Is There a Dose-Response Relationship Between Weight Loss and Symptom Improvement in Persons With Knee Osteoarthritis?


Study Overview

Objective. To determine if there is an additive benefit of weight loss for pain and functioning in patients with established symptomatic osteoarthritis (OA) of the knee.

Design. Cohort study.

Setting and participants. Participants living in Australia who had completed the Osteoarthritis Healthy Weight For Life program (OAHWFL), a program run by Prima Health Solutions on behalf of participating health funds in Australia and New Zealand; its full cost is borne by the insurance/health care fund. Patients in the program are invited to enroll based on age (≥ 50) and claims data indicating knee OA; patients wishing to enroll must obtain a referral from their doctor confirming weight and height and radiographic or arthroscopic diagnosis of knee OA. Participants in the program had a body mass index (BMI) > 28 kg/m² and met 1986 American College of Rheumatology clinical criteria for knee OA. Further, participants were deemed to clinically require referral to orthopedic surgeon and were surgical candidates by medical opinion.

Intervention. The OAHWFL program is a specialized knee and hip OA management program that focuses on weight loss, utilizing a portion-controlled eating plan with meal replacements, an activity plan, a personalized online tracker, and personal support. It is delivered remotely via phone, texts, email, message board, and mail. The 18-week program consists of 3 phases. During the first 6-week phase, participants were instructed to consume a nutritionally complete very low calorie meal replacement (KicStart, Prima Health Solutions) for 2 meals per day with controlled portions and “free foods” (eg, berries and leafy greens). During the second 6-week phase, participants were transitioned off the meal replacements onto a portion-controlled meal plan, with 1 meal replacement per day. In the final phase, participants consumed portion-controlled whole foods for all 3 meals. All phases included recommendations for moderate aerobic exercise 3 times per week for an increasing time period and intensity, online healthy eating and lifestyle education, and telephone motivation and support at predetermined intervals and on demand.

Main outcome measure. The main outcome measure was percentage of body weight lost from baseline to
18 weeks. Additionally, the validated Knee Injury and Osteoarthritis Outcome Score (KOOS) questionnaire was administered to all participants. The 5 KOOS subscales (pain, other symptoms, function in daily living, function in recreation, and knee-related quality of life) were co-primary outcomes. The validated Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) function score was derived from KOOS. The dose-response relationship was assessed using weight change categories (< 2.5%, 2.5–5.0%, 5.1–7.5%, 7.6%–10%, and > 10%) and change in KOOS scores.

Main results. At the time of analysis, 3827 persons with knee or hip OA were approved by their doctor to participate. Of these 155 had not yet started the program, 728 were undergoing the program, and 846 had discontinued or were lost to follow-up. Of the 2098 who completed the program, 715 were excluded because of incomplete data or OA of the hip, leaving 1383 participants. Overall the baseline mean weight was 95.12 ± 17.2 kg with a mean BMI of 34.39 ± 5.17. Average age was 64 ± 8.7.

94.2% (1304 participants) had a greater than 2.5% reduction in body weight at the end of 18 weeks. 31.1% lost ≥ 10% body weight, 22.9% lost between 7.5 and 10%, 24% lost between 5 and 7.5%, 16.1% lost between 2.5–5%, and 5.7% of participants lost ≤ 2.5%. The greatest amount of weight loss was associated with the greatest improvement of both KOOS and WOMAC scores, with a significant dose-response relationship between weight loss and knee OA symptoms. This persisted in regression analysis adjusted for baseline KOOS and weight, sex, and age. Those with the largest weight loss improved their KOOS scores by 16.17 ± 16.1. The second highest weight loss group has an improvement in KOOS scores by 13.3 ± 15.1, then next highest 12.0 ± 17.1, followed by 9.9 ± 16.8 and finally an improvement of 6.1 ± 13.0 in the weight loss of ≤ 2.5% cohort.

Conclusion. This study showed a relationship between weight loss and improvement in knee OA pain and functioning, with greater weight loss resulting in greater improvement in both categories. Those who were better functioning at the commencement of the study required less weight loss to reach a meaningful improvement in functioning and pain compared to those who started with worse functional status. The OAHWFL intervention was shown to be an effective method of weight loss over an 18-month period.

