The Association between Nonspecific Low Back Pain and Spinal Radiographic Findings among Power Plant Workers

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Abstract

Low Back Pain(LBP) is a very common disorder in the general population. To determine the occurrence of LBP among industrial workers and compare radiographic findings by work group.

Total 554 were split in to two working groups: group 1(365 production workers), and group 2(189 administrative workers). The following methods for data collection were used: a standardized questionnaire, clinical and radiological analysis, and an ergonomic questionnaire. The severity of LBP was evaluated on the basis of a visual analogue scale (VAS). The association between radiographic findings and nonspecific LBP was expressed as the odds ratio with a corresponding 95% confidence interval.

The two groups were similar in age, weight, and length of work (p<.001). Low back pain occurred in total 73% of workers. The mean VAS score was higher among production workers (group 1) (p<0.001). Specifically, we observed an association between disc space narrowing (OR=3.4, 95% CI 1.7-6.2), osteophytes (OR=2.8, 95% CI 1.6-4.9), and spondylosis (OR=1.4, 95% CI 1.1-1.9)and LBP among production workers that was not seen among administrative workers.

The results of the present study suggest that radiographic findings, such as disc space narrowing, osteophytes, and spondylosis, are significantly associated with the development of LBP in production workers.

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Introduction

Lower back pain (LBP) is very common throughout the industrial world, with a high prevalence that causes major personal and socio-economic consequences[1,2]. The main causes for the onset of LBP are degenerative changes of the dynamic vertebral segment[3].

Several factors lead to the early appearance of lumbar spinal degenerative processes, such as: improper maintenance of the body, hyper lordosis, scoliosis, congenital or acquired anomalies, and deformities of the spine and lower extremities, which distort normal spinal statics[4]. Recurring micro-traumas accelerate the degeneration process of the disc sand other structures within the dynamic vertebral segment[5]. Various epidemiological studies haves how a great frequency of LBP among industrial workers, drivers, construction workers and physical workers, associated with heavy lifting, awkward working postures, sudden body movement sand repetitive tasks[6-8].

Besides occupation there are other risk factors that affect the onset and recurrence of LBP, such as: posture, sitting for long periods of time, insufficient physical activity, and static disorder[9-11].

Radiographic examination is the most common basic method for diagnostic research. Radiological images assist in the diagnosis and location of the causes of LBP[12]. Radiographic examination of the lumbar spine is necessary for identification of disorders such as: inflammatory spondyloarthropathies, infection, malignant tendency and fractures, to exclude specific LBP[13].

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At the Kosovo Energy Corporation (KEC), workers are directly involved in the production process. Here, the most common work activities include: working with heavy weight objects (lifting, carrying, pushing or pulling); working in difficult postures which affect the spinal cord, driving heavy vehicles or operating heavy machinery, body exposure to vibrations, frequent posture changes. In these work conditions a large number of LBP cases are usually expected. Similar findings have been obtained from studies evaluating LBP and the demands of physical work, as presented in a review by the U.S. National Academy of Science[14]. It was concluded that there is a clear relationship between back disorders and physical load, such as manual handling of material, the load moment, frequent bending and twisting, heavy physical work, and whole-body vibration.

The aim of this study was to determine the occurrence of LBP among industrial workers and compare radiographic findings by work group.

Materials and methods

Study design

This study used a cross-sectional design. The study was approved by the Regional Ethical Board at the Institute of Occupational Medicine and by the Research Ethics Committee, University of Prishtina, Kosovo.

Study population

In total, 639 employees, who worked in production and in administration jobs, were invited to participate in the study. Five hundred and fifty-four of the employees agreed to participate and signed informed consent, which was obtained along with the approval of the KEC administration.

The examinees were split in to two working groups: group 1consisted of production workers,(those who work indoors and outdoors) while group 2consistedofadministrativeworkers. The principal tasks of production workers were working with the trunk in awkward postures, necessity to change posture regularly, driving vehicles or machines, lifting weights, pushing and pulling of loads, whereas the work of administrative workers involved long periods of seated work.

