

A statement on the EPI-CT study from the EuroSafe Imaging Paediatric Imaging Working Group

The role of CT examinations is undisputed, thanks to the diagnostic information provided in countless clinical conditions. However, in the past years a few epidemiological studies [1-4] have raised concerns about its use in children, as CT studies were linked to an increase in the risk of brain tumors. Nevertheless, the results of these studies have been questioned because of methodological limitations such as reverse causation, a limited number of cases, indication bias, and lack of individual dose reconstruction.

In the Lancet Oncology, Hauptmann and colleagues [5] very recently presented the results of the EPI-CT cohort study, which aimed to quantify brain cancer risks in a large European cohort of children and young adults (<22-year-old) who had head or neck CT examinations and to overcome the methodological limitations of previous studies. About 660,000 individuals, who had a CT study between 1977 and 2014 in nine European countries, were considered eligible for the study. During a 5.6 year median follow up 165 brain cancers were observed, three quarters of them being gliomas. Mean cumulative brain dose lagged by 5 years was 47 mGy among all individuals and 76 mGy among subjects with brain cancers. A significant linear dose-response relationship was observed for all brain cancers (excess relative risk (ERR) per 100 mGy 1.27 [95% CI 0.51-2.69]) and for gliomas separately (ERR per 100 mGy 1.11 [0.36-2.59]). The authors estimated that for every 10,000 subjects who received a single head CT study, about one person is expected to develop a brain cancer attributable to radiation exposure during a follow up of 5 – 15 years after the CT examination. On the other hand, as the time span of the study also included examinations performed with CT scanners that are now obsolete, it is foreseeable that the availability of better dose reduction systems and a larger diffusion of artificial intelligence in new equipment, could reduce this risk.

In any case, although the risk reported in this study is comparable to that of dying because of accidental gun discharge in the USA [6], it is foreseeable that the EPI-CT study will have a great impact not only among health professionals but probably also among lay people.

In fact, the results reported in the EPI-CT study - based on robust data and methods – represent a novel and unique contribution supporting the linear no-threshold model for cancer risk from doses substantially lower than 100 mGy. Consequently, this study also reinforces the role of the two mainstays of radiation protection of patients: justification and optimisation, which are a long-standing commitment of all professionals involved in the practice of radiology.

The ESR through its EuroSafe Imaging initiative strongly supports improved quality and safety in medical imaging with a series of activities inspired by the so-called Bonn Call for Action [7], formulated by the International Atomic Energy Agency (IAEA) and the World Health Organization (WHO) in 2012. To these regards, EuroSafe Imaging provides up-to-date and evidence-based imaging referral guidelines implemented in the ESR iGuide [8], which can be part of a computerised decision support (CDS) system integrated into electronic requesting systems. In the years to come, fully integrated CDS such as ESR iGuide are expected to improve the justification process and imaging appropriateness, as imaging referral guidelines remain the most effective tool to ensure appropriate justification. The availability of CDS also makes it easier to perform audits on appropriate justification in order to give feedback to both referrers and practitioners. To this

aim, ESR has provided a practical audit tool – Esperanto [9] – which can simplify all the steps of an audit.

Education and training - as provided by EuroSafe Imaging through many initiatives - are another key component to increase health professionals' awareness of appropriateness of medical imaging. Finally, the results of studies such as EPI-CT can be a cause for alarm, especially for parents whose children need to undergo CT examinations. In this context, scientific societies such as ESR play a pivotal role in improving information and communication with patients and parents about radiological procedures, related benefits and potential risks.

In conclusion, the results of the EPI-CT study give further evidence that all the efforts made to create a culture of safety in radiology in terms of appropriateness and justification, auditing, education and training, and information for patients are fully justified and better still, an even stronger commitment is needed.

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