Dr Stephen Westaby attributes his professional approach to his having trained with John Kirklin, MD, at the department of surgery at the University of Alabama, Birmingham, and to a long-standing relationship with Denton Cooley, MD, and Bud Frazier, MD, of the Texas Heart Institute, Houston. Dr Westaby’s detailed knowledge of the history of cardiac surgery culminated in the publication of his book, *Landmarks in Cardiac Surgery*.1

After hearing of Dr Denton Cooley’s implantation of a totally artificial heart in July 1981, Dr Westaby travelled to Houston to meet the surgeon and see the device. Thus began his enduring interest in mechanical circulatory-support technology and his relationship with the centre. The Texas Heart Institute and the Oxford Centre collaborated with Robert Jarvik, MD, already widely known for his work on the development of artificial hearts, to introduce his miniaturised axial flow pump, the Jarvik 2000 left ventricular assist device (LVAD) (Figure 1). They are currently developing an even smaller device for infants and children.

Dr Westaby says, “There are several thousand patients in the United Kingdom with New York Heart Association stage III/IV heart failure who suffer severely debilitating symptoms of fatigue and breathlessness, who would be suitable for LVAD treatment.” These include patients with ischaemic heart disease or idiopathic dilated cardiomyopathy who do not have comorbidities that would terminate their lives within 2 years; for these patients, an off-the-shelf solution could offer good quality of life. “I see mechanical circulatory support not restricted to bridge to transplantation but offered as a widespread alternative to those without access to a donor heart,” he says.

**Figure 1.** The team celebrate the first Jarvik 2000 heart implantation: From the left, Dr Stephen Westaby, Dr Bud Frazier, Dr Denton Cooley, and Dr Robert Jarvik.
Because of cost restrictions—each device costs £60 000 (€84 000) plus around £50 000 (€70 000) in hospital costs—the number of operations has been limited in the United Kingdom. Because of the restricted funds for research and development in the United Kingdom’s National Health Service, the clinical trials planned by Dr Westaby and his colleagues have not moved ahead. “All the destination therapy implants of the Jarvik system have been funded by charitable donations or peer review grants,” he says. “The United Kingdom could be at the forefront of applying new LVAD technology, but we have not been able to move it forward for economic reasons.” Although small, Dr Westaby’s programme has achieved good results. He points out, “The majority of patients have not died from cardiac failure but from other problems, such as cancer or lung disease.”

Dr Westaby also believes that heart failure patients receive unfair treatment within the National Health Service. “My argument is that renal failure patients are offered dialysis irrespective of age, with or without the possibility of transplantation. We have now developed an alternative for advanced heart failure that has proven reliable up to 7 years and that could be applied to probably 20 000 patients a year in this country. Most renal failure patients are treated, but palliation of advanced heart failure is by transplantation alone.” He believes that such operations will become cost-effective, particularly for patients who require multiple hospital admissions for stabilisation and who receive expensive devices such as cardiac resynchronisation and implantable defibrillators. He says, “I predict that the cost of LVADs will fall because of competition with newer and more innovative rotary blood pumps that will eventually be implanted without a major open operation. You only have to avoid 2 or 3 hospital admissions to pay for the device.”

Dr Westaby’s first permanent Jarvik implant has lasted far longer than any other type of artificial heart, and the patient, Peter Houghton has not had a single device-related adverse event. Mr Houghton was breathless at rest, with pitting oedema to the thighs, ulcerated legs, and ascites when he had the device implanted in June 2000. He has since spent less than 10% of his time in hospital; without the device, he would have died within weeks. “The tradeoff has been 7 years of life that is ongoing, with a substantial reduction in hospital costs,” says Dr Westaby. He adds, “The important thing for people who receive these LVADs is that they should not sit home and do nothing.”

Mr Houghton has been able to travel to the United States on several occasions (Figure 2) to give lectures about life with an artificial heart. He emphasises that one could not consider life with an LVAD normal. “You have to change the batteries twice a day and carry the equipment around continuously, but it is much better than being severely symptomatic with heart failure,” he says.

The Jarvik 2000 is implanted within the failing left ventricle via sternotomy or left thoracotomy. The development group addressed the life-threatening problem of power-line infection by bringing electricity through a titanium pedestal screwed onto the skull behind the ear (Figure 3). The development, based on the success of cochlea implant technology, was successful because scalp skin is highly vascular, lacks fat, and heals well. All external components of the system are exchangeable, so cables, the controller, and batteries can be exchanged periodically. This is particularly useful for permanent LVAD implants. Its robustness was once demonstrated when Mr Houghton was at a supermarket. A thief snatched the bag containing the device controller and the battery, disconnecting the cable from the skull pedestal. When the built-in alarm sounded, the assailant dropped the bag. When the cables were connected again, Mr Houghton’s LVAD restarted.

