THE VALUE OF POSITIVE CONTRAST VENTRICULOGRAPHY IN PINEAL AND POSTERIOR FOSSA TUMOURS

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The localization and diagnosis of mass lesions in the parapineal region and posterior cranial fossa is important in surgical planning. This aim may not be fully achieved because of limitation in the present radiological methods of investigation. Vertebral angiography is still an imprecise diagnostic tool due partly to the great variation of its normal vascular pattern. Pneumoencephalography, on the other hand, is more informative but is usually inadvisable in the face of raised intracranial pressure. The latter frequently accompanies mass lesions in the region under discussion and air encephalography may result in serious pressure coning. Even radioisotope localization is relatively insensitive in the detection of third ventricle and posterior fossa tumours (McAfee and Fueger, 1964; Wagner, 1966). The operator is thus often left with the use of air ventriculography but this method usually fails due to difficulty in visualizing the third and fourth ventricles and aqueduct adequately.

Workers in this field have therefore resorted to the use of radio-opaque media to circumvent this shortcoming in air ventriculography. These media included lipiodol employed notably by Balado and his Argentinian colleagues as early as 1928 and thorotrast used by others including Freeman, Schoenfeld and Moore (1936). They were, however, abandoned because of their toxic qualities and are now replaced by a superior compound, ethyl iodophenylundecylate available commercially as Myodil, Pantopaque and Ethiodan.

The technique of positive contrast or Myodil ventriculography, introduced by Bull in 1950 demonstrates mass lesions in the parapineal region and posterior fossa with considerable clarity. It is therefore a matter of surprise that this method has not received universal acceptance. This is doubtless due to adverse accounts of complications following the use of Myodil in spinal myelography. The occurrence of severe arachnoiditis has been confirmed at operation (Peacher and Robertson, 1945; Davies, 1956; Mason and Raaf, 1962) and at autopsy (Bering, 1950; Hurteau, Baird and Sinclair, 1954). A fatal case was also reported, allegedly attributed to late meningeal reaction in the basal cisterns from Myodil used in myelography (Erickson and van Baaren, 1953).

However, a recent animal study, conducted by Howland and Curry (1966), showed that Myodil produced arachnoiditis only when mixed with free blood. This study, though not corroborated yet, is noteworthy in that it suggests a logical explanation for the occasional cases of severe arachnoiditis in spite of widespread use of Myodil. Nonetheless, Myodil which is being used with increasing frequency for ventriculography and stereotaxic surgery on the brain, has not up to date been incriminated for any serious side-effects in connection with these procedures.

TECHNIQUE

In the local practice, the technique used in the study of the ventricles of the brain has been adapted and modified over the years but accumulated experience has evolved the following line of investigation. This is in fact a compromise between the methods using solely air and solely Myodil for the visualization of the ventricular system.

The air is introduced by the neurosurgeon using bilateral posterior burr-holes at the classical site, namely 3 cm. on either side of the midline and about 7 cm. above the external occipital protuberance. The atria of both lateral ventricles are tapped with ventricular cannulae and the cannula on the non-dominant side of the head is then replaced with a Nelaton soft rubber catheter through which a quantity of filtered air, up to 50 c.c., is introduced. The remaining ventricular cannula is removed but the catheter is left in situ and clamped.

In this way, air ventriculography is first employed and if the result is inconclusive, this is followed by positive contrast study. Initially the passage of the contrast medium in the ventricles was guided by fluoroscopic control but this has been given up in preference to a system of manipulation followed immediately by radiography on the Schonander skull table. This procedure has met with fairly consistent success and has the

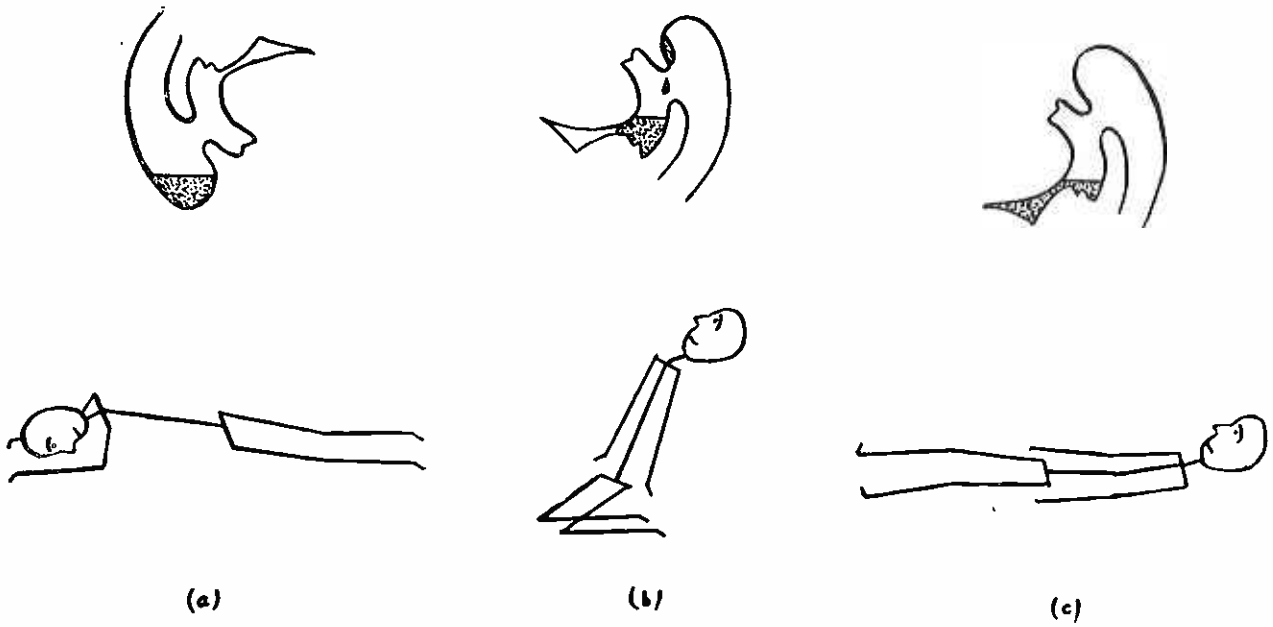

Fig. 1. The local technique of Myodil ventriculography. (a) The oily contrast is introduced with the patient prone. (b) The patient is placed in a kneeling position. The head is gradually extended so that the contrast medium spills into the third ventricle ("Al Jolson attitude"). (c) End of the manoeuvre with the patient supine, ready for radiography.

advantage of sparing the operator from exposure to radiation. Further, a restless or unco-operative patient can be more readily managed without the use of fluoroscopy.

The local method of "blind" manipulation is given schematically in Fig. 1. With the patient lying prone and head flexed, a small quantity of Myodil, 1-2 ml. depending on ventricular size, is introduced into one of the lateral ventricles through the indwelling catheter with exercise of the usual aseptic precaution. For the purpose of the discussion, the contrast is instilled into the right lateral ventricle gravitating by virtue of its hyperbaric property to the frontal horn. The patient is then manouevred into a kneeling position on the X-ray table with the head still kept flexed. The head is gradually extended by the operator who also maintains a lateral tilt of the head 10-15 degrees to the left. In this way the contrast spills over the right foramen and comes to rest in the posterior part of the third ventricle. This extension is continued until the patient looks directly at the ceiling and is accompanied by a gentle agitating movement applied to the head all the time. With the head still hyper-extended, the patient is made to lie supine. The head is then flexed to a neutral position to ensure filling the aqueduct and fourth ventricle with contrast and radiography is carried out immediately afterwards. Companion films, comprising a straight antero-posterior (frontal), a Towne's and a shoot-through lateral view, are taken without change in the position of the head between radiographic exposures.

