

## Commentary

Over the past three decades or so Radiology as a profession has undergone a revolution. As technology has evolved so has the role and the responsibility of the Radiologist. Despite these tremendous changes the essential requirement for a Radiologist is to interpret images. The sheer volume of data generated in today's examinations is overwhelming. It puts the radiologists under tremendous pressure to ensure that all the images are looked and to generate a timely report. MacDonald et al have tried to quantify the load on their radiologists. It is sobering to think that today's radiologists are required to interpret and image every few seconds during their working day. We need to ensure that our workflows and compensation systems keep pace with this expectation.

The age-old debate of training versus experience is revisited by Webb et al in the context of MCQ writing. Before I comment on this article I would like to address the larger debate around the relative value of experience over training. To put it another way the difference between teaching yourself and being taught by an expert. Without validation one may teach oneself something in error and not know it. Undoubtedly the best combination is a combination of training and experience. However the medical profession unfortunately has many who practice based on experience only having given up any effort to educate or train them selves. Unfortunately this is not confined to non-specialists and non-academics only. When it comes to MCQs, one only has to look at the MCQ papers administered during various medical examinations, both undergraduate and postgraduate, to realise that not only do the paper setters do not know how to make good MCQs but also that they do not realise that what they are putting out is substandard. Not surprisingly Webb finds that those with specific training in constructing MCQs do a better job than those who do it based only on experience.

From one contentious debate to another. Transient Elastography versus Shear Wave Elastography for the quantification of liver fibrosis. It seems that the debate is more to do with an inter-professional turf battle than a debate about technological superiority. Gerber et al have done a head to head assessment of the two techniques and have found both to be equally good at this. Transient elastography is however liver specific whereas Shear Wave has the additional ability to be applied to other body regions and organs is therefore likely to be a more cost effective investment in a resource constrained country such as Pakistan.

Moving away from contentious debates into an area where there is broad agreement. Radiation doses need to be kept to a minimum during diagnostic CT examinations. Various dose reduction algorithms and strategies are available from various manufacturers. Adaptive Iterative Dose Reduction and its latest 3D version (AIDR 3D) are the most widely available dose reduction algorithms in Pakistan. Mirsadraee et al evaluate the use of AIDR 3D is pulmonary perfusion and find that it significantly reduces doses while maintaining image quality. All radiology centres that have access to AIDR or an alternative from other manufacturers should ensure that they are using it and keeping a record of the doses that are delivered to patients.

Lastly two reviews on imaging of transplanted solid organs. This is an increasing part of our workload and we need to ensure that we know what we are dealing with.

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## Academic Radiology 2015; 22(9): 1191-8

Robert J. McDonald, Kara M. Schwartz, Laurence J. Eckel, Felix E. Diehn, Christopher H. Hunt, Brian J. Bartholmai, Bradley J. Erickson, David F. Kallmes

### The Effects of Changes in Utilization and Technological Advancements of Cross-Sectional Imaging on Radiologist Workload

**RATIONALE AND OBJECTIVES:** To examine the effect of changes in utilization and advances in cross-sectional imaging on radiologists' workload.

**MATERIALS AND METHODS:** All computed tomography (CT) and magnetic resonance imaging (MRI) examinations performed at a single institution between 1999 and 2010 were identified and associated with the total number of images for each examination. Annual trends in institutional numbers of interpreted examinations and images were translated to changes in daily workload for the individual radiologist by normalizing to the number of dedicated daily CT and MRI work assignments, assuming a 255-day/8-hour work day schedule. Temporal changes in institutional and individual workload were assessed by Sen's slope analysis ( $Q$  = median slope) and Mann-Kendall test ( $Z$  =  $Z$  statistic).

**RESULTS:** From 1999 to 2010, a total of 1,517,149 cross-sectional imaging studies (CT = 994,471; MRI

= 522,678) comprising 539,210,581 images (CT = 339,830,947; MRI = 199,379,634) were evaluated at our institution. Total annual cross-sectional studies steadily increased from 84,409 in 1999 to 147,336 in 2010, representing a twofold increase in workload ( $Q$  = 6465/year,  $Z$  = 4.2,  $P$  < .0001). Concomitantly, the number of annual departmental cross-sectional images interpreted increased from 9,294,140 in 1990 to 94,271,551 in 2010, representing a 10-fold increase ( $Q$  = 8707876/year,  $Z$  = 4.5,  $P$  < .0001). Adjusting for staffing changes, the number of images requiring interpretation per minute of every workday per staff radiologist increased from 2.9 in 1999 to 16.1 in 2010 ( $Q$  = 1.7/year,  $Z$  = 4.3,  $P$  < .0001).

