Cervical disc herniation presenting as a mass lesion posterior to the odontoid process

Report of two cases

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The authors report two cases of herniated intervertebral disc presenting as a mass posterior to the odontoid process and causing myelopathy in previously healthy elderly women. The differential diagnosis of a mass at the craniovertebral junction is reviewed, and the implications of these cases are discussed.

KEY WORDS • herniated disc, odontoid • intervertebral disc • cervical spine • craniovertebral junction

Masses located at the craniovertebral junction can be caused by congenital, developmental, neoplastic, or traumatic disease processes. We present here two cases that illustrate the possibility of herniated cervical intervertebral disc presenting as such a mass.

Case Reports

Case 1

This 74-year-old woman was admitted to the hospital with a 2-week history of intermittent paresthesias of the left hand, each lasting up to 1 hour. The paresthesias had been increasing in frequency, spreading progressively to the left forearm, arm, and leg. For the 2 days prior to admission, the patient had noted numbness over the entire left side of her body. She did not experience any muscle weakness, gait disturbance, incontinence, or changes in vision or speech. She was being treated medically for hypertension, and denied any history of trauma to the head or neck. On the day prior to admission, she presented to a local hospital, where a noncontrast computerized tomography (CT) scan of the head was normal, and a CT scan of the cervical spine was remarkable only for slight narrowing of the spinal canal. The patient was transferred to the Massachusetts General Hospital for further treatment.

Examination. The neck was supple, and the remainder of the general physical examination was unremarkable. On neurological examination, she was awake and alert, with a normal mentation. Cranial nerve examination was notable only for a decrease in the hearing of the left ear. Strength and tone were normal in all extremities; there was no pronator drift. A marked decrease in light touch and pinprick sensation, which did not cross over the midline, was demonstrable over the entire left arm, torso, and leg, with normal sensation on the face and neck. There was also decreased joint position sense in the toes of the left foot. Cerebellar examination was within normal limits, and deep-tendon reflexes were notable for bilateral areflexia of the ankles and an equivocal Babinski reflex on the left. Laboratory evaluation of electrolytes, hematological parameters, and urine was entirely normal.

A chest radiograph was normal. Plain radiographs of the cervical spine showed marked degenerative changes with diffuse disc-space narrowing, most prominent at the C6–7 interspace. The atlantodental interval was at the upper limits of normal. Magnetic resonance (MR) imaging of the craniovertebral junction demonstrated a midline soft-tissue mass indenting the cervicomedullary junction; it was immediately posterior to the odontoid process and extended superiorly to the level of the foramen magnum (Fig. 1 left). The C2–3 disc space...
Retro-odontoid disc herniation

Three years after surgery, the patient's strength is good and her gait is stable. The numbness/dysesthesia of the left leg is slightly improved as compared with her preoperative condition. On follow-up MR examination, an isodense mass, much smaller than that found on the preoperative study, is situated posterior to the odontoid process, representing either tissue left at the time of surgery or postoperative changes (Fig. 1 right).

**Case 2**

This 82-year-old woman was admitted to the hospital with a 1-year history of progressive neck pain, right-sided sensory symptoms, and ataxia of the right leg. She had enjoyed good health until 14 months prior to hospitalization, when she fell with resulting right leg pain and ataxia. During the ensuing several months, she noted the onset of left occipital pain, as well as numbness over her right arm, torso, and leg. She denied incontinence or constipation, but did detect increasing difficulty with gait, secondary to right-leg “stiffness.” Her medical history was entirely unremarkable. She was admitted to a local hospital, from which she was transferred to the Massachusetts General Hospital for further evaluation and treatment.

**Examination.** The general physical examination, including the range of neck motion, was normal. On neurological examination, the patient had a normal cranial nerve examination. Her strength was judged to be 5/5 in the right arm and leg, 4/5 throughout the left upper extremity, and 4/5 throughout the left lower extremity. There was decreased pin-prick and cold sensation demonstrable over the entire right side of her body, which did not cross over the midline, with a sensory level at T6-7. Joint position sense was diminished in the toes bilaterally. The right biceps, brachioradialis, triceps, patellar, and ankle reflexes were 1++; the corresponding left-sided reflexes were 2+. There were bilateral equivocal Babinski reflexes. Finger-to-nose testing was normal in both arms, but the patient had some difficulty with heel-to-shin maneuvers on the left, secondary to weakness. Her gait was spastic, and she required supports to walk. Laboratory examination of blood and urine was normal.

A plain radiograph of the chest was normal. Magnetic resonance imaging of the craniovertebral junction revealed a large midline soft-tissue mass, posterior to the odontoid process, which indented the medulla and upper cervical cord (Fig. 2 center). This mass developed peripheral enhancement with the administration of intravenous gadolinium contrast material (Fig. 2 center). The C2-3 disc space appeared normal. There was no obvious evidence of congenital abnormalities or bone involvement.

