EXTRADURAL ARACHNOIDAL CYSTS OF TRAUMATIC ORIGIN

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Acquired extradural arachnoidal cysts of the spinal canal have received scant attention. Although one occasionally hears reference to this complication, a review of the literature reveals only 2 cases, reported by Hyndman and Gerber. When one considers the number of dural lacerations following trauma or incomplete dural closures following laminectomy, undoubtedly this pathological entity has presented itself more frequently than the literature on the subject would indicate.

In our series of 1700 exploratory laminectomies, acquired extradural arachnoidal cysts have been encountered in 4 cases, constituting an incidence of .068 per cent. In 3 of these, the patients had previously undergone lumbar laminectomies for intervertebral disc ruptures, and 1 was related to a non-penetrating injury to the lumbar spine. A 5th case was encountered in a patient without a specific history of trauma, but in whom symptoms began following a severe paroxysm of sneezing in association with hay fever, and nerve root symptoms were thereafter seasonal in occurrence with each episode of hay fever. This case was considered to be a congenital type of cyst. Because of the paucity of experiences recorded and the clinical implications a report of our experiences seems justified.

Case 1. This 38-year-old crane operator was first seen on Mar. 11, 1944, complaining of recurrent attacks of low back pain of 8 years' duration. One year prior to admission, acute and incapacitating low back pain and left leg pain had developed. After 3 months of total disability, he was admitted to the hospital and through a left hemi-lumbar laminectomy, a ruptured intervertebral disc was removed at the 4th intervertebral space. During the process of mobilizing the nerve root, which was adherent to the posterior longitudinal ligament, a tear in the dural sleeve was noted near the axilla of the nerve root. The laceration was repaired by means of a supposedly water-tight closure with two interrupted silk sutures and a muscle stamp was then placed over the suture line. Following this procedure, he was relieved of his acute leg pain, but continued to note back pain of a lessened degree. In view of the fact that this patient was involved in compensation litigations, some doubt was expressed as to the authenticity of his complaints. Because of recurrence of his former leg pain, he was readmitted to the hospital on Mar. 11, 1945 for evaluation. On this occasion, spinal fluid studies revealed no evidence of manometric disturbances and the spinal fluid protein was reported as 41 mgm. per cent. Because of the persistence of his acute leg distress and recalling the dural laceration at the former operative procedure, a decision was made to re-explore this patient.

Operation. On Mar. 3, 1945, the old laminectomy scar was excised and the muscles were subperiosteally dissected off the posterior spine of the 4-5th lumbar and the 1st sacral on the left side. At the laminal level a large collection of clear fluid was encountered. When the dissection had been completed, this fluid was found to be escaping from an extradural cyst. The cyst was fully 3½ cm. in length and about 1½ cm. in diameter and extended from the level of the 4th lumbar arch to the rim of the sacrum. Once inside this cyst, a small pin-head opening
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was seen communicating with the subarachnoid space at the level of the axilla of the 5th lumbar root. The lining of the cyst was identical with the normal arachnoid and cerebrospinal fluid was constantly seen to well up into the cyst. A plastic repair of this cyst was carried out and the interspace explored for evidences of a recurrent disc lesion, but none was found.

Postoperative Course. This patient was readmitted to the hospital on May 2, 1945 still complaining of moderate leg pain and of numbness in the left leg. Other than for anesthesia over the 5th lumbar dermatome and an absent Achilles reflex on the left, together with subjective pain in the left leg on straight leg raising, there were no findings. An epidural saline

![Fig. 1. Case 2. Left, Anteroposterior view of lipiodol filling extradural cyst. Right, Lateral film to demonstrate relationship of extradural cyst and dura.](image)

injection netted very little relief. The patient subsequently returned to work complaining of mild leg pain.

