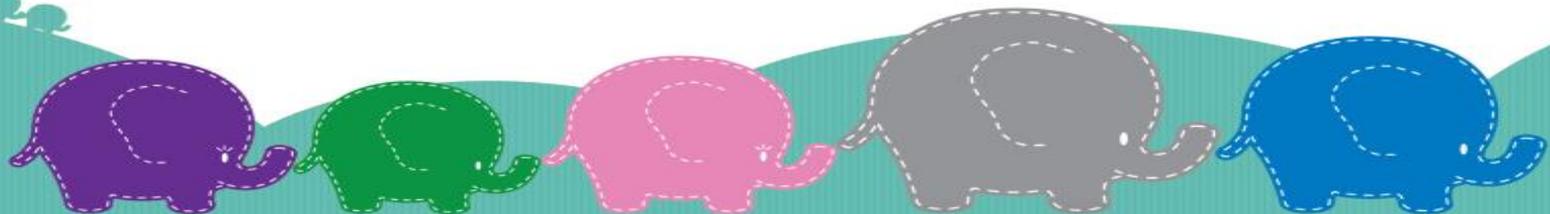


Paediatric CT Scanning

Neil Fanning

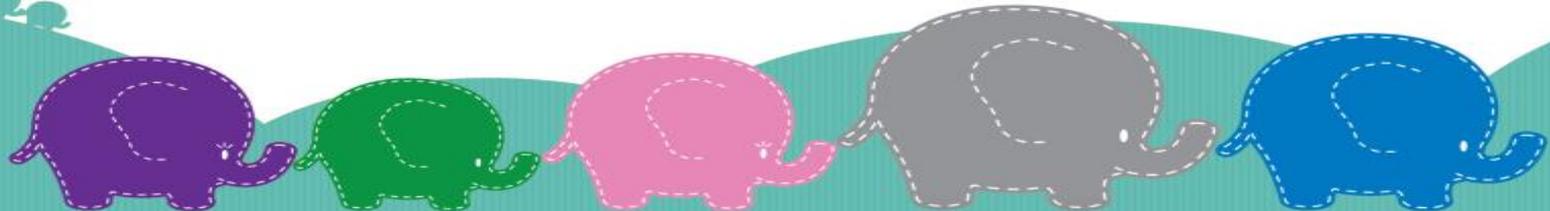
CSI Radiographer

Alder Hey Children's NHS Trust



Who are We?

- Tertiary centre
- Major trauma unit
- Specialist centre: Oncology, Neuro surgery, Burns, Plastics, Renal, Cardiac & More
- Treat 330,000 patients each year
- 32 Bed ITU
- 230 In-patient beds



Our Scanner

- Philips Ingenuity 128 Elite since October 2015
- Reserve scanner : Siemens Gamma camera/CT
- Jan 2018-Dec 2018: 2951
- Jan 2019-July 2019: 1748 (Predicted >3000 for 2019)
- CT Heads = 25% of workload
- Cardiac, biopsy & RF ablation
- Adult scanner with Paediatric dose





PHILIPS

+ 0.0
360
+ 135.39

+ 0.0
360
+ 135.39

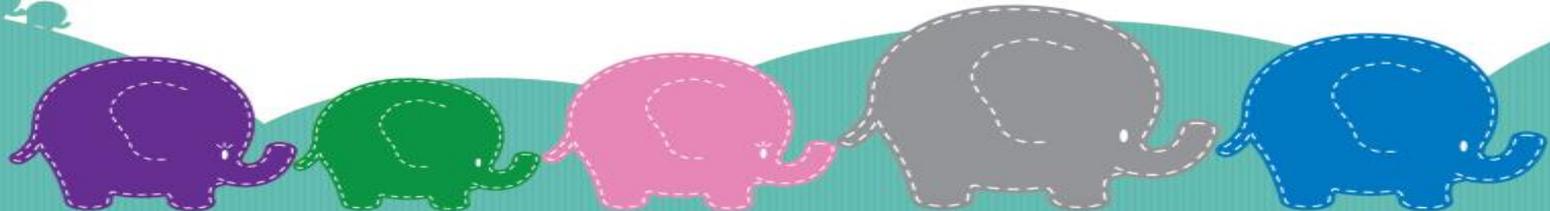
The Work

- Every request is justified by a Radiologist
- Radiologists discuss patients - appropriate imaging is done
- Adhere to the ALARP principle – if possible to get diagnosis without a radiation dose, then all the better
- Balance the potential risk of radiation with adequate exposure for accurate diagnosis
- Use dose-saving techniques



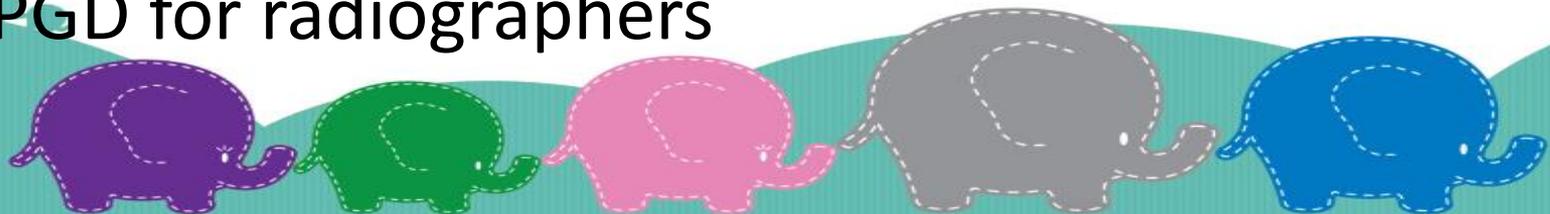
Dose

- Protocols are grouped by weight or age
- Dose Right with Z- Dose Modulation always used
- Iterative Reconstruction (iDose) gives reduced dose
- Dose Right Index means we can adjust exposure in a measured way when necessary
- Chest with Abdomen use Liver Area Dose Right Index +2
- All dose comparable to EDRL
- Fast rotation times reduce motion artefacts
- Wrap lead rubber around pelvis
- Place bismuth coated latex over eyes, thyroid and/or breast tissue after scannogram with 2cm spacer



