



## Morgagni Spine Fractures-Dislocations per *Anatomen Indagatis*: Since the Dawn of Modern Medicine A Taxonomy and Pathomorphology Problem

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### Key words

- Kyphosis
- Morgagni
- SCI
- Spine fractures-dislocations
- Spine trauma

### Abbreviations and Acronyms

SFD: Spine fracture-dislocation

SCI: Spinal cord injury

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### INTRODUCTION

Giovanni Battista Morgagni is considered the father of modern anatomoclinical correlations and thus of anatomic pathology. Because of his constant and painstaking work, which spanned more than 30 years, he was able to match many of the most common clinical presentations of diseases with their respective anatomic alterations. He gained enormous scientific renown throughout Europe, earning the nickname "His anatomical Majesty", because of his contribution to the knowledge of the anatomy of the brain, the spinal cord, the ear, and the heart.

*De sedibus et causis morborum per anatomen indagatis*<sup>1</sup> (1761) (Figure 1) encompasses Morgagni's enormous experience in anatomic dissections and pathologic investigations. Although his depictions of many neurosurgical condition such as hydrocephalus, epilepsy, intracranial infections, and intracranial bleeding are of undisputed historical value, his work concerning spinal disorders and especially

The aim of this study is to retrieve and bring back to light a part of the astonishing and painstaking work of the legendary Italian father of modern pathology Giovanni Battista Morgagni, concerning one of most discussed topics in spine surgery: spine fractures-dislocations. All the excerpts selected for this study are contained in *De sedibus et causis morborum per anatomen indagatis*, the summa maxima of the entire production of Morgagni. This treatise encloses the enormous experience of Morgagni in anatomic dissections and pathologic investigations. With the aid of a strict dissection and description methodology, Morgagni identified and described many of the most important aspects of spinal fractures-dislocations, from the importance of the mechanism of injury, to the relevance of ligamentous complex, or the risk of posttraumatic kyphosis and the clinical expression of spinal cord injury.

spine fractures-dislocations (SFDs) has been poorly reviewed and has lacked appreciation over the decades.

From the early 1960s, spine surgeons realized that in planning a correct conservative versus operative treatment of a stable versus unstable SFD, one of the major problems lies in the classification and in the pathomorphologic description of SFDs. As far as the thoracolumbar spine is concerned, static biomechanical 2-column<sup>2,3</sup> and 3-column<sup>4</sup> models were developed and largely accepted before Magerl et al.<sup>5</sup> in 1994 introduced their complex classification based on 3 etiopathogenetic morphologies: A, compression; B, distraction; and C, axial torque. Vaccaro et al.<sup>6</sup> promoted the current concept that not only osseous and ligamentous conditions but neurologic status too should have a critical impact on the decision of whether to perform surgery or not.

A similar classification conundrum developed in regards to subaxial cervical spine SFDs: from the mechanistic approach of Holdsworth<sup>2</sup> and Allen et al.,<sup>7</sup> in which the mechanics of injury embodied tout-court the probabilistic judgment on the stability of the cervical SFD, to the modern evaluation scores of the Cervical Spine Injury Severity Score<sup>8</sup> and Subaxial Injury Classification,<sup>9</sup> which are aimed at creating a homogeneous

classification, indication, and treatment algorithm, virtually worldwide.

The aim of this study is to retrieve the astonishing and widely forgotten work of Morgagni in regards to SFDs, analyzing the outstanding similarity between the obstacles found by this legendary researcher in classifying the anatomic evidence he faced during dissections, with the contemporary issues in trying to obtain an all-embracing and definitive taxonomy of SFDs.

All the excerpts reported are enclosed in the treatise *De sedibus et causis morborum per anatomen indagatis*, in the first chapter of book I (Injuries of head and spine) and book IV, letter LIV and LVI (Of wounds and blows on the belly, loins, and limbs, and of fractures and luxations of the bones and of other disorders injurious to motion).

### THE VARIABILITY OF CLINICAL PRESENTATION

Another man forty-six years of age, was struck on the back by a piece of timber. He lost the power of moving his legs, but the sense of feeling was retained. His faeces passed off involuntarily, and it was requisite for the urine to be drawn off by the catheter. Towards the close of life the urinary

# JO. BAPTISTÆ MORGAGNI

P. P. P. P.

## DE SEDIBUS, ET CAUSIS MORBORUM PER ANATOMEN INDAGATIS

L I B R I Q U I N Q U E.

DISSECTIONS, ET ANIMADVERSIONES, NUNC PRIMUM EDITAS  
COMPLECTUNTUR PROPEMODUM INNUMERAS, MEDICIS,  
CHIRURGIS, ANATOMICIS PROFUTURAS.

Multiplex præfixus est Index rerum, & nominum  
accuratissimus.

TOMUS PRIMUS

DUOS PRIORES CONTINENS LIBROS.



VENETIIS,

M D C C L X I.

EX TYPOGRAPHIA REMONDINIANA.

SUPERIORUM PERMISSU, AC PRIVILEGIO.

Figure 1. The frontispiece to the Venetian edition of *The seats and causes of diseases: investigated by anatomy*.

secretion was bloody. The patient complained of but little pain in the loins: he gradually sunk, however, and expired on the fourteenth day. Dissection. [...] and one of the lumbar vertebrae was fractured.

It frequently happens that the different consequences of spinal lesions are not easily explicable. When there has unquestionably been injury done to the medulla, as, for instance, when it has been

perforated by a bullet, life has been carried on for many days and even weeks. Indeed paralysis has not uniformly resulted even though the medulla had been wounded in the back. It is related of a soldier that the point of a sword, two inches in length, had passed through the twelfth dorsal vertebra, and was fixed there, exciting the most excruciating pains, but there was no consequent paralysis although the patient lived some months. Probably some of these variations of result are ascribable to the different degrees of concussion arising from the blow [...] If the injury is inflicted upon the inferior lumbar vertebrae, of course it is the cauda equina which sustains lesion.

A young man twenty-four years of age, received a wound from a dagger on the left side of the neck. The point of the weapon entered about three digits below the external ear, and pursued a direction towards the beginning of the spinal marrow. Scarcely any blood was effused from the wound, yet the young man fell, and was deprived of sensibility and motion in all the parts below the head. He spoke but little, and even that was attended with some difficulty of respiration. When put into bed he complained of coldness; and to remedy this inconvenience a warming pan was resorted to, by which his legs were severely burnt without his being conscious of pain. At first he neither evacuated the bladder nor intestines; but after some days the urine flowed involuntarily. About the seventeenth day he began to have some feeling in the left side, and on the twentieth day he was able to move the fingers and toes on that side a little. On the thirty-second day he discovered returning sensation on the right side: and the degree of sensibility gradually improved, so that by the fortieth day the man had regained tolerably perfect feeling, and also considerable power of motion. Some months elapsed, however, before he

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