

# Modified Cardiac Rehabilitation for Obese Patient with Severe Bilateral Knee Osteoarthritis

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## Abstract

This case report describes the presentation of an obese patient with status Post Coronary Artery Bypass Surgery (CABG), severe bilateral knee osteoarthritis who was enrolled into traditional outpatient cardiac rehabilitation program including both weight bearing and non weight bearing aerobic exercise then she developed severe knee pain and effusion after 2 sessions, she stopped the exercise and was treated by NSAID and rest for 2 weeks then her cardiac rehabilitation program has been modified to include non weight bearing aerobic exercise only and resistive exercise. After 36 sessions, there were marked improvements of all coronary risk factors.

## Introduction

Obesity which is one of coronary risk factors is also positively correlated with increased risk of knee osteoarthritis [1]. Increased body mass index leads to increase the loading forces upon weight bearing joints, thus rapid cartilage degeneration. This seems particularly important because force across the knee and hip during walking and stair climbing are 2-4 times the body weight [2]. Moreover, prolonged walking lead to early fatigue of quadriceps muscle in elderly obese sooner than in non obese. This would change knee kinematics and increasing the loading of the knee [3]. Thus the indirect effects of body weight through quadriceps muscle fatigue may exacerbate the direct effects of carrying a heavier total load [1].

## Case Description

66 year-old lady with status post Coronary Artery Bypass Graft (CABG) on 8/28/2001. Her past medical history is positive for obesity, diabetes mellitus type II, hypertension, hypercholesterolemia and severe bilateral knee osteoarthritis. Her drug history includes antihypertensive, anti-anginal drugs, insulin, oral hypoglycemic drugs and acetaminophen for pain. The patient was using right knee brace for knee support. Her clinical examination revealed, elder obese lady (obesity class 3) not in acute distress, with normal cardiac examination. Knees examination demonstrated bilateral genu valgum more at the right side, mild tenderness over the joint outlines, Crepitus, mild effusion at the right knee and very mild lax right medial collateral ligament (Figure 1).

The patient was enrolled into cardiac rehabilitation unit at Montefiore medical center, after signing consent. The ordinary cardiac rehabilitation program included aerobic exercise, using both weight bearing and non weight bearing machines. The patient complained of knee pain and swelling after 2 sessions. Then, she was advised to rest with intake of NSAID for 2 weeks. Later on, her cardiac rehabilitation program has been modified to non weight bearing aerobic exercise using stationary bike and Nu step machine. Resistive exercise was added after 18 sessions.

## Objective

Rehabilitate an obese patient with status post CABG and severe bilateral knee osteoarthritis.

## Methods

The patient agreed to maintain dosage of her medications at same dose during the course of the study.

## Initial evaluation

**Baseline physical tests:** All the baseline physical tests were performed by the same physician at the beginning and end rehabilitation program. Body weight and sum of skin folds measured by lange calipers or Skyndex had been measured and body mass index, body density, percent body fat and lean body mass were calculated for the patient [4]. Total Cholesterol (TC), Triglyceride (TG), High Density Lipoprotein (HDL), and Low Density Lipoprotein (LDL) were measured.

**First exercise monitoring session data:** The patient performed aerobic exercise using bike then Nu-step machine with recording of the duration and intensity of effort on each machine. Blood Pressure (BP) and Heart Rate (HR), were measured at rest, during aerobic exercise, then at the end of the session. Rate pressure product (RPP) was calculated [5]. Workload on each aerobic exercise modality (Metabolic



**Figure 1:** The Lady has severe knee osteoarthritis with bilateral genu valgum more at the right and morbid obesity preferentially abdominal.

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**Received** March 04, 2014; **Accepted** April 17, 2014; **Published** April 27, 2014

**Citation:** Hussein NA, Thomas M (2014) Modified Cardiac Rehabilitation for Obese Patient with Severe Bilateral Knee Osteoarthritis. J Clin Exp Cardiol 5: 303. doi:10.4172/2155-9880.1000303

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Equivalent level) was recorded. At the end of the first exercise session, the average estimated Metabolic Equivalent (MET) performed by the patient from the individual recorded MET using the standardized tables was calculated. Average exercise HR was calculated by calculation of the mean HR performed during exercise on each exercise modality. All these data (RHR, RSBP, Resting diastolic BP, RPP, exercise SBP, exercise DBP, average exercise HR, average exercise MET level) were kept for to be compared with similar data obtained from last monitored exercise session at the end of the study.

