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President's Message

Times They Are a Changin'... Take 2

In August of 2019, my SCA President's Message was titled "The Times They Are a Changin'" and focused on a future vision and new initiatives which I was hoping to achieve during my term. The title of this message was derived from Bob Dylan's famous lyrics:

Come gather 'round people, wherever you roam
And admit that the waters around you have grown
And accept it that soon you'll be drenched to the bone
If your time to you is worth saving
Then you better start swimmin' or you'll sink like a stone
For the times they are a-changin'

At the time, little did I appreciate how prophetic the title of my message would become. Today, we find ourselves immersed in one the most extraordinary challenges that we have ever confronted in the modern era—a significant risk to our physical, emotional, and social well-being as a species. I have been astounded by the extremes of the human response to this COVID-19 pandemic, from vices including greed manifesting as hoarding of food and even toiletries to exceptional acts of compassion and kindness exemplified by the virtues of heroism demonstrated by healthcare professionals and so many other essential providers and enablers who have risked their own safety for the protection and welfare of others.

As physicians specializing in the relatively wide spectrum of anesthesiology, perioperative, and pain medicine, we now find ourselves often focused daily caring for critically ill patients either directly as intensivists or under the supervision of our colleagues in a critical care setting. Our casual lexicon has become dominated with terms and acronyms previously rarely mentioned as well as newer ones—donning and doffing, powered air-purifying respirator hoods (PAPR), N95 masks, PPE. Our focus has shifted to include struggles to obtain equipment to care for our patients

and PPE just to protect ourselves, as well as healthcare economics, political struggles involved in maintaining fiscal stability, and even significant ethical dilemmas and the risk of moral injury including consideration for crisis standards of care. When the world reveled during this past New Year's holiday, who would have ever thought we would be vulnerable to these unprecedent liabilities only a couple of months later.

The times they certainly are a changin'. It is not unreasonable to expect that certain ways we interact with one another professionally, personally, and socially may remain as permanent fixtures in our culture. In our efforts to come together by staying apart, we have become more proficient in communicating and perhaps educating ourselves differently with remote platforms including Zoom, GoToMeeting and Teams. In fact, on Saturday, April 4, SCA hosted a live educational webinar produced by the leadership of the International Committee and SCA Management in a very brief period of time, entitled "COVID-19 Challenges for the Cardiovascular and Cardiothoracic Anesthesiologist." This session included an extraordinary panel from experts around the world and included over 1,500 registrants from 65 countries. Perhaps one of the small benefits of this crisis will be the mainstream adoption of remote technologies options for communication and e-learning—I believe they will.

It has long been said that the best way to predict our future is to create it—we can control a major part of our destiny following this pandemic by remaining logical, following evidence-based medicine, and engaging in practicing what we preach by promoting social distancing and vigilant hygiene in our professional and personal lives among our colleagues, friends, and family. As anesthesiologists, we are known and respected as experts in crisis management, and while we are human and therefore susceptible to physical and emotional fatigue, now more than ever it is important to demonstrate our extraordinary skills, knowledge, versatility, resiliency, and professionalism. We are fortunate to live in a world with exceptional minds who will develop therapies to both manage and prevent COVID-19 from resurfacing to the same devastating extent. While we will most likely be challenged again in the future as we have in the past with other stressors to our well-being, we have hopefully learned enough to better mitigate the dissemination of future diseases more proficiently and efficiently.

The well-known children's author Dr. Seuss said, "When something bad happens you have three choices. You can either let it define you, let it destroy you, or you can let it strengthen you." I am fully aware of what is happening in the United States, and having communicated very closely with friends and colleagues throughout the world, I am significantly saddened with the knowledge that tens of thousands have suffered severely.

There will be a better tomorrow. I am confident that we will survive and evolve to become wiser, more versatile, and even more resilient. In addition to benefiting from our experiences, perhaps most importantly we will have learned to be kinder, more sympathetic, and more respectful to one another. No one can develop therapies to help us with these human traits—it is up to us.

My friends, there is still much work to be done. But until we meet again, and we absolutely will during better times, stay safe and be well.

