EVALUATION OF THE COMPLICATIONS OF VENTRICULOPERITONEAL SHUNTING

THESIS

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BY

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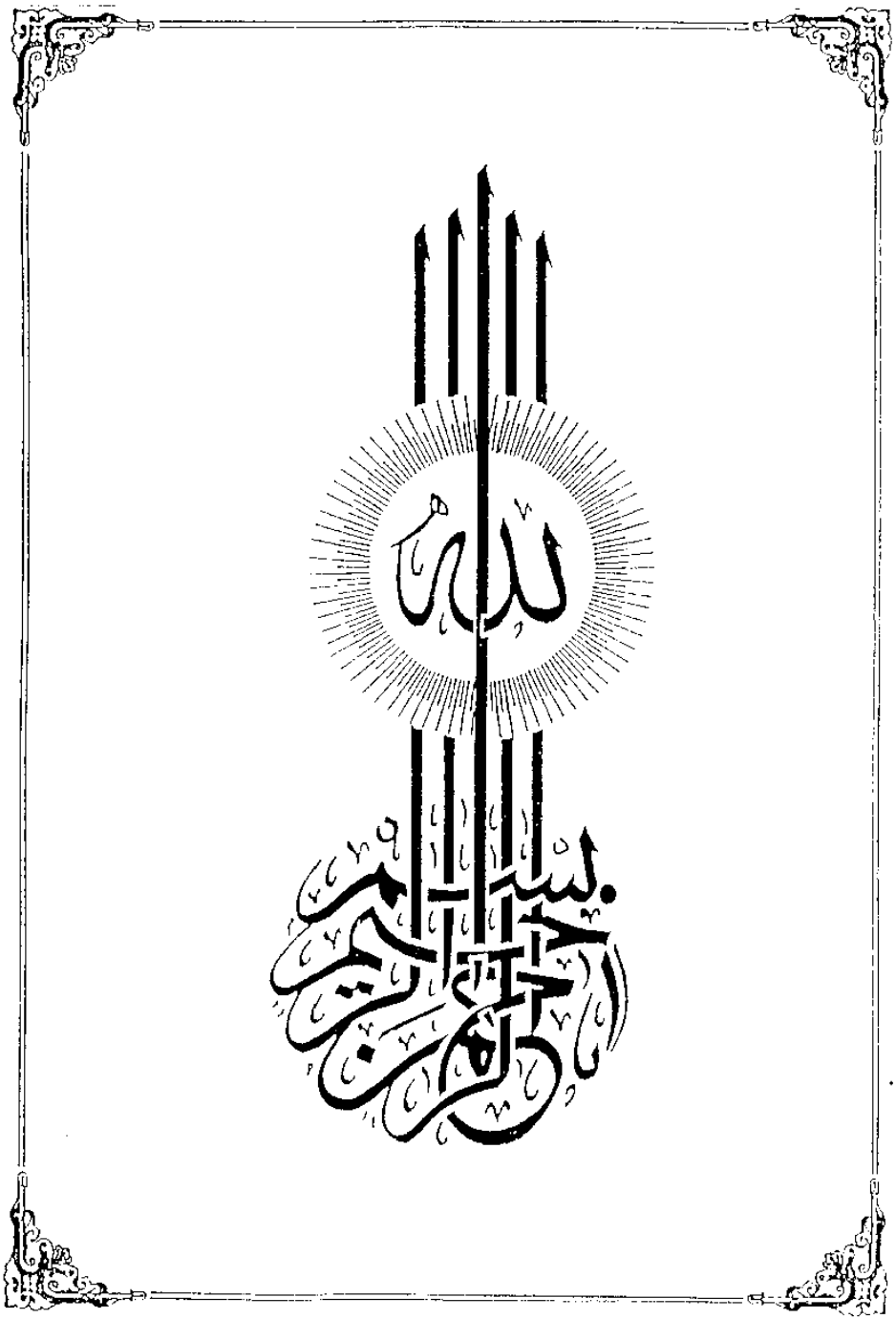
بسم الله الرحمن الرحيم

"وأن ليس للإنسان إلا ما سعى"

صدق الله العظيم

سورة النجم آية ٣٩



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INTRODUCTION

Hydrocephalus can be defined as an enlargement of the cerebral ventricular cavities that results when cerebrospinal fluid [CSF] flow or absorption is impaired *[Del Bigio, 1989]*.

