Whiplash associated disorders: a review of the literature to guide patient information and advice

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Objectives: To review the literature and provide an evidence based framework for patient centred information and advice on whiplash associated disorders.

Methods: A systematic literature search was conducted, which included both clinical and non-clinical articles to encompass the wide range of patients’ informational needs. From the studies and previous reviews retrieved, 163 were selected for detailed review. The review process considered the quantity, consistency, and relevance of all selected articles. These were categorised under a grading system to reflect the quality of the evidence, and then linked to derived evidence statements.

Results: The main messages that emerged were: physical serious injury is rare; reassurance about good prognosis is important; over-medicalisation is detrimental; recovery is improved by early return to normal pre-accident activities, self exercise, and manual therapy; positive attitudes and beliefs are helpful in regaining activity levels; collars, rest, and negative attitudes and beliefs delay recovery and contribute to chronicity. These findings were synthesised into patient centred messages with the potential to reduce the risk of chronicity.

Conclusions: The scientific evidence on whiplash associated disorders is of variable quality, but sufficiently robust and consistent for the purpose of guiding patient information and advice. While the delivery of appropriate messages can be both oral and written, consistency is imperative, so an innovative patient educational booklet, The Whiplash Book, has been developed and published.
Grade IV (fracture or dislocation) and surgical interventions were excluded. Initially, abstracts of the retrieved articles were screened by one of the authors for their general content; full papers were obtained for those that appeared applicable. Acceptable studies and reviews were then selected as those that presented information relevant to the management and treatment of whiplash, together with selected articles covering epidemiology, mechanisms of injury, and social policy. Articles not pertinent to the development of patient information, or that did not add to the understanding of injury mechanisms or management in WAD, were excluded. In some areas (notably patient education) the whiplash literature was seriously lacking, so background evidence was taken from selected papers in other musculoskeletal conditions. In addition to the formal search, a few papers published in the last two months of 2001, which were especially relevant to the objectives of the review, were included.

A full systematic review methodology in such a multidisciplinary field would be impracticable and inappropriate, so an alternative strategy had to be adopted. This was based on a qualitative evaluation of the available scientific evidence in each relevant field for its appropriateness for developing patient information. Included articles were scrutinised and the pertinent information extracted; extensive discussion, reiterative drafting, and consensus between the three reviewers resulted in the synthesis of evidence statements reflecting the evidence currently available, while recognising the limitations of that evidence in many areas. Evidence statements were categorised under a number of headings: biomechanics, epidemiology, clinical, investigation, psychology, theoretical models, treatment, education, and social policy (though inevitably there was some overlap between these headings). The strength of the evidence for each statement was then rated qualitatively on its quantity, quality, and consistency by consensus between the three authors:

- **Consistent**: Generally consistent findings in multiple studies (albeit of variable scientific quality).
- **Balance**: Balance of available evidence (including existing reviews).
- **Limited**: Limited or weak scientific evidence.

Thus, the literature review may best be summarised as systematic searching of the published scientific literature with a qualitative evaluation of the quantity, consistency, and relevance of the evidence as the basis for patient information and advice on WAD.

**RESULTS**

One hundred and sixty three papers were included in the review and examined in detail. Table 1 lists the evidence statements (with identifying letters) together with a rating of the evidence and links to the references.

The QTF found very little scientifically admissible data. Having examined all material published since 1994, we feel this is, by and large, still the case. Published studies frequently have methodological shortcomings such as low sample sizes, differing inclusion/exclusion criteria and differing outcome measures, although there were some notable exceptions. In view of the limitations of the scientific evidence we believe, in common with the QTF, that a “best evidence synthesis” is appropriate, and our findings show this can provide a useful overview that highlights areas where there is a reasonable degree of consistency.

**Biomechanics**

Biomechanical considerations give some insight into the likelihood of injury, the tissues involved, and the severity of injury. Consistent evidence from both in vitro and in vivo studies suggest that a whiplash type injury can result in tissue injury to various spinal structures; potentially affecting the intervertebral discs, zygapophysial joints, ligaments and muscles (see table 1: B1, B6, B7). The majority of whiplash injuries probably involve predominantly muscles and ligaments, resulting from direct stretching or neuromuscular reflex contractions (B2).