METHODS OF LOCALIZATION ON THE VENTRICULOGRAM

Two methods are popularly employed for determining the normal position of the fourth ventricle and aqueduct on the lateral radiograph (Fig. 2). The first is the Twining (1939) or the TTT method which localizes the fourth ventricle. It consists of drawing a line joining the tuberculum sellae with the torcular Herophili. The midpoint of this line should fall on the floor of the fourth ventricle or just posterior to it. The second is the Stockholm method for the localization of the aqueduct (Sahlstedt, 1935). A line

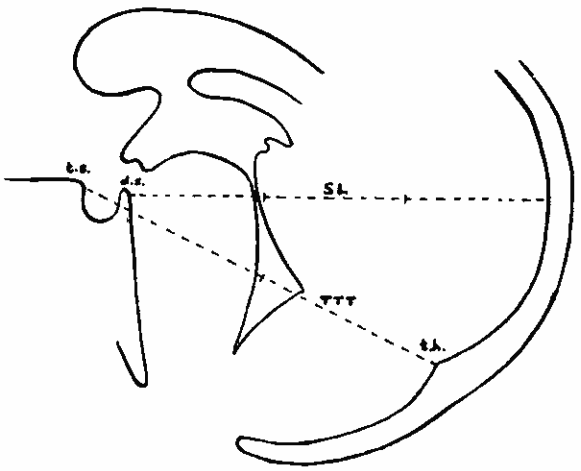

Fig. 2. The Stockholm and Twining methods for determining the normal position of the aqueduct and fourth ventricle respectively. The Stockholm line (SL) is drawn from the dorsum sellae (d.s.) through the lower third of the aqueduct to meet the inner table of the skull. The Twining or TTT line connects the tuberculum sellae (t.s.) with the torcular Herophili (t.h.).

joining the dorsum sellae with the lower third of the aqueduct is extrapolated to reach the inner table of the skull. When this line is trisected, the aqueduct should be at the junction of the anterior and middle thirds of this line.

To this may be added the Singapore method (Fig. 3) for localizing the pineal gland in adults (Oon, 1964). The pineal is readily identified by its characteristic calcification. Otherwise its position may be deduced as it lies wedged between the suprapineal and infrapineal recesses on the lateral ventriculogram. The method consists of erecting a perpendicular arm to a line connecting the tuberculum sellae and the anterior lip of the foramen magnum. The arm is sited 1 cm. from the tuberculum and the expected position of the pineal gland is given by a point 5 cm. on the arm.

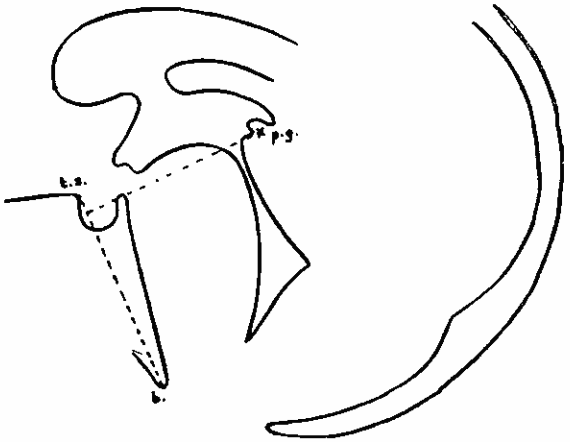

Fig. 3. Singapore method of pineal localization. A line joins the tuberculum sellae (t.s.) with the anterior lip of the foramen magnum or basion (b). A perpendicular arm is erected 1 cm. from the tuberculum. The expected position of the pineal gland (p.g.) is given by a point 5 cm. on this arm.

ILLUSTRATIVE CASES

A number of cases is presented to illustrate the value, diagnostic difficulties and limitation of positive contrast ventriculography.

Case 1

C.B.S., a boy of 11 years, first presented with symptoms and signs of diabetes insipidus, thought to be post-encephalitic in origin and was treated with Pitressin. 4 months later, he was noted to have choked discs associated with a defect of upward gaze and no other neurological signs.

RADIOLOGICAL STUDY: Though the pituitary fossa was not enlarged, its floor and dorsum were found to be greatly decalcified. The carotid angiogram only showed evidence of severe and symmetrical internal hydrocephalus. Positive contrast without air was used in the ventriculogram (Figs. 4a, b and c) and this revealed gross enlargement of the third ventricle with indentation from behind by a large lobulated mass. The suprapineal recess was patent and in fact much dilated but the infrapineal recess was obliterated. The side-walls of the third ventricle were irregular. The commencement of the aqueduct was displaced downward and forward. This large mass lesion originating in the region of the pineal gland was thought to be a pinealoma.

PROGRESS: The patient died after a few months and autopsy showed a large *pinealoma* infiltrating forward along the floor and sides of the ventricle as far as the optic chiasma.

Case 2

N.Y.S., a boy of 7 years, was first seen 2 years before his last illness with a history of vomiting and loss of consciousness and the only positive neurological sign elicited then was a bilateral plantar response. He made a rapid complete recovery and was discharged as a case of "encephalitis". Subsequent to his recovery, he showed a growth spurt and signs of precocious puberty. He was readmitted 2 years later with a history of persistent vomiting and was noted to have bilateral papilloedema, failure of upward vertical gaze and evidence of pyramidal involvement. The clinical diagnosis was that of a pineal tumour.

RADIOLOGICAL STUDY: The pituitary fossa was not enlarged but the posterior clinoids were eroded. A right carotid angiogram showed

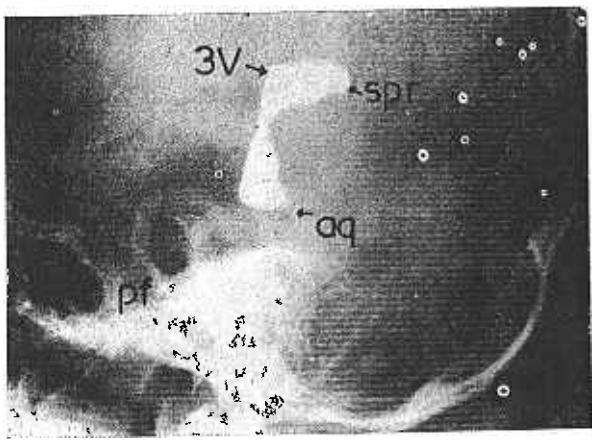

Fig. 4a. Case 1. Pinealoma. Lateral view. Only the back part of the third ventricle (3V) is opacified by Myodil. This shows a marked increase of size and presents a large irregular filling defect on the posterior aspect in the region of the pineal gland. The infrapineal recess is encroached upon but the suprapineal recess (spr) is enlarged. The commencement of the aqueduct (aq) is pushed downward and forward. The pituitary fossa (pf) is decalcified.