Because the majority of cases are not correctable by direct surgical intervention, CSF diversion with implantable devices applies in most clinical situations. Ventricular and spinal CSF have been diverted to nearly every conceivable systemic receptacle site including veins and potential absorptive cavities of the head, neck, spine, thorax, and abdomen.

The ventriculoperitoneal [VP] shunt has emerged as the preferred diversionary procedure for growing children and most adults. Its major advantages are the ability of the peritoneal cavity to accept a large loop of tubing to accomodate axial growth and the ease of shunt revision. *[McCullough, 1985]* . Although this technique was first performed in 1898, it gained popularity in the middle of this century with the introduction of suitable Silastic materials *[Moazam et al., 1984]* .

The widespread usage of VP shunts has been followed by a plethora of complications *[Pomeranz et al., 1988]*. The history of the evolution of shunting for hydrocephalus is largely a history of efforts to prevent these complications *[McLaurin, 1982]*.

REVIEW OF LITERATURE

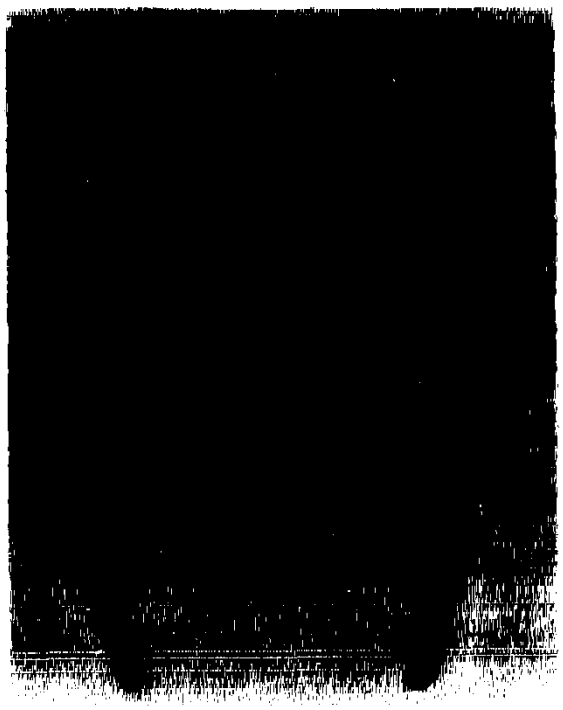

Fig. 1. Drawing of a cast of ventricular system of the brain, seen from above. R.S.P.: supraspinal recess.

[Romanes, 1981]

Fig. 2. Cast of the ventricles of the brain.

[Romanes, 1975]

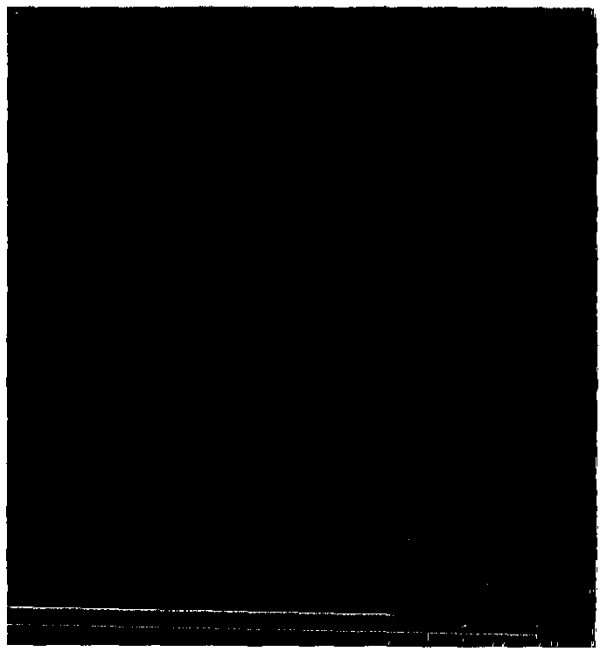

Fig. 3. Dissection from above to show posterior and inferior horns of lateral ventricle.

