Floor Activities and Degenerative Spinal Diseases

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Background: *The typical oriental life style in Thailand involves significant time spent on activities on the floor. This introduces an abnormal load against the spine and can cause the low back pain leading to the degenerative change of the lumbosacral region.*
Objective: *To determine whether various floor activities in the early adult life could result in late degenerative lumbar stenosis in the elderly patients. A case-controlled study was conducted. The patients having undergone spinal surgery according to the degenerative spinal stenosis were the case subjects. The control group consisted of the subjects having no significant back pain. The cases and the controls were matched by age, gender, and residence location. The data were collected from their medical records, roentgenograms and the standardized questionnaire. A variety of floor activities categorized by common behaviors in the Thai life style was recorded.*
Results: *There were 65 matches of cases and controls. Fifty-four patients were female performing floor activities for more than 28 times/week or more than 2 hours/week for longer than 10 years significantly increased the risk of degenerative spinal diseases by more than 15 times when being compared to the control. The most predictable activities related to the degenerative spinal diseases were occupational, cooking, and latrine use.*
Conclusion: *Floor activities increased the risk of symptomatic degenerative spinal diseases in the Thai population. The question whether the prolonged postures of these routine activities could result in lumbar spinal stenosis needs more investigation in further studies.*

Keywords: *Case-control studies, Floors and floorcoverings, Life style, Low back pain, Lumbosacral region, Spinal diseases*

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The degenerative spinal disease is one of the major health problems in the elderly[1]. It is the most common cause for people of over 60 years of age to undergo back surgery[2]. The risk factors for this condition are significantly important; they, conversely, are still undetermined.

Physical loading is related to low back pain[3-5]. Several studies found that various jobs related to physical loading and cigarette smoking were the risk factors for low back pain. Nurses[6] and drivers[7] have also been believed to be associated with a high prevalence of low back pain. Viderman T and Battie MC[8] pointed out that the degree and duration of gestures toward a specific loading resulting in the spinal degeneration were controversial; they could be explained as the only part of the degeneration. Wilhelmina E et al[9] in their kinematical analysis of workers mainly using their trunks while working observed the increasing low back pain among the workers using the trunk in a minimum of 60 degrees of flexion for more than 5% of the working time. They concluded that the flexion and rotation of the trunk and long lifting weights at work are the moderate risk factors for the low back pain. Granata KP and Wilson SE[10] recorded the EMG activity based on the trunk muscles of 10 subjects during the static exertions in various trunk postures. They found that a stable spinal load was increased in asymmetric postures as a result of the antagonistic muscle recruitment leading

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to increase neuromuscular control that was necessary to maintain the stability in asymmetric lifting postures.

Floor activity is a cultural behavior in the Thai community. It is normally performed in the rural areas. This performance demands constant bending of the torso. Its frequency can be rated by scoring. The reliability of floor activity score has been proved in the previous study[11]. The impacts of the prolonged postures to the spinal loading are worth exploring.

Material and Method

This case-controlled study was conducted at Ramathibodi Hospital from January 2003-December 2004. The case was defined as a group of the Thai patients whose age was 50 years old or older. The patients were diagnosed that they had the degenerative spinal diseases: spinal stenosis, degenerative spondylolisthesis, and degenerative scoliosis by using the roentgenographic criteria. They, also, were clinically examined by orthopedic surgeons. All cases underwent a spinal surgery at the Department of Orthopedics, Ramathibodi Hospital and were followed-up at the Orthopedic outpatient clinic. The subjects were the patients having at least one of the following: congenital spinal disorders, spinal injuries from high-energy trauma, primary and secondary spinal tumors, spinal infections, and inflammatory spinal diseases such as seronegative spondyloarthropathies. On the other hand, the patients having a previous spinal surgery were excluded.

