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Predicting factors of quality of life in Chinese knee osteoarthritis patients with or without knee replacement surgery: Weight loss, physical exercise and patient expectations.

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Abstract

Objective: To evaluate the effect of physical exercise (PE) and dietary weight loss on health related-quality of life (HRQoL) in Chinese obese adults with OA of knee. We also evaluated the role of patients' pre-operative expectations in improving the HRQoL.

Materials and methods: Each selected patient was asked to give score on two HRQoL tools: Knee Injury and Osteoarthritis Outcome Score (KOOS) and 36-item short form (SF-36). In obese patients, effect of dietary weight loss and exercise on HRQoL was evaluated. The patients undergoing surgery were asked to complete HRQoL questionnaires before surgery and after 1 and 2 year of surgery, and evaluated the effect of fulfillment of their pre-operative expectation on HRQoL.

Results: Dietary weight loss and PE have reported comparatively better HRQoL score compared to inactive individuals. Significantly higher HRQoL was observed with combined intervention of physical exercise and dietary weight loss compared to weight loss only and exercise only interventions ($p<0.05$). Similar trend of higher HRQoL was also observed in patients whose pre-operative expectations were fulfilled after knee replacement surgery ($p<0.05$).

Conclusion: We suggest PE, dietary weight loss/control and fulfillment of pre-operative expectations are the predicting factors of HRQoL in Chinese knee osteoarthritis patients with or without knee replacement surgery.

Keywords: Health-related quality of life, Weight loss, Exercise, Obese, Knee replacement surgery, Knee osteoarthritis.

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Introduction

Osteoarthritis (OA) of knee is one of most common and fourth leading cause of disability1, and highly prevalent among elderly obese patients, with the estimated incidence rate of 10% to 15% in adults aged more than 60 year [1,2]. Due to increasing prevalence of obesity and aging population, the prevalence of knee OA is expected to increase and becoming more common [3,4], and the demand of knee replacement is increasing [4].

Pharmacologic therapy offer temporary relief in symptoms and associated with serious risk after long-term use in patients with OA of knee. Non-pharmacological approaches are recommended for the management of symptoms of osteoarthritis. Among non-pharmacological approaches, physical exercises is found beneficial and also improve physical activity and quality of life in patinets with OA of knee [5]. In obese OA of knee patients, weight loss is one of key non- pharmacological approaches and counted as ongoing treatment priority since risk of progression of OA was higher in patients with high Body mass index [6,7]. In patients with severe knee OA, demand of knee replacement surgery is increasing since knee replacement surgery is one of cost-effective intervention with evidence of improvement in OA symptoms and HRQoL [8]. It is important to know the patient expectations on outcomes of HRQoL. Expectations of patients on outcomes of HRQoL usually defined in terms of requirements, desires, or needs [9].

The effect of physical exercise and weight loss on HRQoL of Chinese obese adults with OA of knee in post clinical setting is not known; therefore we investigated the effects of physical exercise and weight loss on physical and mental related HRQoL of Chinese obese patients with OA of knee that were not willing to undergo knee replacement surgery. We also examined role of pre-operative expectations on HRQoL among OA of knee patients who underwent knee replacement surgery.

Materials and Methods

In this study, the patients (aged ≥ 40, either gender) with knee osteoarthritis who had been treated from Jan 2011 to December 2014 at Department of Orthopedics, Nanchang Hongdu hospital of TCM, Jiang xi, China were selected, and contacted. We have reviewed the medical records of our patients treated

during January 2011 to December 2014. Among selected patients, we have stratified the knee osteoarthritis patients in two subgroup: 1) Overweight/obese patients (body mass index: ≥ 28 kg/m^2 at the time of treatment at hospital) with OA of knee who were not willing to undergo knee replacement surgery; 2) patients with OA of knee who were scheduled to undergo knee replacement surgery. The patients with any conditions (psychiatric disorder, cancer etc.) which could prevent them in completion questionnaires and have potential to affect outcome variables were excluded. The objective was to evaluate whether the pre-operative expectation of patients was fulfilled after knee replacement, and to examine whether fulfilment of patients' pre-operative expectations having any role in improving the HRQoL among OA of knee patients who underwent knee replacement surgery.

Institutional ethics committee approval was obtained from Nanchang Hongdu hospital of TCM, China. We have emailed questionnaires of 36-item short form (SF-36) and Knee Injury and Osteoarthritis Outcome Score (KOOS) to all eligible patients of both sub-group and were asked to answer the each question of SF-36 and KOSS questionnaires. The subgroup of patients with OA of knee who were scheduled to undergo knee replacement surgery were asked their pre-operative expectation for 5 key areas of improvement in their current condition: pain relief, improvement in ADL, improvement in walking ability, improvement in interaction ability, and improvement in psychological well-being.