[Romanes, 1981]

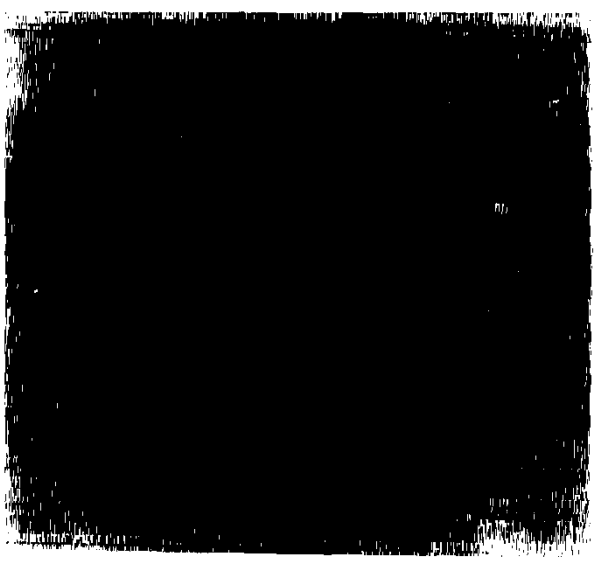

Fig. 4. Dissection from above to show the lateral ventricle. Blue: ependyma. Red: choroid plexus. It should be appreciated that the choroid plexus is covered with ependyma on its ventricular aspect, but this is not shown. *[Romanes, 1975]*

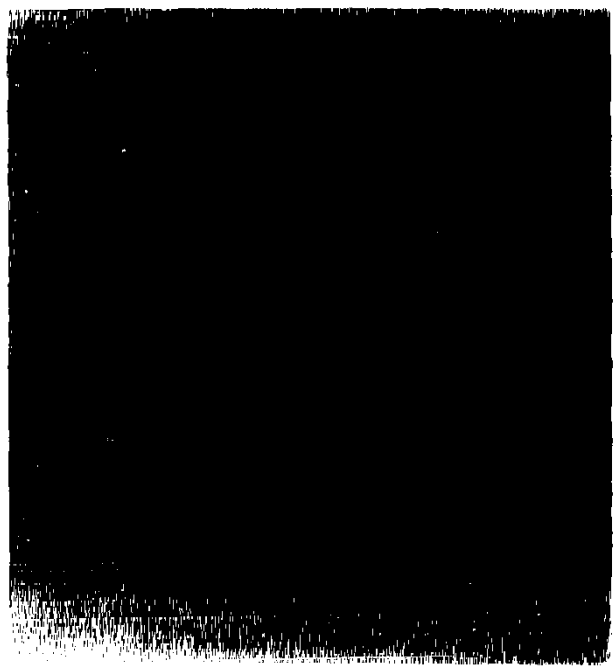

Fig. 5. Dissection to show tela choroidea of third and lateral ventricles, and the parts near it. *[Romanes, 1981]*

