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Prognosis of Accidental Low Back Pain at Work

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Shinohara, S., Okada, M., Keira, T., Ohwada, M., Niitsuya, M. & Aizawa, Y. *Prognosis of Accidental Low Back Pain at Work.* Tohoku J. Exp. Med., 1998, **186** (4), 291-302 —— Accidental low back pain at the workplace was classified into two groups; 177 cases of the organic type and 176 cases of the non-specific type. Concerning the recuperation period, the length of leave, and the amount of compensation for recuperation, medical cost and leave of absence, a comparison was made between two groups. Regarding age, sex, and the type of work, no difference was found between the organic and the non-specific groups. However, the non-specific group showed lower values than the organic one for the duration of recuperation and leave and the amount of compensation for medical cost and leave of absence. Multiple regression analysis showed that the difference in the type of low back pain had more influence on the duration and cost than that in sex and age. The prognosis of non-specific low back pain is better than that of organic one in terms of cost and duration. ———— low back pain; amount of compensation; cost analysis; duration of recuperation; medical cost

Industrial accidents and hazards cause serious social and economical problems. Incidences of illnesses and accidents while at work are detailed in the statistics based on "Report on Worker's Casualties" submitted by companies as specified in Article 97 of the Ordinance on Industrial Safety and Health. There were 9915 cases of occupational illnesses in total in 1994 (Ministry of Labour 1995).

These cases can be divided into six groups of diseases. The largest group, 7183 cases, was complications of injuries, accounting for 72.4%. Among them, 5556 victims suffered from accidental low back pain (ALBP). ALBP is usually

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caused when unexpected force is given accidentally on the hip. This happens particularly when one makes an action different from one's ordinary behavior while working. A force given on the hip invites the low back pain (LBP) or aggravates it in one's past history as well as some underlying diseases. Because ALBP is the most frequent illness occurring at the workplace, it is important to clarify the courses of this illness after it has happened.

There have been reports of descriptive studies on ALBP at the workplace (Committee of Occupational Health 1988; Kuwashima et al. 1997), but there has been no report on the course and cost of this illness. This study therefore examined the course of the illness by dividing the ALBP into the organic type and the non-specific type. Recuperation period, length of leave, and amount of compensation for recuperation, medical costs and sick leaves were compared between the two types.

Subjects and Methods

Subjects

The subjects were 353 ALBP patients whose one or more data on the amount of compensation for recuperation, medical cost, and sick leaves and the duration of recuperation and leave were available. All information was obtained from the bills submitted to the Labour Standards Inspection Office for amount of compensation for medical cost, leave and recuperation of on-the-job illnesses during the term of 1991 to 1995.

Items for assessment

The expense and duration of recuperation refer to those required for the victims of on-the-job hazards to undergo rehabilitation training at the medical institution or to pick up medical prescriptions from the designated pharmacy. Medical cost refers to the expense paid to the medical institution for consultation and treatment. The amount of compensation for leave refers to the amount of compensation paid to the affected employee at 60% of the ordinary salaries and wages. The duration of leave refers to the duration during which such amount of compensation was paid.

Classification of ALBP

According to the diagnosed diseases, the patients were divided into two groups; 177 patients with organic low back pain (OLBP) and 176 patients with non-specific low back pain (NLBP), as shown in Table 1. Among the OLBP cases, the most frequent disease was vertebral compression fracture and vertebral process fracture (68 cases), followed by lumbar contusion (52 cases), herniated disk or discopathy (49 cases), and spondylolysis or related diseases (8 cases). The category of NLBP is defined by WHO to indicate LBP with no organic lesion (WHO 1994). Among the NLBP cases, there were 149 cases diagnosed as lumbar

TABLE 1. *Classificaiion of low back pain, number of cases and medical cost*

Type	Disease	Number of cases (%)	Medical cost (×1000 yen)
Organic	Vertebral compression fracture or process fracture	68 (19.3)	1077.5±198.2
	Lumbar contusion	52 (14.7)	567.7±165.8
	Herniated disk or discopathy	49 (13.9)	617.2±119.6
	Spondylosis, spondylolisthesis or Spondylosis deformans	8 (2.3)	990.8±534.0
Non-specific	Lumbar distortion	149 (42.2)	120.2± 19.3
	Others	27 (7.6)	501.1±176.7

Mean±S.E.

distortion and 27 cases as LBP, although the difference between two diagnoses was not clear.

