·临床研究·

老年住院2型糖尿病患者合并肌少症的情况及其影响因素

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【摘 要】 **目的** 分析老年住院2型糖尿病患者合并肌少症的患病情况及其影响因素。**方法** 按照纳入与排除标准,连续入选2018年1月至2019年12月于北京协和医院老年医学科住院治疗且年龄≥65岁的2型糖尿病患者为研究对象。运用老年综合评估,评价患者的共存疾病及老年综合征情况。采用SPSS 24.0统计软件进行数据分析。根据数据类型,分别采用t检验、Wilcoxon秩和检验、χ^2检验或Fisher精确概率法进行组间比较。采用多因素logistic回归模型分析老年2型糖尿病患者合并肌少症的影响因素。**结果** 最终入选225例患者,其中59例合并肌少症(肌少症组),166例未合并肌少症(非肌少症组)。与无肌少症组比较,肌少症组患者的年龄更大,住院时间更长,有跌倒史、需要辅助行走、合并糖尿病靶器官病变及尿失禁的比例更高,5次起坐时间明显延长,不能完成全足距测试的比例更高,血肌酐水平更高,差异均有统计学意义(均$P<0.05$);男性比例较低,体质量指数(BMI)水平较低,微营养评估简表、基本日常生活活动、工具性日常生活活动分值较低,差异均有统计学意义(均$P<0.05$);空腹血糖、糖化血红蛋白、血清白蛋白及前白蛋白等其他血液学指标差异无统计学意义(均$P>0.05$)。多因素logistic回归分析显示,低BMI($OR=0.716$,95%CI 0.609~0.842,$P<0.001$)和需要辅助行走($OR=4.391$,95%CI 1.167~16.512,$P=0.029$)是老年2型糖尿病患者合并肌少症的影响因素。**结论** 老年住院2型糖尿病患者合并肌少症的患病率高,且患病率随增龄而进一步升高。对于低BMI、躯体功能下降的老年糖尿病患者,应注意肌少症的筛查并进行相应干预。

【关键词】 老年人;2型糖尿病;肌少症
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Prevalence of sarcopenia in hospitalized elderly patients with type 2 diabetes mellitus and its influencing factors

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【Abstract】 **Objective** To determine the prevalence of sarcopenia among the elderly inpatients with type 2 diabetes mellitus (T2DM) and investigate its influencing factors. **Methods** According to our inclusion and exclusion criteria, consecutive elderly T2DM inpatients (≥65 years old) in Geriatrics Department of Peking Union Medical College Hospital between January 2018 and December 2019 were enrolled in this study. Geriatric assessment was performed to evaluate their existing comorbidities and geriatric syndromes. SPSS statistics 24.0 was used to perform the statistical analysis. For different data types, student's t test, Wilcoxon rank sum test, *Chi*-square test, or Fisher exact test was employed for intergroup comparison. Multivariate logistic regression model was applied to analyze the influencing factors of sarcopenia in the elderly type 2 diabetes mellitus (T2DM) patients. **Results** A total of 225 patients were finally enrolled in the study, including 59 cases complicated with sarcopenia (sarcopenia group) and 166 without (non-sarcopenia group). Compared with the patients from the non-sarcopenia group, those of the sarcopenia group were older, and had longer hospital stay, higher ratios of fall history, assisted walking, diabetic target-organ lesions and urinary incontinence, longer time of 5-times sit-to-stand, and proportion of being unable to achieve a tandem stance, and higher level of serum creatinine (all $P<0.05$). Lower ratio of males, lower body mass index (BMI), lower scores of mini nutritional assessment short form, activities of daily living and instrumental activities of daily living were seen in the sarcopenia group than the non-sarcopenia group (all $P<0.05$). There were

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no significant differences in the levels of fasting blood glucose, glycosylated hemoglobin, serum albumin, prealbumin and other hematological indicators (all $P>0.05$). Multivariate logistic regression analysis showed that low BMI ($OR=0.716$, 95% CI 0.609–0.842, $P<0.001$) and assisted walking ($OR=4.391$, 95% CI 1.167–16.512) were influencing factors of sarcopenia in elderly T2DM patients. **Conclusion** The prevalence of sarcopenia is quite high in hospitalized elderly T2DM patients, and it was further increased with age. For the elderly diabetic patients with low BMI and reduced physical function, attention should be paid to the screen and corresponding intervention for sarcopenia.

