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Review Article

Advanced Role and Field of Competence of the Physical and Rehabilitation Medicine Specialist in Contemporary Cardiac Rehabilitation

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The definition of physical and rehabilitation medicine (PRM) given by the Union of European Medical Specialists (UEMS) is that it is an independent medical specialty concerned with the promotion of physical and cognitive functioning, behavior, and quality of life (QoL), and modifying personal and environmental factors. Nowadays PRM specialists are responsible for the prevention, diagnosis, treatment and rehabilitation management of people with disability. The background competences and skills required of PRM specialists during the cardiac rehabilitation (CR) process are described in the White Book of Physical and Rehabilitation Medicine and the Action Plan of the Professional Practice Committee of the UEMS-PRM Section.[1-3] The majority of aptitudes and competences of PRM specialists are provided during the core specialty training and are further enhanced by knowledge and experience of work in other medical specialties (orthopedics, neurology, internal medicine, etc.).[4] Nowadays, CR is increasingly recognized as an integral component of the comprehensive cardiac care of patients with chronic heart failure.[5] Known benefits of CR include a reduction in morbidity and mortality, improved functional capacity, better QoL, improved blood lipid levels, more psychosocial well-being, less stress, fewer recurrences of myocardial infarction (MI), and less need for myocardial revascularization procedures.[6-8] Contemporary outpatient CR services are medically supervised and conducted by an interdisciplinary team including other professionals, such as cardiologists, PRM specialists, physical therapists, psychologists, dietitians and nurses.[9,10] Outpatient CR programs offer a cost-effective, interdisciplinary and comprehensive approach, aiming to modify the underlying risk factors, and to restore maximal physiological, psychosocial, and functional status.[11] Papadakis et al[12] reported evidence to support the cost-effectiveness of supervised CR services as compared to usual care in MI and heart failure, with the range of cost per life-year gained estimated to be from US$2193 to US$28193.[12] The ultimate goal of the CR process is the reintegration of cardiac patients into the community, although many factors contribute

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to the degree of success achieved. The reported reduction in mortality and morbidity rates by supervised CR approaches 25%, in comparison with usual care, where CR services are underutilized.[13] Despite this recognition and exhortation, current statistics continue to demonstrate disappointingly low participation and referral rates of eligible patients.[14,15] Several factors are responsible for the poor referral and participation rates of outpatient CR. Poorest participation is particularly associated with low socioeconomic status, low education, advanced age, rural areas, and and/or female sex.[16,17] The pioneers of CR (Tobis, Wenger, Zohman and Bruce) would not be able to imagine in their time the amount of development that their modest exercise training for low-risk patients underwent in the following decades. The poor CR program applied in the USA in the early 1960s has now become a multidisciplinary strategy for secondary prevention and an interventional tool of public health.[18]

The role of the PRM specialist in CR has changed during recent decades, as a result of reductions in mortality, morbidity, and hospitalizations and improvements in QoL.[19,20] PRM specialists on CR teams are optimally situated to ensure that behavioral lifestyle treatments and drug therapies are applied systematically to attain favorable clinical outcomes in patients with heart disease. The decision-making role of the PRM specialist in contemporary CR is to define policies and strategies, to perform patient assessments, to communicate in an effective and timely fashion with the referring cardiologist or general practitioner (GP), to assure patient safety, and to ascertain that the plan of care is cost-effectively attaining favorable patient outcomes for participants.[21] Contact with other medical specialists and health professionals involved in the CR team is vital and should occur regularly.[22]

Another field of competence (FOC) of the PRM specialist is to minimize CR team conflicts. The PRM specialist is ultimately responsible for ensuring that systems are in place to facilitate this process and that appropriate communication with referring physicians is maintained.[23] The roles and FOC of the PRM specialist in contemporary CR are presented in Table 1.

Any contemporary CR program should have a manual issued, describing the elements that are also managed by the PRM specialist (Table 2).

The American Heart Association suggests that strict compliance with the indications and contraindications listed in Table 3 is of crucial importance to the safety and success of CR programs.[24] Of all the criteria, the following have to be taken most attentively into account: basic and accompanying/concomitant disease; type of treatment—drugs or intervention; electrocardiogram (ECG) and echocardiogram data; patient lipid profile; functional capacity; risk factors; and psychoemotional and occupational status.[25] In addition to the abovementioned criteria for assessing patients for inclusion in CR programs, an in-depth analysis and evaluation of the QoL of cardiac patients is carried out by means of health-related QoL questionnaires, such as the Minnesota Living with Heart Failure[26] and the MacNew questionnaire.[27]

Recently, the National Institute for Health and Care Excellence, (NICE) published an updated, and much wider list of inclusion criteria, recommending the delivery of CR with an exercise component in a non-judgmental, respectful and culturally sensitive manner to all patients, regardless of their age. Furthermore, it suggests that people should not be excluded from the entire program if they choose not to attend specific components of it, and most importantly, that CR should be started as soon as possible, at least within 10 days of their discharge from hospital, and preferably before discharge. Despite all such ef-

Table 1. Key roles of the physical and rehabilitation medicine specialist in cardiac rehabilitation (CR).

Carrying out and coordination of diagnostic therapeutic CR events
Design and assessment of included patients
Monitoring patient progress and modifying the CR program
Coordination of the safety parameters for CR programs and management of emergency and urgent conditions
Communication with referring cardiologists and GPs
Coordination and resolution of health insurance issues

Table 2. Cardiac Rehabilitation Manual.

Diagnostic and evaluation criteria for inclusion and exclusion of patients
Methodology of the various cardiac rehabilitation programs
Measures for clinical assessment of patients
Daily notes on the course of treatment after every training session, including the achieved parameters and results
Keeping a record of changes in patient's functional status
Registration of changes in drug therapy
Registration of changes in patient's psycho-emotional status
Emergency management activities
Communication with referring health professionals to report the results achieved by patients

Table 3. Indications and contraindications for exercise training.[24]

Indications	Contraindications
Primary: • Detection of coronary artery disease (CAD) in patients with chest pain (chest discomfort) syndromes or potential symptom equivalents • Evaluation of the anatomic and functional severity of CAD • Prediction of cardiovascular events and all-cause death • Evaluation of physical capacity and effort tolerance • Evaluation of exercise-related symptoms • Assessment of chronotropic competence, arrhythmias, and response to implanted device therapy • Assessment of the response to medical interventions Additional: • Development of the exercise plan or prescription • Response to medication • Evaluation of perioperative risk for non-cardiac surgery	Absolute contraindications: • Acute myocardial infarction within 2 days • Ongoing unstable angina • Uncontrolled cardiac arrhythmia with hemodynamic compromise • Active endocarditis • Symptomatic severe aortic stenosis • Decompensated heart failure • Acute pulmonary embolism, pulmonary infarction, or deep vein thrombosis • Acute myocarditis or pericarditis • Acute aortic dissection • Physical disability that precludes safe and adequate testing Relative contraindications: • Known obstructive left main coronary artery stenosis • Moderate to severe aortic stenosis with uncertain relation to symptoms • Tachyarrhythmias with uncontrolled ventricular rates • Acquired advanced or complete heart block • Hypertrophic obstructive cardiomyopathy with severe resting gradient • Recent stroke or transient ischemic attack • Mental impairment with limited ability to cooperate • Resting hypertension with systolic or diastolic blood pressures >200/110 mmHg • Uncorrected medical conditions, such as significant anemia, important electrolyte imbalance, and hyperthyroidism

forts, the NICE report bitterly notes that only 44% of English post-MI patients start an outpatient CR program, with a average waiting period of 53 days.[28]

The PRM specialist must:

- be completely aware that the patients' diagnosis allows for his/her inclusion in the CR program;
- be certain about the clinical and psychological status of every patient;
- have investigated the patient's exercise tolerance.

The above precautions aim at setting up an appropriate personalized CR program that is safe for the patient, while on the other hand preventing major cardiovascular events.[25] The patient's functional capacity assessment is aided by cardiopulmonary exercise tests (CPET)[29] and field tests (fixed duration walking tests and fixed distance walk test),[30] which are the key examinations from which the PRM specialist prescribes a CR program and decides which patients to discharge from the hospital.[31] The data obtained from patient's medical history, clinical and laboratory data, as well as from CPET, assist the PRM specialist to individualize an exercise training program that aims to improve the cardiac patient's functional capacity. The prescribed CR program needs to be flexible and adapted to the needs of the individual patient. While focusing particularly upon the patients' physical needs, the PRM specialist should also address the patient's emotional concerns and explore any perceived barriers to exercise.[32] In fact, the assessment of functional capacity in the inpatient setting by the PRM specialist decides which patients are deemed ready to return home or need to spend additional time at outpatient CR centers.[33]