The control was defined as a group of the Thai patients who did not have low back pain or symptomatic degenerative spinal diseases: spinal stenosis, degenerative spondylolisthesis, degenerative scoliosis or any spinal problems that required a treatment at least 6 months prior to the study, including those who have had a treatment within the past 10 years. The spinal problems were verified by using the medical records, and history taking. The radiographs of the spine were not done in this study because the control and the study groups were clearly distinct in their clinical symptoms. All of the control participants were randomly selected and matched to the case subjects (1:1) by age within a 5-year range, gender, and residence areas in terms of the same vicinity. The controls were recruited at the time when the patients came to the Ear-Nose-Throat (ENT) outpatient clinic as the incidence of back pain in this group was very low.

All the cases and the controls presented the informed consents. This study was approved by the Institutional Review Board (IRB).

The data were collected from the participants' medical records and roentgenograms. The participants were interviewed through the standardized questionnaire (General health questionnaire-12, GHQ-12) by a well-trained interviewer. The patient's demography was recorded including age, gender, marital status, educational level, income, residence areas, history of spinal anesthesia, occupation, floor activities, psychological status, Oswestry and Roland Morris functional score prior to the spinal surgery and smoking. The categories of floor activities were based on the normal Thai life style in accordance with the previous study[11]. They were latrine use, eating, mopping, laundry, cooking, ironing, meditation, leisure, sleeping, occupation, working habit, and resting. The frequency and duration of each floor activity were also recorded. The outcomes were the symptomatic degenerative spinal diseases. These were in harmony with the patients who underwent the spine surgery because of degenerative problems. The control group was defined as asymptomatic patients.

Statistical analysis

Each posture data was analyzed as the mean $\pm$ standard deviation, and unpaired t-test. The categorical data were analyzed according to Fisher's exact test. According to the frequency matching for age, gender, and residence location, the analysis was performed by the unconditional logistical regression. The univariate analysis was done for each study factor in order to select the significant factors. The p-value was set at < 0.2 as a criterion. All the significant study factors from the univariate analysis were included into the final model for the multivariate analysis. The significant p-value was equal to or less than 0.05.

Sample size

The calculated sample size was 206. Driving, the lowest risk factor of low back pain[5], was used as a model for calculation with the driving probability among the cases[3] = 0.39 and estimated to 0.40[7], the driving probability among the controls = 0.30 (difference = 0.10), alpha = 0.05, and power = 0.8.

Results

Ninety-three cases and 268 controls were eligible for the study. After matching by the aforementioned criteria, there were 65 cases and 65 controls. The distribution of the baseline characteristics for both groups was demonstrated in Table 1. There was no statistically significant

Table 1. The comparison of the baseline characteristics between cases and controls

Variables	Cases (n = 65)	Controls (n = 65)	p-value
Age, years (mean $\pm$ SD)	62.6 $\pm$ 5.2	62.4 $\pm$ 5.8	0.7879[a]
Female (%)	54 (83.1)	54 (83.1)	1.000
Live in Bangkok (%)	25 (38.5)	25 (38.5)	1.000
Married (%)	35 (53.9)	42 (64.6)	0.105
Income, Bahts (median, range)	0 (0-200,000)	3,000 (0-50,000)	0.2265[b]
Below high school education (%)	46 (70.8)	31 (47.7)	0.033
Farmers (%)	17 (26.2)	8 (16.7)	0.245
Smoking/ex-smoking (%)	7 (10.8)	3 (4.6)	0.426
History of spinal block (%)	7 (10.9)	13 (20.3)	0.111
Hormonal replacement therapy (%)	13 (23.6)	14 (28.0)	0.659
Duration of hormonal replacement therapy, years (mean $\pm$ SD)	1.9 $\pm$ 5.3	2.1 $\pm$ 7.4	0.849
Abnormal general health questionnaire-12 (%)	24 (38.1)	17 (28.8)	0.339

p-value from Fisher's exact test
[a] p-value from unpaired t-test
[b] p-value from Wilcoxon rank sum test
* Significant p-value $\leq$ 0.05

difference in matching profiles for age, gender, residence locations, marital status, income, occupation *e.g.* farmer, smoking, history of spinal block, hormonal replacement therapy and its duration, and General Health Questionnaire-12 between both groups. However, the case patients had significantly lower education levels than the controls.