**Operation.** The patient underwent a suboccipital craniectomy with C-1, C-2 laminectomies. Upon incision of the dura, it was apparent that the upper cervical and inferior medulla were posteriorly displaced; the cerebellum, medulla, and spinal cord appeared grossly normal. A large extradural, firm, rubbery, yellow mass was identified ventral to the spinal cord in the corresponding left-sided reflexes were 2+. There were bilateral equivocal Babinski reflexes. Finger-to-nose testing was normal in both arms, but the patient had some difficulty with heel-to-shin maneuvers on the left, secondary to weakness. Her gait was spastic, and she required supports to walk. Laboratory examination of blood and urine was normal.

A plain radiograph of the chest was normal. Magnetic resonance imaging of the craniovertebral junction revealed a large midline soft-tissue mass, posterior to the odontoid process, which indented the medulla and upper cervical cord (Fig. 2 center). This mass developed peripheral enhancement with the administration of intravenous gadolinium contrast material (Fig. 2 center). The C2-3 disc space appeared normal. There was no obvious evidence of congenital abnormalities or bone involvement.

**Operation.** The patient underwent a suboccipital craniectomy with C-1, C-2, and partial C-3 laminectomies. After the dura was opened, a firm yellow mucinous mass was identified anterior to the spinal cord in an epidural location (Fig. 3). Upon incision, this mass...
extruded abundant yellow mucinous material, which composed approximately half that portion of the mass that indented the dura. In all respects, this was identical to the mass found in the preceding case. After removal of this mucoid material, the remainder of the mass had a tough fibrous consistency and was removed in its entirety.

**Pathological Examination.** Fibrocartilage with extensive fibrillation and necrosis was observed on microscopic examination of the removed tissue (Fig. 4). The viable chondrocytes tended to be arranged in groups, and the matrix stained inhomogeneously. Some pieces of fibrocartilage were surrounded by reactive fibrous tissue, which contained scattered macrophages. There was no evidence for neoplasia or abnormal calcification.

**Postoperative Course.** The patient's left-sided weakness was worse in the immediate postoperative period. A transient worsening in this paresis, accompanied by increased somnolence on the 4th postoperative day, prompted a CT scan of the head, which revealed a small amount of interventricular blood (consistent with postoperative changes) and mild ventriculomegaly secondary to cortical atrophy. By the 6th postoperative day, the patient's weakness began to improve and continued to do so throughout the remainder of her hospitalization. The postoperative course was also complicated by intermittent atrial flutter, treated successfully with digoxin. The patient continued to improve, and was discharged to a rehabilitation facility on the 32nd postoperative day, having regained her preadmission level of activity.

On examination 3 months after surgery, the patient continued to show gradual improvement. There was still some demonstrable weakness of the left leg, but she could use a walker without assistance. In addition, there had been steady improvement of her sensory deficits. An MR image obtained at that time (Fig. 2 right) demonstrated marked reduction in the size of the retro-odontoid mass, without evidence of recurrence.
Retro-odontoid disc herniation

FIG. 4. Case 2. Photomicrograph showing fragments of extruded degenerating fibrocartilage of the anulus fibrosus surrounded by reactive fibrovascular tissue. H & E. x 23.

Discussion

Mass lesions located at the craniovertebral junction can be classified according to their etiology as congenital, developmental, inflammatory, neoplastic, or traumatic. The differential diagnosis, especially in the elderly patient, would include rheumatoid arthritis with pannus formation, calcium pyrophosphate dihydrate deposition in the periodontoid region, and spinal extradural tumors (meningioma, neurofibroma, schwannoma, metastasis, or chordoma), although congenital malformations or developmental anomalies resulting from a malformation may play a role. With the finding on microscopic examination of pure non-neoplastic fibrocartilage, the possibility of chondromatous tumor, fibrous metaplasia, and herniated intervertebral disc must be added to the list.

Embryology

The embryology of the craniovertebral junction allows, at least theoretically, the possibility of a fibrocartilaginous mass posterior to the odontoid process. At 6 months of embryonic life, two paramedian ossification centers appear at the base of the odontoid and fuse by the time of birth, resulting in the body of C-2. The two cranial segments of the odontoid fuse by 12 years of age, yielding a wide cartilaginous band (epiphyseal growth plate) at the neurocentral synchondrosis, separating the dens from the body of the axis. This growth plate rarely, but occasionally, persists into adulthood, conceivably causing a fibrocartilaginous mass through growth or herniation. To our knowledge, no one has yet reported the occurrence of such a mass by this etiology. In our patients, radiographic examination (including plain radiographs in the first case) showed no evidence of a disruption of the dens consistent with such a persistent anomaly.