**CONCLUSIONS:** Imaging volumes have grown at a disproportionate rate to imaging utilization increases at our institution. The average radiologist interpreting CT or MRI examinations must now interpret one image every 3–4 seconds in an 8-hour workday to meet workload demands.

## Academic Radiology 2015; 22(10): 1317-22

Emily M. Webb, Jonathan S. Phuong, David M. Naeger

### Does Educator Training or Experience Affect the Quality of Multiple-Choice Questions?

**RATIONALE AND OBJECTIVES:** Physicians receive little training on proper multiple-choice question (MCQ) writing methods. Well-constructed MCQs follow rules, which ensure that a question tests what it is intended to test. Questions that break these are described as "flawed." We examined whether the prevalence of flawed questions differed significantly between those

with or without prior training in question writing and between those with different levels of educator experience.

**MATERIALS AND METHODS:** We assessed 200 unedited MCQs from a question bank for our senior medical student radiology elective: an equal number

of questions (50) were written by faculty with previous training in MCQ writing, other faculty, residents, and medical students. Questions were scored independently by two readers for the presence of 11 distinct flaws described in the literature.

**RESULTS:** Questions written by faculty with MCQ writing training had significantly fewer errors: mean 0.4 errors per question compared to a mean of 1.5–1.7 errors per question for the other groups ( $P < .001$ ). There were no significant differences in the total number of errors between the untrained faculty, residents, and students ( $P$  values .35 - .91). Among trained faculty

17/50 questions (34%) were flawed, whereas other faculty wrote 38/50 (76%) flawed questions, residents 37/50 (74%), and students 44/50 (88%). Trained question writers' higher performance was mainly manifest in the reduced frequency of five specific errors.

**CONCLUSIONS:** Faculty with training in effective MCQ writing made fewer errors in MCQ construction. Educator experience alone had no effect on the frequency of flaws; faculty without dedicated training, residents, and students performed similarly.

## Ultrasound in Medicine & Biology, 2015; 41(9): 2350-9

Ludmila Gerber, Daniela Kasper, Daniel Fitting, Viola Knop, Annika Vermehren, Kathrin Sprinzi, Martin L. Hansmann, Eva Herrmann, et al.

### Assessment of Liver Fibrosis with 2-D Shear Wave Elastography in Comparison to Transient Elastography and Acoustic Radiation Force Impulse Imaging in Patients with Chronic Liver Disease

**ABSTRACT:** Two-dimensional shear wave elastography (2-D SWE) is an ultrasound-based elastography method integrated into a conventional ultrasound machine. It can evaluate larger regions of interest and, therefore, might be better at determining the overall fibrosis distribution. The aim of this prospective study was to compare 2-D SWE with the two best evaluated liver elastography methods, transient elastography and acoustic radiation force impulse (point SWE using acoustic radiation force impulse) imaging, in the same population group. The study included 132 patients with chronic hepatopathies, in which liver stiffness was evaluated using transient elastography, acoustic radiation force impulse imaging and 2-D SWE. The reference methods were liver biopsy for the assessment of liver fibrosis ( $n = 101$ ) and magnetic resonance

imaging/computed tomography for the diagnosis of liver cirrhosis ( $n = 31$ ). No significant difference in diagnostic accuracy, assessed as the area under the receiver operating characteristic curve (AUROC), was found between the three elastography methods (2-D SWE, transient elastography, acoustic radiation force impulse imaging) for the diagnosis of significant and advanced fibrosis and liver cirrhosis in the “per protocol” (AUROCs for fibrosis stages  $\geq 2$ : 0.90, 0.95 and 0.91; for fibrosis stage  $[F] \geq 3$ : 0.93, 0.95 and 0.94; for  $F = 4$ : 0.92, 0.96 and 0.92) and “intention to diagnose” cohort (AUROCs for  $F \geq 2$ : 0.87, 0.92 and 0.91; for  $F \geq 3$ : 0.91, 0.93 and 0.94; for  $F = 4$ : 0.88, 0.90 and 0.89). Therefore, 2-D SWE, ARFI imaging and transient elastography seem to be comparably good methods for non-invasive assessment of liver fibrosis.

