# Autofusion of the Cervical Spine in 2 Children Following Open Biopsy of Langerhans Cell Histiocytosis

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Spontaneous interbody and spinous process fusion are known sequelae of chronic granulomatous disease. In particular, spinal tuberculosis frequently leads to the development of spontaneous fusion. Prior series have reported rates of osseous fusion in spinal tuberculosis from 29% to 73%.[1-4] Spontaneous fusion of the cervical spine has also been noted following treatment of traumatic injuries with halo traction.[5-8] In general, these are short-segment fusions of diseased or injured spinal levels and do not limit cervical spine range of motion to an extent that affects normal daily activities.

An extensive search of the MEDLINE database did not reveal any reports in the English language of spontaneous fusion of the cervical spine following open biopsy. All combinations of the terms *fusion* and *spine* with *biopsy, histiocytosis,* and *langerhans* were reviewed. In the course of conducting long-term follow-up of Langerhans cell histiocytosis of the spine in children, 2 children who had open biopsy of the cervical spine presented at 5 and 6 years of follow-up with spontaneous fusion: one in the anterior elements and the other in the posterior elements.[9] Patients were informed that data concerning their cases would be submitted for publication.

## Case Reports

### Patient 1: Anterior Fusion

A 12-year-old boy presented with a chief complaint of neck pain of 3 weeks' duration. Physical examination revealed full range of motion of the neck. The patient's neck was diffusely tender to palpation of the cervical spine.

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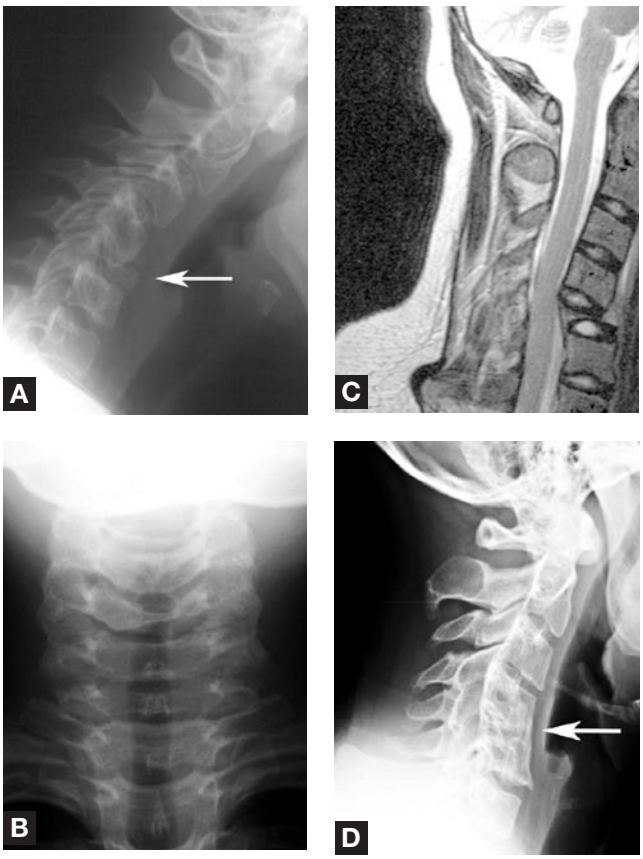


**Figure 1.** **(A)** Lateral plain radiograph of the cervical spine of patient 1 prior to biopsy. There is near complete collapse of the vertebral body of C5 (arrow) and anterior angulation of the cervical spine above C5 leading to a 34° kyphosis. **(B)** Anteroposterior plain radiograph of the cervical spine of patient 1 prior to biopsy. **(C)** $T_2$-weighted sagittal magnetic resonance image showing complete destruction of the vertebral body of C5 (arrow). **(D)** Lateral plain radiograph of the cervical spine taken 5 years after biopsy and revealing fusion of the vertebral bodies of C4 to C6 (arrow) and a 20° kyphosis.

The remainder of the orthopedic examination, including range of motion of all other joints and palpation of all other joints, was normal. A complete neurologic examination, including motor, sensory, and gait evaluation, was normal.

Plain radiographs revealed a destructive lesion of the vertebral body (vertebra plana) of C5 with sharp anterior angulation of the cervical spine above C5 creating a 34° kyphosis (Figures 1A and 1B). Flexion and extension radiographs confirmed that this was a stable deformity,

since there was no change in vertebral alignment when comparing flexion and extension radiographs. Magnetic resonance imaging showed near complete destruction of the vertebral body of C5 (Figure 1C). Fortunately, although the body of C4 was displaced slightly posteriorly, there was no spinal cord compression. The differential diagnosis included Langerhans cell histiocytosis, Ewing's sarcoma, and lymphoma. Since Langerhans cell histiocytosis was the suspected diagnosis, a technetium pyrophosphate bone scan was performed that demonstrated increased uptake at C5 without other areas of increased tracer uptake. Biopsy was done to rule out malignancy and to confirm the diagnosis of Langerhans cell histiocytosis. Computed tomography–guided needle biopsy was not done, since there was total destruction of the vertebral body and our radiology colleagues did not feel that it was safe to perform this biopsy without direct visualization.