Stanton K. Shernan, MD

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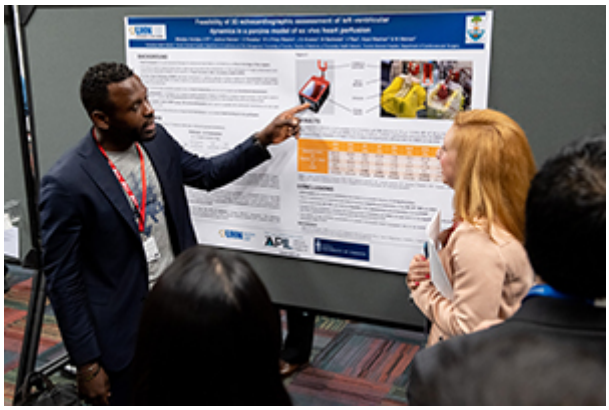

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Join SCA in Montreal for the 2021 TAS

Make your plans to attend the 2021 Thoracic Anesthesia Symposium in Montreal, Quebec, Canada!

Meeting Date: April 23, 2021

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Echo attendees—have you claimed your CME credits yet? To do so, visit www.scahq.org/EchoWeek and complete your 2020 Echo Week evaluations. You will need to log in with your SCA username and password. The deadline to submit your evaluations is **Friday, May 29, 2020**. The deadline will not be extended.

Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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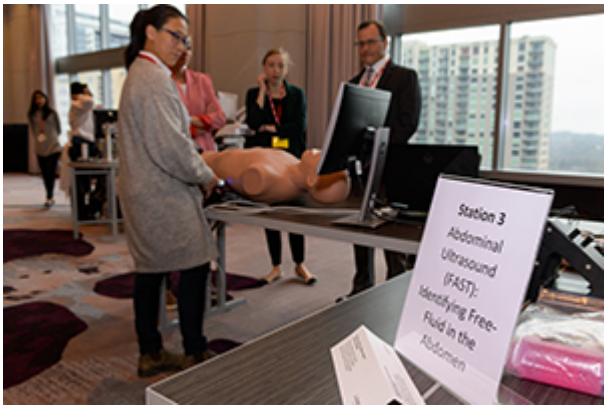
SCA Perioperative Ultrasound Course

2020 PoCUS Hands-On Workshop Highlights

The 2020 Perioperative Ultrasound Course proved to be another year of educational content and hands-on experience. More than 40 participants joined us in Atlanta, GA, on February 16 for a full day of ultrasound. Thank you to the PoCUS Program Planning Committee and faculty for all their hard work in putting together this year's course!



Make plans now to join us for the 2021 PoCUS Hands-On Workshop on February 7 at the Loews Atlanta Hotel.

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Thoracic Corner

The Impact of Anesthetic Management on Perioperative Outcomes in Lung Transplantation

Martin A, Yalamuri S, Wilkey B, et al. *J Cardiothorac and Vasc Anesth*. 2019 Aug 23 [epub ahead of print]

Reviewer:
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Background

The management of lung transplantation patients has evolved a great deal since the first transplant was performed by Hardy in 1963. Advances in surgical techniques and peri- and postoperative care have led to improvements in outcomes for lung transplant recipients. Median survival in the most recent data from the International Society for Heart and Lung Transplantation was 6.5 years, with survival in double lung transplant recipients up to 20 years.[1] Cystic fibrosis patients had the best median survival at 9.5 years, while those with idiopathic interstitial pneumonia had the worst survival at 5.2 years. Numerous investigations over the years have demonstrated that patient outcomes can be influenced by a host of factors, which can be divided into donor, recipient, surgical, and anesthetic categories.

Non-Anesthetic Factors Affecting Outcomes in Lung Transplantation

A variety of donor characteristics have been tied to worse outcomes, including older donor age, diabetes, a positive smoking history, cytomegalovirus status mismatch, donor-to-recipient weight ratio < 0.7, and female donor-to-male recipient, while a donor history of hypertension has been linked to improved outcomes.[1,2] Recipient characteristics associated with reduced survival include preoperative extracorporeal membrane oxygenation (ECMO), estimated GFR < 33 mL/min, age ≥ 70, oxygen requirement ≥ 5L, previous lung transplant, steroid dependence, and BMI < 18.5 or > 30.[2,3] Not surprisingly, multiple surgical factors have been identified that impact lung transplantation outcomes, with surgical volume leading the way. A study by Weiss and colleagues found that each 1 case/year decrease was associated with a 2% increase in 30-day mortality, and those institutions with the highest volumes also had the best outcomes.[4]

