

【DOI】 10.3969 / j.issn.1671-6450.2026.08.021

综 述

心脏脂肪瘤诊断与治疗研究进展

董维凯,吕智康,刘梦综述 王强审校



基金项目: 国家外国专家项目(H20240729)

作者单位: 210008 南京 南京大学医学院附属鼓楼医院心血管医学中心(董维凯、吕智康、王强); 210008 南京 南京中医药大学附属鼓楼医院临床学院药学院(刘梦)

通信作者: 王强 E-mail: njuwangqiang@ 163.com

【摘 要】 心脏脂肪瘤是一种罕见的心脏肿瘤,临床表现差异较大,可从无症状到出现心律失常、流出道梗阻甚至模拟心肌梗死等恶性样特征。多模态影像学,尤其是心脏磁共振(CMR),凭借脂肪组织特异性信号成为诊断与鉴别诊断的核心工具,可精准评估肿瘤侵犯范围并指导治疗决策。心脏脂肪瘤治疗需个体化,有症状或高危影像特征者应积极手术;心室及浸润性肿瘤切除难度大,预后较差。鉴于缺乏统一诊疗指南,未来需多中心研究明确无症状患者管理策略与手术干预阈值,本文就此作一综述。

【关键词】 心脏脂肪瘤; 临床特征; 诊断; 治疗; 研究进展

【中图分类号】 R732.1

【文献标识码】 A

Research progress on siagnosis and treatment of xardiac lipoma Dong Weikai*, Lyu Zhikang, Liu Meng, Wang Qiang.

* Cardiovascular Medical Center, Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, Jiangsu, Nanjing 210008, China

Funding program: National Foreign Expert Project(H20240729)

Corresponding author: Wang Qiang, E-mail: njuwangqiang@ 163.com

【Abstract】 Cardiac lipoma is a rare type of heart tumor. Its clinical manifestations vary greatly, ranging from asymptomatic to arrhythmias, outflow tract obstruction, and even mimicking myocardial infarction, which may indicate malignancy. Multimodal imaging, especially cardiac magnetic resonance, which relies on the specific signal of fat tissue, serves as a core tool for diagnosis and differential diagnosis. It can accurately assess the extent of tumor invasion and guide treatment decisions. Treatment should be individualized. For patients with symptoms or high-risk imaging features, active surgery should be performed. Resection of ventricular and invasive tumors is technically challenging and associated with poor prognosis. Due to the lack of unified diagnostic and treatment guidelines, future multi-center studies are needed to clarify the management strategies for asymptomatic patients and the threshold for surgical intervention. This article aims to provide a comprehensive review on this topic.

【Key words】 Cardiac lipoma; Clinical characteristics; Diagnosis; Treatment; Research progress

心脏脂肪瘤是一种罕见的心脏肿瘤,由成熟脂肪细胞构成,通常具有完整包膜,可发生于心腔内、心肌内、心外膜或心包等部位^[1]。一项纳入 255 例病例的统计显示,心脏脂肪瘤可分布于心腔(53.1%)、心包(32.5%)、心肌(10.7%) 及多部位(3.7%)。临床表现既可长期无症状,也可因位置特殊或体积巨大而引发致命性心律失常、血流动力学障碍或栓塞事件^[2-5]。尽管总体预后良好,但部分大型或侵袭性脂肪瘤可导致严重并发症,如心律失常、心室流出道梗阻、瓣膜功能障碍甚至心力衰竭^[6-7]。心脏磁共振(cardiac magnetic resonance, CMR) 成像能准确评估肿瘤的位置、大小及其与周围结构的关系^[4,8]。在 CMR 不可用或存在禁忌证时,计算机断层扫描(computed tomography, CT) 亦可提供关键诊断信息^[9]。但目前仍面临诸多问

题: 首先,治疗决策高度依赖个体化评估^[4];其次,无症状患者是否应行手术治疗尚存争议;再次,心脏脂肪瘤与恶性肿瘤的鉴别仍较困难,术前活检及分子检测有助于明确诊断^[1];最后,心室部位肿瘤解剖复杂、易浸润心肌,且与术后恶性心律失常及死亡风险相关^[10]。因此,深入理解心脏脂肪瘤的生物学行为、优化影像诊断策略、明确手术干预阈值,是当前亟待解决的核心问题。

1 心脏脂肪瘤的疾病特征与临床表型

1.1 解剖学分布与病理学亚型 心脏脂肪瘤是一种由成熟脂肪细胞构成的、具有完整包膜的良性原发性心脏肿瘤,可发生于任何年龄,无明显性别差异,占有原发性心脏肿瘤的 2.4%~8.4%^[6,9,11]。其解剖分布具有多样性,可发生于心腔、心

