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Break Through in Artificial Heart Valves

The human heart has four chambers separated by valves which direct the blood flow. The actions of some of these valves are controlled by fine strands of tendon and muscle. Rheumatic heart disease, prevalent in the third world, commonly destroys the mitral valve, and to a lesser degree, also the aortic valve, necessitating valve replacement operations for treatment.

Artificial heart valves are in clinical use since late 60's, and are classified as mechanical and biological heart valves, with mitral and aortic prostheses assuming similar design but different sizes. However in real life, the shape and construction of these two valves are quite different. Mechanical heart valves vary in design and construction as well as use of metals and material. They have variable durability and known complications such as material failure leading to fracture of components, blood clot formation, or bleeding from anticoagulation therapy. Mechanical valves are non physiological, produce excessive turbulence and are destructive to blood components.

Biological heart valves in the past are not without problems, such as early structural failure from tear of the leaflets making up the valve and secondary failure like degeneration and calcification, jeopardising therefore long term durability. Failure of the present biological heart valves are due to use of rigid frame (stent), defective design and construction, use of three leaflets in place of two leaflets in the mitral position, and lack of rigid quality control during the process of manufacturing.

Dr Baruah's extensive laboratory research has started in 1982 in Glasgow, UK, and his present laboratory is in Bombay where present break-through in development of artificial heart valves has taken place. His aim has been to design and construct biological heart valves close to nature to maintain normal anatomical configuration in the human heart and produce physiological performance by increasing efficiency of the left heart and minimising turbulance of blood flow through the heart, reducing thrombogenicity and eliminating the need for anticoagulation.

Trileaflet biological valves are made from bovine pericardium which is the tough outer covering the ox heart. The new valves are stentless and flexible mimicking our own natural trileaflet aortic and pulmonary valves. Similarly, bileaflet mitral valves with attendent strands of tendon and muscle made from bovine pericardium simulating our native mitral valves have been developed. Durability, functionality and reliability have been tested vigorously in the laboratory in Bombay and it is found that these valves are of similar properties and characteristics as our native valves, capable of life long durability, and requiring no anticoagulation.

These valves have recently been implanted successfully in Prince of Wales Hospital, Hong Kong, and subsequently by Dr Prabhu Dev in Srijayadeva Institute of Cardiology, Bangalore, India.

Dr Jonathan Ho, Chief of Cardio-thoracic Surgery of The Chinese University of Hong Kong, became the first surgeon in the world to use these new Baruah biological heart valves in both mitral and aortic positions, and the Department of Surgery of The Chinese University of Hong Kong once again has pioneered important advances in the international medical field.

Professor Arthur Li Kwok Cheung, Chairman of the Department of Surgery of The Chinese University of Hong Kong, said that "This is a breakthrough in the history of critical cardiac devices, and we are proud to have contributed in this development to help our patients."

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Dr Jonathan Ho, Chief of Cardio-thoracic Surgery of the CUHK, Department of Surgery, Prince of Wales Hospital, Hong Kong

Attachment: Four pictures of artificial heart valves