The cases had the mean preoperative Oswestry score of 22.9 $\pm$ 9.2, and the mean preoperative Roland Morris score of 15.1 $\pm$ 5.7. All of them underwent posterior laminectomy and spinal fusion either with or without instrumentation.

All participants completed the floor activity questionnaires by the interviewer, except the items, as follows, relating to laundry and cooking (1 control), meditation (1 case and 1 control), and sleeping (2 controls). However, the proportion of the incomplete questionnaires was not significantly different between the case patients and the controls (p-value = 0.15). The frequency mean of the floor activities was 56.9 $\pm$ 32.8 times/week in the cases and 19.2 $\pm$ 16.7 times/week in the controls. The duration mean of all floor activities was 530 $\pm$ 401.6 minutes/week in the cases, and 103.1 $\pm$ 143.9 minutes/week in the controls. These activities were recorded only when they had been undertaken for over 10 years. Both the frequency and the duration of the floor activities were significantly higher in the cases compared to the controls (p-value < 0.001).

The frequency of floor activities was categorized into a quartile range of frequency, (0-7, > 7-16, > 16-28, > 28 times/week). As demonstrated in Table 2, the risk of having degenerative spinal diseases significantly increased in the fourth quartile compared to the first quartile (the Odds Ratio (OR) was 17.29 with 95% confidence interval (CI) = 4.52-66.11). The frequency of floor activities which was less than 28 times/week did not show any significant risk of having degenerative spinal diseases. The duration of all floor activities was categorized into quartile range (0-7, > 7-45, > 45-145, > 145 minutes/week).The risk of

Table 2. Frequency and duration of floor activities associated with degenerative spinal diseases

Floor activities	Odds ratio (95% CI)	p-value
Frequency (times/week)		
0-7[a]		
> 7-16	3.60 (0.82-15.74)	0.089
> 16-28	1.60 (0.31-8.30)	0.576
> 28	17.29 (4.52-66.11)	<0.001*
Duration (minutes/week)		
0-7[a]		
> 7-45	9.56 (1.09-84.24)	0.042*
> 45-145	9.00 (1.02-79.03)	0.047*
> 145	52.13 (6.39-425.43)	<0.001*

[a] Reference group
* Significant p-value $\leq$ 0.05

Table 3. The univariate analysis of floor activities and degenerative spine

Floor activities	Cases (%) n = 65	Controls (%) n = 65	OR (95% CI)	p-value
Meditation	34 (53.1)	40 (62.5)	0.68 (0.34-1.38)	0.284
Sleeping	36 (55.4)	23 (36.5)	2.16 (1.06-4.39)	0.033*
Ironing	26 (40.0)	15 (23.1)	2.22 (1.04-4.76)	0.040*
Eating	42 (64.6)	24 (36.9)	3.12 (1.52-6.38)	0.002*
Mopping	43 (66.2)	20 (30.8)	4.40 (2.11-9.18)	<0.001*
Leisure	47 (72.3)	23 (35.4)	4.77 (2.27-10.03)	<0.001*
Resting	37 (56.9)	13 (20.0)	5.29 (2.42-11.55)	<0.001*
Laundry	52 (80.0)	27 (42.2)	5.48 (2.50-12.01)	<0.001*
Latrine use	57 (87.7)	35 (53.9)	6.11 (2.52-14.82)	<0.001*
Working habit	38 (58.5)	11 (16.9)	6.91 (3.06-15.60)	<0.001*
Cooking	39 (60.0)	9 (14.1)	9.17 (3.87-21.70)	<0.001*
Occupation (farmer)	33 (50.8)	4 (6.2)	15.72 (5.12-48.32)	<0.001*

* Significant p-value ≤ 0.05

having degenerative spinal diseases significantly increased in the second to the fourth quartile in comparison with the first quartile (Table 2). There was a dose-response relationship in the duration of the floor activity performance. The Odds Ratio increased from 9 in the second and the third quartile to 52 in the fourth quartile.

