



Aetiological Apportionment in Spine-Related Medicolegal Matters: A Neurosurgical Perspective

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Editorial

Medicolegal matters related to the spine can be quite complex from an aetiological perspective. By the time an assessee presents to a neurosurgeon/spinal surgeon for an Independent Medical Examination (IME), the condition may be chronic and subject to one or more spinal surgeries or claimed injuries/aggravations. Further, the clinical presentation may be adversely influenced by the compensation/litigation umbrella itself [1]. In order to better understand causation in such circumstances, a thorough IME needs to be undertaken involving a methodical, scientific and impartial approach, with careful consideration of a plethora of potentially contributing factors (Table 1). As an actively operating neurosurgeon who also regularly undertakes IMEs, the present Editorial summarizes the author's decision-making process (which has been evolutionary with experience) in relation to aetiology, during almost 15 years and almost 2,000 reports in the medicolegal area.

Fundamental Approach

As expected, a systematic medical history and comprehensive clinical examination by the IME specialist are essential. Ideally, there is consistency between the stated medical history, the examination findings, documentary information, and imaging data. In reality, in the author's experience, this is often not the case. In the History component, there should be questions regarding the originating "index" (and any subsequent) injury, as well as details regarding the alleged mechanism of injury, the latter of which may involve substantial forces or, alternatively, relatively trivial or innocuous mechanical circumstances. Relevant past history in relation to the spine should also be enquired about, given its aetiological significance and its potential as a focal point in any future cross-examination. This includes any previous (pre-incident/pre-existing) spinal symptoms, injuries/accidents, surgeries and insurance/compensation claims. A family history of relevant spinal conditions and/or surgeries needs to be asked about. A smoking history must also be obtained given this activity's implications regarding accelerated spondylosis and adverse surgical outcomes [2]. As the history is being obtained, concurrent observations regarding unusual posturing or excessive transfers and pain vocalization or catastrophizing, level of eye contact, any leading or influential interaction with an attending support person, and vagueness or evasiveness of responses particularly to relevant past history, should be noted. In subsequent careful review of pertinent documents accompanying the matter, historical variations (particularly pertaining to the originating circumstances and symptoms thereafter) communicated by the assessee are to be identified, along with any lack of contemporaneous symptom reporting/documentation. With regard to the claimed originating or "index" injury/incident involving the spine, it should be recognized if the condition's natural history or treatment's expected outcome is being followed and, if not, why not?

The physical examination carried out systematically is, in the author's opinion, as important as general observations of the assessee made outside of formal physical/neurological testing. The latter, which may be in addition to "Waddell signs" after the seminal work of Waddell and colleagues, [3] are paramount to helping determine if a *bona fide* physical injury still exists, as opposed to "functional overlay". Clinical inconsistencies and non-physiological presentation should be looked for, including: marked hypersensitivity to light touch; variable gait and movement ranges between passive and active observation; nociceptive guarding or refusal of movements; collapsing or excessively slow and stiff gait; non-myotomal and non-dermatomal symptom distribution (particularly without accompanying reflexopathy); or "textbook-exact" neurological symptoms in the absence of substantiating/objective signs. Absence of symptoms while testing during conversational distraction is also important to note.

The relevant medical imaging should be carefully studied by the IME specialist, as opposed to substantial reliance on radiological reports. Remote access to Picture Archiving and Communication

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Received Date: 20 May 2022

Accepted Date: 08 Jul 2022

Published Date: 12 Jul 2022

Citation:

Khurana VG. Aetiological Apportionment in Spine-Related Medicolegal Matters: A Neurosurgical Perspective. *Clin Surg*. 2022; 7: 3545.

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Table 1: Aetiological factors versus weighting.

