Aortic Pathology Determines Midterm Outcome After Endovascular Repair of the Thoracic Aorta: Report From the Medtronic Thoracic Endovascular Registry (MOTHER) Database

Summary—Endovascular repair is increasingly being adopted as the treatment of choice for many thoracic aortic conditions. As the application of this technology widens, developing an evidence-based understanding of which patients are most likely to benefit is a priority. A barrier to this has been the relatively few number of procedures that are performed, so that randomized controlled trials on the scale of those performed for infrarenal aortic aneurysm have not been feasible. At present, many published series fail to discriminate between different aortic pathologies when outcomes are reported, making pooled analysis difficult. This first report from the Medtronic Thoracic Endovascular Registry (MOTHER) combines raw data from 5 trials and 1 institutional series, characterizing the difference in early outcomes between the major pathology groups. Regional trends in practice suggest that thoracic endovascular repair has complemented open surgery rather than replaced it and has allowed more patients to be offered therapy than was previously possible. Significantly, some will have been deemed unfit for open surgery because of poor physiological reserve, and although thoracic endovascular aortic repair all but abolishes aortic death, individuals remain subject to an increased risk of mortality from all other causes in comparison with matched controls. Follow-up data collected for the component registries have allowed a description of midterm survival in such patients, and this report serves to highlight the importance of considering all-cause mortality in aneurysm patients and to reinforce the ability of thoracic endovascular aortic repair to prevent aortic-related death in both aneurysm and dissection patients.

Conclusions—This study indicated that the midterm outcomes of endovascular repair of the thoracic aorta are defined by presenting pathology, associated comorbidities, and mode of admission. Nonaortic mortality is high in the midterm for patients with thoracic aortic aneurysm, and managing modifiable risk factors appears vital. Endovascular repair of the thoracic aorta results in excellent midterm protection from aortic-related mortality, regardless of presenting pathology.1

Enhanced Effect of Combining Human Cardiac Stem Cells and Bone Marrow Mesenchymal Stem Cells to Reduce Infarct Size and to Restore Cardiac Function After Myocardial Infarction

Summary—Stem cell–based therapy represents a potentially transformative new therapy for left ventricular dysfunction and other cardiovascular diseases. Bone marrow mesenchymal stem cells (MSCs) and cardiac stem cells (CSCs) are two of the leading candidates for cellular cardiomyoplasty. On the basis of earlier observations that MSCs interact with and promote survival and lineage commitment of CSCs, we tested whether combining MSCs with CSCs would augment a therapeutic response relative to either cell alone. Using xenotransplantation of human MSCs and c-kit+ CSCs delivered intramyocardially to swine after myocardial infarction, we show that combining MSCs and CSCs greatly enhances the reduction in infarct size and the improvement in left ventricular diastolic and systolic function achieved with either cell alone. These data support the idea that cell combination therapy is a practical and effective strategy to improve responses to cell therapy and support the conduct of clinical trials testing coinjection of MSCs and CSCs in humans with cardiac injury resulting from myocardial infarction and possibly other sources of left ventricular dysfunction.

Conclusions—Combining hMSCs and hCSCs as a cell therapeutic enhances scar size reduction and restores diastolic and systolic function toward normal after MI. Taken together, these findings illustrate important biological interactions between c-kit+ CSCs and MSCs that enhance cell-based therapeutic responses.2

Cardiovascular Outcomes After the Arterial Switch Operation for D-Transposition of the Great Arteries

Summary—As the initial cohort of patients with arterial switch procedures for transposition of the great arteries reach their adult years, it is essential to characterize sequelae and longer-term outcomes to inform and guide screening and surveillance. We, therefore, conducted a retrospective cohort study on 400 patients with arterial switch surgery between 1983 and 1999. Excellent overall (96.7%) and arrhythmia-free (96.6%) survival was observed at 25 years of follow-up. Late fatalities were predominantly attributable to myocardial infarction or sudden death of presumed arrhythmic cause. The few acute coronary events occurred exclusively in infants aged <3.5 months. The most common cardiovascular sequelae were stenoses of the main pulmonary artery or its branches, pulmonary regurgitation, neoaortic stenosis and regurgitation, and coronary artery disease. Nearly one quarter of the patients required reintervention by 25 years of follow-up, whether surgical or percutaneous. Adverse cardiovascular events were predicted by a single right coronary artery and acute postoperative low cardiac output syndrome. Despite the prevalent postoperative sequelae and occasional adverse events, the mean left ventricular ejection fraction was 60.3% at the last follow-up, with 97.3% of patients having New...
York Heart Association class I symptoms. The peak oxygen uptake was 86.1% of predicted values. Chronotropic incompetence was nevertheless identified in more than one third of patients, perhaps reflecting sympathetic denervation. These results compare favorably with the much higher arrhythmia burden, incidence of sudden death, and prevalence of systemic (right) ventricular dysfunction previously reported in patients with atrial switch (ie, Mustard or Senning) procedures.

