심폐재활

게시일시 및 장소 : 10 월 19 일(토) 08:30-12:30 Room G(3F)

질의응답 일시 및 장소 : 10 월 19 일(토) 11:00-11:30 Room G(3F)

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One-year follow-up of heart transplant recipient with cardiac rehabilitation, a case report

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Introduction

Heart transplantation (HT) is known to be the treatment of choice for advanced heart failure patients, but their exercise capacity remains under aged-predicted value after HT. Cardiac rehabilitation (CR) is a multifactorial rehabilitation program and many current studies described the effectiveness of CR in HT recipients. However, in Korea, there is a lack of research on CR in HT recipients. Moreover, recent systematic review of CR shows that long-term follow-up data is insufficient. Therefore, an evidence for the long-term effects of CR is lack in HT recipients. In this case report, we present objective findings of the benefits of CR in a HT recipient and the serial follow-up data for 1 year.

Case report

A 48-year old female visited our CR clinic, due to dyspnea on exertion after HT. She was diagnosed with dilated cardiomyopathy and received HT on June 22, 2018. When she first visited our CR clinic at one month after HT, she needed a wheel chair for travelling a long distance and had to stop for breath when walking at her own pace. We prescribed phase I CR program for 1 month and each CR session was performed five times per week with 10 minutes warm-up exercise, 30 minutes main aerobic and 10 minutes cool-down exercise. The exercise intensity corresponded to 60% of heart rate reserve (HRR) measured by initial cardiopulmonary exercise test (CPX). We used both bicycle and treadmill with moderate intensity continuous training (MICT) protocol. After 1 month CR, we changed the protocol to high intensity interval training (HAIT). HAIT protocol was performed for 50 minutes using treadmill and consisted of 4 minutes interval training period at 85% of HRR and 3 minutes active rest period at 40-60% of HRR. After phase I CR period for 67 days, we recommended the phase II CR, but the patient refused outpatient CR. So we prescribed a home exercise CR program five times a week, once a day. One year after HT, VO2max increased from 12.3 ml/kg/min to 22.8 ml/kg/min and chronotropic incompetence recovered after CR. The 6-minute walk test result increased from 281 meters to 520 meters (Table 1). Furthermore, pulmonary function parameters, grip power, leg strength, skeletal muscle mass and phase angle value improved after the CR program (Table 2, 3).

Conclusion

This case showed that CR programs with the HAIT protocol can be successfully performed in HT recipients and showed objective improvements in muscle strength, pulmonary function and exercise capacity. In the future, we need a large-scale, prospective study of CR in Korean HT recipients.

Table 1. Exercise results

Date	Aug 18, 2018 (Baseline)	Sep 11, 2018 (3-month after HT)	Oct 30, 2018 (4-month after HT)	Apr 26, 2019 (10-month after HT)	June 26, 2019 (1-year after HT)
CPX protocol	Manual	Manual	Modified Bruce	Modified Bruce	Modified Bruce
Total CPX time	12 min 30 sec	24 min 57 sec	12 min 5 sec	12min 9 sec	12 min 45 sec
VO_{2max} (ml/kg/min)	12.3	15.7	18.0	20.8	22.8
VE/VCO_2 slope	31.5	37.6	34.4	27.9	37.4
RER	1.17	1.18	1.01	1.19	1.25
HR_{rest} (bpm)	75	71	67	87	99
HR_{max} (bpm)	100	114	108	134	150
HRR (bpm)					
> Beats at 1 min	101 (+1) [a)]	115 (+1)	114 (+6)	130 (-4)	148 (-2)
> Beats at 2 min	102 (+2)	114 (0)	116 (+8)	125 (-9)	142 (-8)
> Beats at 3 min	104 (+4)	112 (-2)	115 (+7)	120 (-14)	134 (-16)
> Beats at 4 min	106 (+6)	110 (-4)	112 (+4)	114 (-20)	127 (-23)
> Beats at 5 min	104 (+4)	106 (-8)	107 (-1)	113 (-21)	121 (-29)
SBP_{max} (mmHg)	173	178	198	167	160
DBP_{max} (mmHg)	88	78	90	88	82
RPP (mmHg·bpm)	17646[b)]	18370[c)]	13746[d)]	16530[d)]	17080[d)]
6MWT (meter)	281	357	445	501	520

[a)]Difference between maximal heart rate while in exercise test and each heart rate while in recovery period
[b)]Measured at 3.2 METs, [c)]Measured at 4.6 METs, [d)]Measured at 5.1 METs
HT = heart transplantation, CPX = cardiopulmonary exercise test, RER = respiratory exchange ratio, HR = heart rate, HRR = heart rate recovery, SBP = systolic blood pressure, DBP = diastolic blood pressure, RPP = rate pressure product, 6MWT = 6minute walk test.

Table 2. Pulmonary function test results

Date	Aug 18, 2018 (Baseline)	Oct 30, 2018 (4-month after HT)	Apr 26. 2019 (10-month after HT)	June 26, 2019 (1-year after HT)
FVC (L)	3.29	3.64	3.01	3.08
FEV_1 (L)	2.16	2.39	2.46	2.57
MIP/MEP (cmH_20)	18/47	29/43	43/49	55/57
PCF (L/min)	250	260	280	300

HT = heart transplantation, FVC = forced vital capacity, FEV_1 = first second of forced expiration, MIP = maximal inspiratory pressure, MEP = maximal expiratory pressure, PCF = peak cough flow.

Table 3. Muscle strength and bioelectrical impedance analysis outcomes

Date	Aug 18, 2018 (Baseline)	Oct 30, 2018 (4 month after HT)	Apr 26, 2019 (10 month after HT)	June 26, 2019 (1 year after HT)
Extension peak torque[a)], Rt (Nm)	28.6	37.4	41.2	39.3
Extension peak torque[a)], Lt (Nm)	23.6	38.7	32.4	38.5
Flexion peak torque[a)], Rt (Nm)	11.7	16.5	21.8	18.8
Flexion peak torque [a)], Lt (Nm)	9.6	15.5	19.7	17.3
Grip power[b)], Rt (kg)	18.2	24.0	27.0	30.6
Grip power [b)], Lt (kg)	16.1	18.8	25.1	27.5
PhA [c)] (degree)	2.1	3.4	4.0	4.1

[a)]Measured with isokinetic protocol at speed 60°/sec, using BIODEX System 4 Pro™ (BIODEX, USA)
[b)]Mean value after three time measurements, using JAMAR® Plus+ hand dynamometer (Performance health, USA)
[c)]Measured using InBody S10® (Biospace, Seoul, Korea)
HT = heart transplantation, PhA = phase angle.