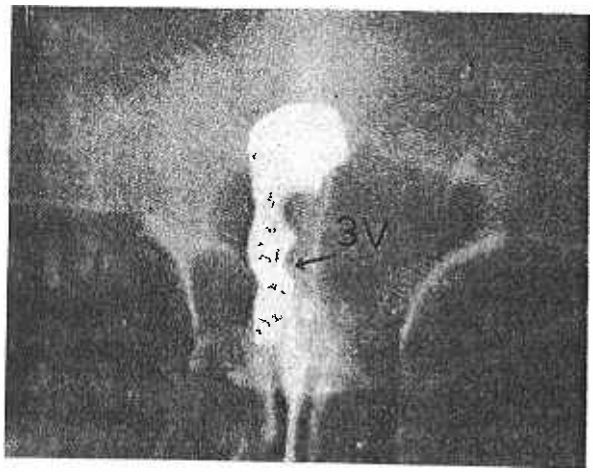

Fig. 4b.

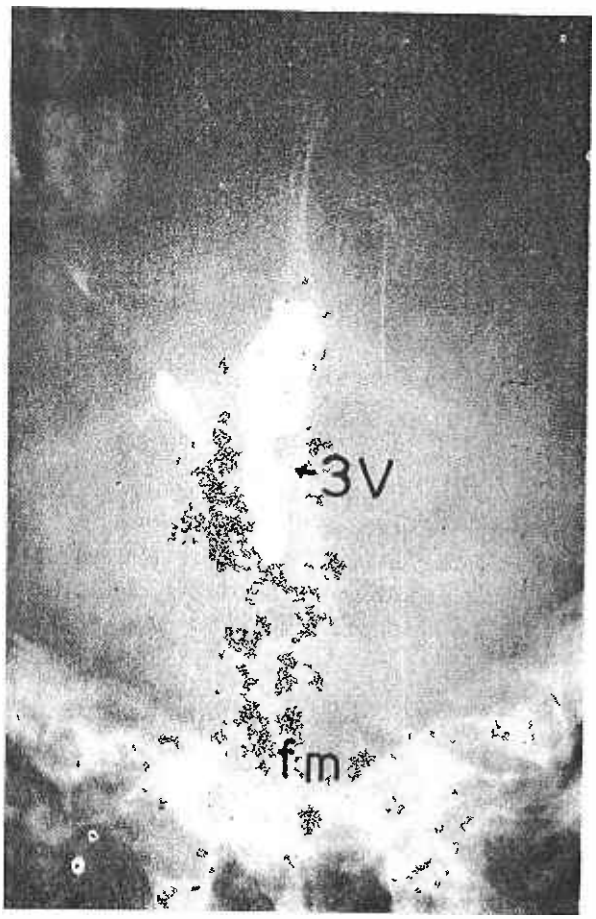

Fig. 4c.

Figs. 4b and c. Case 1. Pinealoma. Frontal and Towne's views. The third ventricle (3V) is visualized between the orbits (orb—orb), and above the foramen magnum (fm) showing no increase of width. The side-walls are markedly irregular.

features of internal hydrocephalus. The posterior cerebral artery exhibited a marked dip near its origin, suggesting the presence of tentorial coning. Air-Myodil ventriculogram (Figs. 5a and b) revealed moderately dilated lateral ventricles and a slightly enlarged undisplaced third ventricle. The positive contrast was seen to be irregularly dispersed suggesting a diffusely infiltrative intraventricular tumour like an ependymoma. Follow-up radiographs which included a pneumoencephalogram (Figs. 6a, b and c) after a ventriculo-peritoneal shunt showed the contrast still retained within the third ventricle, but now outlining an ellipsoidal mass situated in the centre of the ventricle. It became evident that this lesion was either a colloid cyst or a pineal teratoma.

PROGRESS: As permission for operative relief was not granted, the patient received radiotherapy. He went into coma from time to time and failed to come round from one of these comatose episodes. Autopsy showed the presence of a large *pineal teratoma* filling the entire third ventricle.

COMMENT: These two cases illustrate the point that pineal tumours often attain a large size before detection and may involve anteriorly the hypothalamic region producing diabetes insipidus or precocious puberty as well as the tectal plate posteriorly to produce the eye-signs grouped as the Parinaud's syndrome. A pineal tumour may be associated with a patent suprapineal recess as shown in the above cases. This is emphasized by Jennett, Johnson and Reid (1963), although most radiological textbooks regard an obliterated suprapineal recess as a cardinal sign of a pineal tumour. In Case 2, the contrast delineation of an intraventricular mass on late follow-up films is invaluable in indicating a surgically correctable condition.

Case 3

T.A.M., a girl of 19, presented with symptoms and signs of acutely raised intracranial

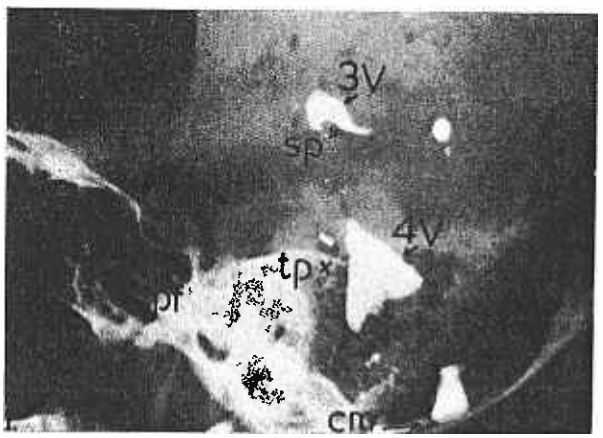

Fig. 7a. Case 3. Brain-stem glioma. Lateral view. The fourth ventricle (4V) is slightly displaced backward with reference to the Twining point (tp). Some contrast has already spilled from the fourth ventricle into the cisterna magna (cm). The pineal gland is not displaced as assessed by its relation to the Singapore point (sp).

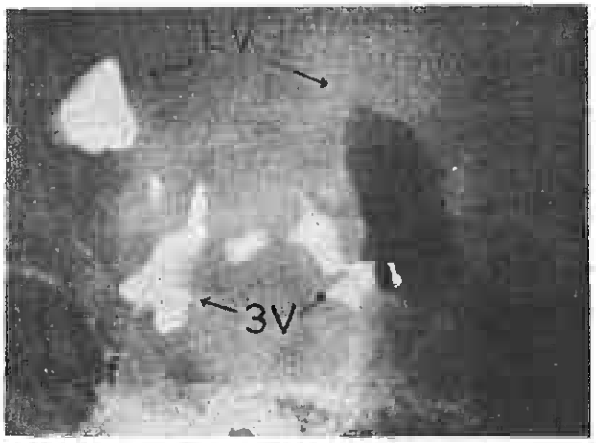

Fig. 5a.

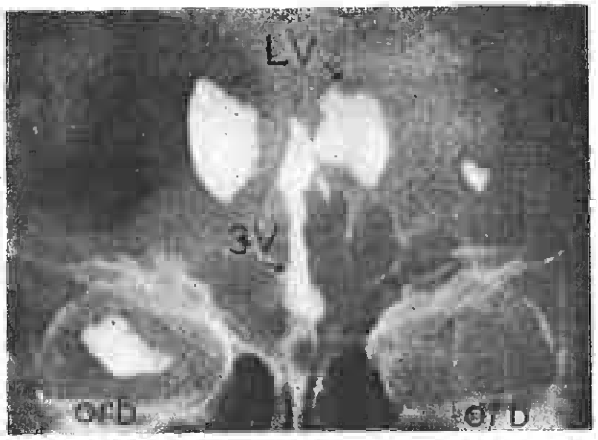

Fig. 5b.