Conclusions—Long-term and arrhythmia-free survival is excellent after arterial switch operation. Although sequelae include chronotropic incompetence and neoaortic, pulmonary, and coronary artery complications, most patients maintain normal systolic function and exercise capacity.1

Chest Compression Alone Cardiopulmonary Resuscitation Is Associated With Better Long-Term Survival Compared with Standard Cardiopulmonary Resuscitation

Summary—Early bystander cardiopulmonary resuscitation (CPR) is the foundation for successful cardiac arrest resuscitation. Unfortunately, the majority of persons who have had cardiac arrests do not receive bystander CPR before arrival of professional rescuers. In comparison with traditional chest compression plus rescue breathing, chest compression alone is a CPR strategy that simplifies the psychomotor requirement and may enable easier training and more widespread implementation. However, the long-term survival effects of chest compression alone versus compression plus rescue breathing among bystanders in a generalizable community setting is uncertain. The current study leveraged 2 randomized clinical trials of 2500 cardiac arrest events involving dispatcher-assisted CPR instruction to evaluate whether long-term prognosis differed among those who received chest compression alone in comparison with those who received compression plus rescue breathing. Those who received chest compression alone experienced a 10% relative benefit in survival in comparison with compression plus rescue breathing. These findings provide strong support for long-term mortality benefit of a dispatcher CPR instruction strategy consisting of chest compression alone rather than compression plus rescue breathing among adult patients with cardiac arrest. Emergency dispatchers have a vital role in resuscitation, and community stakeholders should leverage this important role to increase early arrest recognition and effective layperson CPR and, in turn, improve survival following cardiac arrest. Bystanders can proceed with the chest compression alone approach with the appreciation that this strategy on average provides optimal long-term survival benefit.

Conclusions—The findings provide strong support for long-term mortality benefit of dispatcher CPR instruction strategy consisting of chest compression alone rather than chest compression plus rescue breathing among adult patients with cardiac arrest requiring dispatcher assistance.4

Risk Stratification and Outcome of Patients With Hypertrophic Cardiomyopathy ≥60 Years of Age

Summary—Hypertrophic cardiomyopathy (HCM) is the most common cause of sudden death in the young and is responsible for heart failure and stroke-related disability and death in adults of all ages. Although HCM is known to be compatible with normal longevity, a common perception also remains that this disease is ultimately associated with unrelenting progression throughout a patient’s lifetime. Therefore, whether patients of more advanced ages harbor disease-related risks similar to young patients is unresolved. By assembling and analyzing 428 HCM patients presenting at ≥60 years of age to 2 major centers, we were able to clarify the natural history of this complex disease at more advanced ages. Over follow-up, 279 patients (65%) survived to 73±7 years of age, and 149 (35%) died at 80±8 years. Only 16 patients (3.7%) had HCM-related mortality events (0.64%/y), including embolic stroke (n=6), progressive heart failure or transplantation (n=3), postoperative complications (n=2), and arrhythmic sudden death events (n=5, including 2 who died; 0.2%/y). Notably, all-cause mortality was increased compared with a matched US general population, predominantly resulting from non–HCM-related causes. Consequently, these data suggest an inverse relationship between the inherent risks from HCM and achieving advanced age, with survival itself generally declaring lower-risk status. Patients surviving into the seventh decade with this genetic disease are at low risk for HCM-related mortality and morbidity, including sudden death (even when conventional risk factors are present). These data do not support aggressive prophylactic defibrillator implantation at advanced ages for HCM patients. Indeed, in such older patients, other cardiac or noncardiac comorbidities, as competing modes of death, pose a greater threat to long-term survival.

Conclusions—HCM patients surviving into the seventh decade of life are at low risk for disease-related morbidity/mortality, including sudden death, even with conventional risk factors. These data do not support aggressive prophylactic defibrillator implantation at advanced ages in HCM. Other cardiac or noncardiac comorbidities have a greater impact on survival than HCM in older patients.5

Elevated Blood Pressure in Pregnancy and Subsequent Chronic Disease Risk

Summary—Hypertension during pregnancy affects ≥10% of all women, and the incidence of hypertensive disorders in pregnancy is increasing. The current study followed women with diagnosed hypertensive disorders during pregnancy for ≥40 years. We observed that ≤33% of all pregnant women had some form of hypertension, with 6.5% having chronic hypertension before or during pregnancy. Any elevation in blood pressure during pregnancy, even isolated systolic or diastolic blood pressure elevations that resolved during or after pregnancy, was associated with increased risk of subsequent cardiovascular diseases. Highest risks were associated with chronic hypertension (63% increase) and superimposed preeclampsia/eclampsia (98% increase) compared with normotensive women. Especially high risks were observed for fatal myocardial infarcts, with risks 100% to 400% higher in hypertensive women compared with normotensive women. We also observed that gestational hypertension was associated with 49% higher risk of subsequent diabetes mellitus and 90% higher risk of chronic kidney disease. All of the women who had transient hypertension during pregnancy were at higher risk (64% to 153%) of developing chronic hypertension. History of blood pressure elevations during pregnancy could be used to identify at-risk individuals for cardiovascular events. Detection of hypertension during pregnancy warrants further cardiovascular disease risk factor screening and at least counseling on lifestyle factors to reduce disease risk.

