TUMORS OF THE FORAMEN MAGNUM OF SPINAL ORIGIN

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Tumors in the region of the foramen magnum may be divided into two groups: (1) those arising primarily in the posterior fossa and extending downward into the foramen magnum and (2) those arising primarily in the upper cervical cord and extending upward into the foramen magnum. The former are essentially brain tumors and the symptoms and signs in this group are primarily those of brain tumors; the latter are more strictly spinal tumors and these are spoken of as spinocranial and cause the symptoms of a spinal tumor.

The occurrence of such spinal tumors is relatively rare. In the series of 234 verified spinal cord tumors from the Sachs collection, there were 6 verified cases or an incidence of 2.5 per cent. It seemed worth while to call attention to their occurrence and as far as possible to correlate some of the common characteristics of their symptomatology.

Other case reports and collected series indicate their relatively rare occurrence but this may suggest a higher unrecognized incidence. Elsberg and Strauss,6 in a report of 185 cases of spinal cord tumors, found 3.7 per cent in the foramen magnum. Love and Adson10 reported 23 cases, 12 of which were definitely craniospinal. Elsberg,5 Abrahamson1 and Symonds and Meadows,16 attempted to describe the findings in foramen magnum compression. Struly, et al.19 called attention to the protean and insidious neurologic manifestations of high cervical lesions caused by compressions other than neoplasms. Piehl, Reese and Steelman12 called attention to the spinocranial syndrome as described by Bogorodinski. Until recently, the diagnosis has been infrequently made ante mortem and still less often has surgical treatment been performed. That the actual incidence of these lesions may, however, be greater than heretofore suspected, is suggested in a report by Bennett and Fortes.2

Study of the cases recorded in the literature,4,7,11,13,17 as well as the cases reported here, indicates that the capricious and bizarre picture frequently diagnosed as demyelinating disease or infectious disease of the central nervous system may, in fact, be caused by a tumor at the foramen magnum.
The true diagnosis can be arrived at only by careful correlation of symptoms, signs, spinal fluid dynamics, chemistry and use of contrast myelography.

The following 6 cases of spinocranial tumors describe the train of symptoms and signs encountered in our series. In 5 instances the diagnosis was made and operative procedure was carried out, and in 1 case the diagnosis was not established until post mortem. These cases also illustrate the gravity of surgical interference when the disease is far advanced.

**CASE REPORTS**

*Case 1.* "#9507. H.V.D., a 46-year-old white female, was admitted to Barnes Hospital on Feb. 12, 1942. Her illness had begun in the Fall of 1941 when her neck became stiff and ached a good deal, at times so severely as to make turning of the head impossible. This persisted in spite of osteopathic treatments. Seven weeks before admission, numbness and tingling developed in the fingers of both hands, more marked on the left. These sensations spread progressively up her arms, involving her chest. She stated that her lungs felt tight and heavy. The sensation of heaviness spread through the abdomen and finally to her lower extremities. As the numb, dead feeling became more severe, the patient lost the use of her extremities except for a slight movement in the right hand and right leg. Throughout this period, the symptoms were more marked in the early morning, improving during the day. She was hospitalized at another institution, where, 4 nights before entry into Barnes Hospital, another woman, who was mentally deranged, attempted to choke her. From that time on the patient was unable to speak above a whisper. No change was noted in function of her bowels or bladder until 8 days before entry, when constipation became extreme. On the night before entry, she had incontinence of urine. There had been a gain of 25 lbs. in weight in the last 6 months.

*Examination.* Temperature was 37.5°C., respiratory rate 24 per min., pulse rate 110, and B.P. 120/75. The patient was a well developed, obese woman, apparently not suffering from any pain and quite adjusted to her environment. She was alert, cheerful, cooperative and showed no signs of apprehension.

There was no involvement of the cranial nerves. There was slight tenderness at the base of the skull on passive movement of the neck but no rigidity. At the 2nd or 3rd cervical dermatomes there was a disturbance in the temperature sense forming a collar type of deficit, but this was not constant. Deep reflexes were hyperactive and equal but superficial reflexes were absent. There were bilateral Babinski and Hoffmann signs. The tone of the rectal sphincter was poor.