The comparisons of each floor activity between the two groups were shown in Table 3. The univariate analysis showed that all the floor activities led to the significant risks of having degenerative spinal diseases except meditation. All the floor activities and the education level which had p-values of less than 0.2 were included in the multivariate analysis. The final model was chosen by using the forward stepwise logistical regression with a significant p-value equal to or less than 0.05. The floor activities that significantly increased the risk of having degenerative spinal diseases were latrine use, cooking, and occupation (Table 4).

According to the dose-response relationship of the floor activities, the frequency of floor activities was taken into account. The univariate analysis of each activity was presented in Table 5. The Odds Ratios showed that the more prolonged floor activities were performed, the more risks of having degenerative spinal diseases were significantly increased. The only exception was meditation.

Table 4. Multivariate analysis of floor activities in cases and controls

Floor activity	OR (95% CI)	p-value
Latrine use	2.87 (1.06-7.75)	0.037*
Cooking	3.08 (1.11-8.51)	0.030*
Occupation (farmer)	7.48 (2.18-25.70)	0.001*

* Significant p-value ≤ 0.05

Table 5. The univariate analysis of the floor activity frequency between cases and controls

Doing 1 time of floor activities	OR (95% CI)	p-value
Meditation	0.91 (0.81-1.01)	0.076
Sleeping	1.17 (1.05-1.30)	0.003*
Ironing	1.25 (0.96-1.61)	0.093
Eating	1.12 (1.07-1.17)	<0.001*
Mopping	1.25 (1.10-1.43)	0.001*
Leisure	1.25 (1.12-1.39)	<0.001*
Resting	1.42 (1.23-1.63)	<0.001*
Laundry	1.38 (1.20-1.60)	<0.001*
Latrine use	1.27 (1.13-1.41)	<0.001*
Working habit	1.34 (1.18-1.52)	<0.001*
Cooking	1.31 (1.18-1.47)	<0.001*
Occupation (farmer)	1.47 (1.25-1.72)	0.001*

* Significant p-value ≤ 0.05

Discussion

Recently, many investigators have demonstrated the relationship between physical loading and low back pain(12). Waters TR et al(13) studied the risk factors for musculoskeletal symptoms in the workplace. They found the relationship between the physical loads and the musculoskeletal disorders. Barrero LH et al[14], through the cross-sectional study in the community, found the evidence of the linkage between physical exposure and low back pain. Burdorf A and Jansen JP[15] illustrated the potential impact of physical load on both eligible and permanent disability due to low back pain. Sarikaya S et al[16] found higher incidences of low back pain among Turkish underground coal miners compared to their age-matched workers on the ground. However, these kinds of physical load resulting in the radiological changes following the prolonged postures were still unclear[17,18].

This study found that the floor activity was strongly associated with the degenerative spine. This firm link was found among the activities requiring constant motions of the torso, *i.e.* working by sitting on the floor, cooking, and latrine use. In contrast, the static floor activity like meditation seemed to demonstrate the reverse association in the study group. This finding confirmed the effect of the constant prolonged postures particularly the bending and twisting motions of the trunk.

The question whether the constant prolonged postures can lead to the lumbar spinal stenosis is essentially investigated in further studies. On the other hand, whether the activity modification has any effects on the natural history of lumbar spinal stenosis is also worth exploring.

The baseline characteristics did not show a significant relationship with the lumbar spinal stenosis in this study. The results were different from some studies[9,12] while the finding that both control and study groups had a low incidence of psychological problems was similar to the systematic review of psychological factors and low back pain[19]. Nearly 80% of both cases and controls were women; they did not usually smoke. They neither normally had hormonal replacement therapy, nor previously underwent the spinal anesthesia.