Conclusions—Elevated blood pressure during pregnancy, regardless of type and even without known risk factors, signals high risk of later cardiovascular disease, chronic kidney disease, and diabetes mellitus. Clinical monitoring, risk factor evaluation, and early intervention could benefit women with hypertension in pregnancy.6
Cost-Effectiveness of Percutaneous Coronary Intervention With Drug Eluting Stents Versus Bypass Surgery for Patients With Diabetes Mellitus and Multivessel Coronary Artery Disease: Results From the FREEDOM Trial

Summary—Clinical results from the Future Revascularization Evaluation in Patients With Diabetes Mellitus: Optimal Management of Multivessel Disease (FREEDOM) Trial showed that for patients with diabetes and multivessel coronary artery disease, coronary artery bypass graft (CABG) versus percutaneous coronary intervention (PCI) with drug-eluting stents was associated with lower rates of death, myocardial infarction, or stroke, with the benefit driven by significant reductions in both death and myocardial infarction. This prospective economic evaluation was performed to provide additional insight into the relative value of CABG versus PCI in the drug-eluting stents era from the perspective of the US healthcare system. FREEDOM enrolled patients with complex coronary artery disease and approximately one-third of PCI patients required more than one index PCI procedure, with a mean of 4.1 drug-eluting stents implanted per patient. Total procedure costs were roughly $3000 higher with PCI ($13,000 versus $9,700), whereas postprocedure costs were twice as high with CABG, yielding total hospitalization costs that were ≈$8600 higher with CABG ($35,000 versus $26,000). Over the 5-year follow-up period, higher initial costs with CABG were offset by lower costs associated with the need for repeat revascularization, yielding incremental costs with CABG of $3600 at 5 years. Cost-effectiveness analysis based on lifetime projections of quality-adjusted life-years and costs demonstrated that CABG was a highly cost-effective treatment with an incremental cost-effectiveness ratio of roughly $8000/quality-adjusted life-year gained, and showed similarly favorable results across a broad range of sensitivity and subgroup analyses. These findings therefore provide additional support for existing guidelines that recommend CABG for diabetic patients with multivessel coronary artery disease.

Conclusions—Despite higher initial costs, CABG is a highly cost-effective revascularization strategy compared with DES-PCI for patients with diabetes mellitus and multivessel coronary artery disease.

Variation Exists in Rates of Admission to Intensive Care Units for Heart Failure Patients Across Hospitals in the United States

Summary—Increasing attention is being focused on identifying costly hospital practices that do not necessarily lead to improved patient outcomes. Intensive care units (ICUs) account for 20% to 35% of total hospital costs, yet few studies have examined hospital patterns of ICU use for patients admitted with heart failure (HF) and whether these rates are associated with improved patient outcomes. In the present observational study, we describe patterns of ICU use for patients admitted with HF among a diverse group of 341 US hospitals. Once we observed the variation in the use of ICUs, we compared groups of hospitals with distinct patterns of ICU use in terms of their management of HF within the ICU and in-hospital mortality rates. We found substantial variation in ICU admission rates across hospitals with the top quartile of hospitals admitting 32% of patients on average directly to the ICU compared with only 8% of patients at hospitals in the other quartiles (P = 0.0001). In top-quartile hospitals, treatments requiring an ICU were used less often, including mechanical ventilation, noninvasive positive-pressure ventilation, vasoressors and/or inotropes, and vasodilators. Overall HF in-hospital risk-standardized mortality was similar (3.4% versus 3.5%; P = 0.2). Our findings demonstrate that a substantial number of hospitals triage many more patients with HF to their ICUs relative to other hospitals without achieving better in-hospital mortality outcomes. Given the high price of ICU admission, it is plausible that some hospitals may be engaging in a low-value, high-cost behavior. Such findings indicate the potential positive impact of creating guidelines to aid practitioners in the decision of whether to use the ICU for patients admitted with HF.


Prognostic Significance of Silent Myocardial Infarction in Newly Diagnosed Type 2 Diabetes Mellitus: Results From the UKPDS, 79

Summary—In the United Kingdom Prospective Diabetes Study (UKPDS), n = 1 in 6 patients with newly diagnosed type 2 diabetes mellitus had evidence of a silent myocardial infarction (SMI), defined as Q waves on a 12-lead resting ECG in the absence of typical cardiac symptoms. SMI was associated independently with a 58% increased rate of subsequent fatal MI and a 31% increased all-cause mortality rate. Although SMI at diagnosis occurred more often in women, the associated increased rate of a subsequent fatal MI was independent of sex. Some cardiovascular risk factors, including hypertension and microalbuminuria, were more prevalent among patients with SMI. The associations of SMI with increased rates of subsequent fatal MI and all-cause mortality argue for prompt review of the adequacy of management of modifiable cardiovascular risk factors in type 2 diabetes mellitus, but the incremental predictive value of SMI when added to current UKPDS Risk Engine variables (age at diagnosis, sex, ethnicity, smoking, hemoglobin A₁c, systolic blood pressure, and ratio of total to high-density lipoprotein cholesterol) is marginal.

Conclusions—About 1 in 6 UKPDS patients with newly diagnosed type 2 diabetes mellitus had evidence of SMI, which was independently associated with an increased risk of fatal MI and all-cause mortality. However, identification of SMI does not add substantively to current UKPDS Risk Engine predictive variables.