The type of extracorporeal support used during the procedure has also been found to influence survival. Cardiopulmonary bypass (CPB) and ECMO are both options during lung transplantation, but ECMO has become the dominant mode of support over the last several years. A few studies have examined CPB versus ECMO in lung transplantation and found that CPB is tied to increased bleeding, a longer duration of mechanical ventilation, higher rates of renal failure, and an increased incidence of primary graft dysfunction (PGD), but no significant differences in 30-day or 1-year mortality.[5,7] The use of ECMO has also been tied to reduced PGD and improved survival when compared to those transplantations performed without any ECMO support. The decision as to where to cannulate for VA ECMO support also has implications for patient outcomes. Central cannulation can improve ECMO flows but can make reoperation more challenging and requires conversion to peripheral cannulation if VA or VV ECMO is needed postoperatively. Peripheral VA ECMO can easily be transitioned to postoperative use but can lead to limb ischemia or vascular injury.

Anesthetic Factors Affecting Outcomes in Lung Transplantation

Ischemia-reperfusion injury is one of the main pathways that can lead to PGD and acute rejection. Several investigators have examined whether inhaled anesthesia with sevoflurane can reduce the evidence of injury in animal models of lung transplantation. Indeed, those animals receiving sevoflurane anesthesia were found to have reduced levels of pro-inflammatory cytokines such as TNF-alpha, IL-1, and IL-6; improved P_aO_2/F_iO_2 ratios; and reduced pulmonary edema.[7] Whether there is a benefit to inhaled anesthetics over TIVA in human transplant recipients, however, remains unclear. Another area where the anesthesiologist can have a great deal of influence on patient outcomes is the administration of intravenous fluid and blood products, both of which have been tied to higher levels of PGD. Indeed, Guebe and colleagues found that each additional liter of fluid given intraoperatively increased the risk of PGD by 22%.[8] Multiple studies have examined the use of point-of-care coagulation testing to reduce the use of blood products in lung transplantation with mixed results. Recombinant Factor VII and prothrombin complex concentrate have also been used in small series and case reports to reduce the need for transfusion in lung transplant patients. While these factors were effective in reducing bleeding, the bring with them a real risk of thrombotic complications and should not be used widely until much larger studies can be performed.[9,10] The ventilatory strategy used during the post-implantation period has also been tied to the risk of PGD development. Techniques that have been shown to improve outcomes include $F_iO_2 \leq 0.4$, ventilation with low tidal volumes (<6 mL/kg donor's ideal body weight), peak inspiratory pressure < 30 cmH_20, and PEEP 6–8 cm H_2O.[11]

Elevated peak inspiratory pressures can lead to impaired perfusion of the bronchial anastomoses and complications like infection and dehiscence. Gentle recruitment maneuvers have also been shown to improve P_aO_2/F_iO_2 ratios and reduce the duration of mechanical ventilation.

Intraoperative transesophageal echocardiography plays an important role in the management of lung transplant patients by allowing the assessment of right ventricular function as well as the patency of vascular anastomoses. Right ventricular function has been tied to mortality after lung transplant, and postoperative strain was reported to be an independent predictor of all-cause mortality.[12] The pulmonary veins and arteries should always be assessed following transplantation. While there is a lack of large studies to validate what measurements should be considered normal, general recommendations exist that call for pulmonary vein diameters of at least 0.5 cm and peak systolic velocities < 1 m/s, while the pulmonary arteries should demonstrate laminar flow on color Doppler and the donor artery should be at least 75% of the size of the recipient artery.[13] Postoperative pain management is another area in which the anesthesiologist can influence patient outcomes following lung transplantation. While multiple strategies have been tested including thoracic epidural, continuous paravertebral catheters, serratus anterior block, and erector spinae block, there is no clear data pointing to the advantage of one technique over any other. Thus, the pain management strategy should be individualized for each patient and institution.

