CT AND MRI IN THE EVALUATION OF VENTRICULO SUBGALEAL TECHNIQUE FOR C.S.F. DIVERSION

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ABSTRACT

The ventriculo-subgaleal technique for C.S.F. drainage was applied to 60 patients included in this study with acute hydrocephalus of variant etiologies. All patients were evaluated before and after shunt by CT and MRI to assess the degree and cause of hydrocephalus. The value and efficacy of V.SG Drainage Technique was verified both clinically in terms of Glasgow Coma Score in 93.3% and radiologically using the ventricular size index on serial CT scans in 95% of the cases. The V.SG.D replaced the external drainage for periods as long as 3 weeks with no risk of infection and lesser costs. 20% of the patients in this work proved to be shunt independent and V.SG.D has efficiently curved its temporary purpose during the acute phase of hydrocephalus. It also proved its reliability until a definite corrective surgery was performed.

INTRODUCTION

Hydrocephalus is defined as ventricular enlargement secondary to an increase in the intra-cranial content of C.S.F., associated with an elevation in intra-cranial C.S.F. pressure which may be intermittent or present at some times (1).

The history of management of hydrocephalus is a fascinating study of technical innovation and clinical empiricism, culminating in the simple relatively reliable, surgical techniques of the present day (2).

Since their introduction in the early 1970s and 1980s, CT and MRI imaging (respectively) have shown to have numerous advantages in the evaluation of the patients with suspected hydrocephalus. Not only in diagnosing the cause but also in categorizing the degree of hydrocephalus which is very essential in following up the patients after shunt operations (3).

MATERIALS AND METHODS

Sixty patients 35 males (58.3%) and 25 females (41.6%) with a male to female ratio of 7:5 and an age ranging from 4-47 years with a mean age of 21.7 years were included in this study. All were referred from the department of neurosurgery in Kasr El Eini hospital to the radiology department in Kasr El Eini Hospital after being clinically assessed for signs and symptoms of increased I.C.T.

All patients were subjected to CT examination to evaluate the degree and cause of hydrocephalus. 27 out of the 60 patients had additional MRI examination to further evaluate the presence and extent of tumors as well as to further assess the degree of hydrocephalus.

The indications for applying the ventriculo-subgaleal drainage (V.S.G.D) were variant, namely :

1. Deterioration in the level of consciousness before definitive surgery to a tumour obstructing the C.S.F. pathways, in 38 cases.
2. Severe and advanced degrees of papilledema to save the vision, in 12 cases.
3. Persistence of hydrocephalus even after excision of the tumor in the early post operative period in 7 cases.
4. Hydrocephalus with ongoing infection for drainage and injection of antibiotics in 3 cases.

Operative technique :

Under general endotracheal anaesthesia, the operation was performed with the patient put in the supine position. The head was directed according to the decided site of the burrhole, (usually right posterior parietal). The cases of pineal body tumors a left posterior parietal or even a frontal burrhole was done as not to interfere later with the right occipital transtentorial approach. In cases with obstruction to both foramina of Monro (bilateral posterior parietal or frontal burrholes were done accordingly) (Fig. 1). After doing a curvilinear scalp incision, the flap was turned and the dissection of the subgaleal space started. The direction of the dissection was always towards the midline and anteriorly with posterior parietal burrhole, posteriorly and away from the forehead when a frontal burrhole was done.

Perfect hemostasis was achieved by electrocoagulation and repeated irrigation with 3% hydrogen-peroxide in Ringer solution. The burrhole was done followed by opening of the dura and tapping of the ventricle. The brain cannula was replaced by the Nelton catheter (size 10) in the same track.

The compression of the ventricular system was achieved by a gradual controlled release of the C.S.F. to avoid over drainage. The Nelton catheter was then fixed to the periosteum to avoid its slippage, and to keep it in a smooth curve without a kink. The direction of the distal end of the catheter was always towards the midline while anteriorly or posteriorly according to the site of the burrhole. Wa-

ter tight closure of the galea was always the aim to avoid any C.S.F. leak, followed by the skin sutures.