A follow-up study was conducted among the workers, aged 18-65 years, at Kosovo Energy Corporation in Kosovo. The exclusion criteria included other causes of the back pain such as: trauma, cancer, congenital spine disorders, previous low back surgery (in past 3 months), HIV, fever, and autoimmune disorders.

Survey Instrument

The study participants were interviewed using a structured questionnaire, which included questions on age, sex, weight, height, educational level, smoking habits (yes/no), occurrence of LBP in the previous 12 months and the severity of pain. Work-related characteristics were obtained, such as details on length of employment, as well as the physical load at the worksite. After completion of the questionnaire the participants underwent a comprehensive clinical, and radiological (plain radiography) evaluation.

The severity of LBP was evaluated on the basis of the 0-10 range Visual Analogue Scale (VAS).[11] The pain was measured on 0 to 10 numerical scales, with 0 representing no pain and 10 representing the worst possible pain. Study participants were asked to indicate their pain level by placing a mark along this horizontal line.

According to the 9th revision of the International Classification of Diseases (ICD-9) LBP was defined as a pain, without specific underlying cause, localized between the lower angle of the scapulae and above the buttocks[15].

Statistical analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 13.0. The differences between normally distributed continuous variables were tested by the Student t-test and the differences between the categorical variables by the chi-square test(X). For the continuous data, the Mann-Whitney U test was applied. Multiple logistic regression models were used to compute adjusted odds ratios (OR) and their 95% confidence intervals (95% CI) for the radiographic findings and occurrence of LBP as the dependent variable. A p value <0.05 was considered significant.

Results

Six hundred and thirty-nine employees from KEC were recruited to the study. Of the 639 power plant workers, 554 responded (86.7% return rate).

	Group1 (n=365)	Group2 (n=189)	P-value
Age (years)	47.95 ± 9.06	49.71 ± 8.01	>0.189
Weight (kg)	78.40 ± 10.61	75.92 ± 9.62	>0.131
Height (cm)	174.54 ± 6.70	170.31 ± 7.72	<0.001*
Time in job (years)	21.56 ± 9.80	21.07 ± 8.25	>0.725
Educational level			
Basic	85 (23.3%)	-	<0.001*
Technical	241 (66.1%)	111 (58.7%)	
Higher	39 (10.7%)	78 (41.3%)	
Smoking			
Yes	157 (43.1%)	72 (38.1%)	>0.723
No	209 (57.2%)	117 (61.9%)	
Low back pain (n)	290 (79.5%)	115 (60.8%)	<0.001*
VAS (0-10)	7 (2-10)	5 (2-8)	<0.001*

Table1. Demographic characteristic sand VAS of production workers (group 1) and of administration workers (group 2) with LBP.
Group 1. Production workers, Group 2: administration workers
VAS-Visual Analogue Scale.

The demographic details of the participants who participated in the study are summarized in Table 1. The two groups were very similar in age, weight, and work experience. They differed only in body height (p<0.001).The visual analogue scale values of subjects with LBP belonging togroup1andgroup 2are also presented in Table1. The average value of the VAS in LBP participants was higher in group1 (p<0.001).

	LBP			
	Yes	No	Total	P-value
Type of Job				
Production	290 (79%)	75 (21%)	365	<0.001
Administration	115 (61%)	74 (39%)	189	
Age				
Young (<45 years)	143 (56%)	112 (44%)	255	<0.001
Old (>45 years)	222 (74%)	77 (26%)	299	

Table 2. Baseline statistics on LBP reports, according to type of job and age.
P-value of $\chi 2$ test comparing percentage of workers with LBP.

Of the 554 workers evaluated, 405 (73%) presented with LBP, while 149 (27%) had never experienced LBP. Low back pain was least common in the office staff, in 61%, and most common in the production workers, 79%of whom had experienced LBP at some time (p<0.001). Low back pain was more prevalent among older workers (74%) (Table 2).

The plain radiography of the lumbar spine was classified as “abnormal” if one or more of the following features were present: disc space narrowing, osteophytes, sclerosis, spina bifida, spondylosis, spondylolysis, spondylolisthesis. Lumbar spines that did not display any of these abnormal features were termed “normal”. Disc degeneration was present in 193 or 35% of all subjects. The most commonly affected level was L5/S1.

