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ORIGINAL RESEARCH

Association Between Physical Therapy and Risk of Coronary Artery Disease and Dyslipidemia Among Osteoarthritis Patients: A Nationwide Database Study

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Abstract

Objective: To provide empirical evidence on the effect of early physical therapy (PT) within the first year of osteoarthritis (OA) diagnosis on reduction in OA-related comorbidities in patients with OA.

Design: Retrospective cohort study.

Setting: The study was conducted using a nationally representative sample of 1 million National Health Insurance enrollees.

Participants: Newly diagnosed patients with OA (N = 13,545). One-to-one propensity score matching was used to match patients who received PT within the first year of OA diagnosis (PT group; n = 3403) with an equal number of patients with OA who did not receive PT (non-PT group).

Interventions: Not applicable.

Main Outcome Measures: The 4-year cumulative risk of comorbidities including coronary artery disease (CAD), diabetes mellitus, dyslipidemia, osteoporosis, gastrointestinal tract ulcer, and renal failure was estimated. A Cox proportional hazards regression analysis was performed to identify the dose-response relation between the PT dosage and the risk of OA-related comorbidities.

Results: A total of 3403 patients (25.1%) received PT within the first year of OA diagnosis. The PT group had a significantly lower 4-year cumulative risk of dyslipidemia ($P = .05$) and a potentially lower 4-year cumulative risk of CAD ($P = .09$). After adjusting for other potential confounders, the Cox proportional hazards regression analysis showed that patients with OA who received a high PT dosage had a low risk of CAD and dyslipidemia.

Conclusions: Patients with OA who received PT had a lower risk of OA-related comorbidities such as dyslipidemia or CAD.

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Osteoarthritis (OA) is a highly prevalent condition worldwide.[1,2] The prevalence of OA increases with age, and OA is the most frequent cause of musculoskeletal pain in middle-aged to older people. Moreover, OA not only leads to pain, poor quality of life, and loss of productivity[3] but may be associated with several comorbidities.[4] For example, immobility or reduction in activities resulting from pain or the use of nonsteroidal anti-inflammatory drugs (NSAIDs) may increase the risk of cardiovascular diseases and dyslipidemia.[5,6] Long-term use of NSAIDs has been proved to be highly correlated with gastrointestinal (GI) tract ulcer with or without bleeding and renal failure.[7,8] Furthermore, although some studies have reported that patients with OA may have higher bone density,[9,10] elderly patients with OA may be at a higher risk of osteoporosis caused by the decrease in the frequency of weight-bearing exercises or other biomechanical pathways.[11,12] Therefore, while managing patients with OA in clinical settings, preventing OA-related comorbidities will be an essential part of the treatment decision-making process of physicians.

Previous studies that investigated the effectiveness of physical therapy (PT) in treating patients with OA mostly focused on pain release, range of motion, quality of life, and ambulation ability. PT

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modalities that provide these interventions, including thermotherapy; ultrasound; transcutaneous electrical nerve stimulation; whole body vibration; aquatic therapy/hydrotherapy; range of motion exercises; combined modalities of exercise, weight loss technique, strengthening exercise, aerobic exercise, yoga, manual therapy with supervised exercise, manipulation and stretching, land-based exercise, and balneotherapy/spa therapies; knee bracing; wedged insoles; and appropriate footwear, are effective and recommended for treating the initial stages of OA.[13-18] However, only limited evidence is available on the effect of PT on reduction in OA-related comorbidities. Empirical studies have indicated that physical exercise can reduce the incidence of coronary artery disease (CAD),[19] lower blood pressure,[20] decrease inflammation,[21] lower the serum triglyceride concentration,[22] and decrease the fasting blood glucose concentration.[23] Thus, it can be hypothesized that PT programs for OA treatment such as hot packing/ultrasound with transcutaneous electrical nerve stimulation around bilateral knee joint for 10 minutes, and followed by quadriceps muscle strengthening and aerobic exercise for 20 minutes, 3 to 5 times per week may increase aerobic fitness levels and weight loss during treatment programs. These programs also decrease the immobility in daily life by eliminating pain. So, PT may have the potential to reduce the incidence of CAD, diabetes mellitus (DM), or dyslipidemia in patients with OA. Furthermore, the evidence shows that PT modalities, including exercise, ultrasound, or whole body vibration, can increase bone density.[24,25] These PT modalities can be prescribed to patients with OA.[16,26] It may be hypothesized that patients with OA who receive these treatment modalities are at a low risk of osteoporosis. PT may also reduce the use of analgesics, as well as lower the incidence of GI tract ulcers, GI tract bleeding, or renal failure. In this study, we aimed to provide further empirical evidence on the effect of early PT within the first year of OA diagnosis on reduction in these comorbidities in patients with OA.