**Evaluation of muscular strength:** One repetition maximum (1-RM) was performed by the patient on Cybex multi-station weight system to establish initial muscular strength level [4]. The exercises used were chest press, leg extension, and leg curl.

**Intervention:** The patient had dietary counseling. Exercises were telemetry monitored and carried out 3 times per week for 36 sessions. Heart rate was recorded at rest and during each exercise modality. Blood pressure was recorded before, during and after exercise. Aerobic exercise intensity prescription was based on the referral stress test results which were carried out by patient's cardiologist.

**Aerobic exercise program:** Using non weight bearing machines; Nu step and stationary bike. 10 minutes on each. Patient performed five minutes of warm-up and cool down before and after aerobic exercise respectively. In addition, 5 minutes of stretching exercise at the end of the session. Intensity was prescribed, to be 60% of the maximum HR of her referral stress test [6]. The heart rate was checked every exercise, and used periodically to update the exercise loads as needed to maintain the appropriate intensity (Figure 2).

**Resistive exercise program:** During the second 18 sessions, resistive exercise was added to the aerobic program. 1-RM was re-evaluated before the start of resistance program to ensure accurate calculation of 60% 1 RM. Chest press, leg extension, and leg curl were used. The patient had performed 2 sets of 8 repetitions for each machine. The 1 RM measurement had been repeated every two weeks after the addition of the resistive exercise to keep the intensity at constant level.

**Final evaluation:** At the end of the study, all baseline physical tests were repeated for the patient.

## Results

Strength gain for chest press machine was from 40lb to 50 lb (25%). For leg extension was from 30 lb to 40 lb (25%). The gain for leg curl was 100% (from 25 to 50 lb). Body weight decreased by only -2.3% (from 107.91 Kg to 105.41 Kg) with similar results on BMI. Fat decreased by -14.2%. This was accompanied by increase in lean mass by 8.27%.



**Figure 2:** The lady while doing aerobic exercise using Nu step machine (non weight bearing machine).

As regard the lipid profile, total serum cholesterol decreased from 190.8 mg/dl to 160.6 mg/dl (-14.2%). The triglyceride decreased by -17.3% (from 186.5 mg/dl to 142.4 mg/dl) whereas LDL level diminished by -13.9% (from 111.6 to 93.9 mg/dl). HDL increased by 24.5% (from 39.2 to 48.2 mg/dl)

The change of the cardiovascular conditioning parameters showed decline in the mean resting HR by -8.1% ( from 75.6 to 69.4 B/m), mean resting SBP by -6.7% (from 133.7 to 128 mm Hg). While resting DBP decreased by -8.6% (from 80.3 to 73.1 mm Hg). Overall change of rate pressure product was decline by -15.3% (from 103.9 to 88). The average exercise MET changed from 2.6 to 4.4 (69.231%).

## Discussion

Rehabilitating morbidly obese lady with status post CABG and all other coronary risk factors together with severe bilateral knee osteoarthritis is very challenging.

The achieved modification of her cardiac rehabilitation to include non weight bearing aerobic exercise and resistive exercise had succeeded to improve cardiovascular conditioning parameters without deterioration of the status of her knee osteoarthritis. It also improved her lipid profile with marvelous gain in strength that was accompanied by very good increase in lean mass. Revising literature in this context denoted that the use of bicycle ergometer improved mobility and cardiovascular function without flares [7].

Addition of resistive exercise benefited knee osteoarthritis condition as quadriceps strengthening is mandatory in the rehabilitation of knee osteoarthritis. It improves strength, function and painful symptoms [8].

Previous studies showed that combined resistance and aerobic exercise for coronary artery patients resulted in significant reduction of percent of body fat and increase in lean mass [9], as well as improvement of the lipid profile [10]. In addition, the achieved program was able not only to lower LDL but also to decrease triglyceride which is an important factor in diabetic patient since high triglyceride are actually part of an insulin resistance syndrome [11].

## Conclusions

Use of non weight bearing aerobic machines and resistive exercise are beneficial modification for cardiac rehabilitation program in obese coronary artery disease patient with severe knee osteoarthritis.

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