Intra vertebral pneumatocysts are usually discovered incidentally during imaging workup for chronic neck pain. Their origin is uncertain. They are rare lesions. Only 14 intravertebral pneumatocysts have been reported. They are most common in the subaxial cervical region. We present a case report of cervical pneumatocyst and review the current literature.

Case Report

Presentation and History. This 56-year-old right hand–dominant woman was referred for chronic neck pain. Her pain and pressure localized to the subaxial spine in the midline. She reported a subjective sense of intermittent left arm weakness manifesting as difficulty manipulating small objects with her hands and fingers. She also reported paresthesias and numbness in the left hand. Physical and neurological examinations demonstrated no abnormal findings except for a positive Tinel sign over the left median nerve at the wrist. Electromyography demonstrated bilateral carpal tunnel syndrome with no cervical radiculopathy. Cervical spine imaging demonstrated multilevel degenerative disc disease and a pneumatocyst of the C-5 vertebral body. The alignment of the cervical spine was normal. A review of the patient’s cervical imaging studies obtained in 1995, 2007, 2008, and 2010 demonstrated that the pneumatocyst was not present in 1995 but was present in 2007. The lesion had not changed in appearance since 2007. At an outside institution, multilevel fusion of the cervical spine was recommended to treat the pneumatocyst prior to evaluation at the authors’ institution. The authors, however, did not think that the pneumatocyst was the cause of the patient’s neck pain, and cervical pneumatocysts typically have a benign course. As such, the authors recommended conservative management and repeated MR imaging in 6 months. Splinting was used to treat the patient’s carpal tunnel syndrome.

Key Words • cervical spine • intraosseous • pneumatocyst • benign

Initial Diagnosis and Imaging Findings. Electromyography of the arms demonstrated bilateral carpal tunnel syndrome with no cervical radiculopathy. Cervical spine radiography demonstrated mild multilevel degenerative spinal disease with an indeterminate lytic lesion in the body of the C-5 vertebra (Fig. 1). Alignment of the cervical spine was preserved. Cervical spine CT showed that the lytic intraosseous lesion measured approximately 11 × 12 mm, was composed entirely of air/gas attenuation, and, therefore, had imaging features consistent with a pneumatocyst (Fig. 2). The lack of multiple spaces within the lesion and fluid-fluid levels excluded the possibility of an aneurysmal bone cyst. Review of the patient’s cervical imaging studies obtained in 1995, 2007, 2008, and 2010 demonstrated that the lesion was not present in 1995 but was present in 2007. The lesion had not changed in appearance between 2007 and 2010. Studies of the cervical spine revealed that the pneumatocyst was markedly hypointense on T1- and T2-weighted MR imaging (Fig. 3). In the past, the pneumatocyst had shown no evidence of internal contrast enhancement. Although the differential diagnosis for a low signal lesion on T1- and T2-weighted images would include a densely sclerotic or hemosiderin-
Cervical spine pneumatocyst

laden lesion, the lytic nature of the lesion on the radiographs and CT scans excluded the possibility of a large benign bone island, and the lack of enhancement excluded the possibility of pigmented villonodular synovitis.

Conservative Treatment. The origin of intrasosseous pneumatocysts is uncertain and the lesions are rare. They are not usually clinically significant. As such, we did not think that the pneumatocyst was causing the patient’s neck pain. The patient had advanced cervical degenerative arthritis and multilevel degenerative disc disease that was the probable cause of her presenting symptoms.

