

Developing a CTKUB scanning protocol based on vertebral landmarks to minimise patient radiation dose

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Background

- CT-KUB scans are crucial in **investigating urinary pathology**.
- Scans can expose patients to radiation.
- Patients are often young, requiring multiple scans over their lifetime.
- Commencing scans at or below the T10 vertebra has been shown to be a viable strategy to **minimise radiation exposure**^(1,2).
- At our trust, there was **no formal guidance** prior to this audit.
 - Radiographers often used the right hemidiaphragm as the superior limit of the scan.

Aims & Standards

- Aims:**
 - To assess the **extent of overscanning** in CT-KUB investigations in our department
 - To **develop a standardised protocol** for CT-KUB scanning which would:
 - Minimise the proportion of scans that are excessively overscanned (*i.e.* >15% of the scan length was above the superior border of the kidneys).
 - Minimise the average overscan length.
 - Prevent underscanning (*i.e.* incompletely scanning the complete urinary tract in CT-KUB investigations).
- Standards:**
 - 100%** of scans should include the **whole of the urinary tract**.
 - The **percentage overscan length** should be <15% in any individual investigation.
 - The **upper limit of ≥80%** of scans should be at **T10 or below**.

Methods

- Data was collected from three hospitals (Heartlands, Good Hope, and Solihull Hospitals).
- IMPAX software was used to collect all data.
- Microsoft Excel was used for analysis.
- Dataset:**
 - Total scan length
 - Length of scan above the diaphragm
 - Length of scan above the kidney
 - Percentage overscan length** (=length of scan above the kidneys/total length of scan)
 - Vertebral level** at which scan commenced
- Phase 1:** All CT-KUBs in the first 21 days of January 2019 (n = 89) were assessed.
- Phase 2** (post-protocol change): all CT-KUBs in the first 21 days of May 2019 (n = 105) were assessed.

Results (Phase 1)

- n = 89 scans
- One scan was underscanned
- 82 scans (**92%**) were **excessively overscanned**
- Mean overscan length percentage = 28%** (SD = 8.6%) (See Figure 1 for distribution)
- 53 scans (59%) started at T10 or below.
- The percentage overscan length decreased as scans began at successively inferior vertebral levels (see Fig. 2)

Initial Action Plan

- Findings were presented at the local audit meeting.
- New standardized protocol distributed to radiographers (See Figure 3).
- Midpoint of T11 was used as a new landmark.

Results (Phase 2)

- n = 105 scans
- All scans included the superior renal pole
- 37 scans (**35%**) were excessively overscanned
- Mean overscan length percentage = 11%** (SD = 4.4%) (See Figure 1)
- 88 scans (**84%**) started at T10 or below.
- Percentage overscan length again decreased at lower levels (Fig. 2)

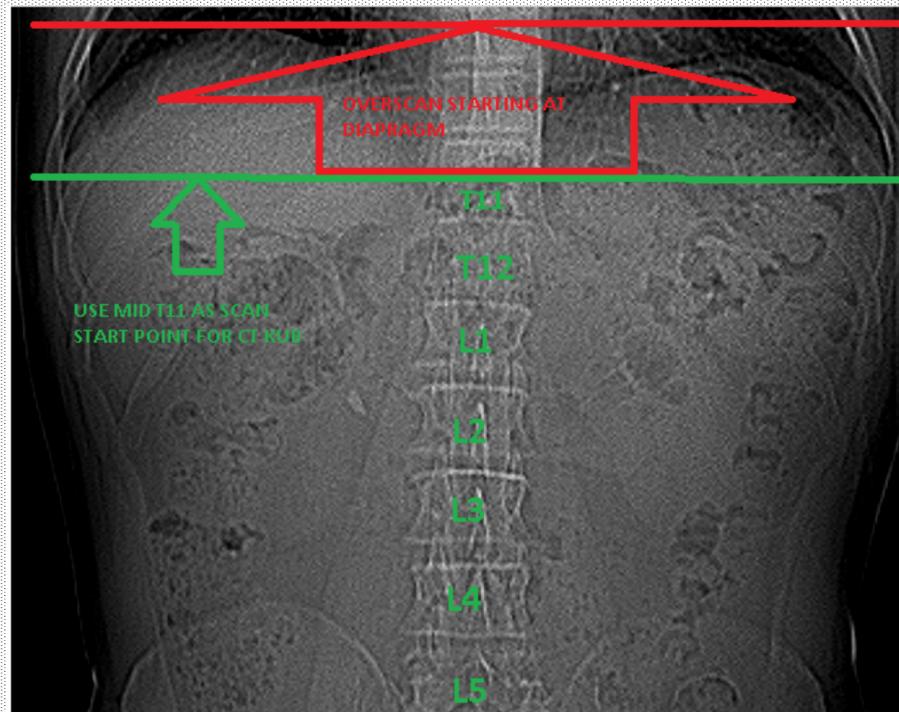


Figure 3: The vertebral-landmark protocol developed following the initial cycle of the audit. Staff were advised of the following:

- This protocol was only for focussed CTKUB scans
- The midpoint of T11 should be used. This is best identified using the articulation of the thoracic vertebrae with the ribs.

