Cervical juxtafacet cyst after anterior cervical discectomy and fusion

Case report

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Anterior cervical discectomy and fusion (ACDF) is a common neurosurgical procedure, and the benefits, long-term outcomes, and complications are well described in the literature. The development of a juxtafacet joint cyst resulting in radiculopathy is a rare outcome after ACDF and merits further description. The authors describe a patient in whom a juxtafacet joint cyst developed after ACDF procedures, resulting in surgical intervention. When a juxtafacet joint cyst develops after ACDF, symptoms can include radiculopathy, neck pain, and neurological symptoms such as paresthesias and motor weakness. The presence of a juxtafacet joint cyst implies instability in that region of the spine. Patients with this pathological entity may require decompression of neural elements and fusion across the segment involved with the cyst. (DOI: 10.3171/2011.8.FOCUS11119)

Key Words • cervical juxtafacet cyst • anterior cervical discectomy and fusion • synovial facet joint cyst • transitional syndrome • adjacent-segment disease • spinal cord

The term “juxtafacet cyst” was coined by Kao et al.28 in 1974 to describe a cyst arising from the joint capsule of a spinal facet joint. Although this is a rare pathological condition, juxtafacet cysts can be a cause of significant morbidity. Cysts arising in this location can be classified histologically either as synovial cysts, containing a true synovial lining, or as ganglion cysts, implying an absence of the synovial lining.5 These cysts can cause myelopathy, radiculopathy, and neck pain because of mass effect on the spinal cord or nerve root compression.5 These extradural cysts are almost exclusively found in the lumbar spine, with only 37 cases identified as occurring in the cervical spine from a variety of causes.12,6–8,11,14,16,19,20,23,26,27,29,31,35–40,43,45–49,51–53

Over the last 2 decades, ACDF has become one of the most common neurosurgical procedures. As spinal hardware has improved and as literature on this topic has mounted, the techniques for the procedure have changed, and ACDFs incorporating more segments can now be performed.17 Although reported complications from these procedures are uncommon and typically minor, both short- and long-term adverse events have been described. Long-term follow-up of patients indicates that symptomatic ASD is a potential sequela of long-segment ACDF.25 Symptomatic ASD rates are typically reported to range from 7% to 19% after up to 10 years of monitoring.24,32 When patients without symptoms are included, postoperative degenerative changes at adjacent segments can be identified radiographically in 50%–60% of patients by the 4-year follow-up.22,23,50 Juxtafacet cysts in the cervical region at a segment adjacent to a spinal fusion construct probably represent one form of ASD. We present a case of juxtafacet cyst causing symptomatic ASD at the cervicothoracic junction after long-segment ACDF.

Case Report

History and Examination. This 67-year-old woman with a history of breast carcinoma presented to our spine tumor clinic due to 6 months of intense tingling accompanied by occasional numbness overlying the fourth and fifth digits of her left hand. There were instances in which this tingling became painful and pressure-like. Of note, she had been involved in a motor vehicle accident 15 years...
earlier that had required a C4–7 anterior decompression and interbody bone graft fusion. On examination, motor strength was decreased in her left upper extremity, specifically her grip. Imaging revealed a facet joint cyst causing compression of the thecal sac on the left side and C-8 root impingement (Fig. 1).

Operation and Postoperative Course. The patient underwent a C7–T1 hemilaminectomy, partial facetectomy, and posterior segmental fixation of C5–T2 with placement of autologous graft. Intraoperatively, the lesion was found to be densely adherent to the dura mater and was sharply dissected from the C-8 nerve root. Pathological analysis confirmed reactive synovium-lined connective tissue consistent with synovial cyst. Postoperatively, the patient’s condition improved rapidly. At the 1-month follow-up visit, her arm symptoms had completely resolved, and she had regained full strength in her left upper extremity. At 6 months after surgery, she continued to be free of neurological symptoms.

Discussion

Juxtafacet cysts, either synovial or ganglion cysts, although common in many joint and tendon sheaths in the body, are relatively uncommon in the spine. Most occur within the thoracic and lumbar spine, with far fewer occurring in the cervical region.47 Only 37 cases of cervical juxtafacet joint cysts have been reported previously in the literature (Table 1).

