

Protocol optimisation: Results from a CT optimisation group

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Overview

- Setting up CT optimisation group at RBFT
- Optimisation Results
 - Cervical Spines
 - Temporal Bones
 - Lower Leg Angiogram
 - Paediatric Brains
- The future for our optimisation group

Comare Report 16

- Published 2014

- Recommendation 7:

“Optimisation of scanning protocols offers significant potential for dose reduction. This scan only be achieved at local level through active promotion and cooperation between professional groups. We recommend that in conjunction with the production of new regulations for medical exposures, the Department of Health provides supporting guidance on optimisation, including a requirement for radiology services to consider formally appointing a team of radiation protection champions, consisting of a radiologist, a radiographer and a medical physicist.”

Our experience at RBFT

- Two new CT scanners installed 2009
 - GE VCT Lightspeed and GE 750HD
- Applications set up scanners
- Initial DRL report showed doses were below NDRLs.
- Dose audit repeated every 2/3years.
 - Review protocol due to dose difference between scanners
 - No major concerns

Cervical Spines Dose Audit

- Request for data by PHE for Trauma Cervical Spines in October 2016
 - Scanner 1 - 10 patients - average DLP = 354mGycm
 - Scanner 2 - 30 patients - average DLP = 1003mGycm
- We had a problem!

