

Postprint: Analysis of Self-Management Status and Influencing Factors in Patients with Degenerative Spinal Deformity

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Date: 2023-07-04T00:00:00+00:00

Abstract

Background In recent years, the prevalence of degenerative spinal deformity (DSD) has been increasing annually. From disease onset until surgical intervention becomes necessary, patients coexist with the disease over the long term, during which self-management is crucial for the development and outcomes of DSD. However, the current status of self-management and its influencing factors in DSD patients remain unclear, preventing the development of targeted and effective intervention measures.

Objective To investigate the current status of self-management in DSD patients and analyze its influencing factors, providing clinical reference for developing targeted intervention programs.

Methods Using convenience sampling, a questionnaire survey was conducted on 200 DSD patients who visited the Department of Orthopedics at the First Affiliated Hospital of Army Medical University between June 2020 and December 2022. Data collected included demographic information, Visual Analogue Scale scores, Oswestry Disability Index questionnaire scores, Medical Social Support Scale scores, and Chronic Disease Self-Management Behavior Scale scores. A multiple linear regression model was constructed to analyze the influencing factors of patients' Chronic Disease Self-Management Behavior Scale scores.

Results A total of 191 valid questionnaires were collected (95.5%). The mean age of patients was (62.6 ± 11.6) years, including 144 cases of scoliosis (75.4 ± 11.97) points, with standardized scores of (26.27 ± 15.83) points, doctor-patient communication (23.53 ± 16.27) points, and cognitive symptom management (26.27 ± 15.83) points. Correlation analysis results showed that age, BMI, monthly household income per capita, education level, smoking history, functional disability, and medical social support were significantly correlated with each dimension score and total score of the Chronic Disease Self-Management Behavior Scale ($P < 0.05$). Multiple linear regression analysis model results indicated that

medical social support, education level, monthly household income per capita, and bone mineral density were influencing factors of the Chronic Disease Self-Management Behavior Scale scores in DSD patients ($P < 0.05$).

Conclusion The level of self-management behavior in DSD patients is relatively low. Medical social support, education level, economic status, and bone mineral density are influencing factors of self-management in DSD patients. Healthcare professionals should enhance patients' self-management behavior in clinical practice by strengthening education and improving social support to help patients effectively manage their disease.

Full Text

Introduction

Degenerative spinal deformity (DSD) refers to cumulative degenerative lesions in spinal alignment, formation, or curvature, clinically manifested primarily as scoliosis and/or kyphosis. The prevalence among individuals over 65 years old reaches as high as 32%~68% [1-2], with curvature progression occurring at a rate of 1° ~ 6° per year [3]. Patients commonly experience low back pain, claudication, and neurological dysfunction, significantly impairing health-related quality of life. As DSD is not a malignant disease and postural compensation can alleviate some symptoms, it has not received adequate attention. Patients lack self-management awareness, leading to rapid disease progression, with most eventually requiring surgical intervention. However, high costs and severe complications result in suboptimal treatment outcomes [4]. Studies have shown that mild to moderate deformities with curvature angles within 30° ~ 40° can be managed through self-management approaches including postural improvement, spinal extension, and core exercises to delay disease progression, reduce pain, and improve disability [5-10]. Unfortunately, the current status and influencing factors of self-management in DSD patients remain unclear, preventing the development of targeted intervention strategies. Therefore, this study aims to understand and assess the current status of self-management behaviors in DSD patients and analyze influencing factors to provide clinical references for developing targeted intervention programs.

Methods

Study Design and Participants

We selected DSD patients who attended the Department of Orthopedics at the First Affiliated Hospital of Army Medical University from June 2020 to December 2022 as study subjects using a convenience sampling method. Inclusion criteria were: (1) meeting DSD diagnostic criteria [11], defined as coronal Cobb angle $>10^{\circ}$ and/or sagittal vertical axis (SVA) >5 cm or kyphosis angle $\geq 40^{\circ}$, but not meeting surgical indications; (2) disease involvement in thoracic and/or lumbar segments; (3) age ≥ 45 years; (4) informed consent from patients and

their families with voluntary participation. Exclusion criteria were: (1) presence of spinal diseases such as ankylosing spondylitis, spinal tumors, spinal tuberculosis, or spinal infections; (2) history of spinal surgery within the past 2 years; (3) history of new traumatic or osteoporotic vertebral compression fractures within the past year; (4) comorbidities causing pain and severely affecting quality of life (such as malignant tumors, cachexia, paraplegia, severe rheumatoid arthritis, and osteoarthritis) and other serious systemic diseases; (5) presence of mental illness, lack of autonomous judgment, or inability to communicate normally.

