Resistance Training for Special Populations

Brian W. Rieger, MS, CES and Jeffrey L. Roitman, EdD, FACSM
Research Medical Center, Kansas City, Missouri

THE USE OF RESISTANCE TRAINING (RT) in clinical rehabilitation and special populations is becoming the standard of practice. Research in results, safety, and techniques of RT in these populations has been consistent in confirmation of the efficacy and safety of this usage of resistance training. This column will summarize some of the research, guidelines, and safety considerations for RT in cardiovascular rehabilitation (CVR) patients.

The most recent American Association of Cardiovascular and Pulmonary Rehabilitation Guidelines for Cardiac Rehabilitation and Secondary Prevention Programs state that RT is indicated in a “comprehensive” cardiovascular rehabilitation program and recommend both guidelines and techniques for RT (1). This addition to the recently published third edition of the Guidelines clearly illustrates the acceptance level for RT in the clinical environment.

Resistance training has been shown to have beneficial effects other than those commonly cited in skeletal muscle. While neuromuscular adaptations are responsible for some of the early increase in strength attained from RT, increased muscle mass is clearly a major outcome in untrained individuals (3). Resistance training has been shown to have positive effects on skeletal muscle enzymes, resting heart rate and blood pressure, peak oxygen consumption (VO2 peak), submaximal endurance, and body mass (decreased fat mass and increased lean mass). Other benefits, such as improved blood lipids and blood glucose, while more controversial, have been reported. Additionally, beneficial changes in self-concept, self-efficacy, and other psychological constructs have been reported as findings of RT studies with CVR patients (4, 6). Finally, it recently has been demonstrated that improvements in strength and functional status may result from a systematic RT program implemented with patients early in a CVR program (2).

The safety of RT for CVR patients has been a somewhat controversial subject. Although there is no large epidemiological study to support the overall safety (probably because it has only recently become common to do RT with CVR patients), the early concern with safety seems primarily to be due to the assumed pressor (blood pressure) response to resistance exercise. Physiologically, RT elicits a response that is proportionate to the amount of resistance utilized relative to maximum strength. That is, a lift at 50% of the patient’s 1-repetition maximum (1 RM) weight will elicit a greater response than a lift at 25% of 1-RM. Therefore, safety may depend upon using a lower relative resistance in this population. In an acute sense, RT with light resistance and increased repetitions has not been found to cause abnormal increases in cardiovascular functions (3, 4). According to Soukup et al., the associated cardiovascular pressor response that occurs during RT is relative to the intensity, duration, and muscle mass involved (5). Excessive pressor response can be avoided by prudent use of both relatively light resistance (30–50% of 1 RM) and by a moderate number (12–15) of repetitions. It is probably prudent not to implement anything but the lightest RT (perhaps no greater than 30% of 1 RM) in patients with a low threshold for angina (<3.0 METs) and/or with poorly controlled stage 2 hypertension (resting blood pressure >160/100). With adaptation and confirmation of safety, resistance loads can be gradually increased in nearly all CVR patients.

Implementation of a safe and effective RT program in CVR patients is relatively simple. The
Considerations for Resistance Training in Cardiac Patients

All CVR patients should initiate resistance training (RT) in a supervised and monitored cardiovascular rehabilitation program.

Diagnosis—5 weeks after myocardial infarction, 8 weeks after coronary artery bypass surgery.

Preconditioning—most patients should have completed 3–4 weeks of aerobic exercise training.

Special Considerations

All Cardiac Patients

- Monitor blood pressure initially and with each intensity increase.
- Do not allow sustained isometric contractions or lifts.
- Use a Rating of Perceived Exertion scale score between 11–14 to control intensity.
- Use the common warning signs to terminate a resistance exercise (1, 2).
- Do not initiate RT in patients with uncontrolled hypertension (see references 1, 2 for other contraindicated populations).
- Avoid Valsalva maneuvers and sustained, tight gripping during lifting movements.
- Maintain good posture and technique on all exercises.
- Perform all exercises through the complete range of motion and with a controlled movement (2 seconds for the concentric and 2 seconds for the eccentric portion of most exercises).
- Terminate exercise if abnormal shortness of breath, chest pain, or abnormal fatigue develops.
- Decrease resistance if abnormal fatigue results in the postexercise period (4–8 hours or more after exercise).

