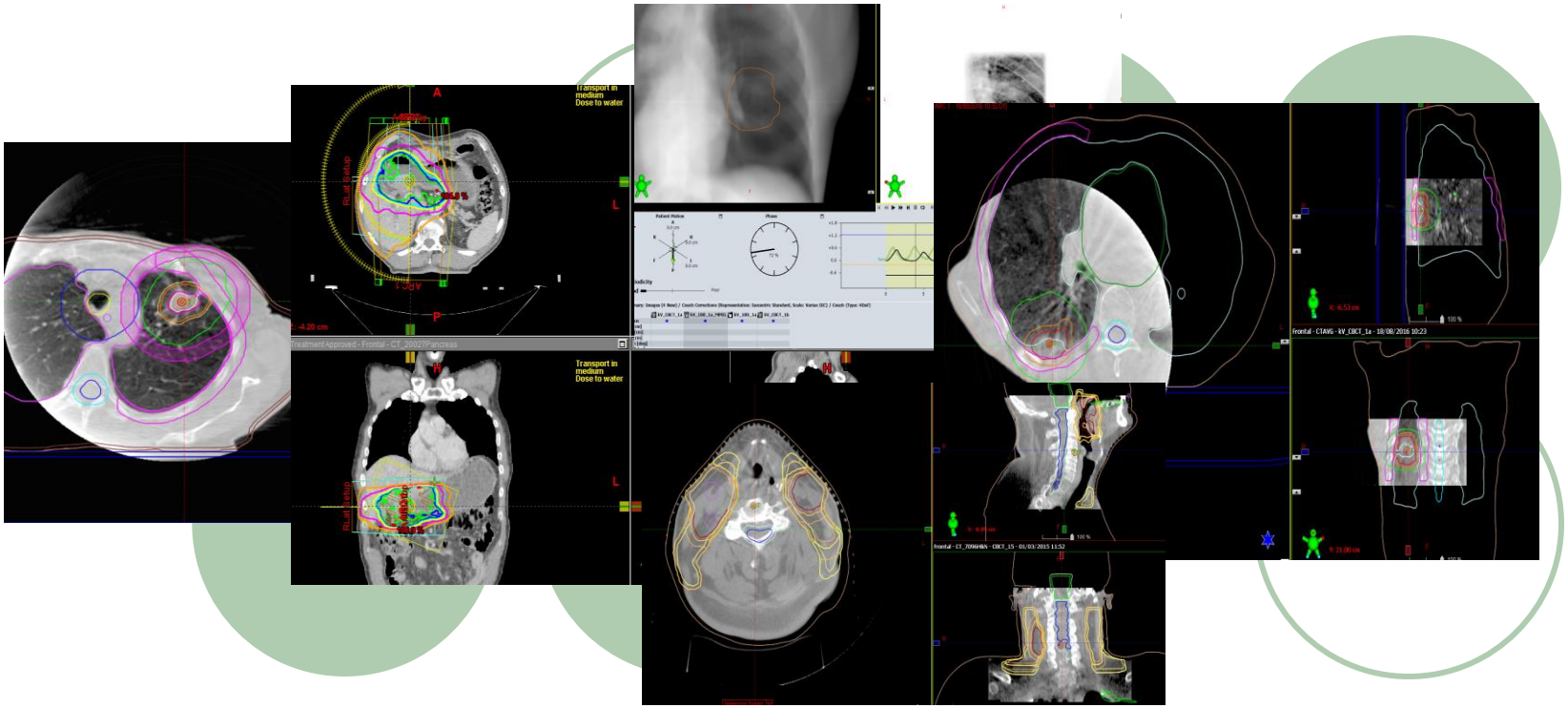
Integrating CBCT into Radiotherapy Verification Protocols



Experiences from a medium-sized Radiotherapy Centre

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Introduction

- Complexity in treatment techniques demands more precision in treatment verification (NRIG 2012)
- Routine 3D verification using Cone-Beam CT (CBCT) & KV planar images
- Allows for Adaptive Radiotherapy
- We will discuss the experiences of Advanced Practitioners at The Queen's Centre, Castle Hill Hospital in introducing and integrating CBCT into radiotherapy imaging protocols