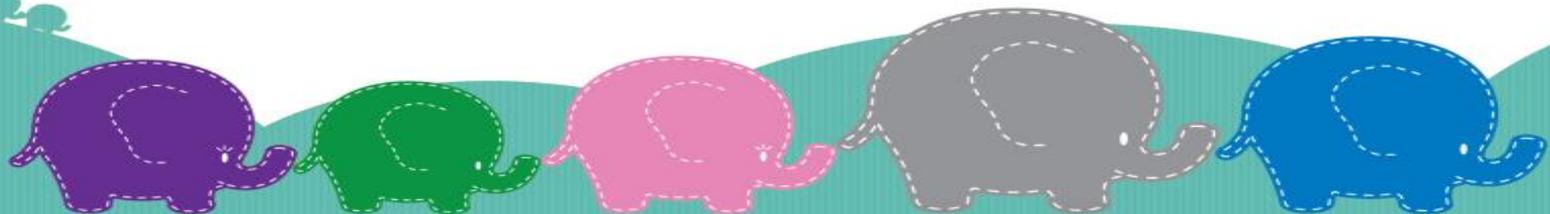
Contrast

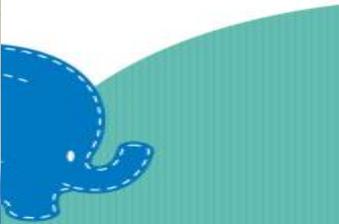
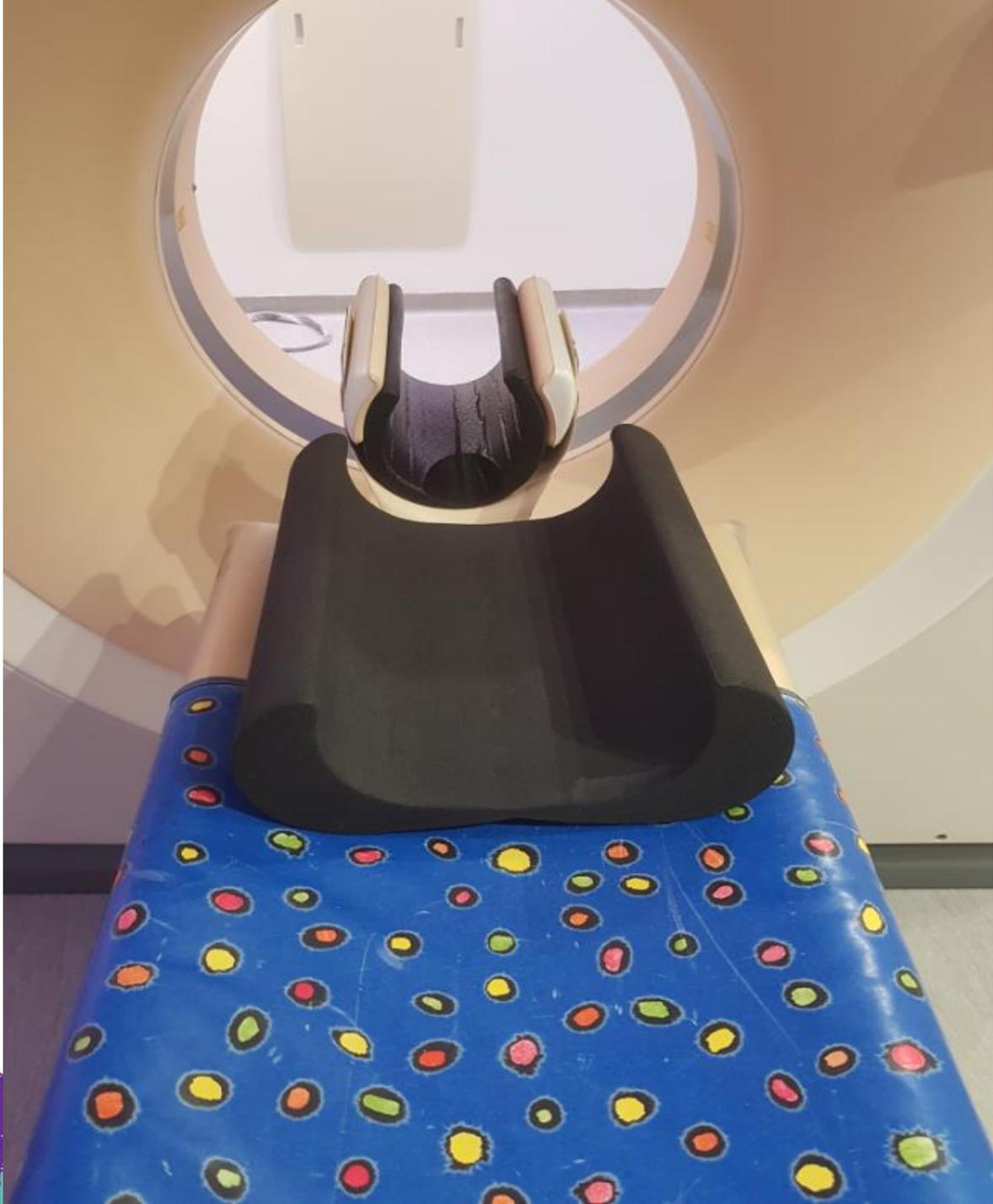
- Radiographer cannulation
- *“magic cream” / “cold spray”*
- 1ml/kg for head scans – max 50ml
- 2ml/kg for everything else – max 100ml
- Injection rates vary – Split bolus 0.5ml/sec – 4ml/sec
- Usual contrast contraindications
- Contrast used less in Paeds – esp Oral contrast
- Pump? or Hand?
- PGD for radiographers



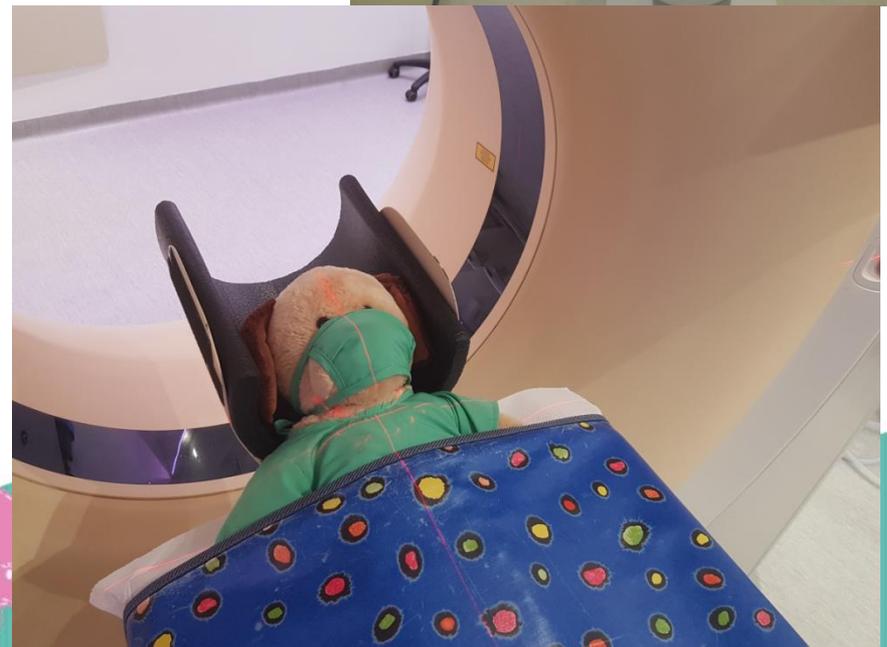
Scanning Technique

- Be prepared
- Lighting
- Pads
- Lead
- Patient & Parent trust
- Keep the room minimal
- Give the patient free roam – touch & feel



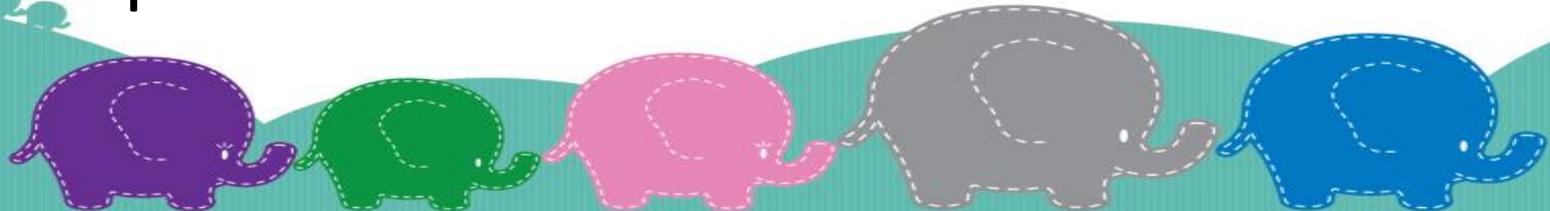


- Kitten Scanner – Interactive
- Encourage before getting into the room
- Play Specialists – Request by referral team & CSI radiographers
- Youtube prior to scan
- Bring a toy/tablet
- Parents!



Babies

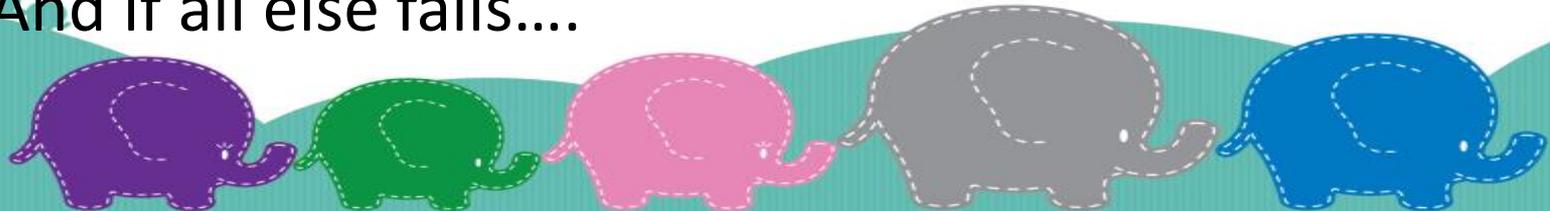
- Scan in their natural sleep
- Feed and wrap baby
- Drink bottle during scan
- Use a dummy - glycerine
- Low lighting room
- CT is quiet and generally non invasive
- With the Ingenuity, scan times have reduced - volume head 2-3 seconds
- Breathing instructions
- Peripheral cannula - foot





Toddlers

- Most CTs performed without GA
- Difficult to keep children still
- GA used for v. young, cardiac, chest, biopsy & ablation
- Explanation essential but needs to be focused and appropriate
- Plan ahead and work quickly
- Get help if needed – Someone to press the button
- Distraction methods
- Audience participation
- And if all else fails....

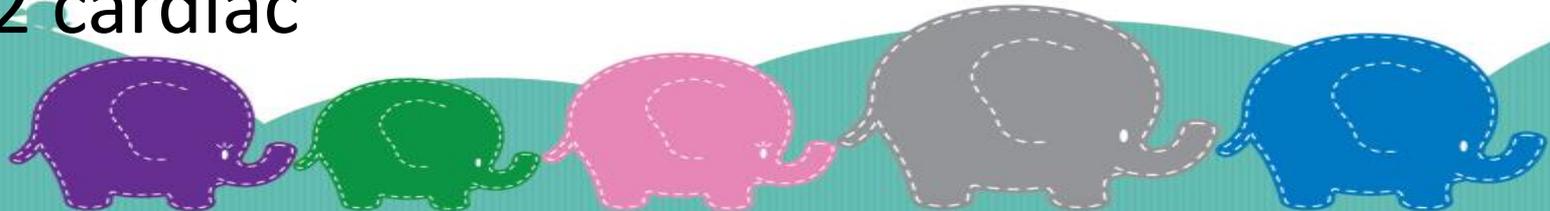


BRIBE THEM!!!!



