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New prototype of expandable polyurethane stent valve for replacement of heart valves in pediatric patients

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Introduction: The biological heart prosthesis on the market today is durable and functional, but still not the ideal valve replacement in children: calcification and reduction of durability are the major events. Heart valve replacements by prosthesis, today represent the most widely used cardiovascular devices.

Objectives: Develop a prototype of polyurethane stent valve, for implant by catheter in pediatric patients that is expandable, accompanying the growth of the patient. The diameter of the expandable stent valve may be increased through the use of balloon catheter.

Material/Methods: Prototype: In the first stage, a cobalt chromium stent valve, with diameter of 22 mm, was built following the a mold having one end in the shape of a cusp aortic or pulmonary valve sigmoid receives the coupling of a stent diameter adjusted to that morphology of aortic sinus. In the second stage, a stainless steel mold procedure for applied the polyurethane, building 3 thin leaflets. In the third stage, the stent valve is incorporate into catheter, using the clipping procedure. A balloon catheter was employed to allow expansion of the diameter of the ring.

Results: The prototype of expandable stent valve, it was analyzed and approved in the macroscopic aspects. The microscopic analysis performed in Chemist Laboratory by optical procedure and scanning images study of polyurethane leaflet, showing regular thigh. The test of clipping procedure from 22mm to 4mm and expansion with catheter balloon of the stent valve from 4mm to 22mm maintaining uniform diameter of opened and competent leaflets closing.

Discussion: The stent valves developed for pediatric use, so far, using biological tissue, have as main drawback: early calcification and the impossibility of changing diameters. Experimental studies of polyurethane valve published showed good hemodynamic performance, low incidence of calcification and resistant to fatigue, thrombosis and infection. The expandable stent has advantages because it is possible to changing the diameter of the stent, using catheter balloon, following the development of the child. The design of the stent valve with three stem, allow fles.

Conclusion: Valves can be expanded as children grow, reducing need for future replacement surgeries and improving the quality of life. It is possible to reproduce these results and further studies, carried out to better understand the properties of the polyurethane, with a view of release by health authorities for clinical application, thus becoming one more option among the prostheses on the market today.

Biography

Miguel Angel Maluf is an Associate Professor of Cardiovascular Surgery and is the Chief of Pediatric Heart Surgery at São Paulo Federal University.

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