C. Sprung, C. Miethke, H. A. Trost, W. R. Lanksch and D. Stolke

The dual-switch valve. A new hydrostatic valve for the treatment of hydrocephalus

Childs Nerv Syst 12(10): 573-81, 1996

Abstract:
The currently available hydrocephalus valves are still far from perfect. Whereas the design principles of differential pressure valves and adjustable devices involve the danger of overdrainage, hydrostatic valves have a tendency to clog. The new dual-switch valve (DSV) avoids overdrainage-related problems such as subdural hygromas/hematomas or slit-like ventricles with the high risk of proximal catheter obstruction by means of two parallel chambers in a titanium casing: one for the the horizontal and the other for the vertical position. The control chamber for the horizontal position is closed by a gravity-activated tantalum ball as soon as the patient moves into an upright position. Now the drainage of CSF is directed into the appropriate controller for the erect position. Thus, the hydrostatic differential pressure between ventricles and peritoneal cavity is counterbalanced and the intraventricular pressure (IVP) remains within physiological values independently of the CSF flow and the position of the patient. To avoid the problem of clogging, the newly designed valve introduces large-area diaphragms to create extensive acting forces. The forces generated in this way are able to overcome sticking forces set up as a result of high protein content or cellular debris. By this mechanism the IVP is maintained in physiological ranges regardless of the CSF composition. The new valve has been investigated with a computer controlled test apparatus especially designed to simulate different positions of the body. The in vitro test results according to ASTM standards document a superior performance in comparison with other valves. When the new device was interposed in external drainage systems precision of its function was confirmed even in the presence of elevated protein content and high CSF flow. Simulation of the upright position of the patient allowed documentation of the valve's reliability in maintaining the IVP within physiological ranges. A clinical trial with implantation of the new dual-switch valve was started at the beginning of 1995; so far follow up has been short. Clinical and computer tomographic monitoring has provided evidence of the valve's capacity to avoid the problems of overdrainage and early clogging.

ISBN/0256-7040 (Print)
0256-7040 (Linking)