To GA, or not to GA? That is the question

- High quality images – Cardiac, chest etc
- Non-compliant patients
- Biopsy & Ablations
- Contrast needed?
- Is the patient having anything else?
“Piggyback” MRI, surgery etc
- Designated CSI GA lists – 8x Lists per week inc
2 cardiac



Brain

- Quick and readily available
- Avoid eye dose – Eye protection
- All performed as a volume scan – Brainlab
- Few contraindications for CT Head
- Where possible MRI is preferred
- Paediatric trauma guidelines – 3D Volume

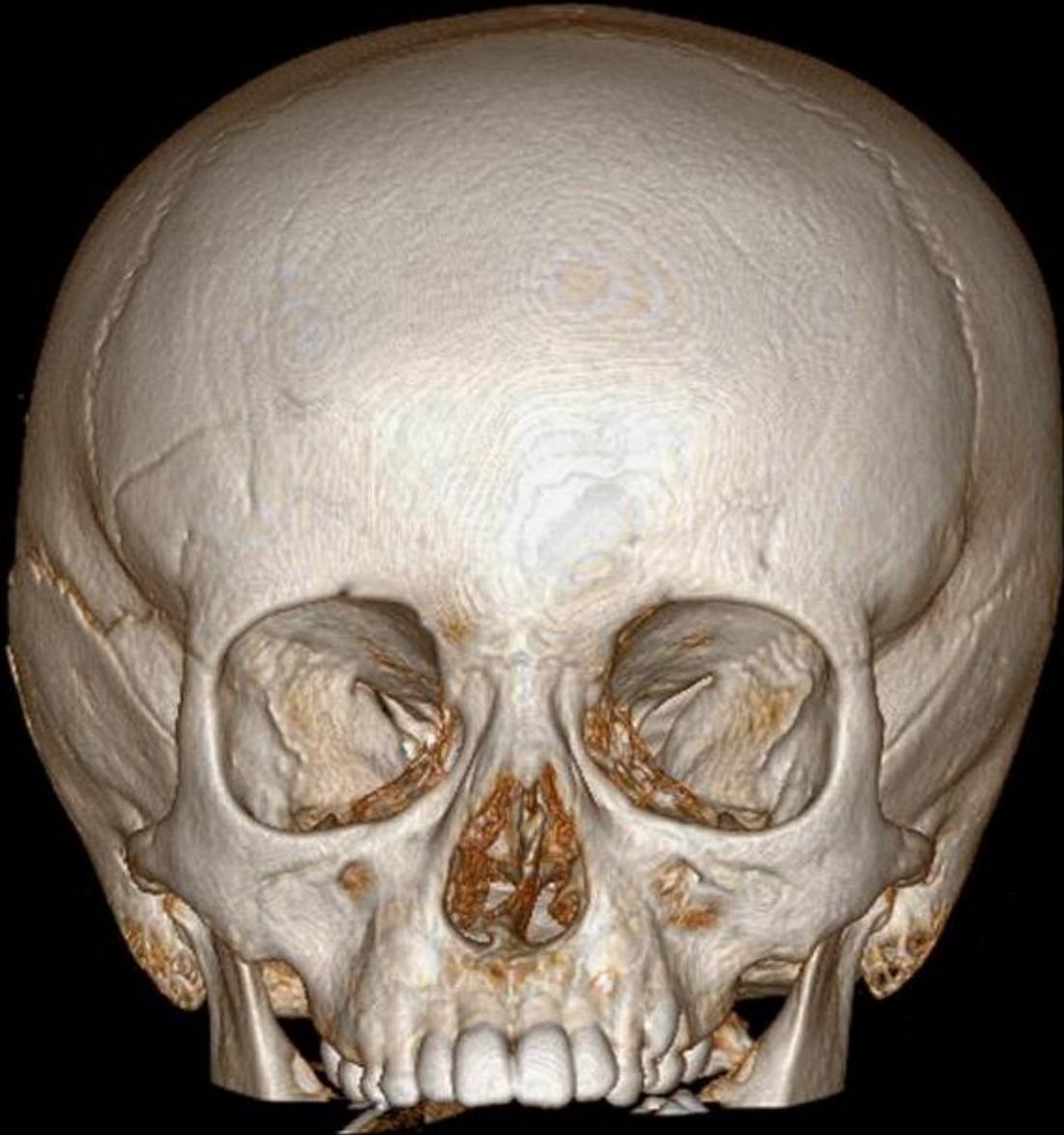






Volume Brain Exposure

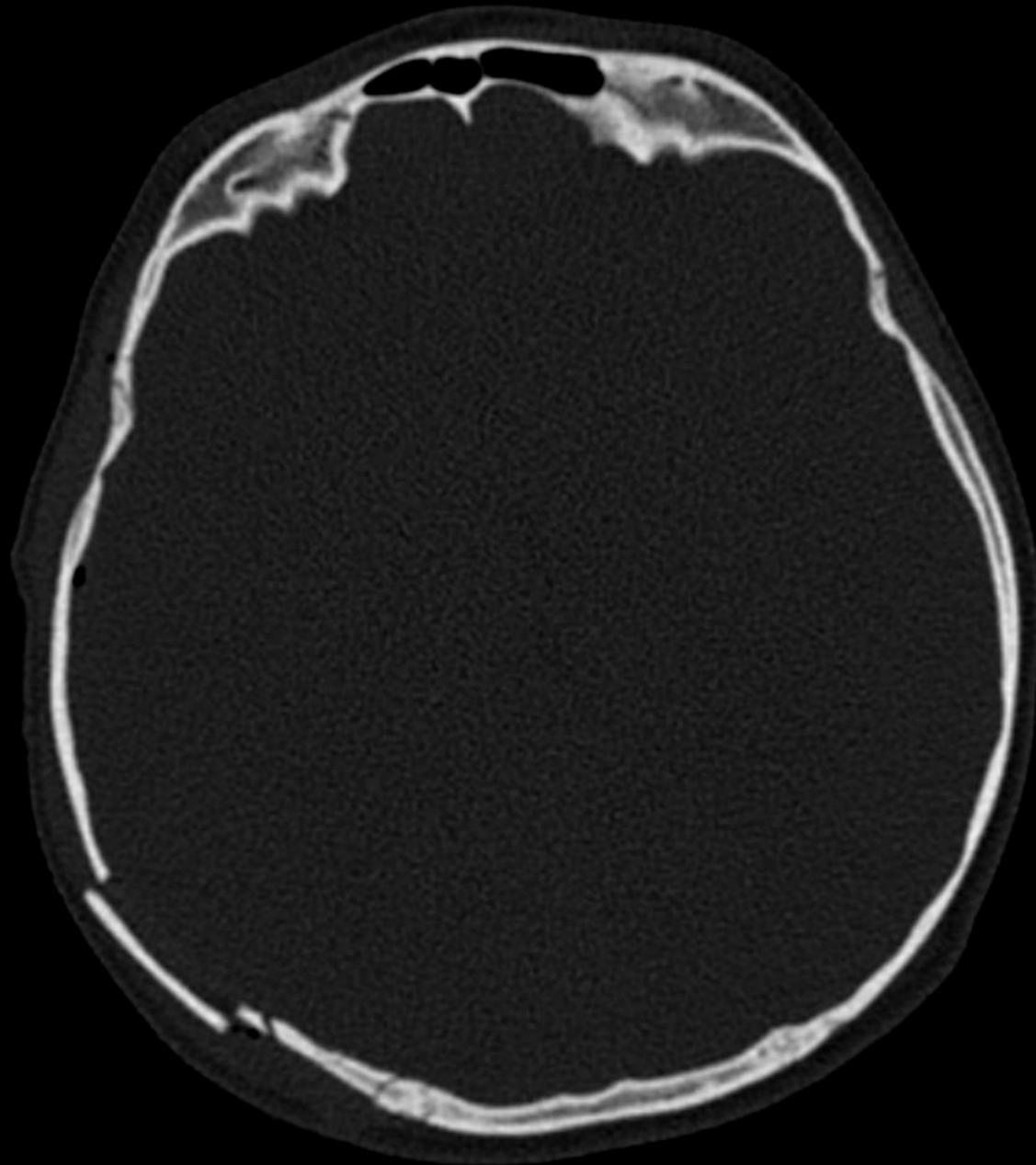
Age	kVp	mAs	Low dose mAs
0-1 month	100	115	35
1-12 month	100	130	65
1-5 years	100	155	80
5-10 years	100	190	115
10-16 years	100	230	145



