· 临床研究 ·

老年肌少症患者动静态平衡功能与其他体适能指标的相关性

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【摘 要】 **目的** 探讨社区老年肌少症患者动静态平衡功能与其他多方面体适能指标的相关性。**方法** 采取方便抽样法,招募于苏州大学周围多个卫生服务中心门诊就诊及体检的社区老年肌少症患者 178 例,知情同意后纳入测试,最终完成所有测试项目者 110 例。采用闭眼单腿站立测试评估静态平衡功能,起立-步行计时测试(TUGT)评估动态平衡功能。对患者行 6 min 步行试验(6MWT)、肱二头肌屈举试验、30 s 座椅站立试验、抓背试验、座椅体前倾试验及体质量指数测量。采用 SPSS 23.0 统计软件进行数据分析。采用 Spearman 相关分析及多重线性回归分析法,分析动静态平衡功能与其他体适能指标之间的关系。**结果** 社区老年肌少症患者闭眼单腿站立时长(2.66±0.64)s,TUGT 用时(7.68±0.22)s。与未合并其他慢性疾病患者相比,合并其他慢性疾病者闭眼单脚站立时长显著降低[1.83(1.03,2.88)和 2.83(1.41,3.81)s],差异有统计学意义($P<0.05$)。与无规律运动患者相比,有规律运动者 TUGT 时长显著降低[7.27(6.43,8.29)和 7.73(7.03,8.76)s],差异有统计学意义($P<0.05$)。闭眼单腿站立时长与 6MWT 距离、抓背试验距离及座椅体前倾距离呈显著正相关($r=0.607, 0.286, 0.361$;$P<0.05$),与年龄呈显著负相关($r=-0.300$;$P<0.05$)。TUGT 时长与年龄呈显著正相关($r=0.413$;$P<0.001$),与 6MWT、肱二头肌屈举次数、30 s 座椅站立次数、抓背试验距离和座椅体前倾距离呈显著负相关($r=-0.538, -0.605, -0.759, -0.274, -0.366$;$P<0.05$)。多元线性回归分析结果显示,合并其他慢性疾病及 6MWT 距离是闭眼单腿站立时长的影响因素($\beta=1.181, 0.008$;$P<0.05$);合并其他慢性病、肱二头肌屈举次数、30 s 座椅站立次数和抓背试验距离是 TUGT 时长的影响因素($\beta=-0.859, -0.197, -0.342, -0.053$;$P<0.05$)。**结论** 社区肌少症老年人中,合并其他慢性疾病是动静态平衡功能共同的显著影响因素,步行能力是静态平衡功能的显著影响因素,上下肢肌力和柔韧性素质是动态平衡功能的显著影响因素。

【关键词】 老年人;肌少症;平衡功能;体适能
【中图分类号】 R685 【文献标志码】 A 【DOI】 10.11915/j.issn.1671-5403.2023.06.085

Relationship between dynamic-static balance ability and other physical fitness indicators in older adults with sarcopenia

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【**Abstract**】 **Objective** To explore the correlation between dynamic-static balance function and other various physical fitness indicators in community-dwelling elderly patients with sarcopenia. **Methods** Using convenient sampling method, 178 elderly patients with sarcopenia in the community were recruited for outpatient treatment and physical examination at multiple health service centers around Suzhou University. After informed consent, they received the test, and 110 patients ultimately completed all the test items. Static balance function was evaluated using a eye-closed and single legged standing test, and dynamic balance function was evaluated using a stand-up and go test (TUGT). The 6-minute walking test (6MWT), biceps flexion and lift test, 30-second seat standing test, back grasping test, seat forward tilt test, and body mass index measurement were performed on the subjects. SPSS statistics 23.0 was used for data analysis. Spearman correlation analysis and multiple linear regression analysis were used to analyze the relationship between dynamic-static balance function and other physical fitness indicators. **Results** The standing time of elderly patients with sarcopenia in the community with eye-closed and single legged standing was (2.66±0.64) seconds, and the TUGT time was (7.68±0.22) seconds. Compared with patients without other chronic diseases, patients with other chronic diseases significantly reduced the duration of eye-closed and single legged standing [1.83 (1.03, 2.88) *vs* 2.83 (1.41, 3.81) s], with statistically significant differences

