Yoga and Lumbar Disc Degeneration Disease: MR Imaging Based Case Control Study

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Yoga is a popular exercise with evidence of various physical and psychological benefits. However, most of these studies are based on subjective scales. To our knowledge, there are very few original studies on MRI analyses of yoga practicing individuals at present. Here we conducted a MRI-based case-control study of yoga and lumbar degenerative disc disease (DDD).

Eighteen yoga instructors were enrolled in our study and other 18 asymptomatic cases were randomly selected from our health check up database as control group. All lumbar discs of these cases were graded by using MRI and analyzed statistically.

The mean practice period is 12.9±7.5 in yoga group. The median grading of the L1/2, L2/3, L3/4, L4/5, L5/S1 and the 90 lumbar discs was 2 (3, 2), 2 (3, 2), 3 (3, 1), 3 (4, 1), 2 (4, 1), 2 (4, 1) in yoga group and 2 (3, 2), 2.5 (4, 2), 3 (4, 1), 3 (4, 1), 3 (4, 1), 3 (4, 1) in control group, respectively. The median grading of the 90 discs was significantly lower in the yoga group than in the control group. The median grading of the L2-3 and L3-4 discs was significantly lower in the yoga group than in the control group.

The grading of DDD was lower in the study group that had practiced yoga for more than 10 years as compared to the control group.

Yoga originated in ancient India, and the term “yoga” was derived from the Sanskrit verb yuj meaning “union,” which is extended to include mind-body techniques practiced today that include meditation, breathing control, and posture integration [1-4]. Yoga is a popular health practice with 15 to 30 million followers in the United States, and 23% of Americans practice some type of yoga [1, 5]. Yoga may be dangerous if performed in an incorrect posture and some related injuries have been reported, especially cervical spine [6-10]. The evident benefits of yoga include better physical fitness, weight control, prevention of heart disease, decreased mood disturbance, asthma control, rehabilitation or pain control in patients with orthopedic surgery, low back pain, spinal cord injury, carpal tunnel syndrome, cancer, Alzheimer’s disease or multiple sclerosis, and thickening of the brain cortex [2-6, 11-19].

Low back pain is a troublesome medical problem marked by great suffering and enormous cost of treatment. It primarily results from degenerative disc disease (DDD) due to inappropriate posture, stress, microtrauma and chronic inflammatory process [11, 20-23]. Magnetic resonance imaging (MRI) is a well-documented diagnostic tool for DDD [20, 21, 24-26]. Yoga is reported to be useful in prevention and relief from low back pain, and these researches are typically based on self-reported or subjective scales. [11, 12, 22] There are very few original studies on MRI analyses of yoga practicing individuals at present. Here we conducted a MRI-based case-control study of yoga and lumbar DDD.

MATERIALS AND METHODS

Study Sampling

Yoga instructors from Taipei city were invited to our study of lumbar spine MRI. Eighteen volunteers that were considered as apparently asymptomatic cases after an initial selection procedure that excluded
volunteers with previous or current systemic diseases such as heart failure, chronic lung disease, dysmotility, stroke and cancer. Another 18 asymptomatic control cases with lumbar spine MRI conducted in the past one year were randomly selected from the health check-up database at our institution.

**MRI protocol**

All MRI studies were performed using a 1.5-T superconducting system (Gyroscan NT 15; Philips Medical Systems, Best, The Netherlands) with a spinal surface coil. The following pulse sequences were performed: (1) sagittal T2-weighted turbo spin echo (repetition time msec/echo time msec of 4,700/120, echo train length of 15, section thickness of 4 mm, field of view of 280_280 mm, matrix of 240_256, and one signal acquired), (2) sagittal T1-weighted spin echo (600/14, section thickness of 4 mm, and other parameters were the same as those mentioned above), (3) axial T2-weighted turbo spin echo in one or multiple levels depending on the findings in the above sequences (4,500/120, echo train length of 15, section thickness of 4 mm, field of view of 200_200 mm, and matrix of 240_256 mm).

**Imaging assessment**

All MRI studies were evaluated by one of the two radiologists with 17-year and 14-year experience. Both specialists were single-blinded for the purpose of our study during their assessments. DDD is classified into 5 grades based on T2-weighted mid-sagittal image depending on the degenerative status of the nucleus. This grading system is well documented in previously published literature and is as follows (Fig. 1) [20, 24].

Grade I: a homogeneous, hyperintense disc and normal disc height. Grade II: an inhomogeneous, hyperintense disc with possible hypointense (gray) bands and clear distinction between nucleus and annulus. Grade III: an inhomogeneous, intermediate intense disc with possible decreased height and unclear distinction between nucleus and annulus. Grade IV: an inhomogeneous, hypointense (dark) disc with decreased height and loss of distinction between nucleus and annulus. Grade V: an inhomogeneous, hypointense (black) disc with collapsed disc space and loss of distinction between nucleus and annulus.

