Attachable Radiation Reduction Extension Support Sheath (ARRESS) to Reduce Radiation Exposure for Endovascular Specialists

Objective:
This study quantitatively compared physician radiation exposure during antegrade femoral artery access and leg intervention with ARRESS versus current procedure standard without ARRESS. The ARRESS is a malleable attachable external extension support sheath, comprised of a universal distal connection hub with sheath intermediary and proximal hemostasis valve with side-arm tubing and a three-way stopcock.

Methods:
Seven endovascular specialists (3 vascular surgeons, 2 interventional radiologists and 2 interventional nephrologists) participated in the study. A swine model was selected and antegrade femoral artery access was performed bilaterally along with balloon angioplasty of a tibial vessel, followed by balloon angioplasty and stent deployment in the swine equivalent of the superficial femoral artery. All procedures were performed both with and without ARRESS following a standard sequence. NanoDot™ Optically Stimulated Luminescent dosimeters were placed on the proximal phalanx of the right and left middle fingers prior to gloving. Furthermore, a standard Luxel +® dosimeter and a NanoDot™ were placed on the outside of the lead apron on the collar area. The radiation doses to the extremities were calculated based on the middle finger NanoDot™ measurements. Whole body radiation doses were calculated based on combined readings from both the NanoDot™ and the Luxel +® dosimeters from the collar area. The average radiation doses to the extremities and to the whole body are reported in a) total radiation dose received (mrem) and b) radiation dose normalized by the Dose Area Product (DAP); the normalized dose value minimizes confounding factors like vessel vasospasm present prior to use of a device leading to difficult placement and increased need for fluoroscopic imaging.

Results:
Table 1 summarizes findings showing that use of ARRESS results in 1) Reduction in average measured extremity radiation dose, and 2) Reduction in average normalized extremity radiation dose. Calculated reductions were 27% and 24%, respectively. Table 2 summarizes findings showing that use of ARRESS results in 1) Reduction in average measured whole body radiation dose, and 2) Reduction in average normalized whole body radiation dose. Calculated reductions were 15% and 18%, respectively. Although not significant, small sample size suggests trending benefit.

Conclusion:
Quantitative analyses of extremity and whole body radiation exposure during standard endovascular procedures identify a beneficial trend of decreased physician radiation exposure when using ARRESS compared to standard practice. Larger studies are required to validate these findings.

Table 1. Average Extremity Dose

	Average Nanodot Dosimeter Reading (mrem)	Average NanoDot Reading Normalized by DAP [mrem/(rad-cm2)]
Without ARRESS	15.2	0.3
With ARRESS	11.1	0.23
% Reduction	27%	24%
p-value	0.21	0.27

Table 2. Average Whole Body Dose

	Average Nanodot Dosimeter Reading (mrem)	Average NanoDot Reading Normalized by DAP [mrem/(rad-cm2)]
Without ARRESS	5.2	0.103
With ARRESS	4.4	0.085
% Reduction	15%	18%
p-value	0.16	0.26