包、心肌及多部位同时受累,具体部位以右心房最为常见,其次为左心室、右心室、房间隔及心外膜下区域^[9-10,12]。一项回顾性研究进一步细化了分布比例:左心室占 40%,右心房或上腔静脉占 35%,右心室占 15%,心外膜间沟和心包各占 5%^[10]。此外,部分病例可表现为跨壁生长,如哑铃形肿瘤同时累及右心房内、外壁,或侵袭性生长延伸至升主动脉和上腔静脉^[7,13]。

在病理学亚型方面,心脏脂肪瘤主要由成熟脂肪细胞构成,通常边界清楚、有包膜^[14]。根据组织学特征,可分为典型脂肪瘤、纤维脂肪瘤、非典型脂肪瘤及浸润性脂肪瘤等亚型。其中,心脏纤维脂肪瘤是一种罕见亚型,组织学上表现为脂肪组织与纤维成分混合,可在尸检中偶然发现^[15]。此外,房间隔脂肪过多症虽在病理分类上有时与真性脂肪瘤区分,但在临床实践中常被纳入脂肪瘤样病变范畴^[16]。值得注意的是,部分脂肪瘤可呈浸润性生长,侵犯心肌甚至瓣膜^[14,17]。

1.2 典型与非典型临床表现 心脏脂肪瘤的临床表现高度依赖于肿瘤的大小、位置及其对邻近结构的影响。多数患者无症状,常在影像学检查中偶然发现^[4,12,18]。然而,当肿瘤体积较大或位于关键解剖区域时,可引发多种症状,严重者可导致多种危及生命的并发症。典型表现包括心悸、胸痛、呼吸困难、头晕甚至晕厥^[12,19-21]。非典型临床表现则更为复杂,包括血流动力学障碍、心律失常或瓣膜功能异常等。左心室流出道梗阻是重要并发症之一,可导致劳力性呼吸困难甚至猝死^[6,8]。心律失常亦较常见,包括非持续性室性心动过速、完全性房室传导阻滞(需植入永久起搏器)以及术后复发性室速^[11,22]。此外,肿瘤侵犯冠状窦或心肌可模拟心肌梗死表现^[23]。极少数情况下,脂肪瘤可累及瓣膜装置,导致瓣膜关闭不全,需行瓣膜置换术^[17]。这些非典型表现提示,即使为良性肿瘤,其临床行为亦可呈现恶性样特征,需高度警惕。

1.3 无症状患者的诊断挑战 尽管心脏脂肪瘤多为良性且生长缓慢,但无症状患者仍面临显著的诊断与管理挑战。首先,由于缺乏特异性症状表现,多数病例依赖影像学发现,常规体检或非心脏相关检查可能成为首次检出途径^[24]。其次,无症状并不等同于无风险,其可导致肿瘤蒂部狭窄、心肌变薄、潜在梗阻风险或心律失常等隐患^[2]。此外,无症状心肌内型脂肪瘤的鉴别尤为困难,因其影像学表现可与心肌梗死后脂肪变性相似^[24]。若未结合多模态影像评估,易导致误诊或漏诊。再者,部分无症状患者拒绝手术,需长期随访监测,但目前尚无统一随访指南^[4,25]。值得注意的是,即使肿瘤较小,也可能因占位效应引起右心房扩张和影响三尖瓣功能,提示不能仅凭体积判断风险^[26]。因此,对无症状患者的评估需综合考虑解剖位置、生长模式、心肌浸润程度及潜在并发症,依赖多模态影像技术进行个体化决策^[2,5,8]。

2 脂肪瘤的诊断技术进展

2.1 影像学诊断 心脏脂肪瘤的诊断依赖于多模态影像技术的综合应用。经胸超声心动图常因其无创、便捷且经济而作为初筛工具,在心脏占位检出方面具有重要价值^[27];经食管超声心动图可提供更高分辨率图像,有助于明确肿瘤起源与毗邻结构关系^[25]。然而,超声心动图在区分脂肪组织与其他回声相

似病变方面存在一定局限性,尤其在心肌内或深部病灶评估时敏感性较低。CT 在识别脂肪密度方面具有优势,典型表现为均匀低密度病灶,有助于初步判断脂肪成分^[28];在 CMR 不可用或存在禁忌证时,增强 CT 仍可有效识别脂肪瘤特征,但其对软组织对比度较低,难以精确评估肿瘤与心肌的浸润关系及功能影响^[9]。相比之下,CMR 凭借其优异的软组织分辨力和多参数成像能力,已成为心脏脂肪瘤诊断的首选影像学方法^[2,4]。

