Radiation protection and pregnancy
Difficults and solutions

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Case 1: refused useful plain radiography

- 32 yo, 27 weeks pregnant
- Fever (39.5°C) and tusk
- Comes to the emergency unit
- Chest radiography refused because of the pregnancy
- Antibiotherapy and no more follow-up
Case 2: Inappropriate post-exposure management

- 25 yo, 1st pregnancy at the beginning – 7 weeks
- Massive retroperitoneal haemorrhage – CT scan 2 acquisitions: angiomyolipomatosis
- Second CT scan 15 days later
- The urologist and the obstetrician told the woman to stop the pregnancy (voluntary abortion), that she did
- Without asking any radiologist or physicist about risks
Case 3 : Major accidental overexposure

- 3rd trimester pregnant woman
- suspicion of complex vertebral fracture of L1 on hemangioma
- helical acquisition without injection is programmed from the middle of T11 to the bottom of L2, but unexpectedly interrupted
- need to explore the L2 vertebra, the technologist decides to use the feature “one more” but pressed the button 51 times!
- CTDIv : 24,9 mGy  DLP : 6000 mGy.cm
- absorbed doses up to 1.6 Gy in some anatomical areas (Eg fetal pelvis)
Case 4: Accidental exposure of a pregnant technologist

- Unannounced triggering of the CT scan while personnel entered the room (radiologist 1 m from the table, pregnant technologist 1.5 m from the table, trainee at least 2 m from the table)
- Technical settings about 1s, 120kV 60 mA
- Estimated delivered dose:
  - at 1 m: 3.75 µSv/s
  - at 1.5 m: 1.67 µSv/s
  - at 2 m: 0.94 µSv/s
Step one : look for a pregnancy

• Could you be pregnant ? => Not enough
• What we propose :
  • Contraception ? : if yes, not supposed to be pregnant
  • No : Search delayed menstruation
• A patient without contraception who has a delay in menstruation should be considered pregnant
• Mandatory gonadotropic chorionic hormone test just before any hysterography (at least)
Uterine dose assessment conducted by IRSN from 2004 to 2008

• Retrospective evaluation of the most often accidental radiation of a pregnant woman
• 307 calls to the IRSN’s* expertise for conventional radiology or CT scan, with the uterus directly in the beam in 75% of cases.

* IRSN = French Nuclear Safety and Radiological protection Institute

Plain radiography

HSG: unacceptable
Numerous abdomen and spine exams: utility?
Fetal dose X-ray

An hysteroography 64 mGy

0.2 to 35 mGy

2 to 127 mGy
(abdo-pelvis 3 acquisitions)

CT scan fetal dose
Conclusions of this IRSN study

• No examination with uterus out of beam delivers more than 0.2 mGy to the uterus

• Maximum difference between doses, min and max, very important
  • (factor 12 for lumbar spine and 36 for abdomen !!!)
  • (factor 10 in abdo-pelvis and lumbar CT scan)

• Causes = different devices, number of images or series, morphotype, and parameters far removed from recommendations+++

• Data often in accordance with the literature, but where doses > x4 => the dispersion justifies an individual analysis

• Special attention to look for a state of pregnancy, justification of the examination, optimization of procedures to limit the dose to the minimum useful for diagnosis.
How to menage when occurs
Care of a pregnant woman

• The decision whether or not to perform the examination is the responsibility of the radiologist
• Justification: emergency, risk/benefit ratio
• Optimization, taking into account the state of pregnancy
  • no need to wear a leaded apron!
• Procedures and dose in the report
How to menage when occurs
Pregnancy discovered after the examination

• The answer must be very fast in order to raise the patient's anxiety
• It is therefore necessary to be able to estimate the dose received by embryo or fetus
• For deterministic effects (malformations), the dose of 200 mSv is actually never reached in radiodiagnosis
• For stochastic effects, if < 100 mSv, no recommendation of termination of pregnancy (IRSN according to ICRP recommendations)
• "100mSv Fetal Dose Will Not Probably be Achieved with 3 Pelvic CTs or 20 Classical Diagnostic Radiographs of the Abdomen and Pelvis" (ICRP)
Accidental exposure of a pregnant patient

If the uterus is out of primary beam
• Negligible uterine dose (<0.2 mSv)
• The patient must be immediately reassured (the examination can not be responsible for malformations)
• Do parallel with natural irradiation

If the uterus is in the direct beam
• Estimate of the required dose
  • need to write dose on the report
  • Need to involve a medical physicist or an organization as soon as the examination includes several pictures
• Declaration in some countries
• Information of the patient during an interview
Organization of the radiology or CT scan centre

- Indispensable initial and ongoing training of operators in the radiation protection of patients: to know what are the ionizing radiations and what a dose is, to know the operation of the machines...
- Have written procedures integrating into a quality assurance process, from the reception at the secretariat
- Effective pregnancy research for all women of childbearing age; mandatory gonadotropic chorionic hormone test just before any hysterography (at least)
- Know how to use referents at the least difficulty
- Involve all the operators of the team and other medical specialties
- The problem of pregnant technologists and radiologists is very different and will not be dealt with here.
Merci beaucoup ! شكرا جزيلا！Thank you very much!