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The times they are a changin’

“The line it is drawn The curse it is cast The slow one now will later be fast as the present now will later be fast The order is rapidly fadin’ and the first one now will later be last for the times they are a-changin’.”
- Bob Dylan

“Bottom line, if you attempt to use the same care delivery model moving forward, faced with the magnitude of reductions in forecasted revenue, you will go out of business.” - Michael Sachs

Healthcare, Reform, and the SCA

One of the undeniable truths that define our healthcare system is its financial impact on our national economy. It should be no surprise that the healthcare system is one of the most heavily regulated sectors of the economy as government is both a provider and purchaser. At the current pace of healthcare growth the Medicare Part A trust fund is projected to be exhausted by 2024.

The interrelationship between public and private sectors in the dynamic healthcare market environment is complex and understanding it is critical for all stakeholders in the U.S. healthcare system. This is clearly true for physicians in general and specialists in particular.

Going forward it is likely that the value proposition of specialty care and specialists will be defined differently. Value (V) = Quality (Q) × Service (S) / Cost (C). Critical questions will need to be asked and answered, such as can specialists justify higher marginal costs with higher marginal quality? Will the specialists shift up the quality axis or down the cost axis or both?

Specialists will need to increase integration, increase efficiency, and focus on reducing complications such as re-admissions. Our sub-specialty of cardiovascular anesthesia will need to distinguish itself as critical to this value proposition in this changing environment.

A Snapshot of the Affordable Care Act (access, quality, cost)

Medicaid Expansion

Medicaid eligibility will be expanded to cover all non-Medicare-eligible individuals under age 65 with incomes up to 133% of the Federal Poverty Level as of 2014. Healthcare reform is complex and extending its Medicaid enrollment to over 75 million. As part of the Acts, the federal government will subsidize 100% of the additional Medicaid funding to states to cover the newly enrolled from 2014 to 2016, with the subsidies declining each succeeding year to 90% for 2020 and afterward. States that have already expanded Medicaid eligibility to adults with incomes of up to 100% FPL will receive a phased-in increase in federal medical assistance percentage so that by 2020 they receive the same 90% funding as other states with these populations.

Health Insurance Exchange

The Affordable Care Act (ACA) requires each state to set up a mechanism known as health insurance exchanges by 2014 via which insurers will compete for the business of individuals and predominantly small employers who have not been able to obtain coverage at the same favorable rates as large employers. In addition, states may form regional health insurance exchanges where individuals and small businesses can buy insurance. To help non-Medicare-eligible individuals and those with incomes of 100–400% of the federal poverty level not enrolled in an employer-sponsored plan, the federal government will provide premium credits to help purchase health insurance coverage through the exchanges. The premium credits will be tied to the second-lowest-cost plan in an area and will be set on a sliding scale, based on income. Each plan participating in an exchange must meet standardized affordability, basic benefit, and consumer protection requirements, as well as state requirements. The concept of the program is to foster competition in all 50 states and the District of Columbia.

New health insurance exchanges would cover 24 million people, including an estimated 8 million who would drop their existing individual or employer-sponsored coverage. These health insurance exchanges are essentially new marketplaces where individuals and small employers can purchase insurance designed to ensure a more level competitive environment for insurers and to provide consumers with information on cost and quality to enable them to choose among plans. Employers with over 100 employees will be able to obtain coverage through the exchange at the discretion of each state effective 2017. States will have the choice not to operate their own exchange, in which case residents of the state would be allowed to enroll in a multi-state exchange run by the Department of HHS. Exchanges will offer two national plans supervised by the office of personnel and management and may include state based non-profit co-ops and multi-state insurance plans.

The Individual Mandate clause in the ACA which states that all US citizens and legal residents who lack health insurance will be required to obtain qualifying health coverage or suffer a phased-in tax penalty unless they meet a hardship exemption is being challenged as a violation of the interstate commerce law and therefore unconstitutional. This will have potential impact on the logistics of implementing the ACA. It is expected that the Supreme Court will hear this case within the year.

Reduced Commercial Insurance Reimbursement

Shift from commercial to health insurance exchanges, an expansion of Medicaid coverage (to all persons under age 65 in households with incomes less than 138 percent of the Federal Poverty Level), combined with the advent of state-level health insurance exchanges, is expected to result in NHE growth of 9.2 percent in 2014 (2.6 percentage points higher than projected before reform was passed). Consequences of these changes remain to be seen but will at least decrease the ability to cost-shift and lower payor tolerance.

Challenges Ahead for Cardiovascular Anesthesia

Regardless of a Supreme Court ruling, it should be expected that increased clinical demand will be accompanied by reduced reimbursement. The elderly (>55y/o) segment of the population continues to grow according to the latest U.S. census bureau which portends a growing need of patients requiring cardiac surgery.

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In addition, an increase in healthcare infrastructure & regulatory costs are expected to continue to rise in this coming decade, while a recession economy will continue to place heavy downward pressure on an already stressed system.

Changes in reimbursement (e.g. readmissions penalties, episodic bundling, value based purchasing, population health initiatives, accountable care organizations, etc.) will evolve and mature.

The Role of the SCA to Help Meet the Challenge and Next Steps

The SCA, directly and through the SCA Foundation, should continue to facilitate and support comparative effectiveness research. Quality and value driven healthcare have emerged as important issues involved in transforming the emphasis for care delivery from a system that rewards volume of services to one that incentivizes evidence-based, appropriate, and efficient care delivery. Comparative effectiveness research is essential to address the need for value in healthcare in the United States.

The SCA needs to be involved in emerging care redesign including post-acute care clinical pathway design by creating standards as part of clinically integrated networks. Establish guidelines and define cardiac anesthesia value including perioperative TEE standards and training recommendations for academic and community-based cardiac surgery, albeit in general care facilities or specialty care “focused factories.”