CMR 在心脏脂肪瘤的无创诊断中具有不可替代的核心地位,其高空间和时间分辨率结合多参数序列能够准确识别脂肪组织并与其他心脏占位相鉴别。典型的心脏脂肪瘤在 CMR 上表现为 T1 和 T2 加权像呈高信号、脂肪抑制序列呈低信号等特征性影像^[28-29]。此外,CMR 可清晰显示肿瘤是否位于心腔内、心肌内或心包,并评估其对周围结构的侵犯情况^[1,14]。

CMR 在鉴别真性脂肪瘤方面和非心脏占位方面亦具有重要价值,可避免不必要的活检^[30]。在临床表现不典型的情况下,如非 ST 段抬高型心肌梗死但冠状动脉造影阴性者,CMR 可发现左心室壁占位性病变,从而揭示潜在的心脏脂肪瘤^[23]。此外,其还能评估肿瘤对心脏功能的影响,如是否导致瓣膜反流或心肌变薄^[8,26],并可在术前评估及术后随访中发挥重要作用^[5,31]。

2.2 病理学诊断标准与鉴别诊断要点 尽管影像学技术高度发展,病理学检查仍是确诊心脏脂肪瘤的金标准^[31]。典型心脏脂肪瘤的病理特征为常被薄层纤维组织包裹的、由成熟脂肪细胞构成的团块,镜下可见形态规则、无异型性的脂肪细胞^[26]。部分病例可伴有受压肥大的心肌细胞及间质纤维化,尤其在心肌内型脂肪瘤中更为常见^[28]。罕见亚型如纤维脂肪瘤,则表现为脂肪组织与纤维组织混合增生^[15]。

在鉴别诊断中,最关键的是排除恶性脂肪源性肿瘤,尤其是低级别脂肪肉瘤。当影像学提示非典型特征时,应考虑术前活检以排除恶性可能^[1]。此外,心脏脂肪瘤还需与心肌梗死后脂肪变性及其他良性心脏肿瘤相鉴别,后者通常缺乏典型的脂肪信号特征^[24,32]。完整的病理评估应包括充分取材以覆盖肿瘤异质性区域,推荐采用完整切除标本进行诊断,以确保诊断准确性^[14]。

3 心脏脂肪瘤与其他心脏肿瘤的鉴别诊断

3.1 心脏脂肪肉瘤 心脏脂肪瘤与心脏脂肪肉瘤虽同属脂肪组织来源的心脏肿瘤,但在生物学行为、临床表现及预后方面存在显著差异。心脏脂肪瘤为良性肿瘤,通常边界清晰、有包膜,由成熟脂肪细胞构成,生长缓慢,多数患者无症状或仅有非特异性表现^[14,26,31]。相比之下,心脏脂肪肉瘤属于高度恶性的原发性心脏肿瘤,具有侵袭性强、易复发和转移的特点,可迅速引起心功能不全甚至猝死^[33]。

在病理学层面,心脏脂肪瘤主要由形态一致的成熟脂肪细胞组成,无细胞异型性或核分裂象;而心脏脂肪肉瘤则表现为脂肪母细胞增生、细胞核异型明显,并可出现黏液样基质或去分化区域^[33-34]。值得注意的是,部分心脏脂肪瘤可呈浸润性生长,影像学上与脂肪肉瘤难以区分,此时需依赖组织学检查及分子检测以明确诊断^[1,14]。良性肿瘤总体预后良好,而脂肪肉

瘤患者术后复发或疾病相关死亡风险较高^[35]。

此外,影像代谢特征亦有助于两者鉴别。PET/CT 研究发现,良性心脏肿瘤的标准摄取值显著低于恶性肿瘤,提示高代谢活性更倾向于恶性病变^[36]。因此,在临床疑似恶性但影像学特征不典型时,应积极行活检或术中快速病理以避免误诊误治。