*Laboratory Data.* Blood and urine were normal. Kahn was negative. Lumbar puncture and Queckenstelt test were performed on Feb. 13, 1942. The initial pressure was 190 mm. of water. When the left jugular was compressed there was good response but not on compressing the right. Lumbar puncture on Feb. 16, 1942, showed a rise when both jugulars were compressed. The fluid was turbid and pinkish in color. The cell count, with acid, was 9; without acid 234, nearly all fresh red cells. Pandy was 4 plus; Wassermann negative; colloidal gold curve 0001111123; and total protein 1,173 mg. per cent. A second lumbar puncture performed on the same day showed 3,700 red cells without acid, 17 cells with acid; total protein was 1,043 mg. per cent. A provisional diagnosis of Guillain-Barré neuronitis was made.

*Course.* On Feb. 17, 1942, her temperature suddenly rose to 41.6°C. Her pulse rate was 130, and respiratory rate 30. Respirations gradually increased in depth, with apneic pauses of 30 to 40 sec. occurring every 5 to 10 min. Pulmonary edema de-
veloped and the heart sounds were distant. Two and one-half hours following this sudden elevation of temperature, the patient vomited 200 cc. of brownish-red material. In spite of oxygen therapy and supportive treatment, she died.

Autopsy. The leptomeninges over the spinal cord and the cerebrospinal fluid were rust-red in color. Situated at the foramen magnum and extending downward toward the 1st cervical vertebra and in the left posterior quadrant was a grayish-white tumor measuring 1½ X 2 cm. (Fig. 1). The tumor was attached to the dura mater and pressed on the spinal cord in a forward direction. Diagnosis: Intradural tumor of the upper cervical segment and foramen magnum with compression of the spinal cord.

Microscopic Diagnosis. Arachnoidal fibroblastoma (meningioma).

Case 2. #102641. P.I.Z., a 52-year-old white female, entered Barnes Hospital with a history that about 1 year before entry she had begun to suffer intense occipital headaches. At that time she was going through menopausal changes and was thought to have a menopausal psychosis. Treatment of 10,000 units of Theelin every 2 or 3 weeks was prescribed. This she took at irregular intervals without improvement. The headache was so intense that she was given codeine and aspirin. She had marked personality change during this period, becoming morose and sullen.

In the 8 months prior to admission she had complained of slight weakness of the right arm. This became progressively worse during the last month, and on admission she was unable to move her right arm and leg. She also suffered from severe constipation which necessitated daily enemas. Two months before admission she had begun to take morphine for relief of her occipital pain.

Following admission, the patient had a syncopal attack during which her blood pressure dropped to 80/60. She complained that she could not get her breath. The possibility that this was a withdrawal symptom was considered. An EEG done at
this time showed myocardial damage of coronary type. A myocardial infarction, however, could not be definitely demonstrated. She also had infection of the bladder. On digitalis therapy she improved gradually but was considered a poor surgical risk.

Neurological Examination. The patient was an emaciated, white woman lying uncomfortably in bed with her head tilted to the left. She was only moderately cooperative. There was no nystagmus. The corneal reflexes were intact and no sensory disturbances of either 5th nerve were noted. There was a suggestion of a slight right facial weakness. There was weakness of the right sternocleidomastoid and trapezius muscles. There was marked weakness of the right arm with almost total paralysis. There were no tremors and no astereognosis. Biceps, triceps and radial reflexes were present and equal bilaterally. There was a right Hoffmann sign. Kinesthetic sensation could not be tested because the patient was uncooperative. Abdominals were absent bilaterally. There was complete loss of function of the right leg with a foot drop, but knee jerks and ankle jerks were approximately equal. There was no demonstrable clonus but there was a suggestive right Oppenheim and Babinski reflex.

Laboratory Data. Red count was 4.36, hb. 12.7 gm., and white count 6,000 with normal differential. The urine showed a 1 plus albumin and many white cells. Kahn was negative. N.P.N. was 18 mg. per cent and fasting blood sugar 74 mg. per cent. CSF was slightly xanthochromic with an initial pressure of 130. Queckenstedt test showed a complete block; there were 40 cells with acid and total protein was 480 mg. per cent with a 4 plus Pandy.