The SCA needs to continue to be the leader and solidify its leadership position for perioperative cardiovascular and thoracic education for all anesthesiologists who practice cardiovascular and thoracic anesthesia (in any capacity), and when reasonable, surgeons and cardiologists as well. We need to lead the way to explore opportunities for clinical vertical integration with partners in cardiovascular medicine (i.e. AHA, ACC and STS alignment).

Fellowship accreditation and certification differentiates our sub-specialty. The application criteria needed for sub-specialty certification includes having a distinct and unique body of knowledge within anesthesiology, having clinical applicability sufficient to support a distinct clinical practice, contribute to the scholarly generation of new information and advance research in the field. The SCA will continue to pursue a path toward certification.

The SCA needs to invest in establishing a database. A database further differentiates our sub-specialty as a leader in healthcare delivery. Moreover, data shapes policy. Healthcare reform will change the practice of medicine in general and anesthesia in particular and these changes will rely on data to define future care redesign. The value propositions for specialty anesthesia services will be greatly challenged in new payment methodologies such as value based purchasing or episodic bundling. Data will provide the only legitimate argument for the value of specialty care.

The SCA needs to continue to be a standard bearer and benchmark for quality improvement and patient safety. Meaningful internal assessment and external comparison is only possible by collecting data and sharing data. The SCA has a significant commitment and investment in the FOCUS project to gain insights into best practice behaviors that should promote a safe environment. We will share the data from that project to our membership, track its use and report advancement in knowledge from that project so we may seed a next generation of leaders to advance quality improvement and patient safety to higher levels.

Summary

The SCA will change the landscape of medical care including the practice of anesthesiology as we know it in the US in the next 2 years. The practice of cardiovascular anesthesia will be influenced by these anticipated changes. In a value base economy, value is defined by unique and differentiating quality. The SCA will continue to push the leading edge in education, research and clinical innovation for our subspecialty of cardiovascular anesthesia and thereby ensure our role in defining true value as the best (safe and effective) quality for the least cost.
The Routine Use of 100% Oxygen in Elective Cardiac Surgery

PRO

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The major goals in the anesthetic care of any patient, no less the cardiac surgical patient, include the maintenance of hemodynamic stability and the preservation of myocardial as well as systemic tissue oxygenation. Is it not just common sense that maximizing the oxygen content of blood would be a useful tool to this end?

Opponents of hyperoxia suggest that 100% oxygen leads to unfavorable hemodynamics in cardiac surgical patients. They point to the fact that studies consistently demonstrate a reduced cardiac output and increased peripheral vascular resistance in response to hyperoxia in healthy volunteers as well as patients with heart disease. (1,2) First off, these findings have not always been replicated in all experimental conditions. (3) Secondly and perhaps more importantly, why should we assume that this is a bad thing? Isn’t this a response we would expect and desire from an increased oxygen content of blood? The reduction in cardiac output is not a direct myocardial depressant effect from oxygen but rather a response to the increased PVR. (4) It is also associated with a decrease in heart rate. Are these not conditions we strive for in our patients with coronary artery disease under anesthesia? – A reduced myocardial oxygen demand and an increase in PVR that counteracts the reduction that is inherent to general anesthesia. The very recently published study by Feiner et al. lends support to this concept. (5) After the induction of “severe” isovolemic anemia in volunteers, the authors showed that breathing 100% oxygen led to a decrease in heart rate that was comparable to the transfusion of 3 g/dl of hemoglobin (approximately 1 unit of packed red blood cells). How could anyone argue against a lower heart rate and the potential to avoid transfusion in the elective cardiac surgical patient through such a simple intervention?

Opponents of hyperoxia will point to studies that show reductions in the oxygenation of peripheral tissues, particularly skeletal muscle, in response to hyperoxia during cardiopulmonary bypass. (6) Despite this, there is no evidence that this results in or relates to any morbidity clinical outcome. In fact, it has been demonstrated that both peripheral and visceral organs demonstrate their worst perfusion/oxygenation profiles after CPB. (7) Ventilation with 30% inspired oxygen during the postoperative phase was not adequate to reverse these defects. (7) Perhaps 100% oxygen continued into the ICU phase would be an easy way to reverse these signs of tissue hypoxemia.

CON

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Supplemental oxygen is warranted and necessary in certain patients undergoing cardiac surgery, however the routine use of 100% oxygen in all patients is detrimental for a variety of reasons. Lung and myocardial injury have been attributed to high concentrations of inspired oxygen in several animal and human studies and there is sparse data that demonstrates a clear beneficial effect. The studies elucidating these findings are discussed below.

Reactive oxygen species (ROS) are well known for their role in myocardial injury. (1) ROS are free radicals that have unpaired electrons that are capable of interacting in oxidation-reduction reactions with other molecules. They are unstable, highly reactive molecules that can result in oxidation of fatty acids, amino acids, enzymes and DNA. Oxygen radicals are implicated in cell death and in enhancing inflammatory mediators that cause tissue necrosis and apoptosis. Formation of ROS in small amounts occurs naturally in the body, however it is enhanced in the setting of a high oxygen tension. Typically there are a number of innate defenses that are in place to attenuate oxidative stress, however these can be overcome when the rate of formation of ROS is multiplied. (2)

During cardiac surgery, the formation of ROS is accelerated from tissue injury and cardiopulmonary bypass (CPB). Studies have demonstrated cell death and DNA fragmentation after ischemia-reperfusion as a result of increased oxidative stress. (3) Endogenous antioxidants are heightened during CPB, however the rate of production of ROS quickly exhausts defense mechanisms and oxidant injury occurs. (4) Free radical production can also directly change contractile filaments and result in myocardial stunning that is sometimes observed after CPB. (5) Using high levels of inspired oxygen further exacerbates this ongoing process without providing much additional benefit. Interestingly, reperfusion injury triggered by ROS and inflammatory mediators was attenuated in a study on porcine lungs by using a low partial pressure of oxygen upon reperfusion. The authors concluded that hypoxic reperfusion after ischemia may be an appropriate intervention to decrease tissue injury. (6)