3.2 心脏其他良性肿瘤 心脏脂肪瘤需与多种良性心脏肿瘤(主要包括黏液瘤、横纹肌瘤、纤维瘤及血管瘤等)进行鉴别,这些肿瘤在临床表现上常存在重叠,故影像学成为关键鉴别手段^[37-38]。超声心动图是初步筛查工具:心脏脂肪瘤通常表现为高回声、边界清晰的均质肿块,内部无血流信号,而黏液瘤多呈分叶状、活动度大,常见于左心房,易引起栓塞或瓣膜梗阻^[11 20];横纹肌瘤多见于婴幼儿,常与结节性硬化症相关,表现为心室壁内多发实性结节^[39-40];纤维瘤多位于心室壁,质地较硬,回声较强^[37]。CMR 在鉴别诊断中具有核心地位,脂肪瘤在 T1 加权像呈高信号、脂肪抑制序列信号明显降低,这是其最具特征性的影像标志^[23-24 28];相比之下,黏液瘤在 T1 像呈等或低信号、T2 像高信号,横纹肌瘤在 T1 和 T2 像均呈中等信号,纤维瘤则表现为 T1 低信号、T2 低至中等信号^[37-38]。此外,CMR 还可评估肿瘤与心肌的关系及对传导系统的影响,对治疗决策至关重要^[8 41]。

CT 亦具重要价值,尤其在无法行 CMR 时:心脏脂肪瘤在非增强 CT 上表现为均质低密度病灶、边界清晰、增强后无强化^[9 28],而其他良性肿瘤如血管瘤可呈明显强化、黏液瘤密度不均^[37]。多参数映射研究进一步支持 CMR 在良恶性鉴别中的优势^[41]。综上,尽管心脏脂肪瘤与其他良性心脏肿瘤在临床表现上相似,但通过多模态影像学可有效实现鉴别诊断,从而指导个体化治疗策略^[8 11 38]。

4 心脏脂肪瘤的治疗策略

4.1 手术切除的适应证与禁忌证 手术切除是目前心脏脂肪瘤的主要治疗方式,尤其适用于有症状或存在血流动力学影响的患者。对于出现心悸、胸闷、气促等症状的患者,或影像学提示肿瘤导致流出道梗阻、显著心肌变薄或传导系统受累者,应积极考虑手术干预^[1 8 42]。此外,即使在无症状患者中,若肿瘤具有高风险特征,亦建议行预防性切除^[2 6 8]。Shu 等^[2]的系统综述表明,83.7%的有症状患者接受了肿瘤切除术,而 68.3%的无症状患者也因预防目的接受了手术。然而,手术并非适用于所有情况,对于合并严重基础疾病或手术风险极高的患者,可暂缓手术,转而采用药物控制症状^[30]。心室部位的脂肪瘤因常伴心肌浸润,手术难以完全切除,且与术后恶性心律失常相关,此类病例的手术决策需更为谨慎^[10]。

4.2 微创手术技术的应用进展 近年来,随着微创外科技术的发展,部分心脏脂肪瘤患者已可接受创伤更小的手术方式。对于边界清晰、非浸润性的肿瘤,尤其是位于右心房区域的占位,可采用胸腔镜辅助下微创切除术^[43]。此外,经验丰富的外科团队可结合术中超声进行精准定位,提高肿瘤完整切除率^[44]。然而,当前证据显示微创手术在心脏脂肪瘤中的应用较为有限,在一项纳入 25 例患者的队列中,仅 1 例采用了微创术式^[31]。

对于心室壁内或透壁浸润性病变,微创入路往往难以实现彻底切除,此时仍需依赖传统开胸手术^[10 13 45]。

4.3 无症状患者的保守治疗与长期随访 对于无症状且无高危影像学特征的患者,可采取保守治疗策略并辅以长期随访。例如,1 例 49 岁女性经 CMR 确诊为左心室壁脂肪瘤后选择保守管理,随访期间病情稳定^[23]。保守治疗的核心在于多模态影像学的动态评估,用以监测肿瘤大小变化及新发症状^[4 25 46]。尽管复发罕见,但长期随访仍不可或缺。目前尚无心脏脂肪瘤管理的具体指南^[47],临床实践中多依据个体风险分层制定方案,可每 6~12 个月复查一次心脏影像学检查。