**Statistical Analyses**

A total 90 discs in yoga cases and 90 discs

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**Figure 1.** 1A: Under T2 weighted images, grade I disc (arrow) is a homogeneous, hyperintense disc with normal height. 1B: Grade II disc (arrow) is a hyperintense disc with a hypointense band. 1C: Grade III disc (arrow) is an inhomogeneous disc with unclear distinction between nucleus and annulus. 1D: Grade IV disc (arrow) is an inhomogeneous hypointense disc with decreased height. 1E: Grade V disc (arrow) is a collapsed, hypointense disc.
in control cases were analyzed in our study. The median grading of each disc (L1/2, L2/3, L3/4, L4/5, and L5/S1) and grading of the 90 discs were noted with median values (maximum, minimum) and compared with the results obtained by the Mann-Whitney U test. These calculations is performed using the software SPSS for Windows 10.0 (SPSS, Chicago, Ill) and a P value of less than 0.05 was considered to indicate statistical significance.

Results

Table and figure 2 are the results of our study.

There were 18 yoga cases and 18 control cases in our study. The mean age was 45.1 ± 10.6 years in the yoga cases and 50.6 ± 8.54 years in the control cases. There were 3 (16.7%) men and 15 (83.3%) women in the yoga cases and 5 (27.8%) men and 13 (72.2%) women in the control cases. The mean period for yoga practicing was practiced was 12.9 ± 7.5 years in the yoga cases.

The median grading of the L1/2 disc was 2 (3, 2) in the yoga cases and 2 (3, 2) in the control cases. The median grading of the L2/3 disc was 2 (3, 2) in the yoga cases and 2.5 (4, 2) in the control cases (P < 0.05). The median grading of the L3/4 disc was 3 (3, 2).

Figure 2. Distribution numbers of grading in each disc level of L spine in Yoga and control groups. 2a. Grading distribution in L1-L2 discs. 2b. Grading distribution in L2-L3 discs. 2c. Grading distribution in L3-L4 discs. 2d. Grading distribution in L4-L5 discs. 2e. Grading distribution in L5-S1 discs. 2F. Grading distribution in 90 lumbar discs.
1) in the yoga cases and 3 (4, 1) in the control cases (P < 0.05). The median grading of L4/5 disc was 3 (4, 1) in the yoga cases and 3 (4, 1) in the control cases. The median grading of L5/S1 disc was 2 (4, 1) in the yoga cases and 3 (4, 1) in the control cases. The median grading of the 90 discs in yoga cases was 2 (4, 1) in the yoga cases and 3 (4, 1) in the control cases (P < 0.05).

In brief, the median grading of the 90 discs was significantly lower in the yoga group than in the control group. Further, the median grading of the L2-3 and L3-4 discs was significantly lower in the yoga group than in the control group.

**DISCUSSION**

Yoga is a philosophy developed thousands of years ago and focuses on the union of oneself with the whole universe using meditation, relaxation, breathing control and posture integration [1-4]. By appropriately practicing yoga, one can bring about a feeling of completeness through one’s experience of a body-mind harness, and the results include enhanced flexibility, along with improved posture, balance, strength, and physical health [1, 2]. Certain existing psychology techniques such as use of breathing with guided imagery in sports and mindfulness-based stress reduction (MBSR) program—a unique group stress-reduction intervention developed at the University of Massachusetts—are based on yoga [1, 12].

Low back pain is a troublesome medical problem [11, 20-23]. The general working population experiences episodes of low-back pain periodically with a reported prevalence ranging from 5% to 69% [11, 21]. Physiologically, the intervertebral disc is a cartilaginous and articulating structure between the vertebral bodies and provides the primary support for the vertebral column during flexion, extension, and rotation of the spine. A normal disc comprises of an elastic collagen ring (annulus fibrosus) surrounding a gelatinous nucleus pulposus and accounts for 25% to 30% of the length of the spine. Normal nucleus pulposus contains 88% water. However, the water content decreases as aging or degeneration occurs and ultimately the nucleus pulposus deteriorates into desiccated fragments [23]. MRI is a well-documented diagnostic tool for DDD, and a comprehensive grading system for DDD using MRI has been developed [20, 21, 24-26]. Though some equivocal studies exist, DDD plays an important role in spinal degeneration and low back pain, which is prevalent in 39% of the individuals suffering from chronic low back pain and most commonly affects the L4/5 and L5/S1 vertebral segments [22].