Overview

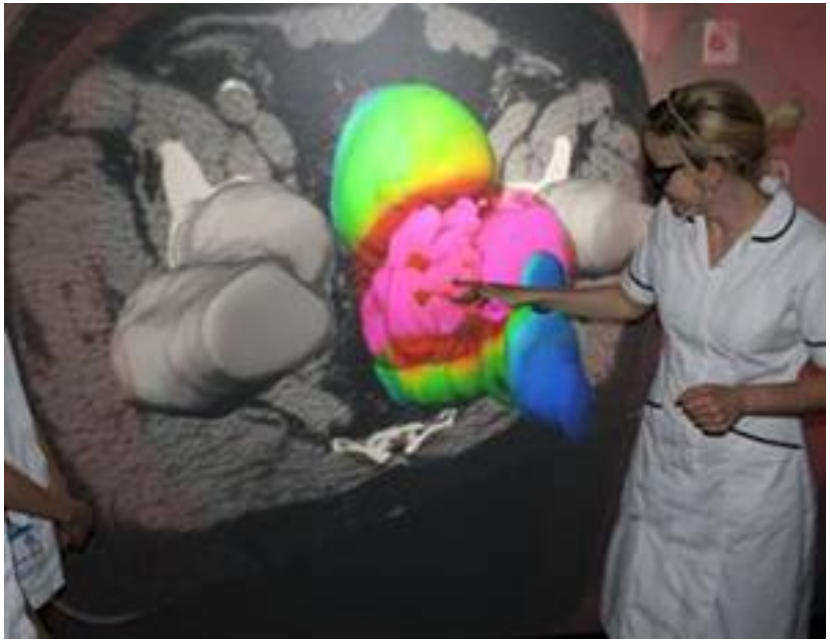
- Fully Varian equipped, with 6 Linacs
- 2 Philips widebore CT scanners
- Gulmay superficial unit, HDR Unit
- Papillion Contact radiotherapy
- Radiographer-led V-sim pathway
- Paperlight department
- Eclipse Planning system

Implementation

- Introduction of RapidArc/VMAT treatments meant greater need for accuracy in treatment positioning
- Imaging protocols were amended in-line with NRIG guidance (2012)
- Advanced Practitioners worked closely with Physicists to aid integration of CBCT
  - VMAT Prostate: Daily CBCT
  - VMAT Anal canal: Daily CBCT
  - VMAT Head and Neck: Dual mode of imaging Fractions 1-3 and weekly Paired Planar KV imaging
  - VMAT Brain : Daily KV planar
  - VMAT Gynae: Daily CBCT

Implementation

- Need more experience with 3D CT anatomy
- 3D anatomy training online
- VERT medium for anatomy training with the aid of Clinicians
- Dual mode of image verification (KV planar with weekly CBCT)
- Image auditing
- Image focus groups (later integrated into site-specific MDTs)