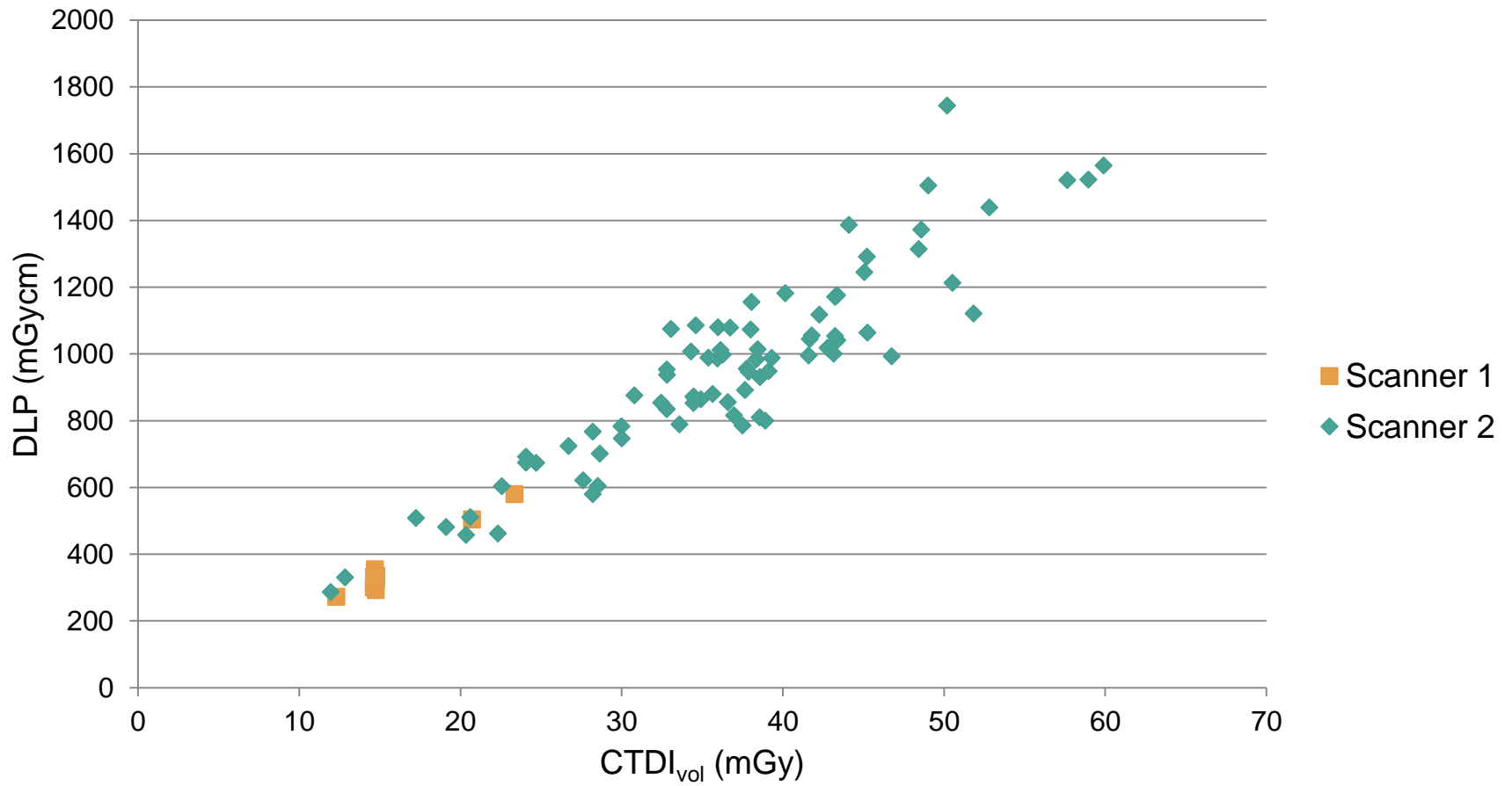
CT optimisation Group at RBFT

- Set up as needed to resolve why doses were different on our scanners for cervical spine imaging
- Lead CT Radiographers
- Medical Physics Expert
- None of us have been formally appointment as “Radiation Protection Champions”
- We meet every 3 months to discuss local dose audits and optimisation work we are undertaking

