Abstract Object: After demonstrating the anti-siphoning properties of a distensible tube in vitro, El-Shafei constructed a shunting system that directs CSF flow into the internal jugular vein against the flow of blood. Though clinically effective, the in vivo pressure dynamics of this type of shunt system have not been investigated. Methods: After failure at multiple other extracranial absorptive sites, an 18-year-old woman was shunted from the lateral ventricle to the internal jugular vein against the direction of blood flow. The shunt system contained an in-line noninvasive telemetry allowing examination of postural intracranial pressure dynamics in the awake state. This shunt system demonstrated postural pressure dynamics that were consistent with a stringent nonsiphoning shunting system. Conclusions: These observations validate the use of the El-Shafei shunt placement as a biologically nonsiphoning CSF absorptive system. In addition, the stringency of the anti-siphoning properties of the internal jugular vein open the possibility of preferentially using this shunting system in patients who clearly exhibit symptoms of shunt overdrainage.

Keywords Hydrocephalus · Anti-siphoning · Ventriculojugular shunting · TeleSensor · In vivo

Materials and methods

The shunt components used in this patient were commercially available and consisted of a standard Holter ventricular catheter (Codman/Johnson & Johnson) with a Rickham burr-hole reservoir.
(Codman/Johnson & Johnson) connected to a Radionics TeleSensor device. A previous shunting system, used before placement of the El-Shafei shunt, contained a Codman-Medos programmable valve (Codman/Johnson & Johnson) distal to the TeleSensor and a siphon control device (Medtronic/PS-Medical) with the distal catheter in the cardiac atrium. After the El-Shafei placement, the Codman-Medos programmable valve was connected and set at 4 cmH2O while the El-Shafei system was in place. Radiographic confirmation of the placement of the shunt components can be seen in Fig. 1. Telemetric intraventricular pressures were determined as previously reported [6, 7] by measurements taken with a Radionics M-3 or M-4 telemonitoring device. Pressures were measured in the supine position and at 15° increments up to 90°. Since two or more measurements performed at each level of postural elevation never varied by greater than 1 cmH2O, mean values were recorded and are presented. Telemetric IVP measurements were performed in the usual fashion in the ventriculo-atrial system containing the programmable valve (set at 12 cmH2O) and the anti-siphoning component and are compared with those seen in the El-Shafei system (Fig. 2).

Clinical history and placement of El-Shafei shunt

An 18-year-old girl shunted for hydrocephalus at an early age had undergone 38 previous shunt revision procedures necessitated by malfunction or infection. Because of abdominal scarring, her peritoneum was no longer suitable for CSF absorption. Owing to severe dyspnea after ventriculopleural shunt placement, her pleural space was also deemed unsuitable for CSF absorption. She had been successfully shunted to her cardiac atrium via an internal jugular route, but had required a nonsiphoning component for correction of overdrainage phenomena (Fig. 2). Owing to shunt infection this hardware was removed; at the time of replacement a stenosis of the left subclavian vein was encountered, so that it was not possible for the catheter to be threaded into the heart. Because of this technical issue, the distal catheter was instead tethered at the insertion of the facial vein and then directed cephalad into the internal jugular vein against the direction of blood flow. The catheter tip was inserted until it could not be advanced any further and then withdrawn approximately 1 cm (Fig. 1). At this point the tubing was connected directly to the proximal hardware that had been placed in the occipital position, which included a TeleSensor and a Codman-Medos programmable valve without an anti-siphoning component. The valve was set at 40 mmH2O pressure. The ventricular pressure was monitored periodically over the next several weeks (Fig. 2).

Observations and results

An example of the telemetric intraventricular pressures seen after placement of this child’s ventriculo-atrial shunt system (containing a Codman-Medos programmable valve with added anti-siphoning device) are shown in Fig. 2 on the same axes as the dynamic intraventricular pressures observed telemetrically after placement of the El-Shafei shunt. The anti-siphoning component of the ventriculo-atrial shunt determines a relatively flat postural pressure curve with no zero intercept, as previously observed for nonsiphoning shunting systems [7]. The El-Shafei shunting system also produces a relatively flat postural pressure curve without a zero intercept even at 90° of head elevation. The dynamics of the El-Shafei system shown in Fig. 2 are essentially indistinguishable from shunting systems with nonsiphoning components [7] and appear to be more stringent than the nonsiphoning component previously used in this patient, as shown by comparison of the two postural pressure curves plotted in Fig. 2.