Research Article

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Whiplash injury might reduce lumbar spine range of motion following trauma

Abstract

Whiplash is the common denominator of a syndrome consisting of several disorders affecting different body areas, termed whiplash-associated disorders. One of the most common such disorders in low back pain. While the occurrence of low back pain following whiplash is well known, little is known regarding the effect of whiplash on spinal range of motion. The current study quantitatively assessed this effect.

A cohort of 156 patients at least one year after a whiplash injury was evaluated for the accident mechanics, radiological findings and lumbar flexion range. 60.2% of the patients had associated low back pain. About one third of the cohort developed the low back pain only after the accident. The lumbar flexion range was lower in this cohort than in whiplash patients without low back pain. Low back pain is particularly common following head-on and sideways injury mechanisms.

In conclusion, it appears that whiplash associated low back pain is often accompanied by a decreased range of motion of the lumbar spine.

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Introduction

Whiplash injury is often associated with other symptoms, such as irradiation to the upper limb. One of the often associated symptoms is low back pain.[1,2] Early low back pain following whiplash injury has been identified as a negative prognostic risk factor.[3] The enigma how pain can exist without tissue damage has recently been explained by the central sensitization theory.[4] Chronic pain syndromes, such as whiplash and fibromyalgia share the same pathogenesis, namely, sensitization of pain modulating systems in the central nervous system. Sensitization is a nerve activation pain induction mechanism, in which neurophysiologic changes may be as important as behavioral, psychological, and environmental mechanisms. The current study was undertaken in order to assess whether the associated low back pain occurring after whiplash injury also affects the lumbar range of motion and specifically lumbar flexion.

Methods

A retrospective analysis was performed using data collected from one of the authors (DR) medicolegal practice.

Inclusion Criteria

A. History of a road accident at least one year prior to examination,

B. Whiplash injury diagnosed on emergency room discharge note

C. Age 18 years and older.

Exclusion criteria

A. Fractures, dislocations and subluxations of the spine,

B. Subjects having more than one accident prior to insurance financial settlement.

C. 156 cases were included in the study.

The severity of the accident was estimated from the patient's account of the incident and reported damage to the vehicle. The accidents were divided into three categories of severity: low (no air bag deployment, estimated impact speed less than 30 km/h, bumper or minor car damage), moderate (air bag deployment, estimated impact speed less than 70 km/h, vehicle damage near or total loss) and severe (estimated impact speed over 70 km/h). Impact speed was estimated according to impacting object velocity, thus inter-vehicular head-on collision is considered as the combined speed of both vehicles.

The patients' injury severity was graded according to the Gargan and Bannister classification system.[5] This grading system was adapted from a previous study of whiplash severity[5] and has been previously validated.[6] The vector of the accident was estimated from the patients account and sub-divided into three categories: head-on, side impact and rear impact injury. Where a patient was reversed into a collision it was considered as a head-on collision. Reported symptoms were recorded from the histories provided by the patients and from their medical records. The past medical history was also corroborated by a review of the patients' computerized records.

All patients were asked whether they were aware of the impending accident. If they were, it was assumed that they were braced for impact. If the patient was looking in any direction apart from straight ahead, they were included in the head inclined category.

All patients examined were still symptomatic at the time of their reports.

All patients had a CT scan of the cervical spine, as well as a five-view radiographic examination. Radiographic findings were recorded as cervical lordosis maintained (over 30 degrees), cervical lordosis reduced and cervical lordosis obliterated (less than 5 degrees of lordosis). CT scan was evaluated as normal or with one or more disc bulges, or with one or more disc protrusions. Spondylosis was graded as present or absent based on cervical radiographs and CT scan.

Back range of motion determination

Back range of motion was determined using a double inclinometer technique, as well as the modified Schober technique, that has been found as more reliable for measuring lumbar flexion and extension.[7]

Results

A. Of the 156 patients, 92 were male (58%). The mean age of the population was 34.5 years (range 18-71). Ages were similar for the female and male groups.

B. Further accident-related parameters are described in Table 1. Lateral radiographs demonstrated a reduced lordosis of 22±12 degrees.

C. Imaging characteristics of the patient cohort are reported in Table 2. Most patients had some signs of spondylosis according to Kellgren's validated classification.[8]

Table 1 Accident Characteristics, n=156

Injury Mechanism	Rear Impact 85 (54.4%)	Side Impact 37 (24%)	Head On 34 (22%)	
Injury Awareness	Braced for Injury 131 (84%)	Head-Inclined 15 (10%)	Unknown 10 (6%)	
Seat-Belt Usage	Seat-belt used 152 (97%)	Seat-belt non used 4 (3%)		
Position in Vehicle	Drivers 118 (75.6%)	Front Seat 20 (13%)	Rear Seat 18 (11.5%)	
Injury Severity	Low 50 (32%)	Medium 55 (35.2%)	Severe 41 (26.3%)	
GBG Grade	Grade A 3 (2%)	Grade B 31 (20%)	Grade C 88 (56.4%)	Grade D 34 (22%)