收稿日期: 2022-09-15; 接受日期: 2022-12-06
基金项目: 国家自然科学基金(81501944);苏州大学人文社会科学科研项目(21XM2012)
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($P<0.05$). Compared with patients with irregular exercise, the patients with regular exercise had significantly reduced duration of TUGT [7.27 (6.43, 8.29) *vs* 7.73 (7.03, 8.76) s], with statistically significant differences ($P<0.05$). The duration of eye-closed and single legged standing was significantly positively correlated with the distance between 6MWT, back grip test, and seat forward tilt distance ($r=0.607$, 0.286, 0.361; $P<0.05$), and negatively correlated with age ($r=-0.300$; $P<0.05$). The duration of TUGT was significantly positively correlated with age ($r=0.413$; $P<0.001$), and negatively correlated with 6MWT, biceps flexion and lift frequency, 30-second seat standing frequency, back grasping test distance, and seat forward tilt distance ($r=-0.538$, -0.605, -0.759, -0.274, -0.366; $P<0.05$). The results of multiple linear regression analysis showed that the combination of other chronic diseases and a distance of 6MWT were the influencing factors for the duration of eye-closed and single legged standing ($\beta=1.181$, 0.008; $P<0.05$). The factors affecting the duration of TUGT included the combination of other chronic diseases, the frequency of biceps flexion and lift, the frequency of 30-second seat standing, and the distance of back grasping test ($\beta=-0.859$, -0.197, -0.342, -0.053; $P<0.05$). **Conclusion** Among community-dwelling elderly individuals with sarcopenia, comorbidity with other chronic diseases is a significant influencing factor for dynamic-static balance function; walking ability is a significant influencing factor for static balance function; upper and lower limb muscle strength and flexibility are significant influencing factors for dynamic balance function.

【Key words】 aged; sarcopenia; balance function; physical fitness

This work was supported by National Natural Science Foundation of China (81501944) *and Research Project in Humanities and Social Sciences of Soochow University* (21XM2012).

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随着老龄化的加剧,老年人相关健康问题成为健康照护工作的重点内容。肌少症是一种增龄相关的进行性和广泛性的全身肌肉质量减少、肌肉力量和(或)躯体功能减退的老年综合征[1],不仅会使老年人身体活动能力下降,引起活动受限和跌倒等健康负性事件发生[2,3],还会进一步降低老年人的生活质量,加重社会负担[4]。研究表明,随着肌少症严重程度的加深,患者平衡功能也呈下降趋势,跌倒的危险性随之增加[5],因此,关注肌少症老年人的平衡功能具有重要意义。但目前肌少症的相关研究,多聚焦于其对肌力和心肺能力方面的影响,关于肌少症患者平衡功能的研究较为不足。

功能性体适能测试作为衡量老年人身体功能的重要指标,反映了人体的心肺功能、肌肉功能、柔韧性和平衡功能等综合生理状态[6]。平衡功能是评价老年人身体素质的重要体适能之一,可以有效预测老年人的跌倒风险[7,8]。平衡功能的高低可能与其他多方面体适能指标水平密切相关,分析其他各项体适能指标对平衡功能的影响,或可为肌少症患者身体功能的评估以及后期运动干预提供新思路。本研究旨在探讨动静态平衡功能与其他体适能指标之间的关系,为老年肌少症患者平衡运动的干预提供多维度参考。

1 对象与方法

1.1 研究对象

采取方便抽样法,招募于苏州大学周围多个卫生服务中心门诊就诊及体检的社区老年肌少症患者 178 例,最终完成所有测试项目者 110 例。纳入标准:(1)年龄≥60 岁;(2)有独立行走能力;(3)知情同意,自愿参加并配合调查人员完成相关调查。排除标准:(1)体内有心脏支架、起搏器及钢板等;(2)存在严重心血管疾病或处于疾病急性期,如急性心肌梗死、急性心力衰竭及支架植入术后等;(3)存在严重膝骨关节炎、肢体手术术后等肢体功能障碍;(4)患有精神疾病,沟通存在障碍;(5)其他不适宜参加本研究者。本研究已获得苏州大学伦理委员会审批(No. EC-SU-2019000161),并完成中国临床试验注册(No. ChiCTR1900027960)。所有受试者在测试前均被告知实验目的及实验具体过程,签署知情同意书。

1.2 研究方法

1.2.1 一般资料收集 采用自制调查问卷收集以下信息:年龄、性别、合并慢性病情况(是否合并高血压及糖尿病等)、运动习惯(一周≥3 次、每次锻炼时间>30 min 则视为有运动习惯,反之则无)、睡眠情况(将睡眠质量分为好、一般及差 3 种情况)。