“The rate of recovery after receiving an LVAD is not dissimilar to that of transplantation,” says Dr Westaby, “though the titanium of the device is completely inert, so there is no rejection and little risk of infection.” Both in the laboratory and from clinical experience, the Oxford Group has shown that patients with continuous flow devices and attenuated pulse pressure in the circulation have normal organ function indefinitely. “The only major change is a predictable thinning
of the aortic medial layer in response to reduced mean blood pressure.” Dr Westaby says, “and I consider the attenuation of pulse pressure as a potential therapeutic option for patients with severe arterial disease.”

He also hopes to use LVADs to promote recovery in the failing left ventricle, and he believes the combination of LVADs with adjuvant therapy such as stem cells, genetic manipulation, or drug therapy will eventually provide an alternative to transplantation for most heart failure patients.

“We will use the LVAD to rest the native myocardium and remove elevated left ventricular end-diastolic pressure. This improves endocardial blood flow and may provide a platform on which stem transplantation rather than whole heart transplantation will be based,” he believes. “With smaller, more reliable devices, the American healthcare system expects LVADs to be a common treatment by 2010, with more than 100,000 implantations per year at a cost of $10,000,000.”

Recently, Dr Westaby has used short-term LVADs to increase the safety of very-high-risk conventional heart failure operations. The blood pump sustains the patient through the period of myocardial stunning. Patients with left ventricular ejection fraction of <15% and elevated left ventricular end-diastolic pressure are identified preoperatively and are then weaned directly from cardiopulmonary bypass onto the LVAD for a period of 4 to 5 days. “Patients who might otherwise have died in cardiogenic shock have been sustained in this way and have subsequently recovered,” says Dr Westaby, “and I think that interventional cardiology, together with statins and lifestyle changes, will substantially reduce the amount of coronary bypass surgery worldwide, and heart failure surgery will increase in scope and become a speciality in itself.” He concludes, “The use of both short- and long-term circulatory support technology will play an important part in this programme.” In 2004, Dr Westaby won recognition for his efforts when he received the prestigious Ray C. Fish award for scientific achievement for his work with continuous-flow LVADs and the pulseless circulation.

Mark Nicholls is a freelance medical writer.

References

European Society of Cardiology Working Groups

Working Group 6: Coronary Pathophysiology and Microcirculation

In this continuation of a series that looks at working groups and their objectives, the chair of the European Society of Cardiology Working Group on Coronary Pathophysiology and Microcirculation, Mario Marzilli, MD, explains how his group tries to raise awareness among cardiologists about the importance of small-vessel dysfunction in the pathogenesis of coronary disease. But it is proving to be an uphill struggle, as he explains to Emma Baines, MSc.

The European Society of Cardiology (ESC) Working Group 6 was one of the earliest of the 19 working groups; researchers in basic science and clinicians with an interest in coronary microcirculation started the group 15 years ago. In 2002, the group expanded to cover coronary pathophysiology as well as microcirculation, in recognition of the close relationship between research work in these areas. The group now includes more than 200 members working in clinical research as well as basic science.

Dr Mario Marzilli, professor and chief of cardiology at the University of Siena, was elected chair of the Working Group at the ESC meeting in Barcelona in September 2006. He completed his specialisation in cardiology at the University of Pisa in 1974, and he has been studying the mechanisms that regulate coronary blood flow ever since.

He studied coronary pathophysiology at the Ford Hospital in Detroit, Mich, from 1977 to 1979 before returning to Pisa, where he did extensive work on coronary pathophysiology. In 2001, he became professor of cardiology at the University of Pisa in 1974, and he has been studying the mechanisms that regulate coronary blood flow ever since.

During his career, Dr Marzilli has carried out research on ischaemic heart disease, using animal models of cardiovascular dysfunction, metabolic disorder, and diabetes mellitus. He also has performed clinical research showing that microvascular problems can contribute to ischaemic heart disease and can even trigger myocardial infarction in some patients.

Dr Marzilli says, “A better understanding of the role that microvascular dysfunction plays in heart disease is urgently needed to improve the treatment of ischaemic heart disease and other cardiovascular conditions, including cardiomyopathies.” He continues, “We can improve on treatment outcomes by treating that part of the cardiovascular system that is not visible through coronary angiography but that does play a major role in the pathogenesis of these conditions. But,” he points out, “unfortunately, this understanding of the disease is not supported by treatment guidelines.”