Many road traffic accidents involve quite low acceleration perturbations, which are similar to other daily living/sport activities (B5). Consistent findings indicate that relatively low velocity changes can be associated with tissue damage, with the threshold suggested to be 10–15 km/h (B3); yet claims may be made for symptoms resulting from accidents with even lower velocity changes (B4). The direction of impact has an influence: for similar vehicle masses, a higher velocity change is required for tissue damage in a front impact or side impact compared with a rear impact, and a poorer prognosis is likely if the neck is rotated or side bent at the time of impact (B9). There is considerable interest in the influence of head restraints on the effects of injury: theoretically head restraints can reduce the incidence and severity of WAD; there is some consensus that the optimum position for a head restraint is close to and level with the head (B8).

**Epidemiology**

Data from different countries suggest that recovery rates from WAD differ, probably depending on social and cultural influences. In cultures of low therapeutic involvement and no litigation, symptoms are short lived with little or no link to chronicity (E6). While there has been criticism of the methodology of these studies, the published data are largely consistent. The prevalence of chronic neck pain after a whiplash injury is very similar to the prevalence of chronic neck pain in the general population (E1), making it difficult to determine if persisting symptoms are directly related to the injury or are simply a reflection of the high prevalence of non-specific neck problems in the population at large. From an epidemiological perspective, it is clear that those with continuing symptoms three months after the accident are likely to remain symptomatic for at least two years, possibly much longer (E2). As with other chronic musculoskeletal disorders, people with chronic WAD typically have a high level of multiple complaints (E3). A poorer prognosis has been suggested for certain factors, although the quality of the evidence and the effect size varies: female sex, older age, a high level of symptom severity at onset, pre-traumatic headache, a greater number of symptoms, and pre-existing degenerative changes on radiograph (E4). There is limited evidence on an increased level of symptoms after a second whiplash injury (E5).

**Clinical history and examination**

There is conflicting evidence on the value of physical examination in the clinical setting. While a clinical history and physical examination are important to establish the WAD grade (and to identify or exclude more serious injuries), the findings do not pinpoint sources of pain and are not closely related to prognosis (C1). The most common presenting symptoms are, in descending frequency: neck pain, neck stiffness, headache, low back pain, shoulder pain, and visual disturbance/dizziness (C4), while generalised hyperexcitability and central nervous system sensitisation has been described in a number of studies of patients with chronic WAD (C6). There is persuasive evidence that the clinical outcome at two years can be predicted at three months. It seems that patients who are symptomatic after three months will remain so after two years or more, although their symptoms will fluctuate during this period. The two year outcome can be predicted with an 82% success rate using a combination of psychological score and neck stiffness assessed at three months (C2). There is consistent evidence that non-collision factors are important in the development of chronic symptoms (including fibromyalgia), emphasising the role of...
psychological and cultural factors (C3), and there is consider-
able individual variability in terms of response to the accident
itself and any resultant symptoms (C5).

Investigations
According to QTF and BCWI, imaging is unnecessary in Grade
0-I, but should be performed for Grade II-III to exclude possi-
ble fracture or dislocation; though it was accepted that
incidental findings unrelated to the injury can be highlighted
unnecessarily. More recently, it has been suggested that the
extent of radiography could safely be reduced substantially
through simple clinical screening, thus limiting unnecessary
investigation and consequent costs (In4). The present review
suggests that an MRI scan is generally not necessary for
Grades 0-II, and probably only helpful for Grade III if surgery
is being considered (In1). MRI scans will reveal a high number
of abnormalities, particularly age related changes, in symptom
free individuals as well as patients (In2). Conversely, while a
high level of abnormalities on MRI has been associated with a
poorer prognosis in WAD patients, these abnormalities are
most commonly degenerative changes not specifically related
to the neck injury (In3).

