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Familial Syringomyelia

A Report of Four Cases

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Summary. The clinical and neurological features of four siblings (2♂, 2♀) affected by syringomyelia are described. A fifth sister was affected by an acoustic neurinoma. Since neither parent showed signs of syringomyelia, this is considered to be a datum substantiating the dysembryogenetic theory of the syringomyelia syndrome.

Key words: Syringomyelia familial – Siblings, 4 syringomyelia – Neurinoma acoustic – Dysembryogenesis.

Zusammenfassung. Die klinisch-neurologischen Befunde von 4 Geschwistern (2♂, 2♀) mit Syringomyelie werden beschrieben. Eine 5. Schwester hatte ein Akustikneuronom. Beide Eltern zeigten keine Zeichen von Syringomyelie. Das familiäre Vorkommen wird als Stütze für die dysembryogenetische Theorie angesehen.

Schlüsselwörter: Familiäre Syringomyelie – 4 Syringomyelie-Geschwister – 1 Akustikneuronom-Schwester – Dysembryogenetische Entstehung.

Introduction

Since references in the literature to cases of familial syringomyelia are extremely rare, we report on a family in which four members of one generation are affected by this disease.

Reports of Cases

This family is made up of two parents and their five children; three daughters and two sons. The parents have never had symptoms attributable to syringomyelia. Their five children form the object of this study.

Case 1 (M. C.). Firstborn, woman aged 51. After suffering from otosclerosis for several years, the patient was found to have an *acoustic neurinoma* on the left side and was operated on at the Milan University Neurosurgical Clinic in 1970.

Case 2 (M. L.). Secondborn, man aged 47. From the age of 44 he complained of weakness and wasting of the hand muscles beginning on the left side. At first he was treated for cervical spondylosis. But after the onset of temperature hypoesthesia on the left shoulder, where he had a burn without being aware of it, he was admitted to our Institute.

Although a general physical examination showed him to be normal, a *neurological examination* revealed bilateral palpebral ptosis and jerking nystagmus with a rotatory component, clockwise on rightward and counterclockwise of leftward gaze. The flexor and extensor movements of both hands and the grasping and opposing movements of both thumbs were clearly weak; definite weakness of the dorsal interossei muscles of the hands, especially of the first interosseous of the left hand was present; a fair degree of flattening of the thenar and hypothenar eminences on both hands, but more marked on the left, was evident. The patient also suffered from slight weakness and modest diffuse wasting of the muscles of both forearms. Sensory examination revealed a band of tactile and pain hypoesthesia with isothermoagnosis from C3 to D4—D5 on the left side and a band of hypodysesthesia, mainly in response to painful stimulation between C3—C4 and L1—L2 on the right side without isothermoagnosis (Fig. 1). The superficial reflexes were normal but the deep reflexes were symmetrically brisk in the upper

