Radiation Exposure to Patient and Surgeon During the Use Of C-Arm Fluoroscopy; Comparison of Standard and Mini C-Arm
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Abstract:

Background:

The use of C-arm fluoroscopy for routine orthopaedic imaging has become commonplace in the operating room, outpatient clinic, and emergency department. Consequently, the increasing reliance on fluoroscopy has led many orthopaedists to raise concerns about the amount of radiation they are exposed to, even when consistently observing recommended safety guidelines. The mini C-arm fluoroscope has gained popularity in recent years due to its practicality, cost effectiveness, and exposure reducing capabilities. However, few studies have quantified exposure during mini C-arm imaging of a body part that is larger than a hand or wrist. Moreover, few studies have compared exposure during large C-arm fluoroscopy with mini C-arm fluoroscopy. The purpose of this study was to create a series of dose mapping scenarios in order to measure radiation exposure to the patient and surgeon during the use of large and mini C-arm fluoroscopy.

Methods:

A standard OEC 9800 C-arm and an OEC MINI6600 C-arm were used to image a cadaveric ankle specimen, which was suspended on an adjustable platform. Film badge dosimeters were mounted at thirteen specific positions and angulations to detect direct and scatter radiation. Testing was conducted in various dose mapping “scenarios” which altered the proximity of the cadaveric specimen relative to the radiation source. We thus attempted to capture a range of exposure data from a best-case to a worst-case scenario, as one may encounter in a true procedural setting.

Results:

At all configurations tested, measurable exposure from the large C-arm was considerably higher than the mini C-arm. Exposure to both patient and surgeon was notably amplified when the specimen was positioned closer to the X-ray source. Exposure levels were consistently higher during ankle fluoroscopy than have been previously recorded during hand or wrist imaging. Potential exposure to the surgeon was detectable and of concern.

Conclusions:

Radiation exposure to the patient and surgeon is dependant on the tissue density and the shape of the extremity that is imaged. Elevated exposure levels can be expected when imaging larger body parts or when the extremity is positioned closer to the X-ray source. When it is possible to satisfactorily image an extremity using the mini C-arm, it should be used over its large C-arm counterpart. Recommended safety precautions should always be followed when using large and mini C-arm fluoroscopes.

Clinical Relevance:
The orthopaedist should exercise caution when using large or mini C-arm units and consistently follow established radiation safety guidelines when imaging.