We have mailed questionnaire designed to assess fulfilment of expectations after 1 and 2 year of surgery, and asked their response about fulfilment of their pre-operative expectation.

Statistical analysis

In this study, at least 500 patients with OA of knee (250 patients in each sub-group) was planned to include in our study. Since, this study was designed as kind of pilot study so no formal sample size calculation was performed. Quantitative variable was presented as mean ± standard deviation, and data were compared using unpaired t test or Mann-Whitney test based on normality test results. Data follow Gaussian distribution (normal data) were analyzed using unpaired t test. Data not follow Gaussian distribution (non-normal data) were analyzed using Mann-Whitney. Categorical variables were presented as absolute number and/or percentage of subjects in each category, and compared using Chi-square test or fisher exact test based on the size of each category. All statistical tests were 2 sided. $P<0.05$ is considered statistical significant. No statistical imputation was performed. Data from each patient was coded and analyzed using Graph Pad Prism statistical analysis software (version 6.0).

Results

Total 550 patients with OA of knee (275 patients in each sub-group) patients who had been treated from Jan 2011 to December 2014 at single china hospital were selected. Of these, 440 patients (220 patients in each sub-group) had returned the questionnaires (return rate: 80%) and were subjected to statistical analysis.

Demography and baseline characteristic

The mean (SD) age of analysis population was 42.42 year (SD=6.34) with the highest proportion of individuals were female (72% female vs. 28% male). Of 220 patients, 78% of patients were overweight having BMI ≥ 28 kg/m^2. Hypertension was found one of the most prevalent comorbidity (49%) among patients with OA of knee followed by cardiovascular disease (18%) and diabetes (11%). The pre-operative expectations of patients were very high, more than 95 % of patients having "many" [n=75, 70] and "very high" [n=135, 120] expectation of pain relief and ability to walk after surgery, respectively. Highest proportion of individuals were in "many" and "very high" category of pre-operative expectations for improvement in routine activities [n=70, 130], ability to interact with others [n=100, 105] and psychological well-being [n=70, 125] respectively. Baseline comparison of HRQoL variables (SF-36 and KOOS) among the three levels of pre-operative expectations (few, many and very high) of the five expectation items before the intervention is summarized in Table 1.

Table 1. *Baseline score of HRQoL variables (SF-36 and KOOS) among the three levels of pre-operative expectations (few, many and very high) of the expectation items.*

Expectations item	KOOS					SF-36 health survey	
	Pain	Symptoms	Function in daily living	Function in sport and recreation	Knee-related quality of life	Mental score	Physical score
Pain relief (N=220)							
Few	52.38 (15.1)	57.38 (12.4)	58.38 (14.3)	27.38 (17.2)	37.38 (18.1)	52.25 (10.4)	33.38 (15.1)
Many	53.36 (10.5)	58.36 (11.3)	57.36 (12.4)	28.36 (13.5)	38.36 (11.9)	52.34 (18.2)	32.36 (13.3)
Very High	54.32 (13.1)	56.32 (16.1)	59.32 (11.1)	26.32 (16.1)	36.32 (19.1)	52.22 (13.9)	31.32 (14.1)
Routine activity (N=220)							
Few	54.25 (10.4)	58.38 (13.1)	58.38 (14.1)	24.25 (10.4)	35.38 (15.1)	52.62 (15.6)	32.38 (15.1)

Many	52.34 (11.1)	57.36 (13.8)	55.36 (13.3)	22.34 (11.1)	39.36 (13.3)	53.38 (17.2)	33.36 (13.3)
Very High	55.22 (15.9)	59.32 (15.1)	58.32 (14.1)	25.22 (15.9)	39.32 (12.1)	51.37 (14.6)	35.32 (16.1)
Walking ability(N=220)							
Few	50.22 (12.1)	56.38 (13.1)	58.38 (14.1)	27.38 (18.3)	38.38 (14.1)	54.38 (18.1)	32.38 (17.3)
Many	54.42 (13.2)	57.36 (13.3)	57.36 (13.3)	28.36 (13.3)	37.36 (13.3)	53.36 (13.3)	33.36 (13.3)
Very High	53.28 (15.15)	58.32 (12.1)	59.32 (14.7)	26.32 (15.1)	39.32 (17.1)	56.32 (13.1)	31.32 (15.1)
Ability to interact with others (N=220)							
Few	56.62 (15.6)	55.38 (15.3)	58.38 (14.1)	28.38 (17.8)	38.38 (14.1)	53.38 (12.8)	34.38 (14.9)
Many	56.38 (17.2)	59.36 (16.3)	57.36 (14.3)	25.36 (11.3)	37.36 (12.3)	55.36 (13.3)	35.36 (14.3)
Very High	54.37 (14.6)	59.32 (19.1)	59.32 (14.1)	28.32 (12.1)	39.32 (13.7)	55.32 (12.1)	36.32 (15.5)
Mental/Emotional well-being (N=220)							
Few	53.34 (14.1)	58.38 (15.1)	58.38 (15.1)	20.22 (12.1)	38.38 (17.1)	53.38 (15.3)	32.38 (19.1)
Many	52.31 (12.3)	55.36 (11.3)	57.36 (14.3)	24.42 (13.2)	37.36 (14.6)	55.36 (17.3)	31.36 (13.3)
Very High	52.25 (13.1)	58.32 (12.1)	59.32 (13.4)	23.28 (15.15)	39.32 (13.1)	54.32 (12.1)	33.32 (13.1)