【**Key words**】 aged; type 2 diabetes mellitus; sarcopenia

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肌少症是一种与年龄相关的骨骼肌质量下降，及肌力和(或)功能下降的老年综合征，增加衰弱、跌倒、抑郁、认知功能减退及死亡风险等不良结局[1,2]，严重影响老年人的生活质量，增加疾病负担。2 型糖尿病(type 2 diabetes mellitus，T2DM)患者肌少症的共病率更高[3]。因此，近年来研究认为，应将肌少症作为老年 T2DM 的共病之一进行筛查和评估[4]。国外报道老年 T2DM 患者中肌少症患病率为 7.0%～29.3%[4,5]。对于老年糖尿病(diabetes mellitus，DM)患者，尤其是高龄患者，评价健康状况更重要的指标是功能状态。国内针对老年 T2DM 患者合并肌少症的报道较少，且缺乏对老年 T2DM 患者共病情况、老年综合征情况及综合管理的临床研究。本研究旨在分析老年住院 T2DM 患者中肌少症的患病情况及其影响因素，探讨基于老年综合评估的老年 T2DM 患者全人管理措施。

1 对象与方法

1.1 研究对象

连续入选 2018 年 1 月至 2019 年 12 月于北京协和医院老年医学科住院治疗，且年龄≥65 岁的 T2DM 患者为研究对象。T2DM 诊断采用世界卫生组织 1999 年诊断标准[6]。排除标准：(1)失语、谵妄或因严重认知功能障碍而无法交流；(2)合并帕金森综合征、严重骨关节病影响躯体活动，或正在治疗的肿瘤患者；(3)体内放置金属支架或起搏器；(4)病情不稳定，不同意参与研究，量表信息或评估资料不全者。本研究获得北京协和医院伦理委员会审批(批准文号：S589)。入选者均签署知情同意书。

1.2 方法

建立临床数据库，详细记录研究对象的年龄、性别、身高、体质量并计算体质量指数(body mass index，BMI)；记录高血压、慢性肾脏病、焦虑/抑郁等基础疾病情况及糖尿病靶器官病变情况。所有入选患者在住院次日清晨空腹取血，检测白细胞总数(white blood cell count，WBC)、血红蛋白(hemoglobin，HGB)、空腹血糖(fasting blood glucose，FBG)、糖化血红蛋白(glycosylated hemoglobin，HbA1c)、肌酐(creatinine，Cr)、血浆总胆固醇(total cholesterol，TC)、甘油三酯(triglycerides，TG)、高密度脂蛋白胆固醇(high-density lipoprotein cholesterol，HDL-C)、低密度脂蛋白胆固醇(low-density lipoprotein cholesterol，LDL-C)、血清白蛋白(albumin，ALB)、前白蛋白(prealbumin，PA)、超敏 C 反应蛋白(high-sensitivity C-reactive protein，hs-CRP)等指标。在完成常规检测的基础上进行肌少症筛查及老年评估(comprehensive geriatric assessment，CGA)。评估者均为接受过标准化 CGA 培训 1 周的老年科医师。

1.2.1 肌少症评估 肌肉功能评估包括测量握力、步速、5 次坐立试验及平衡测试。握力测量采用 Jamar 手握力计，嘱患者双手各进行 2 次握力检测，取握力的最大值进行研究。步速测量采用 6 m 步速测量，计算步速(m/s)。5 次起坐时间测试为患者坐于高 43 cm 无扶手的椅子上，双手交叉于胸前，双脚着地，背部不倚靠椅背。在听到开始命令后，以最快速度完成 5 次起立与坐下动作。记录患者完成 5 次动作的时间，测试数值越小，表明从坐到站动作能力越好。平衡测试为测量全足距站立，站立时间<12 s 为不能完成测试[7]。根据 2014 年亚洲肌少症工作组(Asian working group of sarcopenia，AWGS)制定的亚洲肌少症诊断标准进行诊断[8]。(1)步行速度切点：6 m 日常步行速度评估≤0.8 m/s；(2)握力切点：男性<26 kg，女性<18 kg。存在上述(1)和(或)(2)情况时，进一步采用生物电阻抗法(韩国 Biospace 公司 Inbody720 型身体成分测试仪)测量肌肉质量，计算四肢骨骼肌指数(appendicular skeletal muscle index，ASMI)。ASMI=四肢骨骼肌量(kg)/身高^2(m^2)。ASIM<7.0 kg/m^2(男性)或<5.7 g/m^2(女性)时诊断