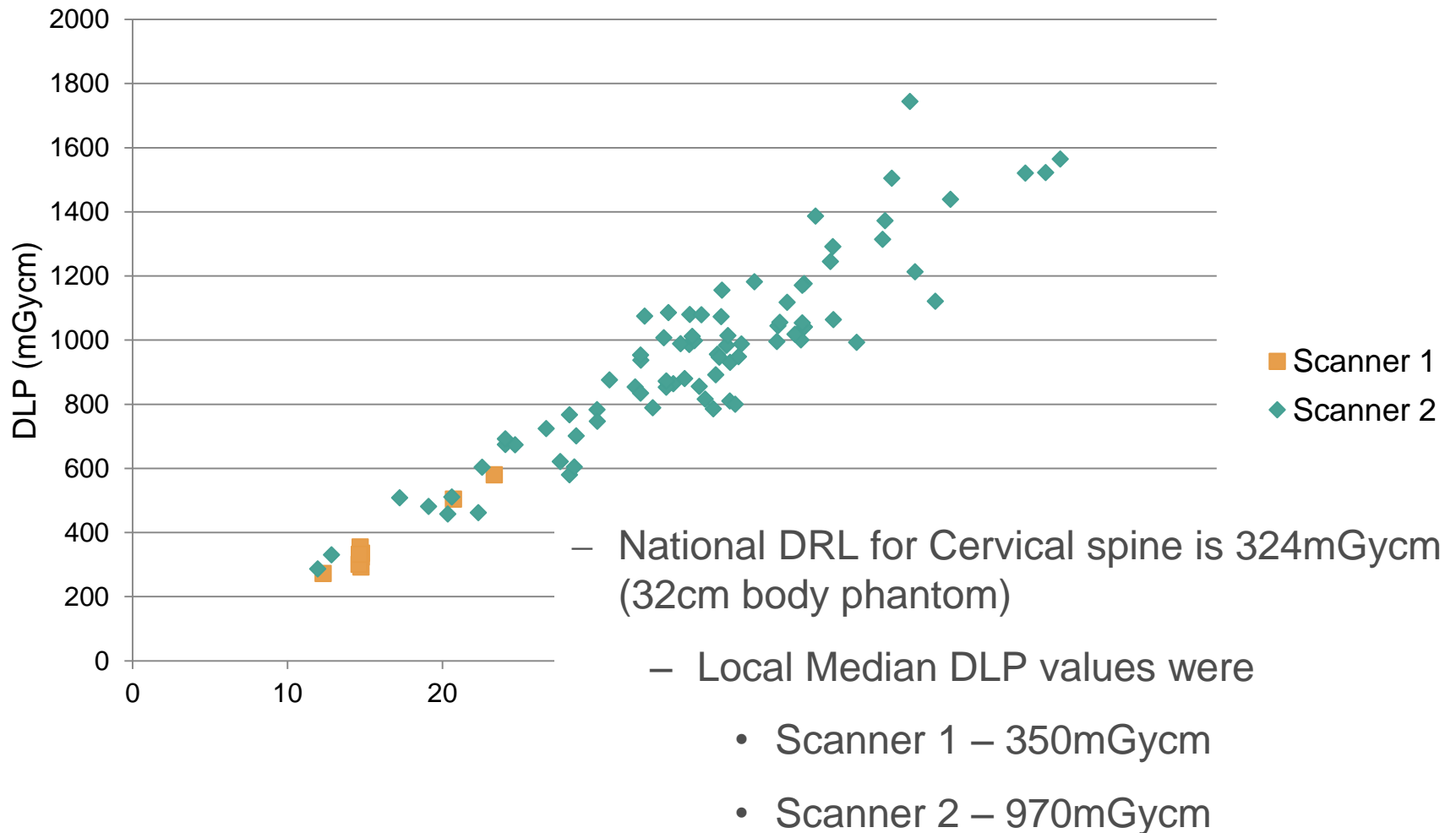
Cervical Spines Dose Audit

- PHE dose survey revealed we had a problem
- A more extensive dose audit undertaken for a 3 months on both scanners
- Data collected retrospectively from PACS system
- Scanner 1 - 10 patients, Scanner 2 - 80 patients

RBH - Trauma Cervical Spine



RBH - Trauma Cervical Spine



Protocol Differences

Parameter	Scanner 1 Lower Dose	Scanner 2 Higher Dose
Automatic Tube Current modulation		
Noise Index	28	17.25
Min – max mA	120-600	100-625
Rotation Time	0.6	0.8
Iterative Reconstruction	Not available	40% ASIR
kV	140	120
High Resolution Mode	Not available	On

Radiologist Review of Clinical Images

- There was a preference for scanning on Scanner 2
 - Are the images on Scanner 1 diagnostically adequate?
- Radiologist reviewed 10 images from both scanners
 - Scored 1 (poor) to 10 (wonderful)
 - Score average was
 - Scanner 1 – 7.4
 - Scanner 2 – 7.5
 - Image Quality was deemed adequate on both scanners

Action Plan

- Remove High Resolution Mode
- Increased Noise Index over a period of weeks to match value on scanner 1
- 2 month dose audit undertaken following these changes

Cervical Spine: Before and after protocol change



Future Work for Cervical Spines

- Questions to answer:
 - Could Noise Index be increased further on Scanner 2 (iterative reconstruction)
 - What effect is the difference in kV having on image quality
- Action plan:
 - Phantom imaging
 - Image Quality Audit by Radiologist on current protocol
 - Meeting with Lead Radiographers and Radiologist to determine plan of action

Temporal Bones

- Temporal Bones was highlighted as a common scan that did not have local DRL value
- Data was collected for whole of 2016
 - Manually collected from PACS system
- 170 patients in total
- Scanner 1 – 24 patients Scanner 2 – 146 patients
 - Again a preference for imaging on scanner 2
- 15 Paediatric patients (Scanner 1 – 3 patients, Scanner 2 – 12 patients)