The limitation of this study was that the hospital controls from the Ear-Nose-Throat (ENT) outpatient clinic may not represent the general population. It was possible that the ENT patients may have some limitations in floor activities. This might result in an overestimation of the Odds Ratio. Moreover, the sample size was small. This might be the reason why we could not find the significant p-value for some factors. However, most of the floor activities showed a significant relationship with the study group who underwent surgery.

In summary, this study showed that floor activity normally performed in the oriental life style increased the risks for degenerative spine whereas there had been no study in the floor activity evaluated as a risk factor for degenerative spine. The continuation of this performance also had a high probability of risk increase. The floor activities associated with occupation, *e.g.* farming led to higher risks than those associated with both cooking and low level movements such as eating, sleeping, and meditation. The less bending repetition while performing floor activities might reduce back pain and the development of degenerative spine. Floor activity is a cultural behavior in the Thai community. It is still commonly performed in the rural areas. The constant bending of the torso is the basic gesture of floor activity. The postures of floor activities can be measured by scoring. The reliability of floor activity score was proved in the previous study[11] The degree of postures, thus, can be estimated. It can also be regarded as a specific physical loading. The concept whether the prolonged postures to such loading have any influence on symptomatic low back problems is an interesting clinical hypothesis for future investigation.

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กิจกรรมบนพื้นและโรคกระดูกสันหลังเสื่อม

วิวัฒน์ วจนะวิศิษฐ, ภัททรวัณย์ วรธนารัตน์, ธเนศ วัฒนะวงษ์, วิเชียร เลาหเจริญสมบัติ

คนไทยมักมีวิถีชีวิตและทำกิจกรรมบนพื้น ซึ่งอาจก่อให้เกิดแรงกระทำต่อกระดูกสันหลังที่อาจเป็นสาเหตุของอาการปวดหลังและนำไปสู่กระดูกสันหลังบริเวณเอวเสื่อม วัตถุประสงค์ของการศึกษานี้ต้องการศึกษาผลกระทบของกิจกรรมบนพื้นต่อการเกิดกระดูกสันหลังเสื่อมในผู้ใหญ่ โดยทำการศึกษาชนิด case controlled ตั้งแต่เดือนมกราคม พ.ศ. 2546 ถึงเดือนธันวาคม พ.ศ. 2547 กลุ่มตัวอย่างเป็นผู้ป่วยที่เข้ารับการผ่าตัดกระดูกสันหลังอันเนื่องมาจากภาวะกระดูกสันหลังเสื่อม กลุ่มควบคุมเป็นผู้ป่วยที่ไม่มีประวัติปวดหลัง และมีอายุ เพศ ที่อยู่เดียวกับกลุ่มตัวอย่าง การศึกษาประกอบด้วยกลุ่มตัวอย่างและกลุ่มควบคุมกลุ่มละ 65 ราย เป็นหญิง 54 ราย จากการเก็บข้อมูลจากเวชระเบียน ภาพรังสีและการตอบแบบสอบถามเกี่ยวกับกิจกรรมบนพื้นซึ่งพบบ่อยในวิถีไทย ปรากฏว่าการทำกิจกรรมต่าง ๆ บนพื้น มากกว่า 28 ครั้งต่อสัปดาห์ หรือ มากกว่า 2 ชั่วโมงต่อสัปดาห์ เป็นเวลานานกว่า 10 ปี เสี่ยงต่อการเกิดกระดูกสันหลังเสื่อมซึ่งสูงกว่ากลุ่มควบคุมถึง 15 เท่า กิจกรรมบนพื้นประเภทที่เป็นปัจจัยเสี่ยงสำคัญได้แก่ การประกอบอาชีพ การทำครัวและการนั่งส้วมยอง ๆ กล่าวโดยสรุป กิจกรรมบนพื้นเป็นปัจจัยเสี่ยงของการเกิดกระดูกสันหลังเสื่อม ในคนไทยทั้งนี้ต้องการการศึกษาเพิ่มเติมเพื่ออธิบายกิจกรรมเหล่านี้ว่ามีผลต่อการเกิดกระดูกสันหลังเสื่อมอย่างไร