Temporary Control of Cerebrospinal Fluid Volume and Pressure by Means of an Externalized Valve-Drainage System*

ROBERT J. WHITE, M.D., PH.D., J. GEORGE DAKTERS, M.D., DAVID YASHON, M.D., AND MAURICE S. ALBIN, M.D.

Division of Neurosurgery, Department of Surgery, Case Western Reserve University School of Medicine, and Cleveland Metropolitan General Hospital, Cleveland, Ohio

Traditionally, the development of acute, sustained increases in ventricular pressure and volume resulting from cerebrospinal fluid (CSF) obstruction has been managed by repeated direct ventricular puncture or the establishment of a tube ventriculostomy. The method of repetitive direct needle puncture of the ventricle leaves much to be desired since it is not only damaging to brain tissue, but is basically unphysiological because it can only discontinuously affect ventricular volume and pressure. Tube ventriculostomy does offer the advantage of continuous drainage, but does not provide satisfactory hydraulic control. Its major drawback, however, is the constant danger of retrograde infection of the brain which severely limits the length of time it can be left in place.

To circumvent some of the disadvantages of these techniques in the temporary management of acute increased ventricular pressure-volume states, we have used a simplified system of continuous pressure-modulated externalized ventricular drainage utilizing standard Spitz-Holter shunt equipment. This report describes our clinical experience with this technique of externalized CSF shunting which we have termed the “externalized 5th ventricle” drainage system.

Methods and Materials

Because of the precarious condition of almost all of the patients in this series, the placement of the externalized valve-regulated drainage system was accomplished under local anesthesia. A small perforator opening was made in the skull at the coronal suture (anterior placement) or occasionally in the occipital area (posterior placement) as shown in Fig. 1. A suitable length of barium impregnated silicone rubber tubing was introduced into the ventricle and connected to a Rickham reservoir positioned in the burr hole. The reservoir was placed in series with an externalized medium or low-pressure Spitz-Holter valve connected to a short section of silicone tubing which exited from the scalp through a small stab wound (treated with local antibiotic†) located about 5 cm from the burr hole. The valve, in turn, was joined to a sterile calibrated bottle or plastic bag (“externalized 5th ventricle”) with an extended length of silicone tubing. The Rickham reservoir provided direct sampling of ventricular fluid and permitted perfusion of the ventricular cavities with antibiotic solutions.

Fifty-one valve-modulated externalized ventriculostomies were successfully implanted in 33 patients (Fig. 2). Each drainage system was the subject of a specially designed protocol which provided for daily estimations of CSF volume, protein concentration, cell count, and bacteriological characteristics. At the time of surgical removal the externalized shunt equipment was divided into various sections (distal tubing, valve, Rickham reservoir, and ventricular tubing) and individually cultured.

Use of the plastic bag made walking possible for the patient. In fact, two children were actually safely discharged from the hospital following careful instruction of the parents regarding the technique of exchanging a full for an empty sterile collecting unit.

† Neosporin Aerosol (Polymyxin B-Bacitracin-Neomycin), Burroughs Wellcome & Co., Inc., Tuckahoe, N.Y.
Fig. 1. Schematic representation of the externalized valve-regulated ventriculostomy displaying the anterior and posterior placement systems.

Fig. 2. Photograph of a patient with the “externalized 5th ventricle” in place. The child can be mobilized both on and off the ward with this self-contained unit.