5 小结与展望

心脏脂肪瘤是罕见的良性原发性心脏肿瘤,临床表现高度异质,可无症状偶然发现,亦可引发心律失常、血流动力学障碍等严重并发症。近年来,心脏脂肪瘤的多模态影像学诊断取得重要进展,超声、CT 及 MR 的联合应用可显著提高诊断准确性,手术切除是有症状或高风险患者的主要治疗方式,预后良好^[48-50]。既往研究多聚焦于影像特征与手术技术,缺乏基于“临床表现-解剖-病理”多维度的风险分层框架。因此,可将心脏脂肪瘤分为 4 种功能表型:(1) 惰性型(无症状、非关键部位、包膜完整);(2) 梗阻型(流出道或流入道受累,伴血流动力学改变);(3) 心律失常型(临近或影响传导系统,表现为室性心动过速或传导阻滞等心律失常);(4) 侵袭型(跨壁生长、包膜不完整或与心肌界限模糊)。不同表型在手术指征、随访强度与预后判断上应区别对待:惰性型可优先选择保守观察;梗阻型及心律失常型应积极考虑手术干预;侵袭型需警惕不完全切除及术后复发风险。该分层相较单纯依据肿瘤大小或有无症状更具临床指导价值,有助于推动个体化治疗决策的规范化。治疗方面,有症状或存在高风险影像特征者应积极手术切除,预后大多良好;心室或浸润性肿瘤切除难度大,需警惕术后心律失常。鉴于现有研究多为个案报告,缺乏高质量循证证据和统一诊疗共识,未来亟需开展多中心协作研究,积累结构化数据;同时探索分子标志物以辅助鉴别诊断,并明确无症状患者的长期管理策略,从而推动诊疗规范化与个体化。

参考文献

- [1] D'Souza J, Shah R, Abbass A, et al. Invasive cardiac lipoma: A case report and review of literature [J]. BMC Cardiovasc Disord, 2017, 17(1): 28. DOI: 10.1186/s12872-016-0465-2.
- [2] Shu S, Wang J, Zheng C. From pathogenesis to treatment: A systemic review of cardiac lipoma [J]. J Cardiothorac Surg, 2021, 16(1): 1. DOI: 10.1186/s13019-020-01379-6.
- [3] Rainer WG, Bailey DJ, Hollis HW Jr. Giant cardiac lipoma: Refined hypothesis proposes invagination from extracardiac to intracardiac sites [J]. Tex Heart Inst J, 2016, 43(5): 461-464. DOI: 10.14503/thij-15-5342.
- [4] Shamsi F, Bajwa G, Ghalib H. "Left ventricular lipoma... a rare case", case report [J]. J Cardiothorac Surg, 2020, 15(1): 85. DOI: 10.1186/s13019-020-01122-1.
- [5] Bath AS, Gupta V, Kalavakunta JK. A right atrial fat ball: Rare case of cardiac lipoma [J]. Clin Case Rep, 2019, 7(9): 1798-1799. DOI:

