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运动康复训练对冠心病多支病变患者运动耐量及血脂的影响

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摘要 目的:探讨运动康复训练对冠心病多支病变患者活动耐量及血脂的影响。**方法:**选取冠心病多支病变患者,所有患者均进行不完全血运重建术,分为运动康复训练组及对照组,运动康复训练组自术后第三日起治疗组进行运动康复训练,对照组对运动量无要求。3 月后,测量两组患者血脂水平及 6 分钟步行试验,比较两组患者步行距离、心绞痛发作次数、运动至心绞痛出现时间、6 分钟内累积运动时间及血脂水平。**结果:**经运动康复训练治疗 3 月后,治疗组 6 分钟步行距离、运动至心绞痛出现时间及运动累积时间较对照组均明显增加,发生心绞痛次数较对照组明显减少。运动康复训练组治疗后甘油三酯、总胆固醇及低密度脂蛋白水平较治疗前明显降低,对照组仅总胆固醇有所降低,甘油三酯及低密度脂蛋白水平较治疗前无统计学差异。**结论:**运动康复训练可减少冠心病多支病变患者心绞痛发作次数,增加患者运动耐量并调节血脂代谢。

关键词:运动康复训练;冠心病;活动耐量

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Effects of Exercise Rehabilitation Training on Exercise Tolerance and Blood Lipids in Patients with Multi - vessel Disease of Coronary Heart Disease

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ABSTRACT Objective: To investigate the clinical significance of rehabilitation exercise training on exercise tolerance and Lipids in patients who had multiple-vessel coronary heart failure. **Methods:** We prospectively studied the patients which were diagnosed as multiple-vessel coronary heart disease. The patients were divided into two groups: rehabilitation training group and control group. The rehabilitation exercise training was started on the third day after coronary intervention in rehabilitation training group, and control group had no exercise training. After 3 months of treatment, blood lipid level and 6-minute walk test were measured. The walking distance, the frequency of angina pectoris, the onset time of angina pectoris and the exercise accumulation time in 6 minutes were compared. **Results:** After 3 months of rehabilitation exercise training, the 6 - minute walking distance, exercise time to the onset of angina pectoris and exercise accumulation time of the experimental group were significantly higher than those of the control group, and the frequency of angina pectoris was significantly less than that of the control group. The levels of triglyceride, total cholesterol and low density lipoprotein in exercise training group were significantly lower than those before treatment. In the control group, total cholesterol was reduced significantly, and the triglyceride and low density lipoprotein had no significance. **Conclusion:** Exercise training can reduce frequency of angina pectoris, increase exercise tolerance and regulate blood lipid metabolism in patients with coronary artery disease.

Key words: Rehabilitation exercise training; Coronary heart disease; Exercise tolerance

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前言

随着冠脉介入治疗和心脏辅助装置的发展,冠心病多支血管病变患者进行 PCI 治疗的比例日益增加,并可有效改善患者预后^[1],但由于该类患者冠脉血管常伴弥漫、钙化、慢性完全闭塞、小血管病变、侧支循环不发达等特点,介入治疗容易出现内膜撕裂、急性闭塞、急性血栓形成等手术并发症,从而使介入治疗技术操作难度加大^[2],并且大部分患者未能进行完全血运重建,术后活动耐量仍受到限制^[3]。心脏康复运动训练近年来逐渐

引起临床重视,研究证实,其可改善冠心病及心力衰竭患者运动耐量及预后^[4-6]。而冠心病多支病变患者中,心脏康复运动训练的临床研究尚较少。

1 材料及方法

1.1 临床资料

入选 2018 年 9 月 1 日至 2019 年 6 月 31 日就诊于海南医学院第一附属医院心内科,经冠状动脉造影检查并进行部分血管血运重建治疗患者,即明确诊断为不完全血运重建患者 94 例。相关定义:包括前降支、回旋支、右冠状动脉及其 2 mm 以上分支中(如:对角支、钝缘支、锐缘支等),若存在 2 支以上的血管,狭窄率为 70%以上,则定义为多支血管病变。若 PCI 后遗