Psychology
A whiplash injury can certainly trigger emotional and cogni-
tive changes, including travel anxiety, post-traumatic stress
disorder, depression, fear of movement, catastrophising, sleep
disturbance, and lower levels of concentration (P1, P6). These
psychological changes, resulting either from the accident or
from the subsequent symptoms and disability, develop
secondarily during the first three months after the accident,
and do not imply that the pain is psychogenic (P2). When
present, psychological factors have a significant detrimental
effect on outcomes (including return to work), and recovery
tends to parallel psychological improvement (P6, P7). Chronic
WAD patients may exhibit inaccurate expectations and ampli-
fication of symptoms; they may attribute their entire symptom
pattern directly to the road accident, thus contributing to a
perpetuation of their problem (P3). Specific coping strategies
(active problem solving and perceived confidence in ability
to complete daily activities) may be helpful (P5).

Models
Numerous models have been proposed to explain WAD. It is
generally accepted that the biopsychosocial model can explain
many clinical and epidemiological findings in WAD (M1).
Accepting an injury event does occur, there is clear evidence
for a biological component in the acute presentation (M2).
The evidence suggests, however, that the development of
chronic symptoms is influenced more by psychological, social,
or cultural factors (M3, E6). More controversially, it has been
argued that evidence for the construct validity of a causal link
between the trauma mechanism and chronic symptoms is
sparse, and that whiplash can be conceptualised as being a
risk factor for cervical symptoms rather than representing a
discrete disease entity (M4).

Treatment
It has been shown consistently in randomised controlled trials
that an early active management strategy is most effective for
WAD patients (Grade 1 to III) (T2). This includes return
to pre-accident activities as soon as possible (T1), analgesic
medication to control symptoms and permit increased activity
levels (T4), and prescription of neck specific exercises (T7).
Manual therapy (T6), and psychosocial interventions (includ-
ing cognitive behavioural therapy) may be helpful, particularly
for achieving early activation (T5). Collars, rest, and passive
physical modalities are generally unhelpful (T3, T8). While the
use of a soft collar can ease acute symptoms there may be a
risk of promoting illness behaviour, especially if used beyond
72 hours (T3). Ill directed and blanket treatment approaches
seem likely to contribute to chronic symptoms (T9). Radiofre-
cy frequency neurotomy can be considered for chronic symptoms
(T10), but the relation between those symptoms and the
injury may be uncertain (E1). There is limited evidence for the
effectiveness of antidepressants in WAD (T11).

Education
There is general consensus that appropriate information and
advice is important (Ed1); while there is little information on
educational interventions specifically for WAD, there is
persuasive evidence from other musculoskeletal literature. It
is known that patients want and seek information on health
issues (Ed2), and it is important that that information is easy
to read, understandable, acceptable, authoritative, believable,
and contains practical advice (Ed3). Patients appreciate and
retain knowledge from health educational booklets (Ed4);
evidenced based patient education (particularly for low back
pain) has been shown to have some effect in creating positive
shifts in beliefs, improving clinical outcomes, and reducing
work loss (Ed4). To counter negative cultural influences on
recuperation and inconsistent advice given by health care profes-
sionals, early delivery of evidenced based information may be
optimal for assisting the return to normal activities (Ed4).

Social policy
The literature showing national and geographical differences
in symptom reporting and recovery rates for WAD imply that
social factors exert an influence on symptomatology and dis-
ability (S1). There is limited evidence to suggest that cultural
over-medicalisation may contribute to illness behaviour (S2).
Other potential social effects will be outside the control of
health care, and involve legal and statutory bodies. Whiplash
injuries represent a substantial cost to society, much of which
is accounted for by cases lasting over six months (S3); there is
therefore a logical basis for early intervention strategies to
reduce the significant individual and societal costs.

DISCUSSION
The important sources of guidance for the management of
whiplash (QTF, BCWI) recommend that patients be given
reassuring information and advice. The results of this review
support that position, and provide a stronger evidence base
that active management strategies should have a beneficial
influence on outcomes (table 1).

