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An Epidemiologic Study of Occupational Low Back Pain in Truck Drivers

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Abstract

The factors in volved in occupational low back pain occurring in professional drivers were investigated epidemiologically with questionnaires (92 items) including low back symptoms, personal factors and occupational factors. The responses of one hundred fifty-three of one hundred eighty-one truck drivers who work in a large chemical industry corporation were analyzed after they had completely filled in questionnaires. As analysis of the results shows, the prevalence of LBP in one month of the survey was 50.3%. Correlating among data of personal factors and LBP, the prevalence of LBP was significantly higher in the drivers (Odd's ratio of 2.7) who answered "yes" to the item "shortage of spending time with family" than in the drivers who didnt answer "yes". The occupational factors, working load and working environment showed no correlation with the prevalence of LBP. In contrast, 3 items of the working format related significantly to the prevalence of LBP: "irregular duty time" (Odd's ratio of 3.0), "short resting time" (2.4), and "long driving time in a day" (2.0). Eighty-one of the 153 drivers (52.9%) pointed out the relationship between LBP and work, especially work which muolves vibration or road shock.

Our results and the results from previous published studies suggested that vibration is an obvious risk factor for LBP. From the viewpoint of prophylaxis, an improvement in working conditions reduces the incidence of drivers' LBP to some extent. (J Nippon Med Sch 2000; 67: 186—190)

Key words: occupational low back pain, truck drivers, questionnaire, epidemiologic study

Introduction

Low back pain is a serious occupational disease. Ministry of Labor reports in 1991 demonstrated that LBP was in volved in 73.8% of 9146 illnesses which refuived workers to be absent from their office more than 4 days. In 1997, while the number of illnesses decreased to 6034, the proportion of low back pain continued to increase to 83.5%. This means that occupational LBP is a serious social problem leading to huge workers' compensation and a decline in productivity.

Truck driving is a job causing occupational LBP. It has been pointed out that the factors leading to occupational LBP include exposure to vibration, repeatedly lifting heavy objects, strained postures, and sitting or standing work for many hours. The purpose of this study is to investigate by use of questionnaires. the prevalence of low back symptoms and its risk factors among truck drivers.

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Table 1 Summary of questionnaires

1. low back symptoms
prevalence of low back pain, frequency and severity, associated symptoms, past-history and family-history, relationship with work, treatments and prophylaxis
2. personal factors
age, height, body weight, sport activity, smoking and other habits, sleeping time, time spent with family, working period (year)
3. occupational factors
(1) working load
sitting and standing posture, half-sitting posture, lifting heavy objects
(2) working environment
noise, temperature, vibration, lighting, foot holds, out door work
(3) working format
working and resting time working schedule, mental stress

The questionnaire consisted of 3 heading with 92 items.

Materials and Methods

In July 1995, 181 truck drivers who work for a large chemical industry corporation were asked in a questionnaire with 92 items about LBP. One hundred fifty three drivers filled in all items in the questionnaire, their questionnaires were analyzed. There were 148 men and 5 women with a mean age of 41.6 years (range: 19 to 61 years).

The questionnaire consisted of 3 headings with 92 items (**Table 1**). The first heading included the low back symptoms with in one month of the survey, past history of LBP in drivers themselves and their families, and prophylactic measurements of LBP. The other 2 headings were personal factors and occupational factors (working load, working environment and working format). Physiological and radiological examinations were carried out on 26 drivers who had LBP. The data were statistically analyzed by Student's t test, and $p < 0.05$ was accepted as the minimum of significance. Univariate Odd's ratios were computed to assess the effect of several predictors on the occurrence of LBP. Multiple logistic analyses were used to obtain Odd's ratios (OR) and 95% confidence intervals for LBP. All statistical analysis of data was executed using an SPSS computer package.

