

Images in Congenital Heart Disease

Gaseous microemboluses after replacement of the mitral valve with a mechanical prosthesis in a child

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A 13-YEAR-OLD CHILD WITH RHEUMATIC MITRAL valvar insufficiency underwent replacement of the valve with a Carbomedics mechanical prosthesis. On post-operative echocardiography in the parasternal long axis plane, using a 2.5 MHz transducer (Fig. 1), transient signals of high intensity (arrows) were identified in the left atrium and left ventricle. No vegetations were detected, and the signals were reduced after inhalation of oxygen, thus excluding non-gaseous microembolisation. The patient was treated with oral enalapril and acetazolamide at a dose of 250–500 mg given twice daily. In addition to its diuretic effect, acetazolamide was chosen in order to lower the partial pressure of carbon dioxide in the blood through metabolic acidosis-induced hyperventilation. After four weeks of treatment, the levels of carbon dioxide had fallen from 35.3 to 23.3 mmHg, levels of bicarbonate from 22.3 to 15 mmol/l, and pH from 7.37 to 7.33. The signals were no longer present on repeated echocardiographic examination, but they subsequently reappeared after withdrawal of acetazolamide.

Transient signals of high intensity are a well-described echocardiographic finding in adults after replacement of atrioventricular valves with mechanical prostheses,¹ and correspond to stable bubbles of carbon dioxide. Bubbles are released from the inflow surface of the mechanical valves as a function of the intensity of cavitation, with excessive drops in pressure induced by the high velocities of closure of the valvar leaflets, the concentration of carbon dioxide dissolved in the blood, and the pressure gradients



Figure 1.

resulting from regurgitation through the valve. Experimentally, their incidence has been shown to increase with increasing levels of arterial partial pressure of carbon dioxide and increasing cavitation. In contrast to the short-lived microbubbles of cavitation, however, these bubbles remain in the blood stream sufficiently long to reach the cerebral circulation. Indeed, it has been suggested that chronic exposure to such gaseous microemboluses in adults may lead to cognitive impairment. Although the occurrence and significance of stable gas bubbles has not been widely recognised in children, they could have important implications for the choice of prosthesis, and the long-term management of children and young adults who require replacement of the mitral valve.

Reference

1. Lin HY, Deutsch S, Fontaine AA, Tarbell JM. Observation and quantification of gas bubble formation on a mechanical heart valve. *J Biomech Eng* 2000; 122: 304–309.

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Accepted for publication 10 March 2004