- 10.1002/ccr3.2335.
- [6] Abdelradi A , Yekta A . A case of asymptomatic cardiac lipoma and literature review [J]. *CJC Open* ,2020 ,3(2) : 207-209. DOI: 10.1016/j.cjco.2020.10.002.
- [7] Zhu X , Cheng Z , Wang S , et al. The characteristics of invasive cardiac lipoma: Case report and literature review [J]. *Front Cardiovasc Med* , 2023 ,10: 1195582. DOI: 10.3389/fcvm.2023.1195582.
- [8] Shu S , Yuan H , Kong X , et al. The value of multimodality imaging in diagnosis and treatment of cardiac lipoma [J]. *BMC Med Imaging* , 2021 ,21(1) : 71. DOI: 10.1186/s12880-021-00603-6.
- [9] Gac P , Jaworski A , Parfianowicz A , et al. Cardiac computed tomography as a method of diagnosing the type of cardiac tumor-example of interatrial septal lipoma filling the right atrium [J]. *Diagnostics (Basel)* , 2024 ,14(22) : 2496. DOI: 10.3390/diagnostics14222496.
- [10] Li L , Meng J , Zhou X , et al. Surgical treatment of cardiac lipoma: 20 years' experience in a single center [J]. *Chin Med J (Engl)* , 2023 ,136(5) : 565-570. DOI: 10.1097/cm9.0000000000002585.
- [11] Mazurkiewicz M , Blachut D , Hrapkowitz T , et al. Intracavitary cardiac lipoma: A benign tumour requiring a complex treatment: A case report [J]. *Eur Heart J Case Rep* , 2025 ,9(9) : ytaf436. DOI: 10.1093/ehjcr/ytaf436.
- [12] Song L , Iroegbu CD , Yang J , et al. Surgical management for a rare pedunculated left ventricular apical lipoma: A case report and review of literature [J]. *Front Cardiovasc Med* , 2021 ,8: 723975. DOI: 10.3389/fcvm.2021.723975.
- [13] Zhu J , Cao X , Chen L , et al. Report of a giant invasive , wall-penetrating cardiac lipoma [J]. *J Cardiothorac Surg* ,2024 ,19(1) : 600. DOI: 10.1186/s13019-024-03035-9.
- [14] Shah OA , Badran A , Kaarne M , et al. Right atrial and SVC infiltrating mass-the entity of infiltrating lipoma [J]. *J Cardiothorac Surg* , 2019 ,14(1) : 210. DOI: 10.1186/s13019-019-1015-7.
- [15] Fragkouli K , Mitselou A , Vougiouklakis T. Fibrolipoma of the left ventricle: An uncommon incidental autopsy finding [J]. *Forensic Sci Med Pathol* , 2020 ,16(2) : 362-365. DOI: 10.1007/s12024-019-00197-0.
- [16] Rocha RV , Butany J , Cusimano RJ. Adipose tumors of the heart [J]. *J Card Surg* , 2018 ,33(8) : 432-437. DOI: 10.1111/jocs.13763.
- [17] Xia J , Liu JP , Hong W , et al. Invasive cardiac lipoma at the left ventricular intermuscular region: A case report [J]. *Exp Ther Med* , 2024 ,27(2) : 85. DOI: 10.3892/etm.2024.12373.
- [18] Piran M , Nolting JK , Körperich H , et al. Clinically atypical abdominal manifestation of the lipoma localized in the right atrium: "Invagination hypothesis" revisited [J]. *Echocardiography* , 2022 ,39(11) : 1462-1465. DOI: 10.1111/echo.15472.
- [19] Liu L , Zuo Y , Huang Y , et al. Echocardiographical findings of giant cardiac lipoma: A case report [J]. *Medicine (Baltimore)* , 2019 ,98(8) : e14456. DOI: 10.1097/md.00000000000014456.
- [20] Naseerullah FS , Javaiya H , Murthy A. Cardiac lipoma: An uncharacteristically large intra-atrial mass causing symptoms [J]. *Case Rep Cardiol* , 2018 : 3531982. DOI: 10.1155/2018/3531982.
- [21] Chen M , Li F , Zhang H , et al. Giant interatrial septal lipoma filling the right atrium causing slight symptoms: A case report [J]. *Heart Surg Forum* , 2021 ,24(6) : E947-E949. DOI: 10.1532/hsf.4135.
- [22] Vriz O , Ahmed MM , Kharabsheha S , et al. Ventricular tachycardia: Beginning and ending fate of a benign invasive cardiac lipoma [J]. *Monaldi Arch Chest Dis* , 2020 ,90(3) : 10. DOI: 10.4081/monaldi.2020.1288.
- [23] Younes A , Ahmad S , Yousaf A , et al. A rare presentation of cardiac lipoma as an acute coronary syndrome: A case report and review of literature [J]. *Cureus* , 2021 ,13(6) : e15503. DOI: 10.7759/cureus.15503.
- [24] Wood CA Jr , Gunther RS , O'Gorman KJ , et al. An intramyocardial lipoma mimicking post-infarction fatty changes: Discussion of key distinguishing imaging findings and clinical implications [J]. *Cureus* , 2023 ,15(10) : e46955. DOI: 10.7759/cureus.46955.
- [25] Altuntas E , Sancar KM , Uygur B , et al. Uninvited guest in the left ventricle: Lipomade [J]. *Turk Kardiyol Dern Ars* , 2026 ,54(1) : 68-70. DOI: 10.5543/tkda.2025.35332.
- [26] Grimmett HJ , Kimbimbi K , Greenberg A , et al. A cadaveric case report of a rare atrial septal lipoma [J]. *Cureus* , 2024 ,16(10) : e71794. DOI: 10.7759/cureus.71794.
- [27] Russo D , Cinque A , Velardi L , et al. Giant pericardial mass case report: Role of echocardiography [J]. *AME Case Rep* , 2021 ,5: 23. DOI: 10.21037/acr-20-141.
- [28] Karameh M , Golomb M , Yarkoni M , et al. Giant intracardiac lipoma: A case report and the role of multimodality cardiac imaging [J]. *Cureus* , 2022 ,14(9) : e29565. DOI: 10.7759/cureus.29565.
- [29] Zhao L , Su X , Song X , et al. A massive cardiac lipoma in the right atrium with multimodality imaging [J]. *J Cardiothorac Surg* , 2024 ,19(1) : 646. DOI: 10.1186/s13019-024-03162-3.
- [30] Nalluru SS , Nadadur S , Trivedi N , et al. Tale of fat and fib -cardiac lipoma managed with radiofrequency ablation: A case report [J]. *World J Cardiol* , 2020 ,12(6) : 285-290. DOI: 10.4330/wjc.v12.i6.285.
- [31] Bajdechi M , Onciul S , Costache V , et al. Right atrial lipoma: A case report and literature review [J]. *Exp Ther Med* , 2022 ,24(5) : 697. DOI: 10.3892/etm.2022.11633.
- [32] Retal H , Bougrine I , El Graini S , et al. Silent metastasis of myxoid liposarcoma to the heart unveiled by multimodal imaging [J]. *Cureus* , 2025 ,17(4) : e81727. DOI: 10.7759/cureus.81727.
- [33] Shen J , Fang Z , Zhang Y , et al. Primary cardiac dedifferentiated liposarcoma in a middle-aged female: A case report [J]. *J Cardiothorac Surg* , 2019 ,14(1) : 156. DOI: 10.1186/s13019-019-0973-0.
- [34] Creytens D. A contemporary review of myxoid adipocytic tumors [J]. *Semin Diagn Pathol* , 2019 ,36(2) : 129-141. DOI: 10.1053/j.semdp.2019.02.008.
- [35] Wang JG , Wang B , Hu Y , et al. Clinicopathologic features and outcomes of primary cardiac tumors: A 16-year-experience with 212 patients at a Chinese medical center [J]. *Cardiovasc Pathol* , 2018 ,33: 45-54. DOI: 10.1016/j.carpath.2018.01.003.
- [36] Meng J , Zhao H , Liu Y , et al. Assessment of cardiac tumors by ¹⁸F-FDG PET/CT imaging: Histological correlation and clinical outcomes [J]. *J Nucl Cardiol* , 2021 ,28(5) : 2233-2243. DOI: 10.1007/s12350-019-02022-1.

