Derivation Of A Clinical Decision Rule For Whiplash Associated Disorders Among Individuals Involved In Rear-End Collisions

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FROM ABSTRACT

A prospective study was used to:
(1) quantify potential risk factors for whiplash associated disorder following a rear-end motor vehicle collision; and
(2) develop a simple clinical decision rule for the early identification of patients at risk for long-term whiplash associated disorder.

Between 1 October 1995 and 31 March 1998, 446 adults involved in rear-end collisions presented to the only two emergency departments serving Kingston, Ontario.

Eligible and consenting subjects (n=353) were contacted by telephone soon after the collisions then at multiple occasions up to 2 years post-collision.

Bivariate and multiple logistic regression analyses were used to identify potential risk factors for persistent symptoms.

A software package that uses Chi-squared automatic interaction detection and classification and regression trees was used to develop a simple clinical decision rule for the identification of patients at high and low risk for persistent whiplash associated disorder.

Risk factors identified by regression analyses included:
(1) Increased age
(2) Number of initial physical symptoms
(3) Early development of the following symptoms: upper back pain, upper extremity numbness or weakness, or disturbances in vision

A simple clinical decision rule that requires asking up to three basic questions of each patient was derived and would have identified the 118 cases of persistent whiplash associated disorder with a sensitivity of 91.5% and a specificity of 51.4%.
This study confirmed the importance of several risk factors for whiplash associated disorder following rear-end motor vehicle collisions.

THESE AUTHORS ALSO NOTE:

Whiplash associated disorders (WAD) injuries most frequently occur among occupants that are in rear-end motor vehicle collisions (MVCs).

These authors conducted a prospective follow-up study of 353 cases of individuals involved in rear-end MVCs, and analyzed:
(1) The quantification of potential risk factors for WAD at 6 months post-MVC.
(2) The development of a simple clinical decision rule to be used in the early identification of patients at risk for persistent symptoms consistent with WAD.

METHODS

The 353 individuals were interviewed initially and then at 1, 2, 3, 6, 9, 12, 18 and 24 months post-MVC.

“Information was collected about:
initial and ongoing symptoms, treatments received, impact of the injury on work and leisure activities, circumstances surrounding the collision, the vehicles involved, and compensation sought and/or received by the injured person.”

OUTCOME

Outcome at 6 months was used in this analysis because it has been shown to be indicative of long-term symptoms of WAD and has been used by other researchers in examining prognosis following neck injuries.

The frequency categories for symptoms were defined as follows:

(1) None No symptoms
(2) Occasional Symptoms less than once a week
(3) Regular Symptoms once a week or more
(4) Daily Symptoms every day
The severity categories for symptoms were defined as:

1. None
2. Minor Symptoms are a nuisance
3. Moderate Symptoms affect regular activities or work
4. Severe Symptoms are a significant handicap to regular work or activities

The authors defined chronic WAD at 6 months post-collision as neck, and/or upper back, and/or shoulder pain with a severity of moderate or severe and frequency of regularly or daily.

RESULTS

“A total of 118 (35.3%) of the subjects experienced WAD at 6 months.”

“Without exception, these results indicated strong and statistically significant associations between the presence of each of the symptoms and the occurrence of WAD.”

“There was a significant trend between the number of symptoms reported early on and increased risk for WAD at 6 months.”

“Risk of reporting WAD at 6 months post-injury increased with increasing age and decreased with increasing height.”

Missing time from work was significantly associated with WAD at 6 months.

“Those who reported a change in their work or leisure activities were also more likely to experience WAD at 6 months post-injury.”

“The strongest predictors of WAD at 6 months were age, the number of symptoms experienced early on and the actual individual symptoms.”

The number of symptoms is clearly a strong predictor of WAD at 6 months.

“The symptoms that emerged as significant, after simultaneous adjustment for other factors, were upper back pain, upper extremity numbness or weakness, and disturbances to vision.”

Age group remained a highly significant predictor of WAD at 6 months.
The three basic questions used to identify high probability persistent whiplash associated disorder (WAD), asked at 2 weeks post-injury:

1. (A) Did the collision occur at a location other than an intersection in the city?
   (B) Have you experienced upper back pain since the collision?
   “If patients answer yes to both of these questions, they are considered high risk for WAD at 6 months.”

If patients answer no to both of these questions, they are asked the following additional question:

2. Do you still experience neck pain (2 weeks post-injury)?
   “Patients answering no are considered low risk, while those answering yes are considered high risk.”

Those patients answering yes to one of questions (1)(A)(B) above are asked the following additional question:

3. Do you still experience shoulder pain (2 weeks post-injury)?
   “Those responding no are considered low risk, while those answering yes’ are considered high risk.”