In a case report and literature review published in 1999, Lunardi et al.31 presented theories regarding the cause of juxtafacet cysts of the spine. Various authors have proposed that the genesis of these cysts may involve degeneration, inflammation, congenital defects, and trauma. Although occasional reports have appeared stating that hemosiderin deposits, indicating old hemorrhage, have been found within these cysts on pathological evaluation, trauma is not believed to be a primary cause.18,44 Additionally, rare reports document synovial cysts arising at periartricular fibroconnective tissue in patients with rheumatoid arthritis, which supports an inflammatory or congenital cause.18 Numerous authors, however, endorse the idea that synovial cysts are the result of increased movement at the spinal synovial joint and of subsequent degeneration and cyst formation of the synovium.31,41,44 Although several factors may play a role in the progression of this disease, our case provides further evidence for the degenerative model of synovial cyst formation.

The ACDF procedure has become one of the most common operations for cervical radiculopathy or myelopathy in patients in whom conservative treatment has failed. Since the operation was first described by Cloward10 in 1958, the rates of arthrodesis and positive clinical outcome have significantly improved for single-level procedures, with refinements in plating systems resulting in improved multilevel outcomes. Success rates of this procedure have been cited as high as 95%.3

In the immediate period after ACDF, postoperative dysphagia, postoperative hematoma, recurrent laryngeal nerve injury, arterial dissection, esophageal perforation, spinal cord contusion, and persistent postoperative pain are all known to occur. With the increased use of this procedure, however, long-term complications have also become clearly evident. Signs of radiculopathy or myelopathy that can be attributed to the segment adjacent to a previous spinal arthrodesis are referred to as ASD or transitional syndrome. There has been a significant increase in the incidence of this condition during the past 50 years, probably stemming from the increased

Fig. 1. Magnetic resonance imaging of a juxtafacet cyst. Sagittal T1-weighted (A) and T2-weighted (B) MR images of the cervical spine showing a circular lesion along the posterolateral aspect of the spinal canal. Axial images obtained without contrast (C–E) illustrate compression of the left C-8 nerve root by the cyst.
TABLE 1: Literature review of cases of juxtafacet joint cysts of the cervical spine*

