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Low Back Pain in Diabetes Mellitus and Importance of Preventive Approach

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ABSTRACT

Background: Musculoskeletal pain is known to be a common problem in diabetic patients. In spite of this fact, there is little information about epidemiology aspect of Low Back Pain (LBP) and necessity of taking preventive approach in diabetic patients. The aim of this study was to determine the prevalence of LBP in diabetic patients and its comparison with non-diabetic subjects.
Methods: Low back pain frequency was examined among 317 diabetic patients referred to endocrine clinic, Sina Hospital, Tabriz city, Iran during 3 months interval. The control group included 100 participants who were parents of students of Tabriz University. All participants were asked to fill out a questionnaire including Roland Morris Disability Questionnaire (RMDQ) and Face Pain Scale (FPS).
Result: Of the 317 diabetic patients, 63.4% (201) reported LBP while in non-diabetic group was 47% (47).The average functional disability in diabetic group was 9 while in control group was 7. Inter-correlation between low back pain intensity scale and functional disability were significant (r=0.52, P<0.01).
Discussion: Low back pain is a common problem in diabetic patients in terms of intensity, frequency and functional level of disability.
Keywords: Low back pain, Diabetes mellitus, Disability

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Introduction

Neuromusculoskeletal pain is known as a common problem in diabetic patients [1], but in spite of this fact and to our knowledge, there is little information about the epidemiologic aspects of low back pain (LBP) in the diabetics. The scarcity of reports of LBP in this population may be because low back problems are relatively trivial in comparison with other health problems like neuropathy, retinopathy and other major problems in this group and therefore seems worth mentioning [2]. There is a wide variation in the reported prevalence rate of LBP in the general population, which may reflect selection bias or variety of populations [3]. According to statistics up to 85% of the general population will experience an episode of LBP at sometime during their lives [4]. In the medical literature, the 1-year prevalence of self-reported LBP in the general population or general work force varies from 12% to 82% [5, 6]. In theory, it has many causes and may originate from any of several pain-sensitive structures around vertebrae i.e. lumbar disc, facet joint [3].

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Potential risk factors for the development of LBP include cigarette smoking by decrease of lumbar extensor muscles strength and susceptibility to fatigue and back muscle injuries and specifically after repetitive mechanical stress to lumbar spine [7-9], multiparty [10], pregnancy [11], driving trucks and displacement of heavy construction equipment [12], female gender [11] and cyclic lifting, overexertion including lifting, pulling, pushing by causing measurable fatigue and increasing peak bending moments have been implicated as a risk factor in creating LBP [11,13,14]. Diabetic patients are at increased risk of cardiovascular, peripheral vascular and cerebrovascular diseases. Although musculoskeletal disorders are less common, they also occur frequently among patients suffering diabetes mellitus (DM) [15]. Although the exact etiology of diabetes related periarticular disorders is unclear, there is evidence that abnormal collagen deposition in theperiarticular connective tissues alters the structural matrix and the mechanical properties of these tissues [15]. The association between diabetes and connective tissue degeneration were partially related to other factors associated with diabetes like impaired blood circulation [16]. One study, which compared the biochemical structure of proteoglycan in disc samples from diabetic and non-diabetic subjects, showed that the accompanying vascular disorders might indirectly lead to a tendency of tissues to tear and increased susceptibility to musculoskeletal problems including low back pain [17].

An extensive health survey in the population of Finland showed that among the diabetic patients the prevalence rate of LBP unexpectedly and surprisingly was low [14]. However, these patients are generally prone to a number of skeletal changes including Osteoarthritis (OA) and diffuse skeletal hyperostosis because of a number of changes in connective tissues due to micro vascular abnormalities, which it was concluded that this might lead increased susceptibility to disc prolapsed or low back problems, which is opposite to comprehensive epidemiologic finding in Finland [14].

The prevention of diabetes related musculoskeletal problems requires preventive approach involving diabetic patients and inters diciprenary team. Diabetic management in an optimal way occasionally musculoskeletal care, education for patients and their family, implementer screening and risk assessment tools by health providers may have a critical role in prevention of diabetic related musculoskeletal problems[18].

