Expanding the trauma code to other causes of hemorrhagic shock — ruptured abdominal aortic aneurysms

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Summary

Expediting life-saving care for hemorrhagic shock through multi-disciplinary code protocols is a potential method to improve outcomes. Trauma codes have become standard of care at most tertiary care centres; however, it is unclear if similar protocols can improve delivery of care for other forms of hemorrhagic shock. We examined the feasibility of a code protocol for ruptured abdominal aortic aneurysms (RAAAs) by reviewing the literature and comparing patient outcomes for RAAA and trauma patients at our institution, where the latter have a well-established trauma code protocol. We show that, despite being similarly unstable, patients with RAAA experienced delays to care milestones compared with trauma patients, even when accounting for diagnostic delays. Combining these data with present understanding of factors implicated in RAAA survival, we propose that a "CodeAAA" protocol may fill an important gap in RAAA care and that further prospective studies examining the utility of such a code are warranted.

Ruptured abdominal aortic aneurysms (RAAAs) represent a surgical emergency with high mortality. New strategies for optimizing prompt delivery of care for RAAA are an important goal. In trauma surgery, implementation of a trauma code has been successful at streamlining diagnosis and treatment. The trauma code notifies all members of the team via overhead page and places the computed tomography (CT) scanner and operating room (OR) on standby. The goal is to clarify each team member's role and prioritize the care of the trauma patient in the emergency department (ED). Elsewhere, code protocols have been implemented to address other medical emergencies, such as ST-elevation myocardial infarction (STEMI), stroke and fetal distress, with a reported reduction in times to treatment. As coordinated, high-level care provided to trauma patients is facilitated by activating a trauma code protocol, it follows that this framework should be extended to conditions of similar acuity, such as RAAAs.

At our institution, traumas are managed using a code protocol, but RAAAs are not. Our centre is the regional vascular surgery referral centre for all eastern Ontario. Coordination of care for a suspected or known diagnosis of RAAA is managed with the standard ED triage model. In contrast, when a trauma code is called, the entire trauma team is notified by overhead page, and the CT scanner, OR and blood bank are placed on standby, often before patient arrival. When an RAAA presents, assessment, and thus definitive management, may be delayed because of the wait for an unreserved CT scanner or administrative delays in the ED. We believe a code protocol should be in place for conditions that have time-sensitive outcomes and for which management depends on the mobilization of multiple hospital resources; RAAA is a condition that satisfies these criteria. RAAA is an important differential diagnosis of abdominal pain in unstable patients and can be rapidly ruled out with point-of-care ultrasound. We also know that time to the OR is critical in ensuring survival of patients with RAAA based on clinical principles and retrospective data. Finally, the management of RAAA requires mobilization of a

large multidisciplinary team, including a vascular surgeon, anesthesiologist, the blood bank, radiologist and interventional radiologist, fluoroscopy technicians, the intensive care unit and OR personnel. This is particularly true in the endovascular era.

We examined the feasibility of a "CodeAAA" protocol at our institution by conducting a retrospective review of all trauma codes and RAAAs over a period of 2.5 years.[1] We showed that patients with traumas and RAAAs had similar hemodynamic vital signs and Canadian Triage and Acuity Scale (CTAS) scores, suggesting that both populations share similar acuity. However, patients with RAAAs overall experienced significant delays to physician assessment, even when accepted in transfer with a known diagnosis. Interestingly, the median time to OR for transferred patients with RAAAs was less than that for trauma patients; 97% of patients with RAAAs required urgent transfer to the OR compared with 20% of trauma patients. Thirty-day mortality was also higher for RAAAs, but the difference was not statistically significant. We believe these data highlight a potential shortcoming in the delivery of care for patients with RAAA that could be addressed by a "CodeAAA," especially considering that both patient populations appear to be equally hemodynamically unstable. The shorter time to OR for patients with RAAAs is likely because RAAAs require less preoperative resuscitation than traumas.

A "CodeAAA" protocol would allow for activation by an emergency physician, or vascular surgeon/senior trainee who has high suspicion of an RAAA either clinically or radiographically (including bedside ultrasound). An overhead page would notify vascular surgery, radiology and OR personnel. The CT scanner in the ED would be placed on standby, and the OR would be prepared for either open or endovascular AAA repair. To our knowledge, no studies published to date have directly examined the impact of a "CodeAAA"; however, there are data supporting its potential utility. A retrospective study reported an association between delays to the OR and poorer survival in patients with RAAA.[2] In addition, improved outcomes have been reported for RAAAs managed at academic centres, possibly because these institutions are more likely to have protocols for hemorrhagic shock in place.[3] Finally, another retrospective study reported a low mortality associated with RAAA after implementation of a multi-disciplinary endovascular aneurysm repair protocol.[4]

The main shortcomings of a "CodeAAA" are that it may not improve the timing of RAAA diagnosis and that there is potential for over-calling codes ("false-calls"). Indeed, RAAA can present subtly with normal vital signs; there is a reported misdiagnosis rate as high as 40%.[5] In our data set, the largest delay was from arrival to physician assessment in patients with RAAA without an admitting diagnosis. Despite this, we believe that a code protocol could expedite the diagnosis of RAAA by maintaining awareness among staff. The potential for RAAA false-calls can be accurately assessed only using a prospective study and will depend on each institution's criteria. Nonetheless, false-calls are an inherent feature we see with STEMIs and strokes, especially the latter, which carries a misdiagnosis rate above 25%.[6] Over time, the detection of RAAA will improve with the uptake of point of care ultrasound in the ED, and the rate of false-calls would be expected to decrease accordingly.

Conclusion

Taken together, the decision to adopt a code protocol for any cause of hemorrhagic shock rests on a critical appraisal of each institution's unique dynamics and patient populations. Here, we approached the possible considerations for RAAA from the perspective of a tertiary care centre. Our data document care delays for RAAAs and establish similar acuity to trauma code patients. A code protocol should be extended to RAAAs to prioritize care, mobilize an interdisciplinary team, minimize delays and maintain staff education, much as it has for trauma codes. Future prospective studies will be required to determine the effectiveness of a code protocol in improving outcomes of patients with RAAA. Given the importance of rapid diagnosis and prompt mobilization of a multidisciplinary team for definitive management of RAAA, the benefits afforded to trauma patients through the implementation of a code protocol should be shared with equally hemodynamically unstable surgical emergencies like RAAA.

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