CT KUB vs Intravenous Urography. Effective dose comparison and scanner protocol optimisation in the investigation of renal colic - a teaching hospital experience.

Poster No.: C-0525
Congress: ECR 2011
Type: Educational Exhibit
Authors: C. Sayer, J. Richenberg; Brighton/UK
Keywords: Acute, Safety, Audit and standards, CT, Conventional radiography, Urinary Tract / Bladder, Kidney, Abdomen
DOI: 10.1594/ecr2011/C-0525

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Learning objectives

- Learn about current practice and radiation dose of CT KUB and IVU at BSUH.
- Highlight if effective dose is too high and modify practice.
- Collect data from CT KUB studies that have been acquired using dose optimisation protocols.
- Compare the results and learn how to effectively reduce dose to patients.

Background

Introduction: The use of CT scanning is now considered to be the imaging modality of choice in the investigation of renal colic. It is more sensitive and specific than IVU in calculi detection, rapid, does not use contrast and allows other pathologies to be seen. However there is concern over the radiation dose imparted to the patient [1].

Imaging findings OR Procedure details

Procedure: The mean effective (HE) dose for 158 prone unenhanced CT KUB studies (performed over a 3 month period) was calculated retrospectively using standardised CTdosimetry effective dose software. This was compared with results from a local audit of IVU procedures and published results in the literature for varying scanning protocols (Table 1). The CT scanning protocols in use were then modified (see comparison tables below) and data was collected for 200 prone unenhanced CT KUB scans. The mean effective doses across differing scanners using differing protocols was compared and analysed.

Results: The initial study demonstrated that Trust wide (using 4 different CT scanners) there was a fivefold increase in mean effective dose from CT KUB compared with a standard 3 film IVU (4.9 mSv vs 0.9mSv). The results from the follow-up study using a revised scanner protocol showed a significant reduction in mean effective dose for all the CT scanners in use (7.6 mSv vs 4.0 mSv $p = <0.05$).

<table>
<thead>
<tr>
<th>Original Scanner Protocols</th>
<th>kV</th>
<th>mA</th>
<th>Slice thickness/collimation</th>
<th>Pitch</th>
<th>Mean HE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanner Model</td>
<td>kV</td>
<td>mA</td>
<td>Slice thickness/collimation</td>
<td>Pitch</td>
<td>Mean HE</td>
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<tr>
<td>Lightspeed 4 slice</td>
<td>120</td>
<td>10-250</td>
<td>5mm (20 mm detected)</td>
<td>1.35</td>
<td>6.6</td>
</tr>
<tr>
<td>Lightspeed 32 slice</td>
<td>120</td>
<td>10-700</td>
<td>1.25mm (20 mm detected)</td>
<td>1.375</td>
<td>7.8</td>
</tr>
<tr>
<td>Lightspeed 64 slice</td>
<td>120</td>
<td>10-650</td>
<td>0.625mm (40mm detected)</td>
<td>1.375</td>
<td>9.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Revised scanner protocols</th>
<th>kV</th>
<th>mA</th>
<th>Slice thickness/collimation</th>
<th>Pitch</th>
<th>Mean HE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightspeed 4 slice</td>
<td>80</td>
<td>10-250</td>
<td>5mm (20 mm detected)</td>
<td>1.35</td>
<td>3.2</td>
</tr>
<tr>
<td>Lightspeed 32 slice</td>
<td>120</td>
<td>20-150</td>
<td>5mm (40 mm detected)</td>
<td>1.375</td>
<td>4.6</td>
</tr>
<tr>
<td>Lightspeed 64 slice</td>
<td>120</td>
<td>20-150</td>
<td>5mm (40mm detected)</td>
<td>1.375</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**Conclusion**

**Discussion:** Careful audit of scanner protocols and dose allowed a significant disparity between CT KUB and 3 film IVU to be recognised. Carefully considered changes in the scanning protocols used across 4 scanners for the investigation of renal colic led to significant reduction in patient dose. These differences compare well with data published in the literature [2-7] resulting a reduction in relative risk from stochastic events. The results highlight that more modern multi-slice scanners impart a significantly higher dose of radiation to the patient if the protocols are not carefully chosen, this was backed up by substantial data from a single slice non-spiral scanner included in the first data set but subsequently not included in the study due to decommission (mean effective dose 2.9 mSv (n=91) vs 7.6 mSv (n=66) p = <0.05).

**Conclusion/Recommendation:** By following the audit cycle and changes in scanner protocols highlighted by this study other units can achieved significant reductions in mean DLP and effective dose from CT investigation of renal colic. The study highlights that further work is needed to achieve a dose reduction that compares to 3 film IVU
investigation, however, the increased diagnostic and differential yield from CT goes a long way to justifying its role in modern practice.

**Personal Information**

Dr C Sayer MBBS (Hons) BA (Hons) - Speciality Registrar in Clinical Radiology. Brighton and Sussex Universities Hospitals Trust, UK.

**References**

References:


