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C4 Radiculopathy without Myelopathy

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Abstract

A radiculopathy above C3-C4 level without myelopathy is rare and difficult to diagnose on physical examination and radiologic findings. We report these three C4 radiculopathy without myelopathy, and discuss clinical manifestations and treatment strategy. The first case was a 50-year-old male patient with a 3-week history of persistent pain and severe allodynia in the distribution of the left posterior neck and anterior chest wall area who had no specific trauma history. The second was a 65-year-old female with vague and intermittent shock-like pain in the right posterior neck after traffic accident. The third was a 63-year-old female with tingling sensation and paresthesia in the right posterior neck area who had an underlying cervical dystonia during one year. On physical examination, all patients had no specific motor weakness in the limbs and no upper motor neuron signs. But, the second case showed a suspicious asymmetry of diaphragm. All patients revealed abnormal sensory test findings such as allodynia, hypoesthesia, or dysesthesia on light touch and pin prick in C3-C4 dermatomal area. The plain radiographs and magnetic resonance imaging (MRI) of the cervical spine of all patients showed C3-C4 neural foraminal stenosis and no evidence of cervical spinal cord compression suggesting isolated C4 radiculopathy without myelopathy. Two patients had good results with conservative management, and one patient had an anterior cervical disc discectomy and fusion.

Key Words : Cervical spine, Diaphragm, Radiculopathy

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Introduction

Cervical radiculopathy is a pathological process involving the cervical nerve root [1]. The common cause of cervical radiculopathy is foraminal encroachment of the spinal nerve due to herniation of the nucleus pulposus and a combination of factors, including decreased disc height and degenerative changes of the uncovertebral and zygapophyseal joints [2]. The most commonly affected nerve root is C7 with an incidence approximating 31-81% of all cervical radiculopathies [3]. The next commonly involved nerve roots are C6, C8, and C5 [3]. Cervical nerve roots from C3 and C4 are uncommonly involved although there can exist C3 or C4 radiculopathy associated with cervical spondylotic myelopathy in which usually demonstrates multilevel spondylosis and upper motor neuron signs [4]. C4 radicular symptoms usually radiate to the posterior neck region. Also the axial neck pain due to degenerative disc disease also is similar to C4 radicular pain. We report three cases of C4 radiculopathy that had no symptoms or signs of myelopathy and discuss the differential diagnosis between C4 radiculopathy and axial pain due to degenerative disc disease.

Case Reports

Case 1.

A 50-year-old male patient was referred for 3 weeks history of unexplained posterior neck pain radiating to the superior aspect of the trapezial area and very severe allodynia in the distribution of the left upper trapezius region and anterior chest wall. He could not put on even loose-fitting underwear or shirt as well as tight one because they irritated his skin. He had no history of previous illness including upper extremity trauma or surgery. On physical examination, he had no subjective and objective weakness. Sensory tests revealed severe allodynia on light touch and hyperesthesia on pin prick in left C3-C4 dermatomal area. Neck and radiating pain was exacerbated by neck extension. Cervical myelopathic symptoms and signs like as gait disturbance, voiding difficulty, Hoffman sign, Babinski sign, ankle clonus and spasticity were absent.

Plains of cervical spine showed enlargement of lateral mass and foraminal stenosis at left C3-C4 level (Fig. 1A). The magnetic resonance imaging (MRI) of the cervical spine revealed osteophytes of uncovertebral and zygapophyseal joint at the left C3-C4 which lead to stenosis of left C3-C4 neural foramen and compression of the C4 root (Fig. 1B). There showed no abnormal findings like compression or signal change of cervical spinal cord (Fig. 1C).

Needle electromyography at diaphragm showed no abnormal spontaneous activity, but polyphasic and long duration motor unit action potentials (MUAP) suggestive of chronic neural remodeling process after nerve axonal damage were suspicious. There was abnormal spontaneous activity in left C3-C4 paraspinalis. Given clinical manifestations, radiologic findings, and electrodiagnostic study, a diagnosis of left C4 radiculopathy was made. Conservative management with physiotherapy, analgesic agents and C4 transforaminal epidural steroid injection was not effective. We administrated a short course of prednisone that started at a dose of 60 mg per day for three days and decreasing by 10 mg every other day. After treatment for 14 days, severe allodynia at C3-C4 dermatomal area was near completely disappeared although mild numbness at same area and neck axial pain was tolerably

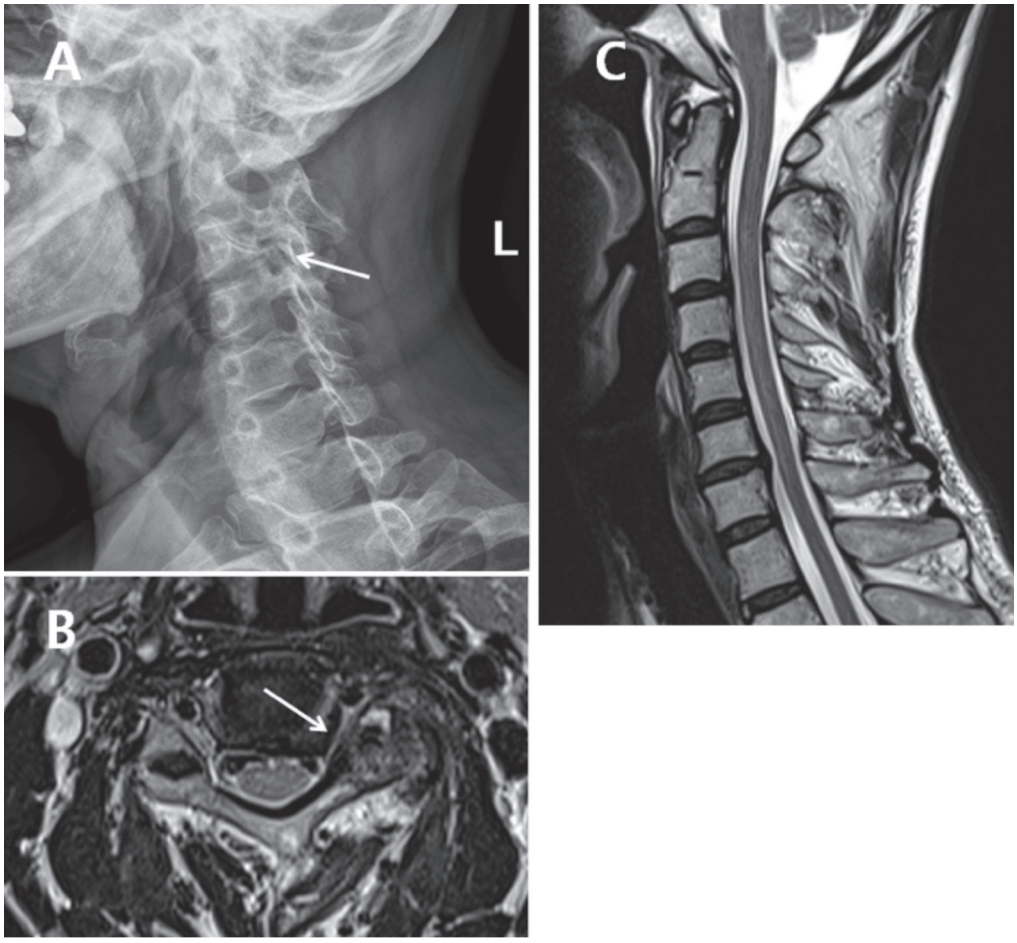

Fig. 1. (A) Oblique view of cervical spine plain shows foraminal stenosis (arrow) at left C3-4 level. (B) Axial T2-weighted MR image shows foraminal stenosis (arrow) and facet hypertrophy at left C3-4 level. (C) Sagital T2 weighted MR image shows no cervical cord compression.

remained. He never complained of C3-C4 radicular pain and allodynia at follow-up 12 months later.

Case 2.