The limitations of this review, its methodology, and the
available evidence must be recognised. The literature was
searched systematically but, as already emphasised, a proper
systematic review methodology was impractical and inappro-
priate. This was mainly because of the aims and scope of the
review, and the range of material included, which was far
beyond the randomised controlled trials for which the stand-
ard systematic review methodology is designed. Adherence to
strict methodological criteria would have excluded much
valuable information important to patients and their clinical
management. The scope of the review and the criteria for rat-
ing the evidence were set to maximise the information avail-
able in an area not characterised by high quality studies. In
common with QTF, a “best evidence synthesis” seemed the
most profitable method for extracting appropriate patient
centred messages. In the event, while some areas of the whip-
lash literature are clearly lacking good scientific evidence,
there is a high level of consistency and consensus in many of
the areas most pertinent to patient education. There remains,
though, a clear need for randomised controlled trials to inform
on specific treatment/management protocols, and their
optimal timings.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Evidence statement</th>
<th>Rating</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomechanics</td>
<td>B1 Forces involved in road traffic accidents can be sufficient to potentially damage spinal structures, intervertebral discs, zygapophysial joints, muscles, ligaments.</td>
<td>C</td>
<td>9 10 11 12 13 14 15 16 17 18 19 20</td>
</tr>
<tr>
<td></td>
<td>B2 Most whiplash injuries involve only the soft tissues.</td>
<td>C</td>
<td>21 22 23 24</td>
</tr>
<tr>
<td></td>
<td>B3 The threshold for tissue damage is a change in velocity of the order of 10-15 km/h (acceleration levels of around 3-4 g).</td>
<td>C</td>
<td>20 25 26 27</td>
</tr>
<tr>
<td></td>
<td>B4 The threshold for symptom generation is a change in velocity of the order of 4-8 km/h.</td>
<td>B</td>
<td>14 28 29</td>
</tr>
<tr>
<td></td>
<td>B5 Acceleration perturbations of daily living can be greater than those in some vehicle accidents.</td>
<td>L</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>B6 In some cases, compression may be the most significant force affecting the zygapophysial joints; zygapophysial joints may be important in understanding chronic symptoms.</td>
<td>C</td>
<td>12 15 19 31 32 33</td>
</tr>
<tr>
<td></td>
<td>B7 Biomechanical analyses should include in vivo studies in order to take account of muscle forces.</td>
<td>B</td>
<td>34 35 36 37</td>
</tr>
<tr>
<td></td>
<td>B8 Head restraints influence the type and severity of injury.</td>
<td>B</td>
<td>38 39 40 41 42 43 44 45</td>
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<tr>
<td></td>
<td>B9 Head rotated or side-bent at time of injury predicts a poorer prognosis.</td>
<td>C</td>
<td>46 47 48 36</td>
</tr>
<tr>
<td></td>
<td>B5 Acceleration perturbations of daily living can be greater than those in some vehicle accidents.</td>
<td>L</td>
<td>30</td>
</tr>
<tr>
<td>Epidemiology</td>
<td>E1 Chronic symptoms after whiplash have similar prevalence to chronic neck pain in the general population.</td>
<td>C</td>
<td>49 50</td>
</tr>
<tr>
<td></td>
<td>E2 Symptom status at three months predicts status at 2 years (or more).</td>
<td>C</td>
<td>51 52 53</td>
</tr>
<tr>
<td></td>
<td>E3 High prevalence of multiple complaints in those with chronic WAD.</td>
<td>B</td>
<td>54 55</td>
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<tr>
<td></td>
<td>E4 Higher risk of persisting symptoms in some groups: eg, women, older patients, high level of symptoms at onset, high prevalence of pre-traumatic headache, greater number of symptoms, degenerative changes on idiography.</td>
<td>C</td>
<td>46 56 57 58 59 60 61 62 63</td>
</tr>
<tr>
<td></td>
<td>E5 Reported symptoms may be more severe after a second whiplash injury.</td>
<td>L</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>E6 In societies with no litigation and/or low therapeutic involvement WAD is short lived, with little or no link to chronic symptoms.</td>
<td>C</td>
<td>65 66 67 68 69</td>
</tr>
<tr>
<td>Clinical</td>
<td>C1 Clinical history and examination are important to determine the WAD Grade, but add little to identifying the source of pain or its prognosis.</td>
<td>C</td>
<td>11 70 71 72</td>
</tr>
<tr>
<td></td>
<td>C2 Clinical outcome at 2 years can be predicted at 3 months.</td>
<td>C</td>
<td>51 52 53</td>
</tr>
<tr>
<td></td>