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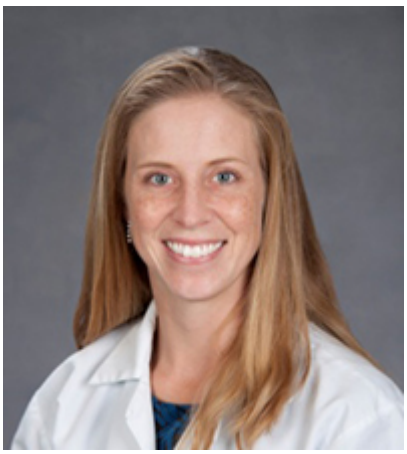
SCA News

2020 SCA Election Results

We are pleased to announce the following individuals who have been elected to Society leadership positions:

Hilary P. Grocott, MD FRCPC FASE
Board Director, 2020–2023

Kenichi Tanaka, MD MSc
Board Director, 2020–2023



Jessica Brodt, MBBS
Early Career Board Director, 2020–2022

Emily Methangkool, MD MPH
Early Career Board Director, 2020–2022

Elvera L. Baron, MD PhD
CME Committee Member, 2020–2024

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SCA News

SCA's Outgoing Leaders—Thank You for Your Service

SCA would like to recognize the leaders whose terms of office have concluded. We greatly appreciate all their hard work towards improving our society, and we thank them for their involvement.

Alex Mittnacht, MD
Board Director, 2019–2020

Albert C. Perrino Jr., MD
Board Director, 2017–2020

Michael P. Eaton, MD
Scientific Program Chair, 2018–2020

Wanda Popescu, MD
TAS Program Chair, 2018-2020

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SCA News

SF Match Fellowship Agreements Close June 1

To provide more consistency and predictability to the Adult Cardiothoracic Anesthesiology (ACTA) fellowship application process, a majority of ACTA programs are now using a match process provided by SF Match for recruitment.

Programs participate by registering with SF Match and applicants by registering and applying to the programs of their choice. Both programs and applicants submit a rank list based on their preferences. Notably, only programs where an applicant has interviewed can be ranked in the match.

Critical to the match process, programs and applicants can make an exception agreement prior to submitting their rank list to SF Match.

Exceptions to the standard match process have been agreed upon by the ACTA Fellowship Program Directors Council, allowing an exception agreement to occur between an applicant and program at the program director's discretion for the following candidates/applicants:

1. applicants who are in active military service at the time of application
2. internal candidates (ie, applicants who are currently in the anesthesiology residency program at the same institution as the ACTA fellowship)
3. applicants who are making a commitment to come to the institution of the ACTA fellowship for more than 1 year
4. applicants who are enrolled in an anesthesiology residency outside of the United States at the time of application
5. applicants who reside outside the United States at the time of application or who are not eligible for American Board of Anesthesiology certification due to non-US training
6. applicants whose spouse or partner is applying for a GME-approved postgraduate training program in a medical specialty in the same region as the ACTA fellowship.

Please Note: Eligible applicants who wish to take advantage of an exception rule are still required to participate in the match-ranking process and must complete an exception agreement on the SCA website with their future program director.

Program directors complete the first part of the match exception process. Program directors—click here to begin. You will need to log in with your SCA username and password.

Once the program director completes this portion of the process, the applicant will receive an email with a link to the form they must complete.

Any match irregularities will be referred to the ACTA Fellowship Program Directors Council of SCA.

Questions? Contact Member Services at (US) 855.658.2828, (International) 847.375.6313, or info@scahq.org.

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SCA Member Corner

SCA Career Center—Now Available!

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SCA Member Corner

A Salute to Hard Work

A huge thanks to the heroes on the front line of the coronavirus pandemic. Not all heroes wear capes— they wear scrubs.

As our country faces a global pandemic, we would like to thank all our doctors, nurses, and other medical personnel who have been on the front line fighting against COVID-19.

While the country was asked to engage in social distancing and stay home to help flatten the curve, our doctors geared up and walked up to the front line, risking themselves to help save lives.

Your hard work, care, and professionalism make a difference in this world. You are all doing a great job, and it's appreciated. Hearts are filled with gratitude for all of you who are working tirelessly day and night to ensure patients recover and are reunited with their families. Thank you for being so selfless and courageous, and for being an inspiration to all of us.

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SOCIETY OF CARDIOVASCULAR ANESTHESIOLOGISTS
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Literature Review

Early Surgery or Conservative Care for Asymptomatic Aortic Stenosis

Kang DH, Park SJ, Lee SA, et al. *N Engl J Med*. 2020;382(2):111-119.

