2020 in review

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Although the year 2020 will be remembered for the viral pandemic that so pervasively impacted our lives, it also featured a number of published articles that garnered considerable interest in the *Journal's* readership. As such, this year-in-review straddles a broad spectrum of critical care topics. Four exemplar articles, summarized below, range in content from the efficacy of extracorporeal support in patients with out-of-hospital cardiac arrests to the elucidation of optimal intensive care staffing strategies.^{1,2} The ongoing, unrelenting opioid epidemic continues to direct much-warranted attention to novel means of preventing opioid dependence, and we are reminded of the wanton devastation of addiction.³ In the same vein, the promotion of early extubation in the prevention of delirium underscores the importance of maintaining neurologic integrity in the context of critical care delivery.⁴

CENTRAL MESSAGE

This review highlights the articles on perioperative care that garnered the greatest interest over the course of the year.

THE OTHER EPIDEMIC

In recognition of the impact of opioid dependence in the United States and the role of cardiothoracic surgeons in the mitigation of the epidemic, the *Journal* highlights the work of Clement and colleagues.³ The authors observed that approximately 8% of patients undergoing coronary bypass graft surgery developed new persistent opioid use. Multivariable analysis identified female sex, anxiety, tobacco use, prior substance abuse, chronic obstructive pulmonary disease, living in the southern United States, and increased amount of prescribed opioids as each independently associated with new persistent opioid use. This use resulted in further downstream healthcare utilization, as indicated by re-admission rates and emergency department encounters. The

challenges of opioid misuse are considerable, and the findings provide an important and relevant message despite the limitations inherent in the Truven Health Marketscan Database. For instance, the database captures neither cardiac surgery-specific variables nor provider-level prescribing practices. Nevertheless, the authors' findings corroborate results from recent studies in the field that collectively highlight the risk of persistent opioid use following cardiothoracic surgery and the role of healthcare providers as targets for reducing the volume of opioids prescribed at discharge.^{5,6} Enhanced recovery post-cardiac surgery may offer an opportunity to reduce inpatient opioid use, which may in turn translate to postdischarge opioid reduction.⁷ Conscientious prescription practices along with enhanced pain management and education may further reduce opioid prescriptions without sacrificing patient satisfaction.

Key Message

This study adds to our understanding of the implications of opioid prescribing and highlights the importance of active opioid management after cardiac surgery. Each surgical team is encouraged to heed the work by Clement and colleagues, as well as other authors who have endorsed multimodal pain management to reduce excessive opioid prescriptions for cardiothoracic patients.

ARRESTING EVIDENCE

The ARREST (advanced reperfusion strategies for patients with out-of-hospital cardiac arrest and refractory

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ventricular fibrillation) Trial is a sui generis study comparing extracorporeal membrane oxygenation (ECMO)-facilitated resuscitation with standard advanced cardiac life support (ACLS) treatment in the management of out-of-hospital cardiac arrest (OHCA).¹ In this single-center, phase 2, randomized control trial performed in North America, ECMO-related resuscitation provided a 43% (6 of 14) survival rate, compared with 7% (1 of 15) for ACLS. In addition, there was a significantly improved survival rate in the early ECMO group at the 6-month follow-up. Patients who sustain OHCA historically have poor survival, and refractory cardiac arrest is the most time-sensitive emergency. Survival is diminished even further when combined with prolonged cardiopulmonary resuscitation. Out-of-hospital cardiac arrests are responsible for a significant proportion of morbidity and mortality globally, with an estimated 350,000 deaths annually in the United States alone.¹ The aging population and increasing prevailing obesity across all age groups portend an increased cardiac burden in the future. Approximately 60% to 80% of patients present with a shockable rhythm, typically ventricular fibrillation.¹ Almost all patients who undergo more than 40 minutes of cardiopulmonary resuscitation eventually die, mainly as a consequence of comorbid coronary artery disease that makes any resuscitative efforts useless.

