Australian Government

Australian Radiation Protection and Nuclear Safety Agency

SAFETY GUIDE

Diagnostic and Interventional Radiology

Radiation Protection Series Publication No. ??

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Safety Guide

- It provides detailed advice and guidance on measures that *should* be employed to assist in meeting the requirements of the Code in the context of diagnostic and interventional radiology
- In some instances the SG may provide reasons for the mandatory requirements in the Code

Safety Guide

- The measures in the SG should be implemented in the interests of reducing radiation exposure and risks
  - non mandatory advisory material
- Meeting the measures in the SG represents good practice
- Note that the language of the SG is more user friendly or conversational than that in the Code!

Safety Guide

- Justification
- Duties & responsibilities
- Optimisation of protection
- Pregnancy & protection of embryo/fetus
- Equipment
- Quality assurance (QA)
- Incidents
- Occupational exposure
- Site requirements
- Training

Justification

- Practice involving exposure needs to be justified in principle
  - Is plain skull X-ray justified in lieu of CT?
  - Is CT abdo justified in context of query appendicitis?
  - These are decisions to be made by professional societies (e.g. RANZCR)
- Exposure must also be clinically justified at individual level

Duties & responsibilities

- Responsible person
  - Radiation management plan will have written procedures typically addressing:
    - Correct patient ID
    - Incidents
    - Monitoring of individuals
    - Protection of patients, staff, carers etc.
    - Pregnant patients
    - Optimisation of procedures
    - Training
    - Regulatory requirements

Duties & responsibilities

- Referrers
  - Clearly identify correct patient on request
    - Numerous examples referred to RAC of errors of this nature leading to unnecessary exposure
  - Indicate pregnancy status of female patients where applicable

Duties & responsibilities

- Operators
  - Follow written procedures on patient ID
    - Again, RAC has many examples referred to it of incorrect patient identification
  - Confirm relevance of procedure with referrer or responsible medical practitioner when any doubts exist
  - Optimise procedures (particularly CT and interventional)

Duties & responsibilities

- The Medical Practitioner (e.g. Radiologist)
  - Has ultimate responsibility for decision to proceed or not with exposure
    - based on the practitioner's knowledge of the hazard associated with the radiological exposure
    - the clinical information supplied by the referrer
  - Should liaise with referrer
  - Should consider whether there are alternative procedures using less or no X-rays
  - Should obtain informed consent
    - interventional procedures

Duties & responsibilities

- The Radiation Safety Officer (RSO)
  - Duties are outlined in Annex of SG
  - May be qualified expert (e.g. a medical physicist
  - May be external provider
  - May be chief radiographer
  - Will usually produce the Radiation Management Plan and audit practice to confirm procedures are being followed

Duties & responsibilities

- The Radiation Safety Officer
  - Oversee QA in so far as radiation protection is an issue
  - If the RSO is a Radiological Medical Physicist, this responsibility should also extend to image quality assessments
  - Perform dose surveys for comparison with Diagnostic Reference Levels (DRL)

Duties & responsibilities

- X-ray equipment suppliers
  - Must ensure equipment meets requirements of relevant regulatory authority
  - Must ensure all new equipment meet AS/NZS standards and other requirements, particularly in context of specialist equipment

Optimisation - General

- This is the most important section in the SG
- It provides fairly detailed practical radiation safety advice about measures that may be taken to assure patient protection

Optimisation – Digital Technologies

- Operator should ensure when using DR, CR systems, or any other digital system with wide dynamic ranges that extra care is exercised:
  - *To avoid exposure creep*
- Use Automatic Exposure Control (AEC)

Optimisation – Interventional

- Deterministic effects can & do occur

Cardiac RF ablation

TIPS

Optimisation - Interventional

- *The ICRP has observed that whilst it is recognised that the majority of interventional procedures are generally for treatment of life threatening conditions, it is an unfortunate fact that most of these radiation induced injuries, and all of the serious ones, can be prevented without compromising the efficacy of the procedure.*

Optimisation - Interventional

- Use automatic brightness control (ABC) and last image hold (LIH) routinely
- Optimise the radiographic geometry
  - Avoid geometric magnification
- Minimise use of electronic zoom with II
- Use low dose rate options (e.g. Pulsed fluoroscopy)
- Minimise fluoroscopic time and digital acquisition time