Reviewers:
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New York, NY

Jessica Spellman, MD FASE
Associate Professor of Anesthesiology
Columbia University Irving Medical Center
New York, NY

Background

The benefit of surgical intervention for asymptomatic severe aortic stenosis has been largely unknown. According to the 2017 American Heart Association (AHA)/American College of Cardiology guidelines, surgical intervention for asymptomatic aortic stenosis has a Class IIa or IIb indication depending on disease progression.[2] However, prior observational studies suggest the risk of sudden death (incidence of 1% per year) during watchful waiting is lower than the risk of surgery itself.[3-5] Nevertheless, with advances in surgical techniques and perioperative care, the current benefits may now outweigh the risks. This question is particularly salient given the increasing prevalence and incidence of aortic stenosis in the aging population.

Design

From July 2010 to April 2015, 145 patients aged 20–80 years with asymptomatic severe aortic stenosis (AVA ≤ 0.75 cm^2 with aortic jet velocity ≥ 4.5 m/s or mean transaortic gradient of ≥ 50 mmHg) at four medical centers in Korea were randomized to early surgery (AVR within 2 months) or to conservative care adherent to the ACC/AHA guidelines. Patients were excluded if they had cardiopulmonary symptoms, concomitant aortic regurgitation, mitral valve disease, significant comorbidities, or history of prior cardiac surgery. Patients were referred to surgery if symptoms developed, left ventricular ejection fraction decreased to < 50%, or peak aortic jet velocity increased > 0.5 m/s on follow-up transesophageal echocardiogram. No significant differences existed in baseline characteristics or risk factors between treatment groups (including EuroSCORE). Mean age was 64.2 years, with 49% men and 51% women. Across groups, pathologies included 61% bicuspid AV, 33% degenerative valvular disease, and 6% rheumatic valvular disease. Primary endpoint was 30-day operative mortality or death from cardiovascular causes in the 4-year follow-up period. Secondary endpoints included death from all causes, repeat AV surgery, thromboembolic events, or hospitalization for heart failure. An intention-to-treat analysis was used, and end points were analyzed with a stratified Cox proportional-hazards regression model.

Results

A total of 69 of 73 patients underwent early aortic valve replacement. Of the 72 patients randomized to conservative care, 74% (53 patients) underwent surgical AVR, and 1 underwent TAVR. Nine patients (17%) were deemed urgent. No operative mortality was reported in either group. Median time to surgery was 23 days in the early surgery group versus 700 days in the conservative care group. A total of 1 of 73 patients (1%) in the early surgery group versus 11 of 72 patients (15%) in the conservative care group died from cardiovascular causes (HR 0.09; 95% CI 0.01 to 0.67; $P = .003$). The number needed to treat to prevent 1 death from cardiovascular causes was 20 patients. Death from all causes included 5 patients (7%) in the early surgery group versus 15 patients (21%) in the conservative care group (HR 0.33; 95% CI 0.12 to 0.90). Death from 30-day mortality or cardiovascular causes was 1% at both 4 and 8 years in the early surgery group versus 6% at 4 years and 26% at 8 years in the conservative care group ($P = .003$ by log-rank and Grey's tests). Incidence of death from any cause was 4% at 4 years and 10% at 8 years in the early surgery group versus 10% at 4 years and 32% at 8 years in the conservative care group.

Discussion

This study clearly demonstrates a decrease in both cardiovascular and all-cause mortality with early aortic valve replacement among asymptomatic patients with severe aortic stenosis as compared to conservative care. These findings are consistent with a growing body of data.[6-8] These findings differ from the previous approach of watchful waiting most likely because of bias of prior observational studies as well as improvements in perioperative and post-operative care, including closer monitoring and advances in surgical materials and techniques. These findings are valuable in that they may help guide early intervention in asymptomatic and otherwise healthy patients and, therefore, change clinical practice guidelines. Nevertheless, the limitations of this study leave one to question its generalizability. First, exercise testing was not performed in all patients to determine if patients were truly asymptomatic. In addition, the small sample size, strict definition for severe aortic stenosis, healthy Korean population, varying aortic pathologies (and,

therefore, varying cardiac structure and function[9-10]), and varying surgical materials and techniques make it difficult to fully evaluate the utility of early intervention on other populations. Finally, it remains unclear whether these patients would have greater benefit from transcatheter interventions. This is a rapidly developing field with additional benefits not considered in this study.[11] Therefore, these results remain incredibly promising but are only the beginning of the unfolding story as to how to best manage aortic stenosis.