Results

Concerning the prevalence of LBP amang the questionnaire's participants, 77 of 153 drivers (50.3%) had LBP in the past one month before the survey. Forty-seven drivers had mild pain, 11 had moderate pain needing no rest, 4 had moderate pain needing rest, 1 had severe pain, and 14 gave no answers (**Fig. 1**). As

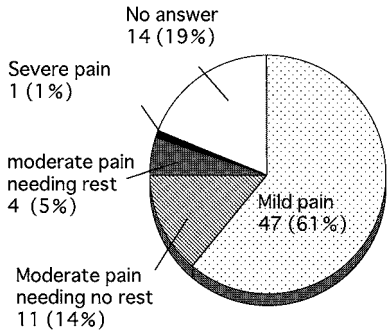

Fig. 1 Severity of low back pain in 77 drivers

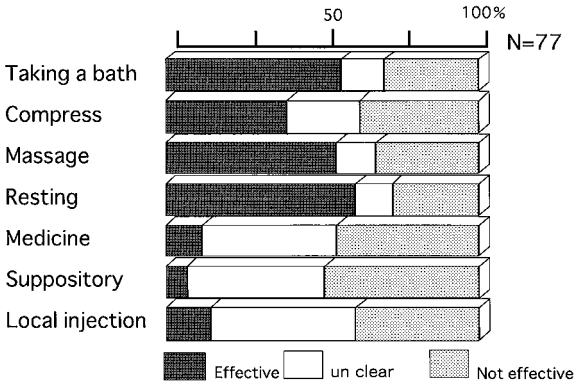

Fig. 2 Treatments for low back pain. Half of the drivers reported that taking a bath, applying compresses, massage or resting lying down improve their LBP.

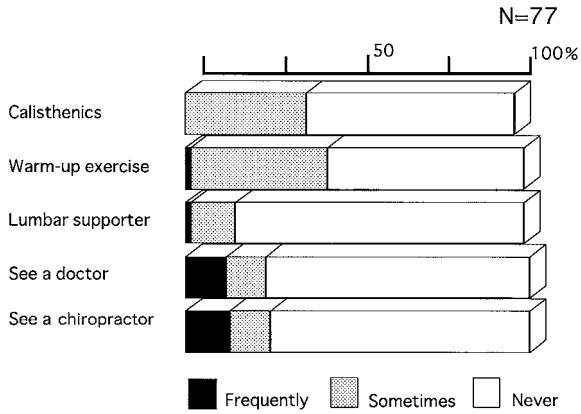

Fig. 3 Prophylaxis for low back pain

to the associated symptoms in the limbs, 48 drivers had no symptoms, 3 had radiating pain to the thigh, 9 had radiating pain to the lower legs and 3 had loss of muscle strength. Half of the drivers reported that taking a bath, using compresses, having a massage or resting lying down improved their LBP (**Fig. 2**). As prophylactic means of avoiding LBP, one-third of the drivers do calisthenics or warm-up exercises, one eighth apply a lumbar supporter, and one-fourth see a doctor or a chiropractor (**Fig. 3**).

There were no statistical differences in quantitative data among personal factors (age, height, body weight, BMI, working period etc) between the drivers with and without LBP (**Table 2**). Regarding correlation between qualitative data of personal factors and LBP, the prevalence of LBP was significantly higher among drivers (Odd's ratio of 2.7) who answered "yes" to the item "shortage of spending time with family" than among the drivers who did not. Odd's ratio in the other qualitative data of personal factors ranged from 1.3 to 1.8, with no correlation to the prevalence of LBP (**Table 3**).

As for occupational factors, working load (sitting and standing posture, half-sitting posture, lifting heavy objects) and working environment (noise, temperature, outdoor work) showed no correlation with the prevalence of LBP. In contrast, 3 working format items related significantly to the prevalence of LBP: "irregular duty time" (3.0), "short resting time" (2.4), and "long driving time in a day" (2.0) (**Table 4**).