A priori analysis (GPower 3.1.9) indicated that with a significance level α of 0.05 (two-sided), statistical power $1-\beta$ of 0.9, and effect size f^2 of 0.15, at least 119 subjects were needed considering a 10% attrition rate. This study distributed 200 questionnaires and recovered 191 valid questionnaires (95.5% response rate). All participants voluntarily joined the study and signed informed consent forms. This study was approved by the Ethics Committee of the First Affiliated Hospital of Army Medical University [(A)KY202268].

Measurements

1.2.1 Demographic Questionnaire Designed by our research team, including general demographic data such as age, marital status, education level, smoking history (defined as smoking at least 1 cigarette daily for more than 6 months), and disease-related information including deformity type, bone mineral density, and number of chronic diseases.

1.2.2 Disease Burden Scales We used the Visual Analogue Scale (VAS) to assess pain, ranging from 0 (no pain) to 10 (severe pain). The Oswestry Disability Index (ODI) questionnaire was used to evaluate the disabling impact of low back and leg pain on daily activities, with each item scored 0~5. The scoring method was: (actual score/maximum possible score) $\times$ 100%, with scores ranging from 0 (no functional disability) to 100 (severe functional disability).

1.2.3 Medical Outcomes Study Social Support Survey (MOS-SSS) The MOS-SSS [12] includes 19 items across 4 dimensions: tangible support, informational and emotional support, positive social interaction support, and affectionate support. Each item is scored 1~5, with total scores ranging from 19~95. Higher scores indicate higher perceived medical social support. The scale's Cronbach's α is 0.71~0.91, with test-retest reliability of 0.84.

1.2.4 Chronic Disease Self-Management Behavior Scale [13-14] This scale consists of 15 items across 3 dimensions: exercise, cognitive symptom management, and doctor-patient communication, with total scores ranging from 0~69. Higher scores indicate stronger self-management ability. The scale's Cronbach's α is 0.72~0.93.

Quality Control

Investigators were trained using standardized instructions and explanations. During the survey, after fully explaining the study and obtaining informed consent, participants completed the questionnaires themselves in a quiet environment or with assistance from investigators. Questions were answered promptly. All questionnaires were collected on-site, and investigators immediately checked completion quality. Missing or incomplete items were supplemented by participants. Two team members independently entered data, which was then verified to establish a unified database. All original scale scores were standardized using the formula: standardized score = (mean score/total possible score per item) × 100.

Statistical Analysis

We used SPSS 26.0 software for statistical analysis. Normally distributed measurement data were expressed as ($\bar{x} \pm s$). Comparisons between two groups used t-tests, while comparisons among multiple groups used one-way ANOVA. Correlation analysis for continuous variables and ordered categorical variables used Pearson and Kendall's tau-b methods, respectively. Multiple linear regression analysis was used to explore influencing factors of Chronic Disease Self-Management Behavior Scale scores in DSD patients. $P < 0.05$ was considered statistically significant.

Results

2.1 Demographic Characteristics of DSD Patients

Among the 191 DSD patients, 144 had scoliosis (75.4%), 37 had kyphosis (19.4%), and 10 had lateral kyphosis (5.2%). The mean age was (62.6 ± 11.6) years, BMI was (24.6 ± 3.4), and 150 were female (78.5%). Ninety-four patients (49.2%) were employed; 135 were married (70.7%) and 56 were single (including unmarried and widowed) (29.3%). Medical insurance covered 154 patients (80.6%), 26 had a smoking history (13.6%), and 32 had a drinking history (16.8%). Regarding monthly per capita household income: 19 earned \$1,000 yuan (9.9%), 54 earned 1,001~3,000 yuan (28.3%), 62 earned 3,001~5,000 yuan (32.5%), and 56 earned >5,000 yuan (29.3%). Education levels: 25 had no formal education (13.1%), 74 had primary education (38.7%), and 92 had junior high school or higher (48.2%). Bone mineral density: 55 had normal BMD (28.8%), 62 had osteopenia (32.5%), and 74 had osteoporosis (38.7%). Regarding chronic disease comorbidities: 40 had 1 chronic disease (20.9%) and 20 had \$2 chronic diseases (10.5%).

