Radiation exposure from CT scans in childhood could triple the risk of leukaemia and brain cancer

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Radiation exposure received from 2 to 3 computed tomography (CT) scans of the head in childhood (aged under 15 years)—giving a cumulative dose of around 60 mGy— can triple the risk of later developing brain cancer, while around 5 to 10 such scans (cumulative dose around 50 mGy) could triple the risk of developing leukaemia (with the differing number of scans related to different absorption rates of the brain versus the bone marrow and age at time of scanning). While the absolute risk of these cancers occurring after CT is small, radiation doses from CT scans should be kept as low as possible and alternative procedures, that do not use ionising radiation, should be considered if appropriate.

These are the conclusions of an Article published Online First by *The Lancet*, written by Dr Mark Pearce and Professor Sir Alan Craft, Newcastle University, UK; Professor Louise Parker, Dalhousie University, Halifax, NS, Canada; Dr Amy Berrington de González, National Cancer Institute (NCI), National Institutes of Health (NIH), Bethesda, MD, USA, and colleagues. The study represents the culmination of almost two decades of research in this area, and is jointly funded by the UK Department of Health and NCI/NIH.

CT imaging is a vital diagnostic technique, and new applications continue to be identified. Use of this technology has increased rapidly in the USA and elsewhere, especially in the past decade. However,

potential cancer risks exist due to the ionising radiation used in CT scans, especially in children who are more radiosensitive than adults. In this retrospective study, the authors studied close to 180,000 patients who underwent a CT scan between 1985 and 2002 according to records from the radiology departments of some 70% of the UK's hospitals. They extracted the number and types of CT scan from the records and estimated the dose absorbed in milli-Grays (mGy) by the brain and bone marrow in patients for each scan. These data were then linked to cancer incidence and mortality reports in the UK National Health Service Registry between 1985 and 2008. From this, they calculated excess incidence of leukaemia and brain tumours. The dose of radiation received by the brain and bone marrow varies by age, and body part scanned (see table 1 of paper).

A total of 74 from 178 604 patients were diagnosed with leukaemia and 135 of 176 587 were diagnosed with brain cancer. The authors calculated that the relative risk of leukaemia increased by 0.036 per extra mGy received, whilst for brain tumours this increased risk was 0.023. Compared with patients who received a dose of less than 5 mGy, patients who received a cumulative dose of at least 30 mGy (mean 50 mGy) had around three times the risk of leukaemia; and patients receiving a cumulative dose of 50-74 mGy (mean 60 mGy) had triple the risk of developing primary brain tumours. The authors say that, of every 10 000 people between the ages of 0-20 years receiving 10 mGy from a CT scan, there would be about one expected excess leukaemia case, whereas there were would be one excess case of brain cancer for every 30,000 people. Applying the dose estimates for one head CT scan before the age of 10 years, this would translate into approximately one excess case of leukaemia and one excess brain tumour per 10 000 patients in the decade after first exposure. The authors note that increased follow-up and analysis of other cancer types is needed to identify the total excess risk for all cancers associated with CT scans.

The authors note that, in the UK, the Ionising Radiation (Medical Exposure) Regulations mean that a CT scan should only be done when clinically justified. This might explain the relatively low levels of CT use in the UK compared with other countries that do not have such regulations.

Lead author Dr Pearce says*: "The immediate benefits of CT outweigh the potential long¬term risks in many settings and because of CT's diagnostic accuracy and speed of scanning, notably removing the need for anaesthesia and sedation in young patients, it will, and should, remain in widespread practice for the foreseeable future."

He concludes: "Further refinements to allow reduction in CT doses should be a priority, not only for the radiology community, but also for manufacturers. Alternative diagnostic procedures that do not involve ionising radiation exposure, such as ultrasound and MRI [magnetic resonance imaging] might be appropriate in some clinical settings. Of utmost importance is that where CT is used, it is only used where fully justified from a clinical perspective."

Dr Berrington de González adds: "It's well known that radiation can cause cancer but there is an ongoing scientific debate about whether relatively low doses of radiation like those received from CT scans do increase cancer risks, and if so the magnitude of those risks. Ours is the first study to provide direct evidence of a link between exposure to radiation from CT in childhood and cancer risk and we were also able to quantify that risk."

In a linked Comment, Dr Andrew J Einstein, New York Presbyterian Hospital and Columbia University Medical Center, New York, NY, USA, says: "This study should reduce the debates about whether risks from CT are real, but the specialty has anyway changed strikingly in the past decade, even while the risk debate continued. New CT scanners all

now have dose-reductions options, and there is far more awareness among practitioners about the need to justify and optimise CT doses—an awareness that will surely be bolstered by Pearce and colleagues' study."

He concludes: "Pearce and colleagues confirm that CT scans almost certainly produce a small cancer risk. Use of CT scans continues to rise, generally with good clinical reasons, so we must redouble our efforts to justify and optimise every CT scan."

More information: www.thelancet.com/journals/lan … (12)60815-0/abstract

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