Effective radiation doses and associated risks

Nuclear medicine

The Royal Children's Hospital Melbourne

Medical Imaging

This poster describes typical effective doses from common paediatric studies performed at the RCH, the associated lifetime risk of cancer incidence and level of risk. The effective doses are also expressed in terms of 'background equivalent radiation time' (BERT). The terminology used, including BERT, will assist you in conveying the associated lifetime risk of cancer incidence and level of risk to health professionals, patients and carers in ways that are easy to understand.

All medical procedures involving ionising radiation exposure must be justified and approved.

All examinations should be conducted so that the dose to the patient is the lowest necessary to achieve the clinical aim.

Nuclear medicine

The activities of radiopharmaceuticals used in the estimates are as per the RCH protocols. Estimates quoted are the maximum values. For example, the effective dose for a bone study is less than 2.5 mSv and the risk of cancer incidence is better than one in 1300 which is considered to be a low level of risk. The effective dose from the bone scan is the same as from the natural background radiation that the patient would receive in less than 20 months.

Nuclear medicine study	Typical effective dose (mSv)	BERT	Risk of cancer incidence	Level of risk
^{99m}Tc MDP bone study (normal uptake and excretion)	<2.5	<20 months	<1 in 1,300	Low
^{99m}Tc pertechnetate thyroid study (IV administration, no blocking agent)	<1.5	<1 year	<1 in 1,900	Low
^{99m}Tc MAG3 renal study (normal and abnormal renal function)	<1	<8 months	<1 in 4,500	Low to very low
^{99m}Tc DTPA renal study (normal and abnormal renal function)	<0.5	<4 months	<1 in 7,000	Low to very low
^{18}F FDG (oncology or epilepsy)	<3	<2 years	<1 in 1,100	Low
^{123}I MIBG neuroendocrine tumour imaging (IV administration with block agent given)	<6	<4 years	<1 in 430	Moderate to low

When multiple studies are performed you can estimate the cumulative risk by summing the risks together. For example two bone scans would have a better than two in 1,300 risk of cancer incidence or better than one in 650.

The natural (non-radiation induced) childhood cancer incidence rate in Australia is about one in 5,800 per year, or one in 600 before the age of 15 years.

For reference, the Calman risk classification and terminology model is used.

Term	Risk range
High	<1:100
Moderate	1:100 to <1:1,000
Low	1:1,000 to <1:10,000
Very low	1:10,000 to <1:100,000
Minimal	1:100,000 to <1:1,000,000
Negligible	≥1:1,000,000

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