The open biopsy was done through an anterior approach without any complications, and the diagnosis of Langerhans cell histiocytosis was confirmed. No attempt was made at surgery to promote or achieve fusion. The patient was given a cervical orthosis to wear for 3 to 4 weeks for comfort following the biopsy. During follow-up, radiographs were taken postbiopsy at 2 and 4 months and revealed no change in appearance from the preoperative images. No fusion of the cervical spine was observed. The patient did not return for regular follow-up.

As part of an institutional review board–approved long-term outcomes study of spinal Langerhans cell histiocytosis being conducted at our institution, patient 1 returned to the clinic for clinical and radiographic follow-up 4 years postbiopsy. He had no complaints of pain, neurologic signs, or neurologic symptoms. Physical examination revealed that the patient lacked 30° of full neck extension and 20° of lateral neck tilt bilaterally. The remainder of the orthopedic and neurologic examination was normal, including range of motion and palpation of all joints and full motor, sensory, and gait examination. Plain radiographs showed reconstitution of the vertebral body of C5 with some mild flattening of the vertebral body. Spontaneous fusion of the vertebral bodies of C4 to C6 also had occurred (Figure 1D). The patient had a stable cervical kyphosis of 20° reduced from prior to biopsy.

### Patient 2: Posterior Fusion

Patient 2 was also a 12-year-old boy who presented with the complaint of neck pain of 7 weeks' duration. Physical examination revealed full range of motion of the neck. Pain was noted only on lateral deviation of the neck in extension. The remainder of the orthopedic examination was normal, including range of motion and palpation of all other joints. A complete neurologic examination including motor, sensory, and gait evaluation revealed no abnormalities.

Plain radiographs revealed mild anterior pseudosubluxation (2 mm) of C3 on C4, but no other significant abnormalities (Figures 2A and 2B). Pseudosubluxation is a finding noted frequently in children.[10] A computed

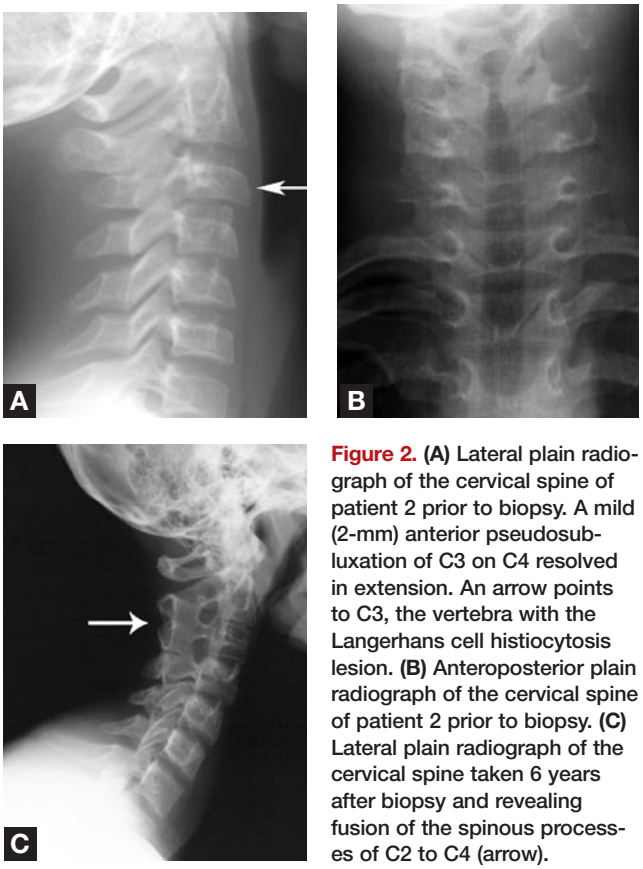


**Figure 2. (A)** Lateral plain radiograph of the cervical spine of patient 2 prior to biopsy. A mild (2-mm) anterior pseudosubluxation of C3 on C4 resolved in extension. An arrow points to C3, the vertebra with the Langerhans cell histiocytosis lesion. **(B)** Anteroposterior plain radiograph of the cervical spine of patient 2 prior to biopsy. **(C)** Lateral plain radiograph of the cervical spine taken 6 years after biopsy and revealing fusion of the spinous processes of C2 to C4 (arrow).

tomography scan, however, showed a destructive lesion in the left aspect of the vertebral body of C3 with extension into the facet joint area. The differential diagnosis included Langerhans cell histiocytosis, osteomyelitis, Ewing's sarcoma, and aneurysmal bone cyst. As for patient 1, a bone scan was done, but it did not reveal any additional lesions. The decision was made to perform a biopsy to rule out malignancy and to confirm the diagnosis of Langerhans cell histiocytosis. Computed tomography–guided needle biopsy was not performed because of the proximity of the lesion to the vertebral artery and to the spinal canal.