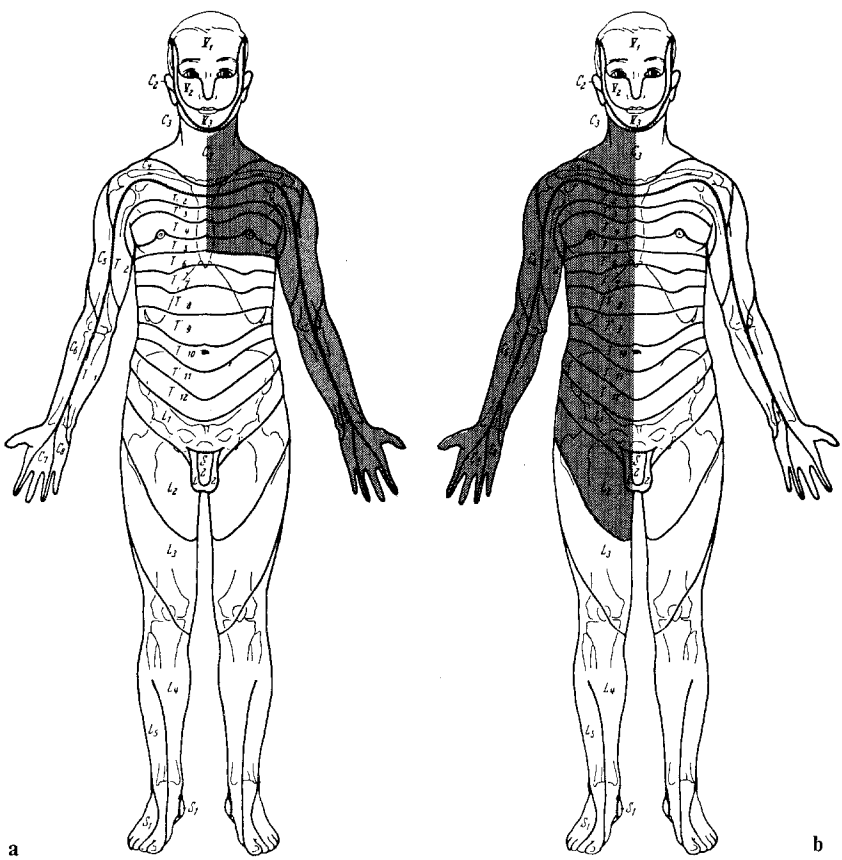

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Fig. 1 a and b. Case No. 2: **a** Tactil and pain hypoesthesia with isothermognosis. **b** Hypodisesthesia to pain without isothermognosis

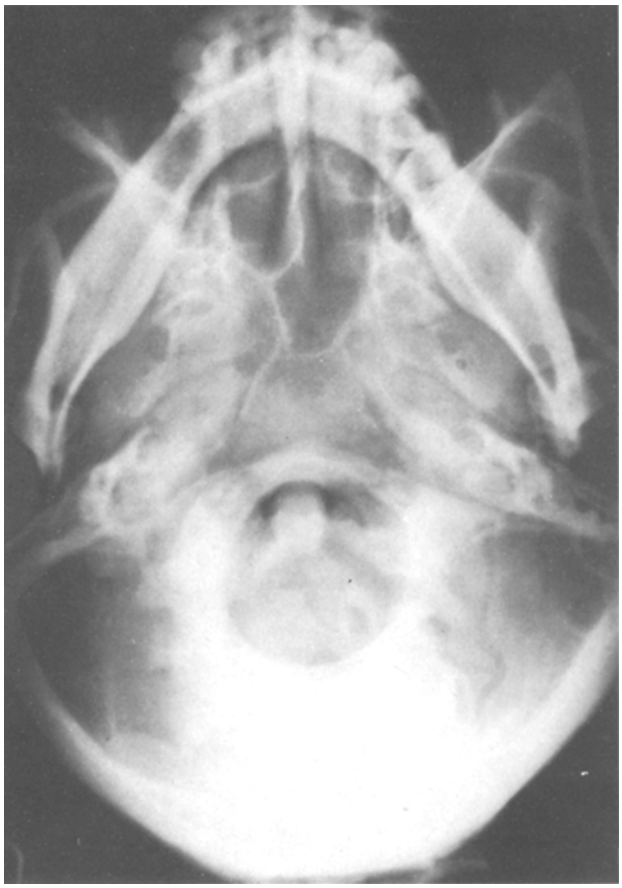


Fig. 2. Case No. 2: Axial view of the skull. The foramen magnum is unusually large

limbs, the knee jerks very brisk, and the ankle jerks normal. There was no Babinski sign. The patient was discharged with a diagnosis of syringomyelia and was readmitted the next year following deterioration of his condition. The neurological findings were virtually the same as before, except for a slight Claude-Bernard-Horner sign on the left, a more marked loss of muscular strength, greater muscle wasting, and sensory loss. The deep reflexes of the left upper limb were absent, except for the biceps reflex, while pyramidal signs had appeared in the lower limbs and dystrophy of the skin and nails of both hands was found.