N=Total number of subject in each category. Values are expressed as Mean (SD). P>0.05 for all comparisons. P value was calculated by Un paired t test.

Effect of physical exercise and weight loss on HRQoL variables

The mean HRQoL score of each domain of SF-36 was significantly higher in physically active individuals when compared to physically inactive individuals with OA of knee. The difference was statistically significant in all HRQoL parameters. The QoL score related to physical health and mental health was significantly lower in individuals who were living sedentary life styles when compared to all other groups (Exercise group, Exercise + Diet Control group and only dietary control group). Physical health and mental health related QoL was significantly higher in Exercise + Diet Control group than all other groups. Summary of HRQoL score in each group are summarized in Table 2.

Table 2. *HRQoL variables (SF-36 and KOOS) by treatment group.*

HRQoL variables	**Diet control only**	**Exercise only**	**Diet control Plus Exercise**	**No Diet and Exercise control**
KOOS				
Pain	51.25 (10.4)	57.38 (15.1)	68.38 (13.4)	31.25 (15.4)
Symptoms	52.34 (11.1)	58.36 (12.3)	77.36 (16.3)	42.34 (13.2)
Function in daily living	51.22 (15.9)	59.32 (14.1)	79.32 (14.1)	42.22 (14.8)
Function in sport and recreation	52.42 (13.2)	58.38 (18.3)	78.38 (17.4)	32.42 (12.4)
Knee-related quality of life	50.28 (15.15	57.36 (14.2)	75.36 (14.3)	40.28 (16.12)
SF-36 health survey				
Mental score	52.25 (10.4)	69.62 (15.6)	83.36 (13.3)	42.15 (12.7)
Physical score	52.34 (11.1)	68.38 (17.2)	86.32 (13.1)	42.34 (15.1)

N=Total number of subject in each category. Values are expressed as Mean (SD). P<0.01 for all comparisons. P value was calculated by Mann-Whitney test.

Health-related QoL after knee replacement surgery by fulfillment of pre-operative expectations

After 1 year of knee replacement surgery, not more than 50 % of patients reported fulfillment of their pre-operative expectations [Pain relief: 49.8%, improvement in daily activities: 45.6%; improvement in ability to walk: 43.5%, improvement in interaction with others: 42.4%, improvement in psychological wellbeing: 46.5%]. After 1 year, we observed that the patients whose pre-operative expectation met after knee replacement surgery had significantly higher HRQoL. Similar trend was observed after 2 year of knee replacement surgery. Moreover, there was slight increment in % of patients whose preoperative expectation was fulfilled with the highest proportion of expectation fulfilled was pain relief (58.3%) and improvement in daily activity (56%) followed by ability to walk (53%), psychological well-being (52%) and improvement in interactions with others (51.3%) after 2 year of knee replacement surgery. There was no meaningful difference in proportion of patients with fulfillment of their pre-operative expectations after 1 year and 2 year of surgery. Health-related QoL score (in every domain of KOOS and SF-36) was significantly higher among the patients whose pre-operative expectation has been fulfilled after 1 year of knee replacement

surgery when compared to patients whose pre-operative expectation were not fulfilled. Similar trend was observed after 2 year of knee replacement surgery (Table 3). Based on the available data (1 year and 2 year), we suggest that the patients and surgeons's belief about the benefit of replacement surgery frequently differ, so the surgeon should convey the realistic benefit of knee replacement surgery to their patients who willing to undergo knee replacement surgery for OA of knee.

Table 3. Health-related QoL score after 2 year of knee replacement surgery by fulfillment of pre-operative expectations.