<td>C3 Non-physical factors are important in the development of chronicity.</td>
<td>C</td>
<td>57 73 74 75 76 77 78</td>
</tr>
<tr>
<td></td>
<td>C4 Most common symptoms on presentation: neck pain –100%; neck stiffness –70%; headache 50-80%; low back pain –60%; shoulder pain 40-75%; visual disturbance/dizziness 10-50%.</td>
<td>C</td>
<td>70 79 80</td>
</tr>
<tr>
<td></td>
<td>C5 There is considerable individual variability in response to the accident and to symptoms.</td>
<td>B</td>
<td>14 26 29 55 81</td>
</tr>
<tr>
<td>Investigation</td>
<td>C6 Generalised hyper-excitability, CNS sensitisation, and muscular dysfunction have been hypothesised in chronic whiplash patients.</td>
<td>C</td>
<td>22 82 83 84</td>
</tr>
<tr>
<td></td>
<td>In1 MRI is generally unhelpful except where surgery planned.</td>
<td>B</td>
<td>85 86</td>
</tr>
<tr>
<td></td>
<td>In2 MRI shows high levels of abnormalities in normal, asymptomatic people – particularly age related changes.</td>
<td>B</td>
<td>87 88 89</td>
</tr>
<tr>
<td></td>
<td>In3 Pre-existing abnormalities on MRI (mainly age related changes), whilst not specifically related to the neck injury, may be a risk factor for longer pain duration.</td>
<td>B</td>
<td>46 87 90</td>
</tr>
<tr>
<td>Psychology</td>
<td>P1 Road traffic accident may trigger emotional and/or cognitive changes.</td>
<td>C</td>
<td>5 69 91 92</td>
</tr>
<tr>
<td></td>
<td>P2 Psychological disturbance may develop in the first three months as a consequence of symptoms.</td>
<td>B</td>
<td>51 81 97 98</td>
</tr>
<tr>
<td></td>
<td>P3 Expectation, amplification, and attribution are important in development of chronic pain and disability.</td>
<td>B</td>
<td>99 100</td>
</tr>
<tr>
<td></td>
<td>P4 WAD symptoms can be associated with illness behaviour.</td>
<td>B</td>
<td>65 92</td>
</tr>
<tr>
<td></td>
<td>P5 Specific coping strategies may be beneficial.</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P6 Psychological factors, such as anxiety, catastrophising, depression, and fear avoidance, have a significant influence on the clinical picture and on outcomes (including employment status).</td>
<td>C</td>
<td>102 103 104 105</td>
</tr>
<tr>
<td>Models</td>
<td>M1 Biopsychosocial model applies; similar to other musculoskeletal pain.</td>
<td>C</td>
<td>106 107 108</td>
</tr>
<tr>
<td></td>
<td>M2 An injury event does occur, with potential for some tissue damage, even if the precise structure cannot be identified.</td>
<td>C</td>
<td>100 109 110 111 112 73</td>
</tr>
<tr>
<td></td>
<td>M3 Chronic symptoms developing after whiplash injury are related closely to the presence of secondary biopsychosocial influences.</td>
<td>B</td>
<td>9 12 18 113</td>
</tr>
<tr>
<td></td>
<td>M4 Whiplash may be conceptualised as a risk factor for cervical symptoms rather than a discrete disease entity.</td>
<td>B</td>
<td>73 99 111 114</td>
</tr>
<tr>
<td>Treatment</td>
<td>T1 Faster recovery with return to pre-accident activities as soon as possible.</td>
<td>C</td>
<td>5 6 116</td>
</tr>
<tr>
<td></td>
<td>T2 Active treatment is the most effective approach, with the corollary that rest is detrimental.</td>
<td>C</td>
<td>6 117 118 78 119 120</td>
</tr>
<tr>
<td></td>
<td>T3 Collars not helpful (grade I, II, and III); certainly beyond 72 hours.</td>
<td>C</td>
<td>5 6 121</td>
</tr>
<tr>
<td></td>
<td>T4 Simple pain control is advantageous for musculoskeletal disorders, including WAD.</td>
<td>B</td>
<td>5 6</td>
</tr>
<tr>
<td></td>
<td>T5 Psychosocial interventions, including cognitive behavioural therapy, are helpful for management of musculoskeletal disorders, including WAD.</td>
<td>C</td>
<td>122 123 124 125 126</td>
</tr>
<tr>
<td></td>
<td>T6 Manual therapy (mobilisation and/or manipulation) helpful in the early stages of WAD.</td>
<td>C</td>
<td>6 127 128 129 130 131 132 133</td>
</tr>
<tr>
<td></td>
<td>T7 Self exercises helpful for early recovery.</td>
<td>C</td>
<td>6 78 134</td>
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<tr>
<td></td>
<td>T8 Traditional physical therapy modalities have limited effect.</td>
<td>B</td>
<td>6 135</td>
</tr>
<tr>
<td></td>
<td>T9 Over-medicalisation may contribute to chronic symptoms.</td>
<td>B</td>
<td>112 136 137</td>
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<tr>
<td></td>
<td>T10 Radiofrequency neurotomy can reduce symptoms related to zygapophysial joints in chronic WAD.</td>
<td>L</td>
<td>138 139</td>
</tr>
<tr>
<td></td>
<td>T11 Antidepressants may relieve pain in chronic WAD.</td>
<td>L</td>
<td>97 140</td>
</tr>
</tbody>
</table>
Table 1 (continued) Results of literature review: evidence statements, rating, and linking