Various CR programs include different types of exercises—aerobic, endurance, strength, interval or continuous training with a variable intensity, duration and frequency[34]—which may be preferred depending on personal characteristics such as age, sex, and comorbidities. For instance, exercise training programs for elderly women aim to improve muscle strength, muscle mass and endurance. CR programs designed for younger males suffering from metabolic syndrome are focused on increased calorie consumption, longer periods of walking, and other aero-

bic workouts with the aim of maximum weight loss.[35] Despite these differences, their aim is to facilitate recovery to a level necessary for patients to resume their work and other activities of daily living.[36] Moreover, patients could be included in group-based CR programs if they are available to participate. There is abundant evidence that group-based models of CR present many advantages, such as eliminating the feeling of anxiety and depression that is characteristic of cardiac patients.[37]

The Bruce protocol is one of the most basic and most common CPET used by the Medical Center of Sport Medicine and Rehabilitation in Plovdiv, Bulgaria.[38] The beginning of the abovementioned protocol is more progressive, providing an evaluation of the patient's hemodynamic and respiratory response to fatigue. Sudden and increased fatigue ensures the optimal duration of the test. Several other protocols exist, such as those of Naughton and Balke,[39] and the modified Bruce protocol.[40] It is estimated that the cardiopulmonary fatigue protocols, such as that of Bruce, increase the possibility of achieving high levels of VO_2/kg (range 45.9-61.3 $mL.min^{-1}.kg^{-1}$), which are rarely seen in patients with chronic heart failure. Frequently, Naughton's protocol is used, consisting of 2 minute MET steps, which are achieved by simultaneously increasing the speed and slope of the treadmill.[41] The optimal duration of the CPET is considered to be 8-12 minutes, while the protocols of Naughton and Balke usually extend the duration up to 15 minutes.[34,42] For patients who have been almost totally inactive, the PRM specialist needs to design an appropriate CR program, encouraging such patients to initiate and continue the recommended exercises. Patients included in CR programs enjoy training sessions and this places great importance upon what they can do physically. Exercise is viewed by patients as something tangible, measurable and understandable. Patients training at high levels require particular attention and a stable functional status. Such patients may benefit from referral to a trained physical therapist.

After the accomplishment of the various CR phases the PRM specialist should:

- keep a record of the results achieved in the training and the functional capacity of cardiac patients;
- mark the points that need additional interventions;
- instruct the patient how to exercise in a home setting;
- set a date for a check-up by the cardiologist in charge and the GP;
- send a report to the cardiologist in charge and the GP.

Communication with the cardiologist and health professionals

Contact and communication with other health professionals involved in the CR team is vital and should occur regularly.[22] It favors better awareness of the patients' status, thus ensuring referral of patients to existing CR programs.[43] By working closely with referring cardiologists and GPs, the PRM specialist can assist the patient in reaching target goals more efficiently. He is responsible for ensuring that systems are in place to facilitate this process and that appropriate communication with referring cardiologists and GPs is maintained.[44] Interim communications may refer to possible adverse cardiovascular events, or to changes in drug therapy, e.g. regulation of antihypertensive therapy and lipid control.

Specialist communication between the PRM and the referring cardiologists and GPs needs to include at least the elements listed in Table 4.

Safety

One of the most important responsibilities of the PRM specialist is the prescription and implementation of a safe CR program.[45] The PRM specialist should provide practical advice to patients about what they can and cannot do safely, including any sport activities. The PRM specialist and the entire CR team must be able to cope with exceptional emergencies and to be trained and re-trained periodically in basic and advanced cardiopulmonary resuscitation (CPR). Cardiac rehabilitation settings in hospitals, CR outpatient centers, and sports dispensaries need to meet all the requirements for carrying out CPR. CR is not assigned to high-risk patients as the goal is to return them to the moderate risk group. Customized activi-

Table 4. Communications of the physical and rehabilitation medicine specialist.