Hospitalization is further complicated by consequent physical deconditioning and a prolonged intensive care unit (ICU) length of stay, typically averaging up to 21 days. Reassuringly, however, functional assessment scores tend to improve at 6 months. ECMO-facilitated resuscitation achieved multiple goals in the study cohort: improved perfusion, provided cardiopulmonary support, facilitated treatment, and served as a bridge to recovery in the face of multiorgan injury. Early implementation of extracorporeal support also facilitates advanced adjunctive therapies, such as angiography. Although promising, the trial nevertheless casts doubt on applicability to other healthcare systems. The cost of ECMO provision is high owing to the specialist nature and resource intensity required to provide the service. Such high-resource care may be acceptable in health systems with a large private infrastructure such as the United States, where there is also comparatively higher monetary reimbursement. Government-led, social insurance systems, such as the National Health Service in the United Kingdom, are unlikely to be as accommodating of the high costs and high mortality. In addition, the demands on scarce ICU resources also should be taken into consideration.

Key Message

The ARREST trial builds off previous cohort study literature on OHCA and provides insight into a potential option for managing cardiac arrest. Despite using a cohort

of only 30 patients, this study provides a glimpse into the future of ECMO-guided resuscitation.

STAFFING ISSUES

A previous meta-analysis suggested that intensivist staffing in medical and surgical ICUs is associated with reduced mortality.⁸ Indeed, some studies contend that intensivist staffing may exert a “dose effect,” and that overnight staffing might further improve outcomes. Randomized studies have reported no incremental benefit in medical and surgical ICUs, but these findings might not necessarily apply to cardiac surgical ICUs (CSICUs), given the unique acuity and complexity of these cases. Propensity-matched studies have reported reductions in ventilation time, length of stay, transfusions, postoperative complications, and CSICU readmissions following the transition to dedicated overnight resident coverage to 24/7 house ICU models.⁹ The study by Huard and colleagues² advanced previous work by leveraging a large dataset of 16,454 adult cardiac surgical patients over an 8-year duration. In a natural experiment, the care model was transitioned from a daytime intensive model with in-house trainees overnight to a 24/7 in-house intensive staffing. Using a propensity-matched analysis of 8348 patients, the authors stratified the cohort into low-risk (<5%) and high-risk ($\geq 5\%$) EuroSCORE II groups. The authors reported no difference in clinical or resource utilization outcomes in the low-risk group; nevertheless, in patients with a EuroSCORE II $\geq 5\%$, the change in the ICU staffing model to include an overnight intensivist model was associated with significant reductions in CSICU mortality (2.1% vs 1.4%), CSICU readmission (2.3% vs 3.5%), duration of mechanical ventilation (5.8 hours vs 4.3 hours), incidence of cardiac arrest (1.3% vs 0.7%), and use of renal replacement therapy (2.3% vs 1.7%). The results of a regression analysis evaluating temporal trends over time suggested that the changes were associated with the staffing model. The overnight intensivist group was associated with a higher risk of reintubation (2.6% vs 1.1%), which may reflect shorter intubation times, as well as a higher risk of delirium (14.8% vs 11.8%), which may, in turn, reflect better screening and recognition that has evolved over time.

However, as the authors acknowledge, their study is observational, and the effect of unmeasured medical, surgical, or temporal confounders cannot be excluded. Recent surveys suggest that approximately one-half of the existing CSICUs in the United States use an open-care model, and one-third do not use in-house providers after hours.¹⁰ Thus, it is plausible that cardiac surgical outcomes may be improved in a shared-care model with postoperative CSICU 24/7 staffing by in-house intensivists. As such, a transition to overnight staffing with intensivists has the potential to improve patient outcomes. Although none of the aforementioned studies can fully elucidate all the changes underpinning the reduction in complications and mortality,

it stands to reason that the dedicated and continuous presence of an intensive care specialist, in conjunction with daily input of the attending surgeon, may allow for more effective recognition and intervention for early hemodynamic aberrations that might otherwise lead to complications and potential cardiac arrest.^{11,12}

Key Message

Although a prospective study likely would provide more rigorous insight into the most optimal model, the authors provide compelling evidence that a shared-care model including surgeons and in-house intensivists is associated with improved patient outcomes in patients with moderate to high cardiac surgical risk.

