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· 综述 ·

肌少症的 CT、MR 诊断及临床意义

齐萌 张思伟* 刘波
广东省中医院影像科,广东 广州 510120

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摘要: 肌少症(sarcopenia)于 1997 年被正式定义,是一种与年龄相关、全身广泛性复杂综合征,主要特征为骨骼肌量减少、肌力下降和功能减退。肌少症发病率随年龄增大而逐渐增高,明显降低老年人的生活质量,提高老年人群死亡率,给家庭及社会带来了极大的负面影响。近年来肌少症受到国内外学者越来越多的关注。肌量的评估是诊断肌少症的重要方面。双能 X 线及生物电阻抗可测量全身肌量,但是精确程度不高。CT 与 MR 目前被认为是评估骨骼肌量的形态学金标准。CT、MR 骨骼肌形态学相关研究,与骨质疏松及脆性骨折的发生有密切关系,可以对老年人及各种疾病患者的预后及生存率进行预测,并对身体成分及增肌训练的效果进行监测。临床在进行 CT 及 MR 检查,尤其是对老年人进行检查的同时应注意对肌少症的筛查与诊断。本文就肌少症的 CT、MR 诊断及其临床意义做一综述。

关键词: 肌少症;CT;MR;临床意义

Clinical significance and diagnosis of sarcopenia with CT and MR

QI Meng, ZHANG Siwei*, LIU Bo
Department of Imaging, Guangdong Provincial Hospital of Traditional Chinese Medicine, Guangzhou 510120, China
* Corresponding author: ZHANG Siwei, Email: z_siwei@163.com

Abstract: Sarcopenia is first proposed in 1997. It is a age-related, systematic, and complicated syndrome, characterized by reduction of skeletal muscle volume and decrease of skeletal muscle strength and function. The incidence rate sarcopenia gradually increases with increasing age. It seriously affects the quality of life of the elderly, increases mortality, and brings a significant burden to the family and community. Sarcopenia has attracted more and more attention from domestic and foreign scholars in recent years. The assessment of muscle mass is an important aspect for diagnosis of sarcopenia. The whole body mass can be measured using dual energy X-ray (DXA) and bioelectrical impedance analysis (BIA), but the accuracy is low. CT and MR are currently considered as morphological gold standards for assessing skeletal muscle mass. Studies with CT and MR show that skeletal muscle morphology is closely related to osteoporosis and the occurrence of brittle fracture. It can predict the prognosis and survival of the elderly and patients with various diseases, and monitor body composition and the effect of muscle training. It should be paid more attention to the screening and diagnosis of sarcopenia in clinical CT and MR examination, especially for the elderly. This article reviews the diagnosis of sarcopenia with CT and MR and its clinical significance.

Key words: sarcopenia; CT; MR; clinical significance

肌少症是一种以骨骼肌肌量减少及功能减退为主要特点的综合征,与机体老化密切相关,多种慢性疾病也会导致此症发生[1-3]。人口老龄化已成为突出的社会问题,同时肌少症也得到了越来越多的关注[4]。但目前肌少症发病原因、发病机制等尚待进一步明确,因此深入对肌少症的系统研究对相关医学领域的发展有重要意义。

肌少症的诊断标准目前仍存在争议,使用较多的标准多为欧洲老年肌少症研究组[5]、国际肌少症工作组[6]、美国国立卫生研究院基金会等机构提出。临床和研究中肌量的测量主要以双能 X 线吸收仪(dual energy x ray absorptiometry,DXA)、生物电阻抗分析(bioelectrical impedancean alysis,BIA)、周边定量 CT(peripheral quantitative CT)、CT、MR 等作为检查方法。DXA 具有中等成本和复杂性,重现性好。生物电阻抗分析在大多数医疗环境中较便宜且易于实现,是临床实践的首选方法。但上述两种方法的精确性及针对性均较差,受检查环境及身体其

* 通信作者: 张思伟,Email:z_siwei@163.com

他成分的影响较大[7]。定量 CT 测量结果差距较大,在兴趣区和测量方案选择一致性上受到限制[8]。CT 与 MR 目前被认为是评估身体成分的金标准,二者的扫描可提供精确的解剖细节,特别是可用于评估骨骼肌体积。此外,它们是唯一可以直接评估内脏和皮下脂肪含量的检查方法。且临床实践中患者进行 CT、MR 检查的同时即可观察骨骼肌情况,并不增加辐射量及费用。对其进行深入研究对临床诊断、治疗及康复训练均有重大意义。本文就肌少症的 CT、MR 诊断及两者的临床意义做一综述。

1 肌少症的 CT 诊断

CT 测量肌量是基于肌肉与其他组织 CT 值的差异,图形软件可对此加以区别并自动测量。目前国外文献 CT 测量的部位包括腹部、大腿及上臂等,最常用的部位为第 3 腰椎层面,包括测量肌肉横断面面积(cross sectional area, CSA)及骨骼肌指数(skeletal muscle index, SMI),即 CSA 与身高比值的平方[9]。一般由第三方软件根据 CT 值进行半自动轮廓勾画,由研究者手动对骨骼肌边缘进行修整,再由软件计算出轮廓内面积。