• Preliminary basic assessment of the patient and design of the cardiac rehabilitation plan
• Interim report on the results achieved in terms of functional capacity and quality of life
• Final summary report supplemented by long-term training program

ties of daily living,[36] accompanied by light exercise in order to maintain the range of motion of the upper and lower limbs, are allowed.[46] Guidelines for the exclusion of high-risk patients are given by different safety protocols issued by the American College of Cardiology and the American Heart Association.[24] These protocols provide guidelines for the close monitoring of high-risk patients, as well as guidelines for managing extraordinary emergencies, e.g. arrhythmias, acute coronary events, cardiac arrest. The safety of contemporary CR programs is quite high, and must be in compliance with the above guidelines: no more than one cardiovascular event per 50,000 patient training hours, or one death per 120,000 patient training hours.[45] Each training session needs to be recorded and all the routine activities have to be described in detail. The name of the CR team member who is responsible for extraordinary emergencies must also be registered.

Prevention

Other key roles of PRM specialists include monitoring patients during CR sessions. Pain and other physical problems reported by patients need to be assessed and managed by the PRM specialists. Many patients exhibit increased fatigue after workout. Since cardiac patients have an increased risk of sudden death, major interventions by psychologists are needed for depression and stress management. Stress syndromes and depression are highly prevalent in cardiac patients, with estimates ranging from 15% to more than 40%.[44] Among others, the following recommendations apply for prevention of adverse events during CR programs:

- training sessions in patients with arrhythmias are avoided, according to a guideline requirement;
- isometric exercises are avoided;
- ECG monitoring is imperative in patients with ventricular tachycardia or hypotension after exercise load;
- longer warm-up and recovery periods are necessary.[36,47]

Future prospects

The future roles and FOC of PRM specialists will be the promotion, coordination and implementation of randomized controlled trials that include cohorts receiving contemporary CR services, and comprehensive cost-effectiveness analyses of CR services.[5,6-11,12] These types of trial should produce new findings and data for updating the contemporary state of CR services.

Conclusion

The roles, responsibilities and FOC of PRM specialists in contemporary CR have been substantially expanded and enhanced. The PRM specialists are the decision makers who are responsible for the design and strategy of contemporary CR programs; the assessment of patients eligible for inclusion; recording their clinical results and progress; and maintaining a dynamic and effective communication with referring cardiologists and GPs.[23] They are also responsible for the efficiency, safety and cost-effectiveness of CR programs, as well as the overall care of participating patients. An important key role of the PRM specialist is to minimize team conflicts, to determine which health professionals have more appropriate skills, and to allocate roles accordingly.[21]

References

1. Gutenbrunner C, Lemoine F, Yelnik A, et al. The field of competence of the specialist in physical and rehabilitation medicine (PRM). Ann Phys Rehabil Med. 2011; 54: 298-318.
2. Gutenbrunner C, Ward AB, Chamberlain MA, editors. White Book on Physical and Rehabilitation Medicine in Europe. Eura Medicophys. 2006; 42: 287-332 [J Rehabil Med. 2007; 45(Suppl.1): 1-4]
3. Gutenbrunner C, Delarque A. Action Plan of the Professional Practice Committee - UEMS Physical and Rehabilitation Medicine Section: description and development of Eur J Phys Rehabil Med 2009; 45: 275-280.
4. Gutenbrunner C, Ward AB, Chamberlain MA. Re: the dream of a medical specialty named physical and rehabilitation medicine: a commentary on the European White Book of Physical and Rehabilitation Medicine. Am J Phys Med Rehabil. 2009; 88: 1037-1039.
5. Clark AM, Hartling L, Vandermeer B, McAlister FA. Meta-analysis: secondary prevention programs for patients with coronary artery disease. Ann Intern Med. 2005; 143: 659-672.
6. Curtis LH, Whellan DJ, Hammill BG, et al. Incidence and prevalence of heart failure in elderly persons, 1994-2003. Arch Intern Med. 2008; 168: 418-424.
7. Cleland JG, Daubert JC, Erdmann E, et al; Cardiac Resynchronization-Heart Failure (CARE-HF) Study Investigators. The effect of cardiac resynchronization on morbidity and mortality in heart failure. N Engl J Med. 2005; 352: 1539-1549.
8. Konstam MA, Gheorghiade M, Burnett JC Jr, et al. Effects of oral tolvaptan in patients hospitalized for worsening heart failure: the EVEREST Outcome Trial. JAMA. 2007; 297: 1319-1331.
9. Lavie CJ, Milani RV. Cardiac rehabilitation and exercise training in secondary coronary heart disease prevention. Prog

