

CT scans for children

Information for referrers



What is a CT scan?

CT scans are X-ray procedures in which multiple images are taken rapidly to produce pictures of soft tissue, bone and blood vessels at different depths. CT scans can show parts of the body that are obscured by other tissues on a standard X-ray image. As a result, they can allow earlier diagnosis and more successful treatment of trauma, disease, and conditions such as intracranial injury and cancer.

How much radiation do CT scans deliver?

A head CT scan exposes a child to approximately 2 mSv (millisieverts) of radiation, which is equivalent to more than one year of natural background radiation. For comparison, a single chest X-ray delivers around 0.02 mSv, which is equivalent to approximately five days of natural background radiation.

Other examples of radiation doses from various sources are shown in the table.

Typical radiation doses from various sources (for children aged 0–10 years)^a

Source of exposure	Effective dose (mSv) ^b
Average dose from natural background radiation per year (in Australia)	1.5
Extremities X-ray	0.005–0.05
Chest X-ray (2 views)	0.03–0.08
Head CT scan	1.5–2.5
Chest CT scan	1–3
Abdomen CT scan	4–10
Dental cone beam CT scan	0.1–0.2
Ultrasound	0
Magnetic resonance imaging (MRI)	0

a Children 0–10 years of age have been chosen because, after this age, the difference between child and adult doses is reduced.

b These figures are based on international sources and national data collected by the Australian Radiation Protection and Nuclear Safety Agency. Effective doses vary, depending on gender, age and weight of the child, as well as CT equipment and imaging settings used.

By improved dose optimisation at the time of the scan, lower effective doses can be achieved.

In Australia, more than 80 000¹ computed tomography (CT) scans are performed annually on children and young people under the age of 20. CT is valuable because it can be a low-risk, non-invasive, fast and accurate technique for diagnosing serious injury and illness. However, it involves exposure to ionising radiation, which has been linked to a slightly increased risk of cancer.

Ultrasound and magnetic resonance imaging (MRI) do not use ionising radiation, but may not be appropriate for all patients, conditions or circumstances.

What are the risks associated with radiation exposure for children?

Radiation exposure is an important consideration for both adults and children when referring for a CT scan, because of the increased risk of cancer. However, there are two factors specific to children:

- Children are growing rapidly and have more dividing cells, providing a greater opportunity for radiation to disrupt cell development.
- Children have a longer life expectancy, providing more time for the effects of any radiation damage to influence long-term health.

A 2013 Australian paediatric study² indicated a risk of one extra case of cancer for every 1800 CT scans, about 10 years after exposure. Based on this study, other evidence³ and international practice, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) considers that a lifetime risk of one cancer per 1000 paediatric scans can be used for comparison with other medical risks.

The risk varies with the age and size of the child, the radiation dose, and the part of the body scanned. If a CT scan is well justified on clinical grounds, the benefit will almost always outweigh the risk of harm.

How can I minimise radiation exposure from CT scans in children?

Referrers should assess the use of CT on a case-by-case basis. Scans should be justified – that is, the benefits must outweigh the risks. Sometimes it may be useful for the referrer to have a direct conversation with the imaging team to discuss alternative techniques that might be available to obtain the information needed.

Resources to help prepare children for a CT scan are available from www.healthdirect.gov.au/ctscansforkids.

Questions to consider when deciding whether a CT scan is justified

- **Have I taken a history, performed a physical examination and come to a provisional diagnosis?**
- **Is imaging required?** Will it:
 - change my diagnosis?
 - affect the patient's management?
 - do more harm than good?
- **Am I duplicating recent tests?** It might be possible to avoid a CT scan by considering previous relevant imaging or reports.
- **Is this the appropriate time for the CT scan?** Is a 'wait and see' approach or a scan at another time an option?
- **If imaging is indicated, what is the best option?** Imaging techniques develop rapidly; it may be useful to discuss with a radiologist or a paediatrician the available alternatives to minimise (or avoid) ionising radiation.
- **If a CT scan is the best option, have I appropriately explained the benefits and risks to patients, and their parents and carers?** A companion brochure for parents and carers is available at www.safetyandquality.gov.au/ctscansforkids, which could be used in this conversation.
- **If an imaging investigation is required, have I defined the clinical question adequately on the request form?** The best patient outcomes occur when referrers provide appropriate information, allowing the imaging team to focus on the clinical issue and write a targeted report. Advise parents and carers to take previous scans and tests with them to the imaging service.

Where can I find more information?

Resources that can assist with imaging choices for patients include:

- Diagnostic Imaging Pathways, an Australian decision support tool that is available to help clinicians assess the indications for imaging, including CT (www.imagingpathways.health.wa.gov.au)
- InsideRadiology, an Australian information web site for patients and referrers developed by the Royal Australian and New Zealand College of Radiologists (www.insideradiology.com.au)
- RadiologyInfo.org, a radiology information resource for patients developed by the Radiological Society of North America and the American College of Radiology (www.radiologyinfo.org)
- information from the International Atomic Energy Agency to help health professionals achieve safer use of radiation in medicine for the benefit of patients (rpop.iaea.org/RPoP/RPoP/Content/index.htm)
- ARPANSA's Radiation Protection of the Patient module, which aims to support referrers in clinical practice (www.arpansa.gov.au/RPOP/Module).

Photo is courtesy of The Royal Children's Hospital Melbourne.

Notes

- 1 Based on 2013–14 financial year Medicare data; does not include patients imaged as public inpatients.
- 2 Mathews JD et al. Cancer risk in 680,000 people exposed to computed tomography scans in childhood or adolescence: data linkage study of 11 million Australians. *BMJ* 2013;346:2360.
- 3 Pearce MS et al. Radiation exposure from CT scans in childhood and subsequent risk of leukaemia and brain tumours: a retrospective cohort study. *Lancet* 2012;380:499–505; Wise KN. Solid cancer risks from radiation exposure for the Australian population. *Australasian Physical & Engineering Sciences in Medicine* 2003;26:53–62.