was designed to investigate the utility of a pregnancy specific algorithm designed to help reduce the amount of CT pulmonary angiograms that were performed on pregnant patients. The study protocol involved an assessment using the 3 components of the YEARS algorithm: clinical signs of a DVT, hemoptysis, and pulmonary embolism (PE) presumed to be the most likely diagnosis-coupled with an elevated D-dimer.

This was a prospective, multicenter, international study that included pregnant women ages 18 and older that were evaluated for suspected PE. Exclusion criteria included anticoagulation within the last 24 hours, poor likelihood of follow up, contrast allergy, and less than 3 month life expectancy. All patients had a D-dimer drawn and were assessed on the above 3 YEARS criteria. If the patient had signs of a DVT they received 2 point compression ultrasonography. If the ultrasound was positive they were started on anticoagulation. If negative, the patients were then evaluated according to their d-dimer level. For those with at least one of the YEARS criteria, D-dimers greater than or equal to 500 ng/mL went on to be evaluated with CT pulmonary angiography with subsequent initiation of anti-coagulation if the study was positive. Those whose d-dimer was less than 500 ng/mL were considered ruled out for PE and anticoagulation was with held. For those patients meeting none of the YEARS criteria, the d-dimer threshold was 1000 ng/mL. Only those patients whose d-dimer was greater than or equal to 1000 ng/mL underwent CT pulmonary angiography. The primary outcome was to evaluate the incidence of symptomatic venous thromboembolism (VTE), confirmed by objective testing, at 3 months in those patients for whom anticoagulation was with held based on the study algorithm. The secondary outcome was to describe the proportion of patients in whom CT pulmonary angiography was not indicated in order to safely rule out PE.

Five hundred ten patients were enrolled, of which 12 met exclusion criteria. Of the 498 patients analyzed, 252 (51%) did not meet any YEARS criteria and 246 (49%) met one or more criteria. Forty-three (19%) had signs concerning for DVT and 3 (7%) of these patients had DVT confirmed with two-point compression ultrasonography of the affected leg. An additional 79 patients underwent compression ultrasonography without clinical signs of DVT, which were considered protocol deviations. One of these patients was diagnosed with a DVT and anti-coagulated. This patient also had an elevated d-dimer at 1480 ng/mL. Of the 494 remaining patients who did not have a confirmed DVT, the d-dimer level was below the minimum threshold in 195 (39%) and these were considered ruled out for PE. The rest of the patients (299, 61%) all received CT pulmonary angiography and 16 patients were diagnosed with a PE. Therefore, a total of 20 patients were diagnosed with PE (prevalence 4.0%; 95% CI, 2.6 to 6.1). At follow up, 1 patient had a confirmed DVT and 1 additional patient was lost to follow up. There were no confirmed PEs. The algorithm tended to be most efficient in early pregnancy in that 65% who began the study during the first trimester avoided CT pulmonary angiography as opposed to 32% who avoided chest imaging when they entered the study in their 3rd trimester.

The authors concluded that the pregnancy adapted YEARS algorithm was able to safely rule out PE and could potentially reduce the radiation exposure during pregnancy in 40% of cases.

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Comments: This study reveals a promising algorithm for the safe management of suspected PE in pregnant patients utilizing CT pulmonary angiography only in selected cases, with a negative predictive value of 98%. It provides physicians with a clinical decision rule where in the past there has not been one. However, as noted by the authors, a main limitation in the study is that the algorithm was only used in patients for whom there was a clear suspicion of PE. It is not intended to be used as a screening tool for pregnant women with non-specific chest symptoms. While the study had a large sample size and complete follow up, they were also limited by non-randomization and by protocol violations.

☐ ASSOCIATION BETWEEN ELEVATED MEAN ARTERIAL BLOOD PRESSURE AND NEUROLOGIC OUTCOME AFTER RESUSCITATION FROM CARDIAC ARREST: RESULTS FROM A MULTICENTER PROSPECTIVE COHORT STUDY.

Roberts BW, Kilgannon JH, Hunter BR, et al. *Crit Care Med.* 2019 Jan;47(1):93-100

For patients with return of spontaneous circulation (ROSC) after cardiac arrest, in-hospital mortality is greater than 50%. A large percentage of those survivors sustain neurologic disability. There is evidence that cerebrovascular autoregulation is disrupted after cardiac arrest and that mean arterial pressure (MAP) <70 mm Hg is associated with poor neurologic outcomes. At present, the blood pressure target that would optimize neurologic outcomes post ROSC is unknown.

This study tested for association between elevated MAP following ROSC and neurologic outcome. This was a preplanned prospective cohort study across six hospitals in the United States. The inclusion criteria were as follows: age greater than or equal to 18 years; cardiac arrest (defined as receiving CPR); ROSC greater than 20 minutes; unresponsive and on mechanical ventilation after ROSC; and intent to perform targeted temperature management (TTM). Exclusion criteria included persistent hypotension defined as MAP < 70 mmHg. For data collection, MAP was measured with a noninvasive blood pressure cuff immediately after ROSC and each hour for 6 hours post-ROSC. Sequential Organ Failure Assessment (SOFA) score was calculated to estimate severity of illness and vasopressor administration was measured. Blood pressure was dichotomized for the primary analysis - MAP between 70-90 mm Hg and MAP>90 mm Hg. The primary outcome was good neurologic function at the time of hospital discharge, defined as a modified Rankin Score (mRS) of 3 or less. Secondary outcomes were survival to hospital discharge and good early neurologic function.

