielded important and life-saving benefits to patients. Medical imaging has allowed millions of patients to avoid more invasive diagnostic and treatment procedures. However, overutilisation of medical imaging services can be detrimental to patients by exposing them to unnecessary radiation. Between 1980 and 2006, the annual U.S. population radiation dose from medical procedures increased seven-fold, according to the National Council on Radiation Protection and Measurements.

In August 2009, the American Board of Radiology Foundation hosted a two-day summit with more than 60 participating organisations to examine the causes and effects of imaging overutilisation. The summit identified several key forces influencing overutilisation, including payment mechanisms and financial incentives in the U.S. healthcare system, the practice behavior of referring physicians, self-referral, defensive medicine, patient expectations and duplicate imaging exams.

"There are many causes of overutilisation of imaging in medicine," Dr. Hendee said. "Some of these causes, such as self-referral to physician-owned imaging facilities and defensive medicine to shield against potential lawsuits, are beyond radiology's influence to correct and must be dealt with more globally within medicine. However, some of the causes do occur within radiology, and the profession is hard at work to address them."

Summit participants offered several suggestions to reduce overutilisation, such as a national collaborative effort to develop evidence-based appropriateness criteria for imaging, greater use of practice guidelines in requesting and conducting imaging exams, decision support at the point-of-care, education of referring physicians and the public, accreditation of imaging facilities, management of self-referral and defensive medicine, and payment reform.

The *Radiology* report outlines several of these suggestions and states that these efforts will require the cooperation and active collaboration of many groups, including radiologists, physicists, oncologists, referring physicians, payers of healthcare services, patient and public interest groups and vendors of medical imaging equipment. A second summit called "Improving Patient Care through Effective Communicating in Imaging" was held in Washington, D.C., August 5 - 6, 2010.

In June 2009, the Radiological Society of North America (RSNA) and the American College of Radiology established the joint Task Force on Adult Radiation Protection to address concerns about patient radiation exposure from medical imaging procedures. The task force subsequently broadened the participating primary member institutions to include the American Association of Physicists in Medicine and the American Society of Radiologic Technologists and is in the process of developing the "Image Wisely" campaign for adult radiation protection.

IV. Managing Risk for Optimal Patient Safety

» Practical Methods for Creating a Culture of Safety in the Workplace

The learning objectives of this session were to recognise ways in which leaders can promote a culture of safety, by examining specific tools used to reinforce safety strategies and methods used to reinforce safety messages in the workplace. The session also focused on specific tools used to prioritise safety goals based on institutional need and regulatory standards and identified the responsibilities and actions of administrators, managers, and front line personnel in reinforcing an organisation's ongoing commitment to safety.

One of the practical ways of creating safety in the workplace outlined during the session was using the 'Impact vs. Effort' or 'Effort vs. Benefits' decision matrix, which allows a decision to be quickly analysed by evaluating the possible outcomes.

The importance of having a safety committee was also highlighted. The committee should include representatives from all areas of the department and even medical facility, including maintenance staff. First of all, the safety committee should meet on a regular basis, for example every month, as this allows for an open exchange of ideas on what to change and improve. The meetings should be more like brainstorming sessions but with an agenda, and should promote creativity and not get caught up in the process of the meeting.

It is also important to determine and prioritise goals and have a clear list of accomplishments at the end of the year. Within the meeting it is common to have sub groups for improvement such as 'patients left unattended' or 'infection control', which allow participants to focus on particular problem areas but it is equally important to allow everyone to meet and discuss ideas together. Audits are also important, as it is necessary to check and ensure that the changes being made are having an effect. There are two types of audits – mandated (regulated and institutional) and internally developed. Both are important as they track progress and can highlight problems areas.

However, when creating a culture of safety in a workplace, the most important factor is active involvement and participation of the front line people as they are the most important for creating a culture of patient safety within the working environment and they should be the ones that decide how this should be promoted.

Any kind of visual aids can be used to promote safety such as colourful signs, flow charts - anything that will make people think, remember and follow the practice. Employees naturally want to make progress so the more they are involved, for example in designing the signs and posters, the more likely they are to take notice of them and adhere to the safety policies. It is after all, the people who create a culture of safety and not the policies and equipment.

» Radiation Fears Should Not Deter Women From Mammography Screening

The risk of radiation-induced breast cancer from mammography screening is slight in comparison to the benefit of expected lives saved, according to a new study appearing online and in the January issue of the journal *Radiology*.

"Our study shows that the risk of cancer associated with routine screening in women age 40 and over is very low, especially when compared to the benefits associated with early detection."

Dr. Yaffe and his colleague, James G. Mainprize, Ph.D., developed a model for estimating the risk of radiation-induced breast cancer following exposure of the breast to ionizing radiation from various screening mammography scenarios and estimated the potential number of breast cancers, fatal breast cancers, and years of life lost attributable to mammography screening.

Using a radiation dose estimate of 3.7 milligrays (mGy), which is typical for digital mammography, and a cohort of 100,000 women, the researchers applied the risk model to predict the number of radiation-induced breast cancers attributable to a single examination and then extended the model to various screening scenarios beginning and ending at different ages.

The results showed that in 100,000 women, each receiving a dose of 3.7 mGy to both breasts, annual screening from age 40 to 55 years and biennial screening thereafter to age 74 years would result in 86 radiation-induced cancers, including 11 fatal cancers, and 136 life years lost. Conversely, for the same cohort it was estimated that 497 lives and 10,670 life years would be saved by earlier detection.

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