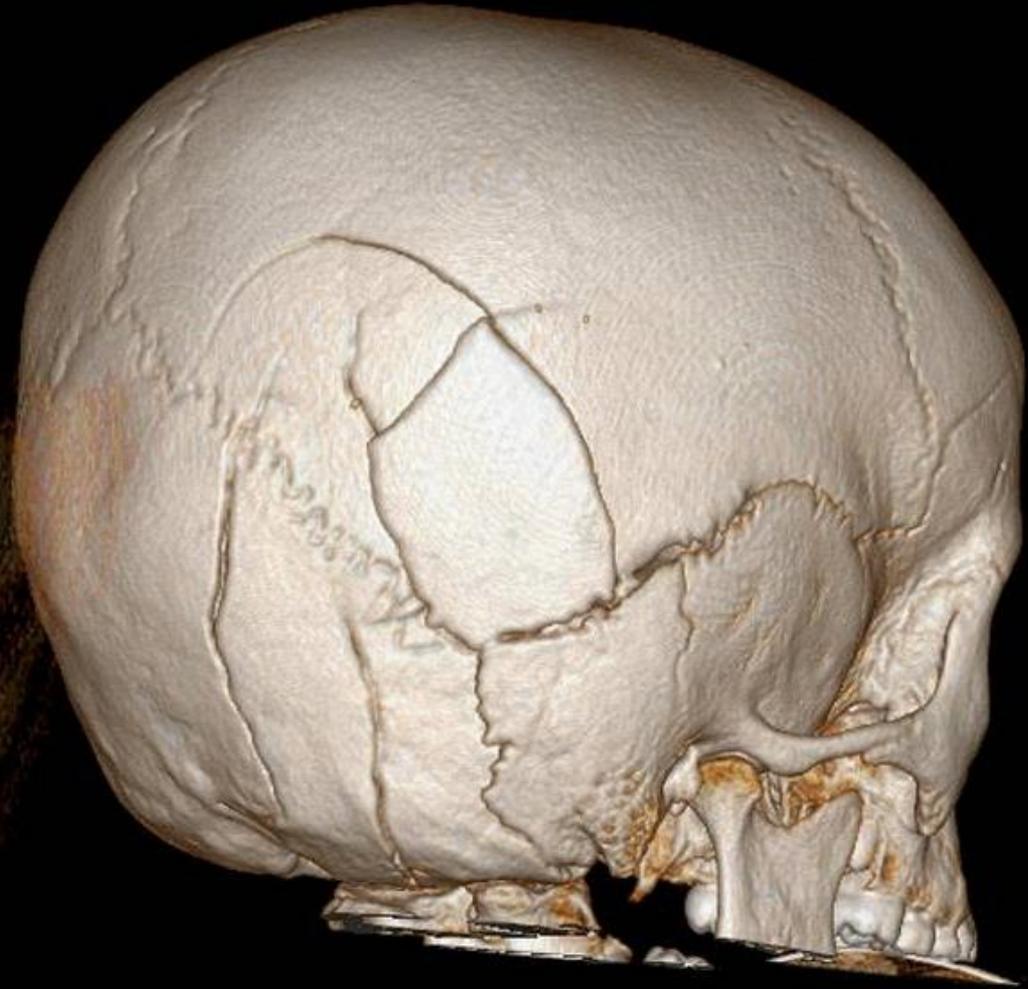
R



10 cm

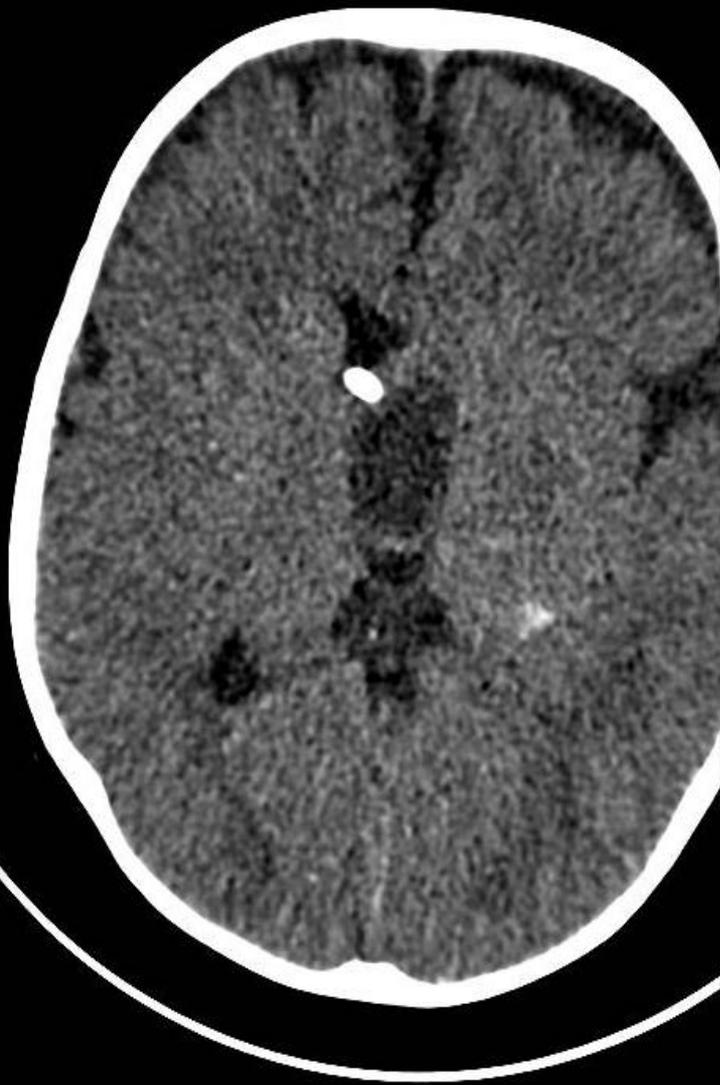


PL



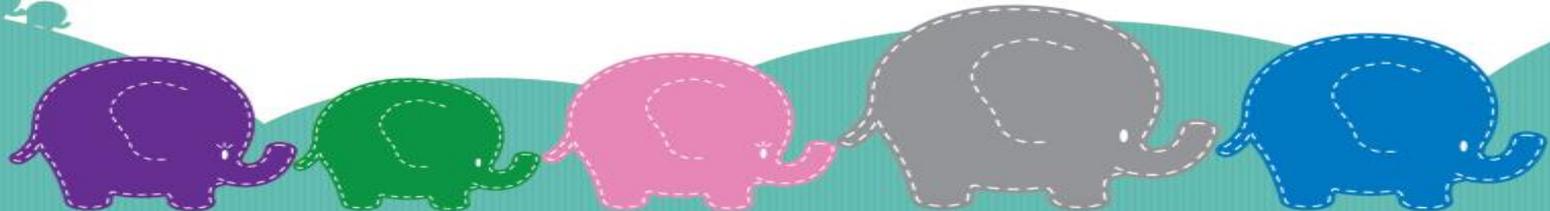
10 cm

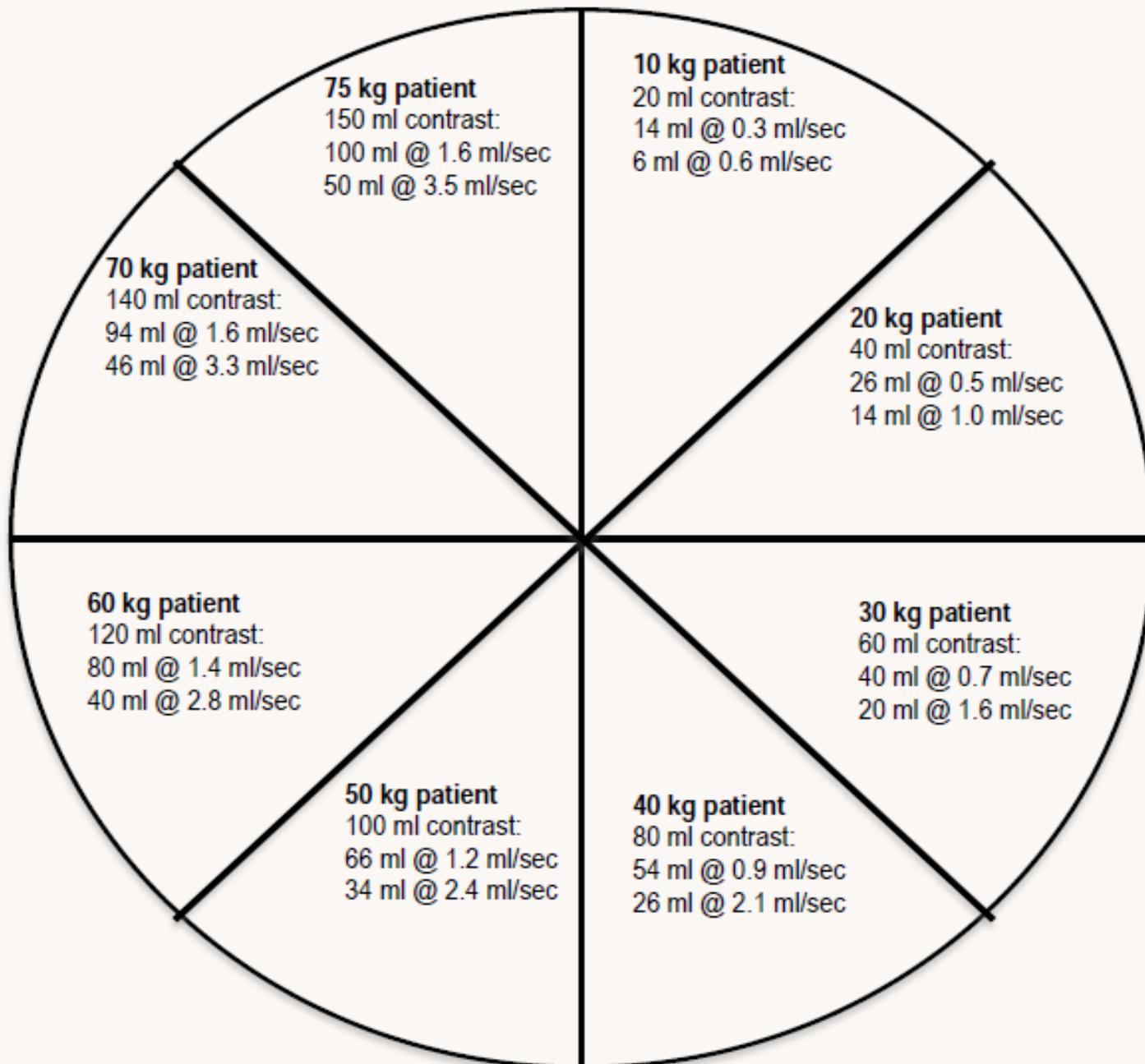




Trauma

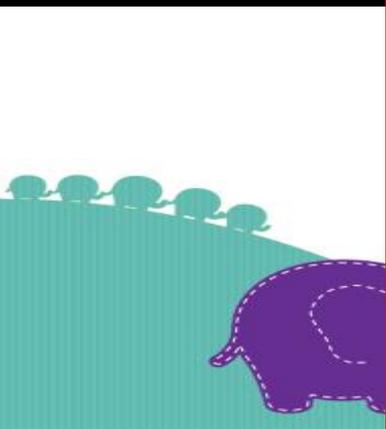
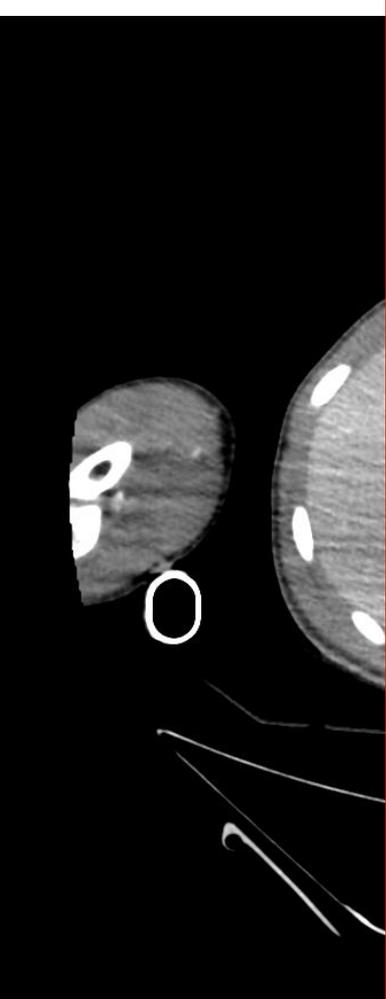
- Major Trauma Centre
- North West & Wales area inc some Midlands
- Helipad – Take five helicopters
- Bastian protocol
- Split bolus – Dual phase scanning
- Reduced radiation dose – Single acquisition