Table 2 Imaging Appearance of Whiplash Patients

Spondylosis	Grade 0 65 (41.6%)	Grade 1 21 (13.5%)	Grade 2 18 (11.5%)	Grade 3-4 52 (33.3%)
CT Disc Appearance	At least one disc bulge 111 (71.5%)	At least one disc protrusion 31 (20%)	Normal Disc appearance 14 (9%)	
Cervical Lordosis	Normal 35 (22.5%)	Reduced 88 (56%)	Obliterated 33 (22%)	

Back and neck pain history

A. A past history of back pain during the last 5 years causing absence from work, was noted in 45 patients (28.8%) of the group, while 62 patients (39.7%) denied a history of back pain either prior to, or after the whiplash injury.

B. 49 patients (31.4%) suffered from back pain following the whiplash injury. Previous neck pain was noted in 18 patients (11.5%) of the whole study group.

Back pain symptom location

A. Of the 49 patients in whom back pain developed after the whiplash injury, most had either, low back pain (45 patients, 92%) or combined low back and mid-spine pain (27 patients, 60%). Only 4/49 patients (8%) reported mid-back symptoms alone without low back pain.

B. Of the 45 patients in whom back pain was present, prior to the whiplash injury, only 2/45 reported mid-spine pain. The rest reported low back pain (25/43 patients, 58.1%), or a combined mid-spine and low back pain (18/43 patients, 42%).

Lumbar range of motion

A. Overall 94/156 patients (60.2%) reported low back pain as being caused by their road accident. This group consisted of 61 males and 33 females.

B. The chances that a male develops low back symptoms following a whiplash injury were higher (61/92 (66%)), than a female (33/64, (51.5%) Chi square test, Pearson's X2 statistic 3.62 $p<0.05$).

C. True lumbar flexion averaged 41±8 degrees in the patients without low back pain (62/156 patients). The flexion range was only 23±12 in the low back pain group (94/156 patients).

D. The intergroup difference was highly statistically significant (t-test, $p<0.001$).

E. Accident vectors contributed to the presence of low back pain, the rear impact group had a prevalence of 47% (40/85), the side impact group 64% (24/37) and the head-on group had a prevalence of 88% (30/34) (Chi2 test, Pearson's X2 statistic 17.6, $p<0.001$).

F. The data was further analyzed to establish whether there was a significantly different range of flexion depending on injury mechanism. The rear impact group had significantly higher flexion (31±6 degrees) as compared to the head-on group (23±4 degrees) and the side impact group (25±8) (ANOVA, F-Statistic 3.12, $p<0.05$).

G. Spondylosis grades 3 and 4 were closely correlated with the presence of low back pain after whiplash injury and with limited lumbar spine flexion (24±5) versus 36±4 in the group without spondylosis.

Discussion

The current data indicates that low back pain is quite common after whiplash injury, particularly in head-on and side collisions.[9] The frequency observed in this study is similar to that reported in other studies,[1] and appears to be related to the presence of prior low back pain episodes, in some of the patients. The low back pain observed was commonly associated with limitation of lumbar segment flexion, without clear sciatica (data not shown). Previous studies have demonstrated that whiplash injury frequently occurs following low velocity collisions.[10] Physicians must recognize whiplash injury as a manifestation of total-body trauma and to treat accordingly, with particular emphasis on alleviating abnormal tension of the fascia.[11] As part of the whole-body injury, it appears that low back pain commonly arises after whiplash injury. Some of the patients had prior complaints, but they uniformly complained of worsening symptoms, following the whiplash injury. In the current study, most patients were harnessed, thus seat belts do not seem to prevent the development of low back pain after whiplash injury.

Due to insurance claims and compensation issues, it has often been suggested that the low back pain following whiplash injuries has no physiological basis,[12] despite contradictory evidence.[13] Recent developments in neurophysiology suggest that some pain syndromes, without obvious tissue injury, are related to central sensitization.[4,14] The central sensitization disorder thus not only explains the association with low back pain, but may also offer an explanation for the long term effect on future health complaints of whiplash associated disorders.[15]

Previous studies have assessed the prevalence of low back pain following whiplash injuries[15] however the effect of whiplash injury on lumbar spine motion has not yet been assessed. How can the limitation in lumbar spinal motion be explained? There is compelling evidence for impaired motor control of spinal muscles in patients with chronic pain syndromes.[15] Individuals after whiplash have altered stability tests, as well as altered spinal muscle activation, consequently limiting trunk stability, both during standing and during sitting.[16]

Conclusion

The current data suggest that low back pain is commonly associated with whiplash injury, which leads to limitation of spinal range of motion, perhaps due to altered activation of brain processing mechanisms.

Acknowledgments

None.

Conflicts of interest

None.

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