

# 导管消融治疗心房颤动合并心力衰竭

张晓钰 周根青 刘少稳

**【摘要】** 心房颤动(房颤)和心力衰竭(心衰)是临床常见的心血管疾病,二者互为因果,导致恶性循环。导管消融治疗房颤合并心衰不仅可以改善心功能、提高生活质量,还能改善临床预后、降低再住院率和病死率。应在房颤患者出现心衰症状前或在心衰早期进行导管消融,才能使患者获益更多。

**【关键词】** 心房颤动;心力衰竭;导管消融

doi: 10.3969/j.issn.1673-6583.2024.02.009

心房颤动(房颤)合并心力衰竭(心衰)的诊治是心血管领域的巨大挑战,近年来研究显示导管消融治疗有良好的临床效果。

## 1 房颤和心衰的关系

房颤和心衰具有共同的危险因素,如高龄、高血压、糖尿病、吸烟、肥胖和结构性心脏病等,二者经常并存<sup>[1-2]</sup>。心衰是房颤的易患因素,而房颤可诱发或加重心衰,二者相互促进,导致恶性循环。心衰时肾素-血管紧张素-醛固酮系统的激活可诱发房颤;随着心功能恶化,房颤发病率逐渐增高,心功能Ⅳ级心衰患者的房颤发病率可达50%<sup>[3]</sup>。Framingham研究<sup>[4]</sup>随访4年发现,20%的心衰患者可发生房颤。房颤可增加心衰的发生风险,20%~30%的房颤患者伴左室收缩功能下降,且有相近数量的房颤患者合并舒张功能不全性心衰<sup>[5]</sup>。房颤合并心衰的预后更差,死亡率上升1.5~3倍<sup>[6]</sup>。随着非维生素K拮抗剂口服抗凝药物的应用,房颤抗凝治疗策略不断优化,心衰已替代脑卒中成为房颤患者的主要死亡原因<sup>[7]</sup>。

## 2 导管消融治疗房颤合并心衰

既往导管消融术主要针对左心收缩功能正常的房颤患者。对于房颤,导管消融术优于心率控制药物治疗。欧洲心脏病学会(ESC)房颤诊断和管理指南指出,对于1种以上Ⅰ类或Ⅲ类抗心律失常药物治疗无效或不能耐受的症状性阵发性房颤患者,行导管消融术为Ⅰ类推荐,A级证据<sup>[5]</sup>。随着研究开展,经导管消融治疗房颤合并心衰的地位

不断提高。2012年ESC房颤诊治指南指出,对于房颤合并心衰的患者,必要时可选择导管消融治疗(Ⅱb类推荐,B级证据)<sup>[8]</sup>。2016年ESC房颤诊治指南将导管消融治疗此类患者上升为Ⅱa类推荐,C级证据<sup>[9]</sup>。2020年ESC房颤诊治指南推荐,对房颤伴左室收缩功能下降的心衰患者,如果有心动过速性心肌病的可能,则应积极行导管消融术(Ⅰ类推荐,B级证据)<sup>[5]</sup>。

## 3 导管消融治疗房颤合并心衰的优势

抗心律失常药物控制节律的有效性并不理想,且有增加死亡的风险,尤其在合并心衰的房颤患者中更为显著。AFFIRM<sup>[10]</sup>、RACE<sup>[11]</sup>及AF-CHF<sup>[12]</sup>等研究发现,节律控制干预未能降低总体死亡率。导管消融治疗房颤合并心衰,可显著改善患者的心功能和生活质量,提高生存率并降低再住院率<sup>[13]</sup>。与药物治疗相比,导管消融能更稳定地长期维持窦性心律,控制房颤进展,降低房颤患者的心衰发生率,且无药物治疗的不良反应。1项荟萃分析比较了近10年导管消融和药物治疗房颤患者的随访结果,发现导管消融治疗房颤虽存在一定的复发率,但其房颤一般不再进展;而使用药物治疗的患者,每年有10%~15%的阵发性房颤进展为持续性房颤<sup>[14]</sup>。

