

Ask EuroSafe Imaging Tips & Tricks

CT Working Group

CT in Pregnancy

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Potential Risk Following Radiation Exposure

- Exposure of an embryo/foetus to ionising radiation can potentially lead to two types of health effects
 - Deterministic Effects
 - Stochastic Effects

Deterministic Effects

- Occur once a threshold of exposure has been exceeded
- The severity increases as the dose of exposure increases
- Foetal death, malformation, abnormal brain development



No deterministic effects of practical significance would be expected to occur in humans below a dose of at least 100mGy (CT doses < 50mGy) (ICRP, 2007)



Potential Risk Following Radiation Exposure

- Exposure of an embryo/foetus to ionising radiation can potentially lead to two types of health effects
 - Deterministic Effects
 - Stochastic Effects

Stochastic Effects

- There is no threshold level for these effects
- The risk of an effect occurring increases as the dose increases
- Risk cancer after birth



Foetal Dose & Childhood Cancer Risk

CT Examination	Typical Foetal Dose mGy	Risk of childhood cancer per examination
CT Head	0.001-0.01	< 1 in 1,000,000
CT Pulmonary Angiogram	0.01-0.1	1 in 1,000,000 to 1 in 100,000
CT Abdomen/KUB	1.0-10	1 in 10,000 to 1 in 1,000
CT Abdomen Pelvis	10-50	1 in 1,000 to 1 in 200
Natural Childhood Cancer Risk \approx 1 in 500		



**Background Radiation for 9 months of pregnancy
0.5-1mGy**

Health Protection Agency, UK 2009

Justification of Exposure

- For CT examinations, as demonstrated in the previous table, with foetal doses of $<1\text{mGy}$ the associated risk of childhood cancer is very low
- CT examinations with foetal doses $<1\text{mGy}$ can be performed on pregnant patients in cases where the CT examination is justified (necessary to answer clinical question)
- Radiation dose is kept to a minimum in those cases
- The radiation dose to the uterus should be calculated following the CT scan



Justification of Exposure

- In cases where a foetal dose $>1\text{mGy}$ CT examination is required, consideration of the risk of childhood cancer versus benefits of proceeding with examination is necessary
- Consideration of another diagnostic examination which does not involve ionising radiation is preferable
- However in some cases CT may be necessary to answer the clinical question
- The childhood cancer risk is still low in absolute terms
- The radiation dose to the uterus should be calculated following the CT scan



CT Examinations Requested During Pregnancy

CT Pulmonary Angiography (CTPA)

Reason	To out rule pulmonary embolism (PE/clot in lung)
Region Scanned	Chest
Foetal Dose	0.01-0.1mGy
Childhood cancer risk	1 in 1,000,000 to 1 in 100,000
Alternative Exam	VQ Scan, Radiation dose up to 0.32mGy
Other risks from CT	Radiation dose to radiosensitive breast tissue



CT Examinations Requested During Pregnancy

CT Kidneys, Ureters & Bladder (KUB)

Reason	To out rule renal stone
Region Scanned	Abdomen & Pelvis
Foetal Dose	10mGy
Childhood cancer risk	1 in 10,000 to 1 in 1,000
Alternative Exam	Ultrasound



CT Examinations Requested During Pregnancy



CT Abdomen & Pelvis

Reason	Trauma Appendicitis Urgent cancer staging
Region Scanned	Abdomen & Pelvis
Foetal Dose	25mGy
Childhood cancer risk	1% increase in risk
Alternative Exam	Ultrasound/MRI





CT Scan of thorax,
abdomen and pelvis in
a pregnant patient
which demonstrates
18 week gestation
foetus and FIGO 2b
cervical carcinoma

Summary

- Foetal radiation doses from CT should not result in foetal death, malformation or abnormal brain development
- Associated risk of childhood cancer is very low in CT examinations, with foetal doses of $<1\text{mGy}$
- In cases where a foetal dose $>1\text{mGy}$ CT examination is required, careful consideration of the risk of childhood cancer versus benefits of proceeding with examination is necessary
- In some cases where the risk to maternal health is significant CT may be necessary



References



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- Health Protection Agency (2009) Protection of Pregnant Patients during Diagnostic Medical Exposures to Ionising Radiation, Advice from the Health Protection Agency, the Royal College of Radiologists and the College of Radiographers, Documents of the Health Protection Agency
- Sadro, C.T. & Dubinsky, TJ (2013) CT in pregnancy: Risks and benefits, Applied Radiology