Post-operative dysrhythmias are a common complication after cardiac surgery resulting in longer hospitalizations and increased cost. Some studies suggest there is a relationship between post-operative atrial fibrillation (AF) and intraoperative inflammatory factors and oxidative stress. (7) After review of more than 100 trials, Elahi and colleagues concluded that increased ROS contributed to the pathogenesis of postoperative AF, and recommended treatment with antioxidant agents. Reducing intraoperative sources of ROS, such as high levels of inspired oxygen, can potentially decrease the additional
Opponents of hyperoxia will attempt to highlight the reactive nature of oxygen in a negative light. They will point to studies that demonstrate a greater increase in pro-inflammatory cytokines in patients exposed to 100% oxygen during cardiac surgery. They will reference experimental studies that suggest concerns related to the reperfusion of oxygen rich blood and concomitant free radicals to tissue that was under hypoxic strain. However, there is a paucity of evidence to demonstrate that these theoretical concerns and molecular level changes translate into clinical issues for real patients. Furthermore, there is evidence that hyperoxia has no negative impact during reperfusion and even evidence that appears to demonstrate some real benefits in limiting tissue damage and in improving healing.

Let’s also not forget that it is oxygen’s reactive nature that makes it an important weapon in the surgical patient’s defense against infection. All can agree that sternal wound infection is a major and potentially life threatening complication for patients undergoing elective cardiac surgery. Any efforts to reduce the incidence of such a serious complication are commendable. Though not specific to elective cardiac surgical patients, a recent meta-analysis showed a significant decrease in surgical site infection from 12% to 9% for patients treated with hyperoxia. Further studies including cardiac surgical patients will be needed before this potential benefit of hyperoxia is confirmed in the setting of elective cardiac surgery but it is not at all illogical to think that it could help.

Another potential issue inherent to cardiac surgery is that of air embolism. Typically, the amount and size of air bubbles introduced into the circulation are small and rarely of clinical consequence. However, any anesthesiologist that has spent a meaningful length of time in the cardiac operating room has seen the sometimes dramatic impact of air in a coronary artery. Therefore, any efforts aimed at decreasing the size and/or impact of an inadvertent air embolism would seem prudent. In a study on pigs assessing the impact of inspired oxygen concentrations as well as nitrous oxide on the impact of venous air emboli, it was found that the animals ventilated with 100% oxygen had better hemodynamics after air embolism than those ventilated with air.

16. Though the exact mechanism for this finding remains unproven, it may well be related to the rate of change in the size of the embolus with a hyperoxic inspired gas mixture leading to a more rapid decrease in bubble size. Though admittedly somewhat presumptuous at this stage, the routine use of 100% oxygen may attenuate the impact of the ubiquitous air emboli seen in cardiac surgery.

Opponents of 100% oxygen will note the well-established association between hyperoxia and atelectasis. Having said this, the clinical significance of this phenomenon is questionable as it has been shown that the use of nominal amounts of PEEP and recruitment maneuvers can prevent or reduce much of the atelectasis that develops. With the potential benefits of hyperoxia outlined, this easily reversible side effect should not be a deterrent to the use of 100% oxygen.

In summary, we recommend the routine use of 100% oxygen during elective cardiac surgery as a means of optimizing tissue oxygenation, improving wound healing, decreasing surgical site infection, and minimizing the impact of potential air emboli. Despite the widespread concerns related to the “toxicity” of oxygen, there is little if any clinical evidence to suggest that hyperoxia may have a negative impact on the welfare of our patients. Our job is to ensure the adequate oxygenation of tissues. What better way to achieve this than to maximize the dose of oxygen we supply to our patients.

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Incidence of aortic complications in patients with bicuspid aortic valves.


Background and Objectives
Bicuspid aortic valve (BAV), the most common congenital heart defect, has been thought to cause frequent and severe aortic complications; however, long-term, population-based data are lacking. This study is to determine the incidence of aortic complications in patients with BAV in a community cohort and in the general population.

Materials and Methods
In this retrospective cohort study, the authors conducted comprehensive assessment of aortic complications of patients with BAV living in a population-based setting in Olmsted County, Minnesota. The authors analyzed long-term follow-up of a cohort of all Olmsted County residents diagnosed with definite BAV by echocardiography from 1980 to 1999 and searched for aortic complications of patients whose bicuspid valves had gone undiagnosed. The last year of follow-up was 2008-2009. The main outcome measured in this study is thoracic aortic dissection, ascending aortic aneurysm, and aortic surgery.

Results
The cohort included 416 consecutive patients with definite BAV diagnosed by echocardiography, mean (SD) follow-up of 16 (7) years (6530 patient-years). Aortic dissection occurred in 2 of 416 patients; incidence of 3.1 (95% CI, 0.5-9.5) cases per 10 000 patient-years, age-adjusted relative-risk 8.4 (95% CI, 2.1-33.5; P = 0.003) compared with the county's general population. Aortic dissection incidences for patients 50 years or older at baseline and bearers of aortic aneurysms at baseline were 17.4 (95% CI, 2.9-53.6) and 44.9 (95% CI, 7.5-138.5) cases per 10 000 patient-years, respectively. Comprehensive search for aortic dissections in undiagnosed bicuspid valves revealed 2 additional patients, allowing estimation of aortic dissection incidence in bicuspid valve patients irrespective of diagnosis status (1.5; 95% CI, 0.4-3.8 cases per 10 000 patient-years), which was similar to the diagnosed cohort. Of 384 patients without baseline aneurysms, 49 developed aneurysms at follow-up, incidence of 84.9 (95% CI, 63.3-110.9) cases per 10 000 patient-years and an age-adjusted relative risk 86.2 (95% CI, 65.1-114; P <0.001 compared with the general population). The 25-year rate of aortic surgery was 25% (95% CI, 17.2%-32.8%).

Conclusions
In the population of patients with BAV, the incidence of aortic dissection over a mean of 16 years of follow-up was low but significantly higher than in the general population.

