
Spine: Volume 29(17) September 1, 2004 pp 1881-1884

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FROM ABSTRACT:

Study Design.
Case report of a patient with a whiplash-associated disorder following a bumper car collision.

Imaging studies failed to provide an anatomic explanation for the debilitating symptoms.

Objectives.
To report a chronic, debilitating pain syndrome after a low-velocity bumper car collision while using complex range-of-motion data for the diagnosis, prognosis, and surgical indication in whiplash-associated disorder.

Summary of Background Data.
The controversy of whiplash-associated disorder mainly concerns pathophysiology and collision dynamics.
Although many investigations attempt to define a universal lesion or determine a threshold of force that may cause permanent injury, no consensus has been reached. [IMPORTANT]

Methods.
Eight years after a low-velocity collision, the patient underwent surgical excision of multiple painful trigger points in the posterior neck.

Computerized motion analysis was used for pre- and postoperative evaluations.

Results.
Surgical treatment resulted in an increase in total active range of motion by 20%, reduced intake of pain medication, doubled the number of work hours, and generally led to a dramatic improvement in quality of life.

Conclusions.
This case of whiplash-associated disorder after a low-velocity collision highlights the difficulty in defining threshold of injury in regard to velocity.

It also illustrates the value of computerized motion analysis in confirming the diagnosis of whiplash-associated disorder and in the evaluation of prognosis and treatment.
THESE AUTHORS ALSO NOTE:

Three things remain unclear in whiplash trauma:
1) The force necessary to produce injury.
2) The exact pathophysiology of the injury.
3) The treatment of the resulting chronic pain syndrome.

“There is no absolute understanding of the factors that precipitate WAD.”

“In regard to collision dynamics, much debate exists over the threshold value for the force that can cause injury and precipitate chronic symptoms in passengers of colliding cars.”

The authors cite two studies that concluded that “rear-end collisions with a delta V of 10-15 km/h [6.2-9.3 m/h] or less cannot result in WAD.”


The authors then cite 3 other studies that disagree with the conclusions of that study.

“There is no consensus regarding a threshold value for the delta V that can precipitate WAD after low-velocity, rear-end collisions.” [IMPORTANT]

A 1997 study showed that cervical range of motion (CROM) measurements obtained at 3 months serve as valid predictors of permanent disability after a whiplash trauma.

Another study notes that CROM can discriminate between asymptomatic patients and patients with persistent symptoms after whiplash trauma, concluding that such measurements are reliable parameters of physical impairment from WAD.

THE CASE REPORT
A 46-year-old man presented with debilitating neck pain and headaches after he was rear ended by another bumper car in 1996. At the moment of impact, he saw stars and experienced sharp neck pain, a more intense kind of occipital headache, and localized sharp pain in his lower cervical spine and left shoulder.

“The patient stated that he was not prepared for the impact.” [IMPORTANT]

His head was projected straight backward and hit the pole behind the driver's seat and then recoiled into hyperflexion.

He was looking forward at the moment of impact and did not believe the collision caused his head to rotate.

“The headaches and neck pain that developed immediately after the accident did not improve over subsequent weeks.”

X-rays of the cervical spine and left shoulder, MRI of the neck, CT scan of the neck and electromyography, did not identify a cause for the unremitting symptoms. [Normal x-rays, MRI, CT, and EMG studies]

The x-rays did not show evidence of acute injury or show any degenerative or other chronic changes that could be associated with his headaches or neck pain.

Because of progressive deterioration and worsening symptoms within a year he was placed on partial disability, working a maximum of 10 hours per week in a less physically challenging position.

“After 2 hours of work in the morning, increased symptoms rendered him nonfunctional in spite of prescription drug use.”

He also experienced diffuse paresthesias in the right, and to a lesser extent, in the left, hand and forearm.

His writing hand has weakness and poor coordination.

In order to function socially he had to nap 3-5 hours every day.

He had never sustained any kind of acute neck trauma before or after the bumper car episode.