Asto the question of how the drivers feel about the effects of work on the occurrence of LBP, 81 of 153 (52.9%) drivers reported that LBP who related to work. Furthermore, 65 of 81 drivers pointed out that vibration, road shock, poor driving seat and unloading

Table 2 Comparison of the quantitative data of personal factors between drivers with and without LBP

	with LBP (N = 77)	without LBP (N = 76)
Male/Female	73/4	75/1
Age (yrs)	40.9 ± 10.9	42.7 ± 11.3
Height (cm)	167.0 ± 7.3	166.4 ± 6.3
Weight (kg)	68.8 ± 9.6	68.0 ± 11.2
BMI	24.4 ± 4.3	23.8 ± 5.2
Working period (year)	14.9 ± 11.3	17.0 ± 11.1
	NS	

There were no statistical differences between the two groups.

Table 3 Odd's Ratio of personal factors affecting the occurrence of LBP

Shortage of spending time with family	2.7 (1.3 ～ 5.4) *
Smoking habit	1.8 (0.7 ～ 4.5)
Less active to sports	1.4 (0.7 ～ 2.6)
Lack of sleeping time	1.4 (0.7 ～ 2.7)
Family history of lumbar disorders	1.3 (0.6 ～ 2.9)
Habit to sleep on the bed	1.3 (0.6 ～ 2.8)

*The item "shortage of spending time with family" significantly related to the occurrence of LBP

Table 4 Odd's Ratio of occupational factors affecting on the occurrence of LBP

	Odd's Ratio (95% CI)
Working load	
Sitting posture	1.3 (0.6 ～ 2.7)
Half sitting posture	1.3 (0.5 ～ 3.4)
Standing posture	1.1 (0.4 ～ 2.8)
Never lifting heavy objects	0.9 (0.5 ～ 1.7)
Working environment	
Noise	1.2 (0.6 ～ 2.5)
Cold	1.2 (0.5 ～ 2.7)
Heat	0.8 (0.4 ～ 1.8)
Outdoor work	0.6 (0.3 ～ 1.2)
Working format	
Irregular duty time	3.0 (1.3 ～ 7.0) *
Short resting time	2.4 (1.2 ～ 4.7) *
Long driving time in a day	2.0 (1.0 ～ 4.3) *
Long driving time in a week	1.9 (0.9 ～ 3.9)
Long working time in a day	1.8 (0.9 ～ 3.7)
Irregular meal time	1.3 (0.6 ～ 3.2)
Long working time in a week	1.0 (0.5 ～ 2.1)
Mental stress in human relations	0.9 (0.6 ～ 2.1)

*These 3 items significantly related to the occurrence of LBP.

heavy objects account for the LBP.

Physiological, neurological and radiographic examinations were performed on 26 drivers. Twelve drivers (46%) had no abnormal physical findings. Among the other 14 drivers, one driver had a round back, 9 had restricted spinal motion and 10 had pain moving. Neurological examinations showed abnormal deep tendon reflex in 5, muscle weakness in 1 and sensory disturbance in 2. On local findings of the spine, step-off deformity was found in 1 and paraspinal muscle stiffness in 4. Tenderness of the paravertebral muscles was found in 8, tenderness of the spinal processes in 5, the gluteus maximus in 3 and the sacro-iliac joints in 2. Radiographic examination demonstrated intervertebral space narrowing in 5, osteophytes in 15, osteoarthritic changes of the facet joint in 5, spondylolysis in 2 and transitional vertebrae in 2.

Discussion

Comparing the prevalence of occupational LBP between the mining and transportation in dustry. In the present study using questionnaires, the prevalence of LBP with in one month of the survey was 50.3% in 153 truck drivers. The causative factors of LBP and working conditions (such as irregular duty time, short resting time and long driving time in a day) accounted for the prevalence of LBP. These unfavorable work formats may be closely related to the result that "shortage of spending time with family" is a personal factor inducing LBP. From the viewpoint of prophylaxis, the results obtained suggest that an improvement in working conditions reduces the incidence of the drivers' LBP to some extent.