Prognostic Value of Energy Loss Index in Asymptomatic Aortic Stenosis

Summary—Aortic stenosis (AS) severity is frequently overestimated by aortic valve area based on the continuity equation in patients with milder degree of AS or smaller aortic root dimensions. Conventional measures of AS severity such as peak jet velocity, mean aortic gradient, and aortic valve area may also grade AS inconsistently. From this, we hypothesized that adjusting aortic valve area for the pressure recovery occurring in the aortic root by calculating the energy loss index (ELI) would improve risk assessment in patients with asymptomatic mild to moderate AS. This was tested in a prospective study of 1563 patients with initially asymptomatic AS and without known atherosclerotic disease or diabetes mellitus. In Cox regression analysis, lower ELI predicted higher risk for aortic valve events, including aortic valve replacement, cardiovascular death, and heart failure resulting from progression of AS, and higher mortality and combined total mortality and hospitalization for heart failure caused by progression of AS independently of peak aortic jet velocity and mean aortic...
gradient. To test whether ELI was superior to mean aortic gradient in event prediction, reclassification analysis was performed. As demonstrated, ELI improved aortic valve event prediction in the total study population, whereas prediction of total mortality and hospitalization for heart failure caused by progression of AS was improved only in the subgroup of patients with an aortic diameter <2.6 cm at the sinotubular junction. The results of the present study support systematic calculation of ELI in asymptomatic AS patients. ELI may be particularly useful in AS patients with a small aortic root.

Conclusions—In asymptomatic AS patients without known atherosclerotic disease or diabetes mellitus, ELI provides independent and additional prognostic information to that derived from conventional measures of AS severity, suggesting that ELI should be measured in such patients.10

Surgical Outcome of Discrete Subaortic Stenosis in Adults: A Multicenter Study

Summary—Discrete subaortic stenosis is a narrowing of the left ventricular outflow tract just beneath the aortic valve. In childhood, discrete subaortic stenosis is known for its unpredictable and sometimes rapid hemodynamic progression. Furthermore, aortic regurgitation is present in 30% to 80% of patients. Because reoperation rates have been reported to be high (8% to 34%), there is ongoing debate about the timing of surgical intervention and type of surgery. This is the first large study to evaluate the surgical outcome in adult patients. In contrast to children, the left ventricular outflow tract gradients in adults progress slowly. Mild aortic regurgitation is common but nonprogressive over time in the majority of patients. Patients with a preoperative peak left ventricular outflow tract gradient 280 mm Hg, however, are at risk for progression to moderate aortic regurgitation. Survival after surgery for discrete subaortic stenosis is excellent, with survival rates comparable to those of the normal population. The reoperation rate in young adult patients, however, is high (2%/y). Given the excellent survival in this young patient population, most patients face a reoperation for recurrent discrete subaortic stenosis throughout their lifetime. Additional myectomy does not reduce the risk for reoperation but significantly increases the risk of a complete heart block requiring pacemaker implantation. Therefore, myectomy should not be performed routinely.

Conclusions—Survival is excellent after surgery for discrete subaortic stenosis; however, reoperation for recurrent discrete subaortic stenosis is not uncommon. Over time, the left ventricular outflow tract gradient slowly increases and mild aortic regurgitation is common, although generally nonprogressive over time. Myectomy does not show additional advantages, and because it is associated with an increased risk of complete heart block, it should not be performed routinely.11

Smoking, Surgery, and Venous Thromboembolism Risk in Women: United Kingdom Cohort Study

Summary—Evidence about the effect of smoking on the incidence of venous thromboembolism, generally and in the postoperative period, is limited and inconsistent. We linked questionnaire data on smoking in a large United Kingdom cohort study (the Million Women Study) with hospital admission and death records to study venous thromboembolism incidence in relation to smoking, both in the absence of surgery and in the 12 weeks after surgery. During 6 years of follow-up, 4630 women were admitted to a hospital for or died of venous thromboembolism. In the absence of surgery, the risk of venous thromboembolism in current smokers was 40% higher than in never-smokers, with the risk increasing the more cigarettes women smoked. Similar relationships were found for women with a pulmonary embolism and for women with venous thrombosis alone. Smokers were more likely than never-smokers to have surgery. In the 12 weeks after surgery, current smokers had significantly higher risks of venous thromboembolism than never-smokers. In conclusion, smoking is another factor to consider in the assessment of venous thromboembolism risk in patients undergoing surgery.

Conclusions—Venous thromboembolism incidence was increased in current smokers, both in the absence of surgery and in the 12 weeks after surgery. Smoking is another factor to consider in the assessment of venous thromboembolism risk in patients undergoing surgery.12

Status of Cardiovascular Health in US Adolescents: Prevalence Estimates From the National Health and Nutrition Examination Surveys (NHANES) 2005 to 2010

Summary—The American Heart Association has committed to the goal of making a 20% improvement in the cardiovascular health of all Americans – both children and adults – by the year 2020. In the present article, we estimate the current status of cardiovascular health among US adolescents aged 12 to 19 years according to sex and race/ethnicity groups. These data highlight the acceptably high prevalence of cardiovascular health behaviors (eg, poor diet, insufficient physical activity, smoking exposure) and environmental factors (eg, excess sodium intake) that adversely influence cardiovascular health in US adolescents. Atherosclerosis begins in childhood and progresses to advanced calcified coronary plaque in the early decades of adulthood. Therefore, postponement of intervention until presentation of elevated risk factors in middle age actually results in secondary prevention because advanced disease is already present. The unfavorable levels of cardiovascular health components currently present in youth populations strongly emphasize the need for public health policy initiatives focusing on improving the cardiovascular health of Americans starting in childhood. Individual-level interventions are often ineffective as a result of limited physician effort, limited preventive care reimbursement, and unsupportive environmental factors. Consequently, broad social and cultural changes that infiltrate the entire population are necessary to evoke changes in youth behaviors that will favorably influence cardiovascular health. The comprehensive support of parents, healthcare professionals, educators, scientists, and legislators is required to ignite a social movement influential enough to facilitate the change needed to improve the currently worrisome status of cardiovascular health in youth populations and to prevent an increased incidence of premature coronary heart disease as the current US youth reach adulthood.