<table>
<thead>
<tr>
<th>Topic</th>
<th>Evidence statement</th>
<th>Rating</th>
<th>References</th>
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<tbody>
<tr>
<td><strong>Education</strong></td>
<td>There is an absence of scientific information on educational interventions for WAD: these statements are mostly from other musculoskeletal literature.</td>
<td></td>
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</tr>
<tr>
<td>Ed1</td>
<td>Guidelines stress that information and advice is important in early management.</td>
<td>B</td>
<td>5 6</td>
</tr>
<tr>
<td>Ed2</td>
<td>Patients want and appreciate written information.</td>
<td></td>
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<tr>
<td>Ed3</td>
<td>Readability, understand-ability, acceptability, and inclusion of practical advice are important elements for booklets.</td>
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<tr>
<td>Ed4</td>
<td>Innovative patient educational materials (eg, The Back Book), that presents unambiguous messages focused on changing detrimental beliefs and attitudes can shift beliefs whilst having a beneficial effect on clinical outcomes, and may reduce care seeking and work loss. (However, more traditional booklets may not have the same effect!).</td>
<td></td>
<td></td>
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<tr>
<td>Ed5</td>
<td>Patients retain knowledge from health educational booklets. Men may be less likely to read information.</td>
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<td></td>
</tr>
<tr>
<td><strong>Social policy</strong></td>
<td>Economic incentives, changes to rules governing eligibility, and moves to no fault compensation can influence reporting rates and societal costs; these issues may be confounded with reduced contact with therapeutic and legal communities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>Ill directed or blanket investigations and treatment may contribute to illness behaviour</td>
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<td></td>
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<tr>
<td>S2</td>
<td>There are high costs to society in many countries; in common with other musculoskeletal conditions, the majority of the costs are incurred by the chronic cases.</td>
<td></td>
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</tr>
</tbody>
</table>

C=consistent evidence; B=balance of evidence; L=limited evidence.

The following core set of evidence based messages represents a simple list of concepts that all clinicians treating or advising patients with a WAD should include in their patient education. These messages should be incorporated into a booklet that, after peer review and final editing, is distributed to patients. The following core set of evidence based messages represents a simple list of concepts that all clinicians treating or advising patients with a WAD should include in their patient education. These messages should be incorporated into a booklet that, after peer review and final editing, is distributed to patients.

**Acknowledgements**

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