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Cystic Cervical Intramedullary Ependymoma with Previous Intracyst Hemorrhage

Magnetic Resonance Imaging at 1.5 T

T. A. Sweasey, MD
Department of Surgery
Section of Neurosurgery
University of Michigan Medical Center

J. A. Brunberg, MD
Department of Radiology
University of Michigan Medical Center

P. E. McKeever, MD
Department of Pathology
University of Michigan Medical Center

H. M. Sandler, MD
Department of Radiation Oncology
University of Michigan Medical Center

W. F. Chandler, MD
Department of Surgery
Section of Neurosurgery
University of Michigan Medical Center
1500 E. Medical Center Drive
Ann Arbor, MI 48109

ABSTRACT

A patient with a cystic cervical ependymoma is described. Magnetic resonance imaging identified evidence of previous intratumor hemorrhage, which was confirmed at surgery. The images, operative findings, and pathology are reviewed.

Sweasey TA, Brunberg JA, McKeever PE, Sandler HM, Chandler WF. Cystic cervical intramedullary ependymoma with previous intracyst hemorrhage: magnetic resonance imaging at 1.5 T. J Neuroimag 1994;4:111–113

Received Feb 9, 1993, and in revised form Jun 16. Accepted for publication Jun 16, 1993.

Address correspondence to Dr Chandler.

Case Report

A 44-year-old, left-handed white woman was initially seen in September 1988 at an outside facility, approximately 2 years prior to her presentation at the University of Michigan. At that time she had noted the sudden onset of numbness on the right side of her face and right side of her body, as well as neck and right-shoulder pain. Her evaluation included computed tomography of the head and a cerebral blood flow study, both without specific abnormalities. Her symptoms resolved with chiropractic manipulation.

In August 1990 she again noted numbness involving the right side of her face and trunk, and also on this occasion, the left lower extremity. She had difficulty with balance, but no double vision or swallowing difficulty. These symptoms persisted unchanged until her presentation at the University of Michigan Medical Center in September 1990.

Her examination on admission showed normal strength, but decreased pin sensation on the right side of her face, right side of her thorax, right arm, and right thigh. There were normal findings on pinprick examination of both feet. Deep tendon reflexes were brisk bilaterally without clonus and with downgoing plantar responses bilaterally. She could tandem walk without difficulty. Her cranial nerves were intact except for the decreased facial sensation.

Sagittal and axial 1.5-T magnetic resonance images (General Electric Signa, Milwaukee, WI) were obtained through the cranial vault and cervical spine prior to and following intravenous gadopentetate dimeglumine (Berlex, Wayne, NJ) administration. T1-weighted (TR 500 or 600/TE 20), spin density (TR 2000/TE 30), and T2-weighted (TR 2000/TE 90) images were obtained. Slice thickness was 3 mm for cervical and 5 mm for cranial images.

An intramedullary mass lesion of the cer-

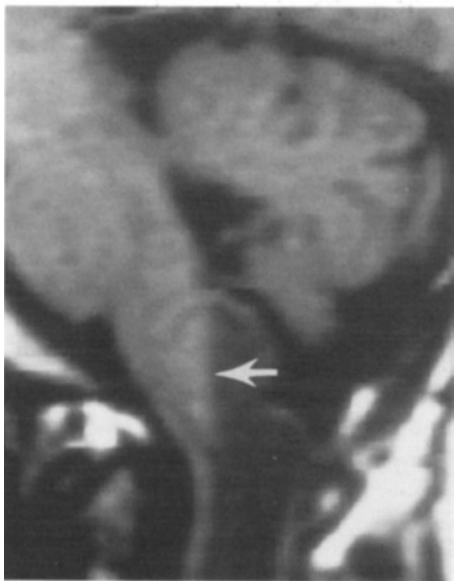

Fig 1. T1-weighted image (TR 500/TE 20) demonstrates an intramedullary cystic lesion of the cord rostral to C3 and extending into the medulla. The cyst-containing portion of the mass demonstrates a linear fluid-fluid interface *(arrow)*.

vical spinal cord extended from the C3–4 disc space level superiorly into the medulla to the level of the obex (Fig 1). There was effacement of cerebrospinal fluid (CSF) around the enlarged spinal cord and at the foramen magnum with bulbous distension of the posterior-caudal aspect of the medulla. A linear alteration in signal intensity consistent with a fluid-fluid interface was present within the lesion on all sequences at the cervicomedullary junction. The patient was imaged in a supine position. The dependent fluid layer was of lower signal intensity than the superior layer on all sequences and there was no alteration in signal intensity in these components of the mass following gadopentetate dimeglumine administration (Fig 2). Only slight enhancement was seen in the cord parenchyma surrounding the apparent cyst. T2-weighted images demonstrated normal contour and signal intensity of the spinal cord caudal to the C6–7 disc space level, and increased signal intensity of the cord parenchyma immediately adjacent to the cystic component at the C1 and C2 vertebral levels (Fig 3).

