Improved Physician Ergonomics and Fatigue Reduction using the Attachable Radiation Reduction Extension Support Sheath (ARRESS) for Endovascular Procedures

Objective:

This study compared the ergonomic differences and physiologic effects on muscle fatigue and operator efficiency when using ARRESS compared to a standard introducer sheath for common endovascular procedures. The ARRESS is a malleable, attachable, external extension support sheath.

Methods:

Seven endovascular specialists 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. Ergonomic domains assessed included upper extremity muscle activation, muscle power generation and traveling distance. Muscle activity was measured using eight electromyography sensors attached bilaterally on four muscle groups: abductor pollicis brevis, flexor carpi radialis, trapezius, and latissimus dorsi. Accelerometers embedded in the electromyography sensors recorded the limb accelerations during the procedure. Total hand traveling distance during the procedure was calculated by integrating the acceleration curve from the hand accelerometer data. Data were presented for the right and left sides due to the role of the dominant versus supporting hand during the procedures.

Results:

Table 1 summarizes paired t-tests showing that use of ARRESS results in 1) Reduction in mean muscle activation, 2) Reduction in total muscle power generated, and 3) Reduction in total hand traveling distance. ARRESS improves ergonomic metrics 11-28% versus standard vascular access intervention.

Conclusion:

Use of ARRESS during standard endovascular procedures improves physician ergonomics and improves procedure proficiency through decreased muscle activation, required total power generated and intra-operative travel distance.

Improved Physician Ergonomics and Fatigue Reduction using the Attachable Radiation Reduction Extension Support Sheath (ARRESS) for Endovascular Procedures

Mean Muscle Activation (% of Maximum) – Right Groin Access			
Muscle	**Standard Sheath (mean +/- std)**	**ARRESS (mean +/- std)**	**p-value**
Right side	0.205 +/-0.065	0.178 +/- 0.056	0.004
Left side	0.272 +/- 0.076	0.236 +/- 0.072	0.003
Mean Muscle Activation (% of Maximum) – Left Groin Access			
Muscle	**Standard Sheath (mean +/- std)**	**ARRESS (mean +/- std)**	**p-value**
Right side	0.219 +/- 0.059	0.195 +/- 0.057	0.004
Left side	0.285 +/- 0.102	0.241 +/- 0.082	0.08
Total Power Generated (% of Maximum) – Right Groin Access			
Muscle	**Standard Sheath (mean +/- std)**	**ARRESS (mean +/- std)**	**p-value**
Right side	4.02 +/- 3.06	3.49 +/- 2.76	0.010
Left side	4.48 +/- 2.73	3.32 +/- 1.88	0.014
Total Power Generated (% of Maximum) – Left Groin Access			
Muscle	**Standard Sheath (mean +/- std)**	**ARRESS (mean +/- std)**	**p-value**
Right side	4.43 +/- 3.53	3.49 +/- 2.58	0.053
Left side	4.93 +/- 3.20	3.62 +/- 2.47	0.010
Total Traveling Distance (m) – Right Groin Access			
Hand	**Standard Sheath (mean +/- std)**	**ARRESS (mean +/- std)**	**p-value**
Right	974 +/- 465	741 +/- 321	0.048
Left	1003 +/- 447	753 +/- 309	0.027
Total Traveling Distance (m) – Left Groin Access			
Hand	**Standard Sheath (mean +/- std)**	**ARRESS (mean +/- std)**	**P-value**
Right	797 +/- 318	651 +/- 361	0.034
Left	793 +/- 386	633 +/- 307	0.043

Table 1