Physiotherapists can treat diabetic patients for a wide variety of diabetes-associated problems, including those from diabetes-related vascular disease. It is becoming increasingly important for physical therapists to be aware of diabetes related vascular complications. The opportunities for effective physical therapy interventions (such as exercise) are significant [19].

Overall, the effect of diabetes mellitus on the development of disc degeneration and in LBP appears inconsistent and remains a subject of controversy in the literature. As far as we know, there is not any known research that in clear way shows the association of LBP and diabetes mellitus. As a result, the aims were to investigate the prevalence of LBP in patients with type 2 diabetes and demonstrate possible associated factors.

Materials and Methods

Participants and procedures

This study was performed at the Endocrine Clinic of Sina Hospital affiliated to Tabriz University of Medical Sciences. During a 3- month span, all subjects referred to this clinic for diabetes mellitus (intervention group) were recruited and asked to fill out a short questionnaire about the presence LBP. Patients with LBP and lower leg radiating pain were identified and after obtaining their consent, they were requested to fill out an additional questionnaire the Roland-Morris Disability Questionnaire (RMDQ) about level of functional impairment. In this span, 317 subjects with diabetes were evaluated.

The key question was "Have you suffered from back pain during the past twelve months". The aim of the question was to recognize subjects who had experienced LBP during the past year in order to examining the 1-year prevalence, severity, and frequency of pain and to compare these between the diabetic group and control groups. Our control group with 100 participants was a sample from the general population, which were selected randomly from parents of students who attended at the university registration office during a 3- month period. We used the same inclusion and exclusion criteria for both diabetic and control groups. The exclusion criteria were LBP due to major trauma, back pain due to car accidents; lumbar ache due to any known other pathological conditions. The inclusion criteria in control group were the same age average with diabetic group.

Measures

The assessment of level of pain on a Wong-Baker Faces Pain Scale (a picture scale) (is developed for illiterate subjects who have difficulties in expressing themselves. All participants were requested to choose the face that best describes how s/he is feeling because of the hurt/pain being experienced by their low back problem [20] based on using the Iranian version of the RMDQ [21]. RMDQ was self-administrated by literate subjects and our observer (L.A) filled out for illiterates. RMDQ and faces pain scale measure the level of pain and disability in diabetic and non-diabetic (control group). Owing to that, about 51.9% of our participants were illiterate, we had been used face expression pain scale with a very happy, no hurt in one end and hurt as much as you can imagine is the other end at pain scale. Picture pain scale is easily evaluated, takes less time, and can be carried out without using of paper and pen. It is very understandable to illiterate subjects [22]. The faces pain scale consists of a line drawing of six faces that express increasing pain. It has been adapted for older adult population from similar pain scale used in pediatric settings [23]. This pain measure is simple, practical, and useful. Each subject was asked to mark the face that reflected his/her experienced back pain level. Once again, the end points were marked "no pain" and "very much pain". The faces pain scale was scored 0-5.

Subjects were asked about the frequency of the LBP during the past year. LBP was defined to be present if the answer is positive. Participants who attended in the clinic were measured height and weight. Body mass index (BMI) was calculated by division of weight/ (height) 2. RMDQ was used to assess disability level due to LBP problem. Roland-Morris Disability Questionnaire back pain specific functional limitation was assessed using a 24-item. The disability scale for RMDQ ranged from 0 to 24, reflecting a simple, UN weighted sum of marked items by the respondent. In addition, age, gender, presence or absent of blood pressure, level of education, smoking, marital status, economic situation, number of children and number of pregnancies for female subjects was recorded as well and weight and height were measured.

Data analysis

Statistical analyses were performed using the SPSS vs. 16.0. Simple correlation between back pain and its determined including pain intensity, level of disability, frequency of disability, and demographic parameters (including gender, age, educational level, financial level, smoking, hyper tension, number of pregnancies in female, number of children and marital status).