Comment
This study shows that patients with BAV develop a clinical aortic pathology that affects outcome. The risk of aortic dissection in this cohort is approximately 8 times higher than in the general population, but despite this high relative risk, the absolute incidence of aortic dissection remains very low. By virtue of searching for dissection in diagnosed and undiagnosed patients with bicuspid valves, the authors corroborate this low rate of dissection in the general BAV population with overlapping 95% confidence intervals. Despite a low incidence of dissection, patients with BAV incur significant morbidity, with 25-year risks of aortic surgery of 25%, aneurysm formation 26%, and valve replacement 53%. It is important to recognize it earlier in order to prevent heart failure due to late valvular surgery referrals, as well as potentially to prevent dissection by elective aorta surgical repair. It is noticed the dissection rate was higher in patients older than 50 years and higher in those with baseline aortic aneurysms, highlighting the importance of close monitoring and current guideline implementation in these subgroups. The observed proportion between aneurysm and dissection rates suggests that the occurrence of aortic dissection in BAV patients may not exclusively be a matter of absolute aortic size. This observation argues for research efforts on elucidating biological pathways of BAV aortopathy amenable to medical treatment, as well as identifying non-size markers for refining risk prediction of aortic dissection in these patients.

Hospital administrative database underestimates delirium rate after cardiac surgery


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Background
There is a large variation in the prevalence of delirium postoperatively in the cardiac surgical patients ranging from 3-47%. Delirium is a clinical diagnosis and is often missed. Administrative electronic databases based on retrospective medical records review are highly specific for postoperative complications but lack sensitivity. The objective of this study was to determine the incidence of postoperative delirium in a cardiac surgical patient population using a prospectively collected database, and to compare this result with the incidence identified in the hospital administrative database. The authors hypothesized that the administrative databases significantly underestimate the incidence of delirium.

Methods
The delirium rates in the same patient cohort identified in two different databases were compared—prospectively collected data in a research database and retrospectively entered data in the hospital administrative database. Delirium was assessed every 12 hours postoperatively by trained nurses using the Confusion Assessment Method in the Intensive Care Unit (CAM-ICU) for the research database. CAM-ICU is a validated screening instrument for delirium. The administrative database identified delirium by using the International Classification of Diseases version 10 (ICD-10) for patient diagnosis. For each patient in the research database, the ICD-10 codes were extracted from the administrative database and checked for the presence of the code for delirium. The delirium rates between the two groups were compared using

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Background

Venoarterial extracorporeal membrane oxygenation (VAE) has long been used to enhance circulation and gas exchange in hemodynamically unstable patients with respiratory failure. Morbidity and mortality is high in patients who receive VAE following cardiac surgery, and it is still unclear what categories of patients are most likely to benefit from postoperative VAE. This study aimed to examine the morbidity and mortality in adult patients who received postoperative VAE and classify the patient group in which postoperative VAE proved to be beneficial.

Methods

This was a retrospective study conducted at a single centre. All adult patients who received postoperative VAE following cardiac surgery, from January 1995 to December 2005 were identified from the hospital database. Data on patient demographics, pre and peri-operative patient variables and mortality was collected. Patient variables were analyzed for association with mortality using the Student t test, Wilcoxon rank sum test, chi-square test and Fisher exact test as appropriate. The logistic regression model was used to identify important predictors of in-hospital death through stepwise variable selection.

Results

During the study period, of the 40,116 cardiac surgery patients just 233 patients (0.58%) required postoperative VAE. 149 patients (64%) died in the hospital. Commonest indications for initiation of VAE were cardiac arrest, difficult separation from cardio-pulmonary bypass (CPB), refractory cardiogenic shock (systemic arterial pressure <85 mmHg or cardiac index <1.1 L/min/m² with adequate preload) and right-sided heart failure with or without concomitant left-sided failure. VAE was ruled out for patients who suffered from prolonged mechanical ventilation, sepsis syndrome, multisystem organ failure and contraindication to systemic anticoagulation, even if they met other criteria. Univariate analysis showed that older age, higher preoperative albumin, history of diabetes, coronary artery bypass graft (CABG) procedure and longer CPB times were associated with increased hospital mortality. Among postoperative variables, global neurologic deficit, renal failure, multiple system organ failure and septic shock were associated with adverse outcome. Presence of cardiogenic shock at the time of initiating VAE was associated with reduced in-hospital death at all ages. The percentage of cardiac surgery patients who required VAE was seen to decrease with time.

Discussion

Postoperative VAE is associated with considerable mortality. The authors conceded that although patient selection could be guided by age, history of diabetes, CPB time and cardiogenic shock, these parameters do not adequately define which patients should or should not receive VAE support. This study also suffered from the limitations of a retrospective study. Hence, there is a need for an observational study that allows randomization. Attempt should also be made to unmask the modifiable variables that increase mortality in patients receiving VAE, so that survival can be improved. The authors have stated that the presence of cardiogenic shock at the time of initiation of VAE was associated with improved outcome; it would be interesting to know the prevalence of aforementioned factors (age, diabetic history etc.) independently associated with adverse outcome, in these particular patients. Although not specifically stated, it is intuitive that chronic conditions were predictive of adverse outcomes whereas acute events, in the absence of such predispositions, were not associated with adverse outcomes.
Intraoperative Transfusion of Small Amounts of Blood Heralds Worse Postoperative Outcome in Patients Having Noncardiac Thoracic Operations

Victor A. Ferraris, MD, PhD, Daniel L. Davenport, PhD, Sibu P. Saha, MD, Alethea Bernard, MA, Peter C. Austin, PhD, and Joseph B. Zwischenberger, MD Annals of Thoracic Surgery 2011; 91:1674–80

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Background
Allogenic blood transfusions are associated with transfusion-related adverse reactions, disease transmission and increased hospital resource utilization. Yet, the number of blood transfusions continues to increase. Surgery accounts for a significant proportion of the total packed red blood cells (PRBCs) transfused annually. The complications associated with massive blood transfusions, defined as more than 10 donor units, are well known. But whether small volume (1-2 units) intraoperative PRBC transfusions are associated with adverse outcomes is not known. This study investigated whether small volume intraoperative blood transfusions in non-cardiac thoracic surgery patients, were associated with adverse outcomes.

