Spinal Subdural Granuloma Caused by Micropulverized Barium Sulphate

Case Report

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It is common practice to use a radio-opaque substance to visualize the anatomy and size of a brain abscess. For initial treatment and long-term follow-up, it is necessary to make the walls of the cavities permanently visible. This can only be achieved by the use of a radio-opaque substance which becomes incorporated in the wall of the abscess. Various substances such as Thoro-trast, Tantalum powder, and Pantopaque have been used. Since 1959, micropulverized barium-sulphate suspension (Steripaqué† or Micropaque) has been available, and it has been used preferentially in this department since 1960. Although "ordinary" barium sulphate is known to produce granulomatous lesions when injected into serous cavities (Kay, 1954; Burrows, 1962), this complication has not been reported with the use of the modified material. Clarke, et al., and Alexander, et al., have reported its satisfactory use in the study of brain abscesses, without encountering complications.

We are reporting a patient with a cerebellar abscess and posterior fossa subdural empyema in whom the successful use of Steripaqué was complicated by the development of a subdural granulomatous reaction.

Case Report

First Admission. An 11-year-old school girl was admitted on December 10, 1965, for the treatment of a right cerebellar abscess. A mid-occipital subcutaneous dermoid cyst was present which had become intermittently infected over the years, although not recently. Ten days before admission, she had developed increasing headaches, vomiting, and unsteadiness. On admission she was drowsy and showed bilateral papilledema and signs of a right cerebellar lesion. The raised intracranial pressure was treated by emergency bifrontal-ventricular drainage. Myodil ventriculography confirmed the presence of a right-sided posterior-fossa space-occupying lesion.

Operation. On December 12, 1965, a large, right-posterior-fossa subdural empyema and a cerebellar hemisphere abscess were aspirated; a catheter was inserted into the abscess for drainage and the instillation of antibiotics. The abscess cavity was washed out with saline, and 2 ml of Steripaqué with 100 mg Streptomycin and 10,000 units of Penicillin were injected into it. Radiographs were then taken (Fig. 1). The superficial part of the dermoid cyst was excised, and a small funnel-shaped opening through the occipital bone was noted.

The infecting organism was a Penicillin-resistant Staphylococcus Pyogenes. The cavity was accordingly irrigated at intervals with a solution containing Neomycin, Polymyxin, and Zinc Bacitracin, and parenteral Ampicillin was given for 10 days.

Postoperative Course. Postoperative recovery was rapid and uneventful, and shrinkage of the abscess cavity was satisfactory (Fig. 2). The patient was discharged 3 weeks after the operation, with only minimal right-sided cerebellar signs. Six weeks after the operation, however, she began to complain of interscapular cramp-like pains, which were aggravated by lying on her back. The pains gradually increased, requiring morphine, and began to radiate into the pre-
Fig. 1. Radiographs of the skull showing catheter lying in the cerebellar abscess, and Steripaque in the abscess and in the posterior fossa subdural space. Note also Myodil and air in the ventricular system. Top: Anteroposterior view. Bottom: Lateral view.
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Axial aspect of the left arm as far as the elbow; at the same time neck stiffness developed.

Second Admission. Examination on readmission to the hospital 2 weeks later showed a localized tenderness over the upper dorsal spine, but no neurological deficits. Lumbar puncture revealed a low CSF pressure, xanthochromic fluid with a white cell count of 136 per cu mm, predominantly lymphocytes, and a protein content of 2.5 gm/100 ml. There was no clinical or laboratory evidence of infection. The CSF was sterile; the sedimentation rate was 17 mm in the first hour (Westergren); the white blood count was 8,100 per cu mm, and the hemoglobin was 14.3 mg/100 ml. Plain radiographs of the cervical and dorsal spine revealed the presence of radio-opaque material from the foramen magnum to the mid-dorsal region of the spine, lying in the posterior aspect of the spinal canal (Fig. 3). Lumbar myelography demonstrated complete obstruction to the contrast medium (Myodil) at the sixth dorsal level (Fig. 4).