Conclusions—The low prevalence of ideal cardiovascular health behaviors in US adolescents, particularly physical activity and dietary intake, will likely contribute to a worsening prevalence of obesity, hypertension, hypercholesterolemia, and dysglycemia as the current US adolescent population reaches adulthood. Population-wide emphasis on establishment of ideal cardiovascular health behaviors early in life is essential for maintenance of ideal cardiovascular health throughout the lifespan.13


Summary—The diseases of affluence paradigm suggests that noncommunicable diseases are the modern scourges of the world and
are hence more common in developed countries. But until now, little has been known about the associations of these risk factors with the macroeconomic characteristics of countries, and how the associations have changed over time. We examined this paradigm by using data from a global analysis of body mass index, systolic blood pressure (SBP), serum total cholesterol, and fasting plasma glucose. We found that in 1980, body mass index, SBP, and serum total cholesterol were in fact higher in wealthier countries. By 2008, there was either no relationship between SBP and national income (for men) or SBP was lower in wealthier countries (for women). This may be partly due to improved diagnosis and treatment in wealthier countries and perhaps subtle improvements in diet and lifestyle, for example, lower salt intake and year-round availability of fresh fruits and vegetables. The relationship between body mass index and national income in more recent years resembled an inverted U, in part, because overweight and obesity increased substantially in many middle-income countries. Unlike SBP and fasting plasma glucose, serum total cholesterol was associated with both income and Western diet throughout this period. We also found that fasting plasma glucose was positively correlated with body mass index but had little association with other national characteristics. If the observed trends continue, developed countries will continue to face an obese population with a high prevalence of diabetes mellitus and hypercholesterolemia, whereas developing countries will be confronted by a combination of obesity, hypertension, and diabetes mellitus. The diseases of affluence paradigm seems inadequate for explaining these nuances in the global epidemiology of cardiovascular risk factors and should be replaced with a more refined framework that better informs both policy and intervention.

Conclusions—The changing associations of metabolic risk factors with macroeconomic variables indicate that there will be a global pandemic of hyperglycemia and diabetes mellitus, together with high blood pressure in low-income countries, unless effective lifestyle and pharmacological interventions are implemented.14

Effect of Time of Day on Prehospital Care and Outcomes After Out-of-Hospital Cardiac Arrest

Summary—Out-of-hospital cardiac arrest is a public health problem affecting nearly 300,000 individuals each year in the United States, with rates of survival at <10% in most cities. Successful resuscitation requires implementing a chain of survival, including both prehospital and hospital-based care measures. The association between time of day and out-of-hospital cardiac arrest outcomes in the prehospital setting was previously poorly understood; any such association has important implications for emergency medical services planning and resource allocation. We performed a retrospective review of cardiac arrest data from a large, urban emergency medical services system and found that rates of 30-day survival were significantly higher for cases of out-of-hospital cardiac arrest occurring during the day compared with at night, even after adjustment for patient, event, and prehospital care differences. We also found significant differences in the rates of bystander cardiopulmonary resuscitation, automated external defibrillator use, and response time intervals by time of day. This analysis represents the largest study to date of temporal variability in out-of-hospital cardiac arrest outcomes in the United States. Reasons for decreased survival at night may include biological differences in patients, decreased physical and mental performance on the part of emergency medical services providers and receiving hospital staff, or differences in the quality of cardiopulmonary resuscitation and other resuscitation care measures at night. These data provide compelling evidence for the need to further study nighttime emergency medical services resuscitation quality and system processes to improve patient safety and survival after out-of-hospital cardiac arrest.

Conclusions—Rates of 30-day survival were significantly higher for OHCA occurring during the day compared with at night, even after adjustment for patient, event, and prehospital care differences.15

Long-Term Safety and Effectiveness of Mechanical Versus Biological Aortic Valve Prostheses in Older Patients: Results From the Society of Thoracic Surgeons Adult Cardiac Surgery National Database

Summary—Estimates indicate that nearly 80,000 aortic valve replacements are performed annually in the United States on an increasingly older and sicker population, yet data are scarce regarding the relative safety and effectiveness of aortic valve prosthesis in elderly patients. Using data from the Society of Thoracic Surgeons Adult Cardiac Surgery Database, we followed patients aged 65 to 80 years undergoing aortic valve replacement (with a biological or mechanical prosthesis) from 1991 to 1999 at 605 centers. We sought to evaluate the long-term mortality and valve-related complications in bioprosthetic versus mechanical aortic valves, as well as the consistency of our findings among commonly encountered patient subgroups. We found that among the elderly, the incidence of both mortality and valve-associated morbidities was high in the first 12 years after aortic valve replacement. Mechanical valves were associated with improved late survival and long-term prosthesis durability, yet they were also associated with an increased incidence of bleeding and stroke. In summary, the comparative safety and effectiveness of prosthetic heart valves was highly dependent on patient age and underlying comorbidities. Our findings emphasize the complexity of choosing an appropriate prosthesis based on the individual needs and risks specific to each patient. These findings highlight the necessity for careful discussion and thorough communication between patients and their healthcare providers, in hopes of making an appropriate decision that is tailored to each individual patient’s unique profile.