A diagnosis of cervical cord tumor in the region of the foramen magnum was made.

Operation. On Jan. 18, 1943 lipiodol was injected into the lumbar space which showed a complete block at C2 (Fig. 2). Under endotracheal anesthesia, a laminectomy was done with removal of the 1st, 2nd and 3rd cervical spinous processes, the foramen magnum, and the lower portion of the occipital bone. The dura mater was opened in the region of C2 and the incision was carried upward, exposing a tumor which was lying on the right side of the cord. Huge vessels covered the tumor and ran over the cord. The left edge of the tumor was tightly adherent to the medulla and was dissected away with some difficulty. As it was lifted up, the patient experienced some difficulty in breathing. The tumor extended up into the lower portion of the 4th ventricle; it was lifted up and removed without any hemorrhage. Closure was then made in the usual manner.

Course. Immediately after the operation the patient responded well but, on the 2nd postoperative day, she began to have some difficulty in breathing. There was a chest lag on the right side. In spite of oxygen and chemotherapy for a bilateral bronchopneumonia, death occurred on the 11th postoperative day.

Autopsy revealed that the tumor had been completely removed but there was myelomalacia of the right lateral columns of the cord.

Pathological Diagnosis. Arachnoidal fibroblastoma (meningioma). Tumor weight: 7 grams.

Case 3. #88942. V.E.S., a 36-year-old white female, entered Barnes Hospital on April 22, 1941. She had been in good health until 8 years previously, when, during the 4th month of her gestation, she began to notice weakness of the right hand and difficulty in handling objects. This progressed until at the time of delivery she had a complete right hemiparesis. This gradually improved during the following 15 months so that she was able to do her housework for about 10 months. From this time on, she began to see various doctors because of the weakness of her right side
and various paresthesias. No diagnosis was made. She was given a course of sex hormone therapy for 2 months.

Between 1936 and 1939, she had periods of dull cramping pain in her right thigh. In 1938 the paresis in the right upper extremity reappeared and spread to the right lower extremity. At times it was associated with dull, cramping pains in the muscles of these extremities. In 1939 she was in another hospital, where a diagnosis of multiple sclerosis was made. She was given intensive Vitamin B therapy. There was no improvement and, from 1940 on, the progressive loss of power in the right side increased until she again became completely hemiplegic. At the same time there were periods when she complained of paresthesias in the left foot, leg, hand and arm. Some weakness of the left hand also developed. During the 8 years of her illness she had had attacks of urinary incontinence and dysuria but these were followed by periods in which she had normal control. At times she had had gross muscular twitchings in the right extremity but no fibrillatory movements were noted.

**Neurological Examination.** She was a fairly well developed, well nourished, white woman lying quietly in bed. Temperature was 37.5°, pulse rate 38, respiratory rate 16, and B.P. 120/75. She was alert, oriented and apparently was in no pain. The left
pupil was larger than the right but both reacted to light and in accommodation. There was slight lateral nystagmus to the right and left. The fundi were normal. The right shoulder could not be shrugged and there was definite weakness of the right sternocleidomastoid and trapezius muscles. There was a spastic paralysis of the right arm and leg. Power of the left arm and leg was diminished. All tendon jerks were hyperactive and equal. Abdominal reflexes were absent. There were bilateral Hoffmann, Babinski, Oppenheim and Chaddock reflexes and a bilateral ankle clonus. Diminution of sensation was noted from the 2nd cervical dermatome down. There was some impairment of stereognostic ability in the right hand. Vibration sense was diminished over the legs and absent below the knees.

On lumbar puncture, the initial pressure was 150, with a normal rise and fall on jugular compression; there was no evidence of a block.

Laboratory Data. The spinal fluid contained 5 cells; Pandy was negative and total protein was 133 mg. per cent. Blood and spinal fluid Wassermann tests were negative. Colloidal gold curve was 001331000. Spinal fluid removed on May 5, 1941 before the injection of lipiodol showed a total protein of 254 mg. per cent. Myelography was carried out, which showed a complete block at the level of C2 (Fig. 3).

