Isolated cervical depressed laminar fracture in a child

Case report and review of the literature

Luis A. Robles, M.D.
Section of Neurosurgery, Hospital Medasist, Puerto Vallarta, Mexico

✓ The author reports the case of a child who presented with an unusual C-5 depressed laminar fracture. The characteristics of the fracture, the mechanism of injury, and the treatment are described. Previously published cases are reviewed.

Abbreviation used in this paper: CT = computed tomography.
patients with cervical fractures have not included any depressed laminar fractures.\textsuperscript{2,5}

Examination of lateral cervical spine radiographs must include visualization of the anterior vertebral line, the posterior vertebral line, the spinolaminar line, and the posterior spinous process line. In the cervical spine, the spinolaminar line represents the cortex of the posterior wall of the spinal canal,\textsuperscript{12} and distortion of this line signifies an abnormality in the lamina. To identify depressed laminar fractures of the cervical vertebrae, examination of the lateral radiographs should focus on the spinolaminar line. Even though the spinolaminar line was disrupted in this case, the abnormality was not detected in the initial review of the radiographs, presumably because the abdominal trauma was an urgent concern and the signs of cervical injury were not noticed. Spinal injuries are particularly likely to be missed in patients with severe head injury, intoxicated patients, and critically ill patients with multiple injuries.\textsuperscript{10}

Depressed cervical laminar fractures are rare, and most of the literature does not properly describe this kind of injury. A MEDLINE search revealed only three reports of cases of depressed cervical laminar fractures.

Hahnle and Nainkin\textsuperscript{7} reported the case of an 18-year-old man with unilateral invagination of two laminae into the spinal canal at the C4–5 level, which was treated with surgery. The patient presented with an associated Type I hangman fracture. The laminar fractures were surgically elevated, and the patient made an excellent neurological recovery. In this case, the laminae were not completely fractured, but were invaginated into the spinal canal as a result of greenstick fractures. The authors of the report suggested that the laminar fractures and the hangman fracture were caused by hyperextension and compression.

Gelbman and Maydew\textsuperscript{6} reported the case of a 6-year-old boy who suffered a mild depressed laminar fracture of C-4 without encroachment into the canal. Because the child presented with a complete spinal cord injury caused by a hemorrhagic cord contusion, the fracture was conservatively treated. The authors do not address the mechanism of injury. The laminar cortex was not disrupted and the authors describe the injury as a torus or buckle fracture, similar to the case reported by Hahnle and Nainkin.

Makan\textsuperscript{9} reported the case of a 21-year-old man who presented with local trauma over the cervical spine. Bruising was visible on the posterior aspect of his neck, and examination demonstrated an incomplete spinal cord injury. A CT scan revealed a unilateral depressed laminar fracture of C-5 and lateral displacement of the spinous process. Because of encroachment into the spinal canal, a laminectomy was performed, and the patient’s neurological condition improved postoperatively.

There are several similarities between the case reported by Makan and our case: 1) The mechanism of injury was the same, direct trauma to the cervical area, confirmed by external signs of local trauma including bruising and tenderness. 2) The imaging findings were similar—unilateral fracture disrupting the laminar cortex, encroachment into the spinal canal, and lateral displacement of the spinous process toward the side of the fracture. 3) In both cases, the

\begin{figure}[h]
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\includegraphics[width=\textwidth]{image1}
\caption{Lateral cervical radiograph showing disruption of the spinolaminar line at the C-5 level (arrow).}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image2}
\caption{Preoperative axial CT scan (left) and axial bone-window CT scan (right) showing the depressed laminar fracture encroaching into the vertebral canal, and left-sided displacement of the spinous process.}
\end{figure}
fracture occurred at C-5. In a quantitative anatomical study, Xu and colleagues\(^1\) showed that the C-5 lamina is thinner than that of any other vertebrae from C-2 to L-5, a finding that helps explain why the fractures occurred at this level in these two patients.

Even though very little information about cervical laminar fractures has been published, some conclusions can be made. These fractures can be divided into two types: longitudinal (split) laminar fractures and depressed laminar fractures, and the latter type can be subdivided into greenstick depressed laminar fractures and true depressed laminar fractures.

**Longitudinal (Split) Laminar Fractures**

Longitudinal fractures of the cervical laminae result from compression–extension injuries.\(^1\)\(^,\)\(^3\)\(^,\)\(^4\)\(^,\)\(^8\)\(^,\)\(^11\)\(^\)\(^1\). They can present as isolated laminar fractures but are frequently associated with other injuries, either ligamentous or osseous. There are five stages of compression–extension injuries.\(^1\) The first through third stages may include isolated laminar fractures that do not produce neurological deficit or instability, whereas the subsequent stages include associated vertebral body fractures or displacement. For isolated laminar fractures, conservative treatment (use of a collar) is generally sufficient, but when a more extensive injury is involved, surgical treatment or immobilization with a halo vest should be considered.

**Greenstick Depressed Laminar Fractures**

Greenstick fractures of the laminae may also be described as laminar invaginations or buckle fractures. The mechanism of injury involved is hyperextension, and the degree of depression of the fracture is not very significant, producing only mild narrowing of the spinal canal. The laminar cortex is not disrupted. The degree of neurological deficit does not correlate with the degree of canal narrowing, and patients may have significant neurological deficits even though the degree of narrowing may be minor. Treatment depends on the severity of spinal canal stenosis.

**True Depressed Laminar Fractures**

In “true” depressed laminar fractures, both laminar cortices are disrupted. This type of fracture results from direct local injury over the posterior aspect of the neck. Typically, the fracture is unilateral, and the spinous process is displaced laterally toward the fracture. The degree of spinal canal encroachment is usually significant in these cases. The mechanism of injury involves substantial local trauma over the spinous process; the force of the blow is transmitted into the lamina, fracturing and depressing it at its weakest point. Laminctomy is indicated for cord decompression.

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**Conclusions**

Depressed laminar fractures of the cervical spine are very unusual injuries. They have a distinct mechanism of injury and usually occur at C-5. The present case is the first reported pediatric case of a true depressed laminar fracture involving a cervical vertebra. This case emphasizes the importance of following the basic principles of cervical spine radiograph interpretation and demonstrates that laminectomy remains useful in the treatment of selected cases.

**References**


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*Address reprint requests to: Luis A. Robles, M.D., Lucerna #148, Col. Versalles, Puerto Vallarta, Jalisco, CP 48310, Mexico. email: larob@prodigy.net.mx.*