Statistical Evaluation

The difference in the means between two groups was statistically evaluated by *t*-test. Multiple regression analysis was perfomed by using REG procedure in the SAS package (SAS Institute Japan 1985).

RESULTS

Subjects classified by sex, age and types

As shown in Table 2, of 353 subjects, 276 were men (78.2%) and 77 were women (21.8%). The 177 cases of OLBP included 135 men (76.2%) and 42 women (23.8%). The 176 cases of NLBP included 141 men (80.1%) and 35 women (19.9%). There was no significant difference in sex between the two types of LBP. As for age, the largest group of the subjects with OLBP was in their fifties for both men and women, followed by those in their forties. In the cases of NLBP, the largest group was in their forties for both men and women, followed by those in their fifties. Patients in their forties and fifties accounted for more than 50% in both of these two types.

Average age of subjects classified by sex

Both men and women were in their early forties on average. No significant difference was found in the average age of patients when they were compared by sex and by the types of LBP (Table 3).

Classification by industry

As shown in Table 4, the largest group was victims in the manufacturing industry, followed by those in construction industry. Together, the two industries counted more than half of all subjects. In the cases of OLBP, the victims

TABLE 2. *Subjects classified by sex, age and types of low back pain*

Type	Age	Men	Women	Total
Organic	~19	3 (2.2)	2 (4.7)	5 (2.8)
	20~29	23 (17.0)	5 (11.9)	28 (15.8)
	30~39	24 (17.8)	8 (19.1)	32 (18.1)
	40~49	34 (25.2)	8 (19.1)	42 (23.8)
	50~59	39 (28.9)	14 (33.3)	53 (29.9)
	60~	12 (8.9)	5 (11.9)	17 (9.6)
	Total	135 (100.0)	42 (100.0)	177 (100.0)
Non-specific	~19	4 (2.8)	0 (0.0)	4 (2.3)
	20~29	30 (21.3)	7 (20.0)	37 (21.0)
	30~39	27 (19.1)	3 (8.6)	30 (17.0)
	40~49	40 (28.4)	13 (37.1)	53 (30.1)
	50~59	31 (22.0)	11 (31.4)	42 (23.9)
	60~	9 (6.4)	1 (2.9)	10 (5.7)
	Total	141 (100.0)	35 (100.0)	176 (100.0)

Number of cases (%)

TABLE 3. *Average age of subjects classified by sex and types of low back pain*

Type	Men	Women	Total
Organic	43.0 ± 1.1 ($n=135$)	44.5 ± 2.1 ($n=42$)	43.3 ± 1.0 ($n=177$)
Non-specific	41.4 ± 1.1 ($n=141$)	41.9 ± 1.9 ($n=35$)	41.5 ± 0.9 ($n=176$)
Total	42.2 ± 0.8 ($n=276$)	43.3 ± 1.4 ($n=77$)	42.4 ± 0.7 ($n=353$)

Mean $\pm$ S.E.

TABLE 4. *Subjects classified by industry and types of low back pain*

Industry	Organic	Non-specific	Total
Manufacturing	49 (27.8)	49 (27.8)	98 (27.8)
Construction	47 (26.5)	36 (20.5)	83 (23.5)
Transportation	19 (10.7)	27 (15.3)	46 (13.0)
Others	62 (35.1)	64 (36.4)	126 (35.7)
Total	177 (100)	176 (100)	353 (100)

Number of cases (%)

in the manufacturing industry, the largest group, accounted for 27.8%, followed by those in construction industry, which accounted for 26.6%. As regards NLBP, the victims in manufacturing industry accounted for 27.8% and in construction

20.%. Similar percentages of industries were shown for these cases in both OLBP and NLBP.

Relatively few OLBP and NLBP victims were engaged in other industries such as forestry, mining, cleaning business, service industries, and building maintenance.

Average amount of medical cost by the disease

As shown in Table 1, the average amount of medical cost was 1077.5 thousand yen in the cases of vertebral compression fracture or process fracture, 567.7 thousand yen in the cases of lumbar contusion, 617.2 thousand yen in the cases of herniated disk of discopathy, 990.8 thousand yen in the cases of spondylosis, spondylolisthesis or spondylosis deformans and 120.2 thousand yen in the cases of lumbar distortion.