“On physical examination, the patient demonstrated limitations in neck mobility with focal tenderness at the posterior cervicothoracic junction. Palpation of several trigger points in that area caused radiating pain along the neck and into the right shoulder.”
“There were no focal motor, sensory, or deep tendon reflex deficits in either the upper or lower extremities, and there was no clinical evidence of a peripheral compression neuropathy.”

Injections of lidocaine into several myofascial trigger points in the trapezius muscle resulted in significant pain relief and increased cervical range of motion.

Since nonsurgical treatment failed to provide any lasting relief and his condition continued to worsen until he was put on full disability in 2002.

“The decision to perform surgery was based on the hypothesis that if injections of local anesthetic to painful trigger points result in temporary pain relief and increased CROM for the duration of the anesthesia, then excision of the same structures can provide permanent relief.”

Surgically, the fascia was resected at the tender points where small sensory nerves and vessels perforated the structures, resulting in decompression. They did not remove muscle tissue.

“On the first postoperative day, the patient reported reduced pain and demonstrated improved cervical flexibility.”

“Two weeks after the operation, a second computerized motion analysis study confirmed significantly improved CROM.”

“Nine months after the operation, the patient continues to experience the same symptomatic relief as he did immediately after the operation, in spite of a significantly increased level of activity at work and during his free time.”

“He experiences very little pain and takes no pain medicine other than over-the-counter drugs for occasional headaches, aches, or pains.”

“He has incrementally increased the number of working hours from 10 hours per week before surgery to 30 hours per week 10 months later. He no longer sleeps or rests in the afternoon, describes increased leisure activities, manipulates small objects without problem, and has been completely free of diffuse paresthesias since the day of surgery.”

DISCUSSION

“The authors report a case of chronic problems precipitated by a low-velocity impact that occurred during a bumper car ride.”

“The resulting clinical signs and symptoms were consistent in every respect with those reported by many patients with a history of high-velocity whiplash trauma.”

“Imaging studies, including MRI, is not sufficient to exclude significant injury after whiplash trauma to the neck.”
“Therefore, the diagnosis of WAD in many cases is deduced from an assessment of the mechanism of trauma as well as from time of onset of the patient's symptoms and their pattern.”

In an effort to identify sets of objective and reproducible data pertaining to the diagnosis and prognosis of WAD, Gargan et al studied CROM.8 The authors found that measurements obtained at 3 months post injury serve as valid predictors of permanent disability after a whiplash trauma. More recently, Dall'Alba et al also concluded that a deficit in CROM is a strong indicator of physical impairment in patients with WAD compared with asymptomatic volunteers.9

These authors are critical of the conclusions of Castro and Szabo.


“Unfortunately, the study groups are uniformly small and fail to take into consideration the effect of low-velocity impacts at varying rotational positions of the head as well as other important variables. They are also based on largely unsupported assumptions regarding associations that may exist between mechanisms of trauma and actual injury. Although acute cervical flexion/extension mechanism is probably one etiologic factor of importance for WAD, one cannot conclude that the severity of WAD is proportional to a given pattern of acute cervical movement. The data presented by Castro et al and Szabo et al thus give support to numerous other models in explaining WAD (e.g., injury is incurred as a result of an acute eccentric contraction of paraspinal muscles).”

“A variety of factors, including the occupant's awareness or head position in a colliding vehicle, defines the risk of neck injury to passengers in colliding vehicles.”[VERY IMPORTANT]

“One can only conclude that the threshold of injury is a complex dynamic relying on velocity, force, head position, head-torso angles, restraint placement, anticipation, tissue elasticity, tissue strength, and any multitude of variables that evade accurate determination.” [EXTREMELY IMPORTANT]

“The risk of permanent symptoms may be minimal after low-velocity collisions, yet research cannot disregard the clinical possibility of injury based on small studies that fail to simultaneously consider all pertinent variables.” [VERY IMPORTANT]

These authors maintain that soft-tissue damage is a more likely cause of WAD in patients when there is negative imaging studies. [VERY IMPORTANT]
“Considering the complex mechanism of trauma, a common pathophysiology is not likely among all individuals with WAD, and their condition must therefore be assessed individually in light of the clinical syndrome and the objective findings.”

