

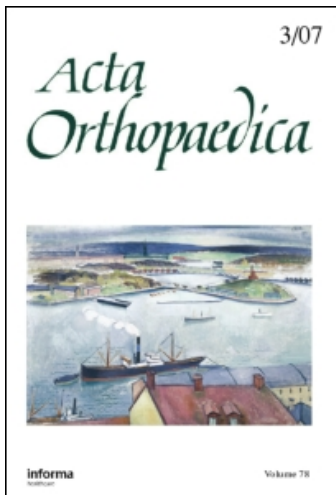
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### Outcome after soft-tissue injury of the cervical spine: A prospective study of 93 car-accident victims

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# Outcome after soft-tissue injury of the cervical spine

## A prospective study of 93 car-accident victims

Christer Hildingsson and Göran Toolanen

**Ninety-three cases with a car-accident soft-tissue injury of the cervical spine were studied prospectively. Neck pain and stiffness were the main initial symptoms, while 4 cases had abnormal neurologic signs. At follow-up, on an average 2 years after the accident, 42 percent had recovered completely, 15 percent had minor discomfort, and 43 percent had discomfort sufficient to interfere with their capacity for work.**

The statistical analysis of 17 factors, including acute symptoms and physical findings, as well as the forces and directions of impact, head rests, radiographs, length, and sex, did not reveal any factor of prognostic importance.

It is difficult to predict the prognosis after soft-tissue injury of the cervical spine. Clinical symptoms such as numbness and pain in the arms or radiographically verified reversed cervical lordosis have been proposed as factors adversely affecting the prognosis (Hohl 1974). In a prospective study, prognostic classification based on the presenting symptoms and physical findings after rear-end collisions, objective neurologic findings, stiffness of the neck, muscular spasm, and preexisting degenerative spondylosis were considered unfavorable signs (Norris and Watt 1983).

The aim of the present prospective investigation was to analyze such factors as type and force of impact, initial symptoms, and radiographic findings in relation to the final recovery.

### Patients and methods

The present prospective study includes 93 consecutive patients, 40 males and 53 females, with a mean age of 31 (17-67) years, treated between September 1985 and July 1988 at our department because of a noncontact injury to the cervical spine resulting

from car accidents. All the patients with a head injury or a fracture were excluded. Initially, 97 patients were treated, but 4 patients did not return for follow-up and were excluded from the study. Four types of collision were responsible for the injuries. Forty-five of the collisions were rear-end impacts, 22 front-end, 16 single and roll-over, and 10 side collisions.

Radiographs were initially taken in all but 5 patients, who declined the examination. Radiographs were exposed in anteroposterior, lateral, and 45° oblique projections. In addition, a detailed view of the first two cervical vertebrae in the anteroposterior open-mouth position was done.

A cervical collar was applied in the casualty department and was used for some 3 weeks. All the patients received instruction in isometric neck exercises. Lateral flexion and extension radiographs were obtained in the course of treatment in 35 patients with persisting symptoms. At the initial consultation and at follow-up, a physical examination was made and a detailed form was completed that recorded personal data, details of the accident, symptoms, and behavioral variables. These data were analyzed by computer.

The follow-up was done 25 (6-43) months after the accident. Thirty-nine patients with no residual problems related to the injury were interviewed by telephone only. The 17 factors studied were *accident parameters*: direction and force of impact, use of head rest; *subjective parameters*: initial symptoms (headache, neck pain, neck stiffness, shoulder

Table 1. Acute and continual symptoms at follow-up in 93 cases with a soft-tissue injury of the neck. Number of patients

Symptoms	Acute	At follow-up
Neck pain	82	27
Neck stiffness	64	23
Headache	50	14
Shoulder pain	37	16
Arm pain/numbness	13	8
Dizziness	21	4
Visual symptoms	8	6
Auditory symptoms	4	5

Table 2. Number of patients with physical findings at follow-up

Physical findings	One side/Both sides
Restricted motion	
rotation	18/5
flexion	19
extension	13
lateral flexion	8/3
Tenderness	
cervical vertebrae	18
cervical muscles	9/7
thoracic vertebrae	11
rhomboid muscles	8/5
trapezius muscle	12/11
cervical plexus/sternocleidomastoid m.	12/3
levator muscle of the scapula	18/14

pain, arm pain and numbness, visual symptoms, auditory symptoms, dizziness or nausea), history of previous neck/shoulder problem; *objective parameters*: height of the patient, sex; *radiographic parameters*: abnormal curve of the cervical spine, degenerative spondylosis.

Continuou pain and ache resulting in an inability to return to previous work were defined as major complaints.

*Statistics.* A multiple general linear program (MGLH) was used, and the models were constructed as MANOVA, two-way analysis of variance and multiple regression. All the calculations were performed by using SYSTAT® (Wilkinson 1986).