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SOCIETY OF CARDIOVASCULAR ANESTHESIOLOGISTS
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Literature Review

E ects of Anesthetic and Sedative Agents on Sympathetic Nerve Activity

Liu X, Rabin PL, Yuan Y, et al. *Heart Rhythm.* 2019; 6(12):1885-1882.

Reviewer:
Antonio Hernandez Conte, MD MBA FASA
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Background

The actual physiologic impact of sedative and anesthetic agents on the sympathetic nervous system is poorly understood and has not been well studied. It has been hypothesized by electrophysiologists that various anesthetic and sedative agents may potentially impact sympathetic nerve activity, thereby altering the elicitation of arrythmias during electrophysiologic procedures. In addition, use of sedatives and anesthetics may require the use of inotropic support. The stellate ganglia (SG) is an important source of cardiac sympathetic innervation. SG nerve activity (SGNA) is important in the genesis of arrythmias and blood pressure (BP) variations.

Study Design

This study was a prospective study that utilized both a canine (n = 6) and human (n = 12) cohort. The canine cohort was implanted with an SGNA as well as subcutaneous nerve activity (ScNA) and intravascular BP monitors in the descending aorta. Each canine received one dose of an anesthetic/sedative (eg, dexmedetomidine, midazolam, hydromorphone, morphine) agent per day for the study period, and various indices were measured. SGNA and ScNA were measured using both low-pass and high-pass lters. The human cohort consisted of patients with persistent atrial brillation undergoing cardioversion; indices measured focused on ECK and super cial skin

sympathetic nerve activity (SKNA). Human subjects were administered either propofol or methohexital. Nerve activity recordings were analyzed using custom software. All quantitative data was measured as mean +/- standard deviation. Paired t-tests were used to compare the means; ANOVA was used to compare differences between various time points.

Results

Canines. Of all four agents, dexmedetomidine had the most significant impact on SGNA and ScNA, as well as on BP and heart rate (HR). Hydromorphone and morphine also decreased SGNA and ScNA but to a lesser extent. Midazolam had very little effect on Sympathetic Nerve Activity (SNA).

Humans. Propofol caused brief decrease in SKNA after administration, but then briefly increased after cardioversion. Methohexital also decreased SKNA after administration, but the effect was shorter acting when compared to propofol. All human subjects converted to normal sinus rhythm after cardioversion.

Discussion

It appears that dexmedetomidine, morphine, and hydrocodone significantly depress SNA in dogs. Propofol and methohexital depress SKNA in humans, but the effect is extremely variable. The impact of dexmedetomidine appears to be related to its alpha2-adrenoreceptor agonist effects and therefore highly correlates with its mechanism of action. Opioid receptors are widely present in the heart, ganglia, and vasculature, therefore their ability to depress SNA is also unexpected. The canine portion of this study is limited due to its small size. In humans, the study size is also quite small, and much variability exists between subjects in terms of SKNA changes. Propofol is reported to be both a proarrhythmic and antiarrhythmic, but this was not evaluated by this study. In humans, HR variability do not possess sufficient temporal to study SNA and blood pressure correlations. In both the human and canine cohorts, this study was also limited in that only 1 dose of anesthetic or sedative was administered, so effects of repeated or continuous infusions are not known. Further studies are necessary to investigate the findings of this study in greater detail.

Related Reading

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SOCIETY OF CARDIOVASCULAR ANESTHESIOLOGISTS
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Literature Review

Percutaneous Coronary Angioplasty Versus Coronary Artery Bypass Grafting in the Treatment of Unprotected Left Pain Stenosis: Updated 5-Year Outcomes From the Randomised Non-Inferiority NOBLE Trial

Holm NR, Mäkikallio T, Lindsay MM, et al. *Lancet*. 2020;395:191–99.

Reviewers:
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Background

Heart disease remains the leading cause of death in the US, with coronary artery disease contributing to 67.4% of all deaths from heart disease in 2017.[1,2] Aggressive treatment strategies have focused on preventative treatment as well as medical versus interventional management of existing coronary artery disease. There has been debate on percutaneous coronary intervention (PCI) versus surgical coronary artery bypass grafting (CABG), in regards to which intervention best reduces mortality and has fewer associated complications. The low complication rate with PCI intervention made it an appealing choice to clinicians, especially because overall mortality was similar based on the current literature.[3] However, none of the trials comparing these interventions were powered enough to definitively compare mortality rates.