<table>
<thead>
<tr>
<th>Authors &amp; Year</th>
<th>No. of Pts</th>
<th>Age (yrs), Sex</th>
<th>Level</th>
<th>Clinical Manifestation</th>
<th>Neuro Study</th>
<th>Findings</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aksoy &amp; Gomori, 2000</td>
<td>1</td>
<td>61, M</td>
<td>C1–2</td>
<td>M, R</td>
<td>MRI</td>
<td>C-2: cyst extension, cord compression</td>
<td>C1–2: laminectomy &amp; ant fusion</td>
</tr>
<tr>
<td>Birch et al., 1996</td>
<td>1</td>
<td>85, M</td>
<td>C1–2</td>
<td>M, R</td>
<td>MRI</td>
<td>dens: extradural mass, no cord compression</td>
<td>dens: transoral decompression; C1–2: fusion</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>84, F</td>
<td>C1–2</td>
<td>M, R</td>
<td>MRI</td>
<td>dens: extradural mass, cord compression</td>
<td>C1–2: hemilaminectomy</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>60, F</td>
<td>C1–2</td>
<td>M, R</td>
<td>MRI</td>
<td>dens: extradural mass, cord compression</td>
<td>C1–2: hemilaminectomy</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>78, F</td>
<td>C1–2</td>
<td>M, R</td>
<td>MRI</td>
<td>dens: extradural mass, cord compression</td>
<td>observation</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>68, F</td>
<td>C1–2</td>
<td>M, R</td>
<td>CT, MRI</td>
<td>dens: extradural mass, cord compression</td>
<td>dens: transoral decompression; C1–2: fusion</td>
</tr>
<tr>
<td>Cartwright et al., 1985</td>
<td>1</td>
<td>41, M</td>
<td>C7–T1</td>
<td>M</td>
<td>CT</td>
<td>C7–T1: midsagittal narrowing of cervical canal</td>
<td>C6–T1: decompressive laminectomy</td>
</tr>
<tr>
<td>Cho et al., 2004</td>
<td>1</td>
<td>80, M</td>
<td>C7–T1</td>
<td>M, R</td>
<td>MRI</td>
<td>C7–T1: mass w/ neuraxial structure compression</td>
<td>C-7: laminectomy</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>84, M</td>
<td>C7–T1</td>
<td>M, R</td>
<td>MRI</td>
<td>dens: large mass, cord compression</td>
<td>C-1: laminectomy</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>60, F</td>
<td>C7–T1</td>
<td>M, R</td>
<td>MRI</td>
<td>dens: large mass, cord compression</td>
<td>C-7: rt hemilaminectomy; C6–T1: partial laminectomy</td>
</tr>
<tr>
<td>Epstein &amp; Hollingsworth, 1993</td>
<td>1</td>
<td>47, M</td>
<td>C7–T1</td>
<td>M, R</td>
<td>CT, MRI, myelo</td>
<td>C7–T1: ovoid soft-tissue mass, cord compression</td>
<td>C7–T1: hemilaminectomy</td>
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<tr>
<td>Fonoff et al., 2004</td>
<td>1</td>
<td>64, M</td>
<td>C3–4</td>
<td>M, R</td>
<td>CT, MRI</td>
<td>C3–4: calcified lesion, severe cord compression</td>
<td>C-3: pst hemilaminectomy</td>
</tr>
<tr>
<td>Fransen et al., 1997</td>
<td>1</td>
<td>75, F</td>
<td>dens</td>
<td>M, R</td>
<td>MRI</td>
<td>dens: cystic mass, cord compression</td>
<td>C1–2: pst hemilaminectomy, suboccipital hemi craniectomy</td>
</tr>
<tr>
<td>Freidberg et al., 1994</td>
<td>1</td>
<td>NR</td>
<td>C7–T1</td>
<td>M</td>
<td>MRI</td>
<td></td>
<td></td>
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<tr>
<td>Goffin et al., 1992</td>
<td>1</td>
<td>65, M</td>
<td>C1–2</td>
<td>M, R</td>
<td>CT, myelo</td>
<td>soft-tissue mass, cord compression</td>
<td>C1–2: laminectomy</td>
</tr>
<tr>
<td>Jost et al., 2003</td>
<td>1</td>
<td>72, F</td>
<td>C6–7</td>
<td>R</td>
<td>MRI</td>
<td>C-6: cystic lesion, no cord compression</td>
<td>C-5/6 &amp; C-6/7: ant discectomy; C-6: hemi corpectomy; C5–7: ant fusion</td>
</tr>
<tr>
<td>Kao et al., 1974</td>
<td>1</td>
<td>52, M</td>
<td>C6–7</td>
<td>R</td>
<td>myelo</td>
<td>C-7: nerve root sleeve defect</td>
<td>C6–7: hemilaminectomy</td>
</tr>
<tr>
<td>Kaiser &amp; Holland, 1998</td>
<td>1</td>
<td>74, M</td>
<td>C4–5</td>
<td>R</td>
<td>CT</td>
<td>C-5: epidural mass</td>
<td>C4–5: laminectomy</td>
</tr>
<tr>
<td>Kotilainen &amp; Marttila, 1997</td>
<td>1</td>
<td>64, M</td>
<td>C7–T1</td>
<td>M</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunardi et al., 1999</td>
<td>1</td>
<td>58, M</td>
<td>C7–T1</td>
<td>M</td>
<td>CT, MRI</td>
<td>C7–T1: hypodense cystic lesion, neuraxial structure compression</td>
<td>C7–T1: laminectomy</td>
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<tr>
<td>Miller et al., 1989</td>
<td>1</td>
<td>67, F</td>
<td>C1–2</td>
<td>M, R</td>
<td>CT, myelo</td>
<td>C1–2: anterolateral mass, cord compression</td>
<td>C1–2: laminectomy, removal of foramen magnum rim</td>
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<tr>
<td>Miwa et al., 2004</td>
<td>1</td>
<td>74, F</td>
<td>C7–T1</td>
<td>M</td>
<td>MRI</td>
<td>C7–T1: cystic lesion, mild cord compression</td>
<td>C7–T1: hemilaminectomy</td>
</tr>
<tr>
<td>Morio et al., 2003</td>
<td>1</td>
<td>71, F</td>
<td>C1–2</td>
<td>M, R</td>
<td>MRI</td>
<td>dens: large cystic mass, cord compression</td>
<td>C1–2: pst fusion</td>
</tr>
<tr>
<td>Nijensohn et al., 1990</td>
<td>1</td>
<td>58, M</td>
<td>C4–5</td>
<td>M, R</td>
<td>CT, myelo, MRI</td>
<td>C5–6: calcified extradural lesion, cord compression</td>
<td>C-5: decompression; C4–6: pst fusion</td>
</tr>
<tr>
<td>Okamoto et al., 2004</td>
<td>1</td>
<td>72, M</td>
<td>C1–2</td>
<td>M, R</td>
<td>MRI</td>
<td>C1–2: large cystic mass, cord compression</td>
<td>C1–2: hemilaminectomy, pst fusion</td>
</tr>
<tr>
<td>Onofrio &amp; Mih, 1988</td>
<td>1</td>
<td>73, M</td>
<td>C1–2</td>
<td>M, R</td>
<td>CT, myelo</td>
<td>upper cervical cord lesion</td>
<td>C1–2: laminectomy, suboccipital craniectomy</td>
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<tr>
<td>Patel &amp; Sanders, 1988</td>
<td>1</td>
<td>42, F</td>
<td>C4–5</td>
<td>R</td>
<td>stratigraphy</td>
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<td>Quaghebeur &amp; Jeffree, 1992</td>
<td>1</td>
<td>82, M</td>
<td>C1–2</td>
<td>M</td>
<td>CT, myelo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shima et al., 2002</td>
<td>3</td>
<td>66, M/68, M/72, F</td>
<td>C7–T1</td>
<td>M/R/M</td>
<td>CT/myelo/MRI</td>
<td>C7–T1: extradural cystic mass</td>
<td>C7–T1 laminectomy/C7-7 laminectomy/C7-7 laminectomy</td>
</tr>
</tbody>
</table>