More than two-thirds of the subjects had experienced LBP, and of these just over half (60%) had abnormal spines. Of the subjects who had never suffered LBP, almost one-third (36%) had abnormal lumbar spines (Table 3).

Risk factor	Group 1 (n=365) LBP			Group 2 (n=189) LBP		
	Yes	No	Total	Yes	No	Total
Disc space narrowing	79(71%)	32(29%)	111	54(66%)	28(34%)	82
Osteophytes	46(64%)	26(36%)	72	44(61%)	28(39%)	72
Spondylosis	34(64%)	19(36%)	53	32(67%)	16(33%)	48
Spina bifida	22(65%)	12(35%)	34	17(65%)	9(35%)	26
Spondilolysis/ lysthesis	15(60%)	10(40%)	25	13(65%)	7(35%)	20
Sclerosis	15(63%)	9(37%)	24	18(82%)	4(18%)	22

Table 3. Number of workers in group 1 and group 2 with and without LBP, according to the radiographic findings.
Group 1: production workers, Group 2: administration workers.

Risk factor	Group 1 (n=365)			Group 2 (n=189)		
	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	P value
Disc space narrowing	**3.4**	1.7 to 6.2	<0.001	**2.6**	1.3 to 5.2	0.01
Osteophytes	**2.8**	1.6 to 4.9	<0.001	**1.1**	0.7 to 1.5	0.2
Spondylosis	**1.4**	1.1 to 1.9	<0.001	**0.8**	0.5 to 1.1	0.2
Spina bifida	**1.4**	0.4 to 5.4	0.6	**1.1**	0.7 to 1.9	0.7
Spondilolysis/lysthesis	**0.8**	0.3 to 2.6	0.8	**0.6**	0.9 to 1.4	0.2
Sclerosis	**1.1**	0.5 to 2.6	0.8	**1.1**	0.7 to 1.8	0.7

Table 4. Multiple logistic regression analysis for occurrence of LBP among workers in group 1 and group 2, according to the risk factors from radiographic findings.
OR: Odds ratio, CI: Confidence intervals.
Group 1: production workers, Group 2: administration workers.

The results from multiple logistic regression analysis, relating to the radiological findings from workers in groups 1 and 2are presented in Table 4. The risk factors for the occurrence of LBP among workers in groups 1 and 2 were: disc space narrowing, osteophytes, spondylosis, spina bifida, spondylolysis and spondylolisthesis and sclerosis. Among the

workers in group 1, disc space narrowing, osteophytes and spondylosis, increase the odds for LBP 3.4, 2.8, and 1.4 times respectively, compared to the administration workers. The association between degeneration and LBP is statistically significant ($p<0.001$).

Discussion

This study found that LBP was significantly more wide spread among production workers ($p<0.001$) (as shown in Table 2), who are engaged in physical work activities, carrying heavy loads, working in awkward and no neutral positions, with extreme trunk flexion. This is in agreement with the findings of other researchers[16-18]. Sitting has also been associated with the risk of developing LBP[19]. Likewise, from our sample, we noted that LBP is more intense among production workers. The average VAS is higher among production workers than those working in administration. These results may be related to no neutral body postures and lifting/carrying heavy loads.

The frequency of degenerative changes in the lumbar column among workers is very high. The degenerative process initially takes place in the intervertebral disc[20,21]. As a result of proteoglycan destruction and loss of water, the collagen changes, and in turn, the annulus and nucleus become less elastic, leading to the development of degenerative disc disease[3,22]. In the present study, disc degeneration was a common radiography finding. More than one third of all subjects (193 of 554 subjects) demonstrated disc degeneration. The most commonly affected discs were L4/L5 and L5/S1. These observations are in agreement with previous studies[18,23].

The results of a systematic review showed that spondylolysis and spondylolisthesis, spina bifida, transitional vertebrae, spondylosis, and Scheuermann's disease do not seem to be associated with nonspecific LBP[24]. However, degeneration does seem to be associated with nonspecific LBP, with ORs ranging from 1.21 to 3.32. Our results support this conclusion. Our study showed that degenerative changes, such as disc space narrowing, osteophytes, and spondylosis, are suggested as risk factors of importance in the development of LBP.