Camp Bastian calculator
 2/3 contrast in slowly
 Final 1/3 quickly
 Trigger scan @ 70sec

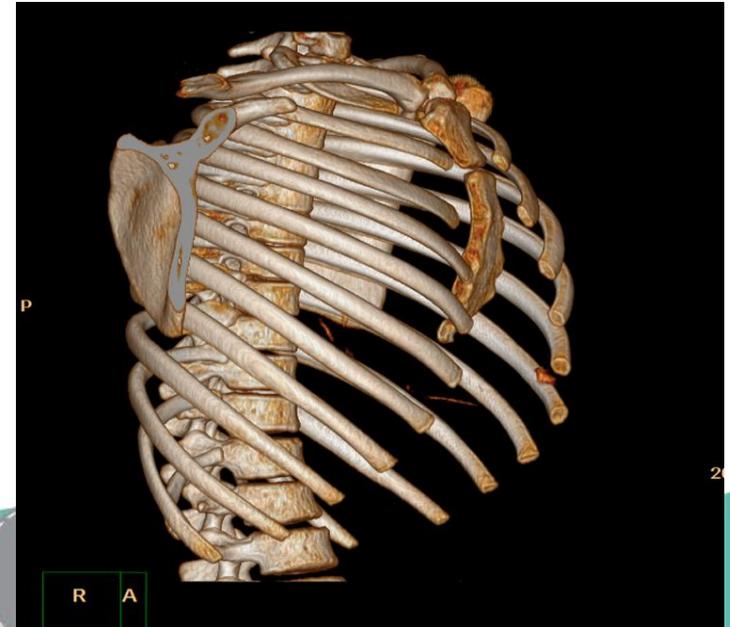
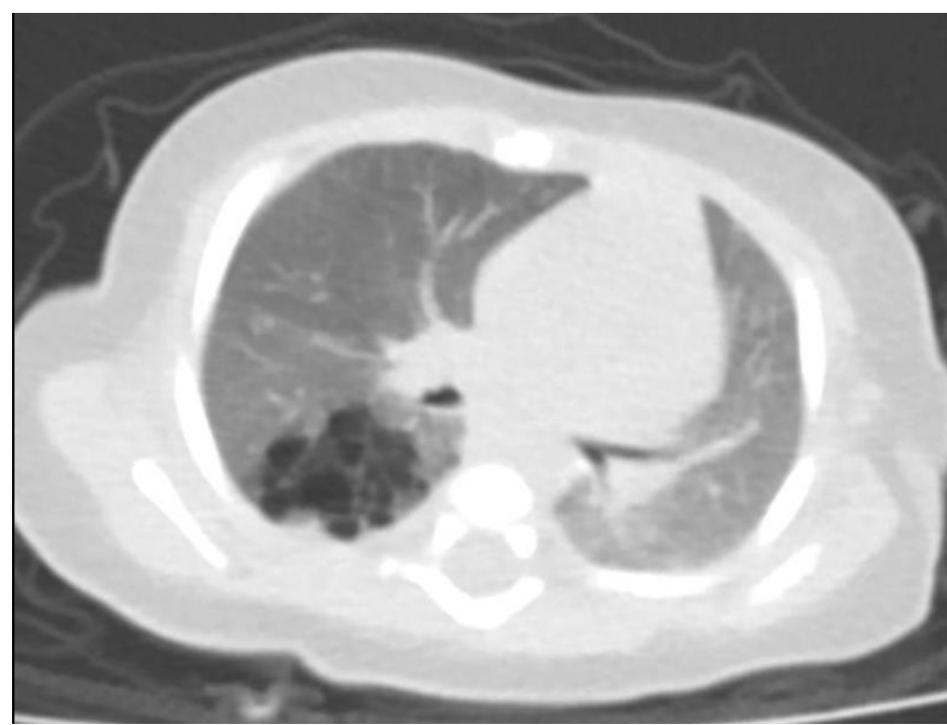






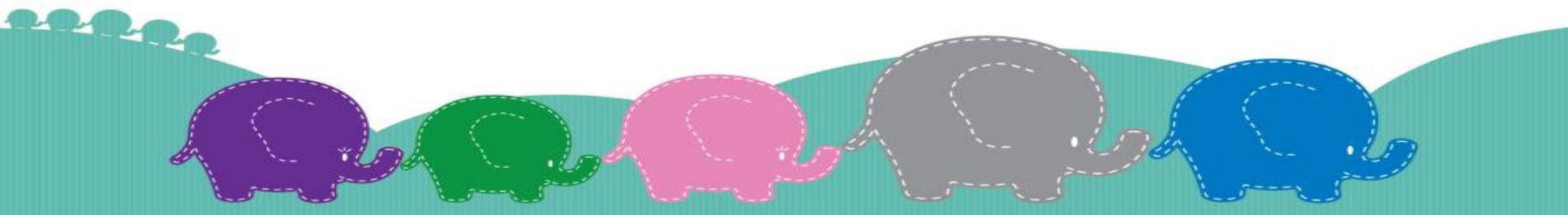
Chest

- Rarely need a GA
- Free breathing does not reduce quality
- Acquisition time less than 2 seconds
- Sequential low dose scans for lungs
- No need for contrast for chest mets
- CCAM or sequestration
- Pectus deformity – Vol whole chest for model