Cardiovasc Dis. 2011; 53: 397-403.
10. Wenger NK. Current status of cardiac rehabilitation. J Am Coll Cardiol. 2008; 51: 1619-1631.
11. Georgiou D, Chen Y, Appadoo S, et al. Cost-effectiveness analysis of long-term moderate exercise training in chronic heart failure. Am J Cardiol. 2001; 87: 984-8; A4.
12. Papadakis S, Reid RD, Coyle D, Beaton L, Angus D, Oldridge N. Cost-effectiveness of cardiac rehabilitation program delivery models in patients at varying cardiac risk, reason for referral, and sex. Eur J Cardiovasc Prev Rehabil. 2008; 15: 347-353.
13. Bunker SJ, Goble AJ. Cardiac rehabilitation: under-referral and underutilisation. Med J Aust. 2003; 179: 332-333.
14. Squires RW. Are cardiac rehabilitation programs underutilized by patients with coronary heart disease? Nat Clin Pract Cardiovasc Med. 2008; 4: 192-193.
15. Gravely-Witte S, Leung YW, Nariani R, et al. Effects of cardiac rehabilitation referral strategies on referral and enrollment rates. Nat Rev Cardiol. 2010; 7: 87-96.
16. Cortés O, Arthur HM. Determinants of referral to cardiac rehabilitation programs in patients with coronary artery disease: a systematic review. Am Heart J. 2006; 151: 249-256.
17. Brown TM, Hernandez AF, Bittner V, et al. Predictors of cardiac rehabilitation referral in coronary artery disease patients: findings from the American Heart Association's Get With The Guidelines Program. J Am Coll Cardiol. 2009; 54: 515-521.
18. Coppieters Y, Levêque A. Which strategies of cardiovascular health promotion and disease prevention for health professionals? Acta Cardiol. 2010; 65: 457-458.
19. Fernhall B. Long-term aerobic exercise maintains peak VO(2), improves quality of life, and reduces hospitalisations and mortality in patients with heart failure. J Physiother. 2013; 59: 56.
20. Harrison MB, Browne GB, Roberts J, Tugwell P, Gafni A, Graham ID. Quality of life of individuals with heart failure: a randomized trial of the effectiveness of two models of hospital-to-home transition. Med Care. 2002; 40: 271-282.
21. Jette DU, Ardleigh K, Chandler K, McShea L. Decision-making ability of physical therapists: physical therapy intervention or medical referral. Phys Ther. 2006; 86: 1619-1629.
22. Neumann V, Gutenbrunner C, Fialka-Moser V, et al. Interdisciplinary team working in physical and rehabilitation medicine. J Rehabil Med. 2010; 42: 4-8.
23. King ML, Williams MA, Fletcher GF, et al. Medical director responsibilities for outpatient cardiac rehabilitation/secondary prevention programs: a scientific statement from the American Heart Association/American Association for Cardiovascular and Pulmonary Rehabilitation. Circulation. 2005; 112: 3354-3360.
24. Fletcher GF, Ades PA, Kligfield P, et al. Exercise standards for testing and training: a scientific statement from the American Heart Association. Circulation. 2013; 128: 873-934.
25. Smith SC Jr, Benjamin EJ, Bonow RO, et al. AHA/ACCF secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update: a guideline from the American Heart Association and American College of Cardiology Foundation endorsed by the World Heart Federation and the Preventive Cardiovascular Nurses Association. J Am Coll Cardiol. 2011; 58: 2432-2446.
26. Rector TS, Cohn JN. Assessment of patient outcome with the Minnesota Living with Heart Failure questionnaire: reliability and validity during a randomized, double-blind, placebo-controlled trial of pimobendan. Pimobendan Multicenter Research Group. Am Heart J. 1992; 124: 1017-1025.
27. Höfer S, Schmid JP, Frick M, et al. Psychometric properties of the MacNew heart disease health-related quality of life instrument in patients with heart failure. J Eval Clin Pract. 2008; 14: 500-506.