Figs. 5a and b. Case 2. Pineal teratoma. Lateral and frontal views, with the patient in the prone instead of the usual supine position. Hyperbaric positive contrast is seen in the frontal horns and air in the atria and occipital horns of the dilated lateral ventricles (LV). The third ventricle (3V) is slightly enlarged and shows irregular dispersion of the positive contrast. The aqueduct and fourth ventricle are not visualised. pf = pituitary fossa; orb = orbits.

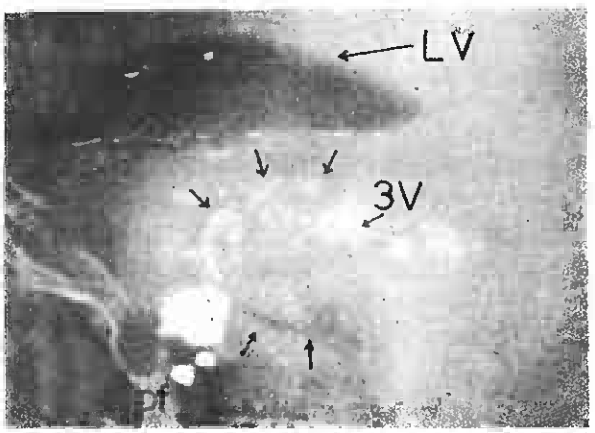

Fig. 6a.

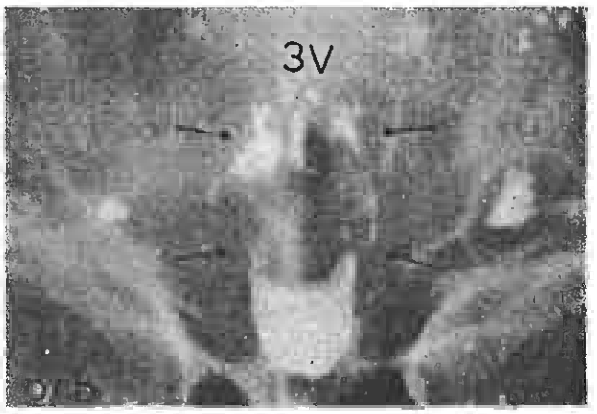

Fig. 6b.

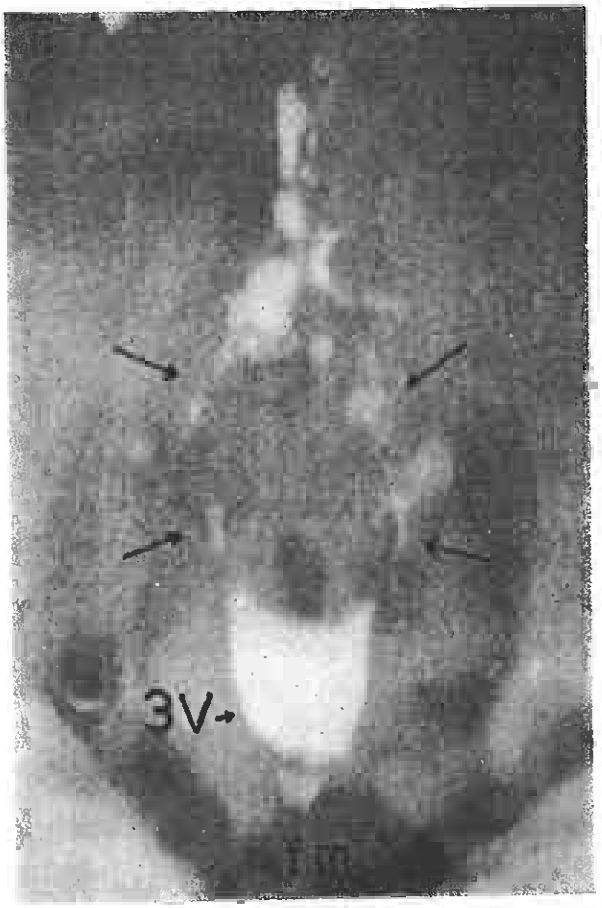

Fig. 6c.

Figs. 6a, b and c. Case 2. Pineal teratoma. Follow-up pneumoencephalogram shows much contrast retained in the third ventricle (3V). A large ellipsoidal mass within the third ventricle is now delineated by contrast (indicated by arrows). fm = foramen magnum.

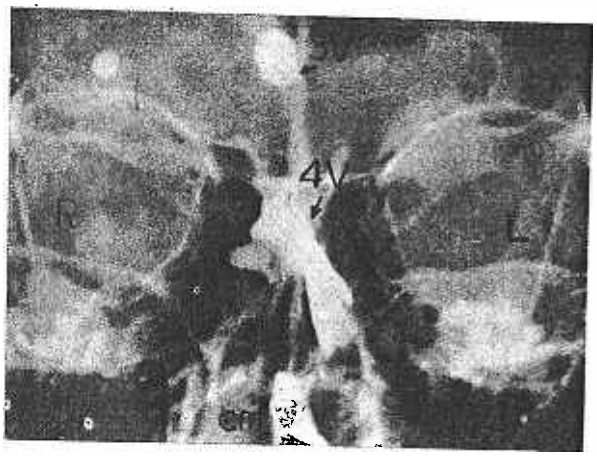

Fig. 7b.

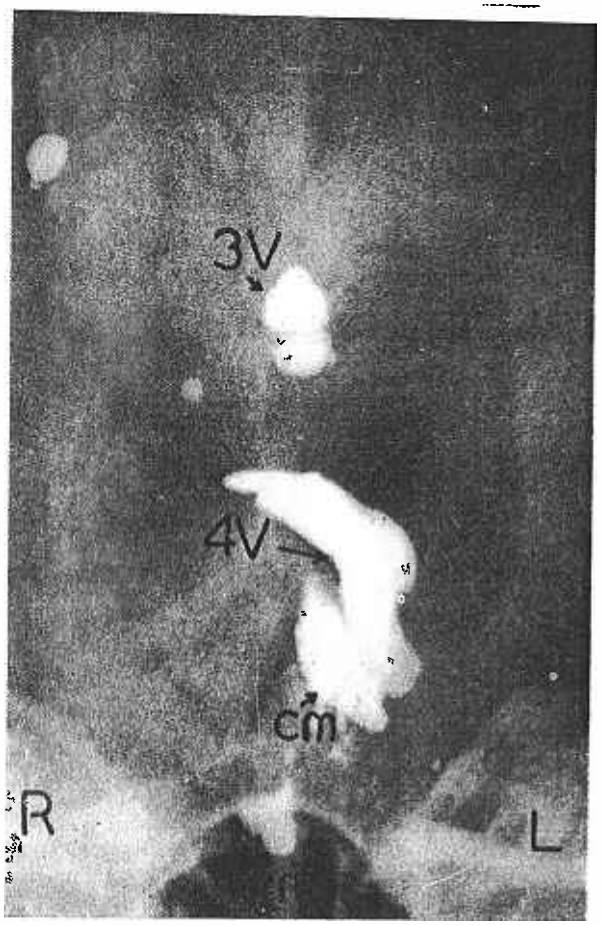

Fig. 7c.