Result

Table 1 gives information on the demographic characteristics and other data of diabetic patients and control group. No significant differences between the diabetic subjects and the control group have been found for level of intensity of physical activity, outdoor and indoor work, because majority of subjects were housewife. The only statistically significant differences between

the diabetic subjects and the control group were education, number of giving birth to children, BMI, hypertension, diabetic and smoking. The mean age of diabetic and non-diabetic group was 52, 50 years respectively. Women comprised 75.4% of the diabetic and 66% of the control group. Of the 317 diabetic patients, the reported last year LBP 201(63.4%) while incidence of LBP in non-diabetic control group was 47 (47%). There was statistically significant difference between two groups (P <0.009). In both groups, there were more females than males who complained of LBP, 67% VS 47% (P <0.01).

There was not any statistically significant association between smoking and LBP among diabetic patients in female and male, compared with non-diabetic group, may be because of a few numbers of smokers in our study population. There was a positive correlation between BMI and LBP (r = -0.196, P = 0.01). A high score on BMI was significantly associated with increased prevalence of LBP. In the diabetic group, subjects response to the question "what was the effect of LBP on routine activities", was 69% patients continued their activities in spite of back pain and 31% of subjects could not continue their activities. In the control population, LBP forced 17% to stop their routine activities, while in 83% the intensity of LBP was not at a level to interfere with routine activities. In the diabetic group, patients that experienced pain less than 10 times per year was 19.4%, while 80.6% reported more than 10 times or had the problems always throughout the year (Table 2). In the control population, the number of subjects had LBP more or less than 10 times per year was almost the same. In the diabetic group, 51.9% of patients were illiterate while in our control group it was 7%. There was not any association between LBP and hypertension (Table 1). The average level of functional disability illustrated by the RMDQ in the diabetic group was 9, in the healthy population it was 7. There was not any significant difference between the two groups. Correlation between LBP intensity pain scale result and RMDQ significantly were related (correlation ratio = 0.521, P<0.01).

Table1: Characteristics of diabetic patients and control group

***P*-Value**	**Non-diabetic(n:100) N (%)**	**Diabetic (n:317) N (%)**	**Characteristics**
Gender			0.009
Male	77(24.6)	33(33)	
Female	240(75.4)	66(66)	
Job status			0.00
Clerk	11(3.8)	35(35)	
Retired	36(11.0)	18(18)	
Self-employed	27(8.5)	7(7)	
Over-load	4(1.3)	2(2)	
Housewife	218(68.8)	37(37)	
Jobless	21(6.6)	1(1)	
Literacy			0.738
Illiterate	165(51.9)	7(7)	
Under diploma	92(29.1)	30(30)	
Diploma	35(11.1)	30(30)	
University	25(7.9)	33(33)	
Hypertension	175(54.9)	26(26)	0.00
Smoking	10(2.8)	9(9)	0.00
Marital status			0.00
Single	25(7.9)	12(12)	
Married	247(78.2)	82(82)	
Salary			0.00

Table 1: Contd…

No salary	32(10.4)	0(0)	
Low	120(38.2)	4(4)	
Average	134(42.3)	79(79)	
High	31(9.1)	17(17)	
	Mean±1SD	Mean±1SD	
Age (years)	52.45±13.85	50.50±12.11	0.233
BMI	28.51	26.86	
Height(cm)	160.52±8.7	160.98±20.6	0.025
Weight(kg)	73.54±13.1	71.28±11.49	0.041
Number of children	4.24±2.14	2.69±1.29	0.00
Number of pregnancy	5.31±2.84	3.2±1.73	0.00

Table 2: characteristics of Low Back Pain among diabetic patients and control group

Characteristics	**Diabetic (N:317) N (%)**	**Non-diabetic(N:100) N (%)**	***P*-value**
Low back pain	201(63.4)	47(47)	0.009
Frequency of LBP			0.00
Less than 10 time a year	39(19.4)	26(54.2)	
More than 10 time a year	162(80.6)	22(45.8)	
FEPS			NS
Hurts little bit	13(12.9)	12(25)	
Hurts little more	33(34.7)	19(39.6)	
Hurts even more	46(42.5)	14(29.2)	
Hurts whole lot	7(6.9)	3(6.3)	
Roland-Morris (24 items)	9.11±4.95	7.18±4.18	NS

