Whiplash injury
30-YEAR FOLLOW-UP OF A SINGLE SERIES

We have reviewed 22 patients at a mean of 30 years (28 to 31) after a whiplash injury. A complete recovery had been made in ten (45.5%) while one continued to describe severe symptoms. Persistent disability was associated with psychological distress but both improved in the period between 15 and 30 years after injury. After 30 years, ten patients (45.5%) were more disabled by knee than by neck pain.

The term ‘whiplash’ is used to denote the mechanism of an indirect flexion-extension soft-tissue injury to the neck resulting from a rear-end motor-vehicle collision. It was originally described by Crowe in 1928 in a presentation to the Western Orthopaedic Association.1 Whiplash describes a syndrome which includes pain in the neck which may radiate to the posterior aspect of the pectoral girdle, the upper limbs and the thoracic and lumbar spine. By two years after the injury it is possible to identify patients who have either made a complete recovery, about 50%, and those who suffer severe symptoms (4.5%).2,3 Those with a disability often develop an abnormal psychological response.4,5

There have been few long-term studies on whiplash injury. There have been studies from Bristol for two,6 ten7 and 15.58 years. Gargan and Bannister7 have previously reported the longest follow-up.

Musculoskeletal pain tends to increase with age and this may be superimposed on the pre-existing symptoms of a whiplash injury thereby causing more severe disability in the neck with advancing years.

Our aim was to establish the long-term physical and psychological outcomes after whiplash injury, to identify any changes between 15.5 and 30 years and to test the hypothesis that disability in the neck after a whiplash injury increases with advancing years.

Patients and Methods
Between September 1977 and May 1980, 61 consecutive patients with a soft-tissue injury of the neck after a rear-end vehicle collision were seen at one of the hospitals in Bristol. All were followed up for two years,6 43 for ten years7 and 40 for 15.58 years. We have now reviewed 22 of these patients again. Of the 40 seen at 15.5 years, six had died and 12 could not be traced. Data were therefore obtained for the remaining 22. There were 12 women and ten men with a mean age of 64 years (49 to 82).

The mean period of follow-up was for 30 years (28 to 31). Data were collected by postal questionnaire.2 Those who did not respond were contacted by telephone.

We assessed disability in the neck using the classification of Gargan and Bannister,7 the psychological state by the Hospital Anxiety and Depression scale9 and the depression inventory of Beck et al,10 and other musculoskeletal pain by the Oxford Knee score (OKS).11 The Gargan and Bannister classification was used to allow comparison with the results of previous studies of this series of patients. It predates the patient-based outcome measures of neck disability which are currently used. The neck disability index12 was developed as a modification of the Oswestry low back pain disability index.13 The Gargan and Bannister scale ranks symptoms in increasing severity from A (asymptomatic) to B (mild, not interfering with work or leisure activities), to C (intrusive, handicapping work and leisure and causing patients to seek relief by the frequent use of analgesia, orthoses or physiotherapy) and to D (severe, causing patients to lose their job and to rely continually on analgesia, orthoses and repeated medical consultations).

The Hospital Anxiety and Depression scale was considered to be normal if it was less than 8, borderline if 8 to 10 and abnormal if greater than 10. A score of less than 10 on the Beck depression inventory indicated no depression; 10 to 29 mild to moderate and more than
20 severe. The OKS ranged from 0, representing the worst outcome, to 48, which was the best. It was converted to a percentage disability. The results were compared with those recorded at 15.5 years.

**Statistical analysis.** Data were analysed with the Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois) using Fisher’s exact test for comparison of the Gargan and Bannister grades at 15.5 and 30 years. A p-value < 0.05 using Fisher’s exact test for comparison of the Gargan and Bannister7 grades at 15.5 and 30 years. A p-value < 0.05 was considered to be significant.

**Results**

**Neck disability.** Of the 22 patients, ten (45.5%) were asymptomatic (group A), nine (40.9%) had mild symptoms (group B), in two (9.1%) the symptoms were intrusive (group C) and in one (4.6%) they were severe (group D). Disability after 30 and 15.5 years was recorded. (Table I). It had improved in ten patients (45.5%), remained the same in ten (45.5%) and deteriorated in two (9.1%). There were significantly fewer patients in groups C or D after 30 years than after 15.5 years (Fisher’s exact test, p < 0.04). These results are presented in Table I.