To our knowledge, there are only few original researches on the MRI analyses of yoga practicing individuals in medline or journal cited report articles. We thus conducted a case-control study of yoga and DDD based on MRI. Our study indicated the significantly lower median grade of DDD in the L2/3 and L3/4 segments, and our study indicated a significantly lower median grade of the 90 lumbar discs in the yoga group compared to the control group, particularly in the L2/3 and L3/4 discs.

The possible mechanisms for the prevention of DDD by yoga include the following: (1) yoga is practiced in pairs with counterposes, and biomechanically this creates a balance by soft tissue lengthening, hyaline cartilage compression and distraction, and reversing intervertebral disc pressures [1]; (2) yoga exercises promote stretching and flexibility by nonsurgical interventions for spine pain and are effective in reducing pain and preventing relapses in patients with chronic low back pain [11, 14, 22]; (3) yoga therapies offers a holistic remedy for various orthopedic conditions and are recommended for orthopedic pre- and post-operation patients [1, 13]. DDD most commonly affects the L4/5 and L5/S1 vertebral segments, and our study indicated a significantly lower median grade of DDD in the L2/3 and L3/4 discs. Such inconsistency deserves further evaluation.

Our study has certain limitations. First, there are many subtypes of yoga such as Bhakti, Guru, Hatha, Ashtanga, Jnana, Karma, Mantra, Raja and Tantra [1]. Although our volunteers were not aware

<table>
<thead>
<tr>
<th>Case number</th>
<th>Yoga group</th>
<th>Control group</th>
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<tbody>
<tr>
<td>Age</td>
<td>45.1 ± 10.6</td>
<td>50.6 ± 8.54</td>
</tr>
<tr>
<td>Sex (Male/female)</td>
<td>3/15</td>
<td>5/13</td>
</tr>
<tr>
<td>Yoga performing years</td>
<td>12.9 ± 7.5</td>
<td></td>
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<tr>
<td>Intervertebral disc degeneration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1-2</td>
<td>2 (3, 2)</td>
<td>2 (3, 2)</td>
</tr>
<tr>
<td>L2-3*</td>
<td>2 (3, 2)</td>
<td>2.5 (4, 2)</td>
</tr>
<tr>
<td>L3-4*</td>
<td>3 (3, 1)</td>
<td>3 (4, 1)</td>
</tr>
<tr>
<td>L4-5</td>
<td>3 (4, 1)</td>
<td>3 (4, 1)</td>
</tr>
<tr>
<td>L5-S1</td>
<td>2 (4, 1)</td>
<td>3 (4, 1)</td>
</tr>
<tr>
<td>Total 90 discs*</td>
<td>2 (4, 1)</td>
<td>3 (4, 1)</td>
</tr>
</tbody>
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*means a p-value< 0.05
of their yoga subtypes, they apparently had Hatha instructors. Since our yoga instructors were volunteers, it resulted in potential selection bias. Second, our study group included only yoga instructors with average experience of approximately 13 years. The results of our study may thus not be consistent with those that obtained if the study group are yoga followers from general population. Third, yoga instructors are probable to enjoy a sound life style and thus impact the confounding factors such as diet, stress, and quality of life.

In conclusion, the grading of DDD was significantly lower in the study group that had practiced yoga for more than 10 years as compared to the control group.

◆

REFERENCES

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瑜伽及腰椎間盤退化疾病：磁振照影之病例對照研究

鄭子傑 1  鄭慶明 12  孔慶惠 1  許慧貞 3  黃玉堅 1  張筱筠 1

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台安醫院 影像醫學科 3

瑜伽是相當普及且一般認為對身心有益的運動，但相關研究往往過於主觀。瑜伽與磁照影的相關研究相當稀少，因此我們設計了瑜伽與腰椎間盤退化疾病的病例對照研究。

研究邀請 18 位瑜伽指導者及 18 位無臨床症狀健檢病例做對照。所有的腰椎間盤的退化程度以磁照影分級並加以統計分析。

在實驗組的瑜伽經驗平均是 12.9 ± 7.5 年；在第一二、第二三、第三四、第四五、第五腰第一薦、和腰部 90 個腰椎間盤的退化分級，在瑜伽指導者中位數依序為 2 (3, 2), 2 (3, 2), 3 (3, 1), 3 (4, 1), 2 (4, 1) 及 2 (4, 1)，而在對照組為 2 (3, 2), 2.5 (4, 2), 3 (4, 1), 3 (4, 1), 3 (4, 1) 及 3 (4, 1)；在瑜伽組 90 個腰椎間盤分級中位數明顯較低，特別是在第二三和第三四兩節。

瑜伽經驗超過十年可有效預防腰椎間盤退化疾病。