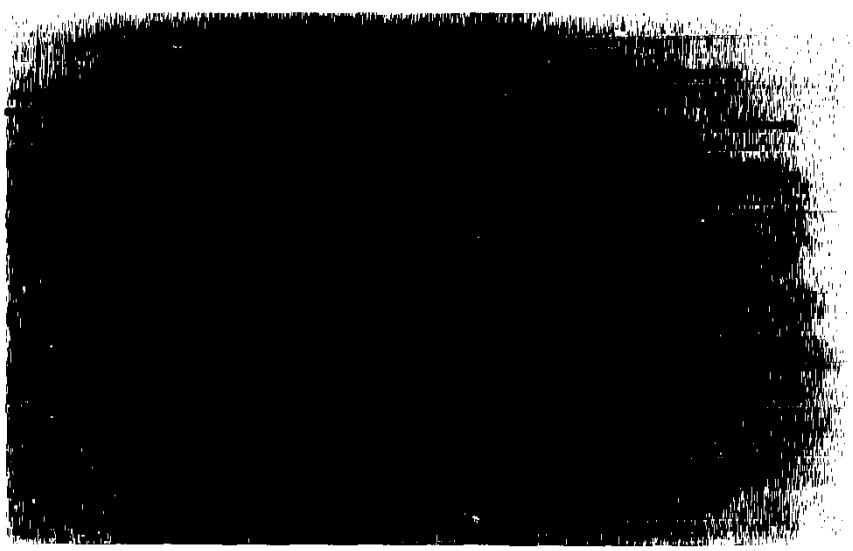

Fig. 6. Median section through the third and fourth ventricles of the brain. The septum pellucidum has been removed to expose the lateral ventricle. *[Romanes, 1975]*

the hypothalamus. The anterior commissure and the lamina terminalis form the rostral limit *[Figure 5]* .

The optic recess is an extension of the third ventricle between the lamina terminalis and the optic chiasm. The funnel-shaped **infundibular recess** is a downward extension at whose apex the hypophysis is attached. A small **pineal recess** projects into the stalk of the pineal body. A variable, often large, extension of the third ventricle above the epithalamus is termed the **suprapineal recess**. The **interthalamic adhesion** is a band of grey matter that crosses the cavity of the ventricle, joining the external walls. This band is present in about 60% of all brains; it has no functional significance *[Figure 6]* .

Cerebral Aqueduct :

The cerebral aqueduct is a narrow, curved channel running from the posterior third ventricle into the fourth. The aqueduct does not contain choroid plexus.

Fourth Ventricle :

The fourth ventricle is a pyramid-shaped cavity bounded ventrally by the pons and the medulla. The floor of the fourth ventricle is also known as the **rhomboid fossa**. The **lateral recess** extends as a narrow, curved extension of the ventricle on the dorsal surface of the inferior cerebellar penduncle. The fourth ventricle extends under the **obex** into the central canal of the medulla *[Figure 7]* .

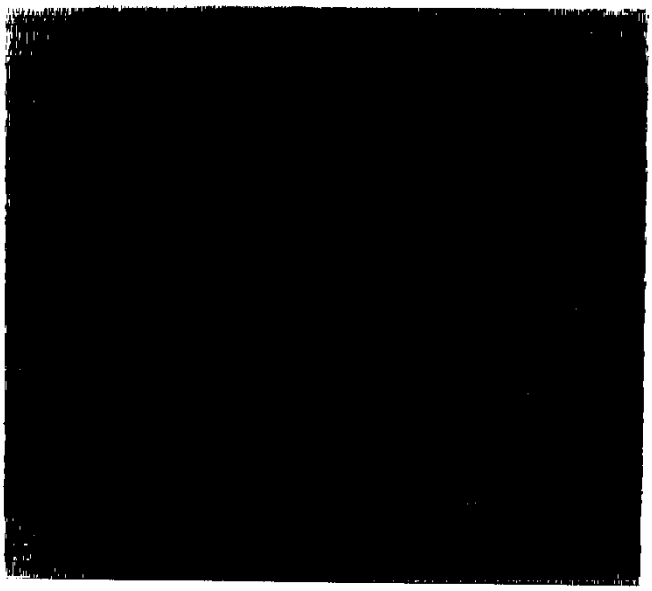

Fig. 7. The rhomboid fossa or 'floor' of the fourth ventricle. *[Warwick and Williams, 1973]*