[VERY IMPORTANT]

“This case history illustrates that a low-velocity collision can cause soft-tissue damage in the posterior neck, which may lead to chronic symptoms consistent with WAD.”

[IMPORTANT]

The authors propose that this case history offers an explanatory model for some cases of WAD with negative x-ray or electrophysiological findings.

KEY POINTS FROM AUTHORS:

1) “The myriad of dynamic variables between occupant and vehicle precludes a definition of change-in-velocity thresholds for neck injury from car collisions.”

[EXTREMELY IMPORTANT]

2) “Computerized motion analysis is a reliable method to confirm whiplash-associated disorder, quantify the patient's physical impairment, and identify indications for surgical treatment.”

3) The authors report a case of debilitating, chronic neck pain after a low-velocity bumper car collision, with negative MRI, CT scan, and electromyography. Objective evidence of injury and indication for adequate surgical treatment was established with computerized cervical motion analysis.

KEY POINTS FROM DAN MURPHY

1) There is no consensus as to the threshold of force required to injure a patient or to cause permanent injury from motor vehicle collisions.

2) Cervical range of motion analysis is important in confirming the diagnosis of whiplash-associated disorder and in the evaluation of prognosis and treatment and permanent disability.

3) The studies by Castro and Szabo that conclude one cannot be injured with delta Vs of less than 15 km/h (9.3 m/h) are wrong.

4) Cervical range of motion measurements obtained at 3 months are a valid predictor of permanent disability after a whiplash trauma.

5) Cervical range of motion can discriminate between asymptomatic patients and patients with persistent symptoms after whiplash trauma.

6) Cervical range of motion measurements are reliable parameters of physical impairment from WAD.
7) Normal x-rays, MRI, CT, and EMG studies do not mean that one is not injured or impaired or suffering from debilitating chronic symptoms.

8) One can suffer from diffuse extremity paresthesias, motor weakness and poor coordination without a radiculopathy.

9) One can suffer from diffuse extremity paresthesias, motor weakness and poor coordination with normal motor, sensory, and deep tendon reflex examinations.

10) Imaging studies, including MRI, do not exclude significant injury after whiplash trauma to the neck.

11) The diagnosis of WAD is often deduced from an assessment of the mechanism of trauma as well as from time of onset of the patient's symptoms and their pattern.

12) An occupant's awareness and/or head position are important factors in assessing the risk of neck injury to passengers in colliding vehicles.

13) Whiplash threshold of injury is a complex dynamic relying on velocity, force, head position, head-torso angles, restraint placement, anticipation, tissue elasticity, tissue strength, and any multitude of variables that evade accurate determination.

14) If imaging studies are negative, the cause of chronic whiplash symptoms is probably soft tissue injury.

15) It is unlikely that all individuals with chronic whiplash symptoms have a common pathophysiology.

16) A low-velocity collision can cause soft-tissue damage in the posterior neck, which may lead to chronic whiplash symptoms.

17) Between the occupant and the vehicle there are so many variables, it is impossible to establish a change-in-velocity thresholds for neck injury from car collisions.

COMMENT FROM DAN

Importantly, the last reference in this article is the 1998 article by Charles Davis, DC. Dr. Davis teaches two modules in the ICA ten module certification program in Spine Trauma that I coordinate (the Certified Chiropractic Spinal Trauma of CCST program). Dr. Davis teaches the module on low impact collisions, and he co-teaches the module on courtroom protocols with attorney Travis Black. Next year the program will be in Dallas. You can sign-up for any class in the series by contacting the ICA at (800) 423-4690. [Davis CG. Rear-end impacts: vehicle and occupant response. J Manipulative Physiol Ther 1998;21:629-39.]