IPEM working party recommendations on hybrid CT DRLs

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Important note

- All data in this presentation is provisional, as of 15 December 2015 and is subject to change prior to publication

- Because if this, any data presented should be treated as indicative only

IPEM hybrid DRL working group

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▶ NM

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   ▶ Natalie Bebbington, Denmark

   ▶ Peter Julyan, Manchester

▶ National bodies

   ▶ PHE Sue Edyvean

   ▶ ARSAC Louise Fraser, Nasreen Parker

Administration of Radioactive Substances Advisory Committee

Public Health England

The need for hybrid DRLs

▶ IR(ME)R 2000 requires a DRL for each investigation

▶ ARSAC has long provided the DRL for the radiotracer part of the test

▶ PHE and predecessors have long provided the DRL for common clinical indications in CT.

▶ The CT aspect of the hybrid CT study may be providing a different function and different scan length from a similar body region in stand alone CT

   ▶ AC, localisation, diagnostic (?contrast enhanced)

▶ There is therefore a need for DRLs related to the clinical question

▶ IPEM working group set up Jan 2014 for 2 years

   ▶ Aim to produce peer reviewed publication with proposed DRLs

   ▶ Further hope that this would be part of an adoption process via PHE

Working party methodology

▶ Drew up list of 10 common indications

    ▶ 3 PET, 7 SPECT

        ▶ PET- whole/half body

        ▶ PET- brain

        ▶ PET- cardiac

        ▶ Bone

        ▶ Parathyroid

        ▶ MIBG

        ▶ Octreotide

        ▶ Sentinel node

        ▶ Post I131 therapy ablation

        ▶ Cardiac SPECT
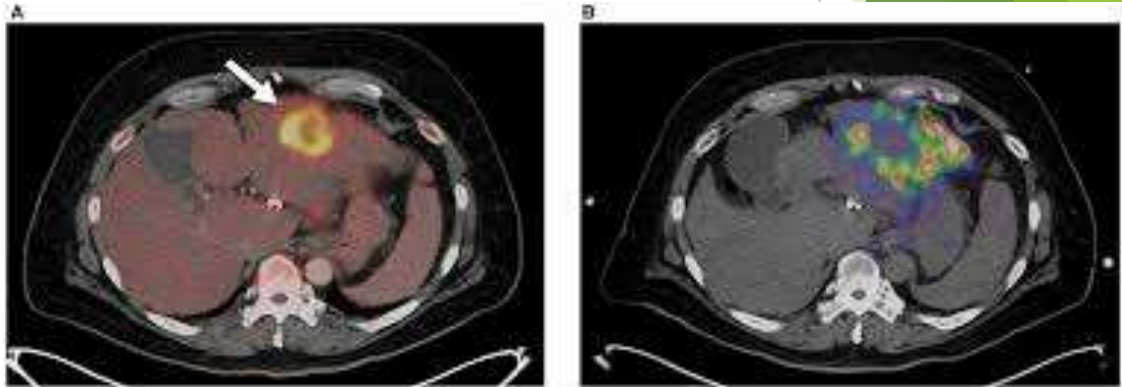
Data sheet template

- Data requested on
  - Exposure parameters and AEC
  - Reconstruction parameters
  - Patient weight
  - Equipment model
  - Reporting staff
- Data requested via
  - Listservers (Medphys, CT)
  - Meetings
  - Websites

CT dose survey datasheet

Data collection and cleansing

- Date received from 47 centres
- Working party members took two investigations each
  - Cleansed data for any anomalies
  - Included data from centres with > 10 patients per dataset OR consistent CTDIs
  - Analysed data to provide
    - Median CDTIvol and DLP
      - Achievable values
    - 3rd quartile
      - National DRL
    - Ratio of max to min + range
    - Variation with AEC, reporter, purpose of study