Optimisation - Interventional

- Develop clinical protocols for each type of interventional procedure
  - Adopt a policy of skin sparing as much as possible
    - E.g. Both lateral views in neuro-radiology if possible
  - Use higher filtration (Cu or Al) than usual
  - Be cognisant of Dose or Dose Area Product values displayed in real time

Optimisation - CT

- Organ doses can reach or exceed levels where radiation induced cancers may occur
- Deterministic effects can occur with perfusion studies

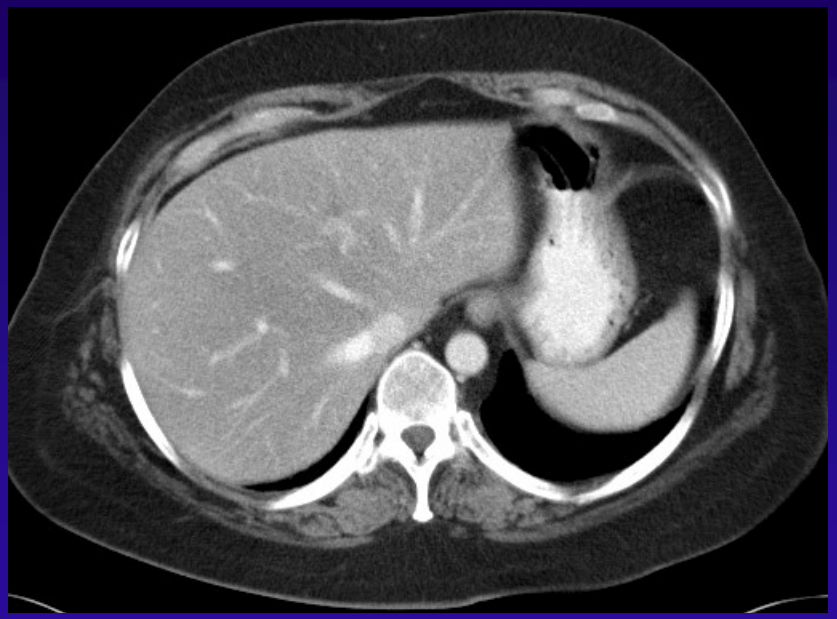
Optimisation - CT

- Develop clinical protocols for each type of CT procedure
- Tailor the technical factors of the examination to the *individual patient anatomy* and the diagnostic information being sought:
  - Use lowest *effective* mAs necessary to achieve satisfactory image quality

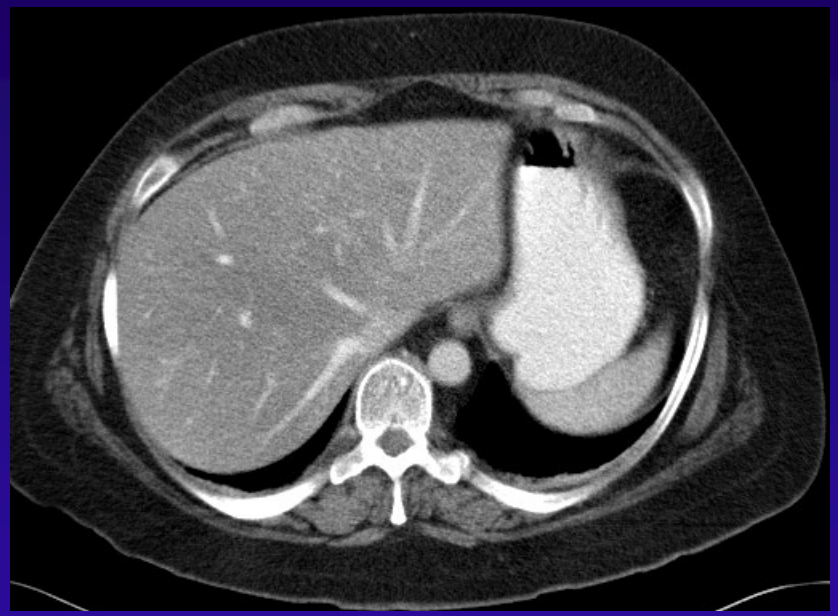
Optimisation - CT

- Use mA modulation techniques routinely (AEC)
  - They attempt to keep image quality (image noise) roughly constant
- *Customise* & *optimise* scan protocols
- Note that the default techniques the manufacturers provide are rarely optimised!