## 4 导管消融治疗房颤合并射血分数降低的心衰

### 4.1 改善心功能

导管消融可改善房颤合并射血分数降低的心衰(HFrEF)患者的心功能,提高左室射血分数(LVEF)。CAMTAF研究<sup>[15]</sup>表明,与药物控制心率组相比,导管消融组可显著增加持续性房颤合并HFrEF患者的LVEF[(40±12)%对

( $31 \pm 13$ )%,  $P=0.015$ ]。CAMERA-MRI 研究<sup>[16]</sup>提示导管消融组对持续性房颤伴特发性心肌病 ( $LVEF \leq 45\%$ ) 患者的 LVEF 改善更为显著 [ $(18 \pm 13)\%$  对  $(4.4 \pm 13)\%$ ,  $P < 0.0001$ ], 且导管消融术后  $LVEF \geq 50\%$  的比例大大提高 (58% 对 9%,  $P=0.0002$ )。及时应用导管消融治疗心律失常介导的心肌病可以最大限度地减轻不可逆的心室重构<sup>[17]</sup>。然而, AMICA 研究<sup>[18]</sup>显示, 对于持续性房颤合并  $LVEF \leq 35\%$  的患者, 导管消融组与最佳药物治疗组相比, LVEF 增加的数值差异无统计学意义, 提示导管消融的治疗效果可能受基线时心衰程度的影响, 房颤伴严重心衰患者从中获益有限。

#### 4.2 改善临床预后

AATAC 研究<sup>[19]</sup>表明, 与胺碘酮相比, 导管消融不仅可以增加无房颤复发率 (71% 对 34%,  $P < 0.001$ ) 和降低住院率 (31% 对 57%,  $P < 0.001$ ), 还能降低房颤合并严重心衰患者的死亡率 (8% 对 18%,  $P < 0.05$ )。CASTLE-AF 研究<sup>[20]</sup>发现, 导管消融组 LVEF 从基线至 60 个月随访时中位绝对值的增加比药物治疗组显著升高 (8.0% 对 0.2%,  $P=0.005$ )。中位随访 37.8 个月后, 与药物治疗组相比, 导管消融组主要终点事件发生率更低 (28.5% 对 44.6%,  $HR=0.62$ ,  $P=0.007$ ), 全因死亡率更低 (13.4% 对 25.0%,  $HR=0.53$ ,  $P=0.01$ ), 因心衰进展而住院的人数比例更少 (20.7% 对 35.9%,  $HR=0.56$ ,  $P=0.004$ ), 且死于心血管疾病的人数比例更少 (11.2% 对 22.3%,  $HR=0.49$ ,  $P=0.009$ )。Chen 等<sup>[13]</sup>的荟萃分析发现, 与药物治疗组相比, 导管消融组可降低房颤合并心衰患者的房颤复发率 (29.6% 对 80.1%,  $OR=0.04$ ,  $P < 0.00001$ )、再住院率 ( $OR=0.44$ ,  $P=0.003$ ) 和全因死亡率 ( $OR=0.51$ ,  $P=0.0003$ ), 显著改善 LVEF [加权均数差 (WMD) = 6.8%,  $P=0.0004$ ], 提高患者生活质量 [明尼苏达心衰生活质量量表评分 (WMD = -9.1,  $P=0.007$ )]。RAFT-HF 研究<sup>[21]</sup>提示, 在降低心衰合并房颤患者的全因死亡率及心衰事件发生率方面, 导管消融组与药物控制心率组间差异无统计学意义, 但前者主要终点事件的发生率更低, 左室功能改善、生活质量改善等次要终点方面更优。

#### 5 导管消融治疗房颤合并射血分数保留的心衰

房颤是射血分数保留的心衰 (HFpEF) 的危险因素, 也是 HFpEF 的并发症之一。Kelly 等<sup>[22]</sup>发现节律控制可改善房颤合并 HFpEF 患者的预后,