CT 诊断肌少症尚无统一阈值。目前大部分文献采用的肌少症诊断阈值范围为 SMI[10]:女性≤39.5~42.1 cm^2/m^2;男性≤42.2~43.0 cm^2/m^2(体质指数 <25 kg/m^2),≤52.0~55.4 cm^2/m^2(体质指数≥25 kg/m^2)。其中最早出现是由 Prado 等[11]定义的阈值,男性 SMI≤52.4 cm^2/m^2,女性≤38.5 cm^2/m^2,也是后期文献中使用较多的界定值。近期,Carey 等[12]通过大型多中心研究推荐使用男性 SMI≤50 cm^2/m^2,女性 SMI≤39 cm^2/m^2 作为诊断终末期肝病患者肌少症的标准,由此可见针对不同疾病,肌肉减少症诊断的阈值也可能存在差异,这也需要更多临床试验或循证方法来验证不同疾病肌少症诊断阈值的可靠性及结局预测的准确性。

CT 在量化脂肪及评估脂肪浸润的肌肉方面是非常可靠的。然而 CT 的骨骼肌测量需要高度专业化的研究人员、专业的软件和相对较长的时间,在广泛应用的过程中也受到高昂成本的阻碍;虽然图像采集所需的时间比 MRI 更短,但也应该考虑到 CT 涉及的辐射暴露问题[13]。

2 肌少症的 MRI 诊断

MR 图像具有非常高的软组织分辨率,可将肌肉与脂肪组织清晰区别,形成明确的肌肉轮廓,测量简单且准确;测量重复性好,对组织结构和成分变化较敏感[14],适用于长期随访和疗效监测。另外,MR 图像还可显示水肿、炎性病变、脂肪浸润、纤维化等改变[15],这是其他影像方法难以做到的。故 MR 可作为骨骼肌形态学测量及成分评估的金标准。

评估影像的序列常用 T1WI,因为该序列图像可清楚区分肌肉和脂肪,使肌肉量化测量更精确。与 CT 相比,MR 对骨骼肌的测量多应用于四肢肌肉,也用于部分头颈部肌肉测量[16]。以股骨近端至远端为大腿全长测量范围,其中间 1/3 段的测量在目前绝大多数文献中都是可实现的,Yang 等[17]认为其中间 50% 层面测量的肌肉面积,最能代表整个大腿肌肉体积,且与肌少症的临床标准关系最密切。MR 常规图像即可对颞肌厚度进行测量,结果与乳腺癌及非小细胞肺癌脑转移患者的生存率息息相关[16]。除常规 MR 对肌肉进行测量或评估外,其余 MR 技术也可用于肌肉的评估[18-19],弥散张量成像、弹性成像、超短回波时间成像等,有望在影像学层面解释骨骼肌解剖和功能之间关系[19];血氧水平依赖成像可对肌肉微循环进行评估,T_2 mapping 可测评肌萎缩状况;高分辨率磁共振光谱可以检测小鼠骨骼肌代谢物与年龄的相关变化[20],从而为未来肌少症的代谢组学调查铺平了道路。但这些先进的 MR 技术均较为复杂,就目前大多数临床机构来讲应用有限,其前景需要进一步验证[21]。

虽然 MR 不涉及放射线暴露并具有优良的定量测量精度,同时能更精确地对脂肪成分进行识别及评估,但由于其成本高,技术困难和空间需求限制了其在临床和研究中的应用,为获取高质量扫描所需的后期处理时间进一步阻碍了大规模应用。另外心脏起搏器、金属假体等检查禁忌缩小了 MR 的应用范围,不同的数据采集协议也影响了 MR 肌量评估的统一及标准化。MR 目前更适合于小规模研究中肌肉数量和质量的准确测量[13]。

3 临床意义

3.1 与骨质疏松及脆性骨折密切相关

多项前瞻性研究[22-24]已证实肌少症与骨质疏松症均是导致骨折的独立危险因子。肌少症是继骨质疏松症之后的临床研究靶点[24]。Bokshan 等[25]认为肌少症患者常发生骨质疏松,而且是独立于骨质疏松的脆性骨折的预测因素,故需要在骨科患者中进行诊断、治疗和预防肌肉减少症的举措。

肌少症在严重的老年髋臼骨折患者中非常常见,与机体能量减低、前柱骨折和 1 年死亡风险显著相关[26]。大多数骨折由跌倒直接诱发,而肌少症可显著增加跌倒风险。一方面肌量减少引起力学负荷减低,可造成废用性骨量降低;另一方面由于 II 型肌肉纤维量减少,可降低肌肉强度,引起身体平衡力下降,更容易导致跌倒发生。

肌少症与骨质疏松症分别累及运动系统的两大器官,二者有着密不可分的关系,内在的联系更是错综复杂[27],主要包括以下方面:①力学影响。骨骼肌的收缩可带动骨骼运动,力学刺激可同时引起肌肉细胞及成骨细胞的分化,相反肌力减低可造成骨骼废用性骨量减少,故老年人或营养不良患者肌少症和骨质疏松常常同时存在;②内分泌调控[24]。部分内分泌因子如维生素 D 的缺乏、雄激素的剥夺等,内分泌疾病如皮质醇增多症、糖尿病、类风湿关节炎[28]等可同时导致肌量和骨量的减低;③代谢调节。Wnt/β-catenin[29]、PI3K/Akt 信号通路已被证实是肌细胞及成骨细胞调节的共同通路[30]。