Commentary

OA is the most common form of arthritis in the United States and the incidence has been rising. A recent study conducted by the Mayo Clinic found OA to be the second most common reason for ambulatory primary care visits, second only to dermatologic complaints [1]. It is estimated that the average direct cost of OA per patient is $2600 per year [2], with job-related costs of $3.4 to $13.2 billion per year [3]. Knee replacements alone amounted to $28.5 billion in 2009 [4]. Aside from the financial burden of OA is its impact on quality of life. While genetic predisposition is important in disease pathogenesis, there are well established modifiable risk factors for OA. Among these is maintenance of a healthy weight and physical activity, both of which were addressed in this study.

There is high-quality evidence that weight loss improves the symptoms of knee OA [5]. The current study evaluated whether a dietary intervention for knee OA would be effective in a real-world setting, outside the controlled conditions of a randomized trial. Short-term weight loss did provide pain relief and increase functioning; however, the study does not report weight trajectory after cessation of the intervention. It would be more meaningful to know how many of the participants maintained weight loss after a longer period of time. In addition, it is unclear if the gain in function and pain control was from the weight loss or regular physical activity. A control group that participated in the physical activity without significant weight loss would have strengthened the association between weight loss and KOOS and WOMAC measures.

Though this study took place in a community setting and was tested in both rural and urban settings, the results may not be generalizable to patients who are not already motivated to lose weight, as patients self-nominated themselves to enroll in the program. This study also made use of meal supplements, which were supplied at no cost to patients. Without dedicated funding to supply the meal replacements in addition to the support program, it would be difficult to replicate these results. However, some insurance carriers will cover similar programs that provide validated methods for weight loss, which may be a feasible alternative. Other limitations to the study included lack of a control group, reliance on self-reported weight loss data, and that persons who discontinued the program were not included in the analysis.
Applications for Clinical Practice

Body mechanics and increased inflammation associated with obesity both contribute to worsening of knee OA. The dose-response relationship shown in this study of weight loss in overweight or obese people with OA of the knee is encouraging. Previous studies have shown a clear relationship between weight loss and improvement in pain. The most well-known is perhaps the 4-pound weight rule, which states that for every pound of weight lost, there is a 4-pound reduction in the load exerted on the knee for each step taken [5]. Concrete examples of the benefits of weight loss that providers can share with their patients makes discussion about weight loss tangible. Further, the study teased out that those with better physical functioning at the start of the study required less weight loss to achieve gains in pain reduction and functional status. As the hazards of obesity continue to come to light, more community-based weight loss programs are becoming available. Most of the participants in this study successfully lost weight using a community-based approach, highlighting the usefulness of these programs. Weight loss in a community setting is a challenge to all providers. Knowing which patients will benefit the most from a weight loss program can help direct providers to personalized recommendations.

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References


Can Cardiovascular Magnetic Resonance, Myocardial Perfusion Scintigraphy, or NICE Guidelines Prevent Unnecessary Angiography?


Study Overview

Objective. To assess whether noninvasive functional imaging strategies reduced unnecessary angiography compared with UK national guidelines–directed care.

Design. 3–parallel group, multicenter randomized clinical trial using a pragmatic comparative effectiveness design.

Setting and participants. Participants were patients from 6 UK centers (Leeds, Glasgow, Leicester, Bristol, Oxford, London) age 30 years or older with suspected angina pectoris, a coronary heart disease (CHD) pretest likelihood of 10% to 90%, and who were suitable for revascularization. They were randomly assigned at a 1:2:2 allocation ratio to the UK NICE (National Institute for Health Care Excellence) guidelines or to care guided by the results of cardiovascular magnetic resonance (CMR) or myocardial perfusion scintigraphy (MPS).

Main outcome measures. The primary outcome of the study was protocol-defined unnecessary coronary angiography occurring within 12 months, defined by a normal FFR (fractional flow reserve) > 0.8, or quantitative coronary angiography (QCA) showing no percentage diameter stenosis ≥ 70% in 1 view or ≥ 70% in 2 ortho-
onal views in all vessels 2.5 mm or more in diameter within 12 months. Because of the study design, this included any unnecessary angiography occurring after a false-positive test result, patients with high CHD pretest likelihood sent directly to coronary angiography in the NICE guidelines group, and imaging results that were either inconclusive or negative but overruled by the responsible physician.

Secondary endpoints included positive angiography rates, a composite of major adverse cardiovascular events (MACEs: cardiovascular death, myocardial infarction, unplanned coronary revascularization, and hospital admission for cardiovascular cause), and procedural complications.