The patient was taken to the operating room and underwent a suboccipital craniectomy and C1–5 cervical laminectomy. The cervical spinal cord extending to the medullary region was markedly expanded. With careful separation of the cerebellar tonsils, there appeared to be a cystic structure that pushed toward the fourth ventricle. Opening of the cyst in the midline resulted in the release of fluid consistent with old blood. The cord collapsed and ultrasound imaging of the spinal cord revealed a mass that extended to the level of the fifth cervical vertebra. A midline myelotomy was performed from C1 through C4 and resection of the tumor was complete except for the cyst wall which extended into the medullary region. Pathological examination of the tissue revealed a typical ependymoma with the exception that hemosiderin was present, especially in the cyst wall.

Postoperatively the patient improved. She noted immediate relief of her numbness and had slight difficulty with proprioception and weakness in her hands, which continues to resolve. She was treated with external-beam radiation therapy consisting of a total of 5,400 cGy delivered with opposed lateral fields to the local area. She will be followed with magnetic resonance imaging at regular intervals for possible recurrence.

Fig 2. T1-weighted image (TR 600/TE 20) following gadopentetate dimeglumine administration demonstrates only minimal enhancement of tumor tissue at the anterior and posterior margins of the mass with no alteration in signal intensity of cyst contents.

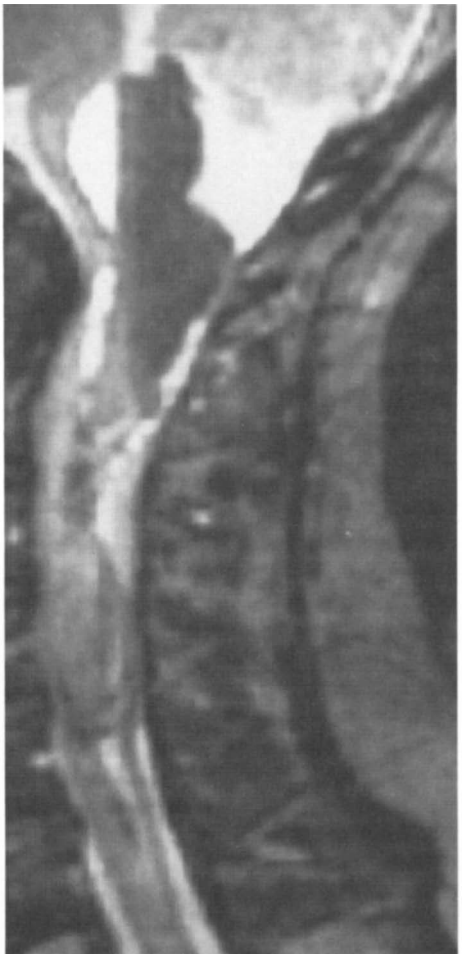

Fig 3. T2-weighted image demonstrates the fluid-fluid level within the cystic portion of the mass, with the superficial layer of fluid being higher in signal intensity. There is a thin rim of high signal intensity at the margin of the cyst which may relate to tumor tissue, gliosis, or interstitial edema. Regions of mixed signal intensity are seen in the central position of the cord extending to the C6–7 disc space level. These may represent regions of tumor, edema, and hemosiderin deposition.

Discussion

Magnetic resonance imaging demonstrated a partially enhancing intramedullary spinal cord lesion with an associated cyst extending into the medulla. There were findings consistent with previous hemorrhage into the cyst, which was subacute or chronic in duration.

The differentiation between cystic and solid intraaxial lesions cannot always be made on the basis of magnetic resonance signal intensity or lesion contour [1]. Solid regions of gliosis from any cause can have a signal intensity on T1- or T2-weighted images that is identical to that of CSF. Both solid and cystic lesions can also be sharply marginated. The occurrence, however, of a linear interface that is appropriate to patient positioning is evidence of a fluid-fluid interface within a cystic structure. Signal loss secondary to turbulence within flowing fluid (not present in this patient) can also establish the diagnosis of a syrinx or cyst [2–4].

In this patient the higher signal intensity within the superficial layer of cystic fluid on all imaging sequences can be explained by the presence of methemoglobin within the fluid or by the presence of a high protein concentration. Methemoglobin is the water-soluble product of deoxyhemoglobin metabolism and contains iron in the ferric state (Fe^{3+}) [5–7]. Unpaired electrons in the outer shell of the iron atom are physically accessible to interstitial or intracellular water protons. They exert a strong paramagnetic effect on adjacent tissue, shortening T1 relaxation times and increased signal intensity on T1 images. A similar increase in signal intensity can occur in cystic fluid when a high protein concentration increases the proportion of protein-bound water. Water molecules bound to macromolecules experience T1 shortening due either to a physical exchange of water protons for relaxed protons of the protein macromolecule or to cross-relaxation between water protons and those of the membrane [8].

