Virtual coaching for the high-intensity training of a powerlifter following coronary artery bypass grafting

Richard Adams, Jenny Adams, PhD, Huanying Qin, MS, Tim Bilbrey, BS, and Jeffrey M. Schussler, MD

A 55-year-old powerlifter in Tennessee learned about the sport-specific, high-intensity cardiac rehabilitation training available in Dallas, Texas, and contacted the staff by phone. He was recovering from quadruple coronary artery bypass grafting (CABG) and had completed several weeks of traditional cardiac rehabilitation in his hometown, but the exercise program no longer met his needs. He wanted help in returning both to his normal training regimen and to powerlifting competition but was unable to attend the Dallas program in person. An exercise physiologist with the program devised a virtual coaching model in which the patient was sent a wrist blood pressure cuff for self-monitoring and was advised about exercises that would not harm his healing sternum, even as the weight loads were gradually increased. After 17 weeks of symptom-limited, high-intensity training that was complemented by phone and e-mail support, the patient was lifting heavier loads than he had before CABG. At a powerlifting competition 10 months after CABG, he placed first in his age group. This case report exemplifies the need for alternative approaches to the delivery of cardiac rehabilitation services.

Patients recovering from coronary artery bypass grafting (CABG) are routinely given weight and activity restrictions to protect the sternum. Instead of cautioning these patients about what they cannot do, the cardiac rehabilitation (CR) program at Baylor Heart and Vascular Hospital in Dallas, Texas, teaches them to modify their desired movements and activities in a way that minimizes shoulder joint abduction, extension, and flexion. We present the case of a powerlifter who, with long-distance coaching by the Dallas CR staff, returned to his sport after CABG.

CASE PRESENTATION

A 55-year-old man presented with unstable angina pectoris at an emergency department in Memphis, Tennessee, in June 2013. Cardiac catheterization revealed severe three-vessel coronary artery disease with well-preserved left ventricular function, and the patient underwent quadruple CABG. He had always been physically active, was not diabetic, and did not smoke. His body mass index was 33.4 kg/m², and his waist circumference was 38 inches. Medications included amlodipine besylate, modafinil, clonazepam, and testosterone cypionate. His father

had a myocardial infarction at age 55 and was found to have an aortic arch aneurysm at that time.

Before CABG, the patient exercised 10 to 12 times per week, including four sessions per week of resistance training appropriate for powerlifting—a sport that consists of three events: squat, bench press, and deadlift. At 3 weeks post-CABG he began attending CR sessions, spending 10 minutes each on a treadmill, recumbent bike, and upper body ergometer, followed by weightlifting that was restricted to 2-pound dumbbells. After completing 10 CR sessions at the hospital, he chose to continue the regimen on his own, using heavier dumbbells that were within the 10-pound weight restriction imposed by his surgeon. He also began researching how to sensibly return to his normal exercise program and especially how to resume powerlifting.

An Internet search on the phrase “recovery from CABG powerlifting” eventually led the patient to a *Wall Street Journal* article about the Dallas CR program for “industrial athletes,” which allows patients to use specificity of training to achieve their goals (1). He called the department and told the exercise physiologist that he wanted to lift heavy weights again and perform at powerlifting competitions (the next of which would occur 44 weeks post-CABG). The patient’s location and work schedule made it impossible for him to attend the Dallas program in person, so the exercise physiologist proposed a virtual coaching model: a sport-specific, symptom-limited exercise program with long-distance support that would enable the patient to train at a higher intensity than is typically allowed in traditional CR.

From the Cardiac Rehabilitation Department, Baylor Jack and Jane Hamilton Heart and Vascular Hospital (R. Adams, J. Adams, Bilbrey, Schussler); the Quantitative Science Department, Baylor Scott & White Health (Qin); and the Division of Cardiology, Department of Internal Medicine, Baylor University Medical Center at Dallas and Baylor Heart and Vascular Hospital, and the Texas A&M Health Science Center, College of Medicine (Schussler).

Grant support was provided by the Harry S. Moss Heart Trust and the Baylor Health Care System Foundation, Dallas, Texas, through the Cardiovascular Research Review Committee and in cooperation with the Baylor Heart and Vascular Institute. The authors thank the committee for their continued support of cardiovascular rehabilitation research projects.

Corresponding author: Jenny Adams, PhD, Department of Cardiac Rehabilitation, Baylor Heart and Vascular Hospital, 411 N. Washington Street, Suite 3100, Dallas, TX 75246 (e-mail: jennya@BaylorHealth.edu).

Figure 1. The patient's average overhead press volume per workout during (left to right) his normal training regimen (5/3/1, a rotating program of four main lifts that vary in intensity over a 3- to 4-week cycle [reference 5]); his immediate post-CABG recovery period, which included a traditional CR regimen; virtual coaching; and resumption of his normal regimen. CABG indicates coronary artery bypass grafting; CR, cardiac rehabilitation.

The patient was sent a wrist blood pressure cuff for heart rate and blood pressure monitoring and was advised to keep his rate-pressure product (heart rate multiplied by systolic blood pressure) below 36,000 (2). He was also taught about exercises that would not negatively affect the sternum. Through e-mail, he was sent the Athletic Identity Measurement Scale–Plus (3, 4); his score of 1660 confirmed the importance of powerlifting in his life, as high scores for athletic identity range from 1467 to 2200.

