

# Evaluation and Management of Spinal Column Fractures in Adults

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## ABSTRACT

Nurse practitioners working in many settings are faced with the challenge of diagnosing and managing patients with potential or actual spinal column fractures. In this article we provide nurse practitioners with the knowledge necessary to evaluate for and diagnose spinal column fractures in adults. We also provide guidelines for the appropriate management of injuries and identify when referral is recommended.

**Keywords:** evaluation, injury, management, spinal, trauma, vertebral

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## INTRODUCTION

Spinal column fractures (SCFs) range from minor injuries that cause pain but do not lead to permanent damage or disability to those that cause long-term disability and, in some cases, death. Nurse practitioners (NPs) working in many settings may be faced with the challenge of making the appropriate diagnosis of a SCF, determining the severity of the injury, and then providing appropriate treatment or referral. The purpose of this article is to provide NPs with the knowledge necessary to evaluate and diagnose fractures of the cervical, thoracic, and lumbar spine in adults; prescribe appropriate management; and determine when it is necessary to refer for emergency and or specialized treatment.

## ANATOMY

### Spinal Column

The spinal column consists of 33 vertebrae. It is divided into 5 functional areas, including the cervical (7 vertebrae), thoracic (12 vertebrae), and lumbar (5 vertebrae) spine. The vertebral column also includes 5 fused sacral and 4 fused coccygeal vertebrae.<sup>1</sup> The spinal column provides structure as well as protection for the spinal cord and accompanying spinal nerves. In this article we focus on the cervical, thoracic, and lumbar spines.

### Cervical Vertebrae

The cervical spine consists of 7 vertebrae. The first cervical vertebra (C1) does not contain a vertebral

body or a spinous process. It is simply composed of a body ring at the base of the skull. It is connected by ligaments to the second cervical vertebrae (C2) via the odontoid process on C2.<sup>2</sup>

The third through seventh cervical vertebrae (C3–C7) each consist of the vertebral body, 2 transverse processes, a spinous process, 2 pedicles, 2 facets, and 2 lamina.<sup>2</sup> The spinal cord is housed within the vertebral arch and is protected by the vertebral body, pedicle, lamina, and spinous process.<sup>2</sup> Any fracture noted in the cervical spine requires immobilization and immediate referral to a spine specialist.

The individual cervical vertebrae are connected via anterior, middle, and posterior ligaments.<sup>2</sup> Damage to the ligaments may also place the spinal cord in danger of injury due to possible vertebral dislocation.

### Thoracic and Lumbar Vertebrae

Both the thoracic and lumbar vertebrae are composed of a vertebral body, 2 pedicles, 2 transverse processes, 2 facets, 2 lamina, and a spinous process. The thoracic spine consists of 12 vertebrae. The first 9 are connected to the sternum and ribs. This provides increased stability in this section of the vertebral column.<sup>2</sup> Fractures within this area of the transverse process or spinous process are considered stable and do not require referral. All other fractures of the vertebral column require immobilization and immediate referral.<sup>2</sup> Fractures from T10 to L1 are particularly susceptible to injury due to spinal mobility in this area.

The lumbar spine consists of 5 vertebrae. This area is not as susceptible to injury due to the surrounding musculature and size of the vertebral bodies.<sup>2</sup> When a fracture does occur in the lumbar or sacral spine it is usually the result of high energy and can lead to vertebral instability.<sup>2</sup>

## MECHANISMS AND CLASSIFICATIONS OF SPINAL COLUMN INJURIES

### Demographics

It is estimated that approximately 8,000 spinal cord injuries occur each year in the United States.<sup>3</sup> These are usually the result of an injury to the spinal column in the form of fractures or dislocations. Those most susceptible include men between the ages of 16 and 30 years. The most frequent causes include motor vehicle accidents (44%), acts of violence (24%), falls (22%), sports (8%), and other (2%). After the age of 45 years, the leading cause of injury becomes falls.<sup>3</sup>

Common forces leading to spinal column injuries include hyperextension, hyperflexion, axial compression, and flexion-rotation injuries.<sup>4</sup> The classification and location of the fracture helps determine the severity of the injury and the likelihood of an associated spinal cord injury.<sup>4</sup>

### Fractures Not Associated With Spinal Cord Injury

Vertebral fractures may be classified as a simple fracture, compressed or wedge fracture, comminuted or burst fracture, and dislocations.<sup>4</sup> Simple fractures of the thoracic and lumbar spinal column, such as those affecting the transverse or spinous processes, do not place the spinal cord in danger of injury and many require only pain management. As noted previously, both spinous and transverse process fractures of the cervical spine place the patient at risk for spinal cord injury and require immediate referral.<sup>2</sup>

### Fractures Associated With Spinal Cord Injury

Compression fractures, also called wedge fractures, occur when the vertebral body is compressed anteriorly. Comminuted or burst fractures occur when the vertebral body is shattered into several fragments. Dislocations occur when the vertebral body is forced out of alignment. These place the spinal cord at significant risk for injury.<sup>4</sup>

## NEUROLOGIC EXAM

Before examination of the spinal column, a neurologic exam should be performed with the patient lying supine with the cervical spine immobilized. This exam should be used to determine the patient's mental status, motor function, sensation, and pain.<sup>5</sup> Herein we present the basics of a neurologic exam for the evaluation of a possible SCF or spinal cord injury.<sup>5</sup> For more information regarding completion of an in-depth neurologic exam, the reader is referred to the website of the American Spinal Injury Association.<sup>5</sup>

### Mental Status

The exam begins by determining whether the patient is alert and oriented to person, place, time and able to follow commands.<sup>5</sup> If the patient is unable to do so for any reason, including but not limited to head injury, alcohol or drug intoxication, or distracting injury, then physical exam alone should not be used to determine if injury has occurred. In situations of alcohol or drug intoxication, a secondary exam should be performed at a later time once the patient is able to participate in the exam process.

### Motor Function

The NP should now determine the patient's muscle strength and ability to perform full range of motion of the extremities against resistance. For example, the NP could ask the patient to shrug their shoulders against resistance, check bilateral hand-grip strength, raise each leg off the bed, as well as plantarflex and dorsiflex their feet against resistance.<sup>5</sup> Deficits should be recorded using the grading criteria in [Table 1](#).<sup>5</sup>

**Table 1. Scoring of Motor Function<sup>5</sup>**

| Score | Physical Exam Finding                    |
|-------|--|
| 0     | Total paralysis                          |
| 1     | Palpable or visible contraction          |
| 2     | Active movement, gravity eliminated      |
| 3     | Active movement, against gravity         |
| 4     | Active movement, against some resistance |
| 5     | Active movement, against full resistance |

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