Our study demonstrated that 52.9% of the drivers participating in the questionnaive reported that LBP was related to work. Most drivers pointed out that vibration and road shock account for the LBP. Troup et al[1]. noted that muscle fatigue due to mechanical stress such as road shock transmitted to the body and a restricted sitting posture also contribute to drivers' back pain. Kelsy et al.[2,3] and Frymoyer et al.[4] stated that vibration is an obvious risk factor for LBP. Bovenzi et al.[5] measured the exposure dose of the vibration of bus drivers, and found that the occurrence of LBP showed an increasing trend with an increase in vibration magnitude, duration of exposure and total vibration dose. They cautioned that vibration-induced LBP could occur in bus drivers within limits of the health-based exposure proposed by the International Standard ISO.

Electromyographic studies[6-8] have shown that the erector spinae muscles are resonant with sinusoidal vibration, and that maximum muscle activities are recorded at a vibration frequency of 4～6 Hz[9], resulting in remarkable muscle fatigue. This vibration frequency has been reported to be consistent with that measured under actual driving conditions.

Gruber et al.[10] and Fishbein et al.[11] noted[9] a high incidence of degenerative lumbar spine diseases in truck drivers, and Schmidt[12] reported that the frequency of degenerative changes in the lumbar spine is significantly higher in truck drivers than in bank clerks. Also in the present study, radiographic examination of 26 drivers demonstrated intervertebral space narrowing in 19.2% of the drivers, osteophytes in 57.7%, and osteoarthritic changes of the facet joint in 19.2%. Moreover, physiological examinations showed restricted motion of the spine and/or pain in motion in 53.8%, and neurological examinations revealed abnor-

mal deep tendon reflex in 19.2%. In the drivers with degenerative changes in the spine or neurological abnormalities, a periodic medical check-up and consultation will be needed to prevent serious lumbar disorders.

References

1. Troup JDG: Driver's back pain its prevention: A review of the postural, vibratory and muscular factors, together with the problem of transmitted road-shock. Applied Ergonomics 1978; 9(4): 207—214.
2. Kelsey JL, Hardy RJ: Driving of motor vehicles as a risk factor for acute herniated lumbar intervertebral disc. Am J Epidemiol 1975; 102: 63—73.
3. Kelsey JL: An epidemiological study of acute herniated lumbar intervertebral discs. Rheumatol Rehabil 1975; 14: 144—159.
4. Frymoyer JW, Pope MH, Clements JH: Risk factors in LBP: An epidemiological survey. J Bone Joint Surg 1983; 65: 213—218.
5. Bovenzi M, Zadini A: Self-Reported Low Back Symptoms in Urban Bus Drivers Exposed to Whole-Body Vibration. Spine 1992; 17: 1048—1059.
6. Cursiter MC, Harding RH: Electromyographic recordings of shoulder and neck muscles of seated subjects exposed to vertical vibrations. Proceedings of Physiology Society 1974; 239: 117—118.
7. Dupuis H: Arbeitsmedizinische Untersuchungen der Schwingungs einwirkung auf wirbelsäule und Magen bei Krafftfarern. 11th Tnternatinal Congress of Automotive Engineering. FISITA 1966; Münich.
8. Seroussi RE, Wilder DG, Pope MH: Trunk muscle electromyography and whole body vibration. J Biomech 1989; 22: 219—229.
9. Wilder DG, Woodworth BB, Frymoyer JW, Pope MH: Vibration and human spine. Spine 1982; 7 : 243—254.
10. Gruber GL: Relationships between whole body vibration and morbidity patterns among interstate truck drivers. 1977; NIOSH Cincinnati.
11. Fishbein WI, Salter LC: The relationship between truck structures. Indust Med Surg 1950; 19: 444—445.
12. Schmidt U: Vergleichende Untersuchungen an Schwerlastwagenfahrern und B ü roangestellten zur Frage der berufsbedingten Verschleibschäden an der wirbelsäule und Gelenken der oberen Extrëmitaten. 1969; Humboldt-University Berlin.

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