Methods

Design and database

We conducted a nationwide population-based retrospective cohort study with a 4-year follow-up period using data from the 2005 Longitudinal Health Insurance Database. This database contains the enrollment and claims information of 1 million randomly sampled enrollees in the National Health Insurance (NHI) program in 2005. The NHI program provides mandatory universal health insurance to all Taiwanese residents, with an enrollment rate of ~99%. The program provides comprehensive coverage, which includes all medically necessary care, including ambulatory care, inpatient services, prescription drugs, traditional Chinese medicine, and dental services. PTs, including thermotherapy, ultrasound, transcutaneous electrical nerve stimulation, whole body vibration, range of motion exercises, aerobic exercises, and muscle strengthening, are also covered. The government prohibits private insurers to provide insurance coverage to the services covered by the NHI program. Although the coverage of PT services by the Taiwan's NHI program is relatively comprehensive, some therapies may still be paid out-of-pocket by patients. These self-paid PTs may not be recorded in the NHI database. The copayment for each PT session is 50 New Taiwan Dollars.[27,28]

List of abbreviations:

CAD	**coronary artery disease**
DM	**diabetes mellitus**
GI	**gastrointestinal**
ICD-9	***International Classification of Diseases-Ninth Revision***
NHI	**National Health Insurance**
NSAID	**nonsteroidal anti-inflammatory drug**
OA	**osteoarthritis**
PT	**physical therapy**

Sample population

Individuals aged ≥18 years and who had any outpatient department visits for diseases diagnosed according to the *International Classification of Diseases-Ninth Revision* (*ICD-9*) code 715.xx between January 1, 2005, and December 31, 2006, were considered as patients with OA. To identify an incident case, patients diagnosed with OA according to the *ICD-9* code 715.xx between January 1, 2002, and December 31, 2004, were excluded. In addition, to avoid possible misclassification due to miscoding or erroneous classification of patients with acute joint pain, only patients diagnosed with OA twice or more within 1 week to 1 year from the initial diagnosis were included.[29] The final sample comprised 13,545 newly diagnosed patients with OA.

Independent variables

Patients who received PT within the first year of OA diagnosis were assigned to the PT group, and those who did not receive PT within the first year were assigned to the non-PT group. PT utilization was defined according to Drug_No code 420xxx in the details of ambulatory care orders data of the NHI database. The PT dosage was measured on the basis of the number of PT sessions received within the first year of OA diagnosis and classified into 2 categories: low and high. The median of 20 PT sessions per year in PT users was chosen as the cutoff point. Sessions ≤20 in 1 year were termed *low dosage*, and sessions >20 were termed *high dosage*. The frequency of outpatient department visits to physicians within the first year of OA diagnosis was also considered as a measure of OA severity. We assumed that the number of ambulatory clinic visits for OA treatment was directly proportional to OA severity.[30-32] In our previous work,[29] we found that some important risk factors including men, elderly patient, low-income socioeconomic status, and different health care−seeking behaviors may significantly affect the probability of receiving PT. These factors should be considered as possible confounders in this study. Insurable wage/category in the NHI program was used as a proxy for the socioeconomic status of an individual. Several variables were used to reflect the health status of an individual, which included presence of any catastrophic illness, comorbidities, and hospitalization in the previous year. We evaluated people's pattern of health care−seeking behaviors using their utilization of outpatient department services in the previous year. This measure has been commonly used as a proxy for health care−seeking behaviors. We defined the utilization of outpatient department services as individual's number of outpatient department visits in the previous year.

Outcome measure

The outcome variable of interest was the time from OA diagnosis to the occurrence of comorbidities, including CAD, DM,