降低其全因死亡风险。Fukui 等<sup>[23]</sup>的研究表明, 与药物治疗组相比, 导管消融组能显著降低 HFpEF 患者的心衰再住院率 ( $P=0.0039$ )。导管消融治疗房颤的成功与否与心衰再住院风险密切相关, 房颤复发患者的心衰再住院率为 50%, 而房颤未复发患者中无因心衰再住院的患者。Aldaas 等<sup>[24]</sup>的荟萃分析表明, 导管消融治疗房颤合并 HFpEF 同样安全、有效。EAST-AFNET4 研究<sup>[25]</sup>表明, 在 1 年内确诊的房颤合并心衰患者中, 与常规治疗组相比, 早期进行节律控制治疗可降低不良心血管事件发生率。EAST-AFNET4 研究亚组分析<sup>[26]</sup>纳入的患者中 55% 为 HFpEF、16.5% 为 HFrEF, 中位随访 5.1 年后发现, 节律控制组主要终点事件发生率更低 ( $HR=0.74$ ,  $P=0.03$ ), 且各类型心衰均可从早期节律控制干预中获益。

#### 6 导管消融治疗房颤合并心衰的时机选择

CASTLE-AF 研究<sup>[27]</sup>的主要终点包括全因死亡及因心衰进展导致的再住院, 该研究发现, 与药物治疗组相比, 导管消融治疗房颤合并 LVEF 降低患者的主要终点事件发生率显著降低; 心功能 I 级和 II 级的患者获益更多, 而心功能 III 级和 IV 级的患者无明显获益。AMICA 研究<sup>[18]</sup>同样提示, 严重晚期心衰患者从导管消融治疗房颤中获益有限。应将房颤导管消融治疗的“战线”前移, 在房颤患者出现心衰之前或心衰早期即进行积极治疗, 可使患者获益更多。

有研究发现预测导管消融治疗房颤合并心衰患者术后效果的指标与模型<sup>[28-30]</sup>; 还有研究表明, 静息心室扩张程度、心率、心衰类型等指标与导管消融治疗房颤合并心衰术后效果有关, 可用于筛选适合进行导管消融治疗的人群<sup>[31]</sup>。观察性研究表明, 房颤合并 HFpEF 是临床中接受导管消融治疗的主要对象, 约占所有心衰患者的 1/2<sup>[32]</sup>。然而, 目前多数随机对照试验的研究对象为房颤合并 HFrEF 患者, 且试验规模较小、随访时间较短, 降低了试验结果的可信度, 应对房颤合并 HFpEF 患者进行深入研究。

#### 7 小结

导管消融治疗房颤合并心衰, 可减少房颤复发、改善心功能、提高生活质量、降低再住院率和病死率。应在房颤患者出现心衰症状前或心衰早期进行导管消融治疗, 可使患者获益更多。