C.T. Technique :

10mm axial cuts were done in all patients. High resolution 3 mm axial cuts were added in cases of posterior fossa and sellar S.O.L. 2c.c./Kgm body weight of iodinated contrast material was I.V. injected only in cases of tumors and in inflammatory conditions.

We adapted a way to classify the degrees of hydrocephalus after Heinz et al which required the calculation of the ventricular size index (V.S.I.) by dividing the bifrontal diameter on the frontal horn diameter and the outcome was divided into four categories according to the extent of ventricular enlargement (4).

* Bifrontal diameter is the transverse inner diameter of the skull in the frontal region.

* Frontal horn diameter is the distance between the Tip of both frontal horns (Fig. 2).

MR. Technique :

27 out of the 60 examined patients were further evaluated by MR not for the sake of hydrocephalus perse, but to elicit the exact extent of the tumour (posterior fossa, sellar or pineal) for surgical planning.

The SE (Spinecho technique) was resorted to in the sagittal, axial and coronal planes with 5mm. T1, PD and T2 weighted images before and after I.V. Gd-DTPA injection. (5).

$$V.S.I = \frac{\text{* bifrontal diameter}}{\text{* Frontal horn diameter}} = \frac{a}{b} =$$

Normal 30%
Mild 30 - 39%
Moderate 40-46%
Severe 47%

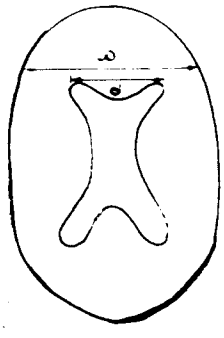

Fig. (2)

RESULTS

The sixty patients with variable degrees of hydrocephalus included in this study were divided into three categories according to the CT findings. (Table I).

Table I : Base line CT showing variable. **Degrees of hydrocephalus :**

	Severe	Moderate	Mild
No. of patients	40	14	6

The follow up CT of those patients showed variable degrees of improvement, compared to the base line CT (Table 2).

Table 2 : Follow up CT, showing improvement in the different degrees of hydrocephalus :

40 Severe	14 Moderate	6 Mild
* 22.5% remained sever but showed ↓ VSI Fig. (3) (a+b) * 42.5% changed to moderate. * 20% changed to mild * 15% changed to normal	* 64.3% changed to mild Fig. (4) (a+b) * 35.7% changed to normal Fig. (5) (a+b)	* 3 changed to normal. * 3 remained the same.

From table (2) we could conclude that 20% of the cases who had the V.SGD. were shunt independent thereafter. the V.SGD. was removed after the definitive surgery with no need for any permanent shunt.

Out of the sixty patients in this study, 93.3% improved clinically in terms of their Glasgow Coma Score. Only 6.7% remained with the same level of conciousness, without further deterioration and their control CT scan showed a definite improvement in the hydrocephalic changes.

The subarachnoid space did not open in 23.3% of the cases in this study. Eight of these patients were in the severe hydrocephalus category and remained in this degree after V.SGD. The rest (6 patients) were also in the group of severe hydrocephalus, but showed radiological improvement in the form of decrease in VSI ratio to the moderate degree but with the subarachnoid space still closed.

In this series only 4 cases (6.7%) showed evidence of shunt obstruction without deterioration in the level of con-

ciousness. Clinicaly the subgaleal space was flat and radiological, the CT Scan showed the tip of the catheter embedded in the parenchyma, the subarachnoid space was closed and the degree of hydrocephalus has decreased according to the VSI ratio but remained in the severe category. All 4 cases were shunt dependent and had a permanent CSF diversion done.

DISCUSSION

The V.SG.D. technique has been successful in tiding the 60 patients of this study over the critical period of acute hydrocephalus. It is an easy, safe and aseptic procedure that has proven its reliability until a definite corrective surgery has been performed, either by tumor removal or placement of a permanent shunt.

The value and efficacy of this technique has been verified both clinically in terms of Glasgow Coma Score in 93.3% and radiologically using the ventricular size index ratio in 95% of the cases.