为肌少症。

1.2.2 其他老年评估 (1)应用 Katz 日常生活能力量表(Katz index of independence in activities of daily living, Katz ADL)[9]评估患者的基本日常生活活动,包括如厕、进食、穿衣、洗澡、梳洗及行走 6 项内容;(2)应用 Lawton 工具性日常生活活动能力量表(Lawton instrumental activities of daily living scale, Lawton IADL)量表[10]评估患者的工具性日常生活活动能力,包括使用交通工具、做饭、服药、洗衣、打电话、理财、购物及做家务 8 项内容;(3)应用 Charlson 共病指数[11](Charlson comorbidity index, CCI)评估患者的共病情况;(4)核查患者长期用药,评估是否存在多重用药(polypharmacy),即同时使用≥5 种药物(包括非处方药、中药、保健品);(5)采用微营养评估简表(mini nutritional assessment short form, MNA-SF)评估患者的营养状况(≤7 提示营养不良,8~11 分提示营养风险)[12];(6)询问患者 1 年内跌倒史,是否合并尿失禁、焦虑、抑郁及居住情况。

1.3 统计学处理

采用 SPSS 24.0 软件对数据进行统计分析。正态分布的计量资料以均数±标准差($\bar{x}\pm s$)表示,组间比较采用独立样本 t 检验;非正态分布的计量资料以中位数(四分位数间距)[$M(Q_1, Q_3)$]表示,组间比较采用 Wilcoxon 秩和检验。计数资料以例数(百分率)表示,组间比较使用 χ^2 检验或 Fisher 精确概率法。采用多因素 logistic 回归模型分析老年 T2DM 患者合并肌少症的影响因素。$P<0.05$ 为差异有统计学意义。

2 结 果

2.1 患者一般资料、老年评估指标及血清学指标情况

本研究共纳入资料完整、年龄≥65 岁的老年 T2DM 住院患者 225 例,其中男性占 52.4%(118/225),中位年龄 70 岁(65~93 岁),中位住院时间 11 d。肌少症患者 59 例(肌少症组),非肌少症患者 166 例(非肌少症组)。患者一般资料、老年评估指标及血清学指标情况详见表 1。

与无肌少症组比较,肌少症组具有以下临床特征:(1)年龄更大、男性比例及 BMI 水平较低(P 均<0.05);(2)合并糖尿病靶器官病变的比例更高、住院时间更长(均 $P<0.05$);(3)MNA-SF 分值较低,既往有跌倒史、合并尿失禁、需要辅助行走的比例更高(均 $P<0.05$);(4)基本日常生活活动(activities of daily living, ADL)、工具性日常生活活动(instrumental activities of daily living, IADL)分值、手握力及步速明显低于无肌少症组(均 $P<0.05$);(5)5 次起坐时间明显延长,不能完成全足距测试的比例明显高于无肌少症组($P<0.05$);(6)血肌酐水平较高($P<0.05$),空腹血糖、糖化血红蛋白、血白蛋白及前白蛋白等其他血清学指标的差异均无统计学意义(均 $P>0.05$)。

2.2 肌少症在不同性别及年龄段 T2DM 患者中的分布情况

肌少症在 65 岁≤年龄<70 岁,70 岁≤年龄<75 岁,75 岁≤年龄<80 岁及≥80 岁 T2DM 患者中的患病率分别为 7.1%, 14.3%, 29.4% 及 56.4%,患病率随年龄增长显著增加,差异有统计学意义($P<0.001$)。肌少症在不同性别、年龄段的患病率详见表 2。

2.3 老年 T2DM 患者合并肌少症的多因素 logistic 回归分析

将肌少症组与无肌少症组患者的一般资料进行单因素回归分析,结果显示,影响老年 T2DM 患者合并肌少症的相关因素包括年龄、性别、合并糖尿病靶器官病变、住院时间、BMI、跌倒史、合并尿失禁、独居、需要辅助行走、MNA-SF 评分、ADL 评分、IADL 评分、5 次起坐时间、不能完成全足距测试及血肌酐水平(均 $P<0.05$)。将单因素分析中与肌少症相关的因素进一步进行多因素 logistic 回归分析,结果显示:低 BMI($OR=0.716$, 95% CI 0.609~0.842, $P<0.001$)和需要辅助行走($OR=4.391$, 95% CI 1.167~16.512, $P=0.029$)是老年 T2DM 患者合并肌少症的影响因素(表 3)。

3 讨 论

近年来,肌少症对 DM、慢性心力衰竭、冠心病等心血管及代谢性疾病老年患者生活质量及预后的影响越来越受到关注[5,13,14]。本研究结果显示,26.2%的住院老年 T2DM 患者合并肌少症。根据 2014 年亚洲肌少症工作组诊断标准,英文文献报道的肌少症在老年 T2DM 患者中的患病率为 7.0%~28.8%[15-17]。肌少症在 DM 患者中的患病率明显高于血糖正常人群[18]。近期的一项 meta 分析入选 1 832 例 T2DM 患者,其中 1 159 例患者合并肌少症,同时入选 4 694 名血糖正常者作为对照。结果显示,T2DM 患者中肌少症的患病率显著高于血糖正常人群($OR=1.55$, 95% CI 1.25~1.91, $P<0.001$)[19]。

