INTRAMEDULLARY SPINAL ABSCESS

BY

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This case of abscess within the spinal cord is reported partly because the condition is rare, but also because of the remarkable morbid anatomy revealed in this case and in some others reported. The prognosis in relation to the degree of neurological function lost before treatment is decidedly better than with epidural spinal abscess, and surgical treatment was successful in this case.

The literature since 1830 (Hart) contains reports of 43 cases, in most of which the cord lesions were revealed at necropsy. Laminectomy was first performed by Cavazzani in 1899 in a case of suppurative complicating traumatic paraplegia. His patient survived, without neurological recovery. In all, 11 cases have been submitted to operation, with four cures and one survival with paraplegia.

Case Report

A boy aged 4½ years came under our care on February 8, 1954, with a history of progressive loss of power in the lower limbs extending over a period of four weeks. The family and previous medical histories contained nothing of note except for a mild attack of pertussis at the age of 1½ years. Two weeks after the appearance of the first indications of paraparesis he developed a respiratory infection with a productive cough; the paresis then increased at a greater rate and within a few days he was unable to stand. He was admitted to a hospital elsewhere and observed for nearly a week. The paraparesis was gross, and initially of a spastic type. Double incontinence dated from the middle of this week and coincided with a lumbar puncture. The cerebrospinal fluid was yellowish; the protein content 1,000 mg. per 100 ml., and no cells. The temperature was slightly elevated, with a maximum of 101° F. A white blood count gave 10,000 per c.mm. (60% neutrophils). A Mantoux test (1 in 2,000 O.T.) was negative. The child did not complain of pain or paraesthesiae. After the paralysis became flaccid and complete he was transferred to the neurosurgical service.

On examination he was a pale, fretful child of normal bodily configuration and stature. The temperature was normal. There was a loose productive cough (sputum not examined). On general examination the only abnormality found was a moderate clubbing of the fingers. The spine was of normal appearance and not

tender to percussion at any level. There was mild resistance to full flexion of the neck, which also caused some pain in the neck.

The lower limbs were flaccid and immobile but the tendon reflexes were exaggerated symmetrically and the plantar responses were extensor. The abdominal muscles were paralysed, and the abdomen protuberant. The abdominal and cremasteric reflexes were absent.

The bladder was not distended and bladder sensation seemed to be preserved in part; he was in the habit of compressing his penis until a receptacle was provided and then voided with a good stream. (It was probable that this intelligent boy had found out for himself how to remain dry, because earlier he was reported as having "wet beds".) The anus was patulous. Sensory examination was necessarily incomplete in this rather frightened child but there was certainly no area of anaesthesia and conduction of joint and vibration senses from the lower limbs was at least partly preserved.

FIG. 1.—Myelogram in erect position. (The anaesthetist's intratracheal tube is also in the picture.)

Lumbar puncture showed a low pressure and a complete spinal subarachnoid fluid block. The yellow fluid clotted almost at once. Cisternal puncture yielded normal fluid. Myodil, 1.5 ml., was introduced, and myelograms (Fig. 1) in the erect position showed arrest of the medium opposite the lower border of T1 body.

On February 9, 1954, a laminectomy from T1 to T3 inclusive was performed.

Epidural fat appeared rather fibrosed but was histologically normal. On opening the tense dura the spinal cord was seen to be enlarged cylindrically for a distance of 4.5 cm. It occupied the theca completely. The expansion of the cord was rather abrupt at its upper and lower limits. The pathological segment of the cord had a rather greyish yellow tint but was resiliently soft to the touch. Small tortuous venules coursed over its dorsal surface (Fig. 2).

FIG. 2.—Operation photograph before incision of abscess.

On puncture with a sharp needle in the dorsal midline a drop of pus was aspirated and films of this, studied immediately by the bacteriologist, showed numerous long, Gram-negative rods with the morphology of *B. fusiformis*. The pus contained some degenerate cells which were not classifiable. (Cultures on ordinary media were sterile but after one week colonies appeared on Sabouraud's medium.)