We depended mainly on the base line CT scan and the serial follow up CT scans, which were done to all of the patients. The V.S.I. proved its validity and showed in 95% of the cases radiological evidence of improvement in the ratio. The remaining 5% kept the same ratio without single case showing an increase in the size of the ventricles.

In cases of hydrocephalus, both CT and MR showed the exact degree of ventricular enlargement, the presence of an underlying cause, the degree of effacement of cortical sulci and the same V.S.I. ratio (6).

Post V.SG.D. MRI was done especially for patients harbouring tumors for better assessment of the nature of this tumor and its relation to the neighbouring anatomical structures (Fig. 6).

Perrt and Graf had reported in 1977 their experience with subgaleal shunting in 173 patients. Their average duration of function was 3 weeks or more and even used it in one patient for as long as 20 months (7).

In this work the minimum duration of the V.SG. drainage was 3 days and the maximum was 3 weeks during which a definite corrective surgical procedure was done.

The sequelae of extra-cranial shunt placement were countless. Infection, obstruction and over drainage (8).

Shunt infection was reported by many as the most serious complication of external drainage. The incidence varied from 3% to higher rates of even 11% (9, 10, 11).

The V.SG. technique for C.S.F. drainage was used successfully in the treatment

of one case of shunt infection. After removal of the infected device, a contralateral V.S.G.D. was applied both to drain and as a route for intra ventricular injection of antibiotics. There was not one single case of post V.S.G.D. infection reported in this series.

In this series shunt obstruction did not manifest itself clinically by signs and symptoms of increased intracranial pressure. In four cases the dissected subgaleal space became flat. Shunt malfunction was confirmed by a control CT scan. The tip of the tube was embedded in the parenchyma. This was attributed to the hard texture and non maliable material of the used Nelton catheter. Although in these 4 cases, the VSI ratio was reduced and the brain had re-expanded, yet they were permanently shunted thereafter.

We did not face any problem of over drainage in our patients. This could be attributed to both the size of the catheter used (10) and the direction of the distal end, which was always upwards and medially.

In this study, 20% of the patients had proven to be shunt independent. The V.S.G C.S.F. drainage technique had efficiency curved its temporary purpose during the acute phase of hydrocephalus.

SUMMARY AND CONCLUSION

The re-introduction of V.S.G.D technique into the neurosurgical practice proved to be of great benefit.

The control of increased intra-cranial pressure with a risk of infection no great than for simple trephines, gives the surgeon leisure to plan the best possible permanent corrective procedure for a time when the patient's general condition is more favourable (6).

The ventriculo-subgaleal drainage of C.S.F. has been an aseptic technique for a prolonged (Up to 3 weeks) temporary diversion. It has replaced the external drainage with lesser risk of infection and most of all lesser costs.

Computed tomography is a reliable mean for investigating hydrocephalus. The ventricular size index is also an important tool for assessing the amount of ventriculomegaly and comparing the base line CT with the control film (1).

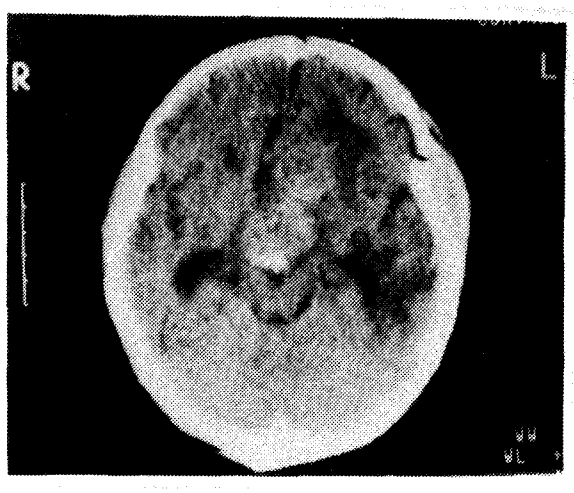

Fig. (Ia) : Post contrast CT head scan revealed.
A nonhomogenously enhancing suprasellar S.O.L. with flecks of calcification is seen obstructing both foramina of Monro with consequent bilateral ventricular dilatation.