1.2.2 肌少症的诊断 肌少症的诊断符合亚洲肌少症工作组 2019 年对肌少症的诊断标准[9]:(1)肌肉力量下降(握力男性<28 kg,女性<18 kg);(2)身体功能下降(6 m 步速<1.0 m/s);(3)肌肉质量下降(骨骼肌质量指数男性<7.0 kg/m^2,女性<5.7 kg/m^2)。若符合标准(1)和(3),或(2)和(3),即诊断为肌少症;若同时符合 3 条标准,则诊断为严重肌少症。使用 120 604 型 Jamar 握力计进行握力测试。采用 6 m 步行速度测试步速。采用身体成分测试仪(日本 TANITA 公司)检测骨骼肌质量指数。

1.2.3 动静态平衡功能评定 采用闭眼单脚站立

和“起立-步行”计时测试(timed up-and-go test, TUGT)对受试者的动静态平衡功能进行评定。(1)闭眼单脚站立(静态平衡功能):受试者闭眼并自然站立,当听到“开始”口令时开始计时,用优势腿保持单脚站立姿势,另一腿屈膝抬离地面,当支撑侧脚位移或抬起脚着地时停止计时。时间越短,平衡能力越差[10]。(2)TUGT(动态平衡功能):受试者坐在靠背椅上(椅面高度约为43 cm),当听到“开始”口令时开始计时,立即从椅子上站起,用尽可能快的速度走到指定距离2.45 m后转身,再回到椅子前坐下,停止计时。一般认为测试时间>10.31 s即存在跌倒风险[11]。

1.2.4 其他体适能测试 采用Rikli和Jones提出的老年人体适能测试法(senior fitness test, SFT)[12]。SFT测试操作简单易行,安全性较高,测试内容与方法包括:(1)6 min步行试验(6-minute walking test, 6MWT)(心肺耐力):受试者在长30 m的长廊上,以尽量快的速度行走6 min的距离;(2)肱二头肌屈举试验(上肢肌力):优势手握哑铃(女性5磅,男性8磅)30 s内完成臂弯举的次数;(3)30 s座椅站立试验(下肢肌力):受试者双手自然抱于胸前,不借助任何外力30 s时间从椅子(高42 cm)上反复站立坐下的次数;(4)抓背试验(上肢柔韧性):受试者一只手自肩膀上方伸向下方,另一只手从背后正中自下向上伸展,测量两中指指尖的距离;(5)座椅体前倾试验(下肢柔韧性):受试者坐在椅子前缘,双腿伸直,用中指触脚尖,测量伸直侧手指尖到脚尖的距离;(6)身体质量指数(body mass index, BMI)(身体成分):通过测量身高和体质量获得[13]。

1.3 统计学处理

采用SPSS 23.0统计软件进行数据分析。计量资料符合正态分布者以均数±标准差($\bar{x}\pm s$)表示。非正态分布者以中位数(四分位数间距)[$M(Q_1, Q_3)$]表示,2组间比较采用Mann-Whitney U检验,多组间比较用Kruskal-Wallis H检验。计数资料以例数(百分率)表示。采用Spearman相关法分析动静态平衡功能与各体适能指标的相关性。采用多元线性回归分析动静态平衡功能的主要影响因素。$P<0.05$为差异有统计学意义。

2 结 果

2.1 肌少症患者的基线资料

本研究共纳入社区老年肌少症患者110例,其中男性36例(32.7%),女性74例(67.3%),年龄60~89(74.95±6.05)岁。患者闭眼单腿站立时长(2.66±0.64)s,TUGT用时(7.68±0.22)s。详见表1。

表1 肌少症患者的基线资料

Table 1 Baseline data of patients with sarcopenia

(n=110)

Item	Data
Age (years, $\bar{x}\pm s$)	74.95±6.05
Gender[n(%)]	
Male	36(32.7)
Female	74(67.3)
Combined with other chronic diseases[n(%)]	
Yes	55(50.9)
No	53(49.1)
Regular exercise[n(%)]	
Yes	71(65.1)
No	38(34.9)
Sleeping quality[n(%)]	
Well	57(52.3)
Medium	27(24.8)
Poor	25(22.9)
Balance function[s, $M(Q_1, Q_3)$]	
Eye-closed and single-legged standing	2.66±0.64
TUGT	7.68±0.22
Other parameters of physical fitness	
6MWT[m, $M(Q_1, Q_3)$]	434.0(380.0, 467.9)
Biceps flexion and lift test(times, $\bar{x}\pm s$)	16.47±3.15
30-second seat standing test(times, $\bar{x}\pm s$)	14.15±3.42
Back grasping test[cm, $M(Q_1, Q_3)$]	−4.5(−10.0,1.0)
Seat forward tilt test[cm, $M(Q_1, Q_3)$]	−3.5(−9.5,0.0)
BMI(kg/m^2, $\bar{x}\pm s$)	20.28±2.16

TUGT: timed up-and-go test; 6MWT: 6-minute walking test; BMI: body mass index.