Of the 280 patients who were enrolled, 11 patients were excluded leaving 269 subjects in the analysis. Mean MAP across the entire cohort was 95 mm Hg, with mean MAP of 101 mm Hg and 93 mm Hg for patients with and without good neurologic function, respectively. Compared with MAP of 70-90 mm Hg, MAP > 90 mm Hg was associated with increased survival to hospital discharge (28% vs 57%; absolute risk difference, 29%; 95% CI, 18–40%; p < 0.001). Among the survivors, there was a significant difference in percentage of patients with good neurologic function at hospital discharge between the MAP 70-90 mm Hg group and MAP > 90 mm Hg group (15% vs 42%, absolute risk difference =27%; 95% CI, 17–37%p < 0.001). After regression, a MAP > 90 mm Hg was found to be an independent predictor of good neurologic outcome at hospital discharge. The association between MAP > 90 mm Hg and good neurologic outcome was increased in patients with chronic hypertension, but the correlation did not vary with increasing vasopressor dose. Post-hoc analysis observed a 15% increase in the probability of good neurologic outcome with every additional hour of BP measurement with MAP > 90 mm Hg.

The authors conclude that an increase in duration of post-resuscitation MAP > 90 mm Hg is associated with good neurologic outcome, and that MAP >110 mm Hg had the strongest association. The correlation between MAP > 90 mm Hg and good neurologic outcome persisted in the subgroup analyses performed. The stronger association seen in patients with chronic hypertension may suggest that these patients have underlying cerebrovascular changes that require higher MAP to maintain adequate cerebral blood flow. Further research should be done to determine if targeting an elevated MAP or blood pressure will benefit patients.

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Comment: This study provides convincing evidence that MAP above 90 mm Hg after ROSC in cardiac arrest correlates with better neurologic outcome. In this study, the cohort with MAP 70-90 mm Hg (who sustained poorer neurologic outcomes) had longer duration of CPR than the cohort who maintained MAP > 90 mm Hg. Although the analysis was adjusted for CPR duration, this introduces the possibility that the cohort with MAP 70-90 mm Hg were sicker overall, and whether or not there is some underlying confounding variable that would explain the difference in outcomes. Randomizing patients to elevated MAP goals would be a promising next step to determine if this approach can improve neurologic outcomes post-ROSC.

☐ NATIONWIDE ANALYSIS OF RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA IN CIVILIAN TRAUMA.

Joseph B, Zeeshan M, Sakran JV, et al. *JAMA Surgery.* 2019 March 20. doi:10.1001/jamasurg.2019.0096

Patients with noncompressible torso hemorrhage are particularly challenging to resuscitate and often have poor outcomes. Resuscitative endovascular balloon occlusion of the aorta (REBOA) was originally used in combat more than 50 years ago, but it is now being studied in the civilian setting. Previous single-center studies of REBOA in emergency department resuscitation of trauma patients have shown conflicting results. The goal of this study was to evaluate the outcomes of patients who underwent REBOA placement for hemorrhage control after trauma.

This retrospective analysis used the national American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP) database to compare patients who received REBOA within 1 hour of arriving to the emergency department with patients who did not receive REBOA. Patients who received REBOA were matched to similar patients who did not receive REBOA using propensity score matching in a 1:2 ratio for demographics, vital signs, mechanism of injury, injury severity score (ISS), abbreviated injury scale score (AIS) for each body region, intraabdominal solid organ injuries by number and grades, pelvic fractures and lower extremity fractures and vascular injuries. All patients who received REBOA within one hour of arrival and were ≥ 18 years of age were included. Patients were excluded if they were dead on arrival, underwent resuscitative thoracotomy in the emergency department, were transferred, or had missing physiologic parameters. The primary outcomes of this study were mortality while in the emergency department (ED), at 24-hours, and after 24-hours. Secondary outcomes were transfusion requirements (at 4 hours and 24 hours), hospital length of stay (LOS), intensive care unit (ICU) LOS, and in-hospital complications including deep venous thrombosis, pulmonary embolism, myocardial infarction, stroke, unplanned additional surgeries, and lower limb amputation.

593, 818 patients from the ACS-TQIP were analyzed. When looking at all patients, patients who received REBOA were more likely to be younger, nonwhite, and male. They had lower mean systolic blood pressure (SBP), higher mean heart rate (HR), lower Glasgow Coma Score (GCS), higher median ISS score and more significant solid organ, bony, and vascular injuries. Out of the 593, 818 patients from the ACS-TQIP, 420 patients were matched (140 patients in the REBOA group; 280 patients in the no-REBOA group). There were no differences between physiologic parameters, ISS scores, or breakdown of injuries. The 24-hour mortality was significantly higher in the REBOA group compared to the no-REBOA group (37 [26.4%] vs 33 [11.8%]; $P = 0.01$), but there was no statistically significant difference in ED mortality or mortality after 24-hours between the groups. Concerning the secondary outcomes, the REBOA group had higher rates of acute kidney injury (15 [10.7%] vs 9 [3.2%]; $P = 0.02$) and lower limb amputations (5 [3.6%] vs 2 [0.7%]; $P = 0.04$) compared to the no-REBOA group. There was no significant difference in the amount of blood products required by each group. When comparing patients based on SBP, patients were placed in subsets based on having a SBP greater than 80 mm Hg or less than 80 mm Hg and both subgroups were associated with higher mortality with REBOA [(OR for mortality if SBP >80 mm Hg, 4.67; 95% CI, 1.35-8.42; $P = 0.03$), (OR for mortality if SBP < 80 mm Hg, 2.51; 95% CI,