2.2 Disease Burden, Medical Social Support, and Self-Management Behavior Scores

The VAS, ODI, MOS-SSS, and Chronic Disease Self-Management Behavior Scale scores for the 191 DSD patients were (40.30 ± 19.80) , (41.71 ± 19.37) , (52.11 ± 16.15) , and (22.94 ± 11.97) points, respectively. The standardized scores for each dimension of the Chronic Disease Self-Management Behavior Scale, from highest to lowest, were cognitive symptom management, doctor-patient communication, and exercise. The standardized scores for each dimension of the MOS-SSS, from highest to lowest, were tangible support, positive social interaction support, affectionate support, and informational and emotional support.

2.3 Correlation Analysis of Self-Management Behavior Scores

Correlation analysis showed that exercise was negatively correlated with age, smoking history, and functional disability, and positively correlated with monthly per capita household income, education level, and medical social support ($P < 0.05$). Cognitive symptom management was negatively correlated with BMI and positively correlated with monthly per capita household income, education level, and medical social support ($P < 0.05$). Doctor-patient communication was negatively correlated with age, BMI, smoking history, and functional disability, and positively correlated with monthly per capita household income, education level, and medical social support ($P < 0.05$). The total score of the Chronic Disease Self-Management Behavior Scale was negatively correlated with age, BMI, smoking history, and functional disability, and positively correlated with monthly per capita household income, education level, and medical social support ($P < 0.05$).

2.4 Univariate Analysis of Influencing Factors

Univariate analysis showed statistically significant differences in Chronic Disease Self-Management Behavior Scale scores among DSD patients with different BMI, monthly per capita household income, education level, smoking history, and bone mineral density ($P < 0.05$).

2.5 Multiple Linear Regression Analysis

Using the Chronic Disease Self-Management Behavior Scale score (assigned as actual value) as the dependent variable, we included variables with significance in univariate and correlation analyses into the model: age, BMI (assigned as actual value), monthly per capita household income (assigned: \$1,000=1, 1,001~3,000=2, 3,001~5,000=3, >5,000=4), education level (none=1, primary=2, junior high or above=3), smoking history (assigned: none=1, yes=2), and bone mineral density (assigned: normal=1, osteopenia=2, osteoporosis=3).

Model 1 results showed that BMI, smoking history, monthly per capita household income, education level, and bone mineral density were influencing factors

of Chronic Disease Self-Management Behavior Scale scores ($P < 0.05$). Based on Model 1, functional disability (assigned as actual value) was added as an independent variable in Model 2, which showed that BMI, smoking history, monthly per capita household income, education level, and bone mineral density remained influencing factors ($P < 0.05$). Based on Model 2, medical social support (assigned as actual value) was added as an independent variable in Model 3, which showed that monthly per capita household income, education level, bone mineral density, and medical social support were influencing factors ($P < 0.05$). After controlling for general demographics and functional disability index, medical social support significantly impacted the multiple linear regression model, explaining an additional 14.6% of the variance.

Discussion

3.1 Current Status of Self-Management Behaviors in DSD Patients

Our results show that the standardized scores of the Chronic Disease Self-Management Behavior Scale in DSD patients were lower than those reported in domestic studies on cancer-related fatigue, chronic pain, and COPD patients [15-17]. Previous studies have shown that self-management behaviors correlate with age, economic level, and education [18]. The patients in this study were mostly from western China (Guizhou, Sichuan, Chongqing), with a mean age over 60 years, over 50% having primary school education or lower, and more than 70% with monthly per capita household income below 5,000 yuan—all of which may contribute to lower Chronic Disease Self-Management Behavior Scale scores. Among the dimensions of the Chronic Disease Self-Management Behavior Scale, exercise scores were relatively low, possibly because DSD patients often lack knowledge and develop fear of exercise due to soreness, leading them to stop exercising [19-20]. Studies have shown that targeted back extensor muscle strength training and proper posture maintenance can improve kyphosis angle, reduce pain, and enhance quality of life [7], but evidence-based health education for DSD self-management is currently lacking in clinical practice.