A 65-year-old female experienced intermittent shock-like pain in the upper trapezius and posterior neck area for 2 months after traffic accident. She had experienced mild discomfort at posterior neck area before the accident. Neurologic examination disclosed hypoesthesia on pin prick in the right C4 dermatome area. The patient did not show motor weakness and upper motor neuron sign. Cervical plain showed mild spondylotic change and right C3-4 foraminal stenosis (Fig. 2A). The MRI of cervical spine also revealed right C3-C4 neural foramen and compression of the C4 root (Fig. 2B), but did not show cervical cord compression (Fig. 2C). Needle electromyography at diaphragm and C4 paraspinalis showed abnormal spontaneous activity suggestive of axonal damage of C4 spinal nerve. Also on the chest X-ray, an asymmetry of diaphragm level was suspicious (Fig. 2D). Despite

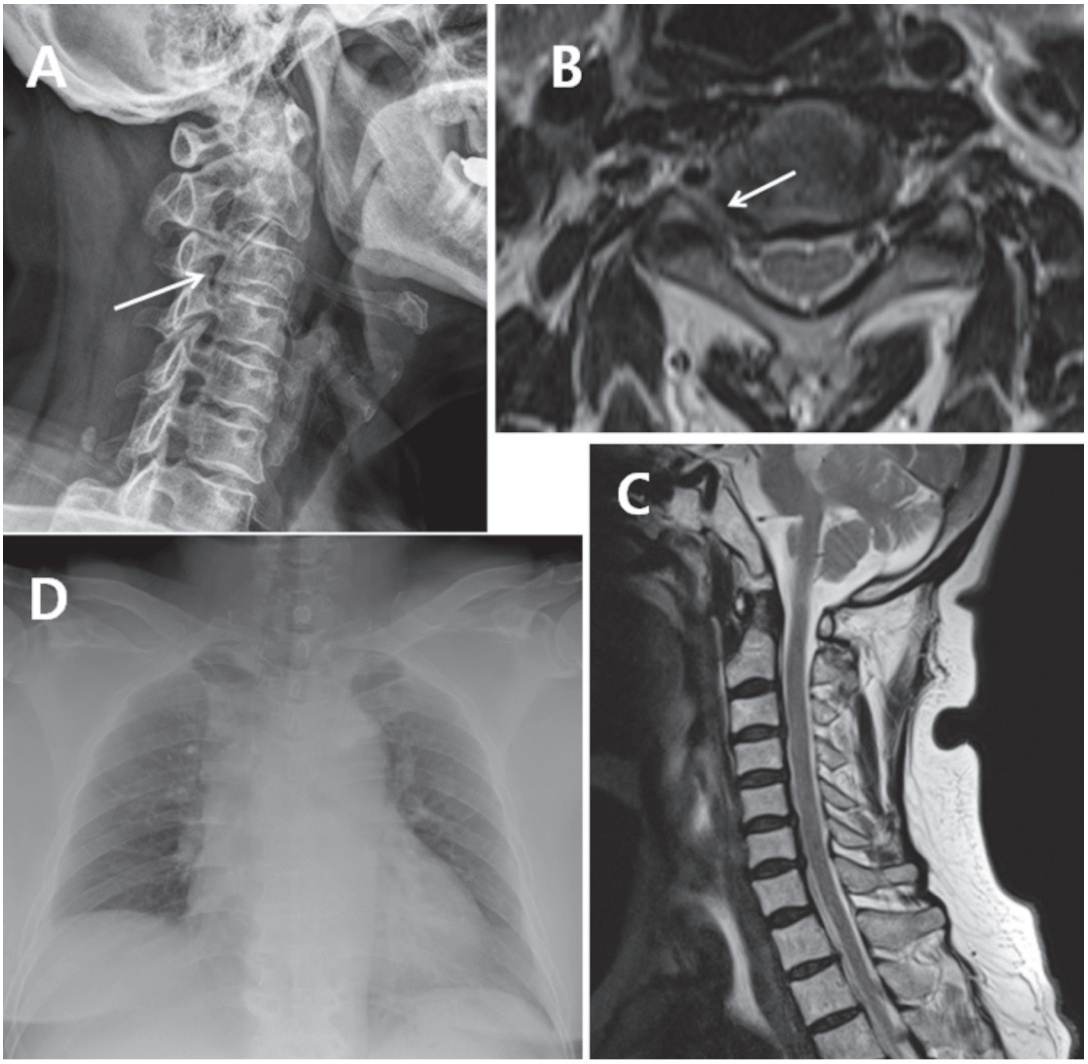

Fig. 2. (A) Oblique view of cervical spine plain shows foraminal stenosis (arrow) at right C3-4 level. (B) Axial T2-weighted MR image shows foraminal stenosis (arrow) at right C3-4 level. (C) Sagital T2 weighted MR image shows no cervical cord compression. (D) On the chest X-ray, an asymmetry of diaphragm level is suspicious.

of the conservative management and epidural steroid injection, the results were not satisfactory. Thus, an anterior cervical disectomy and fusion was performed and the clinical graded outcome at follow-up was excellent.

Case 3.

A 63-year-old female complained of tingling sensation and abnormal sensation in the right scapular spine area for 6 months. She had an underlying cervical dystonia which led to involuntary abnormal neck movement. Neurologic examination revealed paresthesia on pin prick and light touch in the right C4 dermatome area. The patient did not show motor weakness and upper motor neuron sign. Cervical plain showed right C3-4 foraminal stenosis with the hypertrophy of