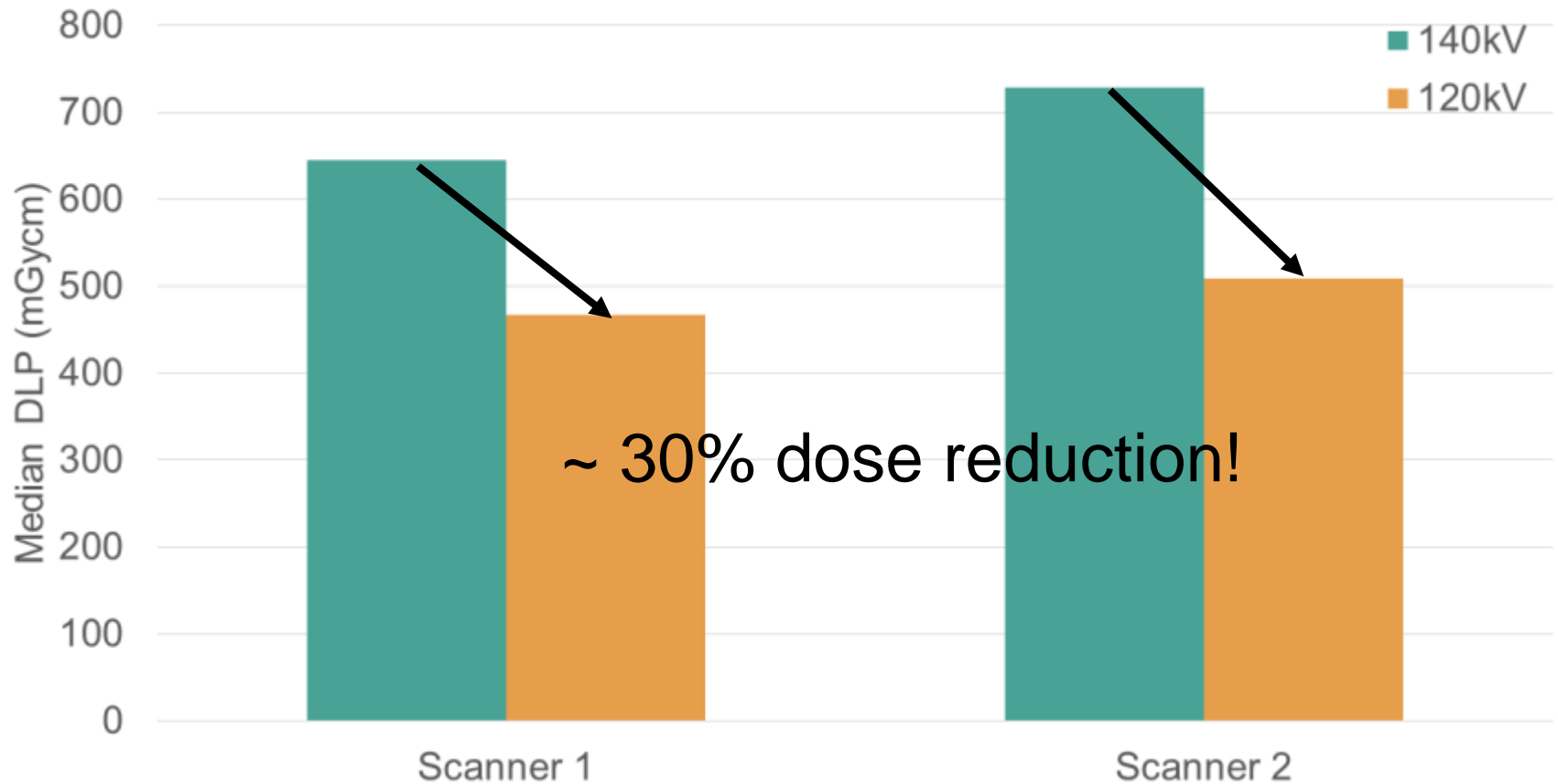
Adult Temporal Bones

- Doses higher on Scanner 2
 - Median DLP = 645mGycm on scanner 1
 - Median DLP = 729mGycm on scanner 2
- Protocol
 - 140kV
 - Fixed mA (same on both scanners)
 - High resolution mode turned on for Scanner 2
 - Iterative reconstruction on Scanner 2 (ASIR – 40%)

Temporal Bones

- No national DRLs for Temporal Bones
- Request for local doses on CT mailbase
 - 4 Responses (7 CT scanners)
 - Range of local DLP was 222mGycm to 450mGycm
 - Our doses were much larger! (~700mGycm)
 - Protocols from other hospital showed all were done at 120kV
- Action Plan
 - Change to 120kV
 - At this point not looking at protocol differences between scanners as there was a preference for scanner 2

Temporal Bones at 120kV



Changing in scanner habit



Future Work for Temporal Bones

- Review protocol difference between scanners
- Image Quality Audit for Temporal Bones
- Possible changes
 - Removing high resolution mode from scanner 2
 - Changing fixed mA on scanner 2 to take into account iterative reconstruction

Paediatric Temporal Bones

- 15 patients in 2016
 - Age range 6 to 15 years
 - Average DLP = 455mGycm
- Using adult protocol
 - Changes to protocol made for 10 patients (67%)
 - Tube voltage reduced to 80kV, 100kV & 120kV
 - mAs reduced from 156mAs to 100mAs
 - Age range of children protocol was unchanged for was 7 to 12 years

Paediatric Temporal Bones

- Action
 - Set up paediatric protocols
 - Staff training – ensuring adult protocols are adjusted for paediatric imaging