Similar data we encountered in the literature also concluded that heavy work is related to the development of disc degeneration[25]. In a study of 164 different workers (machine drivers, construction carpenters, and office workers) by Luoma et al. investigated the relationship between disc degeneration and LBP[25]. Luoma et al. concluded that LBP is associated with signs of disc degeneration, and is strongly associated with occupation. Moreover, in one study done among tractor drivers in India it was concluded that MRI examination of the study group and the control group did not reveal any significant difference in degenerative changes between the two groups, and disc degeneration levels were high in both groups[26].Varghese et al. concluded that disc degeneration as revealed by MRI examination alone is not adequate to predict the prevalence of back pain[26].

The relationship between lumbar disc degeneration and LBP has not been firmly established. In this study, we found that there was an association between radiographic findings and nonspecific LBP. Also, Al-saeed et al, showed that a majority (64%) of patients with LBP were found to have MRI evidence of degenerative disc disease, compared to 10% in the control group, where obesity correlated with MRI prevalence of abnormalities[27]. This is contrary to the findings of Savage et al. who concluded that although LBP was more prevalent in older subjects, there was no relationship between LBP and disc degeneration[23].

Since MRI has become more available in developed countries radiologists have discontinued offering plain radiographs and have made MRI available to general practitioners for examination of their patients with back pain. In addition, MRI is probably much more effective than plain radiographs in detecting the causes of "specific" back pain in this population. In our country, plain radiographic examination is the only required radiologic technique in the investigation of non-specific LBP, due to the high cost of MRI imaging. This is the only imaging system that is readily available and affordable. MRI imaging is requested only in very specific cases. Therefore, it was very difficult to compare our investigation results with other authors, due to the fact that most of them used MRI investigations in their studies to achieve the same objective.

A few limitations should be noted. Work related physical factors were not addressed and thus their potential influence on occurrence of

LBP could not be established. The gender distribution was predominantly male and, for this reason, we were unable to examine gender differences. Finally, in future studies, data gathered from work related physical factors could also be examined and provide additional information for Kosovo power plant workers.

Conclusion

Radiographic findings, such as disc space narrowing, osteophytes, and spondylosis, are significantly associated with low back pain in production workers. We conclude that production workers are at risk for experiencing low back pain and clinicians should consider degenerative changes due to work tasks.

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Declaration of Interest

The author(s) declare that they have no conflict of interest.