The open biopsy was performed through a posterior approach without any complications, and the diagnosis of Langerhans cell histiocytosis was confirmed. No attempt was made at surgery to promote or achieve fusion. The patient was given a cervical orthosis to wear for 3 to 4 weeks for comfort following the biopsy. Radiographs were taken postbiopsy at 2, 4, 6, and 18 months and revealed no new abnormalities from preoperative images. The subluxation had resolved based on images taken at 4 months postoperatively. No fusion of the cervical spine was observed; however, reconstitution of C3 was seen first at 6 months and to a greater extent at 18 months. The patient was not seen again in regular follow-up.

At follow-up 6 years past biopsy, the patient had no complaints of pain, and physical examination revealed full range of motion of the cervical spine, a normal orthopedic examination including full range of motion and palpation

of all other joints, and a normal neurologic examination including motor, sensory, and gait evaluation. Plain radiographs showed that spontaneous fusion of the spinous processes of C2 to C4 had occurred (Figure 2C).

## Discussion

Spontaneous fusion of the spine was first reported by Hippocrates in 380 BC. He observed this phenomenon in a case of spinal tuberculosis. Vertebral fusion secondary to tuberculosis infection at various anatomic levels has since been widely reported.[3,4] Some other factors besides granulomatous infections have also been implicated in occurrence of spinal fusions. Dove and colleagues[7] argued that spontaneous fusion as a consequence of spinal traction was due to formation of a hematoma that consequently promotes bony fusion. They reported 5 patients with spontaneous fusions of the cervical spine in a cohort of 83 patients treated with halo-cervical traction. The hematoma was hypothesized to result from avulsion of the bony attachments of the supporting cervical spine ligaments caused by traction. Although meticulous hemostasis was achieved in both cases of spontaneous fusion we report, some degree of hematoma likely formed postoperatively and contributed to the fusions noted in this case report.

To study the phenomenon of spontaneous fusion better, Korres and colleagues[11] performed a controlled animal study to determine factors promoting spontaneous interbody fusion. Rabbits were injured in the lumbar spine either only in the intervertebral disc (type I), in the intervertebral disc along with one adjoining end plate (type II), or in the intervertebral disc and both adjoining end plates (type III). In 38 rabbits, a total of 82 injuries of these three types were inflicted. Twenty-six injuries were of type I (n = 22 rabbits), 26 were type II (n = 24 rabbits), and 30 were type III (n = 26 rabbits). Spontaneous fusion occurred only in type III injuries. From the 30 type III injuries, fusion occurred in 20 (66.6%). Despite this being an attractive model for spontaneous spinal fusion, it is unlikely to explain the fusion observed in our report. No vertebral end plate was intentionally violated during open biopsy in our cases. Although it is possible that 1 end plate may have inadvertently been injured, it is doubtful that 2 adjoining plates were violated in the course of performing biopsy of a single vertebral lesion.

The specific biologic mechanism causing the spontaneous fusions noted in this case report is unknown. Although this is the first report describing spontaneous vertebral fusion in Langerhans cell histiocytosis of the spine after biopsy, fusion may occur unbeknownst to the patient or physician in other cases of spinal Langerhans cell histiocytosis, since long-term radiographic follow-up is usually not done. Overall, our institution has treated 23 children for Langerhans cell histiocytosis of the spine in the past 32 years who have greater than 2 years' follow-up. Of this group, 14 had an open biopsy done in the spine (7 of these in the cervical spine). As reported here, 2 of these 14 had spontaneous fusion noted at long-term follow-up.

Unfortunately, we are unable to conclude whether the autofusion described in this report is due to the pathology of Langerhans cell histiocytosis disease, due to the process of biopsy, or due to a combination of factors. Athough computed tomography–guided biopsy of spinal lesions has become more common with improvements in imaging technology and instrumentation, it remains an infrequent tool in biopsy of the cervical spine at our institution. Although policy may vary from location to location, at our institution there is not yet widespread use of computed tomography–guided biopsy in the cervical spine because of the presence of many major neurovascular structures in the cervical region.

Langerhans cell histiocytosis lesions in the spine are known to resolve spontaneously and even to restore reasonable vertebral height in most cases.[12,13] Biopsy is routinely performed to establish the diagnosis, and therefore the possible complication of spontaneous fusion should be discussed with the patient and the family before the procedure.

## Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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