Conclusions—Among patients undergoing aortic valve replacement, long-term mortality rates were similar for those who received bioprosthetic versus mechanical valves. Bioprostheses were associated with a higher long-term risk of reoperation and endocarditis but a lower risk of stroke and hemorrhage. These risks varied as a function of a patient’s age and comorbidities.16

Physiological Right Ventricular Adaptation in Elite Athletes of African and Afro-Caribbean Origin

Summary—The ethnic differences in left ventricular adaptation to exercise are well established. Athletes of African/Afro-Caribbean (black) origin exhibit a greater magnitude of left ventricular hypertrophy than their Caucasian counterparts, which occasionally results in diagnostic overlap with morphologically mild hypertrophic cardiomyopathy. The present study provides novel data on right ventricular adaptation in black athletes. The issue is particularly pertinent because black athletes frequently reveal T-wave inversion in the anterior precordial leads (V1 through V3), a common feature of arrhythmogenic right ventricular cardiomyopathy. Six hundred seventy-five elite male and female athletes, of whom 300 were black, were investigated by use of ECG and echocardiography. Right ventricular enlargement was frequently observed in athletes of both ethnicities, exceeding diagnostic thresholds for arrhythmogenic right ventricular cardiomyopathy in approximately half of all cases. More strikingly, anterior precordial T-wave inversion was present in 1 in 7 black athletes, some 4-fold more prevalent than in the Caucasian cohort. The combination of right
ventricular enlargement with concomitant T-wave inversion compatible with 2 major diagnostic criteria for arrhythmogenic right ventricular cardiomyopathy was almost exclusively observed in black athletes (3%), although further investigation did not diagnose a quiescent heart muscle disorder in any case. The result is a diagnostic “gray zone” between the healthy athlete’s heart and arrhythmogenic right ventricular cardiomyopathy that is 10-fold greater in black than white athletes. Recognition of this phenomenon has the potential to reduce the burden of investigations after preparticipation screening and to prevent erroneous exclusion of black athletes from sports participation.

Conclusions—Physiological RV enlargement is commonly observed in both black and white athletes. The impact of ethnicity is minimal, which obviates the need for race-specific RV reference values. However, in the context of frequent ECG repolarization anomalies in BAs, the potential for erroneous diagnosis of arrhythmogenic RV cardiomyopathy is considerably greater in this ethnic group.17

Long-Term Survival of Patients Undergoing Mitral Valve Repair and Replacement: A Longitudinal Analysis of Medicare Fee-for-Service Beneficiaries

Summary—Despite the established superiority of mitral repair over replacement, its adoption in the treatment of elderly patients has not been uniform. Whereas American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommend early surgery for mitral regurgitation in the “nonelderly,” special consideration is urged for the “elderly,” that they be treated medically unless severely symptomatic. These guideline recommendations stem from older studies citing operative mortality rates of 14% to 20%. Our article provides a timely update on the outcomes of 47279 elderly patients (median age, 75 years) undergoing mitral valve surgery. Operative mortality was 7.1%, which is substantially lower than that reported in the ACC/AHA guidelines for the elderly. Furthermore, operative mortality for patients who underwent repair was 3.9% compared with 8.9% for replacement. Patients who underwent repair appear to have a life expectancy similar to that of the age- and sex-matched US population, even in the cohort ≥75 years of age. Current guidelines strongly recommend referral to mitral valve surgery in symptomatic patients, preferably before the onset of left ventricular dysfunction and congestive heart failure. It appears that deviations often occur in the evaluation and treatment of mitral regurgitation in the elderly. In this cohort, 60% of patients had a prior diagnosis of heart failure, an evident delay in referral to intervention. Given the favorable outcomes of elderly patients undergoing mitral valve surgery, especially mitral valve repair, an approach of earlier identification and surgical referral appears justified regardless of age. These findings have relevance both to cardiologists treating mitral valve disease and potentially to the generation of new guideline recommendations.

Conclusions—Mitral valve surgery in the Medicare population carries less risk than previously reported. Given the favorable outcomes of elderly patients undergoing mitral valve surgery, especially mitral valve repair, an approach of earlier identification and surgical referral appears justified regardless of age.18

Intracoronary Injection of Bone Marrow–Derived Mononuclear Cells Early or Late After Acute Myocardial Infarction: Effects on Global Left Ventricular Function

Summary—Bone marrow–derived mononuclear cell (BM-MNC) treatment after acute myocardial infarction is appealing to patients and physicians because it represents a drug-free 1-time treatment to improve left ventricular (LV) remodeling. Harvest of bone marrow is relatively easy, and intracoronary injection of the BM-MNC has been demonstrated to be feasible and safe shortly after myocardial infarction. Many of the randomized controlled trials in the first years after the appearance of BM-MNC treatment showed a promising improvement in LV ejection fraction. In the last few years, enthusiasm is decreasing because many studies, using mainly cardiac MRI to assess LV function, did not confirm those results, showing only marginal benefit in favor of BM-MNC treatment. As in 2 other recently published trials of similar study design, in the present series there was no significant benefit in favor of BM-MNC in terms of LV remodeling or global or regional LV function. Nevertheless, meta-analyses show a potential benefit in terms of prognosis. Whether BM-MNC are the right cell type to be used shortly after myocardial infarction cannot be answered by the present study, nor can the question of whether LV ejection fraction is the most appropriate surrogate end point. Finally, only the recently begun event-driven phase III studies will provide a definitive answer.