Discussion

Although LBP and DM are both very common in the population, no report about their association has been given. In our study, LBP was detected in 63% of DM patients and 47% of our control group. The data on LBP are based on self-reports using a screening question. Self-reporting is the only source to assess information on health problems like LBP, but under or over-reporting may be introduced in both groups [24]. The findings of this study revealed that the prevalence of LBP in diabetic patients was relatively higher than control group. Higher prevalence of LBP were found in the diabetic group than in the sample of the general population group, which holds true for both men and women and was comparable with evidences about prevalence of LBP in general population of other communities as well. If diabetes mellitus could have a strong effect on the micro or macro-vascular network of vertebrae and spinal degeneration, we could expect that a long-term involvement to this condition would be capable of causing some severe diabetes-related consequences and should reveal an effect on the low back area. Our findings confirmed that the rate of LBP was significantly higher than the general population (Table 3).

Table 3: One-year prevalence of self-reported back pain in different general population and its comparison with our study

Authors	Sample	Question	Prevalence of back pain
Picavet et al, 1999	13822 subjects 20-59 years age	"Have you had trouble, discomfort or pain within the lower part of the back during the last 12 month"	Males/Females: 44.7%/51.4
Oinokhodion & Sanya, 2003	840 subjects 20-60 years age	"Presence of low back pain in the previous 12 month"	Males/Females: 40%/34%
Linton et al 1998	6 2305 subjects 35-54 years of age	" Have you suffered from back pain during the past 12 month"	56%
Linton and Ryberg 2000	5 1914 subjects 35-54 years of age	"Have you suffered from back pain during the past 12 month"	Males/Females: 48%/44%
Present Study 2010	100 subject 22-83 years age	"Have you had back pain in the past one year period?"	Males/Females: 11%/33%

Diabetes mellitus is a metabolic disease affecting more than 8% of the general population [25, 26] and may affect the locomotor system in a complex and variety of ways. The metabolic disturbance in diabetes (including glycosylation of proteins; macro and microvascular abnormalities including atherosclerotic process with damage to blood vessels and nerves; and collagen accumulation in skin and periarticular structures) result in changes in the connective tissue. The connective tissue matrix undergoes progressive changes following glycation. These changes affect particularly collagen-rich tissues. An increase in the concentration of glucose increases the rate at which glycation derived crosslinks accumulate on collagen fibers. Collagen-rich tissues such as tendons and bones are highly vulnerable to the glycation process. Consequently, the ability of the tissues to perform normal functions will be compromised [27].

Musculoskeletal complications are most commonly seen in patients with a longstanding history of type 1 diabetes, but they are also seen in patients with type 2 diabetes. Some of the complications have a known direct association with diabetes, whereas others have a suggested but unproven association [21]. Bone and joint alterations that have been related with DM include hyperostosis, OA, and osteoarthropathy, are called diabetic bone diseases" or "diabetic osteopathy" [28, 29]. Research on animals models show that in mild cases of diabetes, autonomic neuropathy is more pronounced than sensory ones. It is possible to observe regional skeletal changes, i.e. osteopenia of vertebrae and long-bone metaphyses, endosteal erosion and preiosteal expansion of diaphyses due to neuropeptide Y (NPY) deficit. The classical effect of NPY is vasoconstriction of peripheral blood vessels and bone with abnormalities of vasoregulation, which may underlie Charcot joint formation [29].

Soft tissue involvement has also been described in DM and can be manifested by calcific periarthritis of the shoulder and diabetic hand syndrome, stenosing tenosynovitis, Dupuytren's contracture (or Dupuytren's disease), carpal tunnel syndrome and limited joint mobility and presence of contractures involving the small joints of hands [30,31]. In this study, we did not assess the presence or absence of limitation of lumbar vertebral joint by digital goniometry to show the correlation between limited joint mobility and back pain problems. A number of studies show that diabetic patients have generalized limitation of joint mobility compared with healthy subjects [5, 32]. The etiology of this association is not clarified, but if this was the case, it might have a role in onset of LBP in

diabetic patients. We suggest further research in this connection.