The Nordic Baltic British Left Main Revascularization trial was a prospective, open label, non-inferior study evaluating whether PCI was non-inferior to CABG in patients with left main coronary artery disease, specifically in the study's primary endpoint: major adverse cardiac or

cerebral events (MACCE). Investigators noted a reduced number of adverse events compared to what was expected at the 3-year mark. There was concern that the needed number of events would not be met and that the study would lack sufficient power. Therefore, interim analysis was performed and suggested a similar mortality between PCI and CABG. This preliminary analysis led to a decision by investigators to increase the level of recommendation of 1A for PCI treatment for left main disease. The current paper discusses 5-year data of the NOBLE trial.

Methods

The study was a prospective, randomized, open label, non-inferior trial enrolling across 36 hospitals. Patients included had either stable or unstable angina, acute coronary syndrome, or a significant lesion in the left main coronary with no more than three additional lesions. Patients were randomized in a 1:1 ratio for PCI with drug-eluting stents versus CABG (with arterial revascularization of the left anterior descending from the left internal mammary artery, though other grafts could be used based on best practice). Patients were stratified according to sex, presence of bifurication disease, and presence of diabetes. Measured primary outcomes were MACCE such as mortality, non-procedural MI, repeat revascularization, or stroke after 5 years. Secondary outcomes measured were as all-cause mortality, nonintervention-related MI, in-stent versus in-graft stenosis, and stroke. Data were analyzed by an intention to treat population. A hazard ratio of 1.35 was defined as the noninferiority limit not to be exceeded by a one-sided 95% confidence interval.

Results

1201 patients were randomized with 598 allocated to PCI and 603 allocated to CABG. All patients completed up to 4 years of follow-up, and 92% of patients completed 5-year follow-up. Kaplan Meier estimates of MACCE events after 5 years were 28% for PCI and 19% for CABG. The hazard ratio (1.58; CI 1.24–2.01) exceeded the predetermined limit for non-inferiority of PCI treatment compared to CABG. Non-procedural MI was 8% in PCI versus 3% in CABG patients (HR 2.99; CI 1.66–5.39). Total repeat revascularization was seen in 17% of patients after PCI versus 10% after CABG (HR 1.73;95% CI 1.25–2.40). Secondary endpoints such as all-cause mortality, stent thrombosis, and stroke showed no statistical difference between the two groups.

Discussion

Interestingly, once the 5-year mark was reached, PCI did not meet criteria to be non-inferior to CABG treatment in patients with left main disease. There were nearly double the amount of MACCE events in the PCI group compared to CABG after a 5-year follow-up. Of note, although all-cause mortality was similar between the groups, the PCI group specifically had higher rates of non-procedural myocardial infarction and repeat revascularization interventions. Despite greater incidence of MACCE events with PCI, current recommendations have not been changed. This is likely due to the risk of stroke, longer hospitalization, and reoperation being higher in the CABG group. These risks need to be balanced with the risk of increased MACCE events, making PCI still a reasonable treatment option for patients who meet criteria for either intervention.

The addition of this new data reinforced the importance of identifying treatment for each individual patient based on the patient's history and comorbidities. For example, patients with multivessel disease and diabetes likely would favor CABG based on the current literature. Alternatively, patients who present with acute coronary syndrome may favor PCI as treatment. This study provides insight to guide clinicians in selecting the correct intervention based on patient characteristics with the hope of helping to reduce mortality and procedure-related complications.

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SOCIETY OF CARDIOVASCULAR ANESTHESIOLOGISTS
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Literature Review

Postoperative Opioid Prescription Patterns and New Opioid Re lls Following Cardiac Implantable Electronic Device Procedures

Lee JZ, Pasha KA, Glasgow AE, et al. *Heart Rhythm.* 2019;16(12):1841–1848

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Due to a rise in opioid prescribing and ultimately dependence, opioid-induced deaths have now surpassed those of other recreational drugs like cocaine.[1] The provider's experience and practice patterns are notable factors in opioid prescribing.[2] This study was performed with the primary objective of understanding patterns of opioid prescribing following cardiac implantable electronic device (CIED) procedures. The secondary objectives were to study and understand factors associated with opioid prescriptions and rates of opioid re lls after the procedure.