Figs. 7b and c. Case 3. Brain-stem glioma. Frontal and Towne's views. The fourth ventricle (4V) is markedly displaced to the left and shows a dog-leg deformity.

pressure. She was too drowsy and unco-operative for a full neurological examination. Following a ventriculo-peritoneal bypass, she showed great improvement and was noted to have evidence of marked cerebellar signs on the right side.

RADIOLOGICAL STUDY: The pituitary fossa was within normal limits, but carotid angiogram and air ventriculogram revealed moderate enlargement of the lateral and third ventricles without displacement. Positive contrast (Figs. 7a, b and c) opacified the fourth ventricle which was minimally displaced backward but showed marked deviation to the left with a dog-leg deformity. The extent of the shift from the midline and the nature of angulation of the fourth ventricle indicated the presence of a large deep-seated mass lesion bulging into it from the right and below.

PROGRESS: Craniotomy revealed an enormous *glioma* arising from the *lower brain-stem* growing posteriorly to occupy almost two-thirds of the right side of the posterior fossa and pushing the medulla to the opposite side.

Case 4

C.H.K., a girl aged 16, referred from Jesselton, Sabah with a history of occipital headache, vomiting and diplopia for six months. She was found to have choked discs and absent corneal reflex on both sides, bilateral VI nerve palsy, left VII lower motor neurone paresis, an absent gag reflex, slight cerebellar dysfunction and bilateral plantar response.

RADIOLOGICAL STUDY: The pituitary fossa was only slightly decalcified. Moderately severe hydrocephalus was suggested on the carotid angiogram and confirmed by air study. The aqueduct, visualized by Myodil (Figs. 8a and b), was displaced upward and backward in a bow shape, as assessed by the Stockholm method. The fourth ventricle was incompletely opacified but also showed posterior shift with reference to the Twining point. It was also flattened on the lateral view but broadened on the frontal view. The lesion was almost certainly produced by a glioma arising from the pontine region of the brain-stem.

PROGRESS: On the strength of the clinical and radiological findings, the patient was given palliative radiotherapy and she subsequently returned to her home-town.

COMMENT: Unlike the above cases, most patients with medullo-pontine glioma have absent or mild intracranial hypertension and can therefore be examined by the elective method of pneumoencephalography. A classicial radiological appearance of a brain-stem glioma, as described by Lysholm (1935) and Sutton (1953) is shown in Case 4 and a definitive diagnosis is confidently made with corroboration of a typical clinical picture. The marked lateral displacement of the fourth ventricle in Case 3 is most unusual

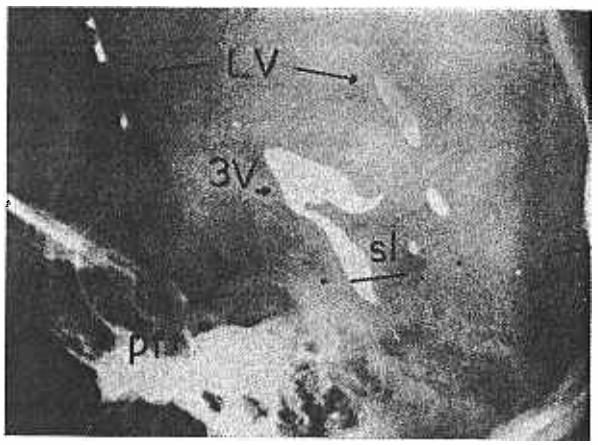

Fig. 8a.

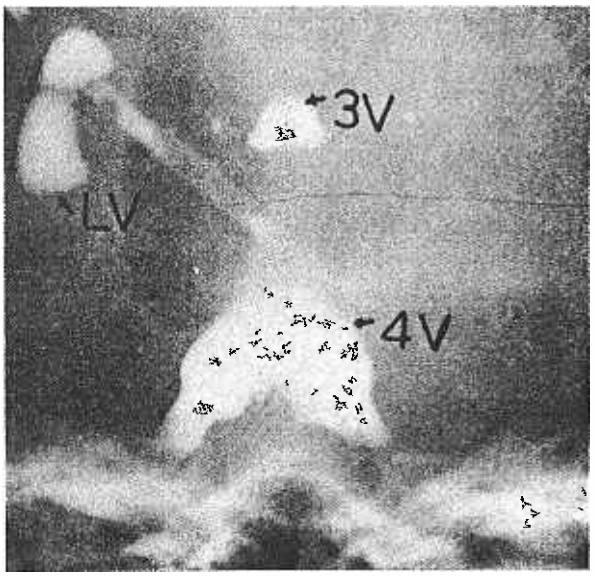

Fig. 8b.

Figs. 8a and b. Case 4. Pontine glioma (unverified). Lateral view. Hydrocephalus of the lateral ventricles (LV) as demonstrated by air and Myodil. The aqueduct shows a funnel dilatation and is displaced upward and backward in a bow shape with reference to the trisected Stockholm line (sl). Towne's view. The fourth ventricle (4V) is considerably widened but not deviated from the midline.

(Taveras and Wood, 1964) and is caused by the extensive backward invasion of the tumour mass.

Case 5

A.B.A., male, 33, was referred from Johore Bahru with a history of progressive blindness in the left eye for a year and intermittent headache and vomiting for the same period. He also complained of buzzing in the right ear for three months. He was found to have bilateral papilloedema, a doubtful left VI nerve paresis and diminished hearing of the right ear. There was no neurological deficit or abnormal signs in the trunk and limbs.

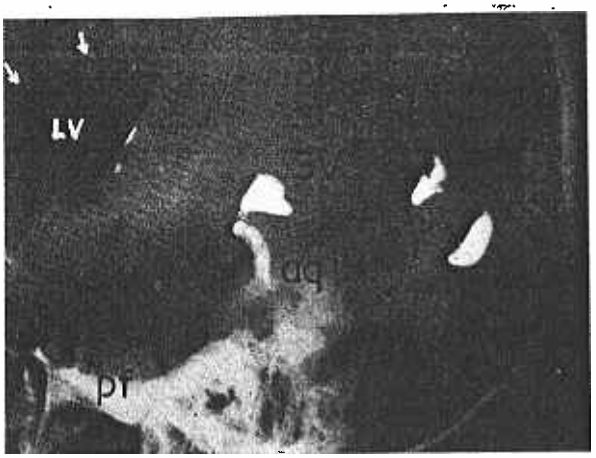

Fig. 9a.

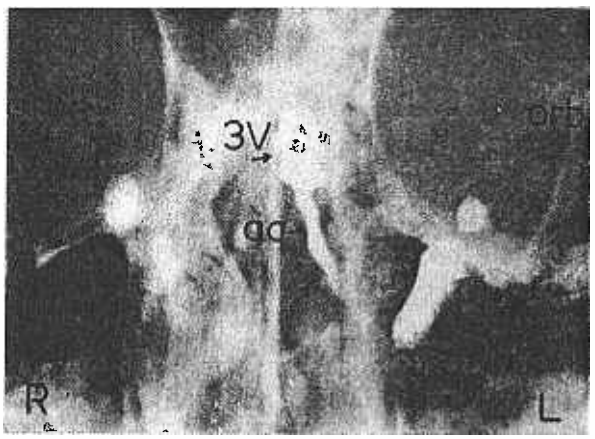

Fig. 9b.