表 1 2 组患者一般资料和老年评估及血清学指标比较

Table 1 Comparison of baseline data, geriatric assessment and serological indexes in patients between two groups

Item	Total (n=225)	Sarcopenic group (n=59)	Non-sarcopenic group (n=166)	$Z/t/\chi^2$	P value
Baseline data					
Age[years, $M(Q_1,Q_3)$]	74.0(69.5,79.0)	80.0(76.0,84.0)	72.0(69.0,77.0)	−6.075	<0.001
Male[n(%)]	118(52.4)	16(27.1)	102(61.4)	20.566	<0.001
High school education and above[n(%)]	107(47.6)	25(42.4)	82(49.4)	0.861	0.353
Family history of diabetes mellitus[n(%)]	39(17.3)	10(16.9)	29(17.5)	0.008	0.928
Complicated with diabetic target organ lesions [n(%)]	91(40.4)	32(54.2)	59(35.5)	6.316	0.012
Receiving insulin treatment[n(%)]	76(33.8)	24(40.7)	52(31.3)	1.702	0.192
Hospitalization day[d, $M(Q_1,Q_3)$)]	11.0(7.0,15.0)	14.0(10.0,17.0)	10.0(7.0,14.0)	−3.507	<0.001
Body mass index(kg/m^2, $\bar{x}\pm s$)	24.6±0.3	21.4±3.5	25.7±3.4	−8.120	<0.001
Geriatric assessment index					
MNA-SF score[points, $M(Q_1,Q_3)$]	12.0(11.0,13.0)	11.0(10.0,12.0)	12.0(11.0,14.0)	−3.603	<0.001
Five-times sit-to-stand[s, $M(Q_1,Q_3)$]	13.2(10.9,18.5)	20.9(15.7,27.8)	11.8(10.0,14.9)	−8.164	<0.001
Grip strength[kg, $M(Q_1,Q_3)$])	24.9(18.8,32.1)	16.7(14.0,22.0)	27.8(22.4,33.4)	−8.701	<0.001
Walking speed[m/s, $\bar{x}\pm s$]	0.82±0.02	0.57±0.18	0.91±0.23	−10.655	<0.001
Failure to complete full tandem stance[n(%)]	65(28.9)	33(55.9)	32(19.3)	28.469	<0.001
Assisted walking[n(%)]	45(20.0)	26(44.1)	19(11.4)	28.952	<0.001
ADL score[points,$M(Q_1,Q_3)$]	6.0(5.0,6.0)	5.0(4.0,6.0)	6.0(5.0,6.0)	−5.907	<0.001
IADL score[points,$M(Q_1,Q_3)$]	8.0(6.0,8.0)	6.0(5.0,7.0)	8.0(7.0,8.0)	−6.883	<0.001
Charlson comorbidity index[$M(Q_1,Q_3)$]	2.0(1.0,3.0)	2.0(1.0,3.0)	2.0(1.0,3.0)	−1.803	0.071
Long-term medication use[$M(Q_1,Q_3)$]	8.0(6.0,10.0)	8.0(6.0,11.0)	8.0(6.0,9.0)	−1.444	0.149
Polypharmacy[n(%)]	201(89.3)	51(86.4)	150(90.4)	0.702	0.402
History of falls[n(%)]	63(28.0)	23(39.0)	40(24.1)	4.785	0.029
Urinary incontinence[n(%)]	61(27.1)	28(47.5)	33(19.9)	16.753	<0.001
Living alone[n(%)]	22(9.8)	11(18.6)	11(6.6)	7.126	0.008
Complicated with anxiety/depression [n(%)]	17(7.6)	5(8.5)	12(7.2)	−*	0.777
Serological index[$M(Q_1,Q_3)$]					
Albumin(g/L)	40.0(38.0,43.0)	40.0(37.3,42.0)	40.1(38.0,43.3)	−1.397	0.163
Prealbumin(mg/L)	230.0(203.0,266.5)	226.0(200.0,250.0)	234.00(207.8,270.0)	−1.806	0.071
Fasting blood glucose(mmol/L)	6.4(5.3,8.1)	6.3(5.5,8.8)	6.4(5.2,7.8)	−0.504	0.614
Glycosylated hemoglobin(%)	7.2(6.5,8.2)	7.2(6.6,8.2)	7.2(6.4,8.1)	−0.644	0.519
Creatinine(μmol/L)	77.4(62.6,95.0)	85.0(65.0,126.0)	75.5(62.1,92.0)	−1.968	0.049
Uric acid(mmol/L)	333.6(277.5,401.5)	343.0(280.0,432.0)	332.4(274.5,390.8)	−0.795	0.427
Homocysteine(mmol/L)	11.7(9.7,13.6)	12.3(10.6,13.9)	11.3(9.5,13.3)	−1.847	0.065
High-sensitivity C-reactive protein(mg/L)	1.7(0.6,3.5)	2.3(0.7,5.1)	1.6(0.6,3.0)	−1.731	0.083
Total cholesterol(mmol/L)	3.7(3.2,4.3)	3.7(3.3,4.4)	3.7(3.1,4.3)	−1.126	0.260
Triglycerides(mmol/L)	1.4(1.0,1.9)	1.2(0.9,1.9)	1.4(1.0,1.9)	−0.838	0.402
Low-density lipoprotein cholesterol(mmol/L)	1.9(1.5,2.4)	2.0(1.6,2.4)	1.9(1.5,2.4)	−0.233	0.816

