

## Radiation risk in the indiscriminate use of CT scan

*O risco da radiação no uso indiscriminado da tomografia computadorizada*

Daniella Braz Parente<sup>1</sup>

Computed tomography (CT) has revolutionized diagnostic radiology. Its use has been increasing year after year due to its wide availability, its sectional imaging technology, and for being a method widely known both by radiologists and referring physicians. Additionally, CT is a fast imaging exam, which can be made with good quality in case of emergency, in claustrophobic and non-cooperative patients, as well as in children, mostly with no need for anesthesia.

CT scan uses a higher dose of radiation than conventional radiology. Multidetector CT scans allow thinner slices that associated with multiple contrast phases further enhance the radiation dose. The indiscriminate use of CT scan has significantly contributed to the increase in the dose of radiation used in patients. Radiologists must remind the referring physicians of the risks of radiation and suggest alternative imaging methods, such as ultrasonography and magnetic resonance imaging.

Studies on the risk for developing cancer due to radiation effects originate from data on survivors of nuclear attacks. Patients submitted to mean radiation doses of 40 mSv, which correspond to a four-phase abdominal CT scan, present with increased risk for developing of various tumor types<sup>(1-3)</sup>. Children are particularly susceptible to radiation because of greater radiosensitivity and/or the greater number of years yet to be lived<sup>(4)</sup>.

Several factors affect the radiation dose at CT scans. The most important of such factors include number of phases, mAs level, peak kilovoltage (kVp), patient's size, extent of the region to be studied, pitch, tube current modulation, automatic exposure control, use of filters and post-processing. It is important to consider that scans requiring very low radiation doses will produce images with higher noise levels, so the proper balance between image quality and radiation dose should always be sought (ALARA principle – as low as reasonably achievable)<sup>(5)</sup>. Thus, the optimization and periodic review of the protocols are very important to achieve such a balance.

Being aware of the radiation risks, it is the radiologists' responsibility to seek for the lowest possible radiation dose for the acquisition of images with good diagnostic quality. In the present issue of *Radiologia Brasileira*, Salvadori et al.<sup>(6)</sup> approach this essential point, highlighting their worry with the radiation dose received by patients during CT scans and evaluating the suppression of the equilibrium phase as a way to reduce it. In this 219 cases study the authors showed that the equilibrium phase does not contribute with significant data for tumor staging, and for the investigation of acute abdomen or abdominal collections. Therefore, it can be suppressed from the protocols. In the rare cases where there was a contribution from the equilibrium phase, it would not significantly affect the treatment. The suppression of the equilibrium phase resulted in change of only one main diagnosis, where an adrenal adenoma could be diagnosed by the presence of washout. In this case, in the absence of the equilibrium phase, the investigation of the adrenal nodule would proceed with magnetic resonance imaging, not justifying the additional radiation dose delivered to all other patients. Also, secondary diagnoses did not impact on the management.

Radiologists must actively participate in the selection of specific CT scan protocols. Patients with renal calculi are submitted to multiple urological CT scans; in these cases perhaps only the non-contrast CT scan would be enough, preferably with a low dose protocol. The split contrast bolus technique is also an alternative that allows simultaneous acquisition of the excretory and nephrographic phases. For most patients undergoing follow-up for neoplasia, only the portal phase is enough. Patients with Crohn's disease must be preferably submitted to magnetic resonance enterography (MRE). When MRE is not available, CT enterography should be performed only with the portal phase. Although the arterial phase is unnecessary in most cases, it is essential for the study of chronic liver diseases, for the characterization of liver nodules, and for the study of hypervascular tumors [neuroendocrine tumors, melanoma, renal cell carcinoma, gastrointestinal stromal tumors (GIST)].

In conclusion, CT scan is an excellent diagnostic imaging method that has revolutionized radiology. However, radiologists

1. MD, PhD, Researcher at D'Or Institute for Research and Education, Radiologist, Rede Labs D'Or, Grupo Fleury, Rio de Janeiro, RJ, Brazil. E-mail: daniella.parente@gmail.com.

must reflect about their responsibility in regard to the radiation dose given to each patient and contribute to the education of the requesting physicians with respect to radiation risks and imaging study options. Dose optimization and protocol individualization must always be a concern.

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