Figs. 9a and b. Case 5. Cerebellar hemisphere tumour (unverified). Lateral and frontal views. The pituitary fossa (pf) is markedly enlarged and decalcified. Severe hydrocephalus of the lateral ventricles is shown. The aqueduct and its junction with the fourth ventricle are displaced forward and to the left.

RADIOLOGICAL STUDY: The pituitary fossa was grossly enlarged and decalcified. The lateral profile area was approximately 190 sq. mm. and the fossa volume 3,420 cu. mm. (Oon, 1963)*. The internal auditory meati were within normal limits. The only significant finding on the carotid angiogram was the indication of bilaterally enlarged lateral ventricles and this was corroborated by air study. Positive contrast ventriculogram (Figs. 9a and b) showed the aqueduct and its junction with the fourth ventricle to be kinked forward and displaced to the left, strongly suggestive of a deep-seated cerebellar tumour on the right in close relation to the fourth ventricle.

PROGRESS: Consent for operation was however refused and follow-up study was not available.

Case 6

W.Y.H., a girl aged 15, was admitted with symptoms and signs of severely raised intra-

* Upper limited of normal: lateral profile area = 130 sq. mm.; fossa volume = 2000 cu. mm.

cranial pressure, becoming drowsy and finally lapsing into coma. There were no localizing signs and no indications of cerebellar dysfunction.

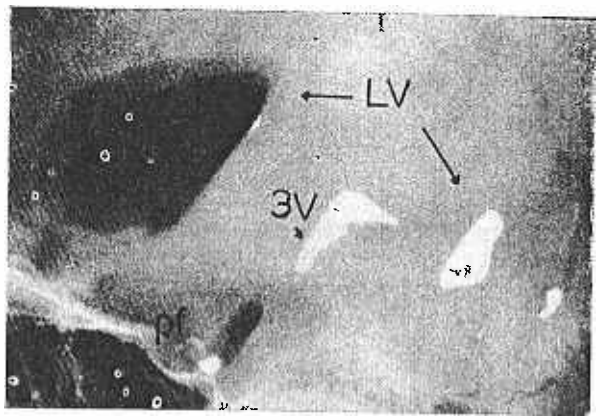

Fig. 10. Case 6. Cerebellar vermis medulloblastoma. Lateral view. The lateral ventricles are considerably enlarged. The hind portion of the third ventricle is opacified by Myodil and shows an irregular cut-off on the inferior aspect with non-visualization of the aqueduct and fourth ventricle.

RADIOLOGICAL STUDY: The pituitary fossa was within normal limits. The carotid angiogram indicated the presence of symmetrical hydrocephalus of the lateral ventricles, suggesting the possibility of obstruction to the distal ventricles. The Myodil study (Fig. 10) carried out later showed the contrast medium to be held up at the aqueduct. An irregular filling defect was observed on the postero-inferior aspect of the third ventricle with obliteration of the infrapineal recess. The appearance suggested a growth of the tectal plate or a more extensive cerebellar tumour.

PROGRESS: A Torkildsen's bypass operation was carried out but the patient's condition deteriorated. At postmortem, a soft grey vascular tumour, about 5 cm. in diameter, was seen arising from the *cerebellar vermis* and invading the cerebellar peduncles and midbrain. The tumour was found at microscopy to be a *medulloblastoma.*

COMMENT: The displacement of the aqueduct and fourth ventricle forward and to the contralateral side is the hallmark of a mass lesion in one of the cerebellar hemispheres. This radiological appearance in Case 5, though lacking operative or postmortem proof, is diagnostic of the condition. In Case 6, the midline cerebellar tumour has invaded the midbrain and its radiological picture is, therefore, indistinguishable from a tectal plate tumour but can be differentiated from benign aqueductal stenosis by the presence of an irregular filling defect of the third ventricle.

Case 7

L.K. was 49 when he died. He had the unfortunate experience of having undergone 4 operations for the removal of a recurring right acoustic neuroma in the last 12 years of his life, suffering progressive deterioration of his neurological state during this period. He had a partial right facial palsy from his initial operation, developed right maxillary and mandibular neuralgia at the first recurrence and deterioration of vision at the second recurrence. At the time of his final admission, he was a dejected man with poor eyesight,

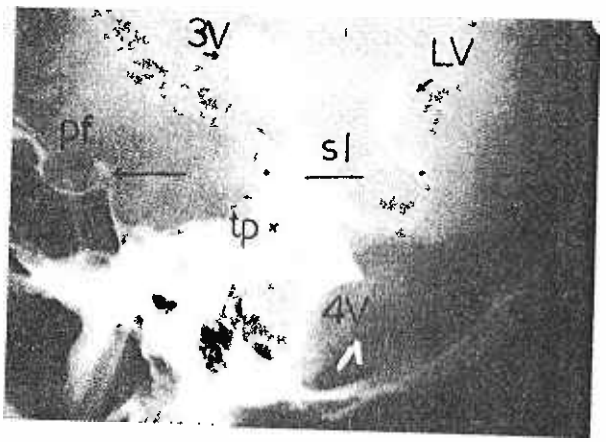

Fig. 11a.

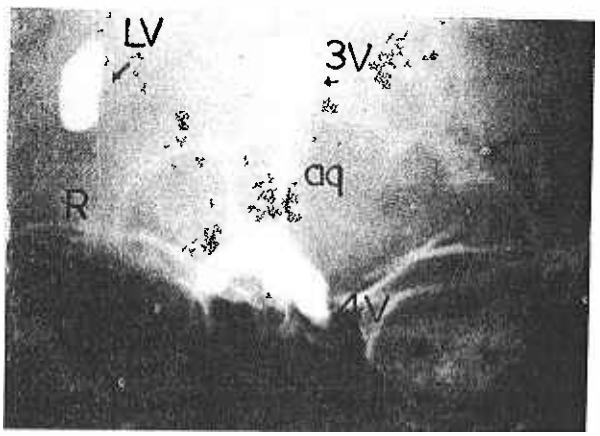

Fig. 11b.

Figs. 11a and b. Case 7. Recurrent right acoustic neuroma. Lateral and frontal views. The aqueduct and fourth ventricle are pushed backward with the aqueduct greatly stretched out. The reference points are those on the trisected Stockholm (sl), and the Twining point (tp). On the frontal view, the aqueduct and fourth ventricle are in the midline but the latter is rotated. A large bone defect is seen in the occiput.