References

1. Fairbank J, Frost H, MacDonald JW, Yu LM, Barker K, Collins R and for the Spine Stabilization Trial Group. Randomised controlled trial to compare surgical stabilization of the lumbar spine with an intensive rehabilitation programme for patient with chronic low back pain: the MRC spine stabilization trial. BMJ. 2005; 330:1233.
2. Paatelma M, Kilpikoski S, Simonen R, Heinonen A, Alen M, and Videman T. Orthopaedic manual therapy, McKenzie method or advice only for low back pain in working adults: a randomized controlled trial with one-year follow-up. J Rehabil Med. 2008; 40: 858-863.
3. Reddy AS, Loh Sh, Cutts J, Rachlin J and Hirsch J. New approach to the management of acute disc herniation. Pain Physician. 2005; 8:385-389.
4. Musculoskeletal disorders and the workplace. Low back and upper extremities. Commission on Behavioral and Social Sciences and EducationNational Research Council and Institute of Medicine. National Academy Press. 2001.
5. Machado L, Maher C, Herbert RD, Clare H, McAuley J. The McKenzie method for the management of acute non-specific low back pain.BMC, Musculoskeletal Disorders. 2005; 6:50.
6. Nieuwenhuyse AV, Fatkhutdinova L, Verbeke G, Pirenne D, Johannik K, Somville PH, Mairiaux Ph, Moens GF, Masschelein R. Risk factors for first ever low back pain among workers in their first employment, Occup. Med. 2004; 54:513-519.
7. Nieuwenhuyse AV, Somville PR, Crombez G, Burdorf A, Verbeke G, Johannik K, Van Den Bergh O, Masschelein R, Mairiaux Ph, Moens GF. The role of physical workload and pain related fear in the development of low back pain in young workers. Occup.Environ.Med. 2006; 63:45-52.
8. Trinkoff AM, Lipscomb JA, Geiger-Brown J, Storr CL, Brady BA. Perceived physical demands and reported musculoskeletal problems in registered nurses. Am J Prev med. 2003; 24:270-275.
9. Sadeghian F, Coggon D, Ntani G, Hosseinzadeh S. Predictors of low back pain in a longitudinal study of Iranian nurses and office workers. Work. 2015;51:239-44.
10. DuttaN, Walton T, Pereira MA. Experience of switching from a traditional sitting workstation to a sit-stand workstation in sedentary office workers. Work. 2015;52:83-9.
11. Poitras S, Blais R, Swaine B, Rossignol M. Management of work-related low back pain: A population-based survey of physical therapists. Physical Therapy. 2005;85:11
12. Johanning E. Evaluation and management of occupational low back disorder. American Journal of Industrial Medicine. 2000; 37:94-111.
13. Koes BW, van Tudler MW, Thomas S. Diagnosis and treatment of low back pain. BMJ. 2006; 332: 1430-1434..
14. Huskisson EC, Jones J, Scott PJ. Application of visual-analogue scales to the measurement of functional capacity. Rheumatology. 1976; 15:185-7.
15. World Health Organization. International classifications of diseases, Geneva: WHO. Revision 9 (1975). Vol 1. 1977.
16. Burdorf A, Jansen JP. Predicting the long term course of low back pain and its consequences for sickness absence and associated work disability. Occup.Environ.Med. 2006; 522-529.
17. Alexopoulos EC, Tanagra D, Konstatinou E and Burdorf A. Musculoskeletal disorders in shipyard industry: prevalence, health, care use, and absenteeism. BMC Musculoskeletal Disorders. 2006; 7:88.
18. Miyamoto M, Shirai Y, Nakayama Y, Gembun Y, Kaneda K. An epidemiologic study of occupational low back pain in truck drivers. J Nippon Med Sch. 2000; 67:3.
19. Lis AM, Black KM, Korn H, Nordin M. Association between sitting and occupational LBP. Eur Spine J. 2007; 16:283-298.
20. Andrusaitis SF, Oliveira RP, Eloy T, Filho B. Study of the prevalence and risk factors for low back pain in truck drivers in the state of Sao Paulo, Brazil. Clinics. 2006; 61(16): 503-10.
21. Omokhodion FO, Sanya AO. Risk factors for low back pain among office workers in Ibadan, Southwest Nigeria. Occupational Medicine. 2003; 53: 287.
22. Lipson SJ, Mair H. Experimental intervertebral disc degeneration, morphologic and proteoglycan changes over time. Arthritis &Rheumatism. 1981; 24(1):12-21.
23. Savage RA, Whitehouse GH, Roberts N. The relationship between the magnetic resonance imaging appearance of the lumbar spine and low back pain, age and occupation in males. Eur Spine J. 1997; 6(2):106-14.
24. Van Tudler MW, Assendelft WJ, Koes BW, Bouter LM. Spinal Radiographic Findings and Nonspecific Low Back Pain. Spine. 1997; 22(4):427-434.
25. Luoma K, Riihimäki H, Luukkonen R, Raininko R, Viikari-Juntura E, Lamminen A. Low back pain in relation to lumbar disc degeneration. Spine (Phila Pa 1976). 2000;25(4):487-92.
26. Varghese M, Kumar A, Mohan D, Mahajan P. A biomechanical and MRI analysis of back pain among drivers exposed to tractor vibrations. International IRCOBI conference on the biomechanics of impact. 2001.
27. Al-saeed O, Al-Jarallah K, Raeess M, Ismail M, Athyal R. Magnetic resonance imaging of the lumbar spine in young Arabs with low back pain. Asian Spine Journal. 2012; 6(4):249-256.