PET whole/half body

- ▶ 37 datasets received
- ▶ Ratio of max to min doses
  - ▶ CTDIvol 3.6, DLP 3.8
- ▶ Centres using iterative reconstruction do not have lower doses
- ▶ No significant differences in dose for radiologist vs NM physician reporting
- ▶ Most centres using for AC + localisation
- ▶ Three centres claimed to use just for AC, only one seemed to reflect that in exposure factors

PET brain

- 13 datasets

- 4 AC only,one not reflected in exposure parameters

- 3 Diagnostic, one not reflected in exposure parameters

- 6 Localisation

- Ratios of max to min doses varied from 9.4 to 13.8 within indications

- Need to clarify with centres before recommending DRLs

- May just publish indicative data

Cardiac SPECT

- 27 datasets
- Purpose of scan AC
  - 3 with qualitative assessment of calcium (no effect on dose)
- Scan range 13-23cm
  - IQ SPECT
- Much larger weight distribution
  - Particularly in some centres
    - Decided to leave in as representative of population
- Decided to also add PET cardiac (3 centres)

Thyroid post ablation SPECT

- 15 datasets
- AC + localisation
- Mean scan range: 18-42cm
- 11 centres use AEC
- 3 centres use IR
- Ratio of max to min
  - CTDIvol 5
  - DLP 8

Octreotide/mIBG

Octreotide 30 datasets mIBG 18 datasets

DLP (mGy.cm)	Octreotide	mIBG	Combined
Mean	196	172	187
Median	147	153	149
Third quartile	256	234	240

CTDIvol (mGy)	Octreotide	mIBG	Combined
Mean	4.3	4.1	4.2
Median	3.2	3.7	3.5
Third quartile	5.6	5.2	5.4

Octreotide/mIBG

- Octreotide and mIBG data combined to generate AC&L DRL

- 37 datasets for attenuation correction and localisation

  - 1 dataset submitted for 'diagnostic' images (data not displayed or used for national AC&L DRL)

- Large variation in scan range mean of centres ranged from 24cm to 75cm

- Large range of doses – max to min 5 for CTDI, 7.8 for DLP

- AEC: 31 using AEC, 16 without AEC

Sentinel node SPECT

- 12 datasets for 'AC and localisation'
- Should be split into scan region
  - 3 head and neck
  - 5 pelvic (penile/vulval)
  - Some unknown scan area – require clarification
- Many datasets < 10patients
- Insufficient data to establish national DRLs, but will publish results submitted

SPECT - parathyroid

▶ 36 datasets from 31 sites

▶ One site AC only

▶ One site used multi phase contrast scan with bolus tracking – very high dose

▶ Suggested removal of this centre for DRL, include as example of effect of change in practice

SPECT bone

- Several centres gave data by area
  - Knees,ankle,hips,l spine,c spine +/- metalwork
- 34 classified as 'bone scan'
  - Likely to still contain mixture of scans, but all single exposure parameters
- 1 centre AC ?clarify
- 3 for diagnosis (reflected in higher exposure parameters
- 5 centres using iterative reconstruction, means lower by 23%

Summary of proposals for DRLs

Indication	DRL CTDI	DRL DLP
PET half/whole body	4.3	400
PET brain	?	?
Parathyroid	5.6	170
Bone	5.6	180
Octreotide/MIBG	5.4	240
Thyroid post ablation	5.9	210
SPECT/PET cardiac	2.0	34

Setting the DRLs in context

- What are we trying to achieve?
- Optimisation vs 'out of the box'
- Comparisons with NM effective doses
- Comparisons with CT 'diagnostic' doses
- Comparisons with US and Europe
- New DRLs in 5 years time!
- ? New generation of scanners
- ?Use of one stop shop/contrast etc

Next steps

- ▶ Check data with centres and generate final figures + narrative

- ▶ Publication

  - ▶ Peer reviewed journal in 2015

  - ▶ ? PHE report

- ▶ ?Feedback to individual centres

- ▶ Presentations 2015/2016

  - ▶ BIR CT educational update

  - ▶ CT user group

  - ▶ BNMS, EANM

  - ▶ UKRC