

Use of the Reamer/Irrigator/Aspirator During Intramedullary Nailing Decreases Carotid and Cranial Embolic Events

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Purpose: Reaming for and placement of intramedullary nails results in bone marrow and fat extravasating into the circulatory system. This may lead to fat emboli syndrome, multiple organ failure, and adult respiratory distress syndrome. Studies show varying results of increased intramedullary pressure and embolic phenomenon with reamed or unreamed nailing. The Reamer/Irrigator/Aspirator (RIA; DePuy Synthes, West Chester, PA) device has been shown to decrease intramedullary pressure during reaming. We hypothesized RIA would reduce the number of micro emboli (ME) detected in the carotid artery and brain compared with both reamed and unreamed nailing.

Methods: A large canine model was used. Each animal underwent either unreamed nailing (UR), reamed nailing (R), or RIA-reamed nailing (RIA) of bilateral femora. During reaming and nailing, the number and size of ME transiting the carotid were recorded by an ultrasonic embolus detector (EDAC; Luna Innovations, Roanoke, VA). The animals remained anesthetized 4 hours, then the brain was harvested for immunostaining (HSP70; hypoxia-inducible factor [HIF]-1 α) and measurement of micro-infarction volumes.

Results: Carotid ME were only detected during the reaming and nailing portions of each procedure. The total ME load passing through the carotid was 0.05 cc (UR), 0.04 cc (R), and 0.01 cc (RIA) (not statistically significant). The number and size of ME of the UR and R group were similar. However, the RIA group had significantly smaller numbers of larger emboli, >200 microns; $P = 0.03$. Pathologic examination of the brain confirmed the presence of particulate emboli (photo center), as well as upregulation of stress-related-proteins, HSP70 and HIF-1 α , detected in all groups.

Conclusion: Further study is required to determine the mechanisms by which ME pass into the arterial system during reaming. RIA decreased ME compared with traditional reamed and unreamed nailing, suggesting intramedullary pressure and heat are important variables. These results may help explain subtle neurobehavioral symptoms commonly seen in patients undergoing intramedullary nailing procedures.

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- The FDA has not cleared this drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an "off label" use). For full information, refer to page 600.