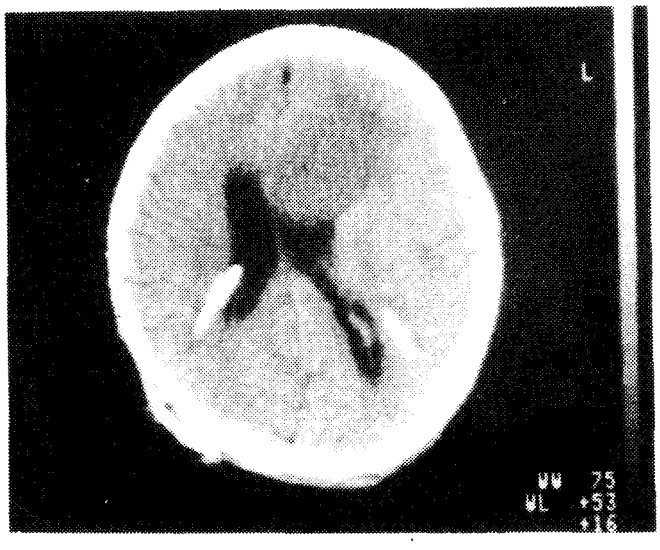

Fig. (Ib) : Post shunt CT head scan showing bilateral shunt through bilateral posterior parietal burrholes. (same patient Fig. 1 a).

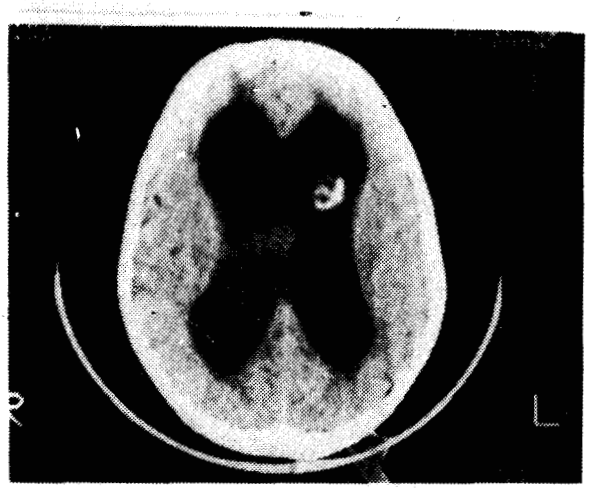

Fig. (3a) : Post contrast CT head scan revealed.
Severe hydrocephalic changes with a left intraventricular neoplasm.

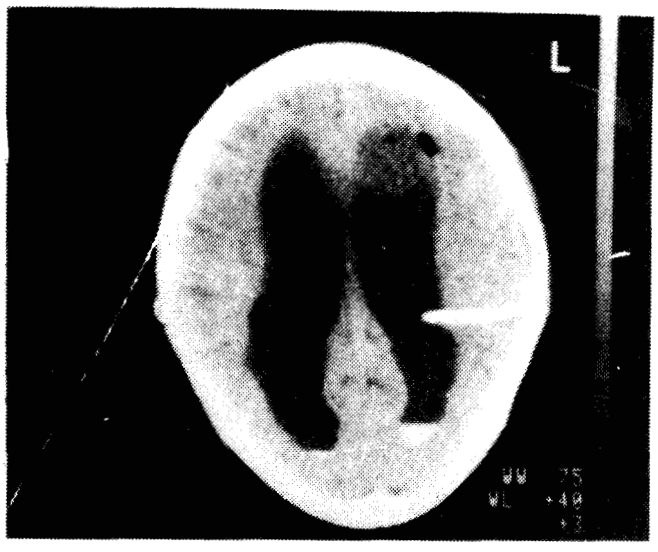

Fig. (3b) : Post shunt CT revealed persistent sever hydrocephalic changes yet with ↓ in the V.S.I. C.S.F. blood fluid level and air loculi are seen within left ventricle (post shunt) (same patient in Fig. 3a).