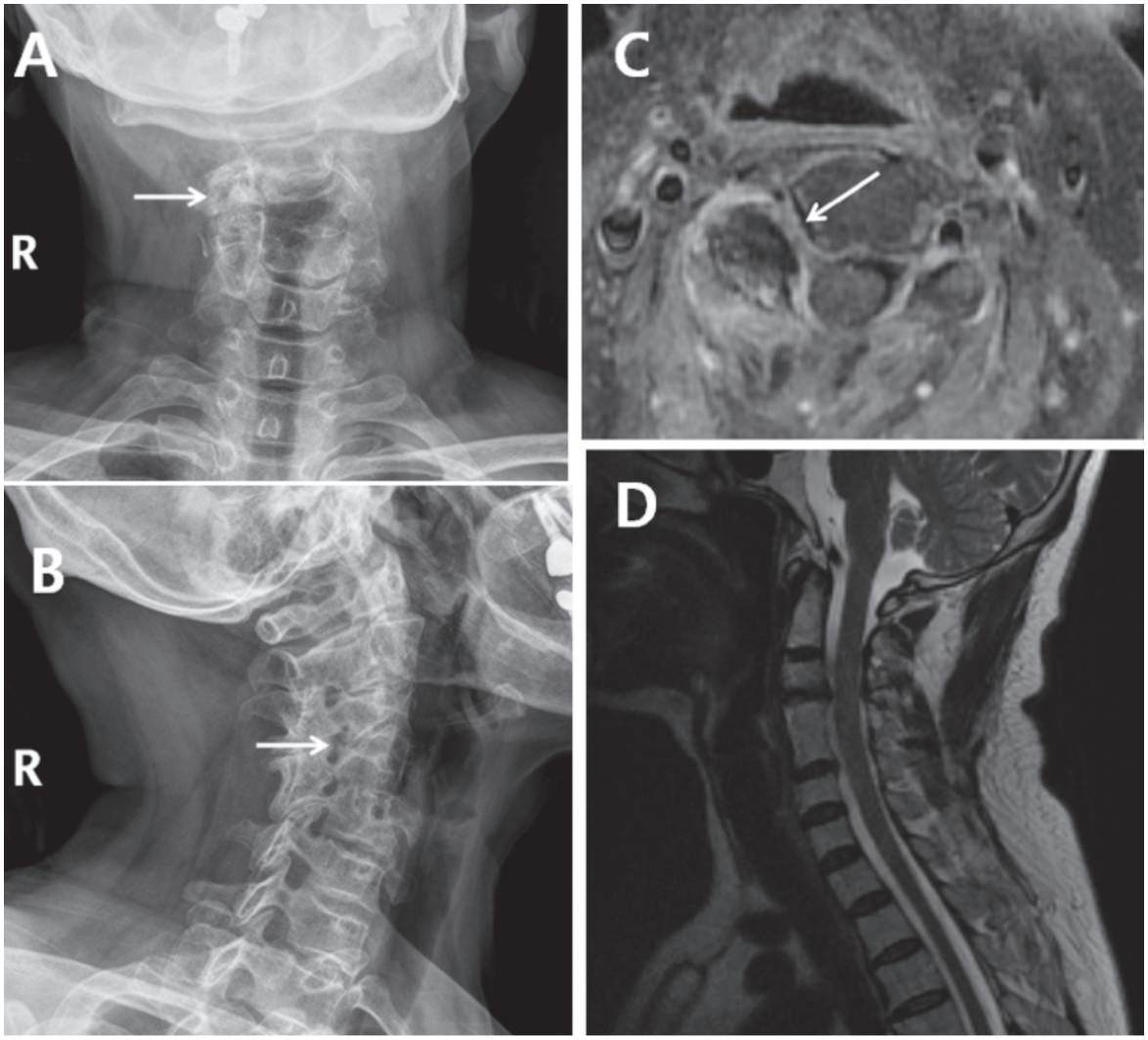

Fig. 3. (A) Anteroposterior view of cervical spine shows the hypertrophy of right lateral mass (arrow). (B) Oblique view of cervical spine plain shows right C3-4 foraminal stenosis (arrow) and C4-5 block vertebrae. (C) Axial T1-weighted MR image shows foraminal stenosis (arrow) and facet hypertrophy at right C3-4 level. (D) Sagital T2 weighted MR image shows no cervical cord compression.

lateral mass and C4-5 block vertebrae (Fig. 3A, B). The cervical spine MRI revealed osteophytes of uncovertebral and zygapophyseal joint at the right C3-C4 which lead to compression of the C4 root (Fig. 3C), but did not show cervical cord compression (Fig. 3D). Electrodiagnostic studies were normal. Also the chest X-ray showed symmetric diaphragm level. With an epidural steroid injection, the clinical outcome at follow-up was good.

Discussion

Upper most cervical radiculopathy without myelopathy above C3-C4 level is rarely discussed because of its rarity and ambiguity of diagosis [5-7]. The common levels of cervical radiculopathy

owing to disc herniation are C5-C6 and C6-C7 [2]. Rarely cervical radiculopathy due to disc herniation above C3-C4 occurs [5]. In cervical spondylotic myelopathy, referred pain into the upper cervical dermatome can exist if the upper cervical nerve roots and/or spinal cord are affected [8]. Usually patients with upper cervical radicular pain in cervical spondylosis have combined multilevel degeneration of uncovertebral and/or zygapophyseal joint and compression of cervical spinal cord. The most common level of involvement of cervical spondylosis was C5-C6, then in decreasing order of frequency, C6-C7, C4-C5, C3-C4, and C2-C3 [8]. Thus upper cervical radicular pain in cervical spondylotic myelopathy is frequently accompanied with contralateral radicular pain, other dermatomal pain and neurologic dysfunction of the extremities, torso and sphincter. Our cases with radicular pain and abnormal sensory change at C4 dermatome demonstrated osteophyte of uncovertebral joint and hypertrophy of zygapophyseal joint at mainly C3-C4 level. Upper cervical disc hernation being able to cause radicular pain, cord compression, and multilevel cervical spondylosis were not present.

