Background

- Computerized tomography (CT) was invented in the early 1970s.
- 71.7 million CT scans were performed in 2007.1
- 600,000 head and abdominal CT scans are performed annually for children <15 years old.2
- It is projected that 500 of these individuals will die from cancer attributable to this irradiation.2

Objective

To determine whether or not a novel CT imaging protocol could produce similar diagnostic capability as compared to conventional CT scanning while minimizing radiation exposure for a given body part.

Methods

Previously an ultra low-dose CT (ULD-CT) protocol was developed to identify articular penetration of the knee joint.3–5 A novel low-dose CT protocol was developed by altering multiple parameters and used to prospectively assess fracture patients. Ten orthopaedic fracture surgeons evaluated de-identified images for diagnosis, management, and image quality. The total radiation dose for each imaging type was determined and recorded.

Results

- Ultra low-dose CT scanning resulted in an estimated effective dose (ED) 14x lower than that of conventional CT (C-CT) scanning.
- Mean ED for ULD-CT vs. C-CT was 0.03 milliSieverts (mSv) vs. 0.43 mSv (p<.005).
- Sensitivity (Sn), Specificity (Sp), Positive Predictive Value (PPV) and Negative Predictive Value (NPV) of ULD-CT scan to detect fractures was 0.98, 0.89, 0.98, and 0.89 with 2 occult fractures excluded.
- Reliability statistics between ULD-CT and C-CT assessments were comparable reflecting that the diagnostic value of CT technology does not decay with an ULD protocol.

Conclusions

1. Our ULD-CT protocol appears to represent a significant advancement in the refinement of an ubiquitous diagnostic tool.
2. This ultra low-dose protocol appears to provide for high fidelity images in appropriately selected patients, with an improved safety profile over conventional CT.
3. By employing dose reduction strategies as demonstrated here, orthopaedic surgeons can address public concerns over radiation exposure in their medical care.

References