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Neck and upper limb disorders among slaughterhouse workers

An epidemiologic and clinical study

by Eira Viikari-Juntura, MD¹

VIKARI-JUNTURA E. Neck and upper limb disorders among slaughterhouse workers: An epidemiologic and clinical study. *Scand j work environ health* 9 (1983) 283–290. The aim of the study was twofold, (i) to detect neck and upper limb disorders in slaughterhouse workers and (ii) to develop methods for the epidemiologic screening of these disorders. A total of 117 slaughterhouse workers underwent a physical examination of the neck and upper extremities and were interviewed for their subjective symptoms. In addition to a prestructured screening diagnosis, a clinical diagnosis was made. The prevalence of tension neck syndrome was 6.2 %, and that of tenosynovitis and peritendinitis of the wrist and forearm 4.4 %. The screening diagnoses were not always the same as the clinical diagnoses obtained in more-detailed examinations. However, the nine disorders in the screening method fairly well represented the disorders detected in the clinical examination.

Key terms: carpal ganglion, cervicobrachial disorder, occupation, peritendinitis, rheumatic diseases, screening method, tenosynovitis, tension neck.

The Finnish Occupational Disease Register has reported high incidences of occupational musculoskeletal disorders (including tenosynovitis and peritendinitis of the wrist and forearm region and humeral epicondylitis) among slaughterhouse workers (17). However no epidemiologic studies with clinical examinations have been done for the detection of neck and upper limb disorders in slaughterhouse workers. The subjective musculoskeletal symptoms of these workers have been screened in questionnaire studies (5, 9).

Suggested causative factors of the disorders include repetitive work in meat cutting, fast work paces, and high resistance, especially of beef (9). In some slaughterhouses the temperature of the meat to be cut is low, and low temperatures increase both the resistance of the meat and the stress of the work.

The diagnosis of musculoskeletal disorders is often difficult and confusing, both at clinics and in epidemiologic settings. Generally accepted and used diagnostic criteria exist for a few disorders only, whereas the criteria for such common disorders as tension neck syndrome, cervical syndrome, humeral epicondylitis, and tenosynovitis and peritendinitis of the wrist and forearm vary widely (18). Diagnostic criteria for these disorders would be of value in the comparison of research results.

Subjects and methods

The slaughterhouse under study in the present investigation employed a total of 119 butchers, meatcutters, and meat by-product workers. Two were on sick leave because of illnesses not related to the study. Of the 117 workers examined, four were excluded from closer analysis, three because of a recent injury and one because of recent surgery for a habitual humeral dislocation. No one reported active rheumatoid arthritis. Eighty-two of

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the remaining 113 workers were men and 31 women; there were 52 cutters, 38 butchers, and 23 meat by-product workers. Twelve cutters and eleven butchers were trainees who did the same work as their more experienced workmates.

The temperature of the meat to be cut varied between 0 and 7°C, and the temperature of the workplace was 10°C.

The slaughterhouse had been operating only seven years. At the beginning many young trainees were hired, and therefore the workers were very young. Their mean age was 31.8 (SD 9.3) years, 30.1 years for the men and 36.1 years for the women. The mean length of employment was 5.5 (SD 5.4) years. The work pace was reported to have been reduced by approximately 25 % for the two weeks preceding the examinations because of salary disputes; the reduced work pace was used throughout the study.

The screening method used in this study (18) was also used in two earlier epidemiologic screenings (6, 8). According to the method a physiotherapist gives each subject a preplanned physical examination and interviews the subject, and the screening diagnosis is made by a predetermined set of criteria. The disorders and the criteria for the disorders, as well as the tests used and the symptoms recorded, are presented in table 1.

In the present study the subjects were asked, at the end of the interview, to make a drawing of the pain experienced during

the last 24 h. The screening diagnosis was approved if it did not conflict with the pain drawing.

All the workers were examined by the author. A neurological examination of the upper arms was added to the standard set of tests. The neurological examination tested for brachioradial and triceps deep tendon reflexes; shoulder elevation; and deltoid, biceps, triceps, lumbrical and interosseus functions (strength, with special reference to the difference between the sides). Sensitivity to light touch and pain in the upper arms was tested, as was sensitivity to vibration at the ulnar styloid processes and the lateral malleoli. Roos' elevated arm stress test for thoracic outlet syndrome (14) was also included in the standard set of tests. The subjective component of performing and judging each test was reduced by the procedure of first examining the subjects and then interviewing them.