Case 2. A 56-year-old white male was seen in consultation Aug. 27, 1946. His history revealed that following a back strain incurred after lifting a heavy object, he had intermittently experienced low back pain until April, 1944, when, following a second period of trauma, left sciatica appeared. He was operated upon at that time, a lumbar laminectomy being performed and a herniated disc reportedly removed at the lumbosacral level. Postoperatively, he was relieved of his acute sciatica but continued to complain of constant low back pain. Because of persistence of symptoms, a spinal fusion was advised by the orthopedist, who had performed the original operation. Prior to this procedure, a lipiodol fluoroscopy was done to rule out a recurrent disc lesion. The oil was reportedly introduced at the 3rd interspace but undoubtedly it was introduced directly into the extradural cyst depicted in Fig. 1, inasmuch as the oil appeared trapped in this cyst on later fluoroscopy. The spinal fluid removed at this time contained 33 mgm. per cent protein.

Operation. On Aug. 30, 1946, the previous laminectomy incision was reopened and an extradural cyst lying posterior to the dura and occupying the defect of the 5th spinous process and arches was encountered. The outer wall of the cyst was continuous with the
muscle scar and was approximately 6 mm. thick. The inner wall was smooth and glistening, communicating with the subdural space by means of a 3 mm. defect in the dura. The cyst was removed and the dural defect closed by utilizing a portion of the cyst wall in a duplicate closure.

**Microscopic Diagnosis.** Arachnoidal cyst. The wall of the cyst is made up of first a layer of flat mesothelial cells and a middle layer of collagenous fibrous tissue which is relatively acellular. Around the cyst wall there are considerable striated muscle, loose fibrous tissue and some vascular tissue (Fig. 2).

**Postoperative Course.** One year following the plastic repair of the extradural cyst, the patient was free of complaints referable to his low back pains.

**Case 3.** A 27-year-old ex-serviceman was admitted to Lawson Veterans Hospital on Jan. 25, 1947, complaining of pain in his back, acute pain in his right leg, headaches, and of a mass beneath the skin at the site of a former lumbar laminectomy. His history revealed that, following a back strain in 1945, symptoms compatible with a herniation of the intervertebral disc in the lumbar region had developed. Early in 1946 a lumbar laminectomy was performed and a herniated cartilage was removed, according to the patient's story, with improvement
of symptoms. Two months following this operation his back pain recurred and persisted until the time of admission to the Lawson Hospital. The symptoms on admission had developed acutely 2 weeks before, following a paroxysm of coughing.

Examination. The patient was obviously in great distress complaining bitterly of pain in his back and right leg which he stated was constant and influenced adversely by the upright position. There was present a well healed right paramedian curved 12 cm. surgical incision in the lower lumbar region. In the erect position a soft, fluctuant, obviously cystic mass appeared in the midline of the lumbar region adjacent to the surgical scar. This mass (Fig. 3)

measured 10 × 3 cm. and extended from the level of the 3rd lumbar spinous process to the 1st sacral process. Compression of this mass repeatedly reproduced the patient’s headache and leg pain. There was present also, pain in the back and right leg upon jugular compression. His pain could be reproduced on straight leg raising on the right. X-rays of the lumbar spine revealed only evidences of a complete laminectomy involving the 4th and 5th spinous processes and laminae. There was no pathological narrowing of the intervertebral spaces. Spinal fluid dynamics were found to be normal and the spinal fluid protein was reported as 48 mgm. per cent.

Operation. On Jan. 29, 1947, under general anesthesia induced with ether, the previous operative scar was excised and thereafter a thin-walled, elongated 12 × 6 cm. cyst was encountered lying between the lumbar fascia and subcutaneous tissue, being covered only by skin. After mobilizing this cyst, the wall was opened and clear fluid obtained. The interior of the cyst was lined with a glistening, mother-of-pearl membrane and at the lower pole a small 1 mm. sinus was encountered through which was seen to escape additional clear fluid when efforts were made to increase the intracranial pressure. This sinus tract traversed the muscle scar and as it was followed deeper into the wound, a second cyst was encountered overlying and compressing the dura (Fig. 4). As this second cyst was opened a communication between the cyst and the subdural space was encountered. This 4 mm. rounded foramen apparently represented an old laceration of the dura. The deeper cyst was mobilized and then by utilizing the wall of the cyst a double closure of the dural defect was effected.
Postoperative Course. The patient was relieved of the local and nerve root symptoms, but continued to complain of headaches of diminishing frequency and severity for 2 months.