EARLIER RECOVERY AFTER BYPASS

Moran Muller and colleagues⁴ provide intriguing, thought-provoking insight into coronary artery bypass grafting (CABG) and the broad implications regarding protocol-driven practice, early recovery following cardiac surgery, and the expeditious restoration of natural physiology.⁴ Their retrospective review included 2561 patients who had undergone isolated CABG in a single institution. The authors evaluated the time to extubation and the impact on the incidence of delirium, stratifying time to extubation as within the operating room (OR) (0 hours), “early” (1-12 hours) post-CABG, and “late” (12-24 hours) post-CABG. The final cohort comprised 2223 patients in the early extubation cohort and 338 in the late extubation cohort. The authors are to be commended for extubating 36% of the patients (920 of 2561) in the OR.

The study highlights that the ICU routinely used standardized data elements for confusion assessment methods to adjudicate ICU delirium (CAM-ICU), facilitating routine care and evaluation. The authors reported that the proportion of CAM-ICU screened delirium events increased with delays in extubation. Similarly, the incidence of major adverse events (MAEs) increased with increasing extubation time. These events included onset of dialysis, pneumonia, sepsis, myocardial infarction, stroke, death, and a composite outcome of these events. From a broad perspective, the MAE rate was roughly 3- to 5-fold higher in the patients with later extubation times. Furthermore, the rate of reintubation increased markedly with late extubation compared with early extubation. Age, history of prior stroke, history of prior myocardial infarction, ejection fraction, urgency of operative intervention, and early/late extubation were each significantly associated with increased delirium in multivariable logistic regression analysis. Establishing an impetus for early extubation and fast-tracking patients decreased the incidence of adverse events in the vast majority of patients; undoubtedly, however, a significant impact of early extubation is predicated on a fast-tracking protocol that has been refined over 20 years.

Although there is variation among providers, a common mindset with a patient-focused approach to protocolized management with clear goals leads to early extubation. Careful attention should be given to intraoperative events explicitly designed to facilitate early extubation, such as minimizing narcotic and benzodiazepine use, reliance on ketamine or propofol induction, maintenance of normothermia, blood conservation, and transitioning to spontaneous breathing as soon as possible following chest closure.

The goals were facilitated by the use of a standardized checklist. Standardized data elements were used prospectively, which increased the validity and accuracy of the data in this large study. Nevertheless, it is a single-institution retrospective experience, with the risk of unmeasured confounding given its observational design. However, the large sample size of CABG patients provides in-depth insight and represents one of the largest experiences of early OR extubation in cardiac surgery. Delirium was identified in 14% of patients and was associated with prolonged length of stay, long-term disability, cognitive impairment, and death. The incidence of delirium increased markedly after 12 hours of ventilation.

Key message

Early recovery and fast-track cardiac surgery protocols are pivotal in facilitating an optimum positive outcome. This is true regardless of patient and procedure complexity, and protocolized care pathways facilitate greater consistency and minimize unintentional variations in quality.

CONCLUSIONS

An unintentional common theme evident in this compendium of articles is the challenge to dogma and current care practices. The collective narrative challenges, for instance, the traditional mandatory reliance on opioids for management of perioperative discomfort. There is budding support for new treatment algorithms that use mechanical circulatory support to improve traditionally abysmal OHCA outcomes. Modifying traditional physician staffing patterns in CSICUs and using “ultra-fast tracking” further suggest a break with the status quo. Indeed, recovery may begin with the preoperative decision to extubate all eligible patients in the OR. Admittedly, each of these studies will require further investigation. Nevertheless, a new mindset may be just the prescription required by cardiac surgery teams to best apply lessons learned during this past year to kick off a postpandemic era of contemporary perioperative cardiac surgery care.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Perioperative Management: Recent Articles From AATS Journals

JTCVS: Does the full-time presence of an intensivist lead to better outcomes in the cardiac surgical intensive care unit? *Huard P, Kalavrouziotis D, Lipes J, Simon M, Tardif MA, Blackburn S, Langevin S, Sia YT, Mohammadi S.* J Thorac Cardiovasc Surg. 2020;159(4):1363-1375.

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Marketscan United States Regions
■ South ■ Northeast
■ West ■ North Central

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