9. DETERMINATION OF OPTIMAL DEPLOYMENT STRATEGY FOR REBOA IN PATIENTS WITH NON-COMPRESSIBLE HEMORRHAGE BELOW THE DIAPHRAGM

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Background: Non-compressible truncal hemorrhage (NCTH) is the leading cause of preventable death after trauma. Resuscitative endovascular balloon occlusion of the aorta (REBOA) achieves temporary hemorrhage control, supporting cardiac and cerebral perfusion prior to definitive hemostasis. Aortic zone selection algorithms vary among institutions. We evaluated the efficacy of an algorithm for REBOA use.

Methods: Prospective, observational study conducted at 6 Level 1 Trauma Centers over 12-months. Inclusion criteria were age >15 years with evidence of infra-diaphragmatic NCTH needing emergent hemorrhage control within 60 minutes of ED arrival. An algorithm characterized by the results of Focused Assessment with Sonography in Trauma (FAST) and pelvic x-ray was assessed post-hoc for efficacy in a cohort of REBOA patients. Patients were excluded if there was no FAST, an indeterminate FAST, a positive cardiac FAST, or unknown primary bleeding source. Outcomes were assessed as to whether the algorithm was followed.

Results: Of the 8,166 patients screened. 78 patients had a REBOA placed. 21 patients were excluded, leaving 57 patients for analysis. The algorithm ensures REBOA deployment proximal to hemorrhage source to control bleeding in 98.2% of cases and accurately predicts the optimal REBOA zone in 78.9% of cases. If the algorithm was violated, bleeding was optimally controlled in only 43.8% (p=0.01). Of the 36 patients treated with a zone 1 REBOA, 4 should have had a zone 3 REBOA, according to the algorithm. Three (75.0%) died , 2 died from multiple organ failure (MOF) with a median time to death of 159 hours. 20 of 32 patients with an appropriately placed zone 1 REBOA had a mortality of 55.6% (p=0.62) with 75.0% dying from exsanguination with a median time to death of 1 hour. In 21 patients treated with a zone 3 REBOA, only 8 (38.0%) were appropriate per the algorithm. Mortality was 23.1% in patients with an inappropriate zone 3 REBOA and 25% in those with an appropriately placed zone 3 REBOA (p=0.92). All 3 dead patients with an inappropriate zone 3 REBOA died from exsanguination with a median time to death of 6 hours. 2 patients with an appropriate zone 3 REBOA died, one from TBI and the other due to unknown causes with a median time to death of 249 hours.

Conclusion: This algorithm, based on FAST exam and pelvic x-ray, ensures proximal hemorrhage control and accurately predicts the primary source of hemorrhage. A zone 3 REBOA should not be performed when a zone 1 is indicated by the algorithm as 100% of these patients exsanguinated which may have been prevented with zone 1 placement. The MOF, perhaps from visceral ischemia in patients with an inappropriate zone 1 REBOA, may have been prevented with zone 3 placement.

Aortic Zone I

Aortic Zone II

Aortic Zone III
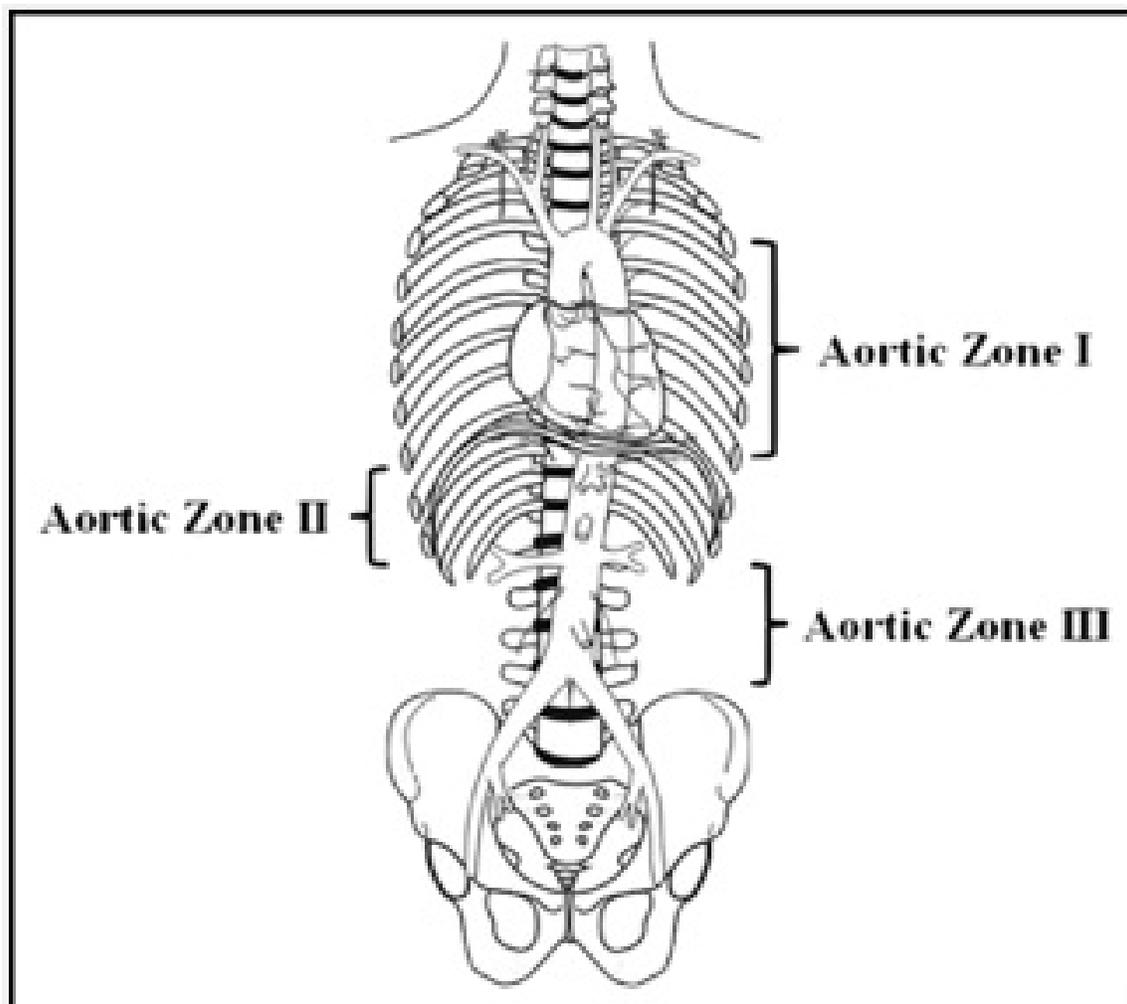
Algorithm
FAST (+) = Zone 1
FAST (-), Pelvis (+) = Zone 3
FAST (-), Pelvis (-) = Zone 1