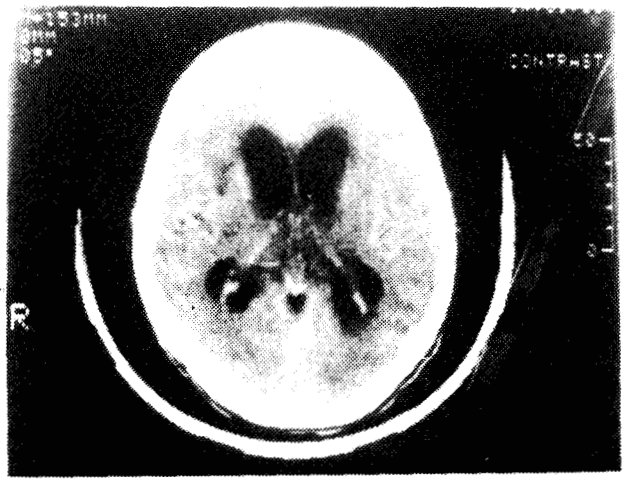

Fig. (4a) : Post contrast CT scan of the head showing moderate hydrocephalic changes. A right frontal area of hypodensity is noted likely representing caudate nucleus infarction.

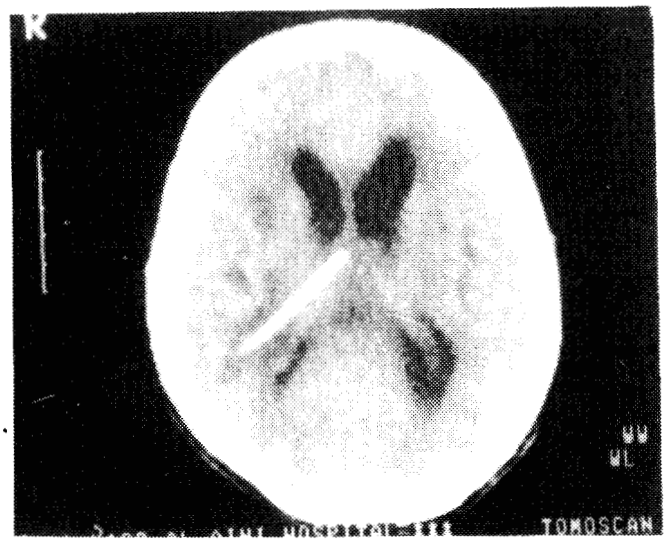

Fig. (4b) : Post shunt CT head scan showing the change of degree of hydrocephalus to the mild form (same patient in fig. 4a).

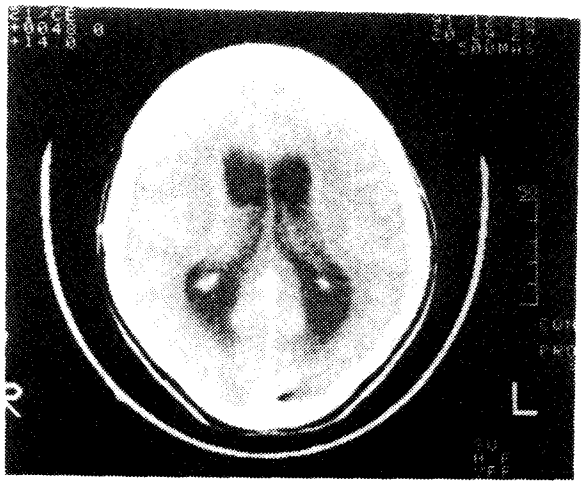

Fig. (5a) : Post contrast CT head scan showing moderate hydrocephalic changes.