He adds that one of the main challenges facing the
Dr Marzilli explains, “Most cardiologists will look for a blockage and, if they don’t find one, will rule out coronary artery disease as a diagnosis. But a number of patients with ischaemic heart disease are not suffering from a single blocked artery at all. And this is not a small minority—it’s around 30% of cases!” He warns, “We need to look at ways to improve outcomes in these patients and to not discard them as being false positives just because no blockage is visible.”

The working group has 2 manuscripts in preparation that will draw attention to this problem. The first will make the case for considering coronary microcirculation in the pathophysiology of heart disease (see Figure), and the other will set out clinical methods to help patients whose disease stems from microcirculatory problems. “In the long run, we want to have the cardiology world fully aware that the problem is not just concentrated at 1 level but that it is spread around all the cardiovascular tree,” Dr Marzilli says.

But he recognises the challenge the working group faces in persuading the cardiology community as a whole to see coronary artery disease as a more complicated problem than the standard model suggests, and to see that simple interventions such as revascularisation and stenting may not provide the optimal solution for all patients.

“I’m fully confident that sooner or later we will achieve this aim,” he says, “but unfortunately, the weight of the individual ESC working groups depends on the financial potential of the research they support, and there is not a lot of money in our field. We are basically fighting a very unfair battle.” He comments, “We are a small group of people with limited, if any, support from industry, which means there is no money available. Yet, we’re trying to prove concepts that are not in the interest of the majority of cardiologists. In fact, our ideas may be perceived as negative by those people who just aim to increase the number of procedures of any kind because of the economics involved.”

Dr Marzilli says that the working group hopes to expand its numbers and attract new members, especially among young people. He adds, “I would like to see better communication between the leaders of the ESC and the working groups, and between the leaders of the working groups and the national societies of cardiologists they represent.”

In particular, he opposes the idea of the working group withdrawing from the ESC and forming an independent European society of specialists in microcirculation and coronary pathophysiology. He believes that this would lead to poorer communication with other cardiologists and to less valuable research.

He says, “When a working group becomes an independent society, it limits its interaction with other sections of cardiology. It focuses on its own interests exclusively and intensifies certain procedures and interventions that generally are associated with increasing cost, preventing a fully critical appraisal of the cost–benefit ratio.” Dr Marzilli continues, “This limits the critical comparison and discussion and prevents objective evaluation. And, of course, people who are involved in doing the procedure eventually also become those who say that this procedure is needed. It becomes sort of a scientific label that is not justified.”

He also acknowledges a more straightforward reason for why his working group will probably not follow the example of other specialist societies and split off from the ESC. “The pressure for the working groups to separate out from the ESC mostly comes from industry and the money involved, so we just don’t have that pressure!” he concludes.

Emma Baines is a freelance medical writer.
An Update on Electrophysiology in Poland

Cadioelectrophysiological Procedures in Poland Have Increased Recently by as Much as 300%

In the past 5 years in Poland, the number of implanted defibrillators has increased by 300%, and the number of ablation procedures has increased by >200%. Andrzej Lubinski, MD (pictured right), professor and chief of clinic at the department of invasive cardiology and cardiodiabetology, Medical University of Lodz, Poland, and Andrzej Bissinger, MD, cardiologist and electrophysiologist in the same department, give Robert Short, BSc, a snapshot of the state of cardiology in Poland.

Some details of the health system in Poland and its financing system provide the context in which the country’s cardiology workers. The population of Poland is about 38.5 million, and in 1997 the country had about 91,000 doctors (2.4 physicians per 1000 people), 214,000 nurses, and about 679 general hospitals, with 6.2 beds per 1000 people.¹

The health system in Poland is based on a national budget: the Narodowy Fundusz Zdrowia, or National Health Fund. Those in employment pay social security and health insurance contributions. Employers also contribute social security and national insurance taxes for each employee. Those insured under the Narodowy Fundusz Zdrowia have the right to health services to maintain their health, prevent diseases, have their injuries treated, and have diseases diagnosed and treated. During hospital stays, patients receive all operations, diagnostic tests, and medicines free of charge.

The Narodowy Fundusz Zdrowia has a limited budget; this, in turn, limits access to medical procedures, including electrophysiology. Nevertheless, much progress has been made. In the last 5 years, the number of implantable cardiac defibrillators (ICDs) placed in patients increased by 300%, and the number of ablations increased by >200%. Poland currently has 77 pacemaker-implantation centres, 45 ICD-implantation centres, and 26 ablation centres.