Inflammatory Lesions

Inflammatory lesions, particularly rheumatic involvement of the transverse ligament, can cause mass lesions of the craniovertebral junction. The formation of rheumatoid pannus in the retro-odontoid region is a well-described phenomenon that can cause myelopathy. Although the appearance of pannus on MR imaging is very similar to that of the soft-tissue masses in our two cases, this inflammatory process is usually associated with extensive erosion of adjacent bone. Pathologically, the operative specimens from our patients did not exhibit the intense infiltration of macrophages, lymphocytes, and plasma cells characteristic of rheumatoid pannus.

Calcium Deposition Disease

The case recently reported by Ciricillo and Weinstein of an elderly woman with myelopathy secondary to calcium pyrophosphate deposition in the transverse ligament included an MR image very similar to the images in our report. Several descriptions of this pathology in the cervical spinal canal confirm the characteristic radiographic calcifications of this lesion, however; furthermore, the typical histological features are easily identified, eliminating this possibility in our cases.

Extradural Tumors

The most common extradural tumors of the spinal canal (meningioma, neurofibroma, schwannoma, and metastasis) rarely exhibit cartilaginous change. Chordoma, or its chondroid variant, can present as an extradural tumor of the craniovertebral junction. However, these tumors are frequently calcified and produce bone destruction. Histologically, they are composed of sheets or cords of cells with abundant vacuolated cytoplasm, which stain positively for keratin and epithelial membrane antigen with a prominent myxoid ground substance. This pattern was not observed in the operative specimens from our patients.

Cartilaginous Neoplasms and Pseudotumors

The primary cartilage neoplasms include osteochondroma, chondroma, and chondrosarcoma. Osteochondroma arises from the aberrant development of the epiphyseal plate, resulting in trabeculated exostoses
capped by hyaline cartilage. Theoretically, a tumor could originate from the epiphyseal growth plate of the odontoid, but the absence of bone and well-formed hyaline cartilage helps to exclude this possibility. Chondromas and chondrosarcomas are classified according to their location, either intraosseous ( enchondroma) or on the periosteum (periosteal chondroma). Benign cartilaginous tumors are rare in the spinal canal. Since there was no bone involvement in either of our cases, intraosseous cartilage tumors can be eliminated from the possible diagnoses. Moreover, periosteal chondromas and chondrosarcomas consist of actively growing nodules of hyaline cartilage, which often erode the underlying bone cortex — features that were not present in our cases.

Sze, et al., reported three patients with fibrous "pseudotumor" posterior to the dens in association with chronic atlantoaxial subluxation (as may have been the situation in our Case 1), and raised the possibility of chronic mechanical irritation as an etiology. This is further substantiated by the recent report by Lansen, et al., of a patient with myelopathy secondary to hypertrophic cicatrix, with characteristic scar formation, arising in an undiagnosed Type II fracture of the odontoid process. However, our two patients denied any history of head or neck trauma, they had no evidence of an odontoid fracture, and the pathological findings were not consistent with fibrous scar.

Herniated Intervertebral Disc

The pathological diagnosis in our patients was degenerated intervertebral fibrocartilage. The abundant mucinous accumulation observed at surgery may represent trapping of disc material undergoing myxoid degeneration by the adherent dura of the upper cervical spine. The MR appearance of these soft-tissue masses, including the normal appearance of the adjacent disc spaces (MT Modic, personal communication, 1991) and the peripheral enhancement of the mass observed with gadolinium, is entirely compatible with intervertebral disc herniation. Although the origin of the disc material cannot be conclusively determined, we believe the most likely source to be the proximate disc space (C2–3) in these elderly patients.

Herniation of the C2–3 intervertebral disc is very uncommon. In several series, totaling over 4000 patients undergoing cervical discectomy, only three instances of C2–3 disc herniation were reported. Situated immediately posterior to the dens, the disc material in these cases would have had to traverse the posterior longitudinal ligament and move cranial at the time of herniation. However, both posterior longitudinal ligament penetration and epidural migration of disc fragments are well-described phenomena. It may be that the unique arrangement of mechanical forces and dural adherence of the upper cervical spine may lead to this unusual presentation of herniated nucleus pulposus.

Conclusions

We present two cases of elderly women, each with a mass posterior to the odontoid process at the craniovertebral junction causing progressive myelopathic symptoms. The surgical pathology is typical of herniated nucleus pulposus. These retro-odontoid ruptured discs represent a new benign factor to be considered in the differential diagnosis of masses at the craniovertebral junction.

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