In this study, the 12 months prevalence of LBP was higher among female subjects than male. Some studies have reported this trend and others have shown no sex differences between male and female in general population (Table 3).

A wide spectrum of various musculoskeletal disorders is common in the diabetic population. Most of musculoskeletal complications seem to be associated with long course of DM. Prevalence of shoulder adhesive capsulitis in diabetes were 4 or 5 times more than normal population [23]. According to the report of Cagliero et al, in 82.6% of type 2 diabetics which they had found specific musculoskeletal disorders were including OA and enthesopathy mainly flexor tenosynovitis both in weight bearing and non-weight bearing joints [33]. Our study shows that in more than fifty percent of the study population there was back problems. According to our findings, we suggest in these patients prophylaxis treatment as a method for preventing LBP. Early manual therapy or mobilization may prevent low back problems and subsequently disability in these patients. At the same time, we can use preventive measures, such as clinical sessions with back pain preventive exercise, giving information about the way of handling of heavy equipment and right or wrong lifting techniques and how to take care of a diabetic back. According to anthropometric calculations, our data showed that BMI has association with LBP. As a result, giving advice about weight reduction methods or consulting with a dietician is a good approach to reduction of LBP in diabetic subjects. Paramount measure and according to Tishler et al. fibromyalgia were significantly higher in diabetes than general population. Moreover, in the same study investigation shows that there is association between fibromayalgia in muscles and higher levels of HbA1c in diabetes [34]. On the other hand, several studies have shown that elevated Hb A1C levels sharply raise the likelihood of having or developing micro- and / or macrovascular disease. Each 1% reduction in haemoglobin A1C was associated with a 37% decrease in risk for microvascular complications [34, 35]. Therefore, it might seem that, with control of hyperglycemia, it would be possible to control of LBP in these subjects as well. It is important to emphasize that the detection higher frequency of LBP in diabetes also is important from a therapeutic point of view. Better control of diabetes may reduce the incidence of LBP in these patients. Therefore, LBP might be added to the list of diabetes-related complications as illustrated by this study. Because of high prevalence of the musculoskeletal disorder in upper extremities, taking preventive measures and prophylaxis treatments has a paramount importance. Performing physical activity, i.e. posture/ balance training, walking on foot, and doing exercise in order to improve their muscle strength may have a role in reduction of blood glucose in diabetes and indirectly in reduction of these complications [36].

Limitations

Some variables could possibly bias the results of this study. One parameter, which may be related with LBP, is socioeconomic status, which may have a confounding role in this study. We could require 317 patients during 3 months period. Finally, a small number of control groups were not similar to patients. Therefore, it was not possible to generalize our result to diabetic population.

This study suggests that LBP in diabetic people is a common problem. Further research is needed to identify differences of etiology of LBP problems in the diabetics and non-diabetics population. The identification of subjects in the diabetic population that have high risk for LBP is necessary. The importance of this study for public health lies in the focus of intervention and prevention. According to the findings of our study, a good deal of effort should be put into interventions to reduce the problem of LBP in this population. These interventions may include specific therapeutic exercise, ergonomic adaptation of this population to work

environment at home or work place, preventive education like forming group back school classes for patients to reduce accidents in house-work. With giving knowledge on these issues, it is possible to increase their awareness about the low back problems and decrease their disability level.

Although in most cases, the causes of low back problems are not recognized, but unquestionable risk factors for lumbar ache are high physical-demand activities like heavy lifting, trunk twisting, working in awkward positions, frequent pulling and lifting, being in static postures for a long time, especially prolonged sitting or standing in a standstill positions and driving heavy vehicle for a long time [26]. However, the above-mentioned risk factors would be the case in diabetic population etiology still remained to be proved.

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