During the two hospital admissions the patient underwent several investigations: ECG, EEG, ophthalmological examination, and chest X-ray were normal. An otovestibular examination revealed damage to the lower medulla oblongata.

EMG showed considerable neurogenic pattern in the first interosseous muscle of the right hand and considerable neurogenic changes with anterior horn involvement in the first dorsal interosseous muscle and abductor muscle of the little finger of the left hand. Plain X-rays of the skull and spinal column revealed an unusually large foramen magnum (Fig. 2) and increased sagittal diameter of the spine at the arch of the atlas. Air encephalography revealed signs of cerebellar cortical atrophy and difficult filling of the ventricular system (Fig.3), while a positive contrast myelography and a left brachial arteriography gave normal results. The cerebrospinal fluid was normal.

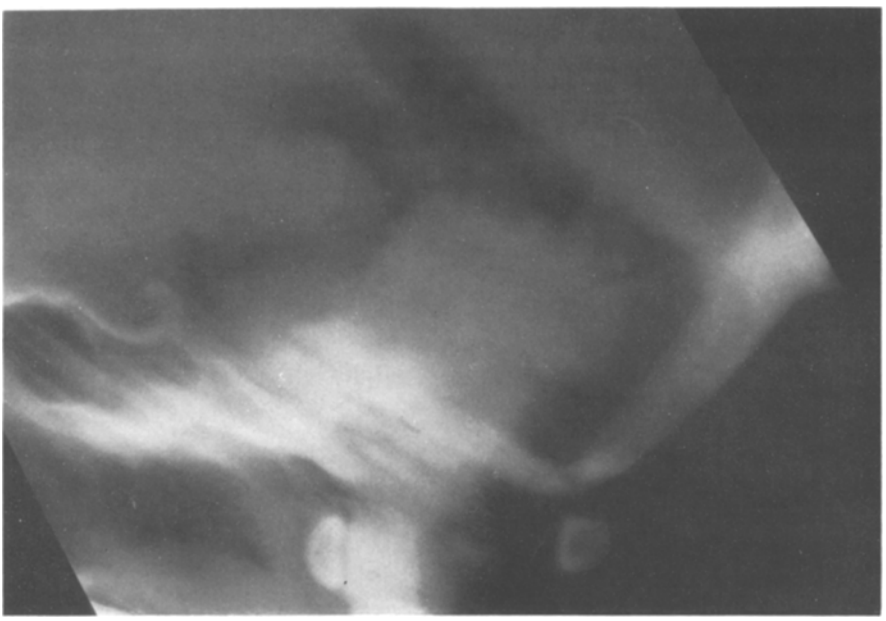


Fig. 3. Case No. 2: Pneumoencephalography. Midline tomogram shows atrophy of the cerebellar cortex. Minimal filling of the ventricular system could be obtained in spite of good amount of air at the level of the foramen magnum

Case 3 (M. Gian). Thirdborn, woman aged 45. The patient was referred to us for symptoms attributable to a subarachnoid hemorrhage. For this reason a lumbar puncture was performed on admission: as this yielded bloody fluid, a complete arteriography of the cerebral circulation was performed, but elicited no evidence of aneurysms or other vascular malformations. The patient's medical history showed that since the age of 42 she had complained of motor loss in the right arm accompanied by a sensation of cold together with difficulty in distinguishing between heat and cold, as a result of which she had had several burns without being aware of them.

Neurological examination demonstrated a horizontal nystagmus in rightward gaze with a counterclockwise rotatory component, mild weakness of the small hand muscles, with a hint of ulnar 'griffe,' especially on the right, and hypoesthesia to heat and pain all over the right side of the body, especially from C2—C3 to T6—T7 (Fig. 4). There were no deep reflexes in the right arm and the right Achilles tendon reflex was very sluggish. There were no pyramidal signs. Urinary incontinence was present.