Average amount of compensation and duration of leave by types of LBP

Both types of LBP were studied in terms of the amount of compensation for recuperation, medical cost, and leave, and of the duration of recuperation and leave, to obtain mean values and standard errors (Table 5). The mean values of the amount of compensation for medical cost ($p<0.001$) and leave ($p<0.01$) and the duration of both recuperation ($p<0.001$) and leave ($p<0.01$) were significantly higher in the OLBP than in the NLBP cases.

Average amount of compensation and duration in men classified by age and types

Mean values and standard errors for the amount of compensation and duration were studied for each type of LBP, by dividing the male subjects into two groups; those of 44 years old or younger and those of 45 years old or older (Table 6). In the group of 44 years old or younger, the duration of recuperation ($p<0.05$) and the medical cost ($p<0.01$) for the OLBP group were longer and higher than those for the NLBP group. In the group of 45 years old or older, the duration of recuperation ($p<0.001$) and the amount of compensation for medical

TABLE 5. *Average amount of compensation and duration by types of low back pain*

Cost	Organic (n)	Non-specific (n)	p Value
Compensation ($\times$1000 yen)			
Recuperation	78.5± 30.6 (44)	26.5± 2.6 (73)	n.s.
Medical cost	808.9±101.7 (163)	207.6±45.2 (108)	$p<0.001$
Leave	691.1±153.5 (54)	207.1±54.6 (64)	$p<0.01$
Duration (months)			
Recuperation	6.7± 0.6 (163)	2.7± 0.5 (108)	$p<0.001$
Leave	3.7± 0.7 (89)	1.2± 0.4 (57)	$p<0.01$

Mean±S.E. n.s., not significant.

TABLE 6. *Average amount of compensation and duration in men classified by age and types of low back pain*

	Organic (n)	Non-specific (n)	p Value
≦44 years			
Compensation (×1000 yen)			
Recuperation	131.4± 68.6 (19)	25.4± 3.6 (37)	n.s.
Medical cost	958.1±232.8 (61)	180.5± 49.6 (55)	$p<0.01$
Leave	789.4±254.1 (22)	309.1±119.5 (28)	n.s.
Duration (months)			
Recuperation	6.7± 1.1 (61)	3.2± 0.9 (54)	$p<0.05$
Leave	3.4± 0.9 (37)	1.2± 0.6 (29)	n.s.
≧45 years			
Compensation (×1000 yen)			
Recuperation	37.1± 13.8 (16)	24.4± 4.5 (20)	n.s.
Medical cost	756.0±105.8 (61)	327.1±118.8 (34)	$p<0.05$
Leave	792.1±286.5 (21)	151.0± 35.8 (20)	$p<0.05$
Duration (months)			
Recuperation	6.5± 0.9 (61)	2.6± 0.6 (34)	$p<0.001$
Leave	2.7± 0.7 (32)	1.4± 0.6 (20)	n.s.

Mean±S.E.

cost ($p<0.05$) and leave of absence ($p<0.05$) for the OLBP group were longer and higher than for the NLBP group.

Average amount of compensation and duration in women classified by age and types

Mean values and standard errors in the amount of compensation and duration were studied for each type of LBP, by dividing the female subjects into two groups; those of 44 years old or younger and those of 45 years old or older (Table 7). In the group of 44 years old or younger, the duration of recuperation ($p<0.01$) and the medical cost ($p<0.05$) for the OLBP group were longer and higher than for the NLBP group. In the group of 45 years old or higher, the duration of recuperation ($p<0.01$) and amount of compensation for medical cost ($p<0.01$) for the OLBP group were longer and higher than for the NLBP group.

Average amount of compensation and duration by industry and types of low back pain

Mean values and standard errors for the amount of compensation and duration were compared between OLBP and NLBP in various industries (Table 8). In the groups of manufacturing and others, the medical cost and the duration of recuperation for the OLBP group were higher and longer than those for the NLBP group. In the group of construction, medical cost, duration of recuperation and

TABLE 7. *Average amount of compensation and duration in women classified by age and types of low back pain*

	Organic (*n*)	Non-specific (*n*)	*p* Value
≦44 years			
Compensation (×1000 yen)			
Recuperation	27.3± 13.7 (2)	25.5± 7.7 (11)	n.s.
Medical cost	737.1±268.9 (17)	53.3±15.3 (11)	$p<0.05$
Leave	337.5±260.5 (3)	104.0±35.4 (9)	n.s.
Duration (months)			
Recuperation	6.0± 1.6 (17)	0.9± 0.4 (11)	$p<0.01$
Leave	3.5± 1.6 (12)	0.0± 0.0 (5)	n.s.
≧45 years			
Compensation (×1000 yen)			
Recuperation	44.1± 19.6 (7)	44.6±12.0 (5)	n.s.
Medical cost	615.1±145.1 (24)	110.5±39.3 (9)	$p<0.01$
Leave	288.7±102.2 (8)	92.6±43.9 (7)	n.s.
Duration (months)			
Recuperation	7.8± 1.9 (24)	2.2± 0.5 (9)	$p<0.01$
Leave	9.8± 5.4 (8)	1.7± 1.7 (3)	n.s.