## Clinical Radiology 2015; 70(8): 844-51

S. Mirsadraee, N.W. Weir, S. Connolly, J.T. Murchison, J.H. Reid, N. Hirani, M. Connell and E.J. van Beek

### Feasibility of radiation dose reduction using AIDR-3D in dynamic pulmonary CT perfusion

**AIM:** To assess the feasibility of radiation dose reduction with adaptive iterative dose reduction (AIDR-6 3D) reconstruction in dynamic pulmonary CT perfusion.

**MATERIALS AND METHODS:** CTP examinations of 10 patients acquired at 100 kVp/50 mAs were reconstructed with filtered back projection (FBP) and AIDR-3D. Artificial noise was added to raw data (pre-reconstruction projection data) to simulate lower tube current scanning. Radiodensity (in Hounsfield units), noise, and perfusion values were compared.

**RESULTS:** There was no significant difference in noise between the full and simulated reduced tube current with AIDR-3D reconstruction ( $p = 1$ ). There was significantly lower noise in lung tissue with AIDR-3D images when compared to reconstructions without

AIDR-3D ( $p = 0.005$ ) and no significant change in the radiodensity ( $p = 1$ ; mean difference  $<6$  HU). Mean perfusion values increased significantly at lower tube currents (25 and 12.5 mAs), compared to 50 mAs ( $p = 0.005$ ). This effect was significantly greater in larger patients compared to thin patients.

**CONCLUSION:** AIDR-3D produced significantly lower noise images than FBP-based algorithms and maintained consistent noise levels in lung at 12.5 mAs, indicating this algorithm is suitable for reduced dose lung perfusion imaging. Iterative reconstruction allows significant radiation dose reduction of up to fourfold in smaller patients, and up to twofold in the medium/large size patients. The increase in perfusion values at 25% simulated tube currents is attributed to attenuation bias.

## Clinical Radiology 2015; 70(8): 898-908

G. Low, J.L. Jaremko and D.J. Lomas

### Extravascular complications following abdominal organ transplantation

A variety of transplants have been performed in the abdomen including liver, kidney, pancreas and islet, bowel, and multivisceral transplants. Imaging plays an important role in graft surveillance particularly to exclude post-transplant complications. When complications occur, therapeutic image-guided interventions are invaluable as these may be graft-saving and even life-saving. Vascular complications following transplantation have been extensively reported

in recent reviews. The focus of this review is to discuss post-transplant complications that are primarily extravascular in location. This includes biliary, urological, intestinal, malignancy, infections, and miscellaneous complications. Familiarity with the imaging appearances of these complications is helpful for radiologists as accurate diagnosis and expedient treatment has an impact on graft and patient survival.

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## Clinical Radiology 2015; 70(10): 1047-59

A.K. Pillai, B. Andring, A. Patel, C. Trimmer and S.P. Kalva

# Portal hypertension: A review of portosystemic collateral pathways and endovascular interventions

The portal vein is formed at the confluence of the splenic and superior mesenteric vein behind the head of the pancreas. Normal blood pressure within the portal system varies between 5 and 10 mmHg. Portal hypertension is defined when the gradient between the portal and systemic venous blood pressure exceeds 5 mmHg. The most common cause of portal hypertension is cirrhosis. In cirrhosis, portal hypertension develops due to extensive fibrosis within the liver parenchyma causing increased vascular resistance. In addition, the inability of the liver to metabolise certain

vasodilators leads to hyperdynamic splanchnic circulation resulting in increased portal blood flow. Decompression of the portal pressure is achieved by formation of portosystemic collaterals. In this review, we will discuss the pathophysiology, anatomy, and imaging findings of spontaneous portosystemic collaterals and clinical manifestations of portal hypertension with emphasis on the role of interventional radiology in the management of complications related to portal hypertension.