At follow-up about a year later the neurological findings were as before plus a definite amyotrophy of the left shoulder girdle was found. While in the hospital the patient underwent bilateral carotidography, left brachial arteriography, and hematological investigations, all of which gave results within normal limits. However, EMGs recorded from the first interosseous muscle, the opponent muscle of the thumb, and the abductor of the little finger of the right hand revealed a neurogenic patterns but no sign of anterior horn involvement. The maximum motor conduction velocity (MMCV) of right and left ulnar nerves was below normal.

Case 4 (M. Li.). Fourthborn, woman aged 42. She has a son of 15 who does not manifest signs of syringomyelia or other neurological disturbances. From the age of 30 she has had some weakness of the right hand, which has remained unchanged for some 8—9 years. At the age of 40 she began to experience difficulty in walking and the motor deficit of her right arm worsened. These disturbances gradually increased, especially in the right limbs. A few months before admission she began to have difficulty in controlling micturition, a tendency to urinary

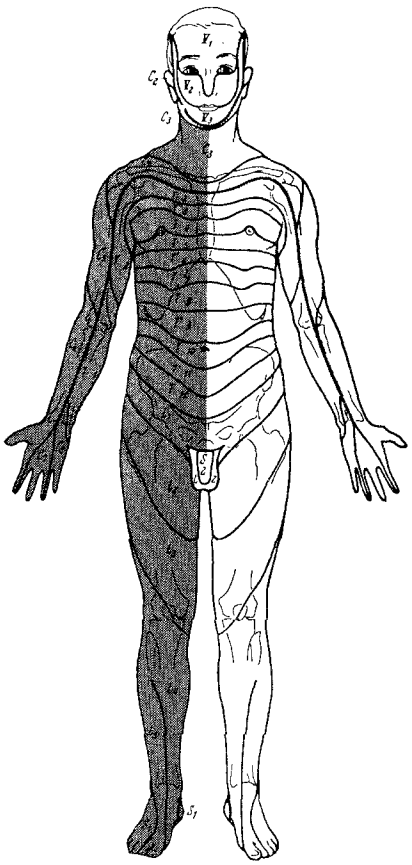


Fig. 4. Case No. 3: Hypoesthesia to heat and pain

incontinence, and constipation. The general physical findings were a thin longilinear subject with a large slightly turricephalic head and severe kyphoscoliosis with right convexity at thoracic level with left compensating convexity at the lumbar and cervical levels.

The patient presented clear signs of mental deterioration.

Neurological examination revealed no cranial nerve deficits. The patient's stance was wide-based and her gait spastic paraparetic, especially on the right side. The hand muscles were very weak, especially on the right, the thenar eminence and first interossei muscles being most affected, while the muscles of the hypothenar eminence were partly spared. The right pectoral muscles were slightly atrophied. Severe spasticity was present in the lower limbs. Both arms showed weakness, more marked on the right and distally, with right first clenching and finger adduction and abduction being badly impaired. The little finger was kept abducted and semiflexed.

Sensory examination revealed a band of hypo-anesthesia to heat and pain starting at the chin and extending to the nipple line on both sides and asymmetrically to the arms, the chief deficit being on the radial aspect of the right arm (Fig. 5). The vibration sense was definitely reduced in the superior anterior iliac spine and perhaps to a lesser degree from the last ribs, and on the right side down to the foot the sense of joint motion was reduced. The abdominal reflexes were absent and Babinski, Chaddock, and Oppenheim signs were present bilaterally. The tendon reflexes were sluggish in the left arm and nonexistent in the right. The knee jerks were very brisk and the ankle jerks were brisk and symmetrical. The patient also had sphincter disturbances, i.e., constipation and urinary incontinence.

