Recent Developments in Valve Surgery

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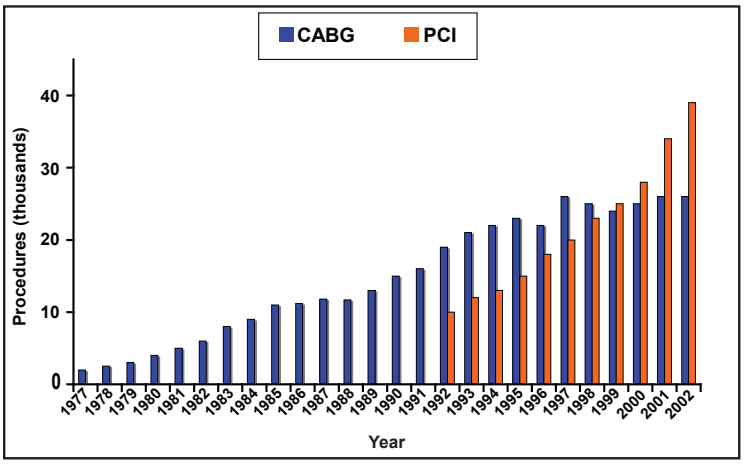
Surgical valve replacement or repair is the gold standard treatment of severe valvular heart disease and severe symptomatic valve stenosis [Guidoin R et al. *Ann NY Acad Sci* 2010]. Andrew Chukwuemeka, MD, FRCS, Imperial College Healthcare NHS Trust, London, United Kingdom (UK), discussed recent developments and challenges in the field of surgery for valvular disease.

Figure 1. Annual Incidence of PCI and CABG in the UK.



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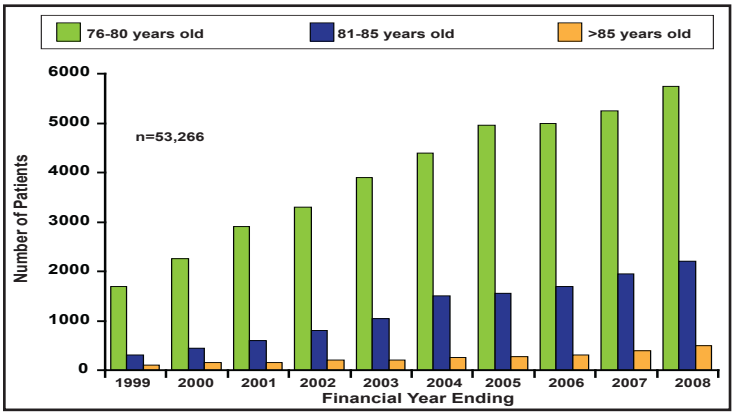
In the past decade, there has been an exponential increase in percutaneous coronary intervention (PCI) compared with a leveling off of coronary artery bypass surgery in the UK (CABG; Figure 1). However, the decline in CABG has been offset by marked increases in the annual volume of aortic and mitral valve operations [The Society for Cardiothoracic Surgery in Great Britain & Ireland. *Sixth National Adult Cardiac Surgical Database Report 2008*].

Figure 2. Rise in the Number of Elderly Cardiac Surgery Patients.



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Many of these procedures were performed in elderly patients with multiple comorbidities—a challenging change in demographics for cardiac surgeons (Figure 2). In spite of increasing age, postoperative survival remains high. "The surgery is safe, effective, removes symptoms, extends survival, and improves quality of life," said Prof. Chukwuemeka, noting that from 2004 to 2008, the survival rate in patients aged >80 years was 65% at 5 years after surgery, which is impressive, considering the patient population that is involved [The Society for Cardiothoracic Surgery in Great Britain & Ireland. *Sixth National Adult Cardiac Surgical Database Report 2008*].

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The Challenges Ahead

Four main challenges lie ahead:

- Adaptation to increasingly elderly patients with significant comorbidities
- Reduction of prosthetic valve-related morbidity
- Establishment of minimally invasive techniques
- Improvement of risk assessment

As the population ages, the number of valve replacement surgeries is expected to increase sharply. Percutaneous aortic valve implantation provides an attractive alternative to standard open heart surgery in elderly patients who are considered to be at high or prohibitive surgical risk in large part due to their advanced age [Guidoin R et al. *Ann NY Acad Sci* 2010].