Conclusions—Among patients with STEMI, left ventricular dysfunction, and LV dysfunction after successful reperfusion, intracoronary infusion of BM-MNC at either 5 to 7 days or 3 to 4 weeks after acute myocardial infarction did not improve LV function at 4-month follow-up.19

Safety of Sports for Athletes With Implantable Cardioverter-Defibrillators: Results of a Prospective, Multinational Registry

Summary—Although current recommendations restrict sports participation for patients with an implantable cardioverter-defibrillator (ICD), the risks are unknown. In this study, athletes with ICDs (age, 10–60 years) participating in organized (n=328) or high-risk (n=44) sports were followed up prospectively for median of 30 months, with sports-related and clinical data obtained by phone interview and medical records at baseline, if a shock occurred, and every 6 months. Median age was 33 years (89 subjects <20 years of age); 33% were female; and 42% had a pre-ICD history of ventricular arrhythmia. Sixty subjects were competitive athletes (varsity/junior varsity/traveling team). Running, basketball, and soccer were the most common sports. There were no occurrences of either primary end point—death or resuscitated arrest or arrhythmia- or shock-related injury—during sports. Shocks were not uncommon; there were 49 shocks in 37 participants (10% of study population) during competition/practice, 39 shocks in 29 participants (8%) during other physical activity, and 33 shocks in 24 participants (6%) at rest. In 8 ventricular arrhythmia episodes (device defined), multiple shocks were received: 1 at rest, 4 during competition/practice, and 3 during other physical activity. The ICD terminated all episodes. Freedom from lead malfunction was 97% at 5 years (from implantation) and 90% at 10 years, similar to that reported in unselected populations. In summary, many athletes with ICDs can engage in vigorous and competitive sports without physical injury or failure to terminate the arrhythmia, despite the occurrence of both inappropriate and appropriate shocks. These data provide a basis for more informed physician and patient decision making in terms of sports participation for athletes with ICDs.20
Association Between Postresuscitation Partial Pressure of Arterial Carbon Dioxide and Neurological Outcome in Patients With Post–Cardiac Arrest Syndrome

Summary—Partial pressure of arterial CO₂ is a major regulator of cerebral blood flow after brain injury. The 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care recommend that ventilation should be titrated to achieve a partial pressure of arterial CO₂ of 40 to 45 mm Hg after return of spontaneous circulation from cardiac arrest. However, at the present time, we are unaware of any previous clinical research studies on the subject of hypocapnia and hypercapnia during the post–return of spontaneous circulation period in adult patients. Specifically, it has been unclear if exposure to hypocapnia and hypercapnia during the initial post–return of spontaneous circulation period is common and independently associated with neurological outcome. In this observational study, both hypocapnia and hypercapnia exposure were common and were independently associated with poor neurological function at hospital discharge. Future research is needed to determine the optimal partial pressure of arterial CO₂ range after the return of spontaneous circulation.

Conclusions—Hypocapnia and hypercapnia were common after cardiac arrest and were independently associated with poor neurological outcome. These data suggest that Paco₂ derangements could be potentially harmful for patients after resuscitation from cardiac arrest.

Bayesian Methods Affirm the Use of Percutaneous Coronary Intervention to Improve Survival in Patients With Unprotected Left Main Coronary Artery Disease

Summary—The 2011 American College of Cardiology Foundation/American Heart Association revascularization guidelines have assigned a Class IIa recommendation ("should be considered") to percutaneous coronary intervention (PCI) to improve survival over medical therapy in selected patients with unprotected left main coronary artery disease, yet no trials have directly compared PCI with medical therapy for patients with this condition. We used traditional frequentist statistical approaches and bayesian methods to analyze the 7 trials comparing coronary artery bypass graft surgery with medical therapy and 12 clinical trials comparing coronary artery bypass graft with PCI for patients with unprotected left main coronary artery disease. The odds ratio (OR) for 1-year mortality after PCI versus coronary artery bypass graft using bayesian meta-analysis (posterior median OR, 1.04; 95% bayesian credible interval [BCI], 0.74–1.39) was not different from the OR using frequentist random-effects meta-analysis (OR, 1.00; 95% confidence interval, 0.72–1.40). A bayesian cross-design analysis suggested that the primary outcomes for randomized clinical trials (OR, 0.99; 95% BCI, 0.67–1.43), matched cohort studies (OR, 1.10; 95% BCI, 0.76–1.73), and other types of cohort studies (OR, 0.93; 95% BCI, 0.58–1.35). A bayesian network meta-analysis suggested that medical therapy alone is associated with a higher 1-year mortality than PCI for patients with unprotected left main coronary artery disease (OR, 3.22; 95% BCI, 1.96–5.30). Bayesian methods support the current revascularization guidelines and suggest that PCI improves survival over medical therapy alone for patients with unprotected left main coronary artery disease. An integrated approach using both frequentist and bayesian methods may yield new insights to enhance the translation of trial data into clinical practice.

Conclusions—Bayesian methods support the current guidelines, which were based on traditional statistical methods and have proposed that PCI, like CABG, improves survival for patients with unprotected left main coronary artery disease compared with medical therapy. An integrated approach using both direct and indirect evidence may yield new insights to enhance the translation of clinical trial data into practice.