## 参 考 文 献

- [1] Trulock KM, Narayan SM, Piccini JP. Rhythm control in heart failure patients with atrial fibrillation: contemporary challenges including the role of ablation[J]. *J Am Coll Cardiol*, 2014, 64(7):710-721.
- [2] Chugh SS, Havmoeller R, Narayanan K, et al. Worldwide epidemiology of atrial fibrillation: a Global Burden of Disease 2010 Study[J]. *Circulation*, 2014, 129(8):837-847.
- [3] Lalani GG, Schricker A, Gibson M, et al. Atrial conduction slows immediately before the onset of human atrial fibrillation: a bi-atrial contact mapping study of transitions to atrial fibrillation[J]. *J Am Coll Cardiol*, 2012, 59(6):595-606.
- [4] Wang TJ, Larson MG, Levy D, et al. Temporal relations of atrial fibrillation and congestive heart failure and their joint influence on mortality: the Framingham Heart Study[J]. *Circulation*, 2003, 107(23):2920-2925.
- [5] Hindricks G, Potpara T, Dagres N, et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): the task force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) Developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC[J]. *Eur Heart J*, 2021, 42(5):373-498.
- [6] Khand AU, Rankin AC, Kaye GC, et al. Systematic review of the management of atrial fibrillation in patients with heart failure[J]. *Eur Heart J*, 2000, 21(8):614-632.
- [7] Healey JS, Oldgren J, Ezekowitz M, et al. Occurrence of death and stroke in patients in 47 countries 1 year after presenting with atrial fibrillation: a cohort study[J]. *Lancet*, 2016, 388(10050):1161-1169.
- [8] Camm AJ, Lip GY, De Caterina R, et al. 2012 focused update of the ESC Guidelines for the management of atrial fibrillation: an update of the 2010 ESC Guidelines for the management of atrial fibrillation. Developed with the special contribution of the European Heart Rhythm Association[J]. *Eur Heart J*, 2012, 33(21):2719-2747.
- [9] Kirchhof P, Benussi S, Kotecha D, et al. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS[J]. *Eur Heart J*, 2016, 37(38):2893-2962.
- [10] Wyse DG, Waldo AL, DiMarco JP, et al. A comparison of rate control and rhythm control in patients with atrial fibrillation[J]. *N Engl J Med*, 2002, 347(23):1825-1833.
- [11] Hagens VE, Vermeulen KM, TenVergert EM, et al. Rate control is more cost-effective than rhythm control for patients with persistent atrial fibrillation—results from the RAte Control versus Electrical cardioversion (RACE) study[J]. *Eur Heart J*, 2004, 25(17):1542-1549.
- [12] Roy D, Talajic M, Nattel S, et al. Rhythm control versus rate control for atrial fibrillation and heart failure[J]. *N Engl J Med*, 2008, 358(25):2667-2677.
- [13] Chen S, Pürerfellner H, Meyer C, et al. Rhythm control for patients with atrial fibrillation complicated with heart failure in the contemporary era of catheter ablation: a stratified pooled analysis of randomized data[J]. *Eur Heart J*, 2020, 41(30):2863-2873.
- [14] Proietti R, Hadjis A, AlTurki A, et al. A systematic review on the progression of paroxysmal to persistent atrial fibrillation: shedding new light on the effects of catheter ablation[J]. *JACC Clin Electrophysiol*, 2015, 1(3):105-115.
- [15] Hunter RJ, Berriman TJ, Diab I, et al. A randomized controlled trial of catheter ablation versus medical treatment of atrial fibrillation in heart failure (the CAMTAF trial)[J]. *Circ Arrhythm Electrophysiol*, 2014, 7(1):31-38.
- [16] Prabhu S, Taylor AJ, Costello BT, et al. Catheter ablation versus medical rate control in atrial fibrillation and systolic dysfunction: the CAMERA-MRI study[J]. *J Am Coll Cardiol*, 2017, 70(16):1949-1961.
- [17] Prabhu S, Costello BT, Taylor AJ, et al. Regression of diffuse ventricular fibrosis following restoration of sinus rhythm with catheter ablation in patients with atrial fibrillation and systolic dysfunction: a substudy of the CAMERA MRI trial[J]. *JACC Clin Electrophysiol*, 2018, 4(8):999-1007.
- [18] Kuck KH, Merkely B, Zahn R, et al. Catheter ablation versus best medical therapy in patients with persistent atrial fibrillation and congestive heart failure: the randomized AMICA trial[J]. *Circ Arrhythm Electrophysiol*, 2019, 12(12):e007731.
- [19] Di Biase L, Mohanty P, Mohanty S, et al. Ablation versus amiodarone for treatment of persistent atrial fibrillation in patients with congestive heart failure and an implanted device: results from the AATAC multicenter randomized trial[J]. *Circulation*, 2016, 133(17):1637-1644.
- [20] Marrouche NF, Brachmann J, Andresen D, et al. Catheter ablation for atrial fibrillation with heart failure[J]. *N Engl J Med*, 2018, 378(5):417-427.
- [21] Parkash R, Wells GA, Rouleau J, et al. Randomized ablation-based rhythm-control versus rate-control trial in patients with heart failure and atrial fibrillation: results from the RAFT-AF trial[J]. *Circulation*, 2022, 145(23):1693-1704.
- [22] Kelly JP, DeVore AD, Wu J, et al. Rhythm control versus rate control in patients with atrial fibrillation and heart failure with preserved ejection fraction: insights from get with the guidelines-heart failure[J]. *J Am Heart Assoc*, 2019, 8(24):e011560.
- [23] Fukui A, Tanino T, Yamaguchi T, et al. Catheter ablation of atrial fibrillation reduces heart failure rehospitalization in patients with heart failure with preserved ejection fraction[J]. *J Cardiovasc Electrophysiol*, 2020, 31(3):682-688.
- [24] Aldaas OM, Lupercio F, Darden D, et al. Meta-analysis of the usefulness of catheter ablation of atrial fibrillation in patients with heart failure with preserved ejection fraction[J]. *Am J Cardiol*, 2021, 142:66-73.
- [25] Kirchhof P, Camm AJ, Goette A, et al. Early rhythm-control therapy in patients with atrial fibrillation[J]. *N Engl J Med*, 2020, 383(14):1305-1316.