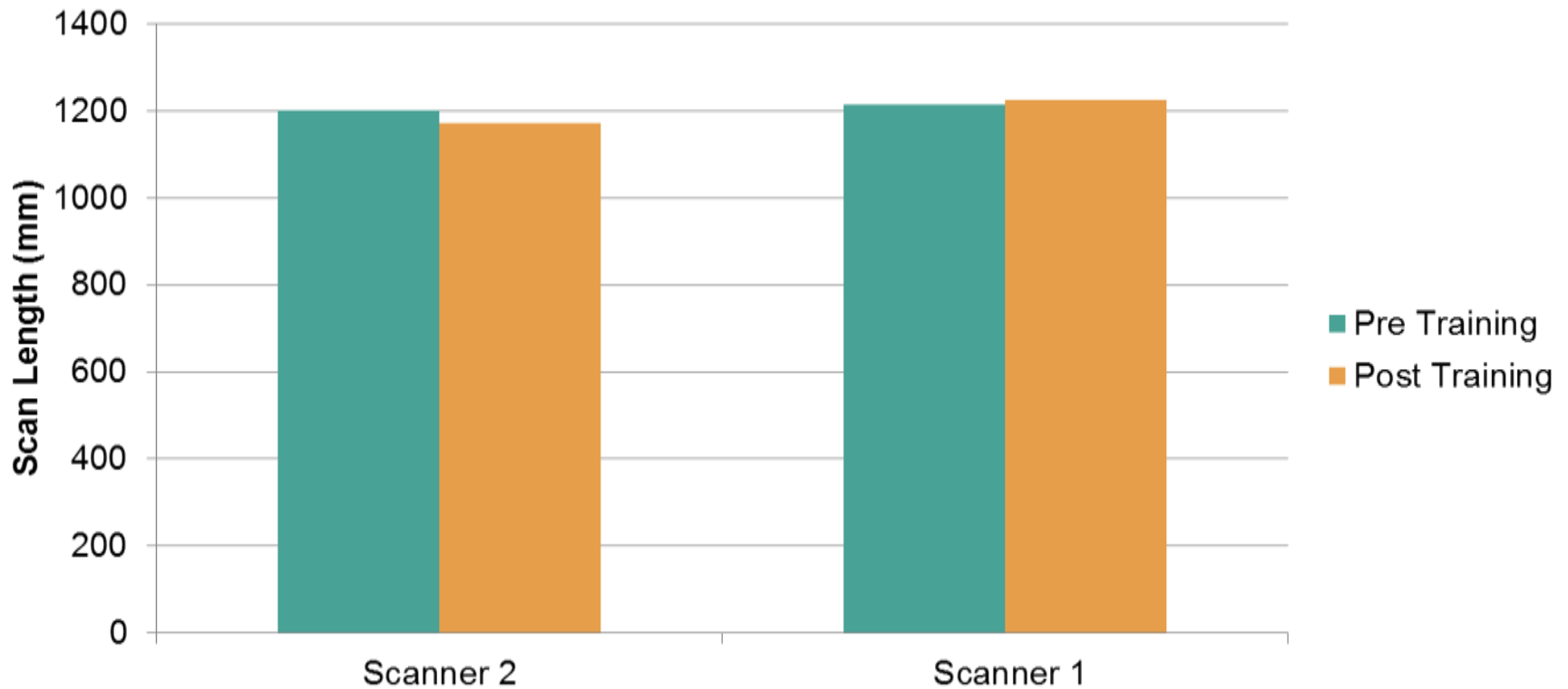
Lower Leg Angiogram

- Dose audit undertaken in January 2017
 - 50 Patients from each scanner
 - Data collected retrospectively from PACS system
 - Scanner 1 = 1330mGycm
 - Scanner 2 = 1720mGycm
 - Small range in scan lengths

Lower Leg Angiogram

- Image Quality Audit undertaken by lead Radiographer
 - Scan should be L3 to feet
 - Images starting too high in chest area
 - Included kidneys and base of lungs on some case
- Radiographers were given local training and shown the written protocol for this procedure
- Re-audit has started (Scanner 1- 7 patients, Scanner 2 – 12 patients)