Pneumatocysts are most often identified in the bones adjacent to the sacroiliac joints where they are associated with degenerative arthritis.3,12 Pneumatocysts in the cervical spine are usually discovered incidentally in the 5th and 6th decades of life, when they are also seen in association with degenerative arthritis.12 The lesions are usually discovered incidentally during the imaging workup for chronic neck pain. Cervical spine radiographs typically demonstrate an indeterminate osteolytic lesion that is worrisome for neoplasm. The subaxial cervical spine, specifically the C4–7 vertebral bodies, is more commonly affected. Lesions are often eccentric, involving the posterior and lateral region of the vertebral body. In our review of the literature, 14 cases, including this case, of intravertebral pneumatocysts have been reported, including 10 cases in the cervical spine (71%), 1 in the thoracic spine, and 3 cases in the lumbar spine.1,5 Nine (90%) of the 10 cervical spine cases involved the vertebral body, and 1 of these was located in the lateral mass of the cervical spine. Five cervical pneumatocysts were similar to the lesion in our case and were located in the C-5 (55%), 2 in the C-6 vertebra, and 1 each in a C-4 and C-7 vertebra.1,2,4–7,9–12 Seven (70%) of the 10 cervical pneumatocysts had no communication with the adjacent intervertebral disc or the spinal canal based on imaging.1,2,4–7,9–11,12 In contrast, 2 cervical pneumatocysts had communication with the spinal canal, and 2 lesions had communication with a degenerated intervertebral disc.1,4,6,10 It is important also to mention the 1996 report by Laufer et al.7 on 4 cases of intravertebral pneumatocysts. Their 4 cases were different from the aforementioned 10 cases as the age of the patients ranged from 30 to 40 years, making them younger than individuals in the other reported cases. Additionally, the size of their lesions was smaller, at 2–5 mm in diameter, than that of the lesions in the aforementioned 10 cases (> 5 mm in diameter).5 Furthermore, in Laufer and colleagues’ 4 patients, there was no evidence of degenerative spinal disease. Therefore, it is important to recognize the possibility of 2 types of intravertebral stability because some pneumatocysts have been reported to enlarge over time. In contrast, some pneumatocysts can also spontaneously evolve to become fluid-filled cysts that subsequently may be replaced by granulation tissue. Our thought was that surgery would be indicated if the lesion increased in size or threatened pathological fracture of the vertebra, resulting in neck symptoms or instability. Surgery would likely include anterior corpectomy and discectomies of the involved segment, structural graft placement, and anterior instrumented fusion involving plate/screw fixation. Splinting was used to treat the patient’s carpal tunnel syndrome. A 6-month follow-up MR imaging study did not show any change in the lesion.

Discussion

We have described the case of a patient with a large intraosseous pneumatocyst of the cervical spine. This gas-containing lesion is rare and often benign. Clinically, we did not think that the pneumatocyst was causing the patient’s neck pain. The patient had advanced cervical degenerative arthritis and multilevel degenerative disc disease that was the probable cause of her presenting symptoms.

Pneumatocysts are most often identified in the bones adjacent to the sacroiliac joints where they are associated with degenerative arthritis.3,12 Pneumatocysts in the cervical spine are usually discovered incidentally in the 5th and 6th decades of life, when they are also seen in association with degenerative arthritis.12 The lesions are usually discovered incidentally during the imaging workup for chronic neck pain. Cervical spine radiographs typically demonstrate an indeterminate osteolytic lesion that is worrisome for neoplasm. The subaxial cervical spine, specifically the C4–7 vertebral bodies, is more commonly affected. Lesions are often eccentric, involving the posterior and lateral region of the vertebral body. In our review of the literature, 14 cases, including this case, of intravertebral pneumatocysts have been reported, including 10 cases in the cervical spine (71%), 1 in the thoracic spine, and 3 cases in the lumbar spine.1,5 Nine (90%) of the 10 cervical spine cases involved the vertebral body, and 1 of these was located in the lateral mass of the cervical spine. Five cervical pneumatocysts were similar to the lesion in our case and were located in the C-5 (55%), 2 in the C-6 vertebra, and 1 each in a C-4 and C-7 vertebra.1,2,4–7,9–12 Seven (70%) of the 10 cervical pneumatocysts had no communication with the adjacent intervertebral disc or the spinal canal based on imaging.1,2,4–7,9–11,12 In contrast, 2 cervical pneumatocysts had communication with the spinal canal, and 2 lesions had communication with a degenerated intervertebral disc.1,4,6,10 It is important also to mention the 1996 report by Laufer et al.7 on 4 cases of intravertebral pneumatocysts. Their 4 cases were different from the aforementioned 10 cases as the age of the patients ranged from 30 to 40 years, making them younger than individuals in the other reported cases. Additionally, the size of their lesions was smaller, at 2–5 mm in diameter, than that of the lesions in the aforementioned 10 cases (> 5 mm in diameter).5 Furthermore, in Laufer and colleagues’ 4 patients, there was no evidence of degenerative spinal disease. Therefore, it is important to recognize the possibility of 2 types of intravertebral

Fig. 1. Lateral cervical spine radiograph demonstrating a lytic lesion in the body of C-5 vertebra that had appeared on CT and MR imaging to represent a pneumatocyst.
pneumatocysts: smaller lesions in younger patients without degenerative arthritis in the spine and larger lesions in older patients seen in association with degenerative arthritis of the spine.\textsuperscript{5,7} It is possible that the patients reported by Laufer et al. were simply diagnosed at an earlier age than those in the other reports, and being younger in age, had not yet developed the degenerative changes seen in the older cohort.

