[Indian J Chest Dis Allied Sci 2010;52:77-78]

Editorial

Perils of Injudicious Medical Imaging: Time for a Wake-up Call!

There is an adage in medicine *"Treat the patient, not the investigations"*. This idiom is becoming all the more true for health care professionals all over the world today. Many a times, patients are subjected to repeated investigations and procedures without any conclusive data indicating improvement in quality of life, prevention of major clinical events or decreased long-term medical expenditure. On the other hand, many of these interventions may expose patients to potential risks.

A classical example in clinical practice is a patient undergoing medical imaging procedures. Of late, the risks and benefits of low-dose radiation used in diagnostic imaging are being increasingly accepted as important issues to be addressed by health care professionals. It is well known that the imaging procedures are frequently performed multiple times in the same patient.[1] It has also been estimated that cumulative doses of radiation from imaging increases with advancing age and are higher in women than in men. In fact, clinicians are referring their patients for so many imaging investigations that 2% of cancers may be attributable to radiation exposure during computed tomography (CT) scanning.[2]

As a matter of fact, the number of CT scans has quadrupled in the last two decades in the United States.[2] The CT along with nuclear imaging accounted for approximately 75% of the cumulative effective dosage with 82% being administered in the outpatient setting. In absolute numbers in United Sates (US), it has been suggested that imaging procedures leading to high dose radiation exposure occur in 40 lac persons every year.[1]

In fact, it is well recognised that cutting edge technologies like CT or its *primordial* alternative, radiograph have improved the diagnostic armamentarium of clinicians. It is not surprising that in a survey conducted among 225 clinicians about relative importance of 30 medical innovations, CT along with magnetic resonance imaging (MRI) scanning was labeled as the *numero uno* medical innovations.[3]

The role of high dose radiation as risk factor of cancer as shown by the Hiroshima tragedy and Chernobyl disasters has always been well recognised. However, there is preliminary evidence that low dose ionizing radiation may also be associated with development of solid tumours and leukemias.[4,5] Currently, health care workers working in radiodiagnosis or nuclear imaging and those working in the nuclear industry are routinely monitored for radiation exposure. However, medical imaging procedures performed on patients are not scrutinised for radiation exposure.

It is imperative that sensitisation of health care professionals about the harmful effects of low dose diagnostic radiation needs to be done. In an interesting study in US,[6] only 9% emergency department physicians were aware that CT was associated with an increased risk of cancer.

The radiation risk associated with chest CT in different conditions is also being addressed lately.[7] It has been observed that in lung cancer screening, as of now there is no scientific data demonstrating reduction in lung cancer mortality using CT as a screening modality. In diagnosis of pulmonary embolism, CT pulmonary angiography has evolved as the imaging modality of choice, whereas in CT coronary arteriography, evidence of benefit is in the process of evolution and is still being accurately defined. It needs to be appreciated by health care professionals that accurate prediction of clinical events may not necessarily lead to a change in outcome or result in prevention.[8]

Another issue is radiation exposure from computed tomography in pediatric age group. The use of pediatric computed tomography is increasing in children also. In the US, 70 lac pediatric computed tomographies are performed annually. The practice of ALARA (as low as reasonably achievable) is applied to reduce radiation exposure in children. In pediatric age group, it is all the more important for health care providers to be more judicious in referring patients for diagnostic imaging. Alternate non-radiation modalities, like MRI and ultrasound need to be further developed as alternate diagnostic pathways.[9]

Chest imaging (chest radiograph and CT chest) is performed very frequently by clinicians in their daily practice. Therefore, it becomes imperative for radiologists and clinicians in the field of respiratory medicine to re-define technology to reduce the risk of radiation hazards to our patients. In patients with pulmonary embolism, it has been observed that reducing the x-ray tube potential from 120 to 100 kVp in 16 slice multidetector CT resulted in reducing the radiation dose to half without compromising on the diagnostic quality.[10] Obviously, this would be of particular benefit in young individuals. Moreover, MRI and ultrasound for chest imaging needs to be further improved to give better spatial resolution of lung parenchyma. Currently, MRI is not considered a valuable imaging tool for evaluating early changes in lung parenchyma as lungs contain mostly air, which is difficult to image by the current generation MRI scanners.