Case 4. A previously healthy 20 month-old female infant was admitted to the hospital on May 1, 1947, 3 hours following an automobile accident. This infant exhibited no objective neurologic symptoms on admission. According to the hospital chart she was admitted for observation inasmuch as other members of her family involved in the same accident were critically injured. Some 10 hours after admission the child had not voided. At this time the resident surgeon observed a bilateral drop-foot and a weakness of the flexors and adductors of both thighs. Further examination revealed an apparent complete anesthesia bilaterally below the 4th lumbar dermatome and complete absence of the Achilles reflexes.

Past History. In reviewing this child's past history, the mother insisted that the child had begun to walk at the age of 1 year and that she had noted no abnormality in her gait. Furthermore, the child had never previously shown urinary retention.

Examination. X-ray studies of the lumbar and sacral spine revealed no evidence of bone pathology. A spinal fluid study done the day following admission revealed an incomplete block in the spinal canal; the spinal fluid contained 3500 RBC, 12 WBC and a protein of 140 mgm. per cent. A second examination of the spinal fluid, 5 days later, revealed essentially similar findings. The red cell count had dropped to 20 per c. cm. Lipiodol introduced at the time of this second fluid study was arrested opposite the 2nd lumbar vertebral level. Because of persistence of neurological changes and the disclosure of a spinal subarachnoid block, a lumbar laminectomy was carried out on May 8, 1947.

Operation. Under ether anesthesia, a lumbar laminectomy was done, first removing the spines and arches of lumbar 1 through 3. As the ligamentum flavum was removed, a thin-walled cyst was exposed protruding through a defect in the dura. At first glance, and because of the escape of clear fluid, fear was expressed that the dura had inadvertently been torn, but with the aspiration of the fluid and further dissection, a true arachnoid cyst was encountered. The defect in the dura was situated in the midline posteriorly beginning at the level of the upper border of the 4th lumbar vertebra. It was not until the remaining lumbar spines and arches were removed that the caudal extent of the dural defect was ascertained. This limitation was found to be at the level of the upper border of the 1st sacral segment. The edge of the dura immediately adjacent to the defect was reduplicated and rolled suggesting that the dural defect was of long standing. Through this defect projected the arachnoid cyst, which occupied the length of the defect and projected laterally to the limits of the vertebral canal. The wall of this cyst was formed by normal appearing arachnoid and several nerve roots were seen to have evaginated into the cyst at an acute angle. When the small arachnoidal tear was extended and the nerve roots visualized, no abnormalities were noted. The nerve roots appeared structurally normal. There was no adherence of the roots and a catheter could be introduced above the level of the dural defect without meeting obstruction. The lipiodol was totally removed by irrigation and the dural defect was repaired as one would a primary dural closure.

Postoperative Course. On the 4th postoperative day the child began to void spontaneously and 2 months after operation there was evidence of return of sensation over the sacral dermatomes, and during this short interval a marked return of motor function had occurred. The only motor deficit remaining appeared to be weakness of dorsiflexion of the left ankle.

Case 5. This 43-year-old white female was first seen in July, 1944, complaining of intermittent attacks of low back pain, pain in the right leg and paresthesias in the right foot. For several years she had experienced seasonal hay fever and she insisted that her symptoms first appeared during an attack of hay fever and that they regularly recurred with each episode of hay fever. In the interval between the latter, she was free of symptoms referable to her back and right leg. The neurological findings at the time of her initial examination were few, consisting of an absence of knee and ankle reflexes but without pathological reflexes or objective sensory changes. There was mild reproduction of her right leg pain on straight leg lifting but
none on jugular compression. The back examination gave essentially normal findings. X-rays of the lumbosacral spine revealed a suspicious thinning of the 1st and 2nd lumbar laminal arches, but contrast studies with lipiodol revealed no defect in the lumbar or dorsal canal. The spinal fluid dynamics were normal but the protein was reported as 54 mgm. per cent. Inasmuch as the patient showed no alarming neurological findings and since the contrast studies were not conclusive and her pain had abated on bed rest, it was decided that further observation was in order. She returned for re-examination in June, 1945, stating that she had gone through the winter without distress but that 1 month previously she had begun to have back pain again, on this occasion at a higher level. This was concurrent with the onset of her seasonal hay fever. Neurological examination again revealed only the absence of knee and ankle reflexes and normal sensory studies. Her back pain was now localized to the level of the