Figure 1: The distribution of percentage overscan length before and after protocol change

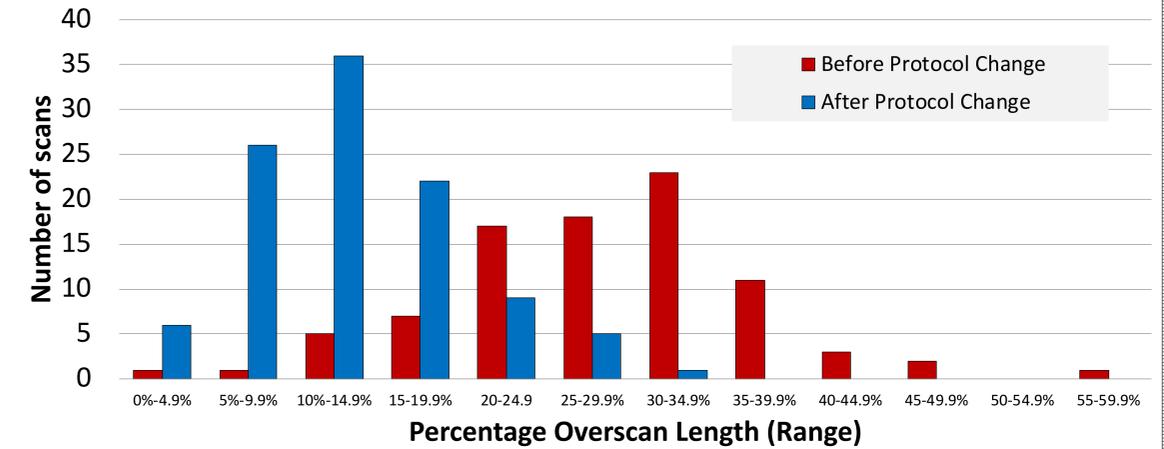
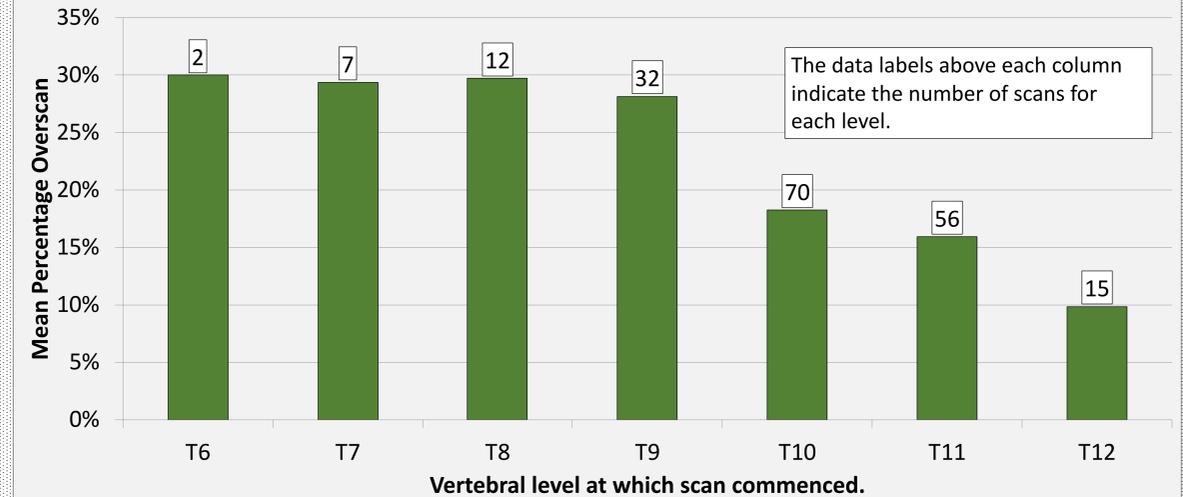


Figure 3: The relationship between vertebral level and percentage overscan length in scans from both phases.



Summary of findings

- The T11 vertebra can effectively be used to set landmarks for CT-KUB scanning
- Successfully introduced a new protocol and met aims:
 - The **incidence of excessive overscan** decreased by **61.8%**
 - Mean overscan length** decreased by **62.4 %**
 - Underscan** was eliminated
- However, underscanning remains common (affecting 35% of cases)

Further Steps

- Ongoing education** is required:
 - Repeat email with updated guidance
 - Face-to-face training
 - Presentation at audit meeting
 - Targeted training
- Reaudit** in November 2019

References

- Maguire J, Gray K. Computed tomography (CT) kidneys, ureters and bladder (KUB) – how low can you go? Clinical Radiology. 2015; 70:S12.
- Cavenagh T, Seager M, Barber J. A dynamic approach to CT-KUB scanning field - an audit to minimise radiation dose. European Congress of Radiology 2017; 2017.