Methods
This was a retrospective study that acquired data from The American College of Surgeons National Surgical Quality Improvement Project (ACS-NSQIP) database. All patients undergoing non-cardiac, non-vascular thoracic operations and who received intraoperative blood transfusions, in the calendar years 2005 to 2009, were included. Pediatric and trauma patients and patients undergoing more than one simultaneous major procedure were excluded. As were patients who received more than 4 PRBCs within 48 hours prior or up to 72 hours after the procedure. Data was obtained regarding number of PRBCs transfused intraoperatively as well as mortality within 30 days of operation, seven individual morbidities, composite morbidity and postoperative length of hospital stay. Chi-square and student t tests were used to compare the rate differences of outcome variables in patients who did and did not receive intraoperative PRBCs. Propensity score matching was used to minimize confounding.

Results
Of 8728 patients who had undergone a non-cardiac nonvascular thoracic surgery, 7875 patients did not receive PRBCs intraoperatively. Of the remaining patients, 579 received 1-2 units and 274 received more than 2 units. Compared with patients who did not receive any intraoperative PRBCs, those who received 1-2 PRBCs had significantly greater rates of mortality, wound complications, pulmonary complications, renal complications, systemic sepsis and composite morbidity. They also had a greater need for re-operation within the first 30 postoperative days as well as longer postoperative length of hospital stay.

Discussion
This study suggests that small volume intraoperative blood transfusion may contribute to adverse outcomes in non-cardiac thoracic surgery patients. Patients receiving 1-2 PRBC units were selected as a key study group because transfusion in this group is most likely to be discretionary and thus avoidable. Patients who receive large volume blood transfusions have overriding indications for the blood products and hence the lifesaving nature of blood transfusions in those patients precludes them from benefiting from the findings of this study.

This study derived data from the ACS-NSQIP database that does not include data on age of the transfused PRBC units. Hence, it is possible that complications seen in the transfused patients were in part due to transfusion of aged PRBC units.

The indications for blood transfusions were also not taken into account, raising the possibility that the worst patient outcomes in the transfused group were in part because of poorer health of the patients. By controlling for the indications of blood transfusions in the patients, this confounding error could have been removed.

The database also does not maintain a record of all of the blood transfusions received during the hospital stay; that blood transfusions received outside the OR, such as in the ICU, may have contributed to the patient outcomes is another possibility. However, despite its shortcomings, the study demonstrates the need for a randomized trial to establish the actual bearing of small volume intraoperative blood transfusions on non-cardiac thoracic surgery patients. Till then, clinicians must be wary of transfusing such patients without sufficient rationale.

Health Outcomes After Stopping Conjugated Equine Estrogens Among Postmenopausal Women With Prior Hysterectomy


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Introduction
In 2004, the Woman’s Health Initiative (WHI) was halted prematurely because the women that had been treated with hormone therapy had increased risk of stroke. Therefore, post intervention health outcomes of the effects of conjugated equine estrogens (CEE) have not been reported.

Methods
LaCroix et al. conducted a double-blind, placebo controlled, randomized clinical trial of treatment with CEE (0.625mg/d). (4) The study included 10,739 (5310 received CEE, 5429 received placebo) postmenopausal women (ages 50-79) with prior hysterectomy and no prior cancer or venous thromboembolism. At the end of the intervention, the median time for receiving treatment was 5.9 years in the CEE group and 5.8 in the placebo group. The study was extended to post-intervention follow-up among the 7645 surviving patients (3778 CEE, 3867 placebo), all of which were instructed to discontinue taking the study pills. Age specific results were also generated with a mean follow up period of 10.7 years. The age groups were divided into three different categories for comparison (50-59 years, 60-69 years, 70-79 years).
Results

In the overall intervention and post intervention period not separated by age groups, a statistically significant lower incidence of breast cancer was found in women in the CEE group when compared to the placebo group (P = 0.02). The risk of coronary heart disease (CHD) during the same period and group was not different between the CEE group and the placebo group.

Within the analysis between the three age groups, total myocardial infarction hazard ratio (HR) increased from 0.54 to 1.05 to 1.23 (P = 0.007) when comparing the CEE group to the placebo group. The HR between the CEE group and the placebo group for CHD during the intervention period in the age 50-59 group was 0.59. The younger women seemed to have more protection from CHD than the placebo group but this was not so in the older women. The HR between the CEE group and the placebo group for CHD the older women showed no difference.

Discussion

Overall, there were both risks and benefits that existed during intervention that were not seen in the post intervention period and risks and benefits that persisted between both periods. The risks of CEE hormone treatment seem greater to older women as opposed to younger women. LaCroix et al suggests that their results emphasize the need to counsel women on hormone therapy according to age and hysterectomy status.

Comments

In 1991, the Nurses Health Study (NHS) reported that postmenopausal women taking estrogen had a significantly reduced risk of and mortality from major coronary disease while not affecting the patients’ risk of stroke. (1) In an observational study, Grodstein et al found that risk of recurrent major coronary heart disease events decreased with an increase in the duration of time on the hormone. (2) Additionally, a randomized Heart and Estrogen/Progestin Replacement Study (HERS) was conducted on women already with coronary disease and found that treatments of estrogen plus progestin significantly lowered CHD events in women taking the hormones in the fourth and fifth year. (3)