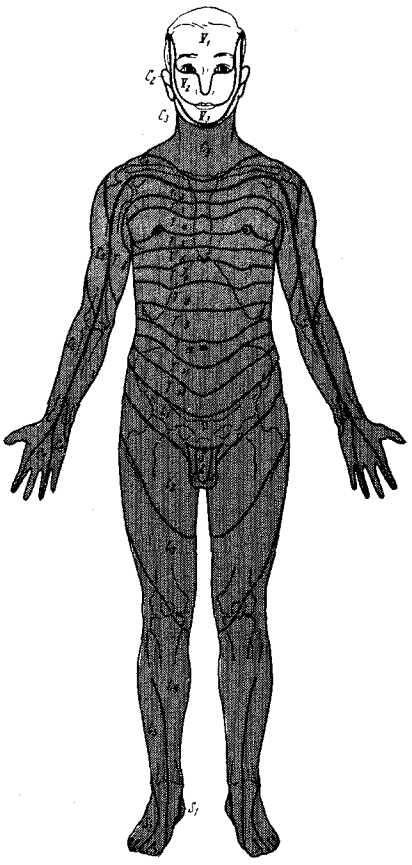
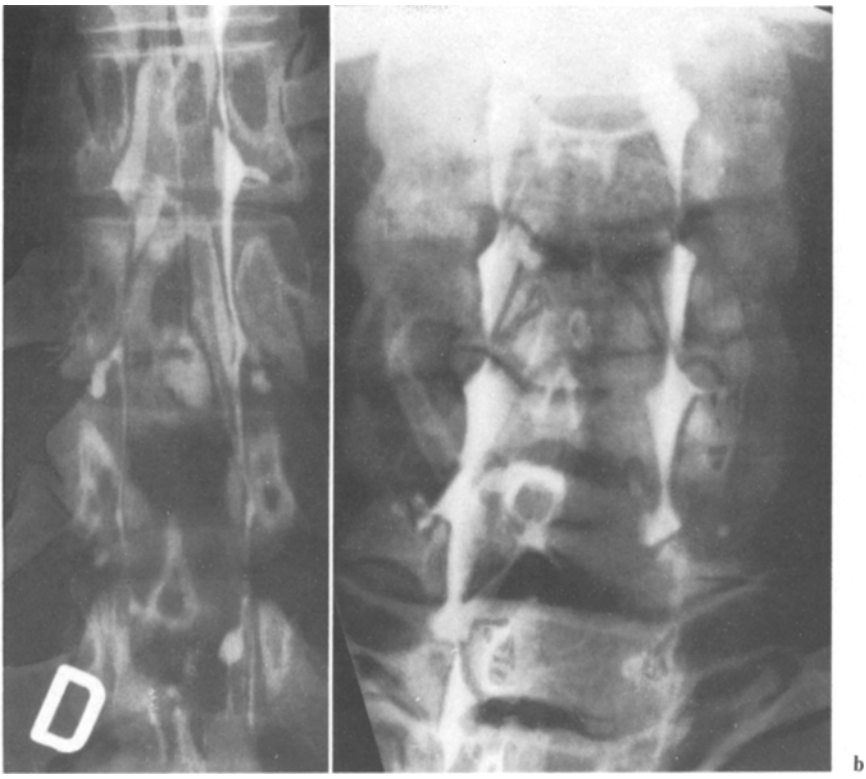


Fig. 5. Case No. 4: Severe hypoesthesia to heat and pain

Several radiological investigations were performed. X-rays of the skull revealed an asymmetry of the base because the petrous bones were on different levels. X-rays of the spinal column revealed a marked scoliotic deviation, especially at thoracic level. Positive contrast myelography showed a uniform pathological widening of the spinal cord throughout its length (Fig. 6). Right brachial arteriography gave negative results, as did water soluble iodoventriculography, except for confirming a widening of the spinal cord, which occupied practically the entire spinal canal. The hematological and cerebrospinal fluids were normal.

Case 5 (M. Giamp.). Fifthborn, male aged 34. This subject was seen as an outpatient to complete the family study.

