

# Radiation protection and pregnancy

Difficults and solutions

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Alger, 27 avril 2019

# 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  $\mu\text{Sv/s}$
  - at 1,5 m : 1,67  $\mu\text{Sv/s}$
  - at 2 m : 0,94  $\mu\text{Sv/s}$

# 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 hystero-graphy (at least)

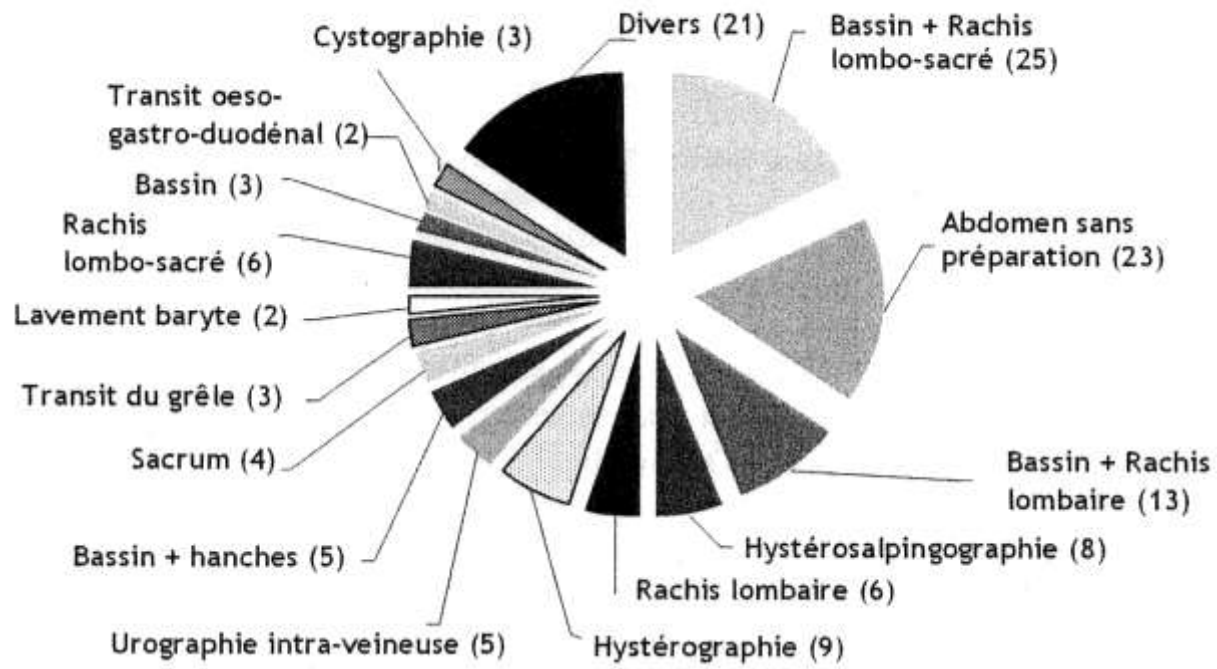
# Uterine dose assessment

## conducted by IRSN from 2004 to 2008

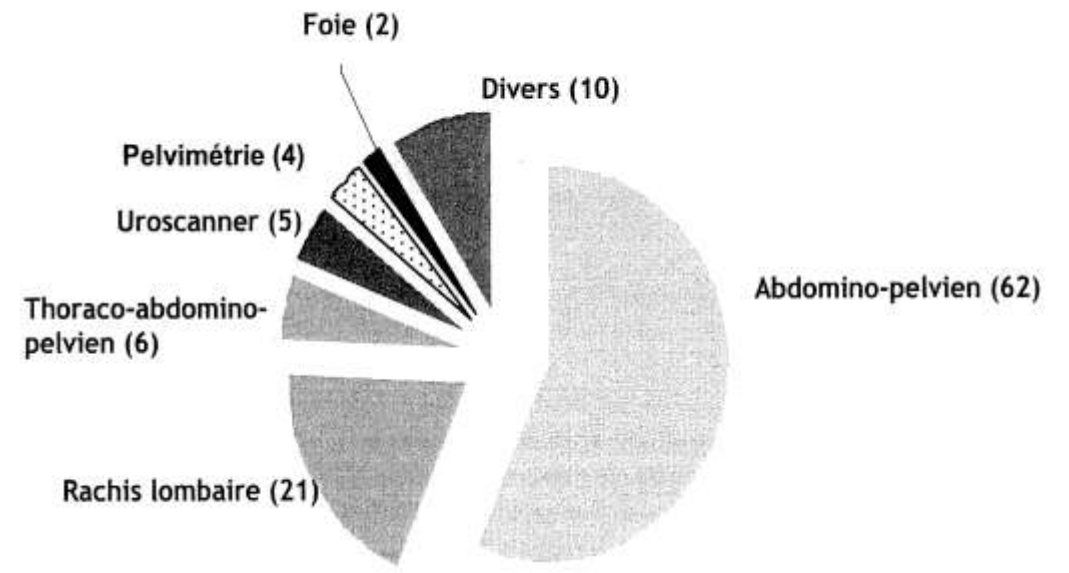
- Retrospective evaluation of the most often accidental radiation of a pregnant woman
- 307 calls to the IRSN's\* expertise for conventional radiology or CT scan, with the uterus directly in the beam in 75% of cases.

\* IRSN = French Nuclear Safety and Radiological protection Institute

- C. Etard, B. Aubert : Analyse des évaluations de dose utérine réalisées par l'IRSN de 2004 à 2008, Radioprotection vol 44 n°4, pp 479-493, EDP Sciences, 2009