RBC was 4.78, hb. 70 per cent and WBC 8,650, with normal differential. Blood count was normal. Urine was normal and stooe was negative for guaiac.

Operation. On May 8, 1941, under avertin, an incision was made from the occipital bone down to the 4th cervical spinous process. The muscles were dissected away from the occipital bone and from the 1st, 2nd and 3rd cervical vertebrae. The spinous processes of C2 and C3 were removed and the exposed dura mater did not pulsate. The posterior part of the atlas was then removed and, when the dura mater was opened, a tumor extending along the right side of the cord was disclosed. In order to get an adequate exposure the posterior portion of the foramen magnum and lower portion of the occipital bone were removed so that both cerebellar lobes were exposed. The dural incision was then carried upward. The cisterna magna was obliterated by the tumor. It had displaced the medulla to the left and was lying in front of the ligamentum denticulatum. It was removed in toto. Closure was made in layers, with silk.

Course. The patient made an uneventful postoperative recovery. Her paralysis cleared up almost completely and she now does all her work.

Pathological Diagnosis. Arachnoidal fibroblastoma (meningioma). Tumor weight: 14 grams.

Case 4. #103637. B.S., a 56-year-old white male, entered Barnes Hospital in February 1943 with the complaint of stiffness of his neck for 3 years. He had had impotence for 1 year, numbness of the left hand for 1 year and weakness of his right hand and both legs for 2 or 3 months. He had experienced a sensation of tightness about his chest for 2 or 3 weeks. He had been seen at another clinic 7 months before admission at which time no definite diagnosis had been made.

Examination. The following findings were noted: no impairment of any cranial nerves, stiffness of the neck, spasticity of the arms, more marked on the right, and diminution of strength in grips on both sides. There was some questionable hypesthesia to pin prick over the left forearm. All tendon reflexes were hyperactive, with bilateral ankle and patellar clonus. There was a positive Hoffmann on the left. No pathological toe signs were found. Position sense was normal. Abdominal reflexes were absent. The patient was up and about but had a spastic gait with legs feeling
stiff and weak. There was some difficulty in beginning urination and some decrease in the caliber of the stream.

Laboratory Data. Lumbar puncture was done which showed no block. There were 3 cells; total protein was 79 mg. per cent; colloidal gold curve 0013331100; Wassermann negative; Pandy negative. X-rays of skull and cervical spine were non-contributory except for some arthritic spurring in the spine.

Course. The patient was discharged as a possible tumor suspect; spastic paraplegia, cause unknown.

2nd Admission. He was re-admitted 4 months later with definite progression of his symptoms. There were increasing stiffness and weakness of both legs. Stiffness of the neck was still present. In addition he complained of numbness over the left arm and the left side of the body and inability to tell the difference between hot and cold on the left side. He did not complain, at this time, of numbness of his right arm and hand but there was weakness of the right hand which had progressed to almost complete paralysis of the right arm with only slight flexor movements of the fingers. The weakness of the legs had steadily increased.

Two months before admission the patient had had a urinary infection and two episodes of pain on passing his urine, associated with chills and fever. He had had his bladder irrigated at another hospital. The patient was constipated.

Two weeks prior to this 2nd admission, there was pain in the right arm. He had never experienced pain in the legs or left side of the body. Occasionally he had pain in the neck.

Examination. The patient was well developed and obese, in no acute distress but lying motionless in bed, able to move only his left arm. His speech appeared normal and his memory was good. There was weakness of both trapezius muscles. There was complete paralysis of the right arm. The left grip was weak but all movements were preserved. Biceps and triceps reflexes were greatly exaggerated on both sides. Hoffmann sign was absent. There was spastic paraplegia of the lower extremities with a few flexor movements of the toes. Tendon reflexes were hyperactive and there was a bilateral ankle clonus. Abdominal reflexes were absent. There was absent sensation to pain and temperature from C1 down on the left side of the body.