The patient and the Dallas CR staff kept in touch by e-mail and phone; together they developed a powerlifting exercise regimen that he did from week 11 post-CABG (when he was cleared to lift >10 pounds) to week 27 (after which, he had been told, his sternum would be completely healed). The core of this training program consisted of exercises that were similar to powerlifting exercises but safer for a healing sternum. Safety bar squats were substituted for low-bar back squats; overhead presses, which had always been part of his training, were substituted for bench presses; and glute-ham raises were substituted for deadlifts. The patient performed 41 workouts over the 17-week period, and the weight loads were increased incrementally. By week 26 post-CABG, he had returned to his pre-CABG exercise loads.

Training was symptom limited, meaning that no specific blood pressure or heart rate limits were used to restrict exercise intensity. The patient monitored himself for elevated rate-pressure product ($\geq 36,000$), angina, dizziness, pain, and shortness of breath. He had no adverse events that required him to discontinue any powerlifting exercise session.

Peak heart rate and blood pressure were successfully recorded a total of 35 times during the virtual coaching period, and the resulting rate-pressure product values were calculated. Because the wrist cuff instructions recommend use of the

device with the wrist at chest level, the measurements taken during the overhead press were deemed inaccurate, so those calculations are not reported here. The rate-pressure product values that were calculated for the other two exercises were well below the threshold of 36,000. During the glute-ham raises, the maximum rate-pressure product was 28,566; the mean peak value was 20,369 (SD, 3723). During the safety bar squats, the maximum was 29,328 and the mean peak value was 23,231 (SD, 3782).

DISCUSSION

In weight training, the amount of work done is expressed as volume and can be calculated as the number of repetitions multiplied by the amount of weight lifted. *Figure 1* tracks the patient's average volume per workout for the overhead press during four periods: normal (pre-CABG) training, immediate post-CABG recovery, virtual coaching, and resumption of normal training. Two observations stand out: 1) the volume during the traditional CR regimen was dramatically lower than the volume during virtual coaching, and 2) the volume was higher after full recovery than it was before CABG. Likewise, at a powerlifting competition 44 weeks after CABG (*Figure 2*), he lifted heavier loads than he did before CABG (average increase, 16%).

CR in general has the potential to improve patient outcomes (6); however, a significant number of patients cannot attend because of logistical conflicts. Of the 2576 patients who were referred to the Dallas CR program in 2013, 919 (37%) could not attend the on-site sessions because they lived too far away. The remote monitoring and guidance of cardiac patients, which is already being studied in the USA and abroad (7, 8), could lead to a much-needed alternative. The long-distance coaching described in this case report has sparked the idea of developing a

Figure 2. The patient performing the (a) squat, (b) bench press, and (c) deadlift at the Southern Powerlifting Federation's Tri-State 3 competition in April 2014, 10 months after quadruple coronary artery bypass grafting. He placed first in his age group.

virtual CR program in Dallas for patients who are self-motivated and disciplined about reaching their fitness goals.

Acknowledgments

Thanks go to David Allen at NBS Fitness in Cordova, Tennessee, for supporting the patient in his powerlifting training following CABG, and to Jim Wendler, whose encouragement and suggestions guided the patient in his search for an appropriate CR program. Beverly Peters, MA, ELS, a freelance medical editor, assisted with manuscript development and preparation.

1. Landro L. After surgery, time to sweat. *Wall Street Journal*, August 6, 2013:D1, D4.
2. Adams J, Cline MJ, Hubbard M, McCullough T, Hartman J. A new paradigm for post-cardiac event resistance exercise guidelines. *Am J Cardiol* 2006;97(2):281–286.
3. Brewer BW, Van Raalte JL, Linder DE. Athletic identity: Hercules' muscles or Achilles heel? *Int J Sport Psychol* 1993;24(2):237–254.
4. Cieslak TJ 2nd. *Describing and Measuring the Athletic Identity Construct: Scale Development and Validation* [dissertation]. Columbus, OH: Ohio State University, 2004. Available at http://rave.ohiolink.edu/etdc/view?acc_num=osu1091219903; accessed August 19, 2014.
5. Wendler J. *5/3/1: The Simplest and Most Effective Training System for Raw Strength*, 2nd ed. London, OH: Jim Wendler LLC, 2011.
6. American Association of Cardiovascular and Pulmonary Rehabilitation. *Guidelines for Cardiac Rehabilitation and Secondary Prevention Programs*, 5th ed. Champaign, IL: Human Kinetics, 2013:2.
7. Black JT, Romano PS, Sadeghi B, Auerbach AD, Ganiats TG, Greenfield S, Kaplan SH, Ong MK; BEAT-HF Research Group. A remote monitoring and telephone nurse coaching intervention to reduce readmissions among patients with heart failure: study protocol for the Better Effectiveness After Transition—Heart Failure (BEAT-HF) randomized controlled trial. *Trials* 2014;15:124.
8. Kraal JJ, Peek N, van den Akker-Van Marle ME, Kemps HM. Effects and costs of home-based training with telemonitoring guidance in low to moderate risk patients entering cardiac rehabilitation: The FIT@Home study. *BMC Cardiovasc Disord* 2013;13:82.