A dorsal median incision into the cord for a distance of 2 cm. opened almost at once into a large central abscess cavity containing pus of cream colour with a slightly green tinge. Aspiration with the sucker was achieved with minimal contamination of the surroundings, leaving a capacious cavity 4 cm. long in the centre of the cord. The wall of the abscess appeared to be merely white matter with a few small blood vessels visible here and there running on its surface. There were no granulations and no visible fibrous tissue lining the abscess. It appeared to have lain approximately within the centre of the spinal medulla; its dorsal covering consisted of substance of the cord only about 1.5 mm. thick. It was thought that the thickness of cord lying anterior to the abscess, and perhaps laterally also, was probably rather greater. Wool pledgets soaked in 1 in 1,000 aqueous proflavine were lightly packed into the cavity and allowed to remain for five minutes. This line of treatment was chosen because of the bacteriologist's report and the appearance of the wall of the abscess which suggested a very indolent infection.

On palpating subsequently the cavity of the abscess with a blunt probe, it seemed that its upper and lower poles had been of conical shape. The appearance of the cord after evacuation of the abscess is shown in Fig. 3.

The dura was not closed. A fine rubber catheter was passed through skin and muscles close to the incision and was laid along the dorsal surface of the cord. The wound was closed in layers with silk. Sulphanilamide and calcium-penicillin powder was placed around the catheter where it emerged through the skin. This dressing was repeated daily until the catheter was removed after three complete days.

Some significant disturbances of chart readings occurred during the operation. About 20 minutes after the abscess had been drained the respiration rate rose sharply to 58 a minute, and simultaneously extrasystoles were noted, recurring every five to 10 beats for a period of 15 minutes. The pulse remained at 100 a minute. Coincidentally the blood pressure rose abruptly from 120/100 mm. Hg to 170/110. Thirty minutes later the pressure was still 160/100 mm. Hg. Respirations were 36 a minute at the conclusion.

The anaesthetic was intratracheal cyclopropane, nitrous oxide, and oxygen. A transfusion of 250 ml. of blood was given.

Streptomycin, 25 mg. in solution, was injected down the indwelling catheter for three days and the catheter was then removed. Penicillin was given in full doses intramuscularly for a week, perhaps on rather empirical grounds. The wound healed well and the chart readings were satisfactory.

Fluid aspirated from the catheter, and lumbar C.S.F.,

FIG. 3.—After evacuation of abscess.

withdrawn on several occasions, showed no indication of meningitis.

The first indication of neurological recovery, noted a week after operation, was return of movements of the toes and simultaneously the plantar responses became flexor. Muscle tone began to return in the lower limbs. Lumbar manometry about this time demonstrated reopening of spinal fluid pathways.

Two months after the operation the boy was walking with assistance, was able to stand three weeks later, and was beginning to walk unaided by the end of the third month.

Bronchograms on April 27, 1954, showed a normal tree. The clubbing of the fingers became hardly detectable.

Discussion

This case is considered to be one of haematogenous infection in the spinal cord from a presumed pulmonary source. The organism recovered from the abscess is a common saprophyte in bronchiectasis. The patient earlier had pertussis and there was a more recent history of febrile illness. The fingers were clubbed. Bronchograms during convalescence showed no pulmonary source of infection. An opportunity was overlooked in omitting examination of the sputum in the acute stage.

The pressor disturbance and the cardiac irregularity appearing soon after evacuation of the abscess are of interest and are not unique after operative interventions on the cervical spinal cord.

Concerning the morbid anatomy of the abscess the impression was gained that the infecting organisms had been delivered into the centre of the cord and that the abscess had enlarged by separation of fibres rather than by destruction of tissue. The tracts appeared to have been flattened by benign pressure from within the cord. The degree of neurological recovery attained is supporting evidence of the benignity of the process.

Relevant points from the literature will be considered under headings.

Bacteriology.—In the 11 reported cases subjected to operation the infection was due to staphylococci, streptococci, pneumococci, *E. coli*, and actinomyces. *B. fusiformis* has not previously been reported. The type of organism was apparently not related to the prognosis but the virulence can be presumed to have been high in eight other cases with a short history and rapid onset of disability.

Morbid Anatomy.—A remarkable feature in many of the reported cases has been the length of the cord involved as disclosed at operation or necropsy. In three cases (Dubreuilh, 1886–87; Cassirer, 1903; Moersch, 1922) the whole length of the cord was found at necropsy to be implicated; in 10 cases about half of the cord harboured an abscess. As might be expected the abscesses were not extensive in the patients who survived but at least three segments of the cord were affected in all of them.