(continued)
number of radiographic studies, more uniform use of the procedure, and longer survival times for its patients.\textsuperscript{42} Adjacent-segment disease has been shown in retrospective analysis to be present radiographically in upwards of 60\% of patients.\textsuperscript{25} Specifically related to ACDF, Baba et al.\textsuperscript{4} noted progressive spinal stenosis in 25\% of patients who received the procedure over an average of 8.5 years, whereas Goffin et al.\textsuperscript{21} noted an incidence of radiographically apparent adjacent-segment degeneration in 92\% of patients at a minimum 5-years follow-up. The majority of these patients, however, were not symptomatic; only 6\% required repeat operation.

The cause of ASD is still debatable; however, there are ample data suggesting that biomechanical alterations as a result of cervical fusion contribute to its pathophysiology. Studies using radiography, fluoroscopy, or biomechanical testing have demonstrated increases in motion immediately adjacent to fixation levels.\textsuperscript{4,12,15} In addition, cadaveric specimens, flexion-extension films, and finite-element analysis have all alluded to increased strain on motion segments in proximity to sites of arthrodiesis.\textsuperscript{13,33,34} Under even normal circumstances, chronic exposure of these motion segments to increased stress and load may result in their progressive degeneration, failure, and symptomatic disease.

In the case we describe, the juxtafacet cyst found after a previous long-segment ACDF probably represents a form of ASD. Interestingly, it was located at the cervicothoracic junction, which represents a significant zone of stress between the mobile cervical spine and the fixed thoracic spine, as well as a location where cervical lordosis transitions to thoracic kyphosis. After long-segment cervical fusion, the range of motion of the cervical spine becomes noticeably restricted. As a result, over the course of several years, there is increased movement at the spinal segments adjacent to the fusion and disproportionate subsequent degeneration of the respective facet joint synovium. Cyst formation represents a possible sequela of this chronic process.

\textbf{Conclusions}

Improvements in spinal stability technology, surgical experience, and surgical technique continue to lead to increased use of ACDF, with better clinical outcomes. Longer subsequent follow-up will probably reveal a higher rate of ASD, which can present as spinal canal stenosis, osteophytes, disc degeneration, and, as described, juxtafacet cysts. Although rare, these cysts can be a cause of significant morbidity, and should be considered in patients who have had previous spine surgery and present with recurrent symptoms. If the cyst is discovered and its components can be completely removed during surgery, patients appear to achieve a progression-free postoperative course. Further study will be needed to elucidate the factors important for cyst development.

\textbf{Disclosure}

The authors do not report any conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.
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Author contributions to the study and manuscript preparation include the following. Conception and design: all authors. Acquisition of data: all authors. Analysis and interpretation of data: Sivakumar, Elder. Drafting the article: all authors. Critically revising the article: all authors. Reviewed submitted version of manuscript: Sivakumar, Elder. Approved the final version of the manuscript on behalf of all authors: Bilsky. Study supervision: Bilsky.

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