Optimisation - CT



157 mAs



94 mAs

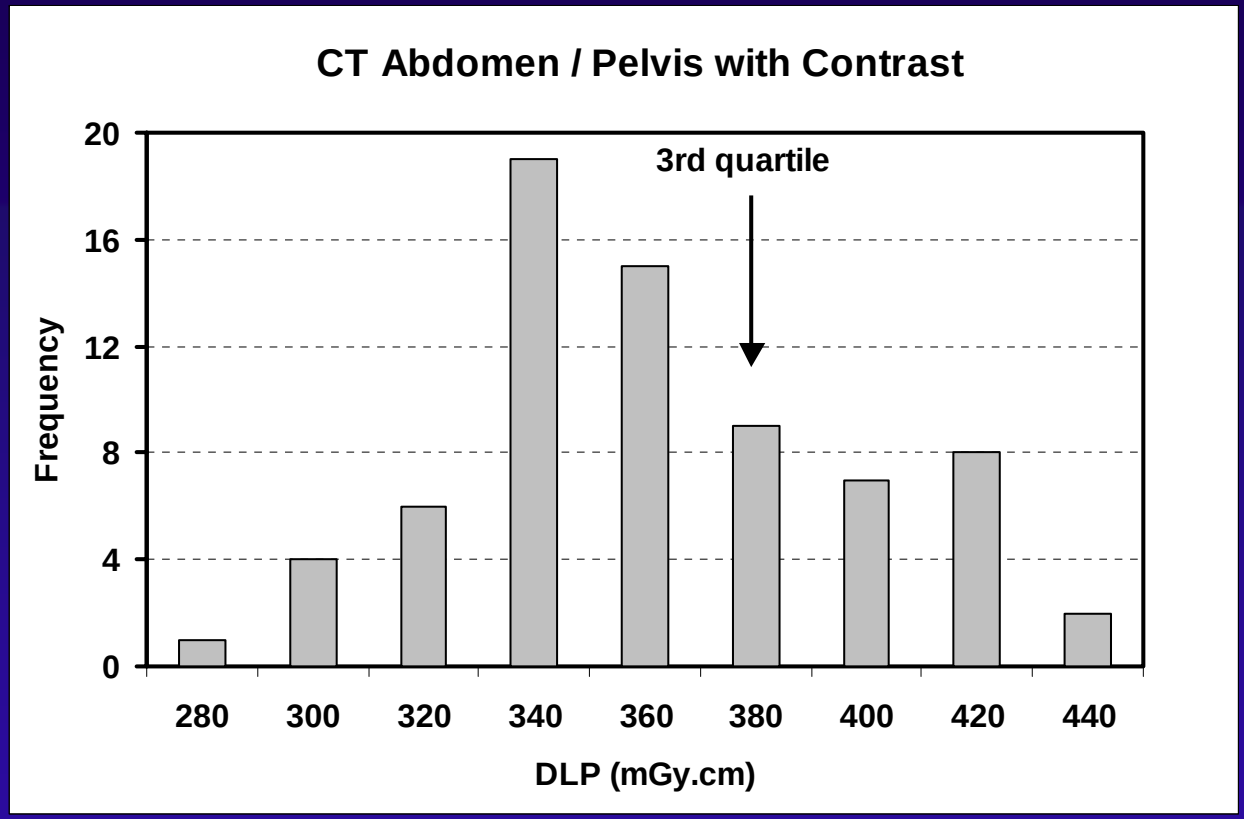
Optimisation – Dose Surveys

- The COP requires that dose surveys are undertaken for common radiology procedures and results compared with diagnostic reference levels (DRLs)
- The SG offers more explicit advice on what parameters have to be measured & under what conditions the dose indices should be measured for CT, radiography and fluoroscopy

Optimisation – Dose Surveys

- *Practices cannot be optimised unless doses are known!*
- DRLs have not yet been established for diagnostic radiology but preliminary values will be forthcoming shortly with the blessing of the professional bodies such as the RANZCR, ACPSEM etc.
- Note that DRL do not represent lowest possible doses – lower values can and should be achieved

Optimisation - establishing DRL



A sample of 71 adult patients underwent routine CT abdominal/pelvic examinations with contrast. The 3rd quartile value of the DLP is approximately 380 mGy.cm which may be rounded up to 400 mGy.cm for use as a local DRL.

Thank you for your attention!