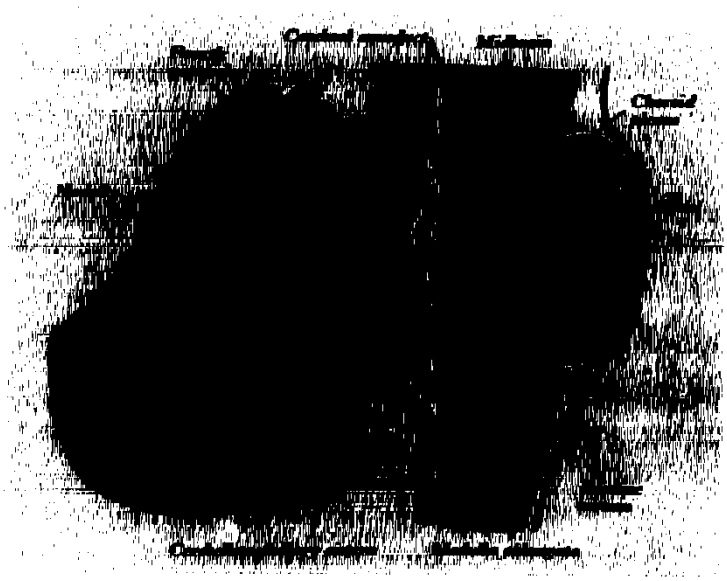

Fig. 8. Sagittal section through the brainstem and the cerebellum close to the median plane. The black arrow is placd in the median aperture of the fourth ventricle. Blue: arachnoid mater. Red: pia mater. Green : ependyma. *[Warwick and Williams , 1973]*

The incomplete roof of the fourth ventricle is formed by the anterior and posterior medullary vela. The **anterior medullary velum** extends between the dorsomedial borders of the superior cerebrellar peduncles. Its dorsal surface is covered by the adherent lingula of the cerebellum. The **posterior medullary velum** extends caudally from the cerebellum. The point at which the fourth ventricle passes up into the cerebellum is called the **apex**, or **fastigium**.

The **lateral aperture** [foramen of Luschka] is the opening of the lateral recess into the subarachnoid space near the flocculus of the cerebellum. A tuft of choroid plexus is commonly present in the aperture and partially obstructs the flow of CSF from the fourth ventricle to the subarachnoid space.

The **medial aperture** [foramen of Magendie] is an opening, variable in size, in the caudal portion of the roof of the ventricle. Most of the outflow of CSF from the fourth ventricle passes through this aperture ***[Figure 6]*** .

The **tela choroidea** of the fourth ventricle is a layer of pia mater and ependyma that contains small vessels and lies in the posterior medullary velum; it forms the **choroid plexus** of the fourth ventricle, supplied by branches of the posterior inferior cerebellar arteries.

[deGroot and Chusid , 1988].

ANATOMY OF THE PERITONEUM

The peritoneum is the largest and most complexly arranged serous membrane in the body. In the male it consists of a closd sac, a part of which lines the abdominal wall, whilst the remainder is reflected over the contained viscera. In the female the free ends of the uterine tubes open into the peritoneal cavity. The part which lines the abdominal wall is named the **parietal** portion of the peritoneum; that which is reflected over the contained viscera constitutes the **visceral** portion of the peritoneum. The parietal and visceral layers of the peritoneum are in actual contact; the potential space between them is the **peritoneal cavity**. The latter consists of [1] a main region, termed the **greater sac**, and [2] a diverticulum from this, the **omental bursa** or **lesser sac**, which is situated behined the stomach and adjoining structures. The neck or communication between the greater sac and the lesser sac is the **epiploic foramen**. The **free surface** of the peritoneum is smooth, covered with a layer of flattened mesothelium and kept moist by a small quantity of serous fluid *[Figures 9, 10]* .

A considerable amount of areolar connective tissue intervenes between the parietal peritoneum and the abdominal walls, with the fascial lining of which it blends. It is known as the **extraperitoneal tissue**. It varies in quantity and contains a varying amount of fat in different regions.