The examination procedure was continued so that a clinical diagnosis could be obtained if the diagnosis based on the screening method conflicted with the pain drawing, if there was marked pain and no screening diagnosis was made, and if there was localized paresthesia, numbness, or a disturbed sensitivity to light touch or pain. At this stage other forms of the mentioned pain syndromes and differential diagnostics were also taken into consideration, as were some other common painful conditions and the most common distal

Table 1. Criteria for screening diagnoses of neck and upper limb disorders (18).

Disorder	Criteria
Tension neck syndrome	Feeling of fatigue or stiffness in the neck, neck pain or headache radiating from the neck; at least two tender spots or palpable hardenings; muscle pain or tightness upon neck movement
Cervical syndrome	Pain radiating from the neck to the upper extremity, limited neck movement, radiating pain provoked by test movements
Thoracic outlet syndrome	Pain radiating to an upper extremity, positive Morley's sign, positive Adson's test, or drooping shoulder
Supraspinous tendinitis	Pain in the shoulder region, local tenderness, pain during abduction, or painful arch; limited active abduction
Bicipital tendinitis	Pain in the shoulder region, local tenderness
Frozen shoulder syndrome	Progressive pain and shoulder stiffness during the last three to four months, active and passive outward rotation limited
Acromioclavicular syndrome	Pain in the shoulder region, local tenderness during palpation or percussion of the joint
Epicondylitis syndrome	Local pain during rest and/or movement, local tenderness at the lateral/medial epicondyle, pain during resisted extension/flexion of the wrist and fingers
Tenosynovitis and peritendinitis of the wrist and forearm	Local ache, pain during movement, tenderness along the course of the tendon or muscle-tendon junction, swelling, weakness in gripping

Fig 1. Schematic representation of the screening and clinical diagnoses.

nerve entrapments of the upper arm. The procedure followed in making the diagnosis is shown in fig 1, and the criteria for clinical diagnoses are presented in table 2.

So that the repeatability of the tests of the screening method could be checked, 33 persons were examined by a specially trained physiotherapist.

Table 2. Criteria for clinical diagnoses of neck and upper limb disorders.