Expectations item	KOOS					SF-36 health survey	
	Pain	Symptoms	Function in daily living	Function in sport and recreation	Knee-related quality of life	Mental score	Physical score
Pain relief (N=220)							
Fulfilled	64.25 (10.4)	55.38 (11.1)	82.62 (13.6)	62.38 (14.1)	55.38 (14.6)	82.62 (11.6)	68.38 (13.1)
Not Fulfilled	21.34 (11.1)	35.36 (13.3)	50.38 (17.2)	30.36 (13.3)	35.36 (13.3)	50.38 (17.2)	33.36 (13.3)
Routine activity (N=220)							
Fulfilled	64.25 (10.4)	78.38 (14.1)	88.38 (13.1)	64.25 (10.4)	55.38 (16.1)	82.62 (12.6)	62.38 (19.1)
Not Fulfilled	49.34 (11.1)	51.36 (14.3)	51.36 (17.4)	21.34 (11.1)	35.36 (13.3)	50.38 (17.2)	30.36 (13.3)
Walking ability(N=220)							
Fulfilled	73.22 (12.1)	86.38 (15.3)	88.38 (13.8)	67.38 (16.3)	68.38 (17.4)	84.38 (13.1)	52.38 (14.6)
Not Fulfilled	51.42 (11.2)	50.36 (15.3)	52.36 (16.2)	23.36 (12.6)	33.36 (15.1)	51.36 (16.2)	31.36 (11.4)
Ability to interact with others (N=220)							
Fulfilled	76.62 (15.6)	85.38 (13.1)	88.38 (14.4)	58.38 (18.1)	78.38 (11.1)	63.38 (13.1)	64.38 (12.1)
Not Fulfilled	56.38 (17.2)	54.36 (13.2)	52.36 (13.8)	23.36 (11.3)	33.36 (15.3)	52.36 (16.3)	32.36 (14.3)
Mental/Emotional well-being (N=220)							
Fulfilled	73.34 (14.1)	78.38 (15.1)	74.38 (18.1)	53.22 (12.1)	68.38 (14.1)	63.38 (13.1)	62.38 (12.1)
Not Fulfilled	52.31 (12.3)	51.36 (13.5)	51.36 (12.3)	22.42 (11.2)	27.36 (10.3)	55.36 (12.3)	30.36 (13.8)

N=Total number of subject in each category. Values are expressed as Mean (SD). P<0.01 for all comparisons (Fulfilled Vs Not Fulfilled). P value was calculated by Un paired t test.

Discussion

To the best of our knowledge, this was the first investigation in Chinese OA of knee patients to evaluate the effect of PE and weight loss on HRQoL and to evaluate the fulfillment of patient's pre-operative expectation in terms of clinical improvement after knee replacement surgery in post clinical setting. In our study, Chinese individuals with OA of knee who were actively involved in physical exercise (PE), and dietary weight loss have reported comparatively better HRQoL score (in all domain of KOOS and SF-36) compared to inactive and individuals who were living sedentary life style.

Our finding was consistent with findings from the Arthritis, Diet, and Activity Promotion Trial (ADAPT), ADAPT was conducted on more than 300 obese patient with OA of knee revealed that the patients who received exercise and dietary weight loss intervention experienced significantly greater improvements in HRQoL, physical function and pain symptoms compared to individuals who received exercise and dietary weight loss alone [10]. Our study suggested that combined intervention of exercise and dietary weight loss could results in greater weight loss due to concomitant use of exercise which results in synergistic effect which is superior to use of either intervention alone.

In our study, the pre-operative expectation for physical or functional symptoms was significantly higher as compared to social or psychological expectation. The possibly reason for this could be because the improvement in physical or functional symptoms after surgery is more expected, therefore the patients were looking for improvement in clinical symptoms such as pain, walking ability, and capability to perform daily activities. We observed that more than 40% of patient's pre-operative expectation was not fulfilled even after 2 year of knee replacement surgery. The possibly reason for this could be because of their pre-operative expectation were very high. The majority of patient had high pre-operative expectation for benefits of knee replacement surgery, mainly for improvement of physical or functional symptoms. It has been reported that the majority of patient who did not met their pre-operative expectation after surgery felt that the sufficient information about the outcome of replacement surgery were not provided by their consulting surgeon [11].

Conclusion

Our finding suggested that daily physical activity and modifications of daily diet are the key non-pharmacological intervention which significantly enhances HRQoL in overweight/obese patient with OA of knee. The patients whose pre-operative expectation met after knee replacement surgery had significantly higher HRQoL. In most of cases, patients and surgeons's belief about the benefit of replacement surgery frequently differ, so the surgeon should convey the realistic benefit of knee replacement surgery to their patients who willing to undergo knee replacement surgery for OA of knee.

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