Factor	Weighting
Innocuous mechanism of claimed trauma	Low
Non-manual occupation	Low
Simple laminotomy/laminectomy (mostly preserved facets)	Low
Spina bifida occulta	Low
Stable, minimally displaced vertebral fracture	Low
Transitional lumbosacral anatomy (without pseudoarthrosis)	Low
Baastrup's disease (interspinous fusion or pseudoarthrosis)	Low-Med
Bertolotti syndrome (with pseudoarthrosis; sacral-alar fusion)	Low-Med
Epidural lipomatosis (diabetes, or obesity-related; stenosis)	Low-Med
Family history of operated spondylosis, scoliosis	Low-Med
Klippel-Feil syndrome (ASD; cervical spondylotic myelopathy)	Low-Med
Post-operative local fibrosis/scarring without arachnoiditis	Low-Med
Previous same-level annular tear without disc herniation	Low-Med
Scheuermann's disease (thoracic or low back pain)	Low-Med
Transitional lumbosacral junction anatomy with hyperlordosis	Low-Med
Ankylosing spondylitis with SIJ ankylosis	Med
Heavy manual occupation with <i>bona fide</i> aggravation	Med
Hip or pelvic dysplasia with gait anomaly	Med
Morbid obesity (BMI ≥ 40)	Med
Osteoporosis	Med
Post-operative local fibrosis/scarring with arachnoiditis	Med
Previous local spinal surgery without instrumentation	Med
Age ≥ 55 years (expected temporal degeneration)	Med-High
Compression/burst fracture ± instability	Med-High
Congenitally narrow spinal canal (accelerated spondylosis)	Med-High
History of spinal (structural) trauma(s) or whiplash/WAD	Med-High
Kyphoscoliosis, scoliosis or alordosis	Med-High
Osteophytosis, moderate to extensive (DISH, OPLL)	Med-High
Past episodes of symptomatic spondylosis (pre-existing)	Med-High
Previous local spinal instrumentation/ASD pattern	Med-High
Smoking, chronic medium to heavy (≥ 10 yr & ≥ 0.5 packets/day)	Med-High
Substantial mechanism of claimed trauma	Med-High
Substantial psychological history and/or Waddell-type signs e.g., in chronic pain syndrome	Med-High
Isthmic spondylolisthesis (pars defects, pars fractures)	High
Multilevel mul iregional spondylotic pathology	High

ASD: Adjacent Segment Disease; BMI: Body Mass Index; DISH: Diffuse Idiopathic Skeletal Hyperostosis; Med: Medium; OPLL: Ossification of the Posterior Longitudinal Ligament; SIJ: Sacroiliac Joint; WAD: Whiplash-Associated Disorder; yrs: Years

Systems (PACS) is readily achieved in this day and age, and also allows for digital imaging comparisons where serial imaging of the assessee has been undertaken, even on different PACS. Analysis of the imaging for the presence or absence of a focal (potentially explanatory) injury versus multilevel, multifocal (or even multiregional) spinal pathology should be undertaken. Serial imaging changes (e.g., diffuse and uniform consistent with a degenerative temporal pattern) and the presence of one or more constitutional or congenital factors (Table 1) need to be identified owing to their potential aetiological relevance to the matter at hand.

Aetiology and Apportionment

The role of an individual's genetics by way of predisposition to spondylosis/degeneration cannot be understated given the large body of evidence from several multinational studies involving many identical twins and published over a period of several years [4]. There are numerous factors that should be considered as potentially contributory when it comes to spinal conditions (Table 1). Each of these factors should be looked for in the medical history and documentary review, as well as in the imaging. Any given factor may make a lesser or greater aetiological contribution. The author has attempted to grade such factors from low to medium to high aetiological weighting based on available science and professional experience. Aetiological apportionment can be best-estimated by the IME specialist based on the presence of such factors (with their relative weighting) in a given matter.

Some important factors that may be causally underappreciated might include: Bertolotti syndrome [5] (with pseudoarthrosis, sacral-alar fusion and low back pain); Klippel-Feil syndrome [6] (with predisposition to adjacent segment disease and cervical spondylotic myelopathy); Scheuermann's disease [7] (with associated kyphoscoliosis and thoracic and/or lumbar pain); morbid obesity [8] (associated with low back pain and physical deconditioning); a congenitally narrow spinal canal [9,10] (predisposing to accelerated spondylosis); diffuse idiopathic skeletal hyperostosis [11] (DISH; with, e.g., bulky thoracic osteophytosis and/or ossification of the posterior longitudinal ligament and associated symptoms); a heavy chronic smoking history [2] (accelerated spondylosis, increased post-operative complications and poorer post-surgical outcomes); previous local spinal instrumentation [12] (with predisposition to adjacent segment disease/accelerated adjacent segment degeneration); and presence of isthmic spondylolisthesis [13] (with expected temporal progression and symptomatology).

Conclusion

In medicolegal matters involving the expert evaluation of assessee with spinal conditions, the aetiology may be multifactorial and complex. To arrive at an accurate understanding of the diagnosis and its causation requires the application of a meticulous, independent, and scientific approach to all of the key components of the IME. These include the history, observations and examination, direct review of the imaging and relevant documentation, and an appropriate analysis of the data. Evidence- and experience-based weighting can be applied to identifiable causative factors in order to provide guidance to clients regarding aetiological apportionment. The apportionment information may itself be useful in determining non-economic as well as financial costs related to claim lifestyle limitations, incapacity to work, need for ongoing treatment, and any permanent impairment.

Acknowledgement

This manuscript was delivered as an oral presentation at the 2022 Australian Lawyers Alliance, Sydney, Australia. The author would like to thank Ms. Cathy Zhou for her invaluable assistance in the preparation of this manuscript.

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