Contrary to the NHS, the Women’s Health Initiative (WHI) Estrogen plus Progestin and Estrogen Alone trials showed that patients involved in either therapies did not show the expected protection from CHD. (4) Furthermore, the WHI estrogen plus progestin trial was stopped prematurely after a mean of 5.2 years because health risks outweighed the benefits. This finding is reflected in the overall results by LaCroix et al. When the women in the study were not broken down into separate age groupings, risk of CHD does not differ between the CEE group and the placebo group. Thus, the WHI studies concluded that CEE should not be used for chronic disease prevention in menopausal women. (5) Beral et al also found that breast cancer risk was greater in women that used estrogen and progestin rather than estrogen alone. (6) The HERS, which was conducted with estrogen and progestin which had found benefits in the fourth and fifth year of treatment, also found that hormone therapy increased the risk of heart attacks in the first year of the study. From this study, Wells and Herrington concluded that clinicians should not use estrogen and progestin for the sole purpose of secondary prevention of CHD. (7)

Subsequent studies attempted to account for the differences in coronary heart disease (CHD) outcomes. The review by Harman et al. which suggests that the “timing hypothesis”, the idea that differences in age or time since menopause when menopausal hormone treatment is initiated affect the reaction of the patient to estrogen therapy, may account for the differences. (8) Toh et al also concludes that there is no decreased risk of CHD within the first two years of hormone therapy (estrogen plus progestin) but they also state that there is a possible cardioprotective effect in the women who initiated the therapy closer to the start of menopause and maintained the therapy for at least 6 years. (9) Hernan et al compares the discrepancies between the results of the WHI and NHS and concludes that the hazard risk of CHD is increased only in women who were 10 or more years post menopause before hormone therapy treatment. (10) Starting treatment at the onset of menopause seems to benefit younger women by delaying atherosclerosis and improving vascular endothelial function. LaCroix et al did not focus specifically on the time since the start of menopause when hormone therapy is initiated. There was no recorded correlation between the age at which the hysterectomy was performed to the age three different groups analyzed in the study. Regardless, the coronary protective effect was found in the younger women (ages 50-59) and lost in the older women (ages 60-79).

Overall, estrogen alone hormone therapy seems to be most effective for protecting against CHD in younger women without a previous history with CHD and within 10 years of the start of menopause. Hormone therapy is not recommended for older women who began menopause more than 10 years ago due to an initial increased risk of CHD. Estrogen alone does not seem to decrease incidents of stroke, colorectal cancer, total mortality, and the global index of chronic diseases after a median of 5.9 years of treatment. Combined hormone therapy with estrogen and progesterone is not recommended because of the increased risk of breast cancer and heart attacks early in the study. Currently there are two trials enrolling younger women to see if hormone therapy has any protective effects on them. The Kronos Early Estrogen Prevention Study is monitoring perimenopausal women taking estrogen and progesterone for atherosclerotic plaque and other signs of coronary artery disease. The Early Versus Late Intervention Trial with Estradiol study is comparing estrogen treatments in women within six years of menopause and those at least 10 years past menopause. This can potentially give us information as to whether or not hormone therapy is only beneficial to young women within 10 years of the start of menopause. Thus far, the only use of hormone therapy is symptomatic relieve for menopausal symptoms (hot flashes or vaginal dryness).

References


Association between valvular surgery and mortality among patients with infective endocarditis complicated by heart failure


Reviewer: Hong Liu, MD
UC Davis Health System, Sacramento, CA

Backgrounds and Objectives
Heart failure (HF) is the most common complication of infective endocarditis. However, clinical characteristics of HF in patients with infective endocarditis, use of surgical therapy, and their associations with patient outcome are not well described. To determine the clinical, echocardiographic, and microbiological variables associated with HF in patients with definite infective endocarditis and to examine variables independently associated with inhospital and 1-year mortality for patients with infective endocarditis and HF, including the use and association of surgery with outcome.

Materials and Methods
The International Collaboration on Endocarditis-Prospective Cohort Study, a prospective, multicenter study enrolling 4166 patients with definite native- or prosthetic-valve infective endocarditis from 61 centers in 28 countries between June 2000 and December 2006. The main outcomes measurements are in-hospital mortality and one year mortality.

Results
Of 4075 patients with infective endocarditis and known HF status enrolled, 1359 (33.4% [95% CI, 31.9%-34.8%]) had HF, and 906 (66.7% [95% CI, 64.2%-69.2%]) were classified as having New York Heart Association class III or IV symptom status. Within the subset with HF 839 (61.7% [95% CI, 59.2%-64.3%]) underwent valvular surgery during the index hospitalization. In-hospital mortality was 29.7% (95% CI, 27.2%-32.1%) for the entire HF cohort, with lower mortality observed in patients undergoing valvular surgery compared with medical therapy alone (20.6% [95% CI, 17.9%-23.4%] vs 44.8% [95% CI, 40.4%-49.0%], respectively; P < .001). One-year mortality was 29.1% (95% CI, 26.0%-32.2%) in patients undergoing valvular surgery vs 58.4% (95% CI, 54.1%-62.6%) in those not undergoing surgery (P < .001). Cox proportional hazards modeling with propensity score adjustment for surgery showed that advanced age, diabetes mellitus, health care-associated infection, causative microbiogmism (Staphylococcus aureus or fungi), severe HF (New York Heart Association class III or IV), stroke, and paravalvular complications were independently associated with 1-year mortality, whereas valvular surgery during the initial hospitalization was associated with lower mortality.

Conclusions
In this cohort of patients with infective endocarditis complicated by HF, severity of HF was strongly associated with surgical therapy and subsequent mortality, whereas valvular surgery was associated with lower in-hospital and 1-year mortality.

Comments
Infective endocarditis is associated with substantial morbidity and mortality. Several published studies have reported in-hospital mortality of15% to 20% and 1-year mortality of 40%. In the United States alone, approximately 15,000 new cases of infective endocarditis are diagnosed each year. A variety of complications contribute to the high rates of morbidity and mortality, particularly HF, which occurs in approximately 40%. The main findings of this prospective and multinational study in evaluation of HF in infective endocarditis patients are (1) HF was strongly related to new or worsening left-sided valvular regurgitation, rather than to predisposing heart conditions (previous native-valve disease, presence of a prosthetic valve, or congenital heart disease) or causative microbiogmism; (2) despite a high incidence of severe HF and its poor prognosis, less than two-thirds of patients with infective endocarditis and HF underwent surgery, which was more frequently performed in younger patients with severe HF and paravalvular complications; and (3) surgery was associated with a significant reduction in in-hospital and 1-year. Additional studies are needed to perform better risk-stratify patients with infective endocarditis and HF and optimize the use of surgery for this serious condition.

