Ventriculoatriostomy using Spitz-Holter valve or Pudenz-Heyer valve has brought good results, and is considered to be the best method. Although post-operative revisions were needed in several cases accompanied by obstruction of the ventricular or atrial portion. Salpingothecal anastomosis and third ventriculostomy brought comparatively good results, long-lasting good results were noted in 8 out of 17 and 6 out of 8 respectively. Other surgical procedures did not bring satisfactory results. Advantage and disadvantage of these surgical procedures have been compared and discussed.

20. Complications of the Ventriculo-Atrial Shunt Operation.

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Nowadays the Ventriculo-Atrial Shunt is considered as the best treatment for hydrocephalus, not only of congenital nature, but also of symptomatic one. But various complications have been reported here and there past ten years. We have also experienced several types of complications, some of which were found by autopsy and others were seen under postoperative observation.

Summary of the complications is as follows;

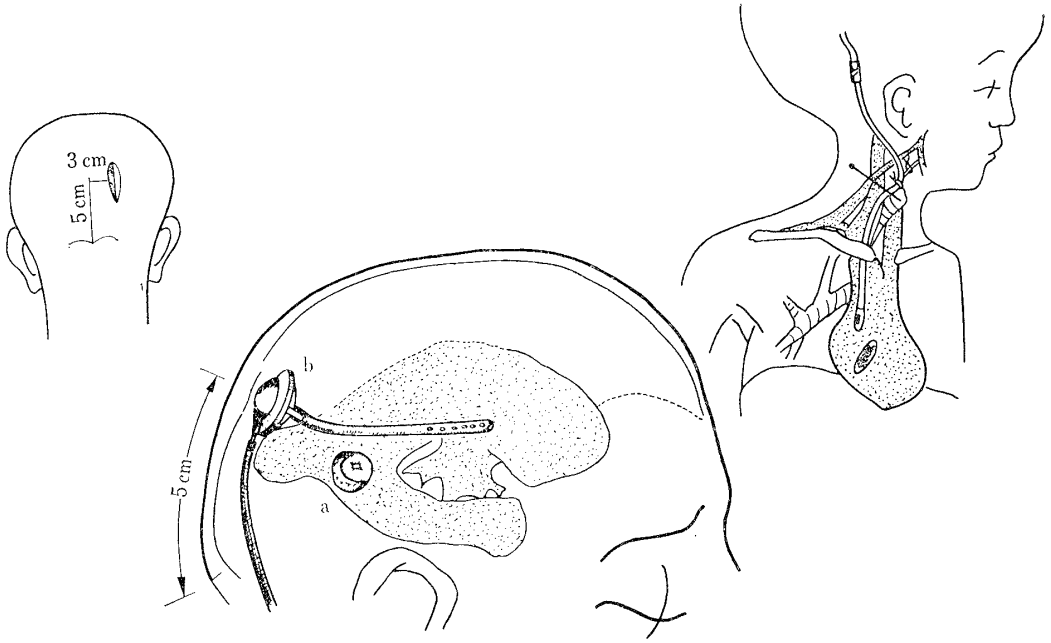
1. Obstruction of the tube.
2. Destruction of the tube and the flushing device, or incomplete fixation of them.
3. Damage to the brain tissue.
4. Damage to the right atrium or the tricuspid valve.
5. Thrombosis of the internal jugular vein and the superior caval vein. pulmonary embolism.
6. Subacute bacterial endocarditis, septicemia and bronchopneumonia.
7. Acute subdural hematoma due to hyperdecompression.
8. Necrosis of the skin covering the tube or the flushing device.

The most frequent complication is obstruction of the tube. The cases of obstruction can be devided as follows;

Ventricular tube

1. The tube is plugged with fibrinoid substance, blood, etc.
2. The part of side perforations is burried in the brain tissue.
3. The brain tissue is scrubbed into side perforations.

Cardiac tube



Modified from GURDJIAN's "OPERATIVE NEUROSURGERY".

1. The slit near the tip is plugged with fibrinoid substance which flowed from the ventricle.
2. Blood regurgitates through the slit and forms the thrombus.
3. The end of the tube is burried in the endocardium.

It is pointed out that most of the cases of obstruction can be avoided if only the flushing device is applied. But when V-A Shunt is applied to secondary hydrocephalus due to brain tumor, meningitis, etc, the operation methode must be modified as foilws. Usually ventricular tube is inserted from the burr hole opened at the temporo-occipital region in the antero-medial direction. This methode can be successfully apllied to primary hydrocephalus, because remarkable increase in the thickness of the brain between the cortical surface and the ventricle will not be seen after the internal decompression with V-A Shunt.

But in secondary hydrocephalus, rapid increase in the thickness is recognized after the internal decompression. As a result, part of side perforations becomes burried in the brain tissue, completely or partially and the brain tissue will be scrubbed into side perforations. In order to prevent this complication, the ventricular tube must be inserted sufficientry deep in the lateral ventricle.

But in secondary hydrocephalus, the transverse diameter of the lateral ventricle is not long enough for the purpose, so that the tip of the ventricular tube is often found perforating into the thalamus, the fornix or the opposite lateral ventricle by autopsy. It is in vain to expect the ventricular tube to bend along the curve of the lateral ventricle. And further more, it is usually impossible for the operator to feel resistance of the ventricular wall with the tube.

We concluded as follows;

1. Ventricular tube must be inserted from the burr hole opened at the occipital region in the postero-anterior direction long enough through the lateral ventricle.
2. The flushing device must be applied to every case. We can not only put away various obstructors, but also we can know the point of obstruction. If return of the dome of the flushing device is incomplete, the point of obstruction is in the ventricular end. And if we feel resistance by compression of the dome, obstruction is in the cardiac end.
3. The cardiac tube must be fixed as higher as possible in the right atrium, in order to prevent the destruction of the tricuspid valve and the cardiac tube. In order to determine the length of the cardiac tube, we adopt the three indicators as follows;
   1. Chest X-Ray.
   2. EKG.
   3. Micro drip chamber.

To prevent skin necrosis over the tube or the flushing device, it is very important to close the operation wound with two layers. Protein anabolic hormone is effective in case of malnutrition.

21. Ventriculosagittal Sinus Shunt in Hydrocephalus

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A new type of the shunt operation was devised first by Paul C. Sharkery in 1964 for the chronic hydrocephalus by of Ventriculosagittal sinus shunt. The experience of this type of operation in 5 patients will be presented.

The shunting system consisted of ventricular tube, flushing device and Pudenz-Heyer tube and the right ventricle was tapped through a burr hole and ventricle tube was inserted into the ventricle and this was connected to the flushing device seated on the burr hole. Next, a small incision was made on the sagittal sinus through another burr hole and Pudenz-Heyer tube was inserted in the sinus towards lcm. distal to the confluens sinuum and this was connected to the flushing device.

The lengh of the venous tube was determined beforehand by measuring the distance between the expected first burr hole and the confluens sinuum in the X-ray film. Moreover, the tip of venous tube was adjusted during operation by using image intensifier.