总之,肌肉与骨骼受以上方面影响,明显增加老年人肌少症和骨质疏松症的患病率,使得肌少症不但与低骨量密切相关,同时明显增加跌倒与骨折的风险。

3.2 预后及结局预测

CT 及 MR 检查在临床实践中被广泛应用,对于肿瘤患者而言,无论是病变的检查、术前评估还是术后的评价及复查,都不可避免地需要进行 CT 或 MR 检查,这也为肌少症 CT 及 MR 诊断的研究提供了大量的病例基础。近几年国外已有不少文章对肌少症及各种肿瘤指标及预后的关系进行了初步探讨,但在国内尚未发现相关文献。

使用 CT 或 MR 图像中肌肉面积测量作为判断肌少症的指标,然后对肿瘤或肿瘤治疗后结局指标进行相关分析,是近几年国外文献中普遍使用的研究思路。在这类文献分析中得出结论,肌少症与胃癌[31]、食管癌[32]、结直肠癌[33]、胰腺癌[34]、肝癌[35]、小细胞肺癌[36]、淋巴瘤[37]、肾癌[38]治疗后的不良结局有显著相关关系,并成为大部分肿瘤预后的独立预测因子。例如 Nakashima 等[39]近期通过分析食管癌切除术患者的资料,发现肌少症患者吻合口漏和院内死亡的发生率明显增高,是食管吻合口漏的危险因子,也是对不良生存预后的显著影响因素。Prado 等[40]总结了 CT 及 MR 等新兴应用的临床价值,突出了肌肉、脂肪等软组织作为发病率和死亡率独立预测因子的重要性,身体组成的健康对于非临床和临床状态的治疗决策、预后生活质量至关重要。Shachar 等[10]通过对 38 个肌少症相关研究进行 Meta 分析,通过循证方法亦证实了上述结论。

另外对于非肿瘤性病变,如肝硬化[41]、呼吸衰竭[41]、腹膜疝修复[42]、动脉瘤修复[43]、紧急剖腹手术[44]预后亦有明显的预测作用。

3.3 机会性筛查

临床实践中 CT 或 MR 应用广泛,尤其是对于老年人,进行 CT 及 MR 检查的机会非常多。在这些情况下进行的 CT 或 MR 检查,除了可以解决临床的实际问题和达到检查目的,还可以同时利用获得图像对骨骼肌进行面积或成分的测量。由此得出的是否患有肌少症的判断,对患者短期及长期生存率的预测均有非常高的参考价值。

Kaplan 等[45]通过机会性筛查肌少症、骨质疏松与老年创伤患者 1 年死亡率关系的研究,指出肌少症与骨质疏松两者均为增加老年创伤后患者 1 年死亡率的独立影响因素,同时提出老年人肌少症及骨质疏松的筛查,对识别创伤后患者的高风险结局,具有潜在的指向性干预作用。早期结直肠癌老年患者中,肌少症普遍存在,在对患者病变进行 CT 评估的同时,对肌少症患者进行识别并及时干预,有利于生存率及生活质量的提高[46]。对于需要进行紧急剖腹手术的急腹症患者,术前的 CT 不但可以对病变进行定位及评估,同时进行的肌少症分析在单变量分析中显著预测死亡率,而且不会额外增加风险或成本,方便用于术前风险评估和咨询[44]。

3.4 身体成分监测

随着年龄增加,肌少症发病率逐渐增高,研究并监测身体组成的兴趣日益增加。监测身体组成对于营养和医疗介入是非常有用的。由于 MR 图像测量的准确性、无辐射性等优势,已成为此类研究的首选检查方法[13]。

MR 图像精确区分肌肉和骨骼、肌肉与肌肉之间的关系,通过对年轻人及老年人大腿组织 MR 图像的测量及对比,Maden-Wilkinson 等[47]发现四头肌比其他大腿肌肉相对地受老化影响更大。

对比测量血流阻力低强度阻力训练(BFR-RT)前后磁共振成像股四头肌的肌肉横截面积(CSA)及心血管指数的变化,得出这种运动可以改善肌肉 CSA 以及最大肌肉力量,但不会对老年人的动脉硬化或肱骨凝血因子产生负面影响[48]。另外通过磁

共振成像获得的大腿中段横截面图像的监测，证明缓慢和强阻力运动可以增加健康老年人的肌肉尺寸和强度[49]。

4 小结

目前来讲，使用 CT、MR 进行骨骼肌量测量的方法、部位均没有统一标准，各地区、各人种使用的具体诊断阈值也不尽相同，但是使用这两种方法对肌少症进行评价的准确性，对临床结局进行预测的价值是肯定的。通过对骨骼肌量的精确监测，可以对肌少症的治疗和干预效果进行评估，从而改善患者的预后，对临床治疗及康复具有重大意义。

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