- [26] Rillig A, Magnussen C, Ozga AK, et al. Early rhythm control therapy in patients with atrial fibrillation and heart failure[J]. *Circulation*, 2021, 144(11):845-858.
- [27] Sohns C, Zintl K, Zhao Y, et al. Impact of left ventricular function and heart failure symptoms on outcomes post ablation of atrial fibrillation in heart failure: CASTLE-AF trial[J]. *Circ Arrhythm Electrophysiol*, 2020, 13(10):e008461.
- [28] Nomura Y, Harada M, Motoike Y, et al. Selvester QRS score predicts improvement of LVEF in atrial fibrillation patients with systolic heart failure[J]. *Pacing Clin Electrophysiol*, 2022, 45(5):619-628.
- [29] Wen S, Pislaru SV, Lin G, et al. Association of postprocedural left atrial volume and reservoir function with outcomes in patients with atrial fibrillation undergoing catheter ablation[J]. *J Am Soc Echocardiogr*, 2022, 35(8):818-828. e3.
- [30] Bergonti M, Spera F, Tijssens M, et al. A new prediction model for left ventricular systolic function recovery after catheter ablation of atrial fibrillation in patients with heart failure: the ANTWOORD Study[J]. *Int J Cardiol*, 2022, 358:45-50.
- [31] Yu L, Jiang R, Sun Y, et al. Catheter ablation for persistent atrial fibrillation with left ventricular systolic dysfunction: who is the best candidate?[J]. *Pacing Clin Electrophysiol*, 2022, 45(5):629-638.
- [32] Tavazzi L, Maggioni AP, Rapezzi C, et al. Heart failure and catheter ablation of atrial fibrillation: navigating the difficult waters of heart failure phenotypes[J]. *Eur J Intern Med*, 2022, 99:13-18.

( 收稿:2023-03-15 修回:2023-11-28 )