MNA-SF: mini nutritional assessment short form; ADL: activities of daily living; IADL: instrumental activities of daily living. * Fisher exact probability.

表 2 肌少症在不同性别及年龄段 T2DM 患者中的分布情况

Table 2 Distribution of sarcopenia in T2DM patients with different gender and ages

Age(years)	Total(n)	Sarcopenia[n(%)]	Females(n)	Female sarcopenia[n(%)]	Males(n)	Male sarcopenia[n(%)]
65≤age<70	56	4(7.1)	21	3(14.3)	35	1(2.9)
70≤age<75	63	9(14.3)	31	8(25.8)	32	1(3.1)
75≤age<80	51	15(29.4)	31	14(45.2)	20	1(5.0)
Age≥80	55	31(56.4)	24	18(75.0)	31	13(41.9)
χ^2		41.273		20.948		23.104
P value		<0.001		<0.001		<0.001

表3 老年T2DM患者合并肌少症的多因素logistic回归分析

Table 3 Multivariate logistic regression analysis of sarcopenia in elderly T2DM patients

Factor	*B*	*SE*	*Wald*	*P* value	*OR*	95%*CI*
Body mass index	−0.334	0.083	16.330	<0.001	0.716	0.609−0.842
Assisted walking	1.479	0.676	4.792	0.029	4.391	1.167−16.512
Grip strength	−0.235	0.056	17.727	<0.001	0.790	0.709−0.882
Walking speed	−0.600	0.171	12.323	<0.001	0.549	0.393−0.767

本研究还发现,合并肌少症的老年T2DM患者不仅合并糖尿病靶器官病变的比例更高,有跌倒史、尿失禁、躯体功能减退(IADL、ADL下降,需要辅助行走及不能完成全足距测试)、独居的比率也显著升高,住院时间更长。同时,本研究中,高达89.3%的老年T2DM患者存在多重用药。提示在临床工作中,对老年T2DM患者管理血糖及DM并发症的同时,还应通过老年评估识别上述问题,通过包括老年科医师、营养师、康复师及临床药师等在内的老年跨学科团队查房,制定相应的营养支持、药物重整、康复训练及中长期照料等方案,对合并肌少症的老年T2DM患者进行协同管理。

本研究中,合并肌少症的T2DM患者中位年龄明显高于无肌少症患者,且肌少症的检出率随增龄而明显升高。近期12篇关于老年T2DM合并肌少症患者的回顾性分析显示,合并肌少症的老年T2DM患者中位年龄为73.6岁,而无肌少症患者的中位年龄为67.2岁,合并肌少症患者年龄显著高于无肌少症患者[20]。本研究中,女性患者肌少症的检出率明显高于男性。肌少症在男性还是女性T2DM患者中的患病率更高,研究结论不一致。回顾近3年发表的19项老年T2DM患者合并肌少症相关的临床研究,其中3项研究提示男性患者肌少症患病率明显高于女性[5,16,18];2项研究显示女性肌少症的患病率显著高于男性[21,22];其余14项研究则显示,不同性别T2DM患者中肌少症的患病率无显著差异[15,17,23]。性别对老年T2DM患者发生肌少症的影响,有待今后更大样本量的临床研究及高质量荟萃分析明确。

本研究结果显示,低BMI及需要辅助行走是老年T2DM患者合并肌少症的影响因素。何清华等[24]对北京地区1 125例≥50岁T2DM患者的横断面研究显示,BMI较低(*OR*=0.241, 95%*CI* 0.138~0.421)是肌少症患病的相关危险因素之一。Cui等[25]对132例≥65岁T2DM患者的横断面分析显示,较高的BMI值是老年T2DM患者合并肌少症的保护性因素(*OR*=0.365, 95%*CI* 0.236~0.661)。吴丽娟等[26]对亚洲地区老年T2DM患者肌少症患病率和影响因素的meta分析显示,低BMI(*OR*=−2.35, 95%*CI* −1.08~−5.11)亦是老年T2DM患者发生肌少症的危险因素之一。本研究结果与上述研究结果一致。