A diagnosis of high cervical cord tumor was made.

On July 2, 1943 lipiodol was injected, which showed separation of the lipiodol column at the 5th cervical vertebra. There was no complete block.

Operation. Under avertin, a laminectomy was performed. The upper cervical cord was exposed. The dura mater did not pulsate. The occipital bone was then opened over the cerebellum and the posterior part of the foramen magnum was removed. The dura mater was split upward. The spinal cord at the level of the 1st cervical segment and the medulla bulged markedly, as if pushed back by a tumor, but no tumor was disclosed. More bone was removed laterally on the right side and the cord was retracted gently, and then a tumor was found lying anterior to the spinal cord in the midline in the basilar groove. Even this slight manipulation of the cord affected the patient’s respiration. More bone was taken away and the capsule of the tumor was split. It was obviously a meningioma. A curette was inserted into the tumor but the tumor itself could not be mobilized. The capsule and tumor were then removed piecemeal. These manipulations interfered with the patient’s respiration and he died of respiratory failure before the operative procedure could be completed.
Pathological Report. There was a $2\frac{1}{2}$×2×2 cm. oval-shaped mass of tumor compressing the medulla oblongata and lying between the two vertebral arteries. The tumor had compressed the spinal cord, thinning it to a ribbon-like structure measuring at its greatest thickness only 7 mm. The tumor was well circumscribed, and there were a few small nodules on its surface which could be shelled out from the dura mater and the brain tissue surrounding it. The dura mater over the tumor was markedly thickened but in no area did it appear to be actually invaded by the tumor.

Pathological Diagnosis. Arachnoidal fibroblastoma (meningioma) involving the anterior surface of the medulla oblongata and the 1st and 2nd cervical sections of the cord.

Case 5. #113390. R.H.T., a 49-year-old white male, entered Barnes Hospital on April 18, 1944. He had been perfectly well until 1 year previously, when he first noticed a sensation of stiffness in his neck, which was not accompanied by pain. The stiffness did not disturb him greatly. Shortly after its onset he began to notice a sensation of numbness and tingling, and a feeling of “pins and needles” in the right upper and lower extremities. These sensations became more marked, but were never felt on the left side. About 4 or 5 months prior to admission, weakness occurred in the right hand and arm and in the right lower extremity, which gradually progressed so that for 2 weeks prior to entry the patient had been unable to move the right upper extremity at all and had been able to walk only by dragging the right leg. He had noticed no weakness of the left extremities. Four or 5 months previously, he had had occasional episodes in which he seemed to be short of breath and unable to speak except in a very low voice or whisper. These spells came on at irregular intervals and usually lasted only a few minutes. They did not seem to be related to any particular activity. He had had urinary incontinence only since admission to the hospital. There was no history of trauma.

Examination. He was a well developed, well nourished male who appeared comfortable and not acutely ill. He was cooperative. There was no fixed attitude of the head. There was no noticeable impairment of speech. The sternomastoid and trapezius were normal on both sides, more on the right than on the left. The fundi were normal and there was no nystagmus. The patient was unable to perform any movements with the right upper extremity, which appeared somewhat swollen. There was slight weakness of the left arm. On both sides sensation to touch and pin prick was diminished from the 2nd cervical dermatome down. The tendon jerks were all hypoactive, more on the right than on the left. There was bilateral astereognosis. Hoffmann sign was positive bilaterally. Abdominal and cremasteric reflexes were absent. There was complete loss of motor power of the right lower extremity and some loss of power on the left. There was bilateral inexhaustible ankle clonus. All pathologic toe signs were positive. There was slight nuchal rigidity but no tenderness nor deformity.

Laboratory Data. On lumbar puncture a partial block was found: 51 cells; 4 plus Pandy; total protein 273 mg. per cent; colloidal gold 3444333210, and Wassermann negative. Lipiodol injection showed a block at the foramen magnum (Fig. 4).

