Hemorrhage Control and Resuscitation

Conventional Endovascular Acute Hemorrhage Control by Common Balloon Occlusion Methodologies May be Inaccurate and Should Account for Age and Anatomic Location

Endovascular balloon occlusion is used to control non-compressible hemorrhage. Recently an imaging-free endovascular navigation technique, which uses specific body landmarks to predict the correct arterial location for insertion, has become increasingly popular because of its potential to reduce imaging requirements for endovascular acute hemorrhage control. However, due to variation in body curvature this mapping could potentially lead to inaccurate placement. Additionally, optimal parameters for balloon occlusion pressures and volumes to control bleeding without causing artery injury are not clearly defined.

Researchers at the University of Nebraska Medical Center (Omaha, NE) address these issues in a study to accurately quantify and analyze the layout of arteries in the torso of trauma populations to validate the utility of the arterial "roadmaps" used in this recently developed navigation technique to determine burst pressure ranges in the most common balloon occlusion locations for endovascular hemorrhage control in the abdominal and thoracic aorta.

The study analyzed CT angiograms (CTAs) from 86 trauma patients to build a 3D-computer model of the aorta and branching arteries. Conventional suprasternal notch lengths taking belly curvature into consideration were determined. The results suggest conventional suprasternal notch lengths may substantially overestimate endovascular device insertion distances with increasing belly curvature, which may result in misplacement of devices into the aortic arch branches or into the heart. Use of xiphoid process distances can substantially reduce the frequency of misplacements in all body sizes; however, even when the precise length of the catheter is known, misplacements can still occur in older subjects with tortuous anatomy.

To define optimal occlusion pressures, aortic occlusion was performed in various locations within 53 donor aortas under flow pressure. The study revealed that safe balloon occlusion pressures and volumes depend on age and anatomic location.

Accurate characterization of vascular location, distribution, and burst pressure ranges could drastically improve survival of vascular trauma victims and inform the development of next generation endovascular hemorrhage control devices to improve safety and use.

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