

Best Practice: Radiation Dose Optimization in Interventional Cardiology



“How can Toshiba help me optimize radiation dose exposure during interventional procedures?”

INTRODUCTION

Physicians at Englewood Hospital and Medical Center are leveraging Toshiba's Infinix™ Elite angiography system to optimize patient care in minimizing the amounts of radiation exposure delivered to their patients and staff. **“Toshiba unique technologies empower us to utilize very low radiation exposure levels,”** says Joseph De Gregorio, MD, chief of invasive cardiology at Englewood Hospital and Medical Center.

METHODS

Several technologies are offered on Toshiba's Infinix systems for dose management:

- **Industry leading dose rates:** No other system comes close to providing as much flexibility with nine variable frame rates (1, 2, 3, 5, 7.5, 10, 15, 20, 30) and four dose modes (low, middle, normal, high), which are standard on every Infinix system. Customizable default settings and tableside selection enable

optimization throughout the interventional procedure.

- **Live Zoom:** Increasing magnification modes increases the demand for higher radiation doses from imaging systems. With Toshiba's live zoom technology, magnification modes are provided via electronic zoom in both fluoroscopy and digital acquisition modes *without* requesting a higher radiation output from the system. This could result in significant radiation dose savings.
- **Dose Tracking System (DTS):** Real-time patient skin dose estimates are provided in an easy-to-interpret color representation on realistic patient graphics, providing added confidence during the interventional procedure.
- **AIP/SNRF:** Advanced Image Processing (AIP) with Super Noise Reduction Filter (SNRF) provides unmatched image quality and enables lower dose rate imaging. AIP enhances visibility by increasing image contrast, enhancing small object detail and reducing halation from lung fields. SNRF reduces

Table 1. Comparison of radiation dose metrics on 18 patients with published data.

	Fluoroscopy Time (min)	Number of digital “cine” acquisitions	Reference Air Kerma (mGy)	Peak Skin Dose (mGy)
Englewood	2.2	6.2	120	80
NEXT Survey ⁴ [Diagnostic Cardiac Cath]	50th percentile: 2.9	10th percentile: 7	10th percentile: 270	Not Available

total noise power by up to 90 percent while maintaining sharp spatial and temporal resolution.¹ In concert, these unique technologies combine to provide image quality improvements greater than 200 percent.² This has resulted in demonstrated reduction to both patient and staff radiation dose levels by more than 50 percent with utilization of lower frame rates and more fluoroscopy as compared to higher dose digital “cine” acquisitions.³

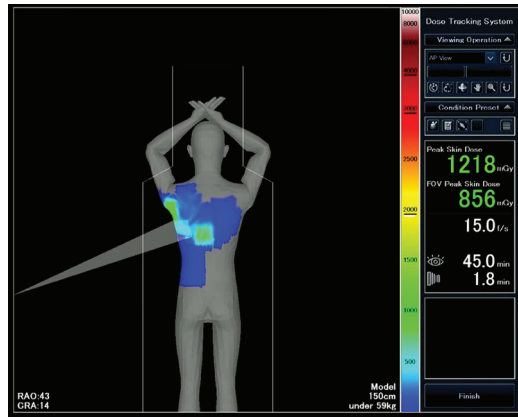


Figure 2. DTS color representation.

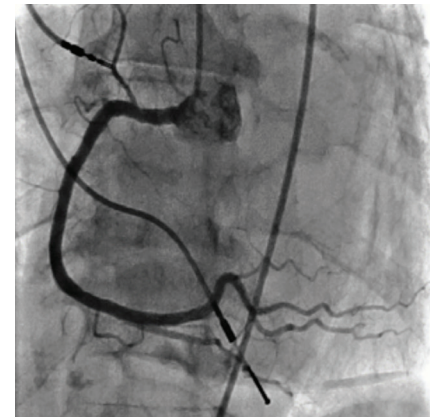
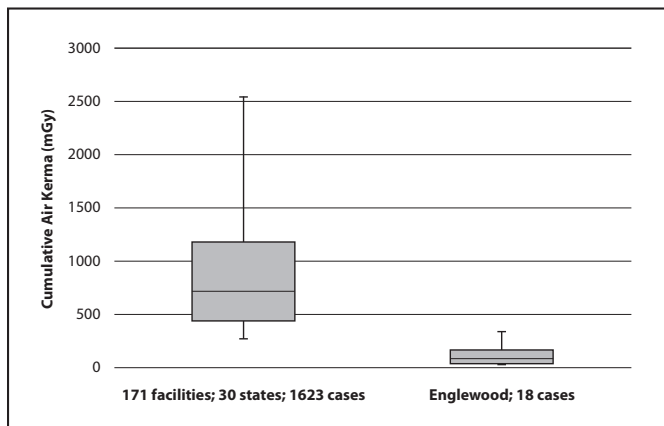


Figure 3. Representative Angiographic Coronary Image

- Spot Fluoroscopy:** Asymmetric and acentric collimation enables tighter collimation nearly anywhere within the field of view. Fusion with the last image hold (LIH) provides anatomical context. Next generation automatic exposure rate control (AERC) algorithm compensates for reduced x-ray scatter.

Over the last several years, there has been a trend to adapt to lower temporal resolution in using lower frame rates in order to reduce the radiation dose rates. Standard practice has shifted from historical utilization of 30 frames per second (fps) or more to now most adult cath labs utilizing 15 or even 10 fps. Pushing the trend even further, the system at Englewood Hospital and Medical Center was defaulted to 7.5 fps for both fluoroscopy and digital “cine” acquisition.

Figure 1. Cumulative Air Kerma comparison.



Live zoom with a 1.2 magnification factor was also employed as a lower dose alternative versus standard magnification modes. In addition, fluoro record is incorporated into the standard practice, replacing the need for higher dose digital acquisitions for interventions as well as groin shots.

RESULTS

Comparing facility patient radiation dose metrics on 18 consecutive patients (mean BMI of 29.4) with published data from a recent survey of over 150 facilities across 30 states⁴ provides early evidence that low dose practices are having a big impact. Both the number of digital “cine” acquisitions and cumulative reference air kerma values were well below the tenth percentile (Table 1). Figure 1 presents box plots of the cumulative air kerma values from the published data and this study. Figure 2 shows a representative image capture from the DTS display, and Figure 3 shows a representative angiographic coronary artery image.

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