Lower Leg Angiogram Scan Length Initial Results



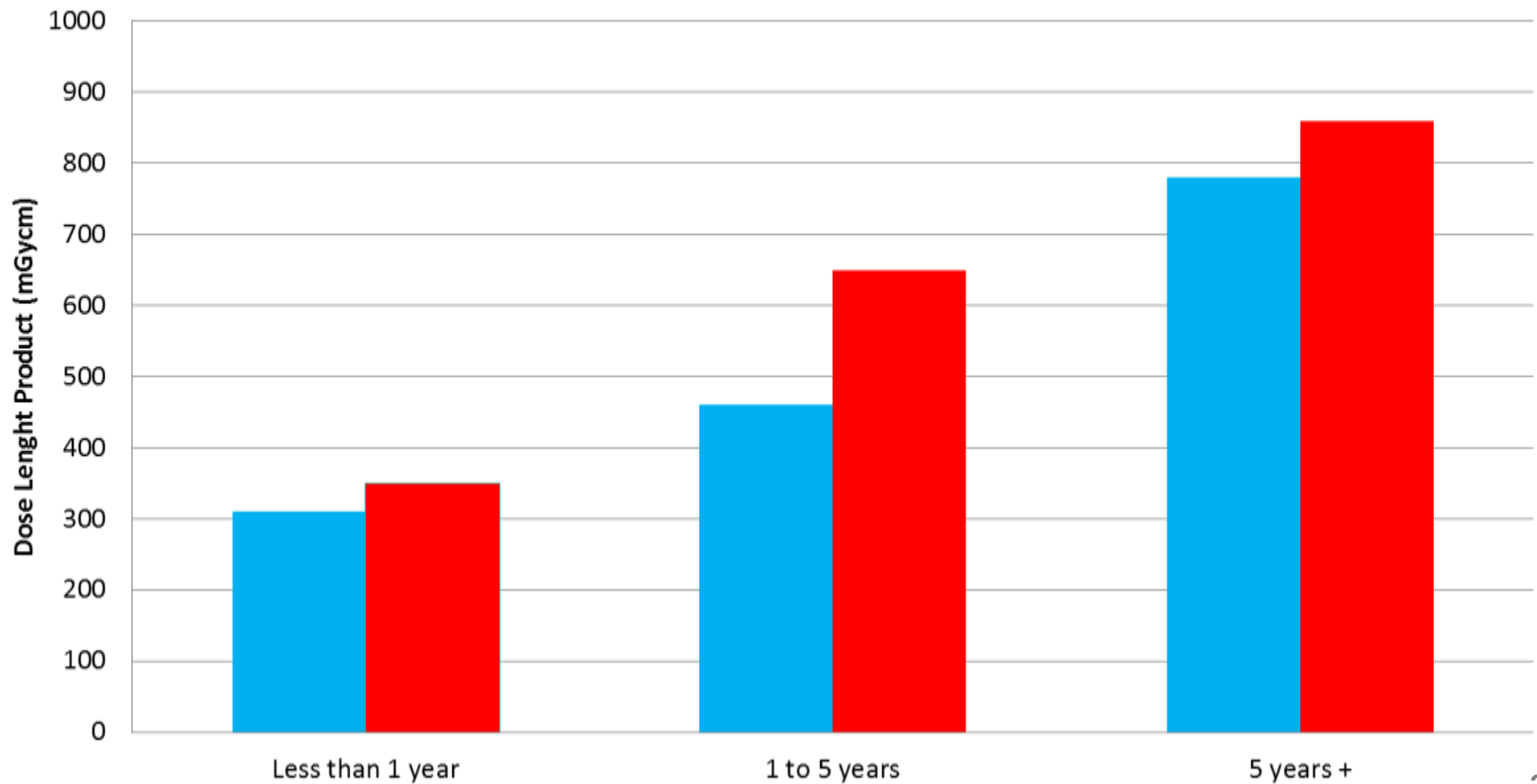
Lower Leg Angiogram

- Future work
 - Image Quality Audit by Radiologist
 - Aim to optimise protocols on scanners