T2DM患者发生肌少症可能有以下原因:(1)糖代谢异常加速蛋白质分解代谢,导致肌肉质量减少和功能下降;肌肉质量下降加重胰岛素抵抗,胰岛素抵抗又进一步抑制肌肉蛋白合成[27]。(2)糖代谢紊乱增加炎症细胞因子和活性氧自由基生成,促进糖基化反应,加重T2DM的神经及肌肉病变[28]。长期高血糖促进骨骼肌内晚期糖基化终末产物(advanced glycosylation end products, AGEs)蓄积,而AGEs水平升高与握力、腿部伸展力量下降及步速减慢密切相关[29]。(3)营养相关问题。Okamura等[30]研究显示,合并肌少症老年T2DM患者的总热量摄入显著低于无肌少症患者(1499和1786 kCal/d);校正年龄、性别、运动量、BMI等因素后,热量摄入不足是患者合并肌少症的风险因素(*OR*=0.86, 95%*CI* 0.78~0.95; *P*=0.001)。另一项研究显示,合并肌少症老年T2DM患者ω-3脂肪酸的摄入量明显低于无肌少症患者(2.6和3.0 g/d)[31]。(4)运动不足。多项临床研究显示,合并肌少症的T2DM患者活动量明显低于无肌少症患者[32]。de Freitas等[18]研究显示,步行>5 401步/d可使老年T2DM患者肌少症的患病风险下降70%。(5)肌肉间脂肪组织浸润。肌肉间脂肪组织(intermuscular adipose tissue, IMAT)浸润与多种疾病状态下骨骼肌力量下降和身体躯体功能减退有相关性,并与胰岛素抵抗、亚临床动脉粥样硬化及代谢综合征相关,且与胰岛素敏感性呈负相关[33]。Sachs等[34]研究显示,IMAT可能是调节骨骼肌对胰岛素敏感性的重要因子,并可能是改善胰岛素抵抗的新治疗靶点。

本研究中,合并肌少症的患者营养相关指标(MNA-SF评分)明显低于无肌少症患者,故需要关

注伴有肌肉功能下降的老年 T2DM 患者的营养状况。此外,老年 T2DM 患者肌少症、衰弱及营养不良存在重叠现象。故应基于老年评估结果,为老年 T2DM 患者制定个体化血糖管理方案,同时纠正引起上述老年综合征的可逆因素。

本研究存在一定的局限性。(1)样本量小,今后应进一步扩大样本量,并随访肌少症对老年 T2DM 患者预后及生活质量的影响。(2)本研究仅为单中心研究,入选患者可能存在选择偏倚,因此,本研究获得的肌少症的患病比例有待更大样本的多中心研究验证。(3)本研究为观察性研究,未能提出针对老年 T2DM 人群合并肌少症的干预措施。基于本研究结果,肌少症在住院老年 T2DM 患者中的患病率较高,而临床医师对此认识尚不足。因此,我们建议对于低 BMI、躯体功能下降的老年 T2DM 患者,应筛查肌少症并进行相应干预。

【参考文献】

[1] Vetrano DL, Landi F, Volpato S, *et al*. Association of sarcopenia with short- and long-term mortality in older adults admitted to acute care wards: results from the CRIME study[J]. J Gerontol A Biol Sci Med Sci, 2014, 69(9): 1154-1161. DOI: 10.1093/gerona/glu034.

[2] Chang KV, Hsu TH, Wu WT, *et al*. Association between sarcopenia and cognitive impairment: a systematic review and meta-analysis[J]. J Am Med Dir Assoc, 2016, 17(12): 1164. e7-e1164. e15. DOI: 10.1016/j.jamda.2016.09.013.

[3] Guerrero N, Bunout D, Hirsch S, *et al*. Premature loss of muscle mass and function in type 2 diabetes[J]. Diabetes Res Clin Pract, 2016, 117: 32-38. DOI: 10.1016/j.diabres.2016.04.011.

[4] Liccini A, Malmstrom TK. Frailty and sarcopenia as predictors of adverse health outcomes in persons with diabetes mellitus[J]. J Am Med Dir Assoc, 2016, 17(9): 846-851. DOI: 10.1016/j.jamda.2016.07.007.

[5] Fukuda T, Bouchi R, Takeuchi T, *et al*. Sarcopenic obesity assessed using dual energy X-ray absorptiometry (DXA) can predict cardiovascular disease in patients with type 2 diabetes: a retrospective observational study[J]. Cardiovasc Diabetol, 2018, 17(1): 55. DOI: 10.1186/s12933-018-0700-5.

