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.

[David Hinckley, MD
Jerrilyn Jones, MD, MPH
University of Arkansas for Medical Sciences, Little Rock, AR]

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.

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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,

1.16-6.41; $P = 0.03$)]. For patients that underwent exploratory laparotomy, there was also an increase in mortality for the REBOA vs no-REBOA group (odds ratio, 2.12; 95% CI, 1.67-3.84; $P = 0.01$).

The authors of this study concluded that trauma patients who undergo REBOA placement have increased mortality compared to patients who do not have REBOA placed. They also concluded that REBOA placement is associated with increased risk of lower extremity amputation and acute kidney injury. The authors raised concerns about a lack of standardized indications for when REBOA placement is appropriate and clear protocols regarding duration of aortic occlusion. The authors also discussed the need for further research regarding outcomes based on what zone of the aorta the REBOA is placed. Limitations of this study include its retrospective nature, inability to determine responsiveness of the patient to resuscitation prior to REBOA placement, the small number of trauma centers which have and use REBOA which may skew the data, and the inability to account for potential confounders such as type and size of catheter, zone of placement, or duration of aortic occlusion.

[Laura Elizabeth Werline, MD
Amanda Young, MD
University of Arkansas for Medical Sciences, Little Rock, AR]

Comment: REBOA has recently gained a lot of attention as an option for hemorrhage control in severe trauma patients. Although this study did not support benefits in mortality, there is still a lot more to be learned regarding when and in which patients REBOA should be used. While trauma surgeons at academic institutions are the ones who primarily place REBOA currently, there is a possibility it may become a more widespread practice in the future if adequate indications and protocols are established and an appropriate subset of patients who benefit can be identified.