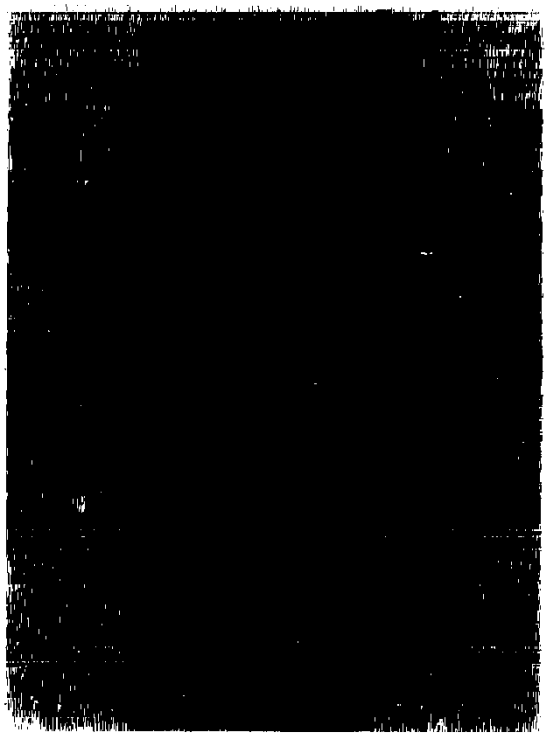

Fig. 9. A diagramatic median section of the abdomen and pelvis to show the arrangement of the peritoneum. Normally the abdominal viscera completely fill the abdominal cavity and the peritoneal cavity is reduced to a slit. In the diagram the cavity has been distended to make it obvious. Blue: peritoneal cavity. Red: omental bursa. The arrow traverses the epiploic foramen.

[Romanes, 1975]

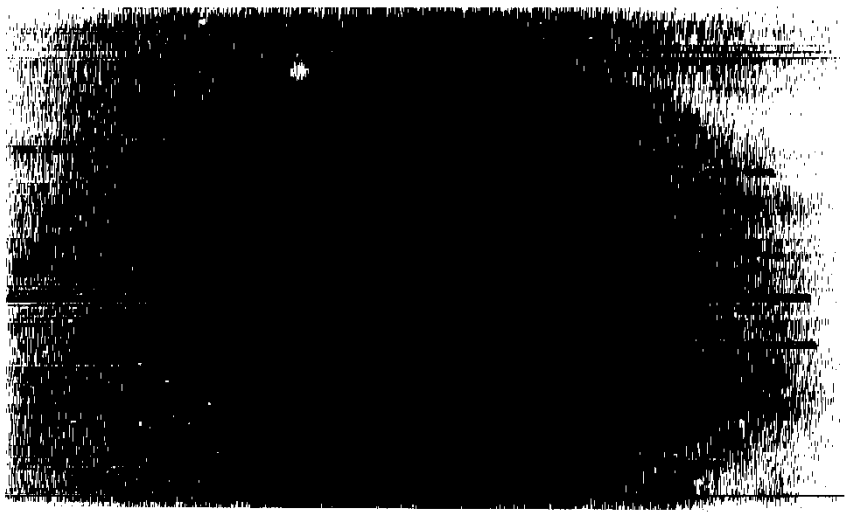

Fig. 10. A horizontal section through the abdomen at the level of the epiploic foramen. *[Romanes, 1975]*

While this tissue loosely connects the parietal peritoneum to the abdominal and pelvic walls in general and so allows the peritoneum to be relatively easily stripped off these walls, it is denser on the under surface of the diaphragm and behind the linea alba, so that the parietal peritoneum is more firmly adherent to these parts. It is especially loosely arranged in some places to allow of alteration in the size of certain organs; for example, in the front part of the pelvis and lower part of the anterior abdominal wall where it allows the urinary bladder to distend in an upward direction behind the anterior abdominal wall, from which it strips off the peritoneum as it ascends. It is usually heavily laden with fat on the posterior abdominal wall in relation to the kidneys. The visceral peritoneum, on the other hand, is firmly united to the viscera which it covers, and cannot be readily stripped off them . In fact, the connective tissue layer of the visceral peritoneum is directly continuous with the fibrous tissue stroma of the viscera; thus from the point of view of pathological conditions of an organ, the visceral peritoneum must be considered to be part of the viscus itself.

Peritoneal Structure :

The peritoneum consists of a single layer of flattened mesothelial cells which covers a layer of loose connective tissue. In most areas the mesothelium forms a continuous surface. Adjacent mesothelial cells are joined by junctional