(下转 1015 页)

- and a nutritional intervention have a synergic effect on muscle mass , strength , and physical function in older adults? A systematic review and Meta-analysis [J]. BMC Geriatr ,2021 ,21 (1) : 639. DOI: 10.1186/s12877-021-02491-5.
- [40] Hernandez-Lepe MA , Miranda-Gil MI , Valbuena-Gregorio E , et al. Exercise programs combined with diet supplementation improve body composition and physical function in older adults with sarcopenia: A systematic review [J]. Nutrients ,2023 ,15 (8) : 1998. DOI: 10.3390/nu15081998.
- [41] Wu PY , Huang KS , Chen KM , et al. Exercise , nutrition , and combined exercise and nutrition in older adults with sarcopenia: A systematic review and network Meta-analysis [J]. Maturitas ,2021 ,145: 38-48. DOI: 10.1016/j.maturitas.2020.12.009.
- [42] Yoshimura Y , Matsumoto A , Inoue T , et al. Protein supplementation alone or combined with exercise for sarcopenia and physical frailty: A systematic review and Meta-analysis of randomized controlled trials [J]. Arch Gerontol Geriatr ,2025 ,131: 105783. DOI: 10.1016/j.archger.2025.105783.
- [43] Xie C , Yan R , Tao R. Combined resistance training and amino acid-based supplementation for sarcopenia in older adults: A systematic review and Meta-analysis [J]. BMC Musculoskelet Disord ,2026 ,27 (1) : 35. DOI: 10.1186/s12891-025-09436-8.
- [44] Cornish SM , Cordingley DM , Shaw KA , et al. Effects of omega-3 supplementation alone and combined with resistance exercise on skeletal muscle in older adults: A systematic review and Meta-analysis [J]. Nutrients ,2022 ,14(11) : 2221. DOI: 10.3390/nu14112221.
- [45] Dam DL , Christensen JA , Olsen PO , et al. Impact of omega-3 fatty acids supplementation combined with resistance training on muscle mass , neuromuscular and physical function in older adults: A systematic review and Meta-analysis of randomized clinical trials [J]. J Ageing Longev ,2025 ,5(1) : 4. DOI: 10.3390/jal5010004.
- [46] Aschauer R , Unterberger S , Zohrer PA , et al. Effects of vitamin D3 supplementation and resistance training on 25-hydroxyvitamin D status and functional performance of older adults: A randomized placebo-controlled trial [J]. Nutrients ,2022 ,14 (1) : 86. DOI: 10.3390/nu14010086.
- [47] Whaikid P , Piaseu N. The effectiveness of protein supplementation combined with resistance exercise programs among community-dwelling older adults with sarcopenia: A systematic review and Meta-analysis [J]. Epidemiol Health ,2024 ,46: e2024030. DOI: 10.4178/epih.e2024030.
- [48] Nasimi N , Sohrabi Z , Nunes EA , et al. Whey protein supplementation with or without vitamin D on sarcopenia-related measures: A systematic review and Meta-analysis [J]. Adv Nutr ,2023 ,14(4) : 762-773. DOI: 10.1016/j.advnut.2023.05.011.
- [49] Rooks D , Swan T , Goswami B , et al. Bimagrumab vs optimized standard of care for treatment of sarcopenia in community-dwelling older adults: A randomized clinical trial [J]. JAMA Netw Open ,2020 ,3(10) : e2020836. DOI: 10.1001/jamanetworkopen.2020.20836.
- [50] Park SH , Lee H. Effectiveness of combined exercise and nutrition interventions in preventing and improving sarcopenia in frail or healthy older adults: A systematic review [J]. Res Gerontol Nurs ,2023 ,16 (6) : 312-320. DOI: 10.3928/19404921-20230817-03.