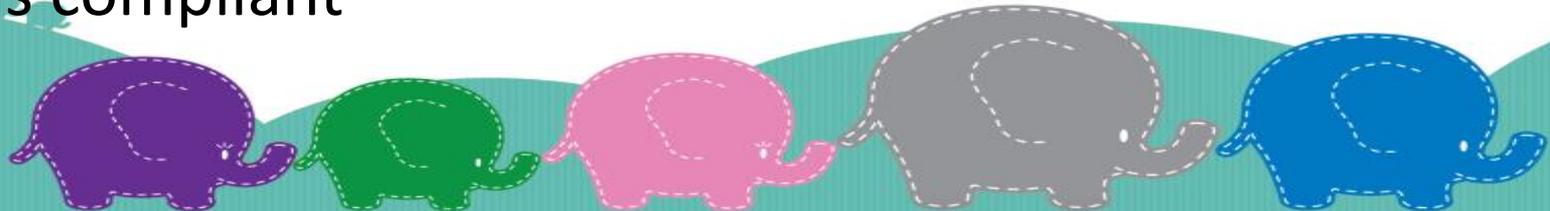
Chest Exposure

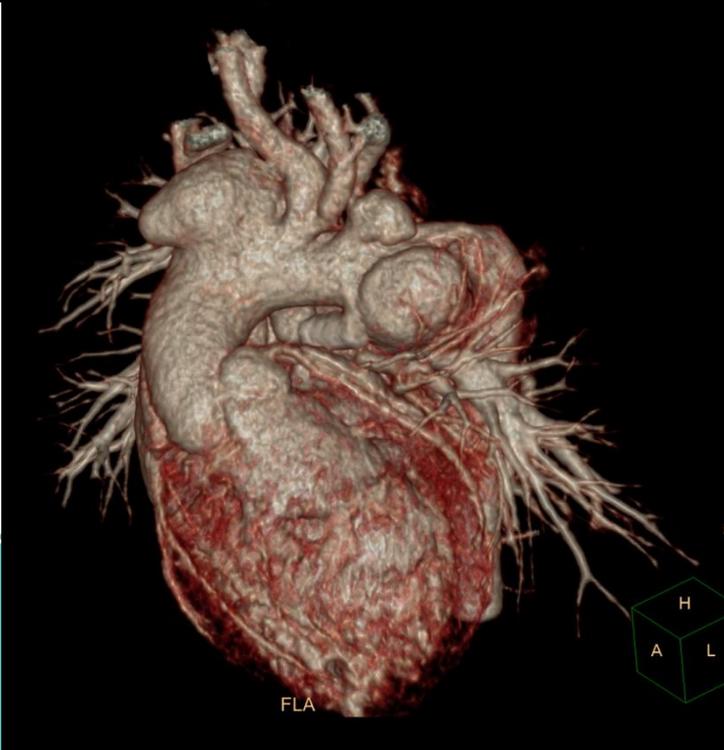
Weight	kVp	Average mAs	DRL @ Alder Hey
0-5kg	80	64	20
5-15kg	80	90	26
15-30kg	100	42	35
30-50kg	100	57	68
50-90kg	100	65	125
90kg+	120	51	180



Cardiac

- Newborn, when echo doesn't provide complete picture
- Suspected coronary artery, lung or airway abnormality
- CT for anatomy rather than function
- When MRI contra-indicated, pacemakers, flow watch PA banding
- GA required until patient is compliant



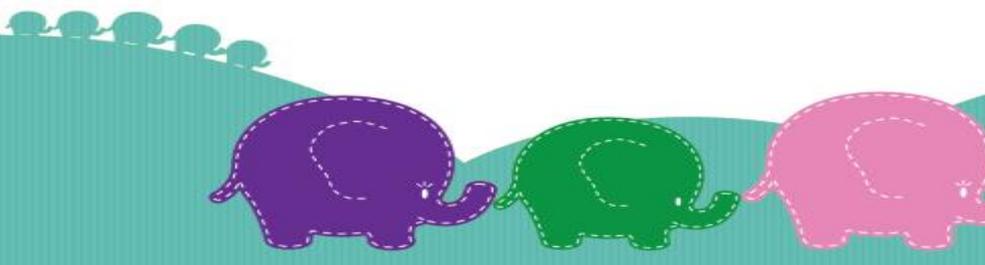
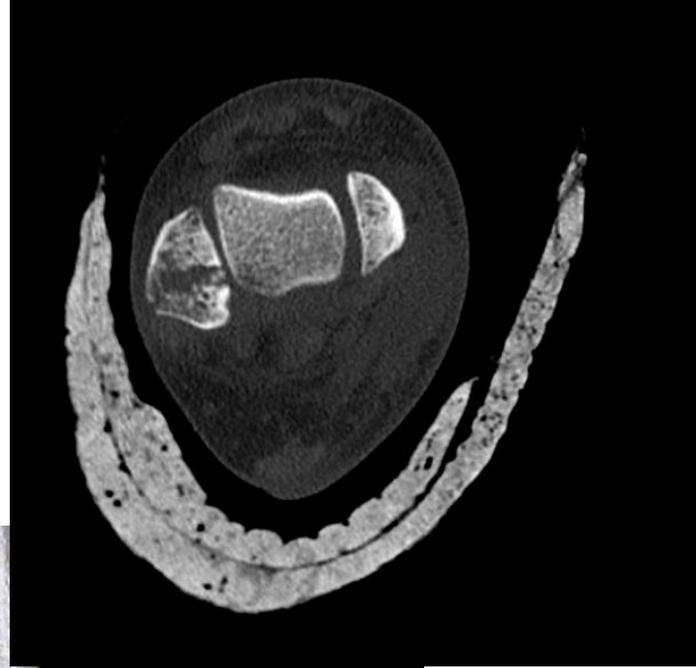


- Need good breath hold
- Heart rate below 140bpm
- 2-3mls contrast per Kg
- 6-14 second scan time
- 80 or 100kV as more sensitive to contrast
- Use cardiac gating to determine start of scan
- 3D volume for planning
- Cardiac Radiologist accompanies all scans



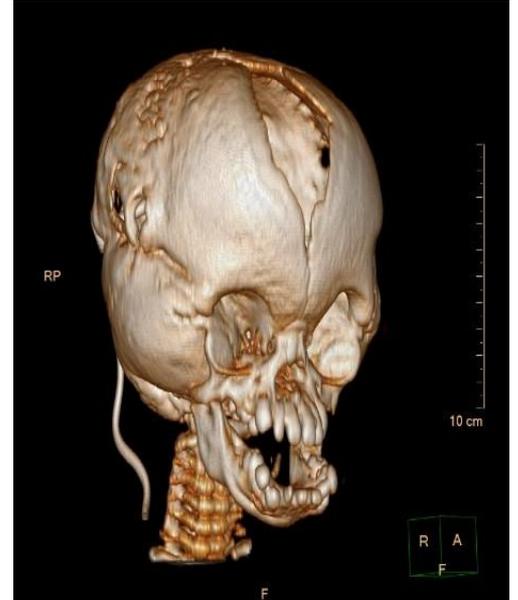
Orthopaedic

- Essential for trauma patients
- Bone detail excellent with multi-planar reformats for surgical planning
- Low dose
- Hip dislocation in babies
- OMAR

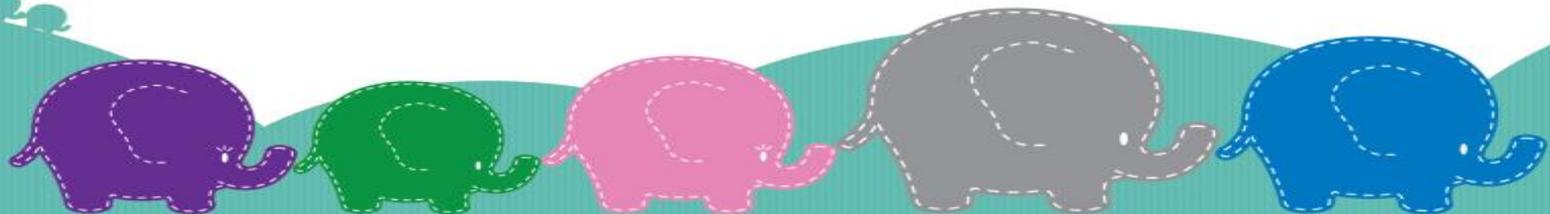


3D Models

- Surgical Planning
- Craniofacial –
Crouzon's, Apert's
etc
- Cardiac
- Orthopaedic

