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EDITORIAL:

Cardiac Arrest in the Operating Room: Reevaluating Advanced Cardiovascular Life Support

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The Advanced Cardiovascular Life Support (ACLS) guidelines have long stood as the global standard for resuscitation efforts, with a particular focus on sudden cardiac arrest and emergency interventions. Yet, as we shift our focus to the operating room, where an intricate and high-stakes ecosystem unfolds, the limitations of ACLS become evident. There are inherent shortfalls of ACLS when applied to the intraoperative environment, which highlights why specialized guidelines, such as the American Society of Anesthesiologists' (ASA) Perioperative Resuscitation and Life Support (PeRLS) certification, may offer a more contextually appropriate approach.

The origins of ACLS lie in managing out-of-hospital cardiac arrest and in-hospital emergencies where standard protocols can be universally applied. This standardized approach has provided a foundational framework that emphasizes early recognition of cardiac arrest, high-quality chest compressions, airway management, and the use of defibrillation and pharmacologic support.[1] However, its applicability begins to diminish when brought into the operating room, where the variables are more complex, and the interventions required are highly specific to the intraoperative context.

Intraoperative cardiac events often stem from unique etiologies distinct from those encountered in out-of-hospital or emergency department scenarios. While cardiac arrests outside the operating room may result from sudden arrhythmic events, arrests during surgery can be precipitated by catastrophic hemorrhage, embolic phenomena, or pharmacologic reactions such as malignant hyperthermia (MH) or local anesthetic systemic toxicity (LAST).[2] These perioperative emergencies necessitate immediate and precise interventions that go beyond the standard ACLS algorithm, which may be inadequate or even inappropriate for such situations.[2] For instance, while ACLS emphasizes early administration of epinephrine, in cases of LAST the dose is much smaller (≤ 1 mcg/kg) than typical doses for ACLS and must be accompanied by the administration of lipid emulsion therapy, an essential step

tain medications commonly used in resuscitation, such as calcium-channel blockers, beta blockers, and lidocaine, are contraindicated in this scenario, underscoring the critical importance of tailoring interventions specifically to the etiology of cardiac arrest in LAST.[5]

In addition to these medical challenges, intraoperative resuscitation is further complicated by the physical environment itself. The positioning of the patient, whether prone, lateral, or in steep Trendelenburg, can significantly affect the efficacy of chest compressions and defibrillation efforts.[6] Prone positioning, for example, can render traditional chest compressions impossible, and transitioning a patient to supine may be impractical or delay life-saving interventions.[7] Emerging research has shown that prone Cardiopulmonary Resuscitation (CPR) can be effective, but it requires modifications to technique and training that ACLS does not provide.[8] Additionally, repositioning these patients could result in fatal outcomes if surgical hemostasis is compromised, as repositioning would obstruct necessary surgical access needed to control bleeding.[7,9]

Moreover, ACLS guidelines do not take advantage of the advanced monitoring capabilities available in the operating room. Anesthesia providers depend on continuous monitoring and frequently have access to inva-

crucial for tailoring interventions and understanding the immediate response to treatment. ACLS, with its reliance on simplified measures like pulse checks and waveform capnography, fails to encompass the depth of data that anesthesia providers routinely utilize to make informed decisions during crises. These protocols are often designed with unwitnessed cardiac arrests in mind, which does not reflect the circumstances typically encountered in the perioperative environment.

The shortcomings of ACLS in these scenarios highlight the need for an approach tailored specifically to the intraoperative environment. The ASA's Perioperative Resuscitation and Life Support (PeRLS) certificate is a prime example of this needed shift. PeRLS was created to address perioperative emergencies by integrating ACLS principles with knowledge specific to anesthesia and surgical care. This program teaches practitioners to recognize and treat life-threatening conditions that can arise under anesthesia, using tools and strategies that are more applicable to the complexities of the operating room.[11] By emphasizing rapid identification of the underlying causes of cardiac instability, PeRLS training prepares clinicians for scenarios where ACLS is insufficient or

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Specialized Protocols Are Necessary to Address Perioperative Emergencies

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where adherence to it without adaptation could lead to suboptimal outcomes.

Similar to how neonatal resuscitation or trauma life support protocols adapt standard resuscitative measures to the specific needs of those populations, perioperative care requires a guideline that can adapt to the intricacies of surgical and anesthetic practice.[12-14] For instance, the Neonatal Resuscitation Program modifies traditional CPR techniques to account for the unique physiology of neonates.[13] Likewise, the European Resuscitation Council and other international bodies have tailored their guidelines to fit special circumstances like traumatic cardiac arrest and drowning, recognizing the limitations of applying one-size-fits-all protocols.[15]

The necessity for specialized training becomes evident when considering the stakes involved. Perioperative cardiac arrest, although rare, carries significant morbidity and mortality risks.[2] Rapid, precise management that integrates the nuances of anesthetic pharmacology, surgical factors, and patient positioning is essential for improving outcomes. PeRLS provides an answer to this challenge by offering a comprehensive approach that equips perioperative teams to respond swiftly with contextually relevant interventions.

The need for specialized guidelines is not an indictment of ACLS; rather, it acknowledges the inherent limitations of applying a generalized protocol in a highly specialized environment. Resuscitative efforts in the operating room should draw from ACLS where applicable but must go beyond its confines to incorporate anesthesiology's distinct needs and capabilities. This approach underscores the importance of training that prepares perioperative teams not only to recognize cardiac arrest but to do so within the context of surgical, pharmacologic, and positional realities that define their practice.

In conclusion, the ACLS guidelines serve as a fundamental template for cardiac arrest management, but their limitations in the intraoperative environment are evident. Emergencies such as MH, LAST, and significant surgical complications necessitate a flexible, informed approach that ACLS alone cannot provide. Programs like ASA's PeRLS exemplify the shift needed in the perioperative environment—one that builds on the foundation of ACLS while tailoring it to the high-stakes, variable environment of the operating room. Adapting resuscitative protocols to specific patient populations and scenarios will ultimately bridge the gap between standardized emergency care and the specialized needs of perioperative patients, ensuring that practitioners are equipped not just to respond, but to do so with precision and efficacy.

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