The Role of the Minimally Invasive Beating Heart Technique in Reoperative Valve Surgery


Reviewers: Henry Liu, MD
Lihua Zhang, MD
Sabrina Bent, MD
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Background
Redo cardiac surgery poses clinical challenges to cardiac surgery and anesthesia teams due to high incidence of perioperative morbidity and mortality. This study by Botta et al compared the minimally invasive beating heart technique with traditional median sternotomy with aortic clamping and cardiopulmonary technique for the management of patients who needed reoperative valvular surgery.

Methods
The authors reviewed all cardiac surgical patients from August 2008 to August 2010 in their institution. Twenty-two reoperative valve procedures were performed through a minimally invasive approach (right anterolateral thoracotomy at 4th intercostal space) without aortic cross-clamping [no-clamp group (NG)]. Patients with patent coronary grafts, signs of heart failure, need for intra-aortic balloon pump (IABP), and previous left thoracotomy

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were included, while significant aortic regurgitation (greater than 2+) and reoperations for immediate or early surgical failures (same hospital admission or less than 30 days) were excluded. They compared the postoperative outcome (inotropic support, stroke, tracheostomy, prolonged mechanical ventilation, acute renal failure, postoperative hospital stay and in-hospital death), laboratory tests including lactate and CK-MB, to a matched group of patients in terms of sex, age, and type of surgery, and operated through median sternotomy with aortic cross-clamping and cardioplegic arrest [clamp group (CG)].

Results
Of the 22 redo minimally invasive cardiac surgical procedures, 17 were mitral valve replacements (MVRs), one mitral valve repair, one MVR associated to a tricuspid plasty (TVP), and three isolated TVP. Cardiopulmonary bypass (CPB) time was 166 and 163 minutes in NCG and CG, respectively. Intra-aortic balloon pump was necessary in two (NCG) and three (CG) patients. Two patients died in both groups from multi-organ failure. Biochemical analysis showed no significant differences in perioperative lactate or creatine kinase-MB values. The postoperative outcome data including inotropic support, stroke, tracheostomy, prolonged mechanical ventilation, acute renal failure, postoperative hospital stay and i-hospital death were not significantly different.

Conclusions
The authors concluded that redo valvular surgery with an unclamped aorta is feasible, effective, and at least as safe as surgical techniques using median sternotomy and cardioplegic arrest. They did not find any advantage of minimally invasive technique with beating or fibrillating hearts over conventional sternotomy with aortic clamping and cardioplegic technique. The study revealed no difference in biochemical or clinical outcomes from conventional surgery using aortic clamping and cardioplegic techniques versus minimally invasive, non-aortic clamping technique.

Comments
1. This is a small retrospective clinical study included only 22 patients in the minimally invasive group, so the statistical analysis may not be as convincing as large randomized prospective clinical study.
2. The matching group was from 2006 to 2010, the matching methodology per se may not be ideal for the comparison.
3. The authors did not look at beating heart procedures without cardiopulmonary bypass. Many postoperative morbidity and mortality are due to aortic cannulation and cardiopulmonary bypass.
4. This study did show that right anterolateral thoracotomy approach is feasible, without aortic clamping and cardioplegic technique is at least as safe as conventional median sternotomy with aortic clamping and cardioplegic technique in patients who need reoperative valvular cardiac procedures.

The Biochemical Effects of Restricting Chloride-rich Fluids in Intensive Care

Nor’azim Mohd Yunus, In Byung Kim, Rinaldo Bellomo, Michael Bailey, Lisa Ho, David Story, Geoff Gutteridge, Graeme Hart Crit Care Med 2011; 39:2419 –2424

Reviewer: Laura Myers
Harvard Medical School

Introduction
In critically ill patients, IV hydration is commonly used to replace sensible and insensible losses when patients cannot tolerate oral hydration. Often patients require aggressive volume resuscitation. Since some patients may have concurrent metabolic derangements such as metabolic acidosis, chloride-containing IV fluids may alter the ion difference, which may exacerbate metabolic acidosis. This paper, the authors examine the effect of administering chloride-poor IV fluids on the serum concentration of various biochemical markers, pH and cost in ICU patients in an academic institution in Sydney, Australia. They hypothesized that chloride-poor IV hydration would decrease the incidence of metabolic acidosis as well as cost of hydration in the ICU.

The control group consisted of ~800 consecutive patients who were admitted to the ICU for any reason over a 6 month period. There was no exclusion criteria. Providers during this time period were not aware of what variable was being studied. IV fluid solutions available at this time were 0.9% NaCl, Albumex V, Gelofusine, Hartmann’s, Plasma-Lyte 148 and Albumex 20, which are listed in descending order of chloride content (Table 1). The intervention group consisted of all patients who were admitted one year later during the same months of the year in order to avoid seasonal variation. Only the latter three solutions mentioned above were available to use, except when physicians petitioned to use chloride-containing fluids for patients with hyponatremia, cerebral edema or hypochloremic metabolic alkalosis. All drugs were delivered via 5% dextrose except insulin, which was mixed in 0.9% saline.

The authors report that the two groups were similar in terms of baseline characteristics, including age, gender, APACHE II score, etc. The overall volume of IV fluids administered was not statistically significant between groups as evidenced by a randomized subgroup of 100 patients. The cost was significantly lower in the intervention group ($15,000 compared to $4,000), which was mostly attributed to the use of expensive Gelofusine.

The authors also show that the incidence of severe hyperchloremia and hypernatremia are significantly lower in the intervention group, but the incidence of hypochloremia is significantly higher. Additionally, the concentration of sodium chloride, standard base excess and pH tended to be higher in the intervention group during most time points. Lactate was higher in the intervention group in the first 2 days but then was lower from days 3 to 7.