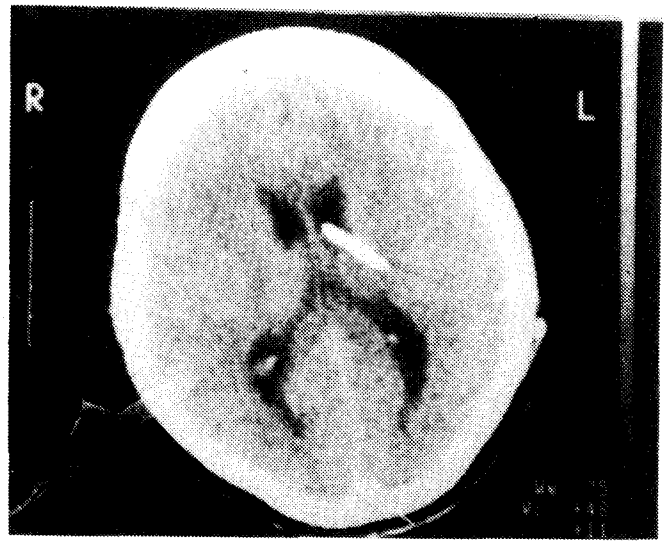

Fig. (5b) : Post shunt CT showing change in the degree of hydrocephalus to normal ventricular size index (same patient in Fig. 5a).

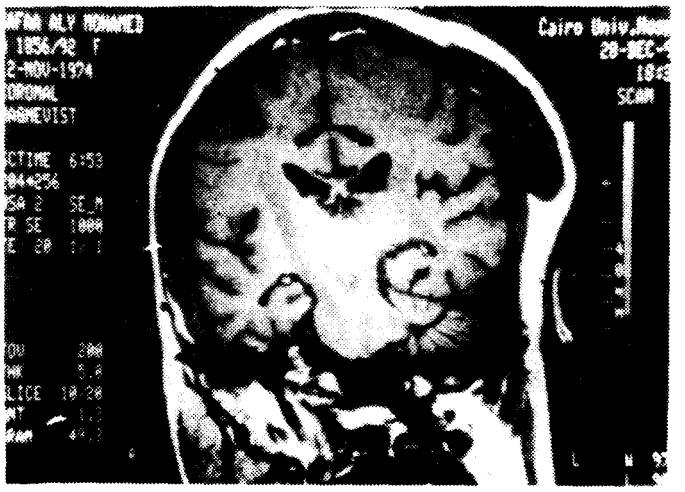

Fig. (6a) : Post contrast MRI in the coronal projection revealed and homogenously and density enhancing pineal body tumour obstructing the 3rd ventricle with consequent supratentorial hydrocephalic (moderate degree) changes.

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تقييم طريقة تحويل السائل النخاعى من بطين المخ إلى ما تحت القنصوة الدماغية بالاشعة المقطعية بالكمبيوتر والرنين المغناطيسى

دربة سالم - أحمد زهدى

قسم الاشعة التشخيصية وجراحة المخ والاعصاب كلية الطب - جامعة القاهرة

الاستسقاء الحاد بالمخ يعتبر من الحالات الطارئة بجراحة الاعصاب حيث يتطلب الى تدخل جراحى سريع لتحويل مجرى السائل النخاعى من البطين . ومع النقص فى صمامات المخ والمشاكل التى تنتج من إستخدام طرق اخرى للتحويل ادى الى إستخدام طريقة تحويل مجرى السائل النخاعى من بطين المخ الى ما تحت القنصوة الدماغية . انها تستخدم لخفض ضغط المخ حتى يتسنى عمل جراحة لعلاج الاستسقاء او سببه . هذه الطريقة تعتمد على وجود قوة امتصاصية للقنصوة الدماغية .

إن هذه الطريقة تعتبر طريقة مؤقته ذات مدة طويلة نسبيا بالاضافة الى كونها طريقة تنقذ المريض فى الفترات الحرجة بدون تلوث أو التهابات حتى يتم الحصول على صمام أو تجرى الجراحة الاولية .

وقد أثبتت نتائج هذه الدراسة كفاءة هذه الطريقة اكلينيكيا وبفحوصات الاشعة أيضا . حيث أن ٣ ر٩٣٪ من الحالات قد تحسنت أكلينيكيا بينما استمرت الحاله كما هى فى ٦ر٧٪ من الحالات ولا توجد أى مضاعفات جانبية فى هذه الدراسة . ومن ناحية أخرى وبالفحوص الاشعات تبين تحسن فى هذه الفحوص بنسبة ٩٥٪ حيث تبين رجوع بطينات المخ للحجم الطبيعى وأسترجاع الفراغات تحت الام العنكبوتيه بينما أستمر الوضع كما هو عليه فى ٥٪ من الحالات ولا توجد أى حالة تدهورت .