Operation. On April 4, 1944 a laminectomy was done. Incision was made over the occipital bone and over the 1st, 2nd and 3rd cervical vertebrae. The dura mater did not pulsate and the occipital bone was rongeured away over the posterior part of the cerebellum and the cisterna was exposed. After opening the dura mater at the level of the 2nd cervical vertebra, a nodular tumor was exposed on the left side of
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the cord. The inferior cerebellar artery had to be carefully dissected away from the tumor, which lay to the left and anterior to the spinal cord and projected into the 4th ventricle. The tumor was removed completely. Closure was made with silk in layers.

**Course.** The patient had a completely uneventful postoperative course and when examined recently, was walking with only a suggestion of slightly spastic gait on the right. He was up and back at work.

**Pathological Diagnosis.** Arachnoidal fibroblastoma (meningioma). Tumor weight: 7 grams.

**Case 6. #421225.** I.B., a 33-year-old white female, entered Jewish Hospital in February 1942. She had been well until the birth of her first child in 1937, 5 years previously. Her weight before pregnancy was 136 lbs.; at term she weighed 160 lbs. Her weight subsequently increased and, at time of admission, was 196 lbs. She felt weak at all times. Following the birth of her second child, 2½ years before admission, her periods had returned and recurred at irregular intervals for a year but she had had no flow for the last 12 months.

Eighteen months before admission the patient began to feel tightness in her neck, "like a stiff neck." She could not turn her neck easily. Tonsillectomy was advised and performed. This did not relieve her stiff neck. She next noticed numbness in the right thumb which spread to the right hand and right forehead, shoulders and chest. Then the left hand was similarly affected. She noticed weakness first of the right arm, then of the left and increasing difficulty in walking for 1 year before admission. For the last 6 months she had had headache and, 1 month prior to entry, the arms had become so weak that the patient had difficulty in feeding herself.

**Examination.** The patient was an obese, white female who appeared in no acute distress. B.P. varied from 180/100 to 160/100. Her face was typical of Cushing's syndrome. Her cheeks were reddened and blown. The hair was prominent over the upper lip and chin and well developed on the forearms and legs. There was a tendency toward male pubic hair distribution. Her neck was very short. Her abdomen was domeshaped. There were purplish striae over the abdominal wall and thighs. There was diminished sensation from the 1st cervical dermatome down. There was an almost complete spastic quadriplegia. All deep reflexes were hyperactive. Abdominal reflexes were absent. Bilateral Hoffmann and Babinski signs and ankle clonus were elicited. There was no cranial nerve involvement.

**Laboratory Data.** Urine was normal. Kahn was negative. Routine blood was negative. There was a low sugar tolerance.

**Comment.** The patient presented the classic signs of Cushing's syndrome including obesity, plethora, amenorrhea, mouchal fat pads, red abdominal striae, decreased sugar tolerance, hirsutism and hypertension. In addition there were the signs of spinal cord compression at a high level. Queckenstedt test revealed a complete block. The fluid was xanthochromic and the total protein was elevated. Lipiodol was injected through the lumbar meninges and myelography showed a block at Cl.

A diagnosis of Cushing's syndrome and spinal cord tumor at the level of foramen magnum was made.

**Operation,** Feb. 2, 1942. There was a very thick fat pad over the neck and the occipital area so that a very long incision had to be made. The spinous processes of the 1st, 2nd, 3rd and 4th cervical were removed. On exposing the dura mater, no extradural fat was found and the dura mater did not pulsate. The muscles were peeled off the occipital bone, much of which was then removed, exposing the
posterior fossa and the upper cervical cord. When the dura mater was opened, a
tumor lying posterior to the spinal cord was exposed. The tumor extended up into
the 4th ventricle. It was nodular and obviously a meningioma. The tumor was
attached to the dura mater over the foramen magnum. With its dural attachment
it was removed en masse from the foramen magnum and the 4th ventricle. After re-
moval, a depression was left in the region of the 4th ventricle and the 1st cervical
segments. The dura mater was then closed over the spinal cord but the cerebellar
dura mater was left open. Closure was made in layers.

Course. The patient had an uneventful postoperative course except for a super-
ificial breakdown of the wound. She was up and walking at time of discharge.