Importantly, while there was decreased incidence of acidosis and acidemia, there was increased alkalosis and alkalemia. In fact, the number of severe metabolic acid-base derangements and pH derangements was significantly higher in the intervention group compared to the control.

Comments
These results indicate that the chloride content of IV fluids administered in the ICU does impact patients’ acid-base status. The higher incidence of severe acid-base derangements, specifically metabolic alkalosis and alkalemia, suggests that restricting chloride may not be the best way to maintain acid-base equilibrium.
In the future, it will be important to examine solutions with slightly reduced chloride content, as well as include laboratory markers that assess organ function such as LFT’s and creatinine. Ultimately, the question about whether chloride content affects clinical outcomes must be tested.

The use of chloride-poor IV fluids has a direct application to fluid resuscitation in the O.R. It is possible that 0.9% NaCl and Lactated Ringers, which are currently used, may not be ideal in a patient with severe blood loss who develops a lactic acidosis secondary to anaerobic metabolism.

Lastly, cost is also an important consideration in the U.S. as hospitals look toward reducing cost of ICU-level care in both the OR and the ICU.

**Table 1**: Content of IV fluids used in study (Recreated from Table 1 in Yunos et al)

<table>
<thead>
<tr>
<th></th>
<th>Control group (Range, mmol/L)</th>
<th>Intervention group (Range, mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>48-154</td>
<td>48-140</td>
</tr>
<tr>
<td>Potassium</td>
<td>0-5</td>
<td>0-5</td>
</tr>
<tr>
<td>Chloride</td>
<td>0-164</td>
<td>0-108</td>
</tr>
<tr>
<td>Calcium</td>
<td>0-2</td>
<td>0-2</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0-1.5</td>
<td>0-1.5</td>
</tr>
<tr>
<td>Lactate</td>
<td>0-29</td>
<td>0-29</td>
</tr>
<tr>
<td>Acetate</td>
<td>0-27</td>
<td>0-27</td>
</tr>
<tr>
<td>Glucose</td>
<td>0-23</td>
<td>0-23</td>
</tr>
<tr>
<td>Octanoate</td>
<td>0-32</td>
<td>0-32</td>
</tr>
</tbody>
</table>

**Moderate Tricuspid Regurgitation with Left-Sided degenerative heart valve disease: to repair or not to repair?**


**Reviewers**: KiKi Olga Nin, MD

Yong G. Peng, MD, PhD

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**Background**

Uncertainty about long-term effects of surgically unaddressed moderate (2+) secondary tricuspid valve (TV) regurgitation (TR) accompanying left sided degenerative heart valve disease led us to identify reasons for and factors associated with TV repair, compare safety and clinical effectiveness of relieving TR, and identify factors associated with severe (3/4+) postoperative TR.

**Methods**

From 1997 to 2008, 1,724 patients with 2+TR underwent 830 mitral, 703 aortic, and 191 double-valve procedures; 91 (5%) had concomitant TV repair. Logistic regression analysis was used to identify factors associated with TV repair and for propensity-matched comparison of safety (in-hospital morbidity, mortality) and effectiveness of TV repair (longitudinal echocardiographic assessment of postoperative TR and New York Heart Association class, TV intervention, survival).

**Results**

Factors associated with TV repair of 2+TR included larger right ventricles and left ventricles (p <0.001), greater TV tethering height (p <0.0002), and prior concurrent mitral valve procedures (p < 0.004). In-hospital complications, subsequent TV interventions, and intermediate-term survival were similar for matched patients. The TV repair patients had less 3/4+ TR at discharge (7% versus 15%), sustained out to 3 years. No TV repair (p <0.05), female sex (p < 0.0001), and mitral valve replacement (p < _0.008) were associated with 3/4+TR.

**Conclusion**

A TV repair for moderate TR concomitant with surgery for degenerative left-sided heart valve disease is reasonable to provide an opportunity to prevent its progression and development of right ventricle dysfunction, particularly for patients with important right ventricle remodeling and evidence of right ventricular failure, and for patients with advanced left-sided disease requiring mitral valve replacement.

**Comments**

This retrospective study addressed the relative safety of correcting 2+TR during left sided surgery in patients with moderate TR. The authors evaluated the results of patients who underwent left sided surgery at the Cleveland Clinic from 1997-2008 and determined that concomitant TV repair was safe, and had similar cardiopulmonary bypass time and only 8 more minutes, on average, of myocardial ischemia. Stroke occurred in five patients in the TV repair group, but these patients had comorbidities or surgical factors not associated with TV repair, including atrial fibrillation preoperatively, previous strokes, transient memory loss, extensive debridement of mitral annular calcium, and one patient with a foramen ovale. Most importantly, the study showed that severe postoperative TR decreased significantly in patients who underwent 2+TR repair, occurring in only 11% of patients who underwent 2+TR repair, as compared to 39% of patients from the non-repair group. Additionally, 15% of the non-repair group had worse TR, compared to only 7% in the repair group.

This study shows that there is a missed opportunity in patients undergoing left sided surgery with moderate TR. Repairing moderate TR has a clinically effective benefit in preventing worsening TR and right-sided failure, which places the patient at high risk of morbidity and mortality for reoperation. The study is limited by the fact that all of the patients were treated at a single institution, and that it was a nonrandomized study. Other limitations include a limited TR echocardiography study (no annular TR diameter, etc), an overall limited TTE study (no reported evaluation of left ventricular function), a limited number of postoperative TTE, and the inability to determine prospective decisions given the retrospective nature of this study. Still, this study does present a good overall argument that the conservative nonsurgical approach to moderate TR might present a missed opportunity, and that concomitant TR repair might prevent further RV remodeling and dysfunction, progression of TR to severe, and might help patients avoid having to undergo later reoperation. Further controlled prospective studies are needed to make conclusions regarding changes in operative management of moderate TR.