## Results

### Acute stage

The most frequent acute symptoms after injury were aching and stiffness in the neck and headache, followed by dizziness and shoulder pain (Table 1). The onset of symptoms after the accident occurred within 1 hour in 65 of the patients, in 77 within 5 hours, and in 85 cases within 15 hours. Fifty-nine of the patients consulted the hospital the day of the injury and 89 patients within 3 days.

The physical examinations revealed different degrees of muscle spasm, tenderness, and restriction of movement of the cervical spine in the majority of patients. Abnormal neurologic signs were present in 4 cases. One had sensory impairment in the upper limb, 2 had unilateral sensory loss in the ulnar border of the hand, and 1 patient had reduced motor power in the arm and pectoral muscles. However, all

4 patients with initial neurologic deficits had normal neural function at follow-up. One patient developed Horner's syndrome 4 weeks after the injury, but complete recovery occurred after 2 days.

Radiographic examination of 88 patients showed normal radiographs in 45, degenerative spondylosis in 7, and a straight or kyphotic cervical curve in 33 cases. Spondylosis with a straight or kyphotic cervical curve was found in 3 of the cases. Flexion-extension radiographs were made in 35 cases and showed no instability.

### Follow-up

Symptomatic recovery, whereby in the patient's opinion there were no residual problems related to the injury, occurred in 39 patients, while 13 reported some minor discomfort, manifested by such minor symptoms as pain on doing unusual exercises or unusual lifts. Forty-one patients had major complaints and of these 17 had changed jobs, worked part-time, or were applying for other jobs, and 10 patients were retraining. One patient was pensioned and 13 were reported sick.

Neck pain and stiffness were the most frequent complaints; nearly one fifth of the patients complained of continual shoulder and interscapular pain (Table 1). Twenty-three of the patients complained of low back pain related to the injury. Restricted motion of the neck and muscular tenderness were common findings in symptomatic patients. (Table 2). Four patients showed neurologic signs at follow-up. In all of these the initial examination was normal. One patient had reduced motor power and sensory loss in the hand, and 3 had sensory loss in the ulnar border of one hand.

A cervical collar was used by 19 patients, but only 1 wore it daily. Analgetics were used daily by 8 patients, whereas 15 used them once or twice a week and 9 patients reported a more sporadic use.

There was no significant relationship between the 17 factors and the development of persisting symptoms.

## Discussion

Our study compares favorably with other series concerning the time of follow-up (Balla 1980, Norris and Watt 1983), as well as rate of dropout (Gotten 1956, Hohl 1974, Hodgson and Grundy 1989).

The most common direction of impact, the rear-end, often results in the whiplash type of injury. Rear-end impacts have been studied exclusively (Gay and Abbott 1953, Norris and Watt 1983), whereas others have comprised all impact directions (Hohl 1974, Greenfield and Ilfeld 1977, Hodgson and Grundy 1989). About half of our cases had experienced rear-end impacts, which is comparable with previous reports (Hohl 1974, Hodgson and Grundy 1989). The rear-end impacts per se did not influence our final outcome contrary to others (Macnab 1971, Nygren 1984, Hodgson and Grundy 1989).

The initial symptoms in our patients did not differ from earlier series (Hohl 1974, Norris and Watt 1983). Numbness and radiating pain in the arms had no adverse effect on the prognosis, as reported by Hohl (1974) and Norris and Watt (1983). Perhaps the selection of the patients with inclusion of cervical fractures (Norris and Watt 1983) and a high rate of dropout at follow-up (Hohl 1974) might have influenced their results. It is difficult to quantify the severity of symptoms in conditions such as this where the pain is subjective and the objective findings are sparse except for neck stiffness and muscle tenderness. Continuous pain or ache resulting in inability for patients to return to their previous work were considered major complaints and were present in 41 of the 93 cases.

The lack of a definition of persisting symptoms in most of the studies makes a comparison difficult. However, our results are equivalent to the frequency of residual symptoms published by Macnab (1971), Hohl (1974), and Hodgson and Grundy (1989), but lower than the figures reported by Gotten (1956).

The second most frequent symptom at our follow-up was low back pain. It has been earlier reported to

appear in a large proportion of the cases during the course of treatment (Gay and Abbott 1953, Hohl 1974).

Our radiographic findings, as well as those of Greenfield and Ilfeld (1977), do not support the theory that reversal of the cervical lordosis (Hohl 1974, Norris and Watt 1983) or the presence of degenerative spondylosis (Norris and Watt 1983) is prognostically unfavorable. Neither did we find any relationship between return to work and sex, nor could we verify that chronic symptoms are more common in women (Balla 1980) or that the incidence of recovery is lower (Hohl 1974). Yarnell and Rossie (1988) recently presented similar findings.

## Acknowledgements

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