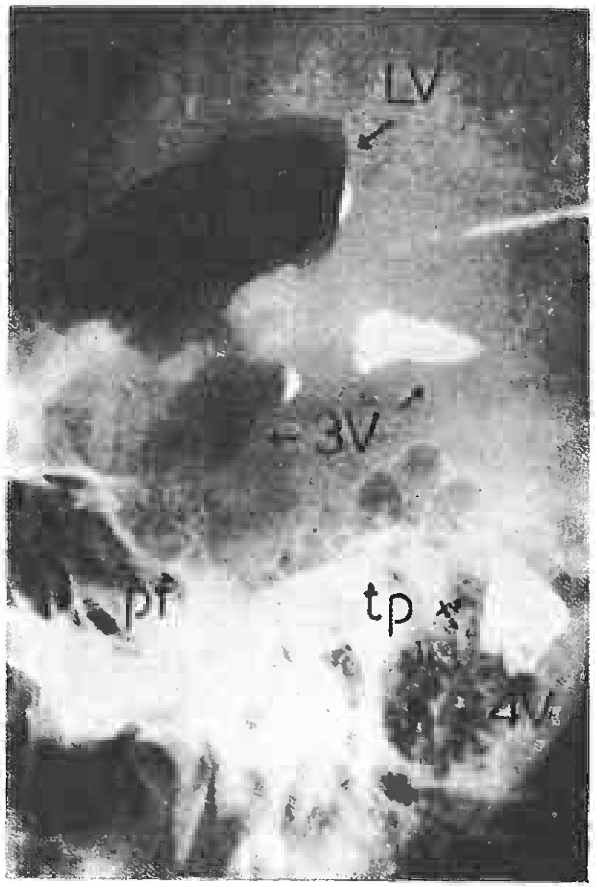

Fig. 12a.

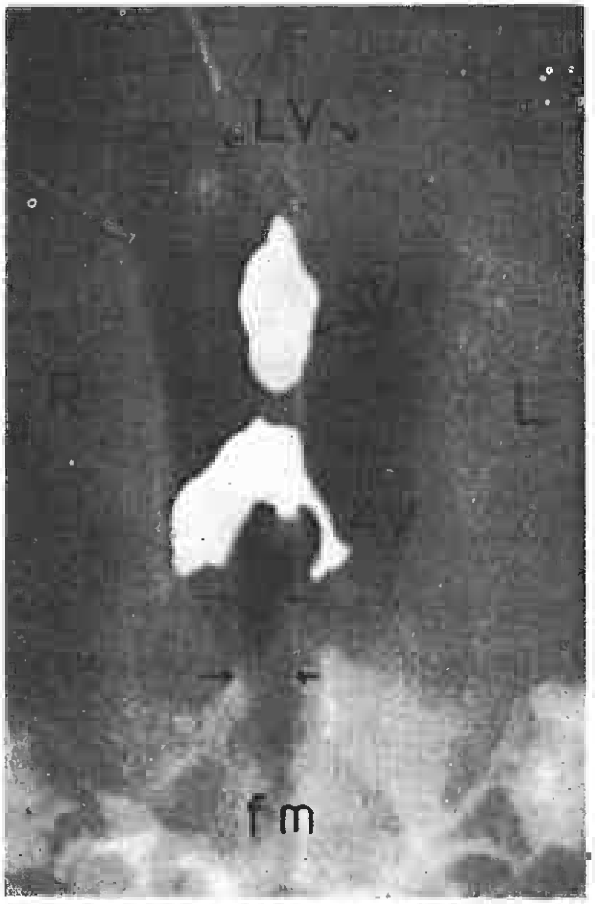

Fig. 12c.

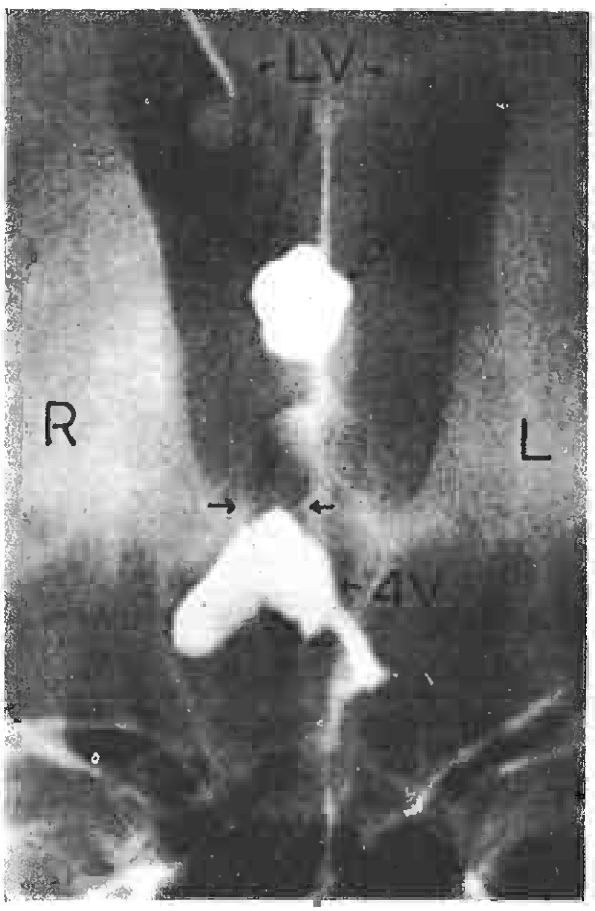

Fig. 12b.

Figs. 12a, b and c. Case 8. Left cerebello-pontine angle neurinoma. Lateral, frontal and Towne's views. The fourth ventricle is displaced posteriorly with reference to the Twining point (tp) and shows minimal shift and rotation to the right. The lateral and third ventricles are dilated. The air-filled anterior end of the third ventricle is also seen to be bowed to the left on the frontal and Towne's views (indicated by arrows).

slurred speech, multiple cranial palsies and extreme weakness of legs.

RADIOLOGICAL STUDY: The plain skull radiographs showed a large defect of the occipital bone on the right side, a mark of previous surgery. There was, in addition, extensive erosion of the right petromastoid and porus acousticus. Positive contrast (Figs. 11a and b) showed the aqueduct and fourth ventricle displaced posteriorly to a considerable extent with the aqueduct greatly stretched out as well. On the frontal view, these structures were not laterally displaced but the fourth ventricle was rotated. The appearance was consistent with a large mass lesion in the right cerebello-pontine angle.

PROGRESS: At operation, a large infiltrating recurrent *acoustic neuroma* was found on the right side involving the basilar artery and pushing the brain-stem backward.

Case 8

L.L.H., a 36 year old man, gave a history of periodic headache, dizzy spells and buzzing in the left ear. A diminished acuity of hearing accompanied the buzzing in the left ear but was not progressive in severity. He also complained of episodic attacks of pain over the left cheek. On examination, he was found to have bilateral papilloedema with a small haemorrhage in the left fundus and a partial left VIII nerve lesion. Cerebellar functions were intact and there was no long tract sign.

RADIOLOGICAL STUDY: Preliminary investigation showed a mildly decalcified pituitary fossa, normal internal auditory meati and a large jugular foramen on the left side. Symmetrical hydrocephalus was noted on the carotid angiogram. Positive contrast study (Figs. 12a, b and c) revealed a picture similar to that seen in the preceding case, characterised by fairly marked backward shift of the fourth ventricle with minimal lateral and rotatory displacement.

PROGRESS: A massive *neurinoma* of the left cerebello-pontine angle was successfully removed in toto by Mr. Frank Morgan in Melbourne. The excision had to be carried out in two stages entailing a total operating time of 16 hours. The dimensions were so considerable that the upper pole extended through the tentorial notch almost to the level of the III nerve and the superior cerebellar artery while the lower pole reached the foramen magnum. The tumour was seen to have grown from and through a very greatly enlarged jugular foramen and most probably originated from either the IX, X or XI nerve or one of the smaller nerves like the Jacobson's within the foramen.