Angina Pectoris Patients

- Upper-body exercise may be more likely to elicit symptoms.
- Good cardiovascular warm-up is extremely important to allow for coronary artery vasodilatation.
- Use very light weight (~30% of 1 RM) initially.
- Initiate RT program with caution for patients with low anginal thresholds (<3.0 METs).

Myocardial Infarction Patients

- Patients should have 3–4 weeks of supervised aerobic exercise prior to RT.
- Patients should not start RT until 5 weeks postevent.

The process described below is a brief description of one method for implementing such a program in CVR patients.

1. After careful selection of patients for supervised RT, a baseline training load must be determined. Several techniques may be used for evaluation, including a 1 RM or a modified 1 RM (90% of 1 RM). The latter is assessed by progressively increasing resistance to attain the greatest amount of weight that can be lifted twice, but not 3 times, while maintaining proper technique.

2. Begin patients with a relatively low weight on each resistive exercise (30–35%) and progress according to patient response to the RPE (Rating of Perceived Exertion) scale. An RPE score of 11 (fairly light) to 14 (somewhat hard) is acceptable. An RPE of 15 or greater should be avoided. If the patient tolerates the exercise and is asymptomatic, progression utilizing the RPE scale is acceptable.

3. An initial workload of 12-15 repetitions has been recommended (1). This level of work should not only decrease the risk of injury but should also prevent muscle soreness. Using 40–60% of the 1 RM is safe and should achieve an acceptable level of effort (1).

As with any RT program, designing a program that meets the specific needs of the patient is important. Cardiac patients may want to develop muscular strength for occupational and/or recreational needs; therefore, muscle groups used in these activities should be the focus of the resistive-training program.

The prescription of RT in cardiac patients uses the same variables—intensity (number of repetitions, sets, and length of rest periods), duration (minutes per session), frequency (sessions per week), type/modality (free/machine weights or elastic bands), and the order in which the exercises are performed. Using these variables to write the prescription will allow for safe and effective RT in CVR patients.

Duration is dependent on the needs and interests of the individ-
ual, but generally, 15–30 minutes is adequate. Patients entering Phase II (at 5 weeks after myocardial infarction or at 8 weeks after coronary artery bypass surgery and with a minimum of 3–4 weeks of postevent aerobic training) may benefit from an RT program (even at intensities as low as 20–40% of 1 RM) consisting of 1–2 sets of 12–15 repetitions and of 6–8 exercises. A rest period of ~1–2 minutes is recommended between sets. Performing exercises from large to small muscle groups works well in CVR patients to increase muscular endurance and muscular strength, depending upon the relative level of resistance used. In general, RT should accompany the aerobic exercise sessions 2–3 times per week.

Alternative modalities should be considered when specific to individual needs. Free and machine weights, while popular, may not be an option because of lack of equipment. Elastic-band exercise may be useful to patients early in the rehabilitation process, especially for those with recent open-heart surgery, although exercises that may cause sternal movement prior to full healing of the sternal wound are contraindicated. Elastic bands are inexpensive and safe and can be stored easily. Bands can also be used effectively to initiate RT for those starting at a very low level, prior to graduating to heavier hand or machine weights.

It is clear that cardiac patients benefit from RT as part of a comprehensive cardiovascular rehabilitation program. It is also clear that RT is safe in this patient population. Implementing RT carefully and prudently will enhance quality of life and overall fitness for most cardiac patients. RT is becoming standard practice in cardiovascular rehabilitation programs.

### References


Brian W. Rieger is a Cardiac Rehabilitation Specialist at Research Medical Center, Cardiac Rehabilitation Department, Kansas City, Missouri.

Jeffrey L. Roitman is Director of Cardiac Rehabilitation at Research Medical Center, Cardiac Rehabilitation Department, Kansas City, Missouri.