The dependent layer of fluid was isointense with CSF on T1 and spin density images but was hypointense relative to CSF on T2-weighted images. Deoxyhemoglobin within intact red blood cells (RBCs) causes decreased signal intensity on T2-weighted images because of a differing magnetic susceptibility between the RBCs and surrounding fluid. A continued diffusion of water

across the RBC membrane results in a loss of coherence of precessing protons because of the differing rates of precession of protons in the two magnetic environments that result within each imaging voxel. In the patient reported here the history was not suggestive of a significant recent hemorrhage. A more likely explanation for lower signal intensity in the dependent fluid layer relates to the presence of hemosiderin or ferritin, products of methemoglobin metabolism that contain ferric iron inaccessible to tissue water and therefore unable to shorten T1 relaxation times of adjacent protons. Hemosiderin is insoluble in water and accumulates within lysosomes of macrophages, while ferritin is water soluble. The densely packed iron atoms of hemosiderin and iron act as small magnets, altering in an inhomogeneous manner the intravoxel field strength of the applied external magnetic field. This inhomogeneity of field strength within each voxel results in a loss of coherence of precessing protons within the voxel. The loss of coherence is most evident with imaging at a late echo time, resulting in low image signal intensity. Findings at surgery confirmed the presence of remote hemorrhage within the cyst.

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Parinaud's Syndrome as the Initial Manifestation of Acquired Immunodeficiency Syndrome

Denise K. Griffin, MD
Department of Neurology
James A. Haley Veterans' Hospital
13000 Bruce B. Downs Blvd.
Tampa, FL 33612

Mary Ellen Shriver, DO
Department of Neurology
University of Southern Florida College of Medicine
Tampa, FL

Robert Hauser, MD
Department of Neurology
University of Southern Florida College of Medicine

ABSTRACT

The initial manifestation of human immunodeficiency virus infection is highly variable. This reports Parinaud's syndrome as the initial manifestation of acquired immunodeficiency syndrome.

Griffin DK, Shriver ME, Hauser R. Parinaud's syndrome as the initial manifestation of acquired immunodeficiency syndrome. J Neuroimag 1994;4:113–114

Received Apr 9, 1993, and in revised form Jun 22. Accepted for publication Jul 1, 1993.

Address correspondence to Dr Griffin.

Infection with the human immunodeficiency virus (HIV) may range from an asymptomatic carrier state to illness complicated by multiple opportunistic infections. Cell-mediated immunity becomes incompetent, allowing endemic opportunistic organisms to cause overt infection, thus heralding the onset of acquired immunodeficiency syndrome (AIDS). The central nervous system (CNS) is susceptible to numerous infections, of which *Toxoplasma gondii* is most common. Toxoplasmosis typically causes focal neurological symptoms or seizures related to abscess location, and less commonly produces encephalitis, headache, or brainstem signs. Although *Toxoplasma* infections have been associated with a number of brainstem syndromes, this is the first reported case of Parinaud's syndrome as the initial manifestation of AIDS.

Case Report

A 25-year-old woman presented with the gradual onset of vertical binocular diplopia. There was no history of trauma, visual loss, or eye pain. She denied any concurrent headache, dysarthria, dysphagia, numbness, or weakness.

She was on no medications, and her medical history was unremarkable. She was married and had been monogamous for the past 8 years. Prior to this, however, she had had a sexual relationship with an intravenous drug user.

On physical examination, she had a temperature of 98.4°F, a blood pressure of 111/77 mm Hg, and a heart rate of 93 beats/min. Her general physical examination was remarkable only for obesity and a tinea corporis skin infection.

Neurological examination showed her to be alert and oriented, with normal fluent speech. Pupils were 4 mm bilaterally and reacted to light and convergence. Attempted upgaze resulted in convergence-retraction nystagmus without upward ocular excursion. Red glass test revealed a left superior oblique palsy. Visual fields were full to confrontation and findings on funduscopic examination were normal. Results of motor and sensory examinations were normal. Deep tendon reflexes were symmetrical with flexor plantar reflexes. Gait was slightly wide based and mildly ataxic. No dysmetria or dysdiadochokinesia was present. There were no frontal release signs.

HIV testing by enzyme-linked immunosorbent assay (ELISA) and Western blot revealed positivity with an absolute CD4 count of 15 cells/mm^3. The serum IgG *Toxoplasma* titer was 387 EU/ml (>300 is very high) and the IgM titer was 9.6 EU/ml (<40 is negative). Brain magnetic resonance imaging (MRI) with a contrast agent revealed multiple ring-enhancing lesions with the largest of these in the midbrain (Fig 1). Treatment with pyrimethamine and sulfadiazine for 2 weeks caused resolution of the symptoms and regression of MRI findings (Fig 2).

Discussion

AIDS was recognized as a clinical entity in 1982 and presumably 1.5 million Americans have become HIV seropositive. They develop opportunistic infections when sufficiently immunocompromised. *T. gondii* is the most common CNS infection in AIDS patients. *Toxoplasma* is a protozoan to which 40 to 50% of young healthy Americans have been exposed [1]. In adults, the organism is transmitted by consumption of food infected with cysts. It has been estimated that 25% of lamb and pork inspected in the United States contains *Toxoplasma*