Neurological examination showed considerable amyotrophy of the hands, particularly of the thenar eminences, especially of the right hand, and very sluggish abdominal reflexes, especially on the left side, with pyramidal signs more marked on the left. On rising from the supine to the sitting position the patient exhibited bilateral extensor synkinesis of the hallux. Sensory loss was marked with a clearly syringomyelic dissociation and hypoesthesia to heat extending to the whole of the right side of the body, especially from T5—T6 downwards, and affecting dermatomes T11—T12 and L1 on the left side. There was hypoanesthesia to pain from C3 to L3 on the right and from T9 to L1 on the left (Figs. 7a and b). EMG revealed a slight neurogenic pattern in the interosseous and somewhat more in the opponent muscle of the thumb with collateral regeneration phenomena. MMCV values determined on the ulnar nerves were both below normal.



a b

Fig. 6 a and b. Case No. 4: Positive contrast myelography. Widening of the spinal cord throughout its length. **a** Lower thoracic level; **b** cervical level

Discussion

Our family thus comprised two healthy parents and 5 children, of whom 4 presented clear clinical signs of syringomyelia and one of whom had been operated on for an acoustic neurinoma. Only Case 4 is married, and she has a child of 15 who has no present signs of neurological disease. Of the 4 syringomyelic siblings, 3 were admitted to our Institute and subjected to various investigations, including neuroradiology. Skull and cervical column X-rays for Case 2 revealed an abnormal widening of the foramen magnum and of the spinal canal at the arch of the atlas, whereas pantopaque myelography and left brachial arteriography were normal. This patient also underwent an air study (PEG), which revealed nothing noteworthy apart from atrophy of the cerebellar cortex with difficult filling of the ventricular system. Case 3 underwent a full cerebral circulation study because of symptoms indicative of a subarachnoid hemorrhage at admission, but arteriography revealed nothing pathologic and no vascular abnormalities to justify the clinical picture. In Case 4 the neuroradiological examinations were more significant: myelography with Myodil showed uniform widening of the spinal

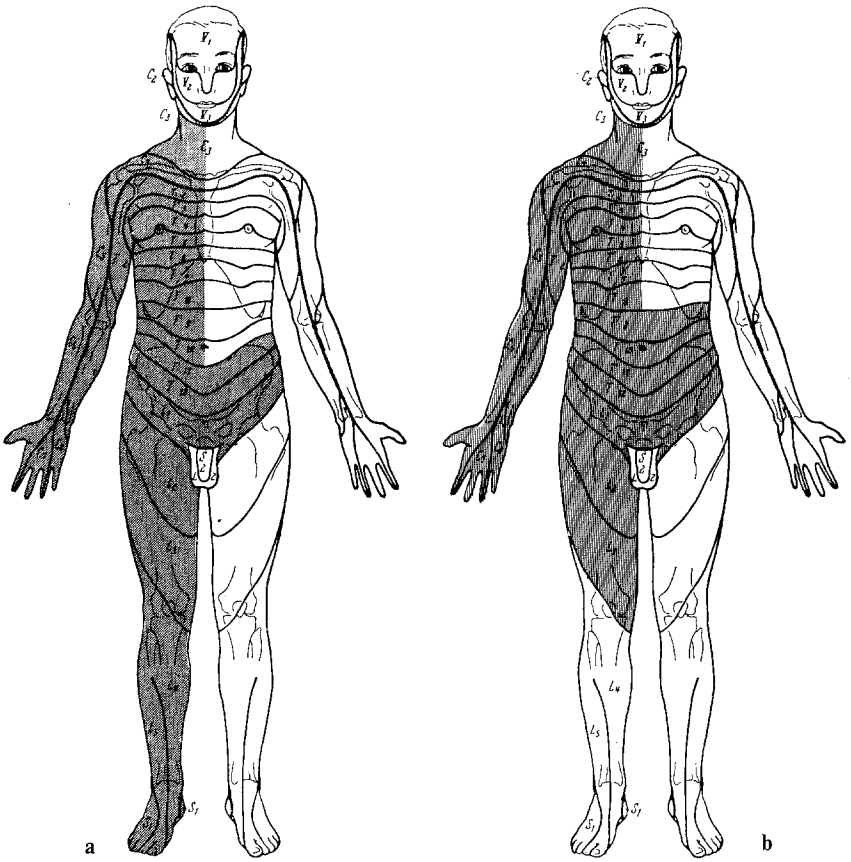


Fig. 7a and b. Case No. 5: a Hypoesthesia to heat; b Hypoesthesia to pain

cord, which occupied practically the entire spinal canal. We have no data of this kind on Case 5, since this patient was not investigated neuroradiologically, having been seen as an outpatient only.