**Psychometric testing.** Anxiety and depression were associated with neck disability. Eight patients (36.4%) had borderline/abnormal scores on the Hospital Anxiety Depression scale and five (22.7%) were depressed. These results are presented in Table II.

After 30 years psychometric testing was compared with the findings after 15.5 years. On the Hospital Anxiety Depression scale, anxiety and depression had improved in 13 patients (59.1%), was unchanged in four (18.2%) and had deteriorated in five (22.7%). On the Beck depression inventory, ten patients (45.5%) had improved, four (18.2%) were unchanged and eight (36.4%) had deteriorated. There were no significant differences (p = 0.612 for

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**Table I. Distribution of disability at 15.5 years and 30 years by number and (%)**

<table>
<thead>
<tr>
<th>Group (Gargan and Bannister)</th>
<th>15.5 years</th>
<th>30 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8 (36.4)</td>
<td>10 (45.5)</td>
</tr>
<tr>
<td>B</td>
<td>5 (22.7)</td>
<td>9 (40.9)</td>
</tr>
<tr>
<td>C</td>
<td>8 (36.4)</td>
<td>2 (9.1)</td>
</tr>
<tr>
<td>D</td>
<td>1 (4.6)</td>
<td>1 (4.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group (Gargan and Bannister)</th>
<th>HAD</th>
<th>BDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2. Normal (prev 0)</td>
<td>2. Not depressed (prev 10)</td>
</tr>
<tr>
<td>D</td>
<td>3. Normal (prev 0)</td>
<td>4. Not depressed (prev 10)</td>
</tr>
</tbody>
</table>

**Table II. Details of psychometric testing using the Hospital Anxiety Depression (HAD) scale and the Beck depression inventory (BDI) according to the disability group by number and percentage**

<table>
<thead>
<tr>
<th>Group (Gargan and Bannister)</th>
<th>HAD</th>
<th>BDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1/10 (10.0)</td>
<td>0/10 (0.0)</td>
</tr>
<tr>
<td>B</td>
<td>4/9 (44.4)</td>
<td>2/9 (22.2)</td>
</tr>
<tr>
<td>C</td>
<td>2/2 (100.0)</td>
<td>2/2 (100.0)</td>
</tr>
<tr>
<td>D</td>
<td>1/1 (100.0)</td>
<td>1/1 (100.0)</td>
</tr>
</tbody>
</table>

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* NDI, neck disability index; G & B, Gargan and Bannister
† HAD, Hospital Anxiety Depression
‡ BDI, Beck depression inventory
§ OKS, Oxford knee score
Hospital Anxiety and Depression, p = 0.391 for BDI, chi-squared test) in the proportions with psychological abnormalities in each Gargan and Bannister group after 15.5 and 30 years.

**Comparative severity of neck and knee pain.** Disability in the neck secondary to whiplash injury was compared with knee pain. Ten patients (45.5%) were disabled to a greater extent by knee than by neck pain, nine (40.9%) by neck more than knee pain and three (13.6%) were disabled equally by knee and neck pain.

Further details are shown in Table III.

**Discussion**

After 30 years, ten (45.5%) patients had made a full recovery while one (4.5%) continued to describe severe symptoms. These results are better than those which have been previously reported for this series6-8 and are now comparable with those of the combined literature.4 Symptoms appeared to improve between 15.5 and 30 years with a change mainly from moderate to mild disability. The hypothesis that age-related neck symptoms become superimposed on those from the whiplash injury is disproven.

The concurrent improvement in psychological disturbance reinforces its association with disability in the neck which has been established in other series.4,5

Musculoskeletal pain appeared to increase with age. About half was due to low back pain and the rest to arthritis at other sites.14 The knee is a common site of such pain. We used this as a model because the presence of lower back pain may be due to the whiplash syndrome7 and we wished to explore age-related pain at a site not normally associated with the condition. We found that after 30 years almost half of the patients who sustained a whiplash injury in their third or fourth decades were more disabled by knee than neck pain.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

**References**