Fig. 5. Case 5. Left, Anteroposterior film depicting the erosion of the pedicles, laminae and posterior facets at L-1 and 2. Lipiodol, previously injected, is still apparent. Right, Lateral view demonstrating the increase in size of the vertebral foramen between T-12 and L-1 and the erosion of the posterior aspect of the body of T-12 and L-1.

1st and 2nd lumbar segments. X-rays of the spine were not obtained on this examination. She was next seen in April, 1946, complaining bitterly of recurrent back pain and right sciatica. Again, neurological changes were minimal but repeat lumbar spine films revealed marked changes.

X-Ray Report. There is present (Fig. 5) marked erosion of the pedicles, laminae, and articular facets, particularly on the left side at the level of L-1. There is erosion of the medial margin of the left pedicle of T-12 and slight erosion of the right and left pedicle of L-2. A graph of the interpedicular spacing at the level of lumbar and lower thoracic regions showed definite widening of these spaces opposite the levels of T-12 and L-1 and 2. There was marked increase in the size of the vertebral foramen between T-12 and L-1, particularly on the left side and the posterior margin of the bodies of T-12 and L-1 and 2 showed definite evidence of erosion.

Operation. On April 6, 1946 a midline incision was made extending from the 11th dorsal
to the 3rd lumbar spines. The muscles were subperiosteally dissected off the arches of T-12 and L-1, 2 and 3. The spines and the laminal arches were removed completely, L-1 and 2 being almost tissue-paper thinned. It was only when the upper part of the 3rd lumbar arch was removed that normal epidural fat was encountered, and it was then possible to visualize the entire lesion. This was a whitish cystic extradural mass that contained clear fluid. It was about one-half the thickness of the normal dura, was firm to touch and except for some cobweb attachments, stripped off the dura very freely and easily. The cyst extended well into the angle of the nerve root exits both on the right and left. A small opening was made into this cyst and clear fluid obtained. The opening was enlarged and a catheter inserted upward and found to encounter a resistance beneath the lower rim of the 11th dorsal arch, making it necessary to remove this arch to visualize the entire extent of the cyst. As the cyst was removed \textit{in toto} an opening in the dura opposite the 2nd lumbar nerve root on the right was found. Through this 2 mm. defect was seen to escape cerebrospinal fluid. The cyst was removed, the dural defect closed and the wound closed in layers after filling the dead space with absorbable gel-foam. The patient made an uneventful recovery.

\textbf{Microscopic Diagnosis.} Arachnoid cyst with lipoidal granuloma. "The sections showed a cyst-like fibrous wall which in some places showed lining cells and structures typical of arachnoid. Throughout the tissue are deposits of non-staining, globular material in small cyst-like spaces and small tissue slits. Some of this material is surrounded by foreign body giant cells. There are numerous foci of fibrosis with infiltration by large mononuclear phagocytes and giant cells. The unstained material has the appearance of lipoid." The tissue reaction was considered to be the result of the lipoid and not a reaction to the cyst, since no such reaction was observed in the microscopic studies of any of our other cases.

\textbf{DISCUSSION}

Obviously, the cysts in Cases 1, 2 and 3 could not have existed at the time of primary surgery, else they would have been discovered. It is also clear that the causal factor for these cysts was a dural laceration and that failure to close this laceration resulted in a persistent fistula. In each instance there was persistence, or a recurrence, of symptoms following disc surgery. The clinical picture is not unlike that occasionally seen in individuals with a diagnosis of recurrent intervertebral disc lesions or in those patients whose painful symptoms persist following the removal of a frank herniated or ruptured intervertebral disc. The clinical implication here is apparent. With the tremendous wave of enthusiasm for surgery which initially followed the introduction of the intervertebral disc entity and the tendency for some surgeons, unacquainted with the technique of spinal cord surgery, to attempt disc surgery, it is not unlikely that in some instances of poor results, a traumatic extradural cyst might be responsible.