She was re-admitted to Barnes Hospital on Dec. 8, 1943 for chemical studies.
During the postoperative interval her weight had dropped to 163 lbs.

DISCUSSION

The neurological data of a series of 6 spinocranial tumors are summarized
in Table 1. During the early stage of tumor formation these patients pre-
vented changing and vacillating symptoms and signs. It is at this stage that
a variety of diagnoses are made. Abrahamson and Grossman1 suggested that
the early neurological manifestations are caused by distortion of the cord.
Only when compression of the cord begins do the signs become definite and
identifiable.

| Case No. | Duration of Symptoms | Stiff Neck or Headache | Bladder Deficit | Sexual Disturbances | Choked Discs | Motor Deficit | Sensory Deficit | Cranial Nerve Defect | Nystagmus | Pupil Change | "Astereognosis"
|----------|----------------------|------------------------|----------------|-------------------|-------------|--------------|---------------|---------------------|-----------|-------------|-----------------
| 1        | 14 mos.              | +                      | 0              | 0                 | +           | +            | 0             | VII                 | 0         | 0           | ?               |
| 2        | 1 yr.                | +                      | 0              | 0                 | +           | 0            | 0             | XI                  | 0         | +           | +               |
| 3        | 8 yrs.               | 0                      | 0              | 0                 | +           | 0            | 0             | XI                  | 0         | +           | +               |
| 4        | 1 yr.                | +                      | 0              | 0                 | +           | 0            | 0             | XI                  | 0         | -           | -               |
| 5        | 1½ yrs.              | +                      | +              | +                 | 0           | 0            | +             | +                   | -         | -           | +               |

Characteristically most of the patients, sooner or later, complain of pain
or stiffness in the neck or headache. Unilateral sensory and/or motor changes
occur. These are usually homolateral. Late symptoms are frequently of
bladder and, at times, sexual disturbances. Rarely are the cranial nerves
involved, and, in this series, choking of the discs was not encountered.

Weinstein and Wechsler18 and Rubinstein14 have reported the finding of
astereognosis in patients with lesions of the posterior fossa involving the
upper portion of the cervical cord. One of Rubinstein’s cases was from the
Neurosurgical Service at Barnes Hospital. It is not included here, as it be-
longed to the craniospinal group. We do not believe the term astereognosis
should be applied to cases in which there is a gross sensory disturbance. In
true astereognosis there should be no other demonstrable sensory disturb-
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ance. When marked sensory disturbance is present, such dissociation had better be spoken of as stereo-anesthesia.  

The presence of Cushing's syndrome in Case 6 may have been a coincidental occurrence, but it is of great interest that with removal of the tumor those symptoms disappeared in the course of a year. Descending pathways from the hypothalamus have been traced to the pontine level and almost certainly these exist at lower levels. That Cushing's syndrome is related to lesions of the hypothalamic nuclei has been suggested by Heinbecker. Whether removal of the direct pressure on the medullary tracts played a role in the regression of symptoms or whether relief of a slight degree of internal hydrocephalus, as suggested by Heinbecker, was responsible, is a matter of speculation in Case 6. We had no positive evidence of hydrocephalus. Also of interest is the increase of ~5 lbs. in weight during the development of symptoms in Case 1.

Cerebrospinal fluid findings are summarized in Table 2. In all instances the total protein content of the spinal fluid was elevated. In 2 cases, complete block, and in 1 case, partial block to Queckenstedt was present. In all 4 cases there was a block or deformity in the myelogram.

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<th>Pandy</th>
<th>Cells</th>
<th>Xanthochromia</th>
<th>Total Protein Mg. %</th>
<th>Colloidal Gold</th>
<th>Queckenstedt Block</th>
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SUMMARY

1. A series of 6 tumors of the foramen magnum (spinocranial) is presented.
2. These cases illustrate the insidious onset of spinocranial tumors and the great variability of the early symptoms.
3. Patients with suboccipital headache who manifest pyramidal deficits and capricious sensory symptoms may well have a tumor of the foramen magnum.
4. It is important to resort to high cervical myelography if the total protein is elevated.

REFERENCES

9. HEINBECKER, P. Personal communication.