For patients aged >70 years with severe aortic stenosis, transcatheter aortic valve implantation (TAVI) may provide a promising alternative to surgical aortic valve replacement (AVR) [Guidoin R et al. *Ann NY Acad Sci* 2010; Leon MB et al. *N Engl J Med* 2010; Smith CR et al. *N Engl J Med* 2011]. For those with severe mitral regurgitation (MR), which also confers a poor prognosis (particularly in patients with heart failure) [Maisano F et al. *Int J Cardiovasc Imaging* 2011], catheter-based mitral repair systems offer a new option.

MitraClip, a percutaneous mitral valve (MV) repair device, has been compared with surgery in the Endovascular Valve Edge-to-Edge Repair Study (EVEREST II) randomized trial [Maisano F et al. *Int J Cardiovasc Imaging* 2011]. Two-year follow-up data from EVEREST II have shown that although a catheter-based MV repair procedure that uses the MitraClip system was less effective at reducing MR than conventional surgery, similar improvements in clinical outcomes were observed with fewer short-term adverse events [Cleland JG et al. *Eur J Heart Fail* 2011; Feldman T et al. *N Engl J Med* 2011].

Sutureless implantation of the prosthesis is another promising approach that has the potential to shorten aortic crossclamp time, thereby reducing morbidity and mortality in elderly and high-risk patients. A recent study found it possible to implant a well-functioning, sutureless, stent-mounted valve in the aortic position in less than 20 minutes of aortic crossclamping—a finding that was associated with excellent early clinical and hemodynamic outcomes in high-risk patients [Flameng W et al. *J Thorac Cardiovasc Surg* 2011].

Reducing Prosthetic Valve-Related Mortality

There is no perfect valve substitute. All prostheses, whether mechanical or biological, involve some compromise, and all introduce a new disease process: the prosthetic disease. Considerations for choosing between a mechanical valve and a bioprosthesis include hemodynamic performance, long-term durability, and the need for chronic anticoagulation [Goncalo F et al. *Interact Cardiovasc Thorac Surg* 2009].

There is a trend toward use of more bioprosthetic valves [Seeburger J et al. *Cardiac Surgery* 2009]. The main advantage with bioprosthetic valves is that they do not require lifelong anticoagulant therapy due to lower thrombotic risk, although mechanical valves are more durable. For most patients with a bioprosthetic valve, structural valve deterioration starts around 5 years postimplantation and increases rapidly [Tillquist MN, Maddox TM. *Patient Prefer Adherence* 2011].

Another option is reconstructive valve repair. For example, aortic valve-sparing operations in patients with Marfan syndrome provide excellent clinical outcomes: <1% operative mortality, 87.2% 15-year survival, and 79.2% freedom from more-than-mild aortic insufficiency at 15 years [David TE. *J Thorac Cardiovasc Surg* 2009].

Establishing Minimally Invasive Techniques

Controversy surrounds the use of minimally invasive AVR. A 2008 meta-analysis suggested marginal benefits in perioperative mortality (4667 patients; OR, 0.72; 95% CI, 0.51 to 1.00; p=0.05), intensive care unit stay, total hospital stay, and ventilation time in the minimal access AVR group. However, crossclamp, cardiopulmonary bypass, and total operation times were longer [Murtuza B et al. *Ann Thorac Surg* 2008]. Another meta-analysis showed that ministernotomy can be safely performed for AVR, without increased risk of death or other major complications; however, few objective advantages were observed [Brown ML et al. *J Thorac Cardiovasc Surg* 2009].

Improving Risk Assessment

In 1999, the EuroSCORE risk assessment system was recommended for widespread use [Nashef SA et al. *Eur J Cardiothorac Surg* 1999]. But, according to Prof. Chukwuemeka, its predictive assessment for individual patients was limited, and it was a poor tool for valvular heart disease compared with other cardiac surgeries (only 30% of patients in the dataset).

A recent report by The Working Group on Valvular Heart Disease of the European Society of Cardiology reviewed the most widely used risk scores (EuroScore, STS, and Ambler score) and concluded that current risk scores do not provide reliable estimates of exact operative mortality in individual valvular heart disease patients. Scores should be interpreted with caution and only used as part of an integrated approach that incorporates other patient characteristics, the clinical context, and local outcome data. Specific risk models also need to be developed for newer interventions, such as TAVI [Rosenhek R et al. *Eur Heart J* 2011].