Mean±S.E.

TABLE 8. *Average amount of compensation and duration by industry and type of low back pain*

Type	Industry	Medical cost (×1000 yen)	Duration of (months) recuperation	Duration of (months) leave
Organic	Manufacturing	811.3±143.9***	7.7±1.4***	4.7±1.9
	Construction	1126.7±300.8*	7.0±1.1**	5.1±1.2*
	Transportation	347.4± 88.6	2.3±0.5	1.1±0.6
	Others	698.6±130.7***	7.0±1.1***	1.9±0.8
Non-specific	Manufacturing	202.9± 94.2	2.3±0.6	1.3±0.7
	Construction	279.4±124.3	2.7±0.7	1.8±0.8
	Transportation	309.7±153.3	5.4±2.8	1.5±1.3
	Others	121.2± 26.0	1.8±0.4	0.4±0.2

Mean±S.E. *$p<0.05$; **$p<0.01$; ***$p<0.001$ compared with the non-specific ones.

duration of leave for the OLBP group were higher and longer than those for the NLBP group.

Correlation coefficients among age, sex, types, expense and duration

Correlation coefficients were obtainded among age, sex, types of LBP, medical

TABLE 9. *Correlation coefficients among age, sex, type, amount of compensation and duration*

	Sex	Type	Medical cost	Duration of recuperation	Duration of leave
Age	−0.030	−0.054	0.033	0.108	0.093
Sex		0.120	−0.027	0.114	0.150
Type			0.191*	0.180*	0.170
Medical cost				0.555***	0.610***
Duration of recuperation					0.811***

*$p<0.05$; ***$p<0.001$.

cost, duration of recuperation, and duration of leave (Table 9).

The study was conducted for 120 subjects whose data were complete, including medical cost, duration of recuperation, and duration of leave. A weak but significant positive correlation was observed between the type of LBP on the one hand and medical cost and the duration of recuperation on the other hand. A moderate and significant positive correlation was also observed between medical cost and the duration of recuperation and leave, and between the duration of recuperation and the duration of leave.

Multiple regression analysis of amount of compensation and duration against age, sex and types

Multiple regression analysis was carried out, using age, sex (dummy variables with 1 for men and 0 for women) and types of LBP (dummy variables with 1 for OLBP and 0 for NLBP) as independent variables, and using medical cost, duration of recuperation, and duration of leave as dependent variables (Table 10).

The type of LBP had the largest proportion to medical cost, duration of recuperation, and duration of leave. It is considered that the different types of LBP serve to determine the expense and duration rather than age and sex.

DISCUSSION

There have been several reports investigating amount of compensation for occupational LBP in the United States. (Leavitt et al. 1971; Klein et al. 1984; Snook and Webster 1987; Frymoyer and Cats-Baril 1991; Pope et al. 1991), but in Japan, there was no report of the cost analysis of ALBP. This study analyzed data from a jurisdiction of the Labour Standards Inspection Office.

In this research, we divided ALBP into two types, OLBP and NLBP and compared the respective prognoses, using amount of compensation for recuperation and leave, and the duration of recuperation and leave. The results showed that no large difference in age, sex, and industry type was found between these two types. However, comparing expense and duration between the two types of ALBP, the amount of compensation for medical cost and leave, and the duration

TABLE 10. *Multiple regression analysis of amount of compensation and duration against age, sex and type of low back pain*

Independent variables	Dependent variables	Regression coefficient	Correlation coefficient	Proportion (%)
Medical cost	Age	0.042	0.033	0.14
	Sex	−0.049	−0.027	0.13
	Type	0.198	0.191	3.80
Multiple correlation coefficient			0.201	
Duration of recuperation	Age	0.175	0.108	1.90
	Sex	0.097	0.114	1.10
	Type	0.120	0.180	2.20
Multiple correlation coefficient			0.236	
Duration of leave	Age	0.106	0.093	1.00
	Sex	0.134	0.150	2.00
	Type	0.160	0.170	2.70
Multiple correlation coefficient			0.239	

of recuperation and leave showed lower values in the NLBP group than in the OLBP group.