DISCUSSION

“The development of a simple, clinical decision rule for rear-end MVCs has considerable potential for the evaluation and subsequent treatment of persons with acceleration-extension injuries.”

“Such a tool could be used to identify patients at high risk for long-term complications.”

In this cohort, application of the rule identified 92% of those who experienced persistent WAD symptoms at 6 months.

This “confirmed the importance of several important risk factors for persistent WAD using a prospective study approach.”

“Of considerable interest is the fact that symptoms, as opposed to crash and personal characteristics, were the most consistent predictors of persistent WAD.”

[WOW!]

“In the case of rear-end collisions, there are low thresholds of impact
for the occurrence of these symptoms, and that the presence or absence of these symptoms is only modestly affected by variations in the crash circumstances.”

[WOW!]

The most important risk factors for WAD at 6 months in this analysis are age and the number of symptoms reported initially (0-9).

Specific symptoms that were significantly associated with WAD at 6 months were upper back pain, upper extremity numbness and weakness, and disturbances to vision.

“The presence of age as a risk factor makes intuitive sense. It is biologically plausible that both the severity of injury would be greater and recovery from it would be slower with increasing age.”[IMPORTANT]

Importantly, Ontario has a no-fault insurance program that makes it difficult to receive compensation for pain and suffering, which minimizes the error introduced by compensation and litigation.

These authors were able to show that the pre-MVC symptoms of neck pain, shoulder pain and/or upper back pain doubled the probability of experiencing chronic WAD at 6 months.

Factors that did not increase the probability of chronic WAD at 6 months were:
Fewer than 2 symptoms, age 18-30, neck stiffness, shoulder pain, and low back pain.

The following symptoms were reported at initial interview following MVC:
Neck Pain
Shoulder Pain
Upper Back Pain
Lower Back Pain
Headaches
Neck Stiffness
Upper Extremity Numbness or Weakness
Dizziness
Nausea/Vomiting
Vision Disturbances
Difficulty Sleeping
Fatigue
Anxiety
Difficulty Concentrating
Depression

The authors clearly show that in this study the following were not predictive of WAD at 6 months. This means that these factors did not increase or reduce the chances of suffering chronic WAD at 6 months:
Position in Vehicle
Road Conditions (dry, wet, icy)
Prepared for Crash
Head Position (straight, looking in rearview mirror, or turned)
Seatbelt Use
Head Restraint Present
The Size of the Vehicle That Hit Yours (bigger, smaller, same)
Posted Speed Limit (This means that at low speeds, just as many persons suffered chronic WAD at 6 months as persons who apparently recovered and did not suffer chronic WAD at 6 months).

When the authors adjusted for all variables the following factors resulted in the following increased probability of suffering chronic WAD at 6 months post-collision:

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>INCREASED PROBABILITY OF CHRONIC WAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 individual symptoms</td>
<td>22.67</td>
</tr>
<tr>
<td>8 individual symptoms</td>
<td>17.81</td>
</tr>
<tr>
<td>7 individual symptoms</td>
<td>9.87</td>
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<tr>
<td>5 individual symptoms</td>
<td>6.71</td>
</tr>
<tr>
<td>6 individual symptoms</td>
<td>5.87</td>
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<tr>
<td>Aged 51-70</td>
<td>3.78</td>
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<tr>
<td>Upper Back pain</td>
<td>2.91</td>
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<tr>
<td>4 individual symptoms</td>
<td>2.71</td>
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<tr>
<td>Upper Extremity Numbness or Weakness</td>
<td>2.18</td>
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<tr>
<td>3 individual symptoms</td>
<td>2.05</td>
</tr>
<tr>
<td>Visual Disturbance</td>
<td>1.96</td>
</tr>
<tr>
<td>Nausea and/or Vomiting</td>
<td>1.55</td>
</tr>
</tbody>
</table>

KEY POINTS FROM DAN MURPHY

(1) In this study of 334 individuals injured in a rear-end MVC, 35% suffered chronic WAD, while apparently 65% had recovered at 6 months post-injury. This occurred in Ontario, CAN, where apparently there is no compensation for pain or suffering.
(2) The following initial presenting factors and symptoms are associated with a significant increased probability of suffering chronic WAD at 6 months post-injury:
(A) Three or more symptoms
(B) Older than age 51
(C) Upper Back pain
(D) Upper Extremity Numbness or Weakness
(E) Visual Disturbance
(F) Nausea and/or Vomiting

(3) In rear-end collisions, there is a low threshold of impact to cause symptoms.

(4) Patient symptoms are more important predictors of chronic WAD than are crash characteristics.

(5) Patient symptoms are not related to crash characteristics.

(6) Older patients sustain greater injury and recover poorly.