

Ultra Low-Dose CT Scan (REDUCTION Protocol) for Extremity Fracture Evaluation Is as Safe and Effective as Conventional CT: An Evaluation of Quality Outcomes

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Purpose: With an estimated 29,000 future cancers possibly related to CT performed on an annual basis in the United States, there exists a need to properly identify the correct dosing of radiation necessary for diagnosis of extremity fractures. A Reduced Effective Dose Using Computed Tomography In Orthopaedic Injury (REDUCTION) protocol for fracture evaluation was previously demonstrated to yield equivalent diagnostic information to conventional CT scanning. This study seeks to assess clinical and hospital quality outcomes of patients receiving this imaging protocol.

Methods: After IRB approval, a retrospective chart review was conducted for consecutive patients receiving the REDUCTION protocol, beginning in August 2014 until present. 31 patients who received this protocol for traumatic fracture evaluation and had surgery for their fracture were compared to a comparable cohort of 40 patients who previously received conventional CT scanning and underwent fracture surgery at our academic medical center. Estimated effective radiation doses were calculated and compared using Digital Imaging and Communications in Medicine (DICOM) information from all included studies. Patient outcomes included time to union, complications, 30-day readmission, reoperation, and length of stay. Univariate and multivariate analyses were conducted to identify significant differences between cohorts (significance designated as $P < 0.05$).

Results: Patient characteristics between cohorts were not significantly different with respect to injury types, mechanism, age, gender, laterality, body mass index, and comorbidities. Mean clinical follow-up was 8.4 months. Mean estimated effective dose for all REDUCTION scans was 0.18 mSv as compared to 1.55 mSv for the conventional CT cohort ($P = 0.026$). Outcomes including time to union, complications, readmission, reoperation, and length of stay were not significantly different between groups (Table 1).

CT Scan Protocol	REDUCTION N=31	CONVENTIONAL N=40	P value
Average Time to Union (weeks)	13 ± 4	14 ± 4	0.32
Complications	3 (9.7%)	5 (12.5%)	0.09
Readmission (30 day)	1 (3.2%)	1 (2.5%)	0.52
Reoperation	2 (6.5%)	4 (10.0%)	0.11
Length of Stay (days)	3.8 + 2.7	4.5 + 3.3	0.15

Conclusion: The REDUCTION protocol represents an ultra low-dose CT scan developed for minimizing radiation exposure to patients presenting with traumatic fractures. This protocol resulted in an approximate ninefold reduction in radiation exposure. No difference in clinical or hospital quality outcomes was detected between patients who received

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.

this protocol as compared to those receiving automated dose CT scans. The REDUCTION protocol is a safe and effective method of performing CT scans for extremity fractures and should become the standard of care for CT scans of extremity fractures.