[6] Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation[J]. Diabet Med, 1998, 15(7): 539-553. DOI: 10.1002/(SICI)1096-9136(199807)15:7<539::AID-DIA668>3.0.CO;2-S.

[7] Gohil RA, Mockford KA, Mazari F, *et al*. Balance impairment, physical ability, and its link with disease severity in patients with intermittent claudication[J]. Ann Vasc Surg, 2013, 27(1): 68-74. DOI: 10.1016/j.avsg.2012.05.005.

[8] Chen LK, Liu LK, Woo J, *et al*. Sarcopenia in Asia: consensus report of the Asian Working Group for Sarcopenia[J]. J Am Med Dir Assoc, 2014, 15(2): 95101. DOI: 10.1016/j.jamda.2013.11.025.

[9] Arik G, Varan HD, Yavuz BB, *et al*. Validation of Katz index of independence in activities of daily living in Turkish older adults[J]. Arch Gerontol Geriatr, 2015, 61(3): 344-350. DOI: 10.1016/j.archger.2015.08.019.

[10] Bier N, Belchior Pda C, Paquette G, *et al*. The instrumental activity of daily living profile in aging: a feasibility study[J]. J Alzheimers Dis, 2016, 52(4): 1361-1371. DOI: 10.3233/JAD-150957.

[11] Brusselaers N, Lagergren J. The Charlson comorbidity index in registry-based research[J]. Methods Inf Med, 2017, 56(5): 401-406. DOI: 10.3414/ME17-01-0051.

[12] KorenHakim T, Weiss A, Hershkovitz A, *et al*. Comparing the adequacy of the MNASF, NRS2002 and MUST nutritional tools in assessing malnutrition in hip fracture operated elderly patients[J]. Clin Nutr, 2016, 35(5): 10531058. DOI: 10.1016/j.clnu.2015.07.014.

[13] Emami A, Saitoh M, Valentova M, *et al*. Comparison of sarcopenia and cachexia in men with chronic heart failure: results from the Studies Investigating Comorbidities Aggravating Heart Failure (SICAHF)[J]. Eur J Heart Fail, 2018, 20(11): 15801587. DOI: 10.1002/ejhf.1304.

[14] Zhang N, Zhu WL, Liu XH, *et al*. Prevalence and prognostic implications of sarcopenia in older patients with coronary heart disease[J]. J Geriatr Cardiol, 2019, 16(10): 756-763. DOI: 10.11909/j.issn.1671-5411.

[15] Kaji A, Hashimoto Y, Kobayashi Y, *et al*. Sarcopenia is associated with tongue pressure in older patients with type 2 diabetes: a cross-sectional study of the KAMOGAWA-DM cohort study[J]. Geriatr Gerontol Int, 2019, 19(2): 153-158. DOI: 10.1111/ggi.13577.

[16] Sazlina SG, Lee PY, Chan YM, *et al*. The prevalence and factors associated with sarcopenia among community living elderly with type 2 diabetes mellitus in primary care clinics in Malaysia[J]. PLoS One, 2020, 15(5): e0233299. DOI: 10.1371/journal.pone.0233299.

[17] Bouchi R, Fukuda T, Takeuchi T, *et al*. Sarcopenia is associated with incident albuminuria in patients with type 2 diabetes: a retrospective observational study[J]. J Diabetes Investig, 2017, 8(6): 783-787. DOI: 10.1111/jdi.12636.

[18] de Freitas MM, de Oliveira VLP, Grassi T, *et al*. Difference in sarcopenia prevalence and associated factors according to 2010 and 2018 European consensus (EWGSOP) in elderly patients with type 2 diabetes mellitus[J]. Exp Gerontol, 2020, 132(4):

110835. DOI: 10.1016/j.exger.2020.110835.

[19] Anagnostis P, Gkekas NK, Achilla C. Type 2 diabetes mellitus is associated with increased risk of sarcopenia: a systematic review and meta-analysis[J]. Calcif Tissue Int, 2020, 107(5): 453-463. DOI: 10.1007/s00223-020-00742-y.

[20] Izzo A, Massimino E, Riccardi G, *et al*. A narrative review on sarcopenia in type 2 diabetes mellitus: prevalence and associated factors[J]. Nutrients, 2021, 13(1): 183. DOI: 10.3390/nu13010183.

[21] Ida S, Nakai M, Ito S, *et al*. Association between sarcopenia and mild cognitive impairment using the Japanese version of the SARC-F in elderly patients with diabetes[J]. J Am Med Dir Assoc, 2017, 18(9): 809.e9-809.e13. DOI: 10.1016/j.jamda.2017.06.012.