Adoption of Radial Access and Comparison of Outcomes to Femoral Access in Percutaneous Coronary Intervention: An Updated Report from the National Cardiovascular Data Registry (2007–2012)

Summary—Radial access for percutaneous coronary intervention is associated with reduced vascular complications; however, previous reports have shown that <2% of percutaneous coronary intervention (PCI) procedures in the United States are performed via the radial approach. Our aims were to evaluate temporal trends in the radial approach to PCI (r-PCI) and compare procedural outcomes between r-PCI and transfemoral PCI. We conducted a retrospective cohort study from the CathPCI registry (n=2 820 874 procedures from 1381 sites) between January 2007 and September 2012. After multivariable adjustment, r-PCI use in the studied cohort of patients was associated with a lower risk of bleeding (adjusted odds ratio, 0.51; 95% confidence interval, 0.49–0.54) and lower risk of vascular complications (adjusted odds ratio, 0.39; 95% confidence interval, 0.31–0.50) in comparison with transfemoral PCI. There are several important findings in this large, contemporary observational study of a national multicenter PCI registry. First, since early reports, there has been a 13-fold increase over a period of 6 years in the use of r-PCI. Second, there is substantial interhospital and geographic variation in the use of r-PCI. Third, r-PCI is associated with consistently lower rates of bleeding and vascular complications in comparison with transfemoral PCI without compromising procedural success rates. Finally, the greatest benefit of r-PCI in terms of absolute reduction of bleeding and vascular complications is seen in high-risk groups of patients ≥75 years of age, women, and patients with acute coronary syndrome, in whom paradoxically the use and growth of r-PCI are the lowest. These findings indicate that wider adoption of r-PCI in interventional practice presents an opportunity to potentially improve overall PCI safety.

Conclusions—There has been increasing adoption of r-PCI in the United States. Transradial PCI now accounts for 1 of 6 PCIs performed in contemporary clinical practice. In comparison with traditional femoral access, transradial PCI is associated with lower vascular and bleeding complication rates.

Survival After Implantable Cardioverter-Defibrillator Implantation in the Elderly

Summary—The benefit of implantable cardioverter-defibrillators (ICDs) among elderly patients is controversial and may be attenuated by nonrhythmic death. An estimated 28% of those deemed potentially eligible for ICD implantation by conventional criteria are octogenarians. The Ontario ICD registry is a large, prospective, inclusive database designed to evaluate adjudicated clinical and device-related outcomes after ICD implantation. We examined 5399 primary and secondary prevention ICD recipients between February 2003 and September 2010 to determine the effect of age on mortality, hospitalization, device therapy, and complications. Among primary prevention ICD recipients aged 18 to 49, 50 to 59, 60 to 69,
70 to 79, and 280 years, mortality increased significantly with age, as follows: 2.1, 3.0, 5.4, 6.9, and 10.2 deaths per 100 person-years, respectively. Secondary prevention ICD recipients also demonstrated increasing mortality, as follows: 2.2, 3.8, 6.1, 8.7, and 15.5 deaths per 100 person-years. However, rates of appropriate shock were similar across age groups, with a mean of 5.1 and 12.0 events per 100 person-years for primary and secondary prevention cohorts, respectively. Competing risk analysis verified an increase in all-cause mortality but no significant decline in appropriate shocks with advanced age. Furthermore, inappropriate therapy and complications were similar regardless of age. These results suggest that decisions regarding ICD candidacy should not be based on age alone. Cardiovascular and noncardiovascular hospitalizations were elevated in the elderly, reflecting a greater impact of comorbidities. Consideration of prognostic factors that predict mortality in conjunction with individualized clinical judgment will help to identify older patients who are more likely to benefit from ICD implantation.

Conclusions—Whereas elderly patients exhibited increased mortality after ICD implantation, rates of appropriate device shocks were similar across age groups. Decisions regarding ICD candidacy should not be based on age alone but should consider factors that predispose to mortality despite defibrillator implantation.26


Summary—State-of-the-art imaging with cardiac computed tomography angiography (CCTA) provides a safe alternative to reduce length of stay for patients presenting to the emergency department with symptoms suggestive of acute coronary syndrome. Controversy remains as to whether patients at relatively low risk for coronary artery disease merit noninvasive testing, especially involving cardiac imaging. Women are known to be at lower risk for coronary disease than men, yet they have more frequent false-positive stress tests. Issues surrounding increased radiation exposure and more frequent downstream testing, including invasive coronary angiography, remain a concern for clinicians in the widespread implementation of CCTA. In this prespecified analysis from the multicenter, randomized, controlled Rule-Out Myocardial Infarction With Computer-Assisted Tomography (ROMICAT)-II trial of 1000 low-intermediate risk patients who presented to the emergency department with symptoms suggestive of acute coronary syndrome, we compared sex differences in the effectiveness of an early CCTA and standard emergency department evaluation. Women undergoing an early CCTA strategy compared with a standard evaluation strategy have a greater reduction in downstream testing, including invasive coronary angiography, and a lower rate of obstructive epicardial coronary disease than men. These data provide support for clinicians to use an early CCTA strategy in women with such symptoms.

Conclusions—This trial provides data supporting an early CCTA strategy as an attractive option in women presenting to the ED with symptoms suggestive of acute coronary syndrome. The findings may be explained by lower CAD prevalence and severity in women than men.26

References


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