Another noteworthy feature is the central location of the abscess in many instances (Fig. 4), enlargement taking place longitudinally, as might perhaps be anticipated in a cylindrical structure composed peripherally of fibre tracts and lying within a firm

FIG. 4.—Illustration from Woltman and Adson's paper in *Brain*, reproduced by courtesy of the publishers.

membranous tube of dura mater. The process appears to be what might be termed a "pyosyrinx" of the cord.

All levels of the cord have been implicated, with a predilection for the thoracic part which is understandable if the length of many of the abscesses is borne in mind.

Aetiology.—Endocarditis with septicaemia has been responsible for terminal infections of the cord in five of the reported cases. The lesions were of pathological rather than of clinical importance. Infection came from the lung in five other cases, all ending fatally. In the group of 20 cases of haematogenous spread the abscesses were multiple in the cord in eight and solitary in twelve.

Direct spread to the cord from neighbouring foci, such as juxtarenal infection or compound vertebral injuries, has occurred in 16 cases. In addition to these 36 cases there have been seven cases of primary abscess of the cord.

Experimental Observations.—It is noteworthy that as early as 1899 Hoche was successful in pro-

ducing abscesses experimentally in the spinal cord. Using finely particulate emboli such as pollen and clay powder he had earlier produced infarctions in the spinal cord in dogs by injection into the aorta. He found that bacteria free in the blood stream rarely caused intramedullary suppuration unless the experimental emboli were present simultaneously. He concluded that emboli had to be very small to enter the intramedullary arteries and that when they did so they were arrested, mainly in the grey matter. The arteries nourishing the interior of the cord are given off perpendicularly from the parent trunks and he postulated that this circumstance might contribute to the rarity of abscess of the spinal cord in man. Hoche stressed the importance of trauma to the spine in determining the level of infection in the cord, but it is evident from the literature that injury has been an unimportant factor in man.

Treatment.—Laminectomy has been performed in 11 of the reported cases, all with solitary abscesses (Cavazzani, 1899; Hitchcock, 1917; Woltman and Adson, 1926; Nonne, 1926; Sittig, 1927; Abeshouse and Bogorad, 1935; Urechia, 1935; Walker and Dyke, 1936; Altenburger, 1937; Alessi and Fasiani, 1940; Ameli, 1948). Five patients survived and of these four were cured. Dorsal median incision of the cord was practised by Woltman and Adson in a case of idiopathic indolent staphylococcal infection of the thoracic cord, and by Walker and Dyke in a case of congenital dermal sinus in the lumbar region infected by pneumococci and coliform bacilli. Aspiration alone was effective in the hands of Alessi and Fasiani in a case of septicaemia, several pyogens being recovered from the abscess. Aspiration with instillation of antibiotics was used by Ameli at two explorations in his case of metastatic abscess of the lower thoracic cord.

Surveying the histories in the cases which recovered one is impressed by the considerable period over which neurological symptoms existed without permanent and complete damage to the cord. The patient of Woltman and Adson had a sudden paraplegia which recovered spontaneously over four months, but recurred more than a year later. She lay almost completely paraplegic for eight months before operation, yet was able to walk again. Alessi and Fasiani's recorded paraparesis advanced over a period of seven weeks, and Walker and Dyke's patient was paraplegic for a month. Ameli's patient was paraplegic for three weeks before the first aspiration.

It is surprising to find that the prognosis in spinal epidural abscess is potentially much worse than with intramedullary abscess, if presenting as a syndrome of disease of the spinal cord. Hulme and Dott (1954) came to the conclusion from the literature and from their own material that once conduction in the spinal cord becomes seriously affected in cases of spinal epidural abscess it is already too late for successful treatment, even though in some acute cases the opportunity be lost by only a matter of hours. In contrast, almost complete paraplegia had been present for three days in our case of intramedullary abscess, and for much longer in other published cases in which recovery ensued after operation. The patients in all four of the successful reported cases were able to walk within three months of operation. Presumably the indolence of the infection contributed to the good results in these cases and in the one described here.

Summary

A case of intramedullary abscess in the thoracic part of the spinal cord is described. The infecting organism was *B. fusiformis* of presumed but

unproven pulmonary origin. Laminectomy and drainage of the abscess was successful.

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