[22] Chen F, Xu S, Wang Y, *et al*. Risk factors for sarcopenia in the elderly with type 2 diabetes mellitus and the effect of metformin[J]. J Diabetes Res, 2020, 2020: 3950404. DOI: 10.1155/2020/3950404.

[23] Osaka T, Hamaguchi M, Hashimoto Y, *et al*. Decreased the creatinine to cystatin C ratio is a surrogate marker of sarcopenia in patients with type 2 diabetes[J]. Diabetes Res Clin Pract, 2018, 139: 52-58. DOI: 10.1016/j.diabres.2018.02.025.

[24] 何清华, 孙明晓, 岳燕芬, 等. 北京地区中老年2型糖尿病患者肌少症患病率研究及影响因素分析[J]. 中华糖尿病杂志, 2019, 11(5): 328-333. DOI: 10.3760/cma.j.issn.1674-5809.2019.05.004.

He QH, Sun MX, Yue YF, *et al*. Prevalence and determinant factors of sarcopenia in middle aged and elderly patients with type 2 diabetes mellitus in Beijing[J]. Chin J Diabetes Mellitus, 2019, 11(5): 328-333. DOI: 10.3760/cma.j.issn.1674-5809.2019.05.004.

[25] Cui M, Gang X, Wang G, *et al*. A cross-sectional study: associations between sarcopenia and clinical characteristics of patients with type 2 diabetes[J]. Medicine, 2020, 99(2): e18708. DOI: 10.1097/MD.0000000000018708.

[26] 吴丽娟, 郭太林, 李小明, 等. 亚洲地区老年2型糖尿病患者肌少症患病率和影响因素的Meta分析[J]. 中国糖尿病杂志, 2020, 28(9): 651-656. DOI: 10.3969/j.issn.1006-6187.2020.09.003.

Wu LJ, Guo TL, Li XM, *et al*. Prevalence and risk factors of sarcopenia in elderly patients with type 2 diabetes mellitus in Asia: a meta-analysis[J]. Chin J Diabetes, 2020, 28(9): 651-656. DOI: 10.3969/j.issn.1006-6187.2020.09.003.

[27] Visser M, Goodpaster BH, Kritchevsky SB, *et al*. Muscle mass, muscle strength, and muscle fat infiltration as predictors of incident mobility limitations in well-functioning older persons[J]. J Gerontol A Biol Sci Med Sci, 2005, 60(3): 324-333. DOI: 10.1093/gerona/60.3.324.

[28] Mesinovic J, Zengin A, De Courten B, *et al*. Sarcopenia and type 2 diabetes mellitus: a bidirectional relationship[J]. Diabetes Metab Syndr Obes, 2019, 12: 1057-1072. DOI: 10.2147/DMSO.S186600.

[29] Tabara Y, Ikezoe T, Yamanaka M, *et al*. Advanced glycation end product accumulation is associated with low skeletal muscle mass, weak muscle strength, and reduced bone density: the Nagahama study[J]. J Gerontol A Biol Sci Med Sci, 2019, 74(9): 1446-1453. DOI: 10.1093/gerona/gly233.

[30] Okamura T, Miki A, Hashimoto Y, *et al*. Shortage of energy intake rather than protein is associated with sarcopenia in early patients with type 2 diabetes: a cross-sectional study of the KAMOGAWA-DM cohort[J]. J Diabetes, 2019, 11(6): 477-483. DOI: 10.1111/1753-0407.12874.

[31] Okamura T, Hashimoto Y, Miki A, *et al*. Reduced dietary omega-3 fatty acids intake is associated with sarcopenia in elderly patients with type 2 diabetes: a cross-sectional study of KAMOGAWA-DM cohort study[J]. J Clin Biochem Nutr, 2020, 66(3): 233-237. DOI: 10.3164/jcbn.19-85.

[32] Bowden Davies KA, Pickles S, Sprung VS, *et al*. Reduced physical activity in young and older adults: metabolic and musculoskeletal implications[J]. Ther Adv Endocrinol Metab, 2019, 10: 2042018819888824. DOI: 10.1177/2042018819888824.

[33] Aas SN, Breit M, Karsrud S, *et al*. Musculoskeletal adaptations to strength training in frail elderly: a matter of quantity or quality?[J]. J Cachexia Sarcopenia Muscle, 2020, 11(3): 663-677. DOI: 10.1002/jcsm.12543.

[34] Sachs S, Zarini S, Kahn DE, *et al*. Intermuscular adipose tissue directly modulates skeletal muscle insulin sensitivity in humans[J]. Am J Physiol Endocrinol Metab, 2019, 316(5): E866-E879. DOI: 10.1152/ajpendo.00243.2018.

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