( 本文编辑:丁媛媛 )

~~~~~

( 上接第 96 页 )

- [23] Meier C, Staub JJ, Roth CB, et al. TSH-controlled L-thyroxine therapy reduces cholesterol levels and clinical symptoms in subclinical hypothyroidism: a double blind, placebo-controlled trial (Basel Thyroid Study)[J]. *J Clin Endocrinol Metab*, 2001, 86(10):4860-4866.
- [24] Razvi S, Ingoe L, Keeka G, et al. The beneficial effect of L-thyroxine on cardiovascular risk factors, endothelial function, and quality of life in subclinical hypothyroidism: randomized, crossover trial[J]. *J Clin Endocrinol Metab*, 2007, 92(5):1715-1723.
- [25] Curotto Grasiosi J, Peressotti B, Machado RA, et al. Improvement in functional capacity after levothyroxine treatment in patients with chronic heart failure and subclinical hypothyroidism[J]. *Endocrinol Nutr*, 2013, 60(8):427-432.
- [26] 曹昌强. 左甲状腺素钠治疗慢性心力衰竭合并亚临床甲状腺功能减退的临床疗效研究[J]. *基层医学论坛*, 2020, 24(35):5093-5094.
- [27] Zhang X, Wang WY, Zhang K, et al. Efficacy and safety of levothyroxine (L-T4) replacement on the exercise capability in chronic systolic heart failure patients with subclinical hypothyroidism: study protocol for a multi-center, open label, randomized, parallel group trial (ThyroHeart-CHF)[J]. *Trials*, 2019, 20(1):143.
- [28] Ehrenkranz J, Bach PR, Snow GL, et al. Circadian and circannual rhythms in thyroid hormones: determining the TSH and free T4 reference intervals based upon time of day, age, and sex[J]. *Thyroid*, 2015, 25(8):954-961.
- [29] Heidenreich PA, Bozkurt B, Aguilar D, et al. 2022 AHA/ACC/HFSA guideline for the management of heart failure: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines[J]. *J Am Coll Cardiol*, 2022, 79(17):e263-e421.
- [30] Pearce SHS, Brabant G, Duntas LH, et al. 2013 ETA guideline: management of subclinical hypothyroidism[J]. *Eur Thyroid J*, 2013, 2(4):215-228.
- [31] Garber JR, Cobin RH, Gharib H, et al. Clinical practice guidelines for hypothyroidism in adults: cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association[J]. *Endocr Pract*, 2012, 18(6):988-1028.
- [32] 中华医学会内分泌学分会. 成人甲状腺功能减退症诊治指南[J]. *中华内分泌代谢杂志*, 2017, 33(2):167-180.
- [33] Badran HM, Faheem N, Zidan A, et al. Effect of short-term L-thyroxine therapy on left ventricular mechanics in idiopathic dilated cardiomyopathy[J]. *J Am Soc Echocardiogr*, 2020, 33(10):1234-1244.
- [34] Chen X, Bao Y, Shi C, et al. Effectiveness and safety of thyroid hormone therapy in patients with dilated cardiomyopathy: a systematic review and meta-analysis of RCTs[J]. *Am J Cardiovasc Drugs*, 2022, 22(6):647-656.
- [35] Pingitore A, Galli E, Barison A, et al. Acute effects of triiodothyronine (T3) replacement therapy in patients with chronic heart failure and low-T3 syndrome: a randomized, placebo-controlled study[J]. *J Clin Endocrinol Metab*, 2008, 93(4):1351-1358.
- [36] Amin A, Chitsazan M, Taghavi S, et al. Effects of triiodothyronine replacement therapy in patients with chronic stable heart failure and low-triiodothyronine syndrome: a randomized, double-blind, placebo-controlled study[J]. *ESC Heart Fail*, 2015, 2(1):5-11.
- [37] Shi C, Bao Y, Chen X, et al. The effectiveness of thyroid hormone replacement therapy on heart failure and low-triiodothyronine syndrome: an updated systematic review and meta-analysis of randomized controlled trials[J]. *Endocr Pract*, 2022, 28(11):1178-1186.
- [38] Holmager P, Schmidt U, Mark P, et al. Long-term L-triiodothyronine (T3) treatment in stable systolic heart failure patients: a randomised, double-blind, cross-over, placebo-controlled intervention study[J]. *Clin Endocrinol (Oxf)*, 2015, 83(6):931-937.

( 收稿:2023-04-30 修回:2024-01-09 )

( 本文编辑:胡晓静 )