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Shunt assistant valve: bench test investigations and clinical performance

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Abstract *Background:* We tested the flow characteristics of a new siphon-reducing device, the Shunt Assistant Valve™ (SAV) combined with a Codman-Hakim™ (CH) programmable valve and studied 4 clinical cases. We discussed the efficacy of the SAV at preventing low pressure syndrome secondary to overdrainage. *Materials and methods:* In the horizontal position the closing pressure (CP) of the SAV was 0. The SAV was available in five different pressure ranges for the vertical position: 15, 20, 25, 30, and 35 cmH₂O. A bench test was performed in order to obtain pressure-flow curves for the SAV under various conditions. We investigated the simulation of the postural change of the flow performance of the new device. We implanted an SAV in 4 patients who already had an implanted CH valve. Postural changes of the shunt flow and intracranial pressure (ICP) were measured before and after the addition of the SAV. *Results:* Bench test: in the horizontal position the flow increased in proportion to the pressure difference. For all SAVs it reached 14 to 16 mL/min when the pressure difference was 50 cmH₂O. A tantalum sphere determined the CP of the SAV with a maximum in the vertical position. The flow in the vertical position was significantly decreased in comparison with the horizontal position. The external pressures did not influence the flow.

Simulation: in adults shunt flow in the supine position was sufficient at both the low and the high ICP stages. When the SAV 20 and the CH valve (CP=8 cmH₂O) was used in the sitting position we found a reduction of the flow 70–80% compared with the flow-rate found for the CH valve alone. When the CP of the CH valve was adjusted up to 20 cmH₂O, we found a further reduction of the flow of 27–50% in the sitting position and overdrainage was effectively prevented. With this combination the flow in the sitting position significantly decreased in paediatric hydrocephalus and became zero, indicating the possibility of underdrainage in children. *Clinical results:* in 4 patients with overdrainage symptoms we found that these subsided after the additional implantation of the SAV. The ICP increased and the shunt flow decreased in both the supine and the sitting positions. *Conclusion:* The SAV effectively decreased the shunt flow in the erect position. Combined use of the SAV with the CH valve is an alternative treatment for patients with overdrainage, especially in patients in whom the increase of the CP of the CH valve alone had failed to control overdrainage.

Keywords Antisiphon · Hydrostatic valve · Overdrainage · Programmable/adjustable pressure valve · Shunt assistant valve · Siphon effect

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