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留任何 1 支以上及其分支残余狭窄 $\geq 70\%$,则定义为不完全血运重建。入选标准:符合冠心病多支病变定义且进行不完全血运重建患者,年龄 18-65 岁。患者入选前 1 月内,病情稳定,未调整口服用药(包括抗血小板、调脂、降压、降糖药物)。既往无规律运动习惯,即运动频率 <2 次/周,时间 <15 分钟。排除标准:运动障碍患者 合并重要脏器功能不全者(脑、肝、肾等脏器) 合并严重心功能不全(NYHA IV 级)或严重心律失常患者(包括频发频发室性早搏、短阵室性心动过速等)。本研究已报批相关伦理,所有患者入选前均理解试验内容,并签署知情同意书。

患者入选后,采用随机数字表方法将患者分为两组:运动

康复训练组 47 例及对照组 47 例,收集相关临床资料,于入院第二日晨起采集空腹静脉血样,并于当日上午于本院检验科进行血脂等相关数据测量,自冠脉介入治疗第三日开始康复运动训练。所有患者均接受充分而优化的药物治疗,所有患者均规律应用他汀类药物调节血脂代谢,且入选前 1 月内及入选试验期间,均未调整药物种类及用药剂量。患者临床指标如表 1 所示。本研究共入选冠心病不完全血运重建患者 94 例,包括男性 54 名,女性 40 名。87 例患者合并 2 型糖尿病。63 名患者合并高血压。患者口服调脂药物包括:阿托伐他汀钙、瑞舒伐他汀钙、辛伐他汀。两组患者间一般资料均无统计学差异(见表 1)。

表 1 患者一般资料

Table 1 General information of patients

Variable	Rehabilitation training group	Control group	P value
Age(mean $\pm$ SD)	46.96 $\pm$ 5.62	47.04 $\pm$ 5.55	0.941
Male(ratio)	25 (53.1)	29 (61.7)	0.531
Smoking cases(ratio)	23 (48.9)	20 (42.6)	0.679
Type 2 diabetes cases(ratio)	44 (93.6)	43 (91.5)	1
Hypertension cases(ratio)	34 (72.3)	29 (61.7)	0.380
Unstable angina cases(ratio)	35 (74.5)	36 (76.6)	1
Acute myocardial infarction cases(ratio)	12 (25.5)	10 (21.3)	0.808
Previous myocardial infarction cases(ratio)	28 (59.6)	20 (42.6)	0.149
Medication use (ratio)			0.788
Atorvastatin calcium	28 (59.6)	26 (55.3)	
Rosuvastatin calcium	14 (29.8)	17 (36.2)	
Simvastatin	5 (10.6)	4 (8.5)	

1.2 心脏康复训练

对照组进行规范化药物治疗,对日常活动无要求。运动康复训练组在规范化药物治疗基础之上,同时接受运动康复训练。训练前进行 6 分钟步行试验,并根据相关数据,制定合理的运动处方。康复训练第 1 周以预计距离的 10%作为基础运动量,如因心绞痛无法完成,可适当减少训练量,但最低不得少于预计距离的 5%。具体运动量以不超过静息心率+20 次/分为宜,同时监测血压,每次康复训练后,如感觉不太费力,说明运动量适宜。之后根据临床情况(以不出现心绞痛为宜)逐渐将运动量增加到 2000 步,运动持续时间无要求。每周训练次数不少于 3 次。训练全程均需临床工作者陪同,并备有急救药品,若发生心绞痛等不适,则停止运动并记录相关情况。

1.3 记录项目

患者接受治疗 3 个月后,进行临床随访,治疗 3 月结束后的 3 天内测量患者晨起空腹静脉血脂水平,并进行 6 分钟步行试验测定。记录项目:试验距离、试验中发作心绞痛的次数、运动至出现心绞痛的时间(多次出现心绞痛患者取平均时间)、6 分钟内累计运动时间。

1.4 统计方法

本研究采用 R 3.5.1 版本进行统计分析,计量资料采用均数 $\pm$ 标准差进行描述,组间差异性分析选用 t 检验,治疗前后进

行比较分析使用配对 t 检验。计数资料采用频数(百分比)进行描述,采用卡方检验进行组间差异分析。探究血脂与运动康复与否的关系,使用多元线性回归控制混杂因素。假设检验采用双侧检验, $P<0.05$ 即为差异具有统计学意义。