**Plain radiography**

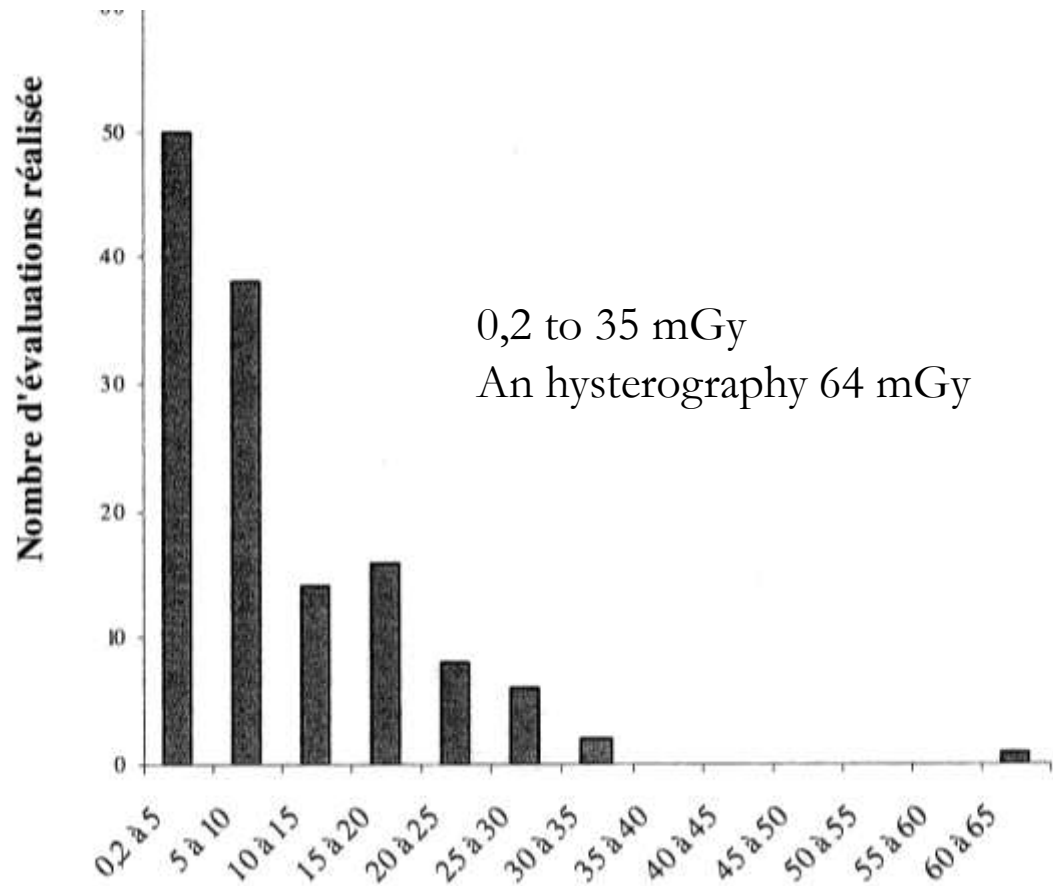


**CT scanner**

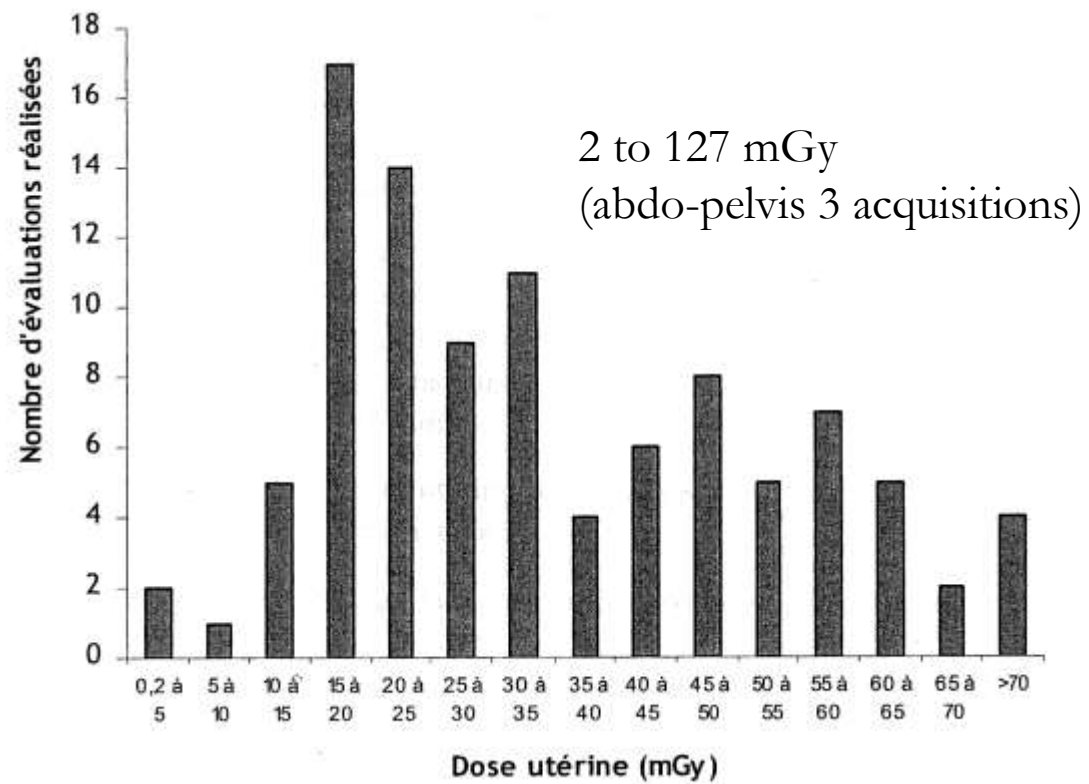
**HSG : unacceptable**

**Numerous abdomen and spine exams : utility ?**





Fetal dose X-ray



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 manage 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 manage 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 hystero-graphy (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 جزيلًا !

Thank you very much !