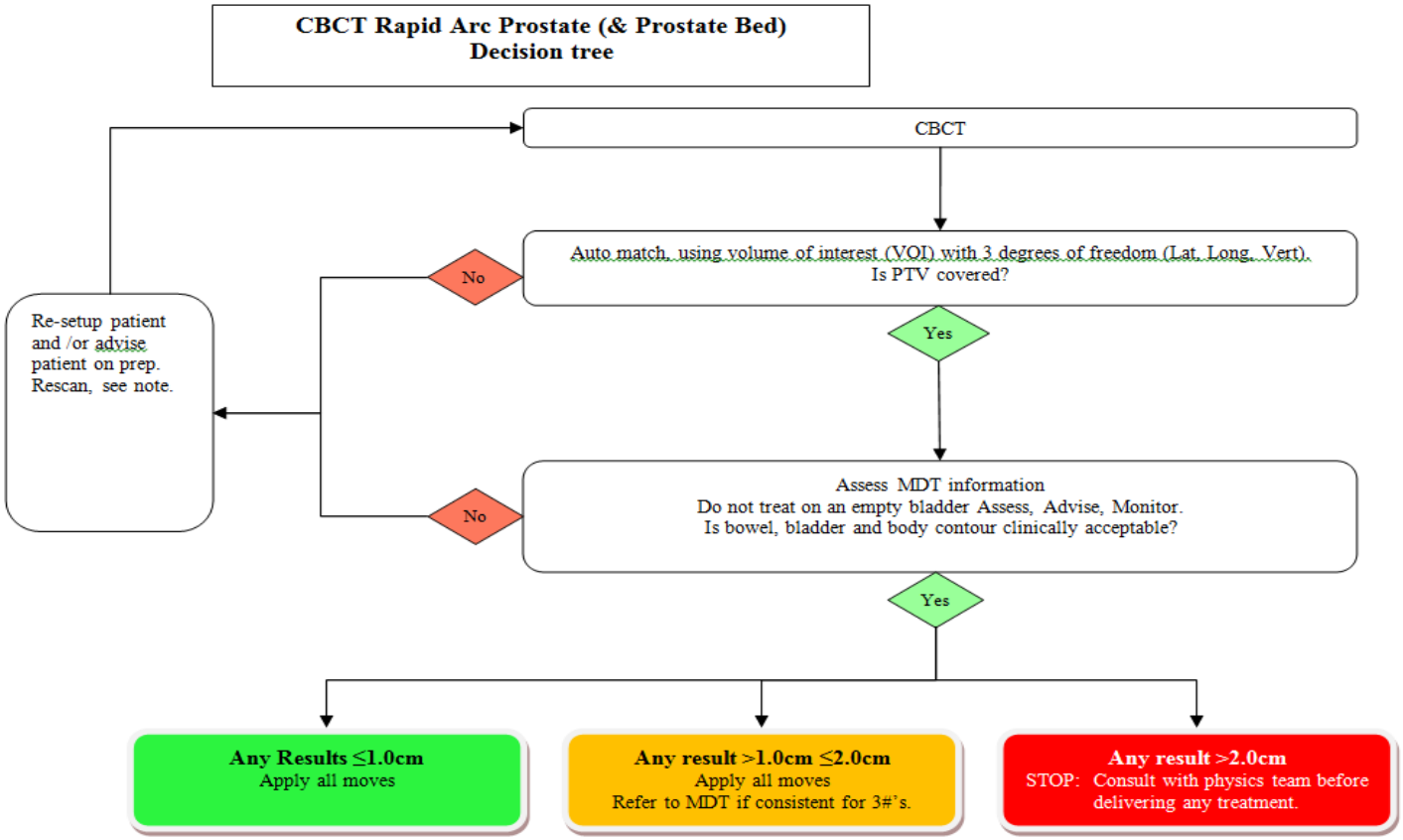


Implementation

- Initially CBCTs more time consuming
- 20mins appointments then down to 10mins
- Limitation of CBCT length (16cm)
- Integrate KV imaging for portions of the PTV where bony anatomy was deemed an adequate surrogate for PTV position

Implementation

- Advanced Practitioners produced Decision Trees for radiographers for each site

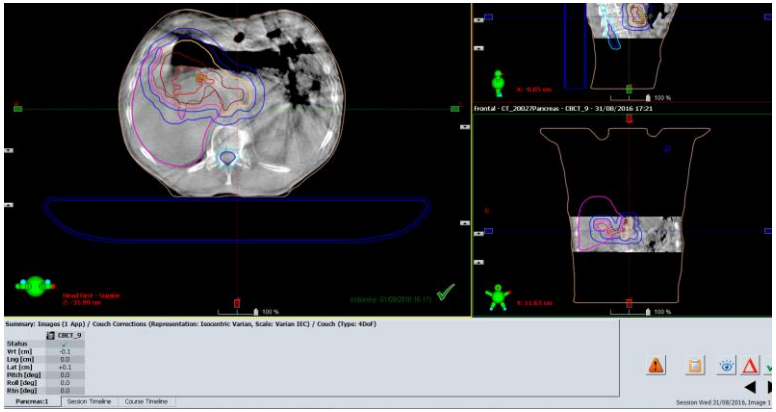


Implementation

- Decision Trees helped provide guidance:
  - Bony and Soft tissue matching
  - Provide tolerances
  - Aids on-line image interpretation and decision making eg. escalating to Advanced Practitioner, Physicist and/or Clinician
- Easily available via quality management system (Q-Pulse)

Implementation

- Offline image approval on VMAT patients
- Weekly multidisciplinary imaging meetings set up by anatomical site (initially Urology and Head and Neck)
- Clinicians, Physicists and all Radiographers invited to attend
- Activity Tasks on Aria used to flag images for discussion and Offline analysis
- Large projection screens
- Helped to hone decision trees and build experience and confidence



Implementation

- Common issues for discussion included:
  - Bladder filling/Bowel issues/Gas
  - Contour change
  - Tumour shrinkage
  - Rotational issues
  - Systematic versus random errors
- Helped to identify patients requiring a replan or rescan
- Identify patterns to promote adaptive radiotherapy
- Decision tree evolution and build experience and confidence

Further Development

- More RapidArc treatments integrating CBCT
  - VMAT Lung (with respiratory gating)
  - SABR Lung (with active respiratory gating & fluoroscopic tumour motion verification)
  - VMAT Anal Canal
  - VMAT Oesophagus
  - VMAT Pancreas
- 4D PET
- Individual adaptive imaging strategy…
- Optimisation of CBCTs according to Automated Exposure control (AEC)on planning CT..

Summary

- Challenges in CBCT include preparatory and continuous work needed to implement the service
- Advanced Practitioners focus on keeping decision trees up-to-date and ensuring training for students, new and current staff are fit for purpose
- Advanced Practitioners can use skills mix and expertise to help to make integration of CBCT into daily practice smoother benefit patients and radiographers

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