2 结果

运动康复治疗 3 月后,所有患者均进行 6 分钟步行试验测定。运动康复训练组步行距离、运动至心绞痛出现时间及运动累积时间较对照组均明显增加,发生心绞痛次数较对照组明显减少。运动后心率两组患者无明显统计学差异(见表 2)。运动康复训练组治疗 3 个月后,血浆总胆固醇、低密度脂蛋白及甘油三酯水平较治疗前均降低,对照组常规药物治疗 3 月后,仅总胆固醇有所降低,甘油三酯及低密度脂蛋白变化无统计学差异(见表 3)。

为探究治疗后总胆固醇、甘油三酯及低密度脂蛋白的混杂因素,本研究使用了多元线性回归分析,控制了临床混杂因素,发现运动康复治疗是总胆固醇、甘油三酯及低密度脂蛋白的独立影响因素($P<0.05$),详见表 4。

3 讨论

冠心病是常见的心血管疾病之一,其发病率和病死率均较

表 2 运动康复训练后两组间比较

Table 2 Comparison between two groups after rehabilitation training Variable

Variable	rehabilitation training group	Control group	P value
6-minute walking distance(metre)	435.19± 87.71	328.70± 67.33	<0.001
time between the beginning of exercise to angina attack(minute)	5.57± 0.74	3.10± 0.98	<0.001
accumulation time of exercise(minute)	4.92± 0.90	3.36± 0.67	<0.001
number of angina attacks(times)	0.66± 0.60	1.57± 0.68	<0.001
heart rate after exercise(beat per minute)	78.04± 7.51	77.77± 6.63	0.850

表 3 运动康复训练前后血脂比较

Table 3 Comparison of lipid between two groups before and after rehabilitation training

Groups	Types of blood lipids	Before treatment	After treatment	P value
rehabilitation training group	total cholesterol(mmol/L)	5.70 ± 0.85	4.08 ± 0.84	<0.001
	triglyceride(mmol/L)	4.13 ± 0.58	3.66 ± 0.75	<0.001
	Low density lipoprotein cholesterol(mmol/L)	3.07 ± 0.54	2.74 ± 0.48	<0.001
control group	total cholesterol(mmol/L)	5.65 ± 0.66	4.52 ± 0.77	<0.001
	triglyceride(mmol/L)	4.01 ± 0.63	4.15 ± 0.63	0.060
	cholesterol(mmol/L)	2.90 ± 0.53	2.76 ± 0.52	0.194

表 4 治疗后总胆固醇影响因素的多元线性回归分析

Table 4 Multiple linear regression analysis of influencing factors of total cholesterol after treatment

Influence factor	β	95%CI	Standard error	t value	P value
intercept	-2.157	-2.896 ~ -1.419	0.377	-5.725	<0.001
Total cholesterol before treatment	0.971	0.797 ~ 1.145	0.089	10.932	<0.001
Group 2	0.427	0.328 ~ 0.526	0.050	8.474	<0.001
age	0.023	0.004 ~ 0.042	0.010	2.396	0.019
female	0.007	-0.093 ~ 0.107	0.051	0.132	0.896
type 2 diabetes	0.011	-0.230 ~ 0.251	0.123	0.087	0.931
hypertension	-0.242	-0.355 ~ -0.130	0.057	-4.231	<0.001
Atorvastatin calcium					
Rosuvastatin calcium	-0.060	-0.180 ~ 0.060	0.061	-0.983	0.329
Simvastatin	-0.200	-0.374 ~ -0.025	0.089	-2.247	0.027
smoking	-0.143	-0.349 ~ 0.063	0.105	-1.357	0.179
unstable angina	-0.029	-0.160 ~ 0.101	0.066	-0.443	0.659
acute myocardial infarction	-0.084	-0.220 ~ 0.052	0.069	-1.213	0.229
previous myocardial infarction	-0.086	-0.213 ~ 0.041	0.065	-1.333	0.186