Amongst the medical fraternity, radiologists are the only health care professionals who receive formal

training in radiation physics during their post graduation years. On the contrary, it is the clinicians who most often decide 'when' to pursue imaging and 'what' type of imaging may best fit the clinical context. It would be more appropriate if radiation-related issues are discussed with radiologists to ensure indication-based and warranted diagnostic procedures.

Further, we need to adopt a new philosophy for our approach to imaging. In our country, there is no robust data on the effects of exposure to low dose radiation used in diagnostic imaging. Clinicians in association with radiologists need to conduct well-designed trials to generate evidence-based data about net clinical benefit to patients. The importance of a thorough history and physical examination should not be substituted by imaging procedures as these become widely available in our country. In fact, no investigation can clinch a diagnosis in the absence of a detailed clinical work-up of the patient. This must include a judicious review of the imaging studies performed earlier to protect patients from radiation exposure due to repeat imaging procedures.

There is an urgent need for sensitisation in each of the health care professionals involved in primary care as well as in tertiary care to keep radiation hazards in mind while referring patients for repeated medical imaging over a short period of time. As chest radiographs are one of the most frequently performed investigations in clinical practice, the respiratory physicians need to take a lead in this awareness campaign. Indeed, it is a time for a wake up call for all of us!

Gautam Ahluwalia[1], Archana Ahluwalia[2] and S.K. Sharma[3]

Member, Editorial Board[1] and Professor, Department of Medicine[1], Medical Officer Incharge, Emergency Services[1], Associate Professor, Department of Radiodiagnosis[2] Dayanand Medical College and Hospital, Ludhiana, Punjab and

Editor[3] and Chief, Division of Pulmonary, Critical Care and Sleep Medicine and Professor and Head Department of Medicine[3] All India Institute of Medical Sciences New Delhi

REFERENCES

1. Fazel R, Krumholz HM, Wang Y, Ross JS, Chen J, Ting HH *et al.* Exposure to low-dose ionizing radiation from medical imaging procedures. *N Engl J Med* 2009;361:849-57.
2. Brenner DJ, Hall EJ. Computed tomography: an increasing source of radiation exposure. *N Engl J Med* 2007 29;357:2277-84.
3. Fuchs VR, Sox HC Jr. Physicians' views of the relative importance of thirty medical innovations. *Health Aff (Millwood)* 2001;20:30-42.
4. National Research Council. Health risks from exposure to low levels of ionizing radiation: BEIR VII phase 2. Washington, DC: National Academies Press, 2006.
5. Smith-Bindman R, Lipson J, Marcus R, Kim KP, Mahesh M, Gould R, *et al.* Radiation dose associated with common computed tomography examinations and the associated lifetime attributable risk of cancer. *Arch Intern Med* 2009;169:2078-86.
6. Lee CI, Haims AH, Monico EP, Brink JA, Forman HP. Diagnostic CT scans: assessment of patient, physician, and radiologist awareness of radiation dose and possible risks. *Radiology* 2004;231:393-8. [Epub 2004 Mar 18].
7. Huppmann MV, Johnson WB, Javitt MC. Radiation risks from exposure to chest computed tomography. *Semin Ultrasound CT MR* 2010;31:14-28.
8. Lauer MS. Elements of danger–the case of medical imaging. *N Engl J Med* 2009;361:841-3.
9. Shah NB, Platt SL. ALARA: is there a cause for alarm? Reducing radiation risks from computed tomography scanning in children. *Curr Opin Pediatr* 2008;20:243-7.
10. Björkdahl P, Nyman U. Using 100- instead of 120-kVp computed tomography to diagnose pulmonary embolism almost halves the radiation dose with preserved diagnostic quality. *Acta Radiol* 2010 Feb 3; [Epub ahead of print].