

The Importance of Early Recognition in Cardiogenic Shock

Identifying cardiogenic shock during the “golden hours” to facilitate timely stabilization, treatment escalation, and access to advanced care.

By Rebecca Chester, MD, and Christopher G. Low, MD

In trauma surgery, the “golden hour” refers to a 60-minute window immediately after injury where medical intervention offers the highest chance of survival. First popularized in the 1970s, this concept led to the first medevac transport and the foundations of modern trauma care. The world of cardiology and cardiothoracic surgery is seeing a renaissance in cardiogenic shock (CS) management rooted in earlier recognition and hemodynamic stabilization. This concept is not unique in medicine and has extensive literature to support immediate interventions and regionalized care systems that have resulted in successful programs, such as trauma centers, ST-segment elevation myocardial infarction (STEMI) receiving centers, and the Surviving Sepsis Campaign. These concepts are now being applied to the world of CS more frequently.

The last decade has seen immense progress in the field of CS, including (1) a common language to classify CS (Society for Cardiovascular Angiography and Interventions [SCAI] SHOCK stages); (2) multiple modalities of mechanical circulatory support (MCS), including the first randomized controlled trial data showing improved survival; (3) precision management guided by invasive hemodynamics developed by the National Cardiogenic Shock Initiative (NCSI); and (4) the formation of regional CS care systems with community referral centers and receiving tertiary shock centers.¹ Although the care of CS has become significantly more sophisticated, patients do not benefit if they are not identified and given access to this care early, regardless of where and how they encounter the health care system. Thus, identification must

occur and be acted upon within hours or risk waiting until the patient reaches advanced stages of shock, which is associated with a sharp increase in mortality. If we cannot identify the patients in need, we cannot treat them, regardless of how much technology and systems of care have advanced.

THE GOLDEN HOURS OF CS

The “golden hours” of CS can be split into three key time frames. The first time frame is the first 6 hours, which is the median time to develop CS in the setting of acute myocardial infarction (AMI).² The second interval is the first 24 hours, where close monitoring is required to evaluate response to initial intervention, consider escalation of therapy, and identify late shock presentations.² The third time frame is beyond 24 hours after the initial presentation.² This period is characterized by developing an exit strategy, which could range from ongoing support and procedures to achieve recovery, consideration for durable ventricular assist devices or heart transplantation, or palliation.

The First 6 Hours

The first 6 hours often include early medical contacts who are critical in diagnosing, classifying, and stabilizing patients in CS. The first medical contact could include emergency medical services (EMS), the emergency department (ED), or the initial inpatient admission team. EMS has the important responsibility to stabilize patients, including securing the airway, providing advanced cardiac life support, and treating hypotension. They have a well-established role in diagnosing STEMI and directing patients to STEMI-receiving

centers.³ STEMI patients are at risk of progressing to CS, and studies have investigated scoring systems to assess risk of progression to CS.⁴ STEMI-receiving centers are controlled at the state and local EMS level and are ubiquitous across the nation. EMS is in a unique position to triage patients to be transported to specialized tertiary shock centers and facilitate rapid access to advanced resources. Unlike STEMI, shock centers are not ubiquitous across the nation, and few EMS systems are empowered to bypass community referral centers in favor of a tertiary shock center. Organization of regionalized systems of care involving EMS, community referral centers, and tertiary shock centers is important to offer communities coordinated high levels of care.

Another early medical contact with the health care system for patients is the ED. The initial evaluation and identification of CS in the ED can be difficult due to the differing phenotypes of CS and differences in their early presentation. AMI complicated by CS often presents with a clearer onset and care pathway that includes activation of the cardiac catheterization lab, revascularization, and invasive hemodynamic assessment. The ED provider has the additional opportunity to gather crucial data, such as point-of-care ultrasound (POCUS), serum lactic acid, and liver function tests to assess the degree of hypoperfusion in AMI patients.⁵ In chronic heart failure (HF) patients, the presentation of CS may be more subtle and can present with normotensive hypoperfusion at times.⁶ Completing a thorough evaluation with POCUS and lab studies for end-organ perfusion can lead to a diagnosis of shock where a hypoperfused state may otherwise not be recognized.

Once hypoperfusion is identified, the ED can initiate stabilization measures and communicate a more accurate description of a critically ill patient to the admitting services. These actions by an ED provider who is trained in early detection of CS can set the momentum for the urgency with which patients are evaluated on admission, the level of care they are admitted to, potential early transfer to a higher level of care, and the urgency with which procedures may be performed.⁷ Considering the demands of the ED, utilizing the electronic medical record (EMR) can help alert providers to a patient at risk of CS. The Surviving Sepsis Campaign used alert systems to trigger early resuscitation with an improvement in mortality from 46% to 30%.⁸ There has been great interest in developing similar EMR alert systems for CS with variable success, and this is an area of ongoing work.