(收稿日期: 2026-04-14)

(上接 1009 页)

- [37] Ren DY , Fuller ND , Gilbert SAB , et al. Cardiac tumors: Clinical perspective and therapeutic considerations [J]. Curr Drug Targets ,2017 ,18 (15) : 1805-1809. DOI: 10.2174/1389450117666160703162111.
- [38] Parato VM , Nocco S , Alunni G , et al. Imaging of cardiac masses: An updated overview [J]. J Cardiovasc Echogr ,2022 ,32(2) : 65-75. DOI: 10.4103/jeecho.jeecho_18_22.
- [39] Wu C , Wang Y , Su W , et al. Cardiac rhabdomyomas with atrial septal defect and tricuspid insufficiency: A case report [J]. J Card Surg ,2019 ,34(10) : 1123-1126. DOI: 10.1111/jocs.14191.
- [40] Shi L , Wu L , Fang H , et al. Identification and clinical course of 166 pediatric cardiac tumors [J]. Eur J Pediatr ,2017 ,176(2) : 253-260. DOI: 10.1007/s00431-016-2833-4.
- [41] Yue P , Xu Z , Wan K , et al. Multiparametric mapping by cardiovascular magnetic resonance imaging in cardiac tumors [J]. J Cardiovasc Magn Reson ,2023 ,25(1) : 37. DOI: 10.1186/s12968-023-00938-9.
- [42] Karangelis D , Palios J , Tzertzemelis D , et al. Surgical resection of a cardiac lipoma of the right ventricle [J]. Ann Card Anaesth ,2019 ,22(4) : 452-454. DOI: 10.4103/aca.ACA_87_18.
- [43] Yan Y , Ma C , Sandeep B , et al. Surgical resection of a lipoma of the right atrium: A case report [J]. Medicine (Baltimore) ,2025 ,104(12) : e41848. DOI: 10.1097/md.00000000000041848.
- [44] Kenawy A , Abdelbar A , Zacharias J. Minimally invasive resection of benign cardiac tumors [J]. J Thorac Dis ,2021 ,13(3) : 1993-1999. DOI: 10.21037/jtd-20-1201.
- [45] Zhang Y , Hou S , Wang L , et al. Cardiac lipoma in left ventricle: A rare case diagnosed using imaging data [J]. J Clin Ultrasound ,2023 ,51(9) : 1464-1465. DOI: 10.1002/jcu.23581.
- [46] Chen Q , Yang D , Liu L , et al. Right atrial cardiac lipoma with distinctive imaging characteristics. A rare case report and literature review [J]. Front Cardiovasc Med ,2022 ,9: 1043427. DOI: 10.3389/fcvm.2022.1043427.
- [47] Varma R , Corbett S , Shambrook J , et al. An epicardial problem case report: Multimodality imaging assessment of a patient presenting with symptomatic ventricular tachycardia , secondary to a large , epicardial , lipomatous mass with myocardial infiltration [J]. Eur Heart J Case Rep ,2025 ,9(5) : ytaf175. DOI: 10.1093/ehjcr/ytaf175.
- [48] 吴晓琴 , 杨新宇 , 李旻 , 等. 心脏脂肪瘤的临床诊治进展 [J]. 山东医药 ,2018 ,58(44) : 109-112. DOI: 10.3969/j.issn.1002-266X.2018.44.032.
- [49] 田萍 , 韩博 , 郑建民 , 等. 心脏脂肪瘤多模态影像学特征 [J]. 中国医学影像学杂志 ,2024 ,32(11) : 1129-1133. DOI: 10.3969/j.issn.1005-5185.2024.11.007.
- [50] 邵千慧 , 柳乾龙 , 童睿 , 等. Carney 综合征 1 例家系调查并文献复习 [J]. 疑难病杂志 ,2020 ,19(9) : 921-925. DOI: 10.3969/j.issn.1671-6450.2020.09.014.

(收稿日期: 2026-04-21)