The number of new pacemaker implantations in Poland is 548 per million/population, and 9 per million/population receive biventricular-pacing pacemaker implantations. Fifty-one per million/population receive ICD implantations and 91 per million/population receive ablation procedures. For comparison, about 300 ablations per million/population are performed in Germany.

Dr Bissinger (pictured left) says, “Despite the increases in electrophysiological procedures in recent years, the numbers are still too small to meet the demand for them.” He explains, “For example, the estimated number of patients with Wolff-Parkinson-White syndrome in our country is about 180,000, but we are only doing ablations at the rate of about 3000 per year. That means we cannot even keep up with the population growth of patients with Wolff-Parkinson-White syndrome.” He continues, “As a result, there is a long line of people on the waiting lists. For example, in our department, the waiting time for ICD implantation is about 14 days; for Wolff-Parkinson-White ablation, it is about 2 months.”

Dr Andrzej Lubinski is chair of the Heart Rhythm Working Group in Poland. This organisation began as a part of the Polish Cardiac Society in 1973. Among its various aims, the working group establishes standards and guidelines of management and treatment of patients with cardiac arrhythmias, lobbies government departments to improve the development and financial support for the treatment of cardiac arrhythmias, and cooperates with heart rhythm organisations in other countries.

Dr Lubinski is also the chief of clinic of a new development: the department of invasive cardiology and cardiodiabetology at the Medical University of Lodz. Dr Lubinski says, “The department was created just 2 years ago, and it is composed of 3 parts,” and explains that these involve invasive cardiology, both elective and in acute coronary syndromes; electrophysiology, with 2 electrophysiology laboratories for pacemakers and ICD implantations, radiofrequency ablations, and CARTO mapping; and cardiodiabetology, where cardiologists cooperate with diabetologists to treat patients with diabetes mellitus and cardiovascular problems.

“In Poland, nearly 1 in 10 people have diabetes, and the number having the disease is expected to double in 20 years,” says Dr Lubinski. Patients with diabetes account for about 25% of all hospitalised patients with cardiovascular disease. Diabetic patients with coronary artery disease have a mortality rate some 2- to 3-fold that of patients without diabetes. Cardiovascular diseases are responsible for 70% to 80% of deaths among diabetic patients. Dr Lubinski says, “Therefore, it is very important to protect patients with diabetes and to have this as a specific focus of our department’s work.”

Dr Lubinski points out, “The new department’s team has presented results of research on cardiodiabetology problems at several congresses in Poland and abroad.” He cites the
example of Dr Bissinger’s work on the effect of diabetic autonomic neuropathy on P-wave dispersion and recurrences of atrial fibrillation in patients with diabetes mellitus type 2. Dr Bissinger presented his findings during the World Congress of Cardiology in Barcelona, Spain, in September 2006.

When asked to identify the most satisfying aspect of his work, Dr Lubinski replies, “It is radiofrequency ablation—especially complicated arrhythmias like atrial fibrillation or ventricular arrhythmias. The procedures take a long time, but one is rewarded by the cure of the patient. It improves not only a patient’s quality of life; it often reduces mortality.”

Dr Bissinger considers successful biventricular pacing implantation to be the most satisfying part of his work. He says, “I enjoy this procedure, not only as a technical success, but for the clinical improvement of the patient. Biventricular pacing is not for all heart failure patients, so those who can potentially benefit need to be carefully identified. It’s gratifying to hear patients who had severe heart failure tell me after implantation just how much better they feel.”

Dr Bissinger also obtains great satisfaction from selecting the right patients for ICD implantation. “I am very satisfied when a patient who has had an ICD implantation for primary prevention of sudden cardiac death subsequently has a ventricular fibrillation incident properly detected and interrupted by the implanted device.” The Figure above demonstrates such an event.

Dr Bissinger concludes, “More information about electrophysiology in Poland will shortly be published in English as well as Polish.” This will be available on the Heart Rhythm Working Group Web site.

Dr Andrzej Bissinger

References

Robert Short is a freelance medical writer.

European Meetings Update

June 2007

15–19 June
17th Scientific Meeting of the European Society of Hypertension
Milan, Italy
For further information, contact info@eshmilano.org

19–23 June
Mayo International Vascular Symposium
Reykjavik, Iceland
For more information, contact cme@mayo.edu

21–23 June
2nd International Symposium Integrated Biomarkers in Cardiovascular Diseases
Berlin, Germany
For further information, contact biomarkers@lorenzinifoundation.org

24–27 June
Europace 2007
Lisbon, Portugal
For further information, contact europace@escardio.org

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