Note: $R_2=0.931$ adjust $R_2=0.921$

高,威胁人类健康。冠心病患者常因冠状动脉病变而导致相应心肌供血、供氧不足,心肌不同步收缩,心脏每搏输出量及循环血量减少,进而影响患者心脏功能^[7]。介入治疗是目前冠心病的主要治疗方式,但冠心病合并多支病变患者,大多只能进行不完全血运重建,术后活动耐量仍较低,生活质量较差。近年来,随着运动康复训练的开展,临床中已对冠心病患者做出安全而有效的合理化建议^[8]。大量研究表明,以医院为核心家庭为单位

的运动康复训练,不仅可促使冠心病患者尽快康复,有效缩短住院时间及节省医疗费用,减轻患者精神及经济负担^[9]。还可降低心血管死亡率和住院率^[10],增强活动耐量及心功能^[11],提高患者生活质量^[12-14]。

有研究报道,运动康复训练可增加一氧化氮合酶表达,提高血管内皮生长因子及一氧化氮水平,促进毛细血管网形成,增加冠状动脉侧支循环血量,同时保护血管内皮功能,减缓冠

状动脉粥样硬化斑块的形成,进而发挥心脏保护作用^[15,16]。同时,运动康复训练还可通过骨骼肌运动,改善骨骼肌细胞氧化及肌纤维分布,增加骨骼肌收缩耐力^[16]。此外,康复运动训练亦可减少单核细胞和淋巴细胞 Toll 样受体表达、增加线粒体数量及增强血管舒张功能,进而促进心脏功能康复^[17-19]。本研究发现,冠心病多支病变患者在进行不完全血运重建之后,通过 3 个月标准的运动康复训练,治疗组患者较对照组患者运动耐力明显提升,6 分钟步行距离明显增加。且运动过程中,心绞痛发作次数明显减少,心绞痛出现时间明显延长,治疗组中 36 例患者(占治疗组 72%)连续行走 6 分钟而未出现心绞痛。这说明,对于冠心病不完全血运重建患者,运动康复训练可改善其活动耐力。

而从血脂代谢的角度分析,冠心病多支病变患者在临床中往往多合并糖尿病,存在血脂代谢异常,即使应用调脂类药物,由于糖尿病对血脂代谢的影响,多数患者血脂控制不佳,疾病持续进展,反复出现心肌缺血及损伤。运动康复训练可通过对骨骼肌的训练,促使肌肉葡萄糖转运蛋白及胰岛素受体增加^[20,21],增加高密度脂蛋白及改善胰岛素抵抗^[22,23],同时还可通过抑制多元醇通路激活,减少蛋白激酶 C 及炎症介质等产物的生成,抑制神经变性、坏死,进而促进血糖血脂的代谢^[24],降低心脏不良事件发生率、降低心血管意外的风险^[25-27]。本研究入选人群中,92%患者合并 2 型糖尿病,基线血脂水平平均高于正常。而康复运动训练组进行自身对照发现,该训练可促进其血脂代谢,患者训练后较训练前血浆总胆固醇、甘油三酯及低密度脂蛋白水平明显降低。而对照组仅血浆总胆固醇有所降低,这可能与应用调脂药物相关。但对照组血浆甘油三酯及低密度脂蛋白水平变化并未发现具有统计学意义。这说明,运动康复训练还可改善血脂代谢,进而防止冠心病多支病变患者疾病进展,改善预后。

在精神心理健康方面,有研究发现,焦虑及抑郁状态可增加患者的炎症反应,进而导致血管内皮功能受损,促进冠心病的疾病进展^[28]。冠心病多支病变患者由于未能进行完全的血运重建,担心运动会增加心绞痛的发作,甚至出现焦虑抑郁症状,无法掌控自身活动耐力,导致日常活动量受到受限,甚至可能不运动,促进疾病进展,影响生存寿命。而运动康复训练可以保持患者良好的精神状态,降低心绞痛发作频率及其严重程度,且不增加心血管不良事件的发生。本研究发现,通过运动康复训练,制定个体化活动量,可减低患者负面情绪,减少心绞痛发作的频次,进而提高生存质量。

综上所述,运动康复训练作为一种简便易行的治疗方式,可增加冠心病多支病变患者的活动耐力,调节多种血脂代谢,改善生活质量,降低心血管事件风险。

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