

Benefit of weight-bearing CT - what have we learned from more than 8,000 scans at a foot and ankle center

Martinus Richter, MD, PhD, Francois Lintz, MD, FEBOT, Alexej Barg, MD, Arne Burssens, MD

Category: Other

Keywords: Weight-bearing CT (WBCT), Radiation Dose, Time Spent, Cost Effectiveness

Introduction/Purpose: Weight-bearing CT (WBCT) has been proven to allow for more precise and valid measurement of bone position than conventional weight-bearing radiographs (R) and conventional CT without weight-bearing (CT). Time spent for image acquisition has been shown to be lower for WBCT than for R and CT2. Radiation dose for WBCT has been shown to be lower for WBCT than for CT. A WBCT device (PedCAT, Curvebeam, Warrington, PA, USA) had been brought on line July 1, 2013 in the first author's foot and ankle department. The purpose of this study was to assess the benefit of using WBCT instead of R and/or CT in a foot and ankle center regarding time spent for image acquisition, radiation dose, disturbances, and cost effectiveness.

Methods: All patients who obtained WBCT July 1, 2013 until December 31, 2017 were included in the study. Age, sex and primary pathology were analyzed. The time spent for image acquisition (T) was calculated based on an analysis of a previous study as follows: R (bilateral feet dorsoplantar and lateral, metatarsal head skyline view), 902 seconds; CT (bilateral feet and ankle), 415 seconds; WBCT (bilateral), 207 seconds. Radiation dose (RD) per patient was calculated based on previous phantom measurements as follows: R, 1.4 uSv; CT, 25 uSv; WBCT 4.2 uSv. For analysis of cost effectiveness device cost, reimbursement and working time cost of radiology technicians were taken into consideration within the local circumstances. All parameters were compared between the time period using WBCT (yearly average) with the parameters from 2012, i.e. before availability of WBCT.

Results: 8,129 WBCT scans were obtained in 3,874 patients (3,874 (48%) preoperatively, 4,255 (52%) follow-up; mean age, 52.2; 39% male). Primary pathologies were forefoot deformities (n=728 (19%) and ankle osteoarthritis/cartilage defect (n=412 (11%)). 1,804 WBCT scans were obtained on average yearly, and 10 CTs (WBCT group). In 2012, 1,750 R and 250 CTs were obtained (R(+CT) group). Yearly RD was 4.3 uSv for WBCT group and 5.0 uSv for R(+CT) group (difference 0.6 uSv decrease with WBCT 13%, p<0.01). Yearly T was 105 hours in total (3.5 minutes per patient) for WBCT group and 961 hours in total (16.0 minutes per patient) for R(+CT) group (difference, 752.0 hours, decrease with WBCT, 78%, p<0.01). Yearly profit was 34,300 Euro for WBCT group, -846 Euro for R(+CT) group.

Conclusion: 8,129 WBCT scans in 3,874 patients as substitution of R(+CT) over a 4.5 year period at a foot and ankle center resulted in 13% decreased RD (minus 0.7 uSv on average per patient). Yearly T decreased 752 hours (78%) in total (12.5 minutes per patient). Yearly financial profit increased 35,000 Euro in total (19 Euro per patient). RD decreased despite higher radiation dose for WBCT than for R alone, based on substitution of a high number of CTs by WBCT. Other centers with low usage of CT might not decrease RD by substituting R alone by WBCT.