2.2 不同特征肌少症患者的动静态平衡功能比较

不同特征肌少症患者的动静态平衡功能比较发现,合并其他慢性疾病者闭眼单脚站立时长较未合并者短,差异有统计学意义($P<0.05$)。有规律运动者TUGT时长较无规律运动者短,差异有统计学意义($P<0.05$;表2)。

2.3 年龄及其他体适能指标与动静态平衡功能的相关性

闭眼单腿站立时长与年龄呈显著负相关,与6MWT距离、抓背试验距离和座椅体前倾距离均呈显著正相关(均$P<0.05$)。TUGT时长与年龄呈显著正相关,与6MWT距离、肱二头肌屈举次数、30 s座椅站立次数、抓背试验距离和座椅体前倾距离均呈显著负相关(均$P<0.05$;表3)。

表2 不同特征肌少症患者的动静态平衡功能比较

Table 2 Comparison of dynamic-static balance functions in patients with different characteristics of sarcopenia

[n=110, s, $M(Q_1, Q_3)$]

Item	Eye-closed and single legged standing			TUGT		
	$M(Q_1, Q_3)$	Z/H	P value	$M(Q_1, Q_3)$	Z/H	P value
Gender		−1.199	0.230		−0.580	0.562
Male	2.17(1.08,3.03)			7.30(6.59,8.47)		
Female	2.47(1.25,3.79)			7.56(6.64,8.45)		
Combined with other chronic diseases		−2.482	0.013		−1.019	0.308
Yes	1.83(1.03,2.88)			7.65(6.58,8.62)		
No	2.83(1.41,3.81)			7.34(6.61,8.31)		
Regular exercise		−1.658	0.097		−2.242	0.025
Yes	2.52(1.32,3.50)			7.27(6.43,8.29)		
No	1.61(0.95,3.14)			7.73(7.03,8.76)		
Sleeping quality		2.113	0.348		0.026	0.987
Well	2.47(1.27,3.58)			7.55(6.65,8.33)		
Medium	1.67(0.96,3.08)			7.41(6.56,8.57)		
Poor	2.56(1.21,3.34)			7.42(6.52,8.91)		

TUGT: timed up-and-go test.

表3 肌少症患者动静态平衡功能与年龄及其他体适能指标的相关性

Table 3 Correlation of dynamic-static balance function with age and other physical fitness indexes in patients with sarcopenia

Item	Eye-closed and single legged standing		TUGT	
	r	P value	r	P value
Age	−0.300	0.002	0.413	<0.001
6MWT distance	0.607	<0.001	−0.538	<0.001
Biceps flexion and lift	0.188	0.052	−0.605	<0.001
30 s seat standing	0.183	0.057	−0.759	<0.001
Back grasping	0.286	0.003	−0.274	0.004
Seat forward tilt	0.361	<0.001	−0.366	<0.001
BMI	−0.182	0.058	0.067	0.490

TUGT: timed up-and-go test; 6MWT: 6-minute walking test; BMI: body mass index.

2.4 动静态平衡功能的多元线性回归分析

分别以闭眼单腿站立时长和TUGT时长为因变量,年龄、是否合并其他慢性疾病、运动习惯及其他体适能结果作为自变量,进行多元线性回归分析。结果显示,合并其他慢性疾病及6MWT距离是闭眼单腿站立时长的影响因素(均P<0.05;表4)。合并其他慢性疾病、肱二头肌屈举次数、30 s座椅站立次数和抓背试验距离是TUGT时长的影响因素(均P<0.05;表5)。

表4 肌少症患者静态平衡功能的多元线性回归分析

Table 4 Multiple linear regression analysis of static balance function in patients with sarcopenia

Item	B	SE	$Beta$	t	P value
Combined with other chronic diseases	1.181	0.371	0.262	3.188	0.002
6MWT distance	0.008	0.001	0.491	5.966	<0.001

6MWT: 6-minute walking test.