References in the literature to familial cases of syringomyelia are extremely scant. In our search we collected the following cases: a father and son described by Nalbandoff (1900), a father and two daughters by Préobrajenski (1900), a father and son by Karplus (1915), two brothers by Redlich (1916), a brother and sister by Barré and Reys (1924), two sisters by van Bogaert (1934), monozygous twins by Wild and Behnert (1964), and two sisters in one family and a brother and sister in another described by Bentley et al. (1975). Cases involving two generations are particularly rare.

According to these data, the most likely of the proposed pathogeneses would seem to be the *dysembryogenetic theory* put forward by Gardner (1965 and 1969). This is a hydrodynamic theory based on the existence of three main defects: abnormal persistence of communication between the central canal of the spinal cord and the fourth ventricle; little or no drainage of ventricular fluid into the

subarachnoid spaces via the normal drainage routes; and high pressure exerted by the sphygmic wave of the choroid plexuses along the ventricular spaces onto the walls of the canal of the spinal cord. Several studies have confirmed this theory by demonstrating the existence of communication between the IV ventricle and the syringomyelic cavity in syringomyelia (Conway, 1967; Ellertson and Greitz, 1969; Barnett et al., 1973).

Experimental studies were carried out to verify the hydrodynamic hypothesis (Hall et al., 1975).

The frequent association of syringomyelia with other malformations provides additional evidence: hydromyelia associated with a typical Arnold-Chiari malformation (Cameron, 1957), syringomyelia associated with Arnold-Chiari malformation, and, vice versa, Arnold-Chiari malformation associated with syringomyelia (Conway, 1967; Logue, 1972; du Boulay et al., 1974; Banerji et al., 1974). In the syringomyelia material of our Institute, of 35 cases studied with gas or positive contrast myelography, an Arnold-Chiari malformation was demonstrated in 32 cases, i.e., about 90%. Bone malformations, such as occipitalisation of the atlas and basilar impression, Klippel-Feil, and spina bifida, have been found frequently (Gustafson and Oldburg, 1940; List, 1941; Lichtenstein, 1943; Garcin and Oeconomos, 1953; Cameron, 1957; Tridon, 1959; Foster et al., 1969; Gardner, 1973) in association with syringomyelia.

We would also mention the more unusual though not infrequent association of syringomyelia with dysembryogenetic neoplastic diseases, such as neurofibromatosis and phakomatoses, as shown by the classic studies of Tridon (1959) and Retif (1964). The case of acoustic neurinoma in the family we have described seems to bear out the possibility of the latter type of pathologic association.

In conclusion, the clinical and experimental data seem to support the dysembryogenetic origin of syringomyelia. On the contrary, reports of familial cases are rare, in fact too rare considering the nature of the disease. Nevertheless this is regarded as another datum supporting the dysembryogenetic theory of syringomyelia.