Computed tomography scanning is the most accurate and sensitive diagnostic imaging modality for intraosseous pneumatocysts. On CT, pneumatocysts demonstrate attenuation that ranges from $-950$ to $-580$ HUs.\textsuperscript{2,3,10,12} It is the latter feature that excludes the diagnosis of other benign and malignant neoplasms and enables an accurate diagnosis of a pneumatocyst to be made with confidence.

The lesions have nearly diagnostic features on MR imaging, exhibiting markedly low signal intensity on T1- and T2-weighted images. The low signal seen with air or gas on T1- and T2-weighted images is more suggestive of a signal void than tissue that has low signal intensity due to fibrosis, hemosiderin, or dense mineralization. The absence of enhancement with CT and MR imaging confirms the cystic nature of the lesion.

The gas is mainly nitrogen in composition. Additionally, gas in soft tissue and bone can sometimes be ominous indicators of infection or necrosis; fortunately, this is not the case with pneumatocysts.\textsuperscript{12} With regard to the origin of pneumatocysts, gas is sometimes seen as part of a vacuum–degenerative disc phenomenon. Some have conjectured that the gas from the disc becomes entrapped

\begin{figure}[ht]
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\includegraphics[width=\textwidth]{image1}
\caption{Computed tomography studies. Coronal (A) and sagittal (B) images of the cervical spine showing a well-circumscribed lobulated lesion, eccentric to the right (A), in the body of C-5, with air attenuation compatible with a pneumatocyst, and an axial image (C) demonstrating the eccentric position of the pneumatocyst on the right in the C-5 vertebra.}
\end{figure}

\begin{figure}[ht]
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\includegraphics[width=\textwidth]{image2}
\caption{Sagittal T1-weighted (A) and T2-weighted (B) MR images showing the pneumatocyst in the C-5 vertebral body as a lesion with marked low signal intensity. Axial T2-weighted (C) and FIESTA (D) MR images of pneumatocyst eccentric to the right of the C-5 vertebra.}
\end{figure}
Cervical spine pneumatocyst

intraosseously due to degenerative erosion of the adjacent vertebral endplate. Other authors have proposed that the gas originates in joint complexes in the spine. The natural history of cervical pneumatocysts is usually benign and surgical intervention is typically not required. Often they remain stable radiologically. Of the 14 reported cases of cervical pneumatocysts, only 4 (28%) have exhibited imaging changes over time. Two of the intravertebral pneumatocysts evolved to fluid-filled cysts within 16 months of being discovered. In a 3rd case the lesion changed to a fluid-filled cyst that subsequently appeared to be replaced with granulation tissue on MR imaging at the 40-week follow-up evaluation. This case was thought to exhibit change due to pressure changes between the bone marrow and the pneumatocyst. The 4th case initially involved the C-5 vertebra and enlarged to involve the adjacent area below the disc space. The C-6 vertebra and later the C-7 vertebra were found to be involved by pneumatocysts 15 months after the initial diagnosis of the C-5 pneumatocyst. To our knowledge, there has not been a reported case of a cervical pneumatocyst requiring surgical intervention.

In our case, sequential imaging allowed us to determine that the lesion had not changed significantly over a 3-year interval. The stability of the lesion over this time period provided insight into the behavior of these often innocuous lesions. The patient’s age and lesion size were typical for the larger cervical pneumatocysts reported in the literature. In our patient the pneumatocyst did not communicate with the adjacent disc complex or spinal canal; it correlated with the many pneumatocysts reported in the literature that failed to demonstrate these communications. To ensure that the pneumatocyst continues to demonstrate behavior typical for most cervical pneumatocysts, the patient will undergo repeated MR imaging this year.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Krauss, Hoover, Wenger. Analysis and interpretation of data: Krauss. Drafting the article: Krauss, Hoover. Critically revising the article: all authors. Administrative/technical/material support: Hoover.

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