Disorder	Criteria
<i>A. Disorders contained in the screening method presented in table 1</i>	
Tension neck syndrome	Same as the criteria for the screening diagnosis (table 1); muscle pain or tightness upon neck movement not necessary (cases that also meet criteria for the clinical diagnosis of cervical syndrome classified as cervical syndrome)
Cervical syndrome	Pain radiating from the neck to the upper extremity or pain in the neck and numbness in the hand, limited neck movement, pain in the neck during neck movement (peripheral entrapment neuropathy of the upper arm excluded)
Thoracic outlet syndrome	Pain radiating to an upper extremity, positive elevated arm stress test (distal nerve entrapments excluded)
Supraspinous tendinitis (18)	Same as the criteria for the screening diagnosis (table 1), but limited active abduction not necessary, pain in resisted isometric abduction possible
Bicipital tendinitis (18)	Same as the screening diagnosis (table 1), possibly also pain in the shoulder at resisted supination with the elbow flexed 90° (the frozen shoulder syndrome excluded)
Frozen shoulder syndrome	Same as the screening diagnosis (table 1)
Acromioclavicular syndrome (18)	Same as the screening diagnosis (table 1), also pain in the shoulder region and pain at the end of abduction or in adduction, all other shoulder diagnoses excluded
Epicondylitis syndrome	Same as the screening diagnosis (table 1)
Tenosynovitis and peritendinitis of the wrist and forearm	Local ache or pain during movement, tenderness along the course of the tendon or muscle-tendon junction, all other diagnoses excluded
<i>B. Other disorders</i>	
Infraspinous tendinitis (3)	Pain in the shoulder region, local tenderness, pain in resisted isometric outward rotation of the humerus, painful arch possible
Olecranon bursitis	Palpable painful olecranon bursa
Carpal ganglion	Dorsal or volar ganglion detected
Painful first carpometacarpal joint	Painful joint at palpation, pain in the joint when moved
Osteoarthritis of finger joints	Heberden's nodes noticed
Carpal tunnel syndrome (10, 12)	Pain or paresthesia in the median distribution of the hand, positive Tinel's sign at the carpal tunnel or positive Phalen's wrist flexion test; diminished sensitivity to touch or pain in three and a half fingers on the radial side of the hand and diminished strength of the short abductor of the thumb possible (median nerve entrapment at the pronator level and cervical syndrome excluded, and the rest of the neurological examination normal)
Pronator syndrome (1, 11, 16)	Pain in the proximal volar aspect of the forearm or paresthesia or numbness on the volar side of the forearm; paresthesia in three and a half fingers on the radial side of the hand possible; symptoms increased by resistance to pronation of the forearm and flexion of the wrist, forearm supination and elbow flexion or flexion of the middle finger at the proximal interphalangeal joint; diminished sensation in three and a half fingers on the radial side of the hand, the thenar eminence, and weakness of the short abductor of the thumb possible (carpal tunnel syndrome, cervical syndrome, and flexor tenosynovitis and peritendinitis of the wrist and forearm excluded)
Posterior interosseus nerve entrapment (Frohse's syndrome) (4, 15, 19)	Pain in the elbow during rest, radiating pain downward or upward and tenderness at the edge of the superficial portion of the supinator muscle (the arcade of Frohse); the extension force of the middle finger possibly diminished (epicondylitis syndrome, tenosynovitis and peritendinitis of the wrist and forearm excluded, and the rest of the neurological examination normal)
Ulnar nerve entrapment at the elbow (1)	Pain, paresthesia or numbness in the fourth and fifth fingers, tenderness to palpation at the cubital tunnel, Tinel's sign at the cubital tunnel possibly present; diminished sensation in the fourth and fifth fingers and weakness of the interossei and the third and fourth lumbricals possible (ulnar nerve entrapment at the Guyon's tunnel, cervical syndrome, and thoracic outlet syndrome excluded)
Ulnar nerve entrapment at Guyon's tunnel (1)	Pain, paresthesia, numbness and/or weakness of the fifth finger, tenderness to palpation at the Guyon's tunnel possible, Tinel's sign at the Guyon's tunnel possible; diminished sensation in the fourth and fifth fingers or weak abduction of the fifth finger (ulnar nerve entrapment at the cubital tunnel, cervical syndrome, and thoracic outlet syndrome excluded)

Results

Screening and clinical diagnoses

The results are presented as screening diagnoses and clinical diagnoses in table 3. According to the set of criteria seven workers (five men and two women) had tension neck syndrome. The syndrome was evenly distributed among the different occupations and occurred in subjects of different ages.

Six men were clinically diagnosed as having cervical syndrome. They represented different occupations. Four were over 40 years of age.

Five cases of peritendinitis were found in the forearm region of four workers (table 4). These cases did not meet the criteria of the screening method. Four were on the extensor side, one was on the flexor side, and one worker had peritendinitis on both the flexor and the extensor side of her forearm. Three of the workers were men.

In addition to the disorders contained in the screening method used, five cases of painful carpal ganglia were found. Four were on the volar side and one on the dorsal side of the wrist. All volar ganglions were found in cutters, and they were in the dominant hand. Three of these cutters were men, and one was a woman. Three cases were residual after earlier surgery. Two workers with a volar ganglion had nocturnal paresthesiae of the median area of the same hand, and one of them also had a positive Tinell's sign and Phalen's wrist flexion test that suggested carpal tunnel

syndrome. Other disorders occurred only seldom.

As the tests of the screening method revealed few positive signs, no statistical analysis was necessary for the findings of the two examiners. There was a trend for the palpation tests of the neck and shoulder region administered by the physiotherapist to reveal more positive results than the palpation tests administered by the author.

Table 3. Distribution of the screening diagnoses and clinical diagnoses among 113 slaughterhouse workers.

