

Pregnancy and Medical Radiation



Information from ICRP Publication 84 and ICRP TG: R. Brent et al.

Presented by: Jon Holm, Medical Physicist, Karolinska Hospital

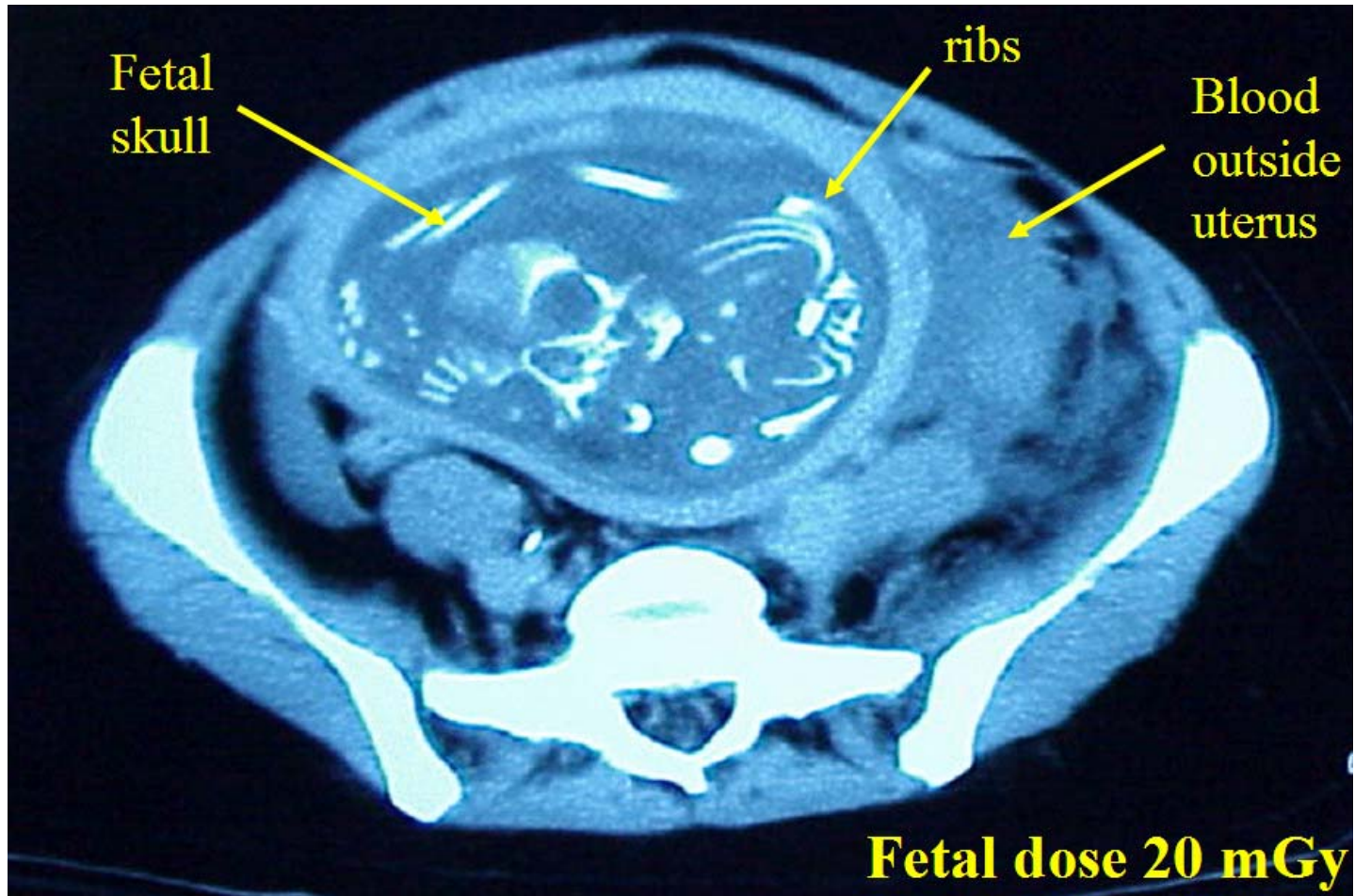
Contents

- Introduction
 - Fetal radiation risks
 - Cancer and leukaemia
 - Radiation-induced malformations
 - Fetal doses from procedures
 - Informed consent, notices, pregnancy determination
 - Issues regarding termination of pregnancy
-