In a study on the duration of recuperation and the rate of reinstatement to the former work position in the cases of LBP, it was found that the longer the duration of recuperation, the lower the rate of reinstatement to work (Frymoyer and Cats-Baril 1991). Therefore, it could be said that patients with NLBP are likely to have a better prognosis than those with OLBP in terms of the rate of reinstatement to work.

Among all the cases who fell ill while at work in 1994, the largest group of 5556 patients had ALBP (Ministry of Labour 1995). According to the "Report on Worker's Casualties" submitted to respective Labour Standards Inspection Offices by companies throughout the country in 1986 and 1988, analytical results are available for the 13 166 cases diagnosed as ALBP (Kuwashima et al. 1997). Classified by industry, 31.7% of the subjects were engaged in manufacturing industry, 22.6% in transportation, and 14.5% in construction. Classified by sex, 85.5% of the subjects were men, and 14.5% women. Classified by age, 27.6% of the cases were in their 30s, 27.5% in their 40s, and 18.6% in their 50s.

Classified by industry, 27.8% of the subjects in the present study were engaged in manufacturing, 23.5% in construction, and 13.0% in transportation. Classified by age, 26.9% were both in their 40s and 50s, and 17.6% in their 30s. There is an appreciable difference in the composition of engaged industries and age between this study and the previous study.

Some U.S. reports concerning occupational LBP show that the amount of compensation per person rose each year from $2911 in 1971 to as high as $8321 in

1989 (Leavitt et al. 1971; Webster and Snook 1994). After conversion at the present exchange rate, there is no major difference between the U.S. level and the level shown in the results of our research.

As regards the medical costs required for LBP patients, the U.S. reports showed that in the cases of herniated disk, the expense ranged from $17 020 to $26 643 for the surgical treatment, and from $4470 to $16 572 for the conservative treatment (Schwartzman et al. 1992; Conrad and Deyo 1994; Malter et al. 1996). In our research on the medical cost for the treatment for herniated disk or discopathy, their expense was lower than that for the surgical treatment in the U.S. and similar to that for the conservative treatment in the U.S. In the case of OLBP, the level found in our research was much lower than that for the surgical treatment for herniated disk in the U.S., and was similar to the expense of the conservative treatment in the U.S.

According to the report of Jette et al. (1994), the average expense of the physical treatment amounted to $776 in the U.S. We could not study the details of LBP treatment in our research.

Concerning the relationship between the social status and the expense of the LBP treatment, studies from various perspectives are required. In a report, the incidence of LBP in the low income group was four times as high as that in the high income group (Pope et al. 1991). As regards the level of education, it has been reported that the incidence of LBP in the gourp only with compulsory education was five times as high as that in the college graduates (Pope et al. 1991). Frymoyer and Cats-Baril report that indirect expenses are about 4 times as high as the direct expenses, such as the medical cost and cost of recuperation (Frymoyer and Cats-Baril 1991). It is also reported that the treatment of LBP is more expensive than other types of on-the-job illnesses (Spengler et al. 1986). It is necessary, therefore, to take some sufficient preventive measures from an economic point of view. One report described that the higher the patient's age is, the higher the medical fee is (Bigos et al. 1986). The problem of medical expense is thus serious as society ages.

From the result of multiple regression analysis using medical cost, duration of recuperation, and duration of leave as dependent variables, it was found that the multiple correlation coefficients were low. Therefore, we cannot fully describe these dependent variables from each of the independent variables, but the proportion of the LBP types was larger than that of sex and age. From a comparison of average values of expense and duration, it was found that NLBP was significantly lower than OLBP in terms of the average value of the amount of compensation for recuperation and leave and the duration of recuperation and leave. The average values of expense and duration classified by sex and by age were studied. The OLBP group showed higher values than the NLBP group mainly for medical cost and the duration of recuperation, regardless of age and sex.

From these results, it is considered that NLBP has a better prognosis than OLBP. In the field of occupational health, the classification of LBP types foretells the prognosis after injury. If the type of LBP of an employee who is injured at work can be classified, then type-identification may be helpful for health control and for assessing the redeployment of the employee.

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