	Screening diagnosis	Clinical diagnosis
Tension neck syndrome	7	6
Cervical syndrome	1	6
Thoracic outlet syndrome	—	1
Supraspinous tendinitis	—	3
Bicipital tendinitis	1	1
Frozen shoulder syndrome	—	—
Acromioclavicular syndrome	—	—
Epicondylitis syndrome	—	—
Tenosynovitis and peritendinitis of the wrist and forearm	—	5
Infraspinous tendinitis	—	—
Olecranon bursitis	—	—
Carpal ganglion	—	5
Painful first carpometacarpal joint	—	—
Osteoarthritis of finger joints	—	—
Carpal tunnel syndrome	—	1
Pronator syndrome	—	1
Posterior interosseus nerve entrapment	—	—
Ulnar nerve entrapment at the elbow	—	—
Ulnar nerve entrapment at Guyon's tunnel	—	—

Table 4. Cases of forearm and wrist tenosynovitis and peritendinitis.

Diagnosis	Sex	Age (years)	Occupation	Duration of employment (years)	Other factors	Other disorders (screening or clinical diagnosis)
Peritendinitis of the long abductor of the thumb	Male	22	Cutter (trainee)	2	Returned from sick leave 1 d before the examination	None
Peritendinitis of the wrist extensors	Male	21	Butcher (trainee)	3.5	Returned from military service six weeks before the examination	Bicipital tendinitis
Peritendinitis of the wrist extensors	Male	18	Butcher (trainee)	0.1	—	None
Peritendinitis of the wrist extensors and flexors	Female	32	Meat by-product worker	4.5	Returned from maternity leave two weeks before the examination	None

Symptoms reported by the subject

In addition to their present symptoms the workers were also asked about pain or trouble in the neck and shoulders, the back, and the arms and hands during the past 12 months. Table 5 shows that neck and shoulder trouble was more common among women than men and, in both sexes, more common than back trouble. There were no appreciable differences between the sexes concerning arm and hand trouble. Neck and shoulder trouble, back trouble, and arm and hand trouble were found about as often in all the age groups.

The workers were also asked if a doctor had diagnosed tenosynovitis or peritendinitis of the wrist or forearm or humeral epicondylitis during the past 12 months. There were 15 (13.3 %) subjects who had had 18 (15.9 %) cases of tenosynovitis or peritendinitis and four (3.5 %) who had had epicondylitis. One worker had had both lateral epicondylitis and flexor tenosynovitis at the same time. Three workers had had tenosynovitis twice

during the past year. Two workers who had experienced peritendinitis earlier also had peritendinitis at the time of the examination. All 15 workers who had previously had tenosynovitis or peritendinitis were men, cutters or butchers by occupation, and 12 of them were under 30 years of age. The workers with epicondylitis were 30 years or older.

Discussion

Results

As shown in table 6, the prevalences of both tension neck syndrome and tenosynovitis and peritendinitis of the wrist and forearm were very low when compared with the corresponding values of three groups of predominantly female subjects examined by the same method. However, the five cases (4.4 %) of current peritendinitis agreed with the reported 18 clinical cases (15.9 %) of tenosynovitis or peritendinitis that had occurred during the past 12 months.

Table 5. Occurrence (%) of pain or trouble (reported symptoms) in the neck and shoulders, the back, and the arms and hands in two groups of slaughterhouse workers during the past 12 months.

Body region where pain or trouble was experienced	Slaughterhouse workers of present study			Swedish slaughterhouse workers in report of Jonsson et al (5) ^a (N = 53)
	Men (N = 82)	Women (N = 31)	Total (N = 113)	
Neck and the shoulders	45.7	58.1	49.1	45
Back	39.5	45.2	41.7	42
Arms and hands	59.3	61.3	59.8	36

^a All the subjects were men.

Table 6. Occurrence (%) of neck and upper limb disorders in slaughterhouse workers and three other worker groups.

Disorder of neck or upper limb	Occupational groups ^a			
	Slaughterhouse workers (N = 113)	Scissor makers (N = 93)	Shop assistants (N = 143)	Factory workers (N = 152)
Tension neck syndrome	6.2	61.3	27.8	37.5
Tenosynovitis and peritendinitis of the wrist and forearm	4.4	18.3	13.5	55.9
Other disorders	1.8 ^b	4.3	0.6	19.0

^a Slaughterhouse workers from the present study, scissor makers from the investigation of Kuorinka & Koskinen (6) and shop assistants and factory workers from the study of Luopajarvi et al (8).

^b One cervical syndrome and one bicipital tendinitis.

The fact that cases of tenosynovitis or peritendinitis were encountered during the past 12 months only among cutters and butchers and predominantly among young workers supported the concept that overexertion and lack of experience are its important causative factors (7). Furthermore, a recently terminated absence was the triggering factor in most current cases of peritendinitis.