Methods

This was a retrospective analysis of all patients undergoing device procedures. The study population comprised adult patients (age ≥18 years) who were admitted for CIED procedures and discharged between January 1, 2010, and March 30, 2018. Five various types of CIED procedures were studied: new CIED implantation, generator change, device upgrade, lead revision/replacement, and subcutaneous implantable cardiac defibrillator (ICD). Exclusion criteria were patients younger than 18 years, in-hospital deaths, and transfers to another hospital. Procedures excluded were the insertion of leadless pacemakers, lead and device extraction, or

removal procedures without reimplantation. The study included both inpatient and outpatient procedures. Providers decided periprocedure and post-procedure prescription pain medications. The surgical technique was standardized. There were no requirements or limitations on prescribing opioids. Data collected included opioid type, dosage, frequency, quantity, and oral morphine equivalents (OME) in the 90 days before the procedure and up to 30 days after discharge. Patients were divided into opioid naïve and preoperative groups. The definition of opioid naïve was patients who did not receive any opioid prescription 90 days before the CIED procedure. Patients who received opioids within that time period were considered preoperative users. Any opioid prescribed within 30 days after discharge was included in the refill category. Opioid naïve patients who received opioid prescriptions and subsequently refilled their opioids were defined as new opioid refills. Opioid prescriptions were converted to OME in milligrams. High-dose opioid prescription was defined as discharge prescription with OME>200 (based on state guidelines).

The primary outcome was opioid prescription following discharge, and secondary outcomes were rates of opioid prescription among the 5 categories of CIED procedures, rate of new opioid refills, patient variables, association between CIED complication rates and opioid refills, 30-day readmission rates, and regional variation.

Results

A total of 16 517 patients (mean age 70 $\pm$ 15 years; 36.5% female) were included during the 9-year study period. 20.2% of patients were discharged with an opioid prescription after procedure, and 79.7% of those were opioid naïve, with 9.4% of opioid naïve patients having had new opioid refills. These opioid naïve patients were younger, mostly female, and were relatively healthy with fewer comorbidities.

The mean OME prescribed were 243 $\pm$ 346, and 38.8% of the patients received a high-dose opioid prescription (OME>200). In preoperative opioid users, the average OME was higher as compared to patients who were opioid naïve (335 vs 219; $P < .001$). One-third (36.9%) of opioid naïve patients were prescribed a high-dose opioid prescription. Patients who underwent subcutaneous ICD implantation had the highest rate of opioid prescription (25.0%), followed by new implants (23.2%), lead revision or replacement (22.4%), device upgrade (18.3%), and generator change (11.6%) ($P < .001$). The rates of opioid refills were also higher in patients who had complications from CIED procedures (14.4% vs. 9.9%; $P < .001$). Patients who received opioid prescriptions at discharge had higher 30-day readmission rates compared to patients who did not receive opioid prescriptions at discharge (9.5% vs. 7.7%; $P < .001$). Regional variation in opioid prescription was also observed.

Discussion

Consequences of unintended over-prescription of opioids include an increase in addiction and opioid-related death. There is also the economic cost of prescription opioid overdose, abuse, and dependence, at an individual level and at a societal level. The rates of opioid prescription following CIED were lower than those for other surgical procedures due to the relatively less invasive nature of these procedures. The opioid naïve group was generally more active, and providers may have had a lower threshold for prescribing opioids for pain relief to help return that group to their

baseline physical functioning. Subcutaneous ICD had the highest rate of postoperative opioids prescription. This is likely because of the larger device footprint of the subcutaneous ICD, highly innervated midaxillary chest wall, and the procedural technique.

Combined use of lidocaine and liposomal bupivacaine for local anesthetic infiltration may help achieve pain relief. The use of multimodality analgesia (ie, a variety of analgesic medications) to target a different mechanism of action in the peripheral and central nervous systems may have a synergistic effect and may provide better pain relief compared to use of a single agent alone. The use of around-the-clock nonopioid analgesic may be adequate for pain relief. Regional anesthesia techniques, such as truncal plane blocks, are also an option.[3]

Conclusion

Among patients who underwent CIED procedures, the overall opioid prescription rate was 20.2%, with 80% of the patients opioid naïve. This study shows that perioperative pain management in CIED procedures warrants attention. When possible, use of multimodal analgesia techniques along with regional anesthesia should be considered. This highlights that short-term opioid prescription may have a longer-term impact on patients.

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