28. MI Secondary Prevention: Secondary Prevention in Primary and Secondary Care for Patients Following a Myocardial Infarction: Partial Update of NICE CG48 [Internet]. National Clinical Guideline Centre (UK). London: Royal College of Physicians (UK); 2013 Nov. National Institute for Health and Clinical Excellence: Guidance.
29. Simeunovic D, Seferovic PM, Ristic AD, et al. Evaluation of oxidative stress markers and catecholamine changes in patients with dilated cardiomyopathy before and after cardiopulmonary exercise testing. Hellenic J Cardiol. 2015; 56: 394-401.
30. Casillas JM, Hannequin A, Besson D, et al. Walking tests during the exercise training: specific use for the cardiac rehabilitation. Ann Phys Rehabil Med. 2013; 56: 561-575.
31. Scherer SA, Hammerich AS. Outcomes in cardiopulmonary physical therapy: acute care index of function. Cardiopulm Phys Ther J. 2008; 19: 94-97.
32. Myers J. Principles of exercise prescription for patients with chronic heart failure. Heart Fail Rev. 2008; 13: 61-68.
33. Eroglu S, Sade LE, Polat E, Bozbas H, Muderrisoğlu H. Association between coronary flow reserve and exercise capacity. Hellenic J Cardiol. 2015; 56: 201-207.
34. Reid RD, Dafoe WA, Morrin L, et al. Impact of program duration and contact frequency on efficacy and cost of cardiac rehabilitation: results of a randomized trial. Am Heart J. 2005; 149: 862-868.
35. Savage PD, Brochu M, Poehlman ET, Ades PA. Reduction in obesity and coronary risk factors after high caloric exercise training in overweight coronary patients. Am Heart J. 2003; 146: 317-323.
36. Bowling CB, Fonarow GC, Patel K, et al. Impairment of activities of daily living and incident heart failure in community-dwelling older adults. Eur J Heart Fail. 2012; 14: 581-587.
37. Nilsson BB, Westheim A, Risberg MA. Effects of group-based high-intensity aerobic interval training in patients with chronic heart failure. Am J Cardiol. 2008; 102: 1361-1365.
38. Bruce RA. Exercise testing of patients with coronary heart disease. Principles and normal standards for evaluation. Ann Clin Res. 1971; 3: 323-332.
39. Kleber F, Waurick P, Winterhalter M. CPET in heart failure. Eur Heart J Suppl 2004; 6: D1-D4.
40. Strzelczyk TA, Cusick DA, Pfeifer PB, Bondmass MD, Quigg RJ. Value of the Bruce protocol to determine peak exercise oxygen consumption in patients evaluated for cardiac transplantation. Am Heart J. 2001; 142: 466-475.
41. Terziyski K, Marinov B, Hodgev V, Tokmakova M, Kostianev S. Standardized peak exercise perception score: validation of a new index of effort perception. J Cardiopulm Rehabil Prev. 2010; 30: 40-46.
42. Deligiannis AP, Kouidi EJ, Koutlianos NA, et al. Eighteen years' experience applying old and current strategies in the pre-participation cardiovascular screening of athletes. Hellenic J Cardiol. 2014; 55: 32-41.
43. Thomas RJ, King M, Lui K, Oldridge N, Piña IL, Spertus J. AACVPR/ACC/AHA 2007 performance measures on cardiac rehabilitation for referral to and delivery of cardiac re-

habilitation/secondary prevention services. Circulation. 2007; 116: 1611-1642.
44. Gravely-Witte S, Leung YW, Nariani R, et al. Effects of cardiac rehabilitation referral strategies on referral and enrollment rates. Nat Rev Cardiol. 2010; 7: 87-96.
45. O'Connor CM, Whellan DJ, Lee KL, et al. Efficacy and safety of exercise training in patients with chronic heart failure: HF-ACTION randomized controlled trial. JAMA. 2009; 301: 1439-1450.
46. Cress ME, Buchner DM, Prohaska T, et al. Best practices for physical activity programs and behavior counseling in older adult populations. J Aging Phys Act. 2005; 13: 61-74.
47. Racine N, Blanchet M, Ducharme A, et al. Decreased heart rate recovery after exercise in patients with congestive heart failure: effect of beta-blocker therapy. J Card Fail. 2003; 9: 296-302.