表5 肌少症患者动态平衡功能的多元线性回归分析

Table 5 Multiple linear regression analysis of dynamic balance function in patients with sarcopenia

Item	B	SE	$Beta$	t	P value
Combined with other chronic diseases	−0.859	0.359	−0.170	−2.394	0.019
Biceps flexion and lift	−0.197	0.069	−0.247	−2.841	0.005
30 s seat standing	−0.342	0.064	−0.464	−5.303	<0.001
Back grasping	−0.053	0.024	−0.162	−2.241	0.027

3 讨论

平衡功能是人体在某种状态下维持身体稳定性的能力,受到前庭器官、本体感觉和肌肉肌腱等多方面影响。进入老年期之后,平衡能力随年龄增加而逐渐下降[14,15]。一项关于老年人平衡功能的Meta分析中,随机效应模型显示老年人闭眼单脚站立时长为8.117 s [95%CI(7.433,8.801)][16],远高于本研究肌少症患者站立时长(2.66±0.64)s。由此推测,肌

少症患者的静态平衡功能差于正常老年人。黄瑾等[17]研究发现老年男性TUGT用时为(9.93±3.04)s,女性为(10.35±2.87)s。本研究中肌少症患者TUGT用时(7.68±0.22)s,与正常老年人较为接近。可能是由于TUGT受到视觉和本体觉等多种因素影响,而闭眼单腿站立缺乏视觉辅助且仅凭单腿支撑,从而导致肌少症患者与正常老年人的差异较为明显,但具体机制有待进一步探索。

老年肌少症患者的身体机能加速衰退,而合并慢性病的老年人由于慢性疾病的消耗以及长期服药物的副作用,会导致平衡功能进一步下降。本研究结果显示,合并其他慢性疾病是动静态平衡功能的主要影响因素。患有高血压、糖尿病等慢性病患者常存在头晕、步态不稳等症状,易导致躯体稳定性不佳[18]。此外,本研究通过单因素分析发现,未合并其他慢性疾病及有规律运动者的平衡功能更好,提示临床需尽早对合并其他慢性疾病者进行平衡功能监测,做到早预防和早干预。同时帮助患者培养运动习惯,以延缓平衡功能的下降速度。但本研究仅针对是否合并其他慢性疾病进行了分析,样本量较小,未对合并不同种类慢性病的亚组病例进行分析,未来仍需针对不同慢性疾病对平衡功能的影响及其机制进行深入的探索。

本研究结果显示,动静态平衡功能与抓背试验距离和座椅体前倾距离均具有一定的相关性,与多数研究结果一致[19,20]。肌少症患者的关节韧带退化明显,而关节柔韧性的好坏会影响到躯体姿势的稳定性,严重者会影响到躯体平衡状态。6MWT可有效反映下肢肌力水平,而肌力又与平衡功能密切相关[21-23]。有研究发现,6MWT是TUGT的最佳预测因子[24]。本研究中6MWT和闭眼单腿站立($r=0.607$)及TUGT($r=-0.538$)具有中等程度的相关性,且6MWT距离是静态平衡功能的影响因素。

本研究结果显示,肱二头肌屈举和30 s座椅站立次数是动态平衡功能的显著影响因素,且与TUGT时长呈负相关。具体表现为肱二头肌屈举和30 s座椅站立次数越多者,起立-步行时间越短,动态平衡功能越好。研究表明,肱二头肌屈举或握力均可有效反映上肢肌肉力量[25,26]。其中,握力与动态平衡功能密切相关[27]。但Strandkvist等[28]研究发现,握力与平衡功能之间的相关性较弱。这可能与研究人群年龄和地域差异有关。人体平衡功能受到下肢肌力的影响[29],正常髋关节的活动强度对动态平衡功能起到正向作用[30],而30 s座椅站立测试的完成离不开髋关节的活动度和内旋力量的作用。Song等[31]也发现,下肢肌力与动态平衡功能之间存在相关性。因此,医务人员在平衡运动锻炼指导时,可以考虑增加下肢肌力训练。

本研究综合分析了社区老年肌少症人群平衡功能之外的其他方面体适能指标对平衡功能的影响,尚存在一定的不足。(1)本研究对象是社区老年肌少症患者,结论对正常老年人或其他疾病患者的适用性和推广性有待考究;(2)本研究为横断面调查,无法评估平衡功能与其他体适能之间的因果关系;(3)本研究纳入的样本量较小,相关性结果代表性不足,未来将扩大样本量进一步验证。

综上所述,动静态平衡功能与其他多方面体适能具有密切的联系。在肌少症老年人中,除了合并其他慢性疾病是动静态平衡功能共同的影响因素外,步行能力是静态平衡功能的影响因素,上下肢肌肉力量和柔韧性是动态平衡功能的影响因素。未来可通过多方面体适能锻炼来提升或改善老年肌少症患者的平衡功能,最大限度地减少跌倒发生率,降低医疗护理负担。

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（编辑：和雨璇）