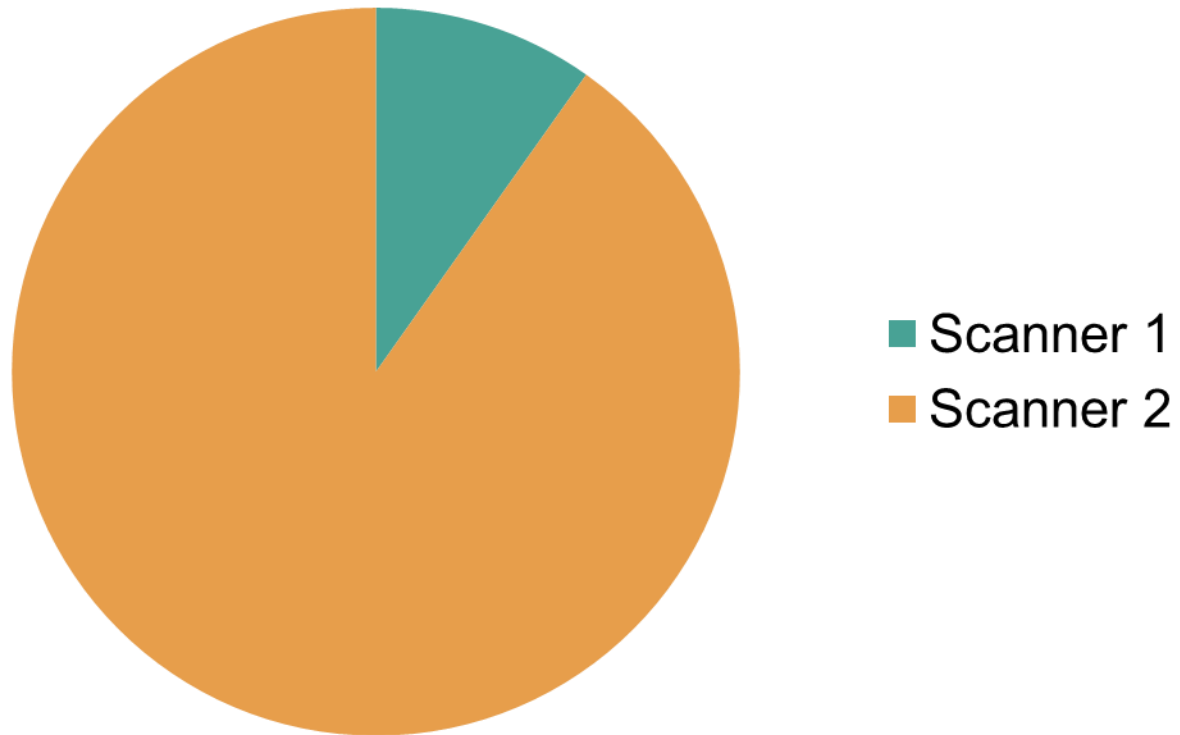
Paediatric Brain

- Previously non paediatric data for RBFT
 - Radiographers could not collect at scanner as did not occur very often
- Paediatric protocol set up on Scanner 2 in February 2017
- Dose Audit by Medical Physics
 - Data collected retrospectively from the PACS system
 - 102 Patients in 6 months
 - Average dose below national DRLs

Royal Berkshire Hospital Median DLP value for CT Paediatric Head Imaging



Paediatric Brain Imaging – use of scanners



Paediatric Brain

- Scanner 2
 - Paediatric protocols used only 61%
- Exceeding NDRL
 - Using paediatric protocols – 14%
 - Using Adult protocol – 68%
- Set up Investigation limits on $CTDI_{vol}$ and DLP
 - Upper and Lower
 - Radiologist and Radiographer to review image quality & why

Future Work for Paediatric Brains

- Set up paediatric protocols on Scanner 1
- Training of radiographer to use paediatric protocols
- Changing of protocol names

Currently	New
Less than 18 months	Less than 18 months
18months to 5 years	18months to 5 years
5 year +	5 year to 10 years
	10 to 15 years


 Same protocol

The future of CT Optimisation Group

- Ideally need a dose management system
 - Reduce time to undertaken dose audit
 - Increase number of examinations in dose audit
 - Currently trailing GE Dosewatch explore software
 - Radimetrics being installed to record contrast data
- Continued optimisation work for Cervical Spines, Temporal Bones, Lower Leg Angio & Paediatric Brains
- Dose audits for examinations carried out regularly
 - MARS, IVUs

The future of CT Optimisation Group

- New scanner (January 2018)
- Promotion of current optimisation work at RBH
 - Radiologist
 - Radiographers
 - Other hospitals
- Formal set up of the CT optimisation group

Summary

- Set up first Optimisation Group at RBFT
- Optimisation of protocols
 - Cervical Spine
 - Temporal Bones
 - Optimisation linked to protocol set up – closer involvement in new scanner set up
- Highlighted protocol requiring optimisation
 - Lower Leg Angiogram
 - Paediatric Brain