Main results. Among 2205 patients assessed for eligibility between 23 November 2012 and 13 March 2015, 1202 patients (55% of eligible) were recruited and allocated to NICE guidelines-directed care (n = 240), or management by CMR (n = 481) or MPS (n = 481). While there were no statistical differences between the 3 groups in terms of baseline characteristics, the study population had a substantial burden of cardiovascular risk factors: 150 patients (12.5%) had diabetes, 458 patients (38.1%) had hypertension, 702 patients (58.4%) were past or current tobacco users, 483 patients (40.2%) had dyslipidemia, and 651 patients (54.2%) had a family history of premature CHD. All patients were symptomatic, with 401 patients (33.4%) reporting typical chest pain and 801 patients (66.6%) reporting atypical chest pain as their primary symptom. Overall, 265 patients (22.0%) underwent at least 1 coronary angiogram and 10 patients underwent 2 angiograms.

The number of patients with invasive coronary angiography after 12 months were as follows: 102 of the 240 patients in the NICE guidelines group (42.5% [95% confidence interval [CI] 36.2%–49.0%]), 85 of the 481 patients in the CMR group (17.7% [95% CI 14.4%–21.4%]), and 78 of the 481 patients in the MPS group (16.2% [95% CI 13.0%–19.8%]). The primary endpoint of unnecessary angiography occurred in 69 patients (28.8%) in the NICE guidelines group, 36 patients (7.5%) in the CMR group, and 34 patients (7.1%) in the MPS group. Using CMR group as reference, adjusted odds ratio (AOR) of unnecessary angiography for CMR group vs. NICE guidelines group was 0.21 (95% CI 0.12–0.34, P < 0.001), and the AOR for CMR group vs. the MPS groups was 1.27 (95% CI 0.79–2.03, P = 0.32).

For the secondary endpoints, positive angiography was observed in 29 patients (12.1% [95% CI 8.2%–16.9%]) in the NICE guidelines group, 47 patients (9.8% [95% CI 7.3%–12.8%]) in the CMR group, and 42 patients (8.7% [95% CI 6.4%–11.6%]) in the MPS group, overall P = 0.36. Annualized MACE rates were 1.6% in the NICE guidelines group, 2.0% for the CMR group, and 2.0% for the MPS group. Adjusted hazard ratios for MACE were 1.37 (95% CI 0.52–3.57, P = 0.52) for the CMR group vs. NICE guidelines group and 0.95 (95% CI 0.46–1.95, P = 0.88) for the CMR group vs. the MPS group.

Conclusion. In patients with suspected CHD, investigation by CMR or MPS resulted in lower probability of unnecessary angiography within 12 months of care than using the NICE guideline-directed care. There was no difference in adverse outcomes as measured by MACE by using NICE guidelines, CMR, or MPS.

Commentary

Coronary heart disease is a leading cause of morbidity and mortality worldwide. Despite the advancement in noninvasive imaging and recommendations in international guidelines, invasive coronary angiography is still commonly used early in diagnostic pathways in patients with suspected CHD [1]. Previous studies demonstrated that majority of patients presenting with chest pain will not have significant obstructive coronary disease; a large US study reported that approximately 60% of elective cardiac catheterizations found no obstructive CHD [2]. Thus, avoiding unnecessary angiography should reduce patient risk and provide significant financial savings. Current guidelines for investigation of stable chest pain rely on pretest likelihood of CHD. These pretest likelihood models can overestimate CHD risk, resulting in the increase in probability of invasive coronary angiography [1,3].

The current study by Greenwood et al investigated whether CMR-guided care is superior to MPS or NICE guidelines-directed care in reducing the occurrence of unnecessary angiography within 12 months. Overall, rates of disease detection based on positive angiogram were comparable for the 3 strategies. In addition, there was no difference in adverse events as measured by a composite of MACE.

While this was an excellently performed multicenter study, there were several major limitations. First, the
study population was predominately white northern European (92% were classified ethnically as white), and therefore the results may not translate to other populations. Second, the NICE guidelines for estimation of high-risk CHD changed after initiation of the study due to overestimation, and recent guidelines have adopted a recalibrated risk model [4,5]. Finally, MACE is not a proxy for a missed diagnosis or treatment. It remains debatable whether revascularization for stable angina has prognostic benefit over optimal medical therapy.

Applications for Clinical Practice
This multicenter randomized clinical trial provides strong evidence to use either cardiovascular magnetic resonance–guided care or myocardial perfusion scintigraphy–guided care instead of NICE guidelines–directed care for symptomatic patients with suspected CHD in reducing unnecessary angiography.

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References