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References

Banerji, N. K., Millar, J. H. D.: Chiari malformation presenting in adult life. Its relationship to syringomyelia. Brain **97**, 157—168 (1974)

Barnett, H. J. M., Foster, J. B., Hudgson, P.: Syringomyelia. Vol. 1. In: Major Problems in Neurology. London-Philadelphia-Toronto: W. B. Saunders 1973

Barré, J. A., Reyes, L.: Syringomyélie chez le frère at la sœur. Rev. Neurol. **1**, 521—530 (1924)

Bentley, S. J., Campbell, M. J., Kaufmann, P.: Familial syringomyelia. J. Neurol. Neurosurg. Psychiat. **38**, 346—349 (1975)

Bogaert, L. van: Syringomyelie bei zwei Schwestern. In einem der Fälle Vorhandensein einer Kleinhirncyste. Anatomisch-klinischer Beitrag. Z. ges. Neurol. Psychiat. **149**, 661—677 (1934)

du Boulay, G. H., Shan, S. H., Currie, J. C., Logue, V.: The mechanism of hydromyelia in Chiari type 1 malformations. Brit. J. Radiol. **47**, 579—587 (1974)
Cameron, A. H.: Arnold-Chiari and other neuro-anatomical malformations associated with spina bifida. J. Pathol. Bact. **73**, 195—211 (1957)
Conway, L. W.: Hydrodynamic studies in syringomyelia. J. Neurosurg. **27**, 501—514 (1967)
Ellertson, A. B., Greitz, T.: Myelocystographic and fluorescein studies to demonstrate communication between intramedullary cysts and the cerebrospinal fluid space. Acta Neurol. Scand. **45**, 418 (1969)
Foster, J. B., Hudgson, P., Pearce, G. W.: The association of syringomyelia and congenital cervico-medullary anomalies: pathological evidence. Brain **92**, 25—34 (1969)
Garcin, R., Oeconomos, D.: Les aspects neurologiques des malformations congenitales de la charnière cranio-rachidienne. Paris: Masson 1953
Gardner, W. J.: Hydrodynamic mechanism of syringomyelia: Its relationship to myelocele. J. Neurol. Neurosurg. Psychiat. **28**, 247 (1965)
Gardner, W. J.: The distending force in the production of 'communicating syringomyelia'. Lancet **1969 II**, 541
Gardner, W. J.: The dysraphic states from syringomyelia to anencephaly. Amsterdam: Excerpta Medica 1973
Gustafson, W. A., Oldberg, E.: Neurologic significance of platybasia. Arch. Neurol. Psychiat. **44**, 1184 (1940)
Hall, P. V., Muller, J., Campbell, L.: Experimental hydrosyringomyelia, ischemic myelopathy, and syringomyelia. J. Neurosurg. **43**, 464—470 (1975)
Karplus, J. P. von: Syringomyelie bei Vater und Sohn. Med. Klin. **49** (1915)
Lichtenstein, B. W.: Cervical syringomyelia and syringomyelia-like states associated with Arnold-Chiari deformity and platybasia. Arch. Neurol. Psychiat. **49**, 881 (1943)
List, C. F.: Neurologic syndromes accompanying developmental anomalies of occipital bone. Arch. Neurol. Psychiat. **45**, 577 (1941)
Logue, V.: 14th Crookshank lecture. Syringomyelia: A radiodiagnostic and radiotherapeutic saga. Clinical Radiol. **22**, 2—16 (1971)
Nalbandoff, S. S.: Syringomyélie héréditaire. Société de Neurologie de Moscou, Vratch 1399 (1899)
Preobrajenski, P. A.: Syringomyélie héréditaire. Société de Neurologie et de Psychiatrie de Moscou, Vratch 120 (1900)
Redlich, A. von: Syringomyelie bei zwei Brüdern. Wiener Med. Wschr. **36**, 1404—1406 (1916)
Retif, J.: Syringomyélie et phacomatose — Etude anatomo-clinique de deux observations de maladie de von Recklinghausen et d'une observation de maladie de von Hippel-Lindau, associées à une syringomyélie. Acta Neurol. Psychiat. Belg. **64**, 832—851 (1964)
Tridon, P.: Les dysraphies de l'axe nerveux et de ses enveloppes craniorachidiennes. Paris: G. Doin 1959
Wild, H., Behnert, J.: Konkordante Syringomyelia mit okzipito-zervikaler Dysplasie bei eineiigem Zwillingspaar. Münch. med. Wschr. **106**, 1421—1428 (1964)

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