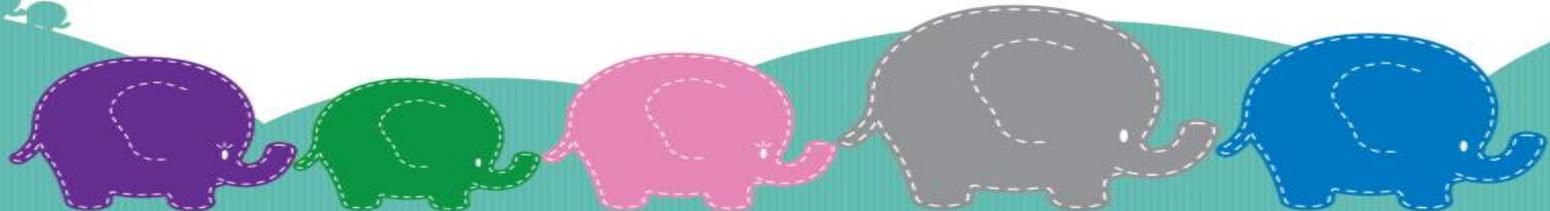


Now, for the topic that no-one
wants to mention... But it does
happen



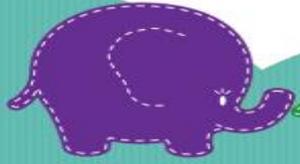
Mortuary work

- Whole body “CT-o-gram”
- Focused area
- Dose?
- Slow rotation time
- Reduce slice thickness & spacing
- Looking for fine details
- This could be used as evidence in court





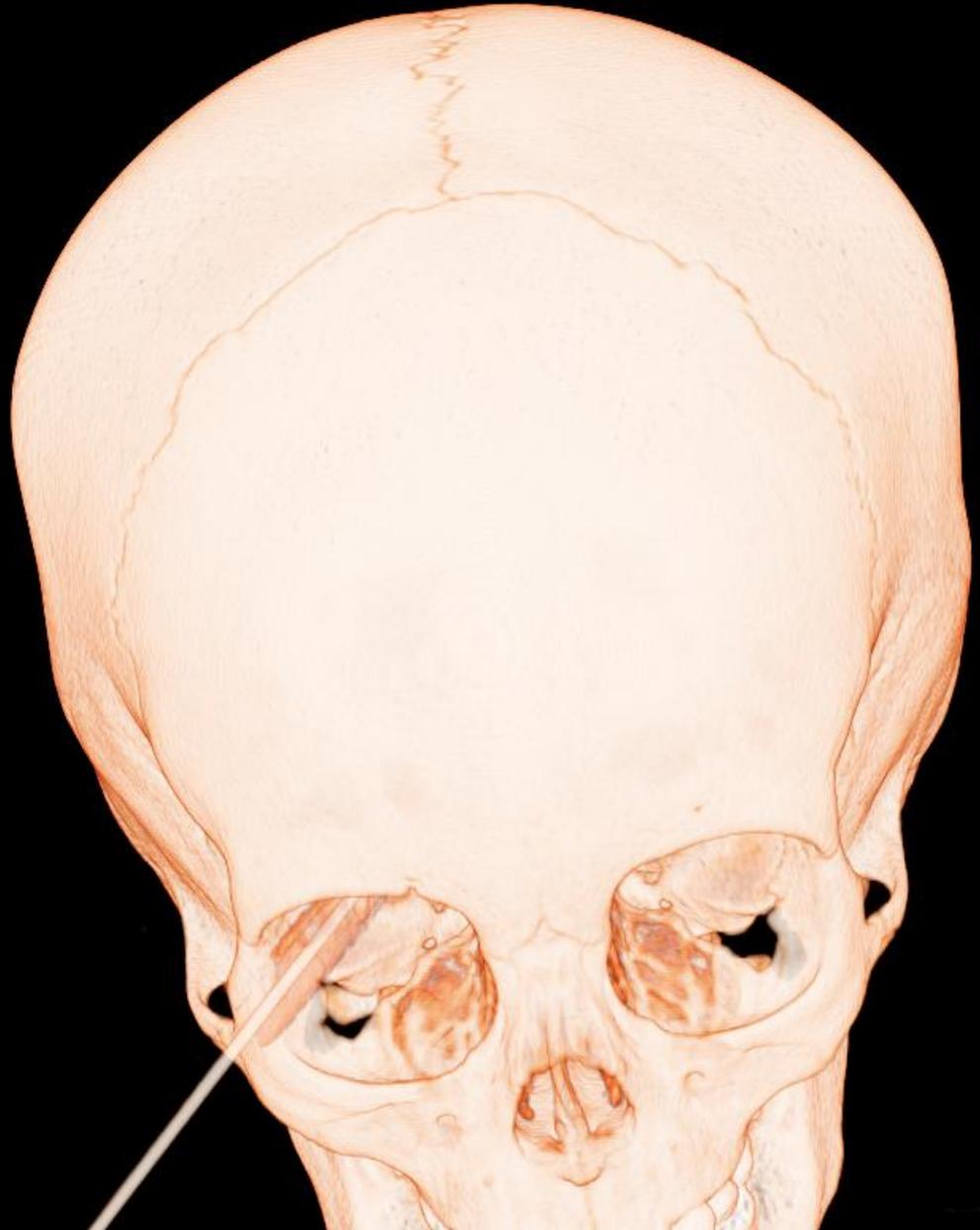
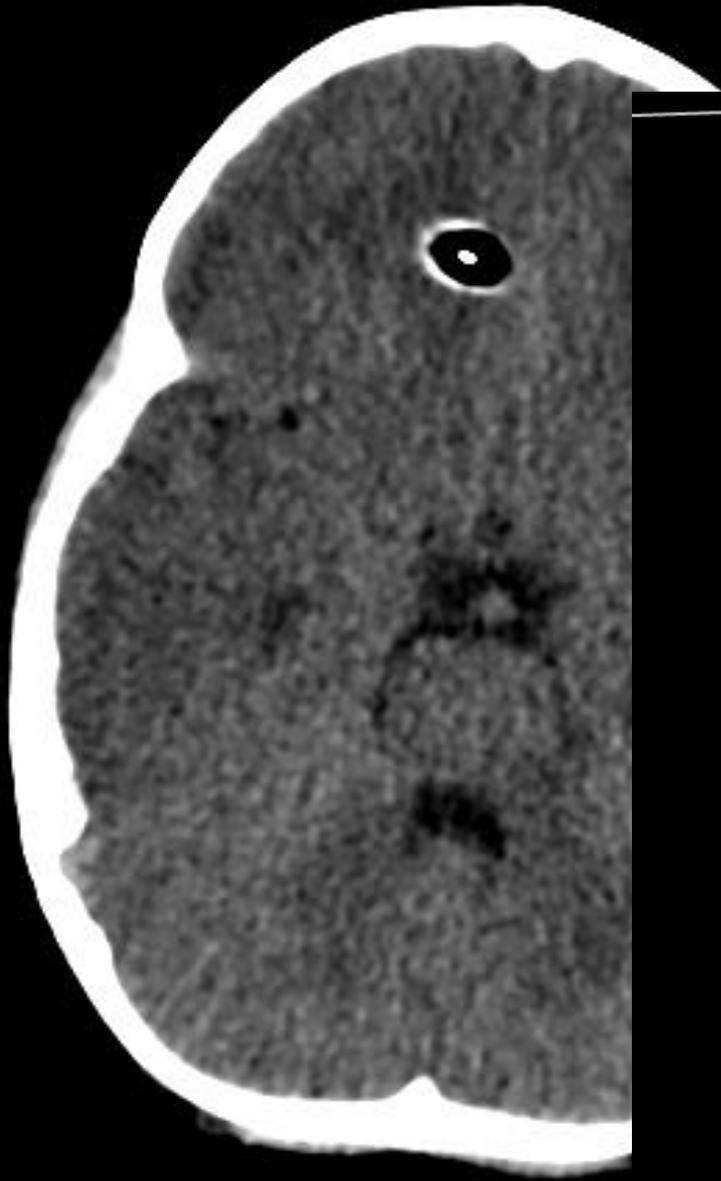
30 cm