The low prevalence of tension neck syndrome and peritendinitis of the forearm can most likely be attributed to two factors, (i) high selection and (ii) reduced work pace. The seven years that the slaughterhouse had been operating provided a suitable time for selection. Young, unfit workers had left the workplace, and the remaining workers became skillful in their work. The reduced work pace evidently had a direct effect on such signs as tenderness and swelling of the muscles and tendons, which were the objective criteria for tenosynovitis and peritendinitis.

The higher prevalence of neck and shoulder trouble in women (table 5) has been noticed also in other studies of working populations (5). The trend was the same in the "normal population" according to the preliminary reports of a recent Finnish study called "Mini-Finland." However the relatively high prevalence of neck and shoulder trouble also in men, which was higher than the prevalence of back trouble, is noteworthy. The situation was the reverse in the "normal Mini-Finland" population, for which back trouble was far more common in men than neck and shoulder trouble. Comparison of the frequencies of neck and shoulder trouble, back trouble, and arm and hand trouble among the men of this study with those among a group of Swedish slaughterhouse workers in similar occupations (table 5) showed that the frequencies for neck and shoulder trouble and for back trouble were approximately the same, whereas trouble in the arms and hands was more common among the Finnish slaughterhouse workers.

The occurrences of painful carpal ganglia, most of which were on the volar side of the wrist, should be noted. The carpal ganglion in itself does not often cause problems. All five ganglia found were painful, probably because of the work demands on the wrist.

The method

The *validity* of the screening method used for this study is unknown, nor can it be directly tested by this study, as the clinical and screening diagnoses were based partly on the same tests.

However the thorough physical examinations did not reveal many cases of disorders not contained in the epidemiologic screening method. The cases of carpal ganglia were an exception. Much has been written lately about entrapment neuropathies and their relation to work (2). Two workers in this study group had symptoms that suggested carpal tunnel syndrome, and one worker had symptoms of a more proximal median nerve entrapment. No other symptoms or signs indicating entrapment neuropathy were encountered.

There were five cases of cervical syndrome, one case of thoracic outlet syndrome, three cases of supraspinous tendinitis, and five cases of peritendinitis of the wrist that could be diagnosed clinically (table 3). But these cases did not meet the set of criteria in the corresponding screening diagnoses of the method. Thus the criteria are "soft" for some disorders (eg, tension neck syndrome and bicipital tendinitis) and "hard" for most other disorders (eg, cervical syndrome, supraspinous tendinitis, tenosynovitis, and peritendinitis of the wrist and forearm). Cases diagnosed according to the "hard" criteria are very likely to be remarkably painful conditions not often encountered at workplaces. For epidemiologic purposes it would be more appropriate to use "softer" criteria so that disorders are detected in their early stages.

Testing the *repeatability* of the tests of the physical examination by having two persons examine the same individual contains many sources of error. As most of the test results rely on the subject's announcement of pain, paresthesiae, disturbed sensitivity, etc, it is probable that the subject learns the results of the test, the objectivity of the examination thereby being reduced.

Opinions differ about the *value* of physical examinations in epidemiologic studies. Comparisons between different groups of workers can be made on the level of subjective symptoms, objective

signs, or complexes of symptoms and signs. The "diagnoses" of the screening method used in the present study are an example of the last-mentioned type.

Some evidence has been found which indicates the predictive value of certain symptoms and signs. Riihimäki et al (13) found that current neck pain better predicted the experiencing of neck pain after five years had passed than did findings of degeneration in cervical radiographs. Tenderness upon palpation of the brachial plexus was predictive of neck pain five years later at a statistically significant level. Nothing is known about the predictive value of the symptom complexes of the screening method used in the present study, as no follow-up studies using this method have been published.

The screening method used in this study is time-consuming and hard for both the subject and the examiner, especially when examinations are performed individually for each worker. Both this study and another unpublished study by the author rarely found objective signs without subjective symptoms. Consequently it could be thought that only persons with subjective symptoms should be chosen for physical examination.

In middle-age and older study groups degenerative changes cause symptoms and signs that cannot be singled out in a physical examination. Thus the method would probably be more valuable when relatively young populations are screened.

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