Furthermore, it is not uncommon to encounter at operation a small persistent fistula at the site of needle puncture done for the purposes of myelographic study. Although the adjacent muscle and soft tissues will absorb a considerable amount of cerebrospinal fluid, eventually, if this fluid continues to escape, it may become encysted by a non-absorbing arachnoidal wall. Ordinarily, one does not concern oneself with the dangers of the failure of closure of a single needle puncture of the dura. However, if multiple needle punctures are made because of difficulty in securing spinal fluid and a large needle used, it is not inconceivable that a permanent fistula may develop. This may account, in rare instances, for persistence of
pain in the back following lumbar puncture. Admittedly, this complication
must be a rare one but it must be considered. Of greater clinical importance
is the extradural cyst occurring following laminectomy for tumor. In the
event the cyst attains such a size as to give rise to spinal cord or nerve root
compression, as occurred in Case 2 of Hyndman and Gerber, considerable
difficulty would be experienced in ascertaining whether or not recurrence of
the tumor had occurred.

In Case 4 of this series considerable doubt may be expressed as to the
traumatic nature of the cyst. It is difficult to conceive of such an extensive
dural laceration without an accompanying penetrating lesion or bony
damage. The course of events was such, however, as to lead one to conclude
that the child had no neurological handicaps prior to the injury. Elsberg,1
in discussing the etiology of congenital extradural and intradural cysts,
states that “the cysts are probably due to congenital abnormalities in the
development of the spinal membranes.” He further states that “the attach-
ment of the cyst is always near the dural opening for a nerve root.” In Case
4 the dural defect was in the midline posteriorly, yet one would not expect
the reduplication of the free dural edge which was present to have occurred
in only 2 weeks. Perhaps the dural defect was actually a congenital defect
and the trauma merely precipitated the prolapse of the arachnoid cyst.

Case 5 undoubtedly represented a congenital arachnoid cyst, the symp-
toms secondary thereto being precipitated and aggravated by the increase
in intracranial pressure attending the sneezing in association with the at-
tacks of hay fever. Assuming that it is a congenital cyst, it represents the
oldest reported case and unlike those previously reported was not associated
with the structural deformities of the spine previously mentioned, namely,
kyphosis and scoliosis. It did, however, destroy the laminal arches in a
characteristic manner that might allow an accurate radiologic pre-oper-
ative diagnosis.

SUMMARY

That acquired or traumatic extradural arachnoid cysts may occur and
be productive of clinical manifestations is demonstrated by this report.
Although this complication must occur rarely, it should be seriously con-
sidered in those cases in which a laminectomy has previously been per-
formed and in which there is a failure of symptoms to totally disappear. A
recurrence of symptoms after an interval of relief should also suggest an
extradural arachnoid cyst. This is particularly true in those individuals in
whom a dural tear occurs or in whom difficulty is experienced in producing a
water-tight dural closure. Sometimes because of tension, closure, partic-
ularly in instances in which a portion of the dura has, of necessity, been
sacrificed, may necessitate the utilization of a foreign substance in sealing
the dural opening. These cases here reported lend credence to the advice
given the inexperienced that all dural lacerations must, if possible, be closed
by the so-called water-tight method. These sequelae to laminectomies make
one consider somewhat more sympathetically the early group of disc patients operated upon by means of a transdural approach, who continue to complain of painful handicaps. In the light of our experience with the 3 postoperative disc cases in which the symptoms were for the most part identical with those complained of by individuals considered either to be psychoneurotic or having compensation neurosis, and in whom none of the cardinal signs of recurrence of disc lesions were present, perhaps our diagnostic acumen is not on a par with our vehement appraisal of these individuals whose results do not meet our expectations. In the congenital cyst, Case 5, another explanation of the lumbago-sciatic handicapped can be added to the numerical etiologies of this syndrome.

REFERENCES