For DSD patients, we recommend that healthcare providers first implement health education focused on improving patient cognition, adaptive coping strategies, and effective communication. Second, after thorough assessment of patients' physical conditions, targeted exercise should be guided according to individual tolerance, including McKenzie therapy, wall back stretches, side planks, and modified Pilates [7-8,10]. Additionally, self-management programs for chronic diseases such as osteoarthritis and COPD have proven effective [21-22], suggesting that researchers should explore comprehensive, targeted self-management measures for patients with mild to moderate DSD.

3.2 Influencing Factors

3.2.1 Education Level and Monthly Per Capita Household Income

Our results show that education level and monthly per capita household in-

come are influencing factors of Chronic Disease Self-Management Behavior Scale scores in DSD patients, consistent with previous findings [18,23]. This suggests that clinical healthcare providers should consider the acceptability and compliance of patients with different economic levels and education. For patients with lower education levels, peer education and role modeling can be utilized to enhance self-management awareness, using simple pictures or audio-visual materials for planned implementation and supervision [24]. Patients with higher monthly per capita household income pay more attention to active medical consultation and self-management participation. Healthcare providers can collaborate with them to develop action plans. For patients with lower economic levels, emphasis should be placed on exploring low-cost self-management methods, such as informing patients about practical approaches to weight control and osteopenia prevention, maintaining neutral spine position during work, setting reminders for maximum lumbar flexion duration, and performing simple spinal rotation and stretching exercises.

3.2.2 Bone Mineral Density Our results suggest that bone mineral density correlates with self-management behaviors in DSD patients. The possible reason is that DSD patients often have comorbid osteoporosis (38.9%~63.6%) [25], and patients who neglect bone quality management and prevention tend to have poorer self-management abilities. Currently, the relationship between bone mineral density and spinal deformity remains unclear. Some studies have shown that lower bone mineral density is a predictor of kyphosis progression over time [25-26], and persistent osteoporosis is closely related to fracture risk and thoracolumbar kyphosis [27], while other studies suggest no direct relationship between bone mineral density and DSD development [28]. Osteoporosis and DSD may influence each other in a cyclical manner, and low self-management ability may accelerate deformity progression and bone loss. Healthcare providers should incorporate bone mineral density screening and prevention knowledge into patients' self-management plans.

3.2.3 Medical Social Support Our results show that medical social support is an influencing factor of self-management behaviors in DSD patients. The lower scores in informational and emotional support dimensions indicate that DSD patients have limited understanding of their disease and lack access to information channels. Multiple studies have shown that good social support is associated with better psychosocial adjustment, but chronic disease patients generally report insufficient social support [29]. Effective self-management requires not only active patient participation but also mutual support from family, community, hospitals, and government. We recommend that family members and communities provide appropriate emotional support and express care, serving as supervisors of self-management plans to improve compliance [30]. Healthcare providers should teach patients symptom monitoring, when and how to seek consultation and advice [31], focus on improving the healthcare environment, guide pain and disability management, teach emotional adjustment methods, and facil-

itate communication channels between patients and healthcare providers. Governments should consider increasing practical support for patients with slow mobility and the elderly, such as public seating and folding ladders for bus access.

Conclusion

This study demonstrates that DSD, as a benign degenerative disease, has not received sufficient attention, and patients' self-management behavior scores are relatively low. Education level, economic status, bone mineral density, and medical social support are key factors influencing self-management in DSD patients. Therefore, for this patient population, healthcare providers should enhance self-management behaviors by strengthening health education, improving disease awareness, and enriching social support to help patients effectively manage their disease, delay progression, and improve quality of life. This study has limitations as a single-center cross-sectional study, and future research should validate these conclusions in multicenter, large-sample populations.

Author Contributions: Zhang Zhao and Liu Lei were responsible for conceptualization and design. Zhang Zhao, Zheng Tingting, and Wang Yushu implemented the study and collected data. Zhang Zhao performed data analysis, statistical analysis, result interpretation, and manuscript writing. Luo Fei provided writing guidance and administrative support. Liu Lei was responsible for quality control, manuscript review, and overall responsibility for the article.

Conflict of Interest: The authors declare no conflict of interest.

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