Introduction

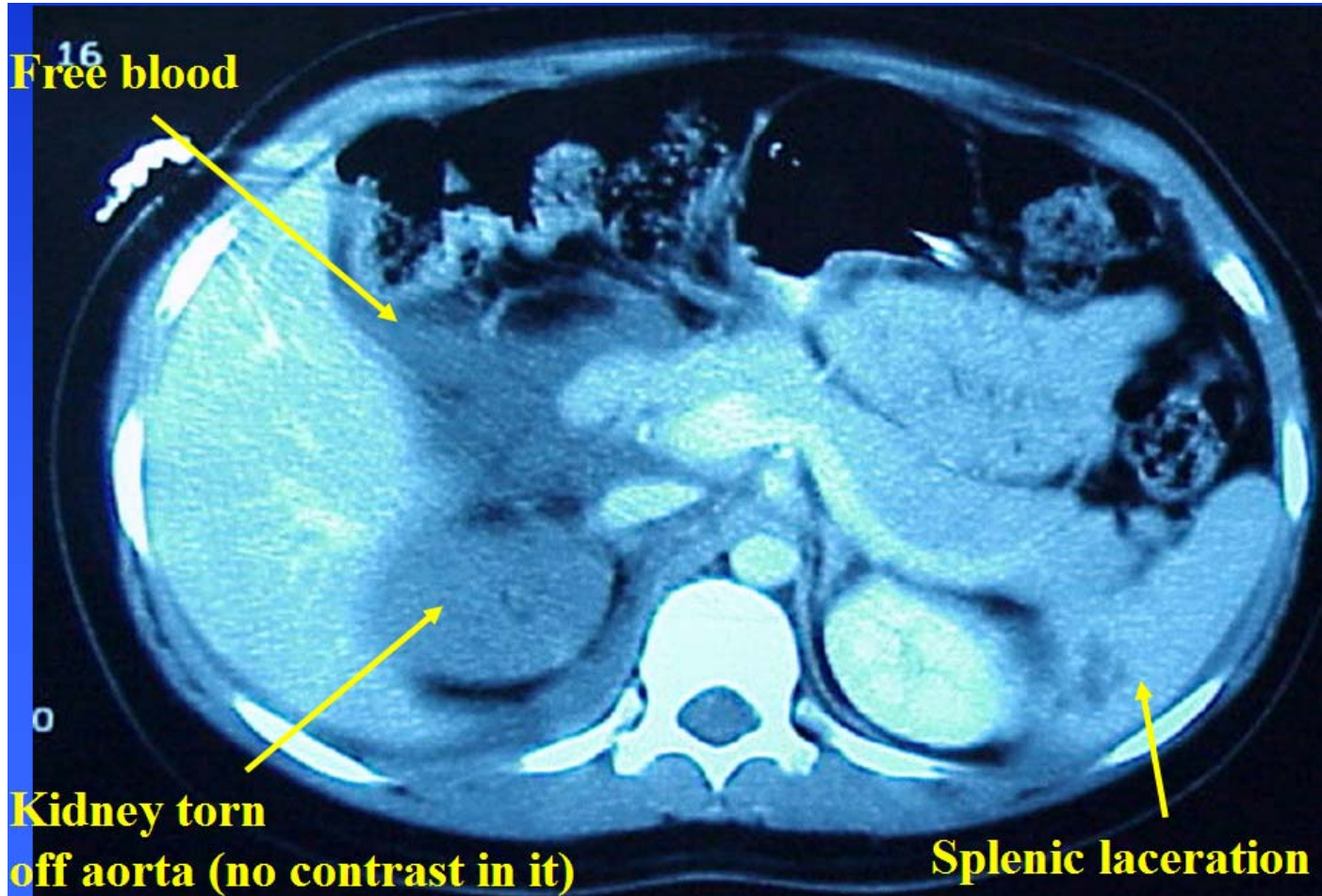
- Thousands of pregnant women are exposed to ionising radiation each year
 - Lack of knowledge is responsible for great anxiety and probably unnecessary termination of pregnancies
 - For most patients, radiation exposure is medically appropriate and the radiation risk to the fetus is minimal.
-

Example: Justified use of CT



Pregnant female, was in motor vehicle accident

Example: Justified use of CT



CT exam and then taken to operating room. She and the child survived.

