Anti-siphon devices

Though some of the devices are designed to reduce the flow instead of providing antisiphoning effect, they are generally called antisiphon devices (ASDs). The basics of siphoning, the mechanisms and physical properties of currently available devices are described in this article. The clinical efficacy, shunt survival, and considerations on patient factors are also discussed. There are three kinds of ASD design, diaphragm, gravitational, and flow reducing devices. Flow reducing ASD is always open and the flow it controls is relatively stable. On the other hand, it may not provide sufficient flow in nocturnal intracranial pressure elevations. Diaphragm and gravitational devices are sensitive to the position of the patients. Diaphragm device is sensitive to the external pressure and the relative position of the device to the mastoid process. The gravitational device is sensitive to the angle between the axis of the device and the head. Many studies showed encouraging results with gravitational devices. Studies regarding diaphragm devices either showed better or similar outcomes comparing to differential pressure valves. Clinical studies regarding flow-reducing devices and head-to-head comparison between different mechanisms are warranted. This review aims to provide a useful reference for clinical practice of hydrocephalus [1].

Integra antisiphon device

Siphonguard

Both CSF shunts work properly, but at the lowest setting the opening pressure of the Strata NSC was near 0 and in the Codman Hakim it was twice the manufacturer's specifications. The resistance in the Strata NSC was below the normal physiological range, and in the Codman Hakim device it was in the lower range of normal. The ASD did not change the shunt characteristics in the lying position and therefore might not do so in children. If this is the case, then a shunt system with an integrated ASD could be implanted at the first shunt insertion, thus avoiding a second operation and the possibility of infection [2].

see SiphonX

Freimann et al. analyzed three gravity-dependent ASDs (ShuntAssistant [SA], Miethke; Gravity Compensating Accessory [GCA], Integra; SiphonX [SX], Sophysa), two membrane-controlled ASDs (Anti-Siphon Device [IASD], Integra; Delta Chamber [DC], Medtronic), and one flow-regulated ASD (SiphonGuard [SG], Codman). Defined pressure conditions within a simulated shunt system were generated (differential pressure 10-80 cmH2O), and the specific flow and pressure characteristics were measured. In addition, the gravity-dependent ASDs were measured in defined spatial positions (0-90°).

The flow characteristics of the three gravity-assisted ASDs were largely dependent upon differential pressure and on their spatial position. All three devices were able to reduce the siphoning effect, but each to a different extent (flow at inflow pressure: 10 cmH2O, siphoning -20 cmH2O at 0°/90°: SA, 7.1 ± 1.2*/2.3 ± 0.5* ml/min; GCA, 10.5 ± 0.8/3.4 ± 0.4* ml/min; SX, 9.5 ± 1.2*/4.7 ± 1.9* ml/min, compared to control, 11.1 ± 0.4 ml/min [*p < 0.05]). The flow characteristics of the remaining ASDs were primarily dependent upon the inflow pressure effect (flow at 10 cmH2O, siphoning 0 cmH2O/ siphoning -20cmH2O: DC, 2.6 ± 0.1/ 4 ± 0.3* ml/min; IASD, 2.5 ± 0.2/ 0.8 ± 0.4* ml/min; SG, 0.8 ± 0.2*/

0.2 ± 0.1* ml/min [*p < 0.05 vs. control, respectively]).

The tested ASDs were able to control the siphoning effect within a simulated shunt system to differing degrees. Future comparative trials are needed to determine the type of device that is superior for clinical application [3].

1)

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2)

Arnell K, Koskinen LO, Malm J, Eklund A. Evaluation of Strata NSC and Codman Hakim adjustable cerebrospinal fluid shunts and their corresponding antisiphon devices. J Neurosurg Pediatr. 2009 Mar;3(3):166-72. doi: 10.3171/2008.10.PEDS08118. PubMed PMID: 19338461.

3)

Freimann FB, Kimura T, Stockhammer F, Schulz M, Rohde V, Thomale UW. In vitro performance and principles of anti-siphoning devices. Acta Neurochir (Wien). 2014 Nov;156(11):2191-9. doi: 10.1007/s00701-014-2201-y. Epub 2014 Aug 16. PubMed PMID: 25123252.