Second Operation. On February 17, 1966, a laminectomy was performed from C-2 to D-7. A sheet of firm, pale, gray granulation tissue was found and removed from the subdural space (Fig. 5). It peeled off easily from

Fig. 2. Anteroposterior radiograph of skull showing shrinkage of the abscess cavity. Note presence of Steripaque in the posterior fossa subdural space.
both the arachnoid and dura, although it was more firmly attached to the latter. The granulation tissue lay mostly in the posterior aspect of the spinal cord; it was more predominant on the left side and was apparently limited in its lateral extent by the nerve roots. It extended from C-1 to D-7. The radio-opacity of the granuloma was confirmed (Fig. 6). Bacteriological examination of the specimen was negative.

Postoperative Course. The patient was treated with Beta-methasone, 4 mg daily for 6 weeks, to prevent the recurrence of the granulation; she made a good recovery. A radiograph of the cervical spine, 6 weeks following the laminectomy, is shown in Fig. 7. At her last follow-up examination 5 months after the second operation, she was well without any neurological deficits.

Pathology. The specimen was a strip of firm, pale-gray, lobulated tissue, measuring 15.0 cm in length, 1.7 cm in width, and 0.6 cm in thickness. Histological examination showed a poorly vascularized mixture of reticulum cells, fibroblasts, and histiocytes, many of which either contained or were encrusted by a pale, brown, finely granular refractile material (Fig. 8). None of the material was free from cells. A few sparsely distributed lymphocytes were present, but
no giant cells were seen. Peripherally, the granulation tissue was bounded by a distinct but thin layer of collagen. The appearances were those of a foreign body reaction rather than of an infective process. The granular material was identical with the Steripaque seen previously in the abscess cavities and with some examined in a wet preparation. It was best demonstrated by an unstained section mounted in an aqueous medium and examined by either dark field or phase contrast (Fig. 9).

Discussion
It has been shown experimentally by Kleinsasser and Warshaw\textsuperscript{6} that barium sulphate, when injected into the peritoneal cavity, produced a granulomatous reaction. The clinical reports by Kay\textsuperscript{5} and Burrows\textsuperscript{8} confirmed this reaction in man as a complication following the use of ordinary barium sulphate in routine investigations of the gastrointestinal tract. No such reaction, however, was reported in animal experiments by Steggerda\textsuperscript{8} and Adolph and Taplin\textsuperscript{1} with the use of Micropaque. Even intravenous Micropaque injection in rabbits produced neither immediate nor delayed toxic effects. Similarly, no adverse reaction was noted clinically by Clarke, \textit{et al.}, (1962)\textsuperscript{4} and Alex-
ander, et al., (1964) even in the intracranial ventricular system. Micropaque produced "only very slight fibrous tissue reaction and no sign of astrocytic response."

The use of microbarium sulphate, however, is not entirely free from risk. In our patient it resulted in the formation of a granuloma, whose sterile granulation tissue and almost total lack of inflammatory cellular infiltration point to a pure foreign-body reaction rather than an infective process. It is interesting to note that the presence of Steripaque in the brain and the ventricular

Fig. 8. Microscopic section of granuloma showing mixture of histiocytes, reticulum cells, and fibroblasts. H. & E., X500.

Fig. 9. Unstained section of granuloma showing dark intracellular granules of Steripaque. Phase contrast (X500).
system is harmless, whereas in the subdural space as shown in our patient it is not. This inconsistency is difficult to explain. Possibly the granuloma is the result of a foreign-body reaction by the mesenchymal tissue, since the three membranes of the spinal meninges are all apparently derived from mesoderm, although the arachnoid and pia mater appear to be closely related to neuro-ectodermal tissue due to the migration of neural crest cells. Yet it is curious to note that microbarium sulphate in contact with mesodermal tissue elsewhere in the body appears to be inert.

The time interval required for the production of barium sulphate granuloma is not known. Estimates have varied from 1 to 6 weeks. In the present case, the symptoms started 6 weeks after the introduction of Steripaque, during which time it must have migrated from the posterior fossa to the dorsal spinal subdural space under the influence of gravity. This could have occurred only after the patient began walking at 1 week following the operation. Hence, we presume that the approximate time required for the production of the granuloma was 4 to 6 weeks.

Summary

We have reported the unique development of a radio-opaque granuloma in the spinal subdural space, following the use of Steri-paque (micropulverized barium sulphate) in the management of a cerebellar abscess with subdural empyema.

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References