COMMENT: The diagnosis of cerebello-pontine angle masses is of great importance as they are usually benign and amenable to surgical treatment. The assessment of their size based on the shift and distortion of the fourth ventricle can be misleading, as amply illustrated in Case 8. It is because space-occupying lesions in these situations indent on an intervening cushion of neural tissue before they can displace or deform the fourth ventricle. The fourth ventricle and aqueduct are often very little, if at all, displaced from the midline.

Case 9

A month old infant, daughter of T.B.H., was referred from the Kandang Kerbau hospital for investigation and management of hydrocephalus and an infected meningocele in the sacral region.

RADIOLOGICAL STUDY: The pneumo-ventriculography was first carried out followed by Myodil study, both contrast media being introduced through the lateral angle of the open

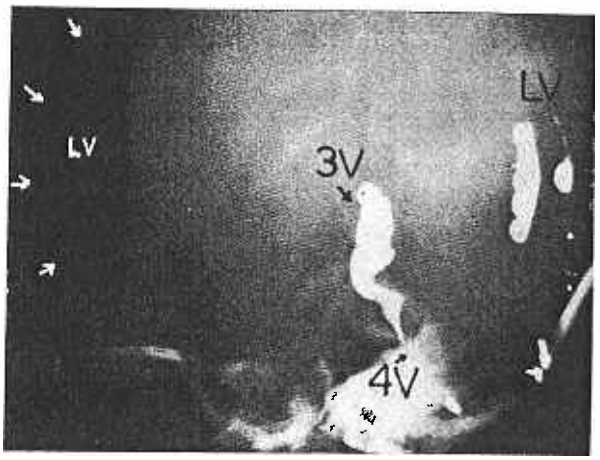

Fig. 13a.

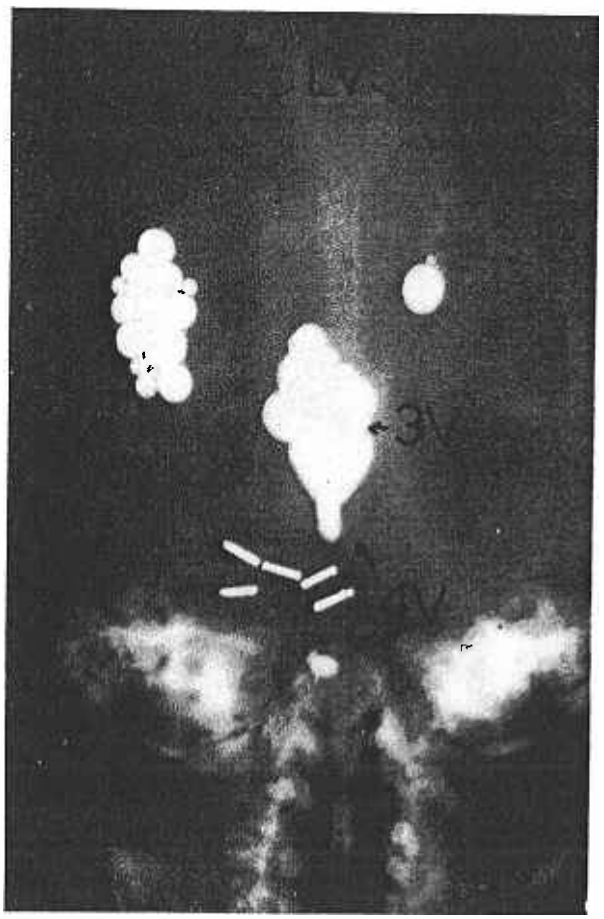

Fig. 13b.

Figs. 13a and b. Case 9. Arnold-Chiari malformation. Lateral and Towne's views. Gross dilatation of the lateral ventricles is shown. The back portion of the third ventricle is opacified by Myodil and is also enlarged. The fourth ventricle, however, is stretched and attenuated but lies in the midline.

anterior fontanelle. Severe symmetrical hydrocephalus was shown with the cerebral tissue reduced to a thickness of 12-15 mm. The fourth ventricle was stretched and attenuated appearing as a narrow canal. The positive contrast was held up at its distal end and this obstruction to the flow was confirmed on follow-up radiographs. (Figs 13a & 13b.)

PROGRESS: At operation, the cerebellar tonsils were found to be elongated and prolapsed through the foramen magnum into the upper cervical canal down to the level of C3. There was marked subarachnoid adhesion in this region.

COMMENT: Positive contrast provides an excellent method of studying the Arnold-Chiari malformation. The elongated appearance of the fourth ventricle is typical of the condition and the diagnosis is often clinched by demonstrating the position of the foramen of Magendie below the foramen magnum (Gros, Roilgren and Vlahovitch, 1963).

DISCUSSION

The illustrative cases have shown that positive contrast ventriculography is a useful adjunct in the investigation of mass lesions in the parapineal region and posterior fossa. In the local practice, it is utilized when air study fails to provide a satisfactory diagnosis. The reason for this common failure is twofold. Firstly, the third and fourth ventricles and connecting iter are small structures with a total capacity of only 2 c.c., so that visualization with air is poor except where vertical tomography using an expensive apparatus is employed. Secondly, both the manipulation of air into the caudal part of the ventricular system and subsequent radiography are fraught with technical difficulty (Bull, 1950; Dowling, Bleasel, Cahill and Miller, 1957). The use of a contrast medium of high radiodensity with relative ease of manipulation of the contrast thus offers a distinct advantage in the diagnosis of lesions in or encroaching on the posterior part of the third ventricle, aqueduct and fourth ventricle.

Since its introduction by Bull in 1950, Myodil ventriculography has been fairly widely used by Horowitz (1956), Ralston, Gross and Newman (1959), Wilson and Snodgrass (1959) and other workers already mentioned. No severe reactions or injurious effects were reported following its use in these series. In our local experience, Myodil has not caused any known ill-effects on the cases studied.

The ventricular system, by virtue of its deep-seated position, is readily displaced and deformed by the presence of a space-occupying lesion. Thus the method of air-Myodil study is capable of localizing with precision a mass lesion in the parapineal region and posterior fossa. The lesion may, however, be so sited that it kinks and completely obstructs the aqueduct so that air or positive contrast will fail to visualize the fourth ventricle. It further lacks the means of visualizing the basal subarachnoid cisterns as is possible in pneumoencephalography, so that occasionally it is difficult to differentiate a mass lesion lying inside or outside the brain and in determining the size of the lesion.

It is also well known that air-Myodil study of the ventricular system is inferior to cerebral angiography in the correct prediction of the histological diagnosis. However, the position of the lesion and the nature of the ventricular deformity correlated with clinical data often provide important clues to the pathology of the lesion.

A feature which is perhaps worthy of note is in Case 2 where contrast delineation of the pineal teratoma was evident only on the follow-up radiographs. This phenomenon is most helpful as it affords a definitive diagnosis of an intraventricular tumour. It is thus worthwhile to carry out follow-up X-rays if the diagnosis is in doubt and the Myodil is retained in sufficient amount in the ventricular system.

SUMMARY

A number of cases with mass lesions in the parapineal region and posterior fossa is presented to illustrate the value, diagnostic difficulties and limitation of Myodil ventriculography. The series comprises pairs of pineal, brain-stem, cerebellar and cerebello-pontine angle tumours. A single case of Arnold-Chiari malformation is also included in the series. The local method of manipulating the positive contrast into the distal portion of the ventricular system without fluoroscopic control is described. No harmful effects are noted in the cases in which Myodil has been used for ventriculography.

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