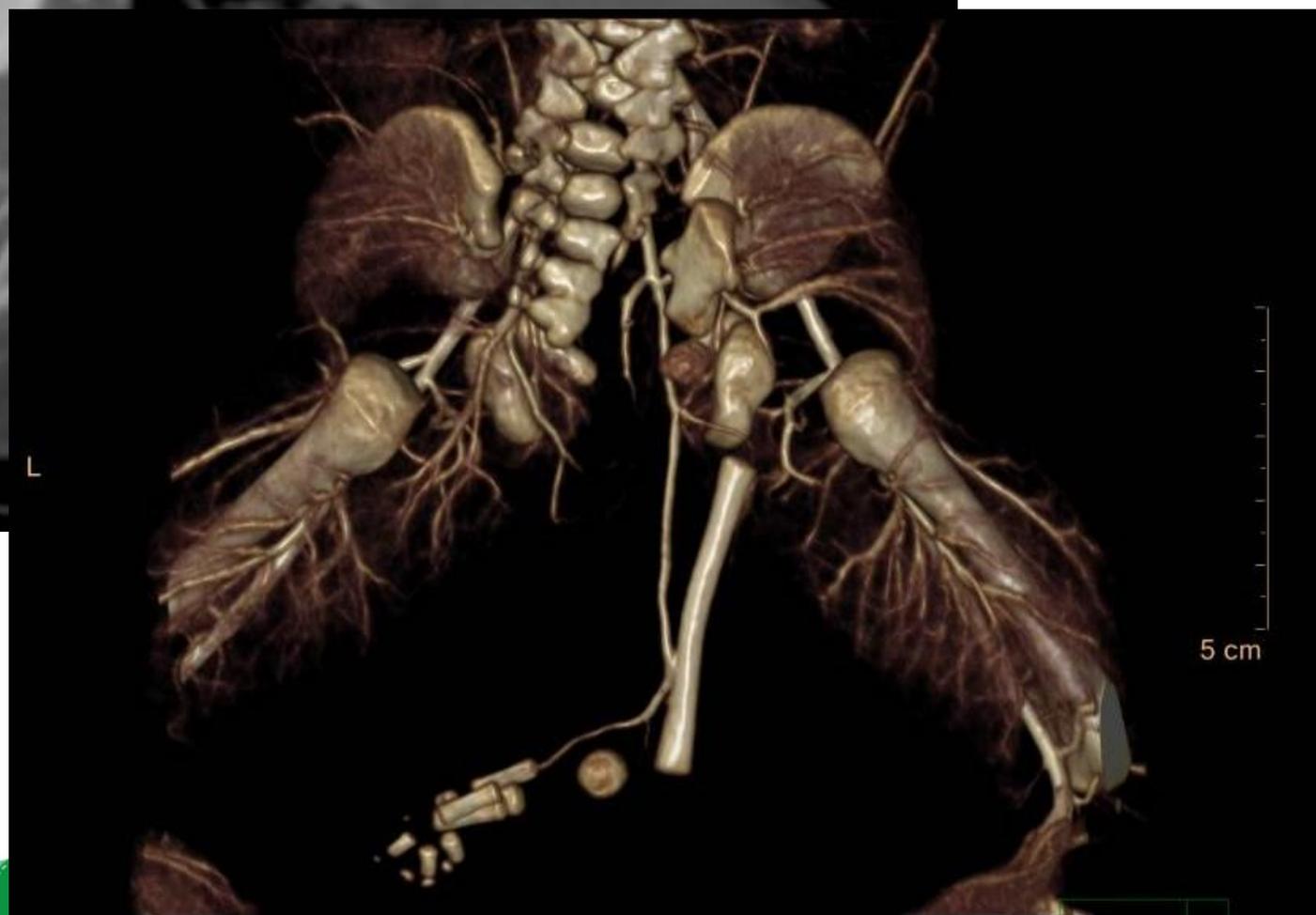
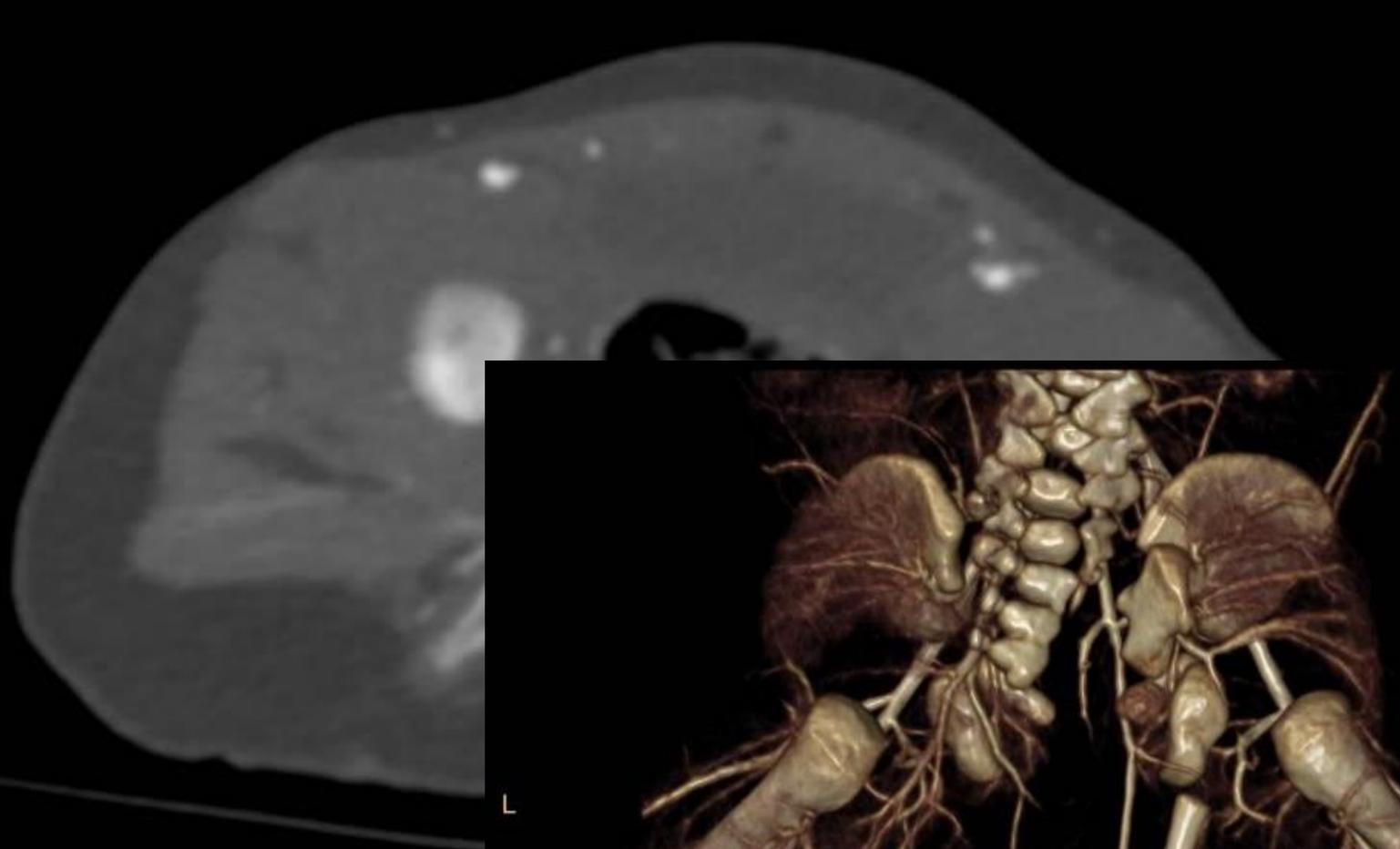


Couple of interesting cases to finish
with:









P R

At the

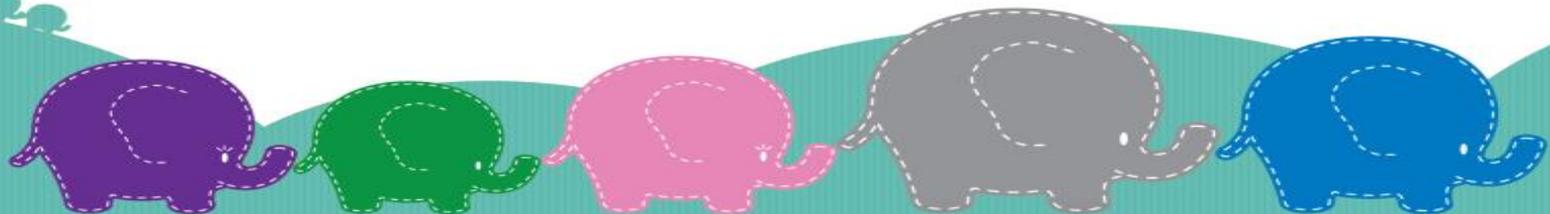


here



Thank you for listening.

Any Questions?



References

- The Royal College of Radiologists "*Paediatric Trauma Protocols*". London. The Royal College of Radiologists, 2014.

Available from :

[https://www.rcr.ac.uk/system/files/publication/field_publication_files/BFCR\(14\)8_paeds_trauma.pdf](https://www.rcr.ac.uk/system/files/publication/field_publication_files/BFCR(14)8_paeds_trauma.pdf)