Clinical manifestations secondary to radiculopathy of the upper cervical nerve roots is rarely discussed in the literature. A radiculopathy above C3-C4 level is difficult to identify on clinical examination because there are lack of key muscles being tested for the strength and reflex and upper cervical dermatomes are unfamiliar and ambiguously demarcated [2]. Pain along the dorsal aspect, lateral aspect or base of the neck with radiating pain to the superior aspect of the shoulder and posteriorly to the scapular can be main symptoms of a C4 radiculopathy [4]. All our cases complained of pain or discomfort over these areas. But, these are not specific findings because axial neck pain owing to degenerative disc disease or zygapophyseal osteoarthritis can mimic upper cervical radicular pain [9]. Imaging studies including plain radiographs, MRI and computed tomography can help distinguishing axial neck pain and radicular neck pain. The latter may demonstrate nerve root compression at the C3-C4 level. Also it is more common that radiographic studies show multiple neural foraminal stenosis rather than single C3-C4 stenosis. Thus, clinically neck and arm pain combined with radiculopathy of the C5 to C8 roots may be more commonly present rather than radicular pain of exclusive C4 dermatome. It is not easy to decide whether the nerve root compression at C3-C4 level shown in imaging studies leads to radicular pain. All our cases showed abnormal finding on sensory tests. In general, key sensory point of C3 is supraclavicular fossa at midclavivular line and C4 is over the acromioclavicular joint. Thorough sensory examination in the C3 or C4 dermatome should be needed especially if radiologic studies reveal upper cervical nerve root compression.

Like the lower cervical radiculopathy, we thought that electrodiagnostic study also could help deciding whether upper cervical root damage concordant to imaging studies exist and cause radicular pain or not. The C3, C4, and C5 nerve roots innervates the diaphragm. The injury of these three nerve roots may lead to the diaphragm weakness. On needle electromyography at diaphragm, we could find the definite evidence of denervation potential in one case and suggestive clue of chronic C4 root injury in one case. In general, the polyphasic and long duration MUAP are the electromyography hallmarks of chronic denervation. Although the polyphasic and long duration MUAP in the first case was not consistent with the duration of symptom, we thought that the phenomenon could be developed in the process of hypersensitivity under the longstanding C3-4

neural foraminal stenosis. The denervation potentials depend on the severity of the axonal damage. Moreover, because the diaphragm are innervated by the triple nerve roots, the positive rate of denervation potentials of upper cervical radiculopathy can be lower than that of lower cervical radiculopathy. Although the electromyography may be relative low sensitive tool, it is reasonable that needle electromyography at diaphragm should be added if physical examination and imaging studies do not distinguish upper cervical radicular pain and axial neck pain.

For cervical radiculopathy without myelopathy, the conservative management including rest, medications, physiotherapy, and translaminar or transforaminal epidural steroid injection is first recommended. Surgery is typically recommended when all of the following are present: definite cervical root compression visualized MRI or CT myelography; concordant symptoms and signs of cervical-root-related dysfunction, pain, or both; and persistence of pain despite of nonsurgical treatment for at least 6 to 12 weeks or the presence of a progressive, functionally important motor deficit [2]. For cervical spondylotic myelopathy in absence of neurologic findings, neck and radicular pain is conservatively managed [6]. Surgery for cervical spondylotic myelopathy shoulder be considered in patients with moderate to severe and/or worsening neurologic deficits clearly attributable to demonstrated spondylotic changes [6]. But the consensus for the management of upper cervical radiculopathy without myelopathy is not clear because the incidence is very low. In the first case, the allyonia and neck and radicular pain was near completely resolved without recurrence after 12 months with oral steroid pulse therapy. If the patient with no specific medical conditions such as diabetes mellitus and chronic renal failure has symptoms of severe cervical root inflammation, oral steroid pulse therapy can be one of treatment options. If nonoperative treatment fail to provide adequate relief of symptoms, then surgical intervention may be considered. Above all things, the differential diagnosis between C4 radiculopathy and degenerative disc disease is the most important in that surgery can change the natural history of neck pain secondary to upper cervical root radiculopathy, unlike axial neck pain owing to degenerative disc disease.

Diagnosis and treatment of upper cervical radiculopathy is not an easy task. Meticulous physical examination, interpretation of imaging studies, and additive electrodiagnostic study will guarantee adequate diagnosis of upper cervical radiculopathy. Upper cervical radiculopathy without myelopathy is rare, but can be successfully managed by conservative or surgical treatment. Because upper cervical radiculopathy can be frequently accompanied with or subsequently followed by spondylotic myelopathy, a physician should pay attention to the change of symptoms and signs.

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