Fetal radiation risks

- There are radiation-related risks throughout pregnancy that are related to the stage of pregnancy and absorbed dose
- Radiation risks are most significant during organogenesis and in the early fetal period, somewhat less in 2nd trimester, and least in 3rd trimester

Most
risk



Less



Least



Radiation-induced malformations

- Malformations have a threshold of 100-200 mGy or higher and are typically associated with central nervous system problems
 - Fetal doses of 100 mGy are not reached even with 3 pelvic/abdomen CT scans or 20 conventional x-ray examinations
 - These levels can be reached with fluoroscopically guided interventional procedures of the pelvis and radiotherapy
-

Central nervous system effects

- During 8-25 weeks post-conception the CNS is particularly sensitive to radiation
 - Fetal doses in excess of 100 mGy can result in some reduction in IQ
 - Fetal doses in the range of 1000 mGy can result in severe mental retardation and microcephaly, particularly during 8-15 weeks and to a lesser extent at 16-25 weeks
-

Leukaemia and cancer

- Radiation has been shown to increase the risk for leukaemia and many types of cancer in adults and children
 - Throughout most of the pregnancy, the embryo/fetus is assumed to be at about the same risk for carcinogenic effects as small children
 - The relative risk may be as high as 1,4 (40% increase over normal incidence) due to a fetal dose of 10 mGy
 - For an individual exposed in utero to 10 mGy, the absolute risk of cancer at ages 0-15 is about 1 excess cancer per 1700
-

Pre-conception irradiation

- Pre-conception irradiation of either parent's gonads has not been shown to result in increased risk of cancer or malformations in children
 - This statement is from comprehensive studies of atomic bomb survivors
-

Probability of bearing healthy child

Dose to conceptus (mGy)	Probability of no malformation	Probability of no cancer (0-19yrs)
0	97	99,7
1	97	99,7
5	97	99,7
10	97	99,6
50	97	99,4
100	97	99,1
>100	Possible	

Approximate fetal doses

Examination	Mean dose (mGy)	Maximum dose (mGy)
Abdomen	1,4	4,2
Pelvis	1,1	4
Abdomen CT	8	49
Pelvis CT	25	80
Chest CT	0,06	1
Head CT	<0,005	<0,005

Approximate foetal doses from common diagnostic procedures in the United Kingdom. (Adapted from Sharp, Shrimpton, and Buiy, 1998)

Informed consent and understanding

- The pregnant patient has a right to know the magnitude and type of potential radiation effects that might result from in-utero exposure
 - Communication should be related to the level of risk. Communication that risk is negligible is adequate for very low dose procedures (<1 mGy to the fetus)
 - If fetal dose are above 1 mGy, a more detailed explanation should be given
-

Exposure of pregnant patients

- In some circumstances, the exposure is inappropriate and the unborn child may be at increased risk of harm to health
 - Prenatal doses from most properly performed diagnostic procedures present no measureably increased risk of prenatal death, malformation, or mental impairment
 - Higher doses such as those from therapeutic procedures can result in significant fetal harm
-

Termination of pregnancy

- High fetal doses (100-1000 mGy) during late pregnancy are not likely to result in malformations or birth defects since all organs have been formed
 - A fetal dose of 100 mGy has a small individual chance of radiation-induced cancer. There is over 99% probability that the exposed fetus will not develop a childhood cancer or leukaemia
-

Termination of pregnancy

- Termination of pregnancy at fetal doses less than 100 mGy is not justified upon radiation risk
 - At fetal doses in excess of 500 mGy, there can be significant fetal damage, the magnitude and type of which is a function of dose and stage of pregnancy
 - At fetal doses between 100 and 500 mGy, decisions should be based on individual circumstances
-