In the first 6 hours of admission, the initial stabilization that has occurred is continuously reevaluated and ideally guided by invasive hemodynamics and serum lactic acid measurements.

Interpreting the initial response to therapy can be complex but guides consideration of escalation of MCS and, in community referral centers, reevaluation of transfer to a tertiary shock center.⁹ Having an experienced shock team can streamline complex decision-making to allow for rapid escalation of therapy, if required. There have been efforts to identify prehospitalization parameters to help predict CS patients who may progress to MCS.¹⁰ On the contrary, in a community referral center, there may be significant variation in knowledge and resources related to managing CS, which could lead to poor outcomes from delayed diagnosis, delayed access to device therapy for stabilization, and delayed recognition for need to transfer to a higher level of care. This highlights how critical initiatives like the NCSI, SCAI SHOCK Initiative, and SCAI Door-to-Lactate Clearance (DLC) Initiative are to educate a broader community on the importance of early recognition and treatment of CS.¹¹

The First 24 Hours

Once CS patients are identified, a complex, multidisciplinary team and a tremendous amount of logistics are required to implement immediate stabilization and intervention. Initial evaluation after diagnosis involves CS phenotyping and identifying the mechanism of shock (eg, AMI, structural shock, HF shock) to guide treatment, with the goal of restoring end-organ perfusion.⁷ This early evaluation may include an interventional cardiologist, critical care physician, cardiothoracic surgeon, and many additional staff, such as an echocardiographer, respiratory therapist, bedside nursing, and pharmacists. Decisions on early procedures may require mobilization of cardiac catheterization lab and operating room teams. A practical implication of early identification of shock and activation of the multidisciplinary team is the ability to plan allocation of resources to reduce delays in treatment.

The initial 24 hours after diagnosis of CS is also critical to reevaluating the initial stabilization strategy to ensure adequate response and consider escalation of MCS or durable advanced therapies. An important and widely available tool for monitoring trajectory of CS is DLC. Peak and persistently elevated lactic acid are well-established markers associated with increased mortality in critical illness. Moreover, lactic acid is widely available at nearly all centers and provides a readily available marker of CS trajectory. Lactate clearance, specifically within the first 24 hours of presentation, is associated with improved survival. The SCAI DLC Initiative calls for widespread adoption of routine lactic acid monitoring along with invasive hemodynamic assessment to

inform escalation and transfer decisions.¹¹ While there can be limitations in interpretation of lactic acid levels to determine tissue perfusion, the universal and simple nature of the test makes it an attractive strategy. The SCAI DLC Initiative creates a shared algorithm across hospitals of varying levels of shock care and can be used in a similar fashion across shock phenotypes.¹¹ It is particularly important that the entire regional care system has accessible tools that can simplify transfer decisions from referral centers to tertiary shock centers.

More Than 24 Hours

After the initial 24 hours, it is important for the multidisciplinary team to start considering available exit strategies and what interventions and evaluations are required to achieve that strategy. This may include revascularization in AMI or a structural procedure in structural shock to facilitate recovery to native heart function. It could also include evaluation for advanced HF therapies, such as durable ventricular assist devices or heart transplantation, which require involvement of specialized advanced HF teams. Exit strategies may also include palliative care services for patients who are not expected to survive. Early recognition of shock facilitates earlier determination of what resources are needed to care for a patient, thus saving time in mobilizing resources and making early decisions about transfer to tertiary shock centers.

CONCLUSION

CS carries a high mortality rate and, similar to other types of shock, can be dramatically improved by early recognition and systems of care that provide rapid treatment. CS is unique in that it has multiple phenotypes that can range from classic to subtle in their presentation, which makes education and protocolized care critical to identifying patients early and triaging them in the local regional care system. The initial presentation of CS is often encountered in the prehospital setting, ED, and regional referral centers, rather than in the tertiary advanced shock centers. Although tertiary centers have advanced resources, such as multiple MCS

devices and advanced HF programs, none of these technologies and therapies matter if patients arrive too sick to use these tools or never arrive at all. Emphasizing early diagnosis of CS in these different settings will improve patient access and increase the number of CS patients who receive timely lifesaving care. ■

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Rebecca Chester, MD

Assistant Professor of Clinical Medicine
Program Director, Interventional Cardiology
Honor Health ASU John Shufeldt School of Medicine
and Medical Engineering
Scottsdale, Arizona
rebecca.clark.chester@gmail.com
Disclosures: Speaker for Abiomed.

Christopher G. Low, MD

HonorHealth ASU John Shufeldt School of Medicine
and Medical Engineering
Scottsdale, Arizona
Disclosures: None.