



doi:10.7659/j.issn.1005-6947.2022.12.001

http://dx.doi.org/10.7659/j.issn.1005-6947.2022.12.001

Chinese Journal of General Surgery, 2022, 31(12):1557-1563.

· 指南解读 ·

TEVAR在非复杂型B型主动脉夹层中的作用 —2022年STS/AATS B型主动脉夹层管理临床实践指南解读

舒畅^{1, 2, 3, 4}

(1. 中南大学湘雅二医院 血管外科, 湖南 长沙 410011; 2. 中南大学血管病研究所, 湖南 长沙 410011; 3. 中国医学科学院阜外医院 血管外科, 北京 100037; 4. 国家心血管病中心, 北京 100037)

摘要

在非复杂型B型主动脉夹层的治疗中, 中西方学界一直存在分歧, 既往欧美指南强调保守治疗。但随着TBAD患者长期随访数据的不断增多和腔内技术的广泛应用与改进, TEVAR在非复杂型B型主动脉夹层中的有效作用在西方学界亦逐渐得到公认, 并在今年的美国STS/AATS指南得到了阐述。因此, 本文对指南中相关部分进行了解读, 供学者们参考讨论。

关键词

动脉瘤, 夹层; 主动脉; 解读

中图分类号: R654.3

Role of TEVAR in non-complicated type B aortic dissection —interpretation of 2022 STS/AATS clinical practice guidelines on the management of type B aortic dissection

SHU Chang^{1, 2, 3, 4}

(1. Department of Vascular Surgery, the Second Xiangya Hospital, Central South University, Changsha 410011, China; 2. Institute of Vascular Disease, Central South University, Changsha 410011, China; 3. Department of Vascular Surgery, Fuwai Hospital, Academy of Medical Sciences, Beijing 100037, China; 4. National Center for Cardiovascular Disease, Beijing 100037, China)

Abstract

In the treatment of non-complicated type B aortic dissection (TBAD), disagreement exists between Chinese and Western academic associations, and previous European and American guidelines emphasized conservative treatment. However, with the increase of long-term follow-up data of TBAD patients and the extensive application and improvement of endovascular techniques, the effective role of TEVAR in non-complicated TBAD has gradually been recognized by Western academic community, and has been elaborated in this year's American STS/AATS guideline. Therefore, this paper interprets the relevant parts of the guideline for discussion among professional scholars.

基金项目: 国家自然科学基金资助项目 (82120108005); 国家自然科学基金国际 (地区) 合作与交流基金资助项目 (8211001122)。

收稿日期: 2022-07-25; **修订日期:** 2022-11-27。

作者简介: 舒畅, 中南大学湘雅二医院主任医师, 主要从事血管外科临床与基础方面的研究。

通信作者: 舒畅, Email: shuchang@csu.edu.cn

Key words Aneurysm, Dissecting; Aorta; Interpretation
CLC number: R654.3

在既往美国 2010 年^[1]与欧洲 2014 年^[2]发表的主
动脉疾病临床指南中，对于非复杂型 B 型主动脉
夹层（type B aortic dissection, TBAD）推荐药物保
守治疗（optimal medical therapy, OMT），存在主动
脉破裂或者灌注不良综合征的复杂型 TBAD 建议行
主动脉腔内修复术（thoracic endovascular aortic
repair, TEVAR）。随着 TBAD 患者长期随访数据的
不断增多、腔内技术的广泛应用与改进，新型器
械的迭代与研发，学者们对于 TBAD 的认识不断深
入。因此，在 2022 年，美国胸外科医师学会/美国
胸外科协会（STS/AATS），针对 TBAD 发表了最新
的临床管理实践指南^[3]，本文对其中的重要部分，
尤其是非复杂型 TBAD 的内容进行了详细解读。

1 新的主动脉夹层分型与命名方法

首先，此次指南在美国血管外科协会/胸外科
医师学会 2020 年发表文章^[4]的基础上再次重申了新
的夹层分型及命名方法，根据夹层第一破口位置
和近远端累及范围进行分型，破口位于 Z0 区的任
何主动脉夹层称为 A 型，破口位于 Z1 区或以远的
主动脉夹层称为 B 型，无明显破口且夹层累及
Z0 区的主动脉夹层称为 I 型，同时在 A/B/I 右下角
增加 2 个下标 P、D，分别表示夹层最近端累及范
围及最远端累及范围。

新的命名方法有两个特点，一是不同于
Stanford 分类方法中 B 型夹层为 Z3 区域以远的夹
层，A/B/I_{PD} 分类法将 B 型夹层破口位置前移到了
Z1 区，这是全腔内治疗和非开胸杂交手术在重建
主动脉弓上分支越来越成熟的结果，新的分类方
法将既往非 A 非 B 型夹层分类为 B 型主动脉夹层。
二是夹层累及的最远范围受到重视，这是因为随
着夹层患者随访时间延长和 TEVAR 术后患者日益
增多，我们发现慢性期主动脉的重塑是 TBAD 患者
远期预后结局的关键。夹层累及范围越远，通常
意味着夹层破口数越多，存在远期假腔瘤样扩张
的风险可能越高。

同时，在既往指南^[1-2]将 B 型夹层分为复杂型

TBAD 和非复杂型 TBAD 的基础上，此次指南新增
了高风险型 TBAD，对既往的非复杂型 TBAD 进行
了更细致的划分（表 1）。复杂型 TBAD 的临床表
现为主动脉破裂或存在灌注不良综合征，高风险
型 TBAD 的临床表现包括顽固性疼痛、顽固性高血
压^[5]、血性胸腔积液、主动脉直径>40 mm^[6]、影
像学灌注不良、再次入院、破口位于小弯侧以及假
腔直径>22 mm^[7-9]。非复杂型 TBAD 的特点为无主
动脉破裂、无灌注不良和无高风险型 TBAD 临床表
现^[4]。虽然仍缺乏高等级的循证学证据支持，但是
既往文献建议将最大药物剂量治疗 12 h 后仍持续
存在的疼痛或高血压，定义为顽固性疼痛或高血
压。

表 1 TBAD 临床表现分型
Table 1 Classification of clinical manifestations of TBAD

临床表现分型
非复杂型 TBAD
无破裂
无灌注不良
无其他高风险特征
高风险型 TBAD
顽固性疼痛
顽固性高血压
血性胸腔积液
主动脉直径>40 mm
影像学灌注不良
再次入院
破口位于小弯侧
假腔直径>22 mm
复杂型 TBAD
破裂
灌注不良(内脏、肾、下肢、大脑和脊髓缺血)

指南指出 TEVAR 目前已成为复杂型 TBAD 的
一线治疗方式。对于从非复杂型 TBAD 中新划分出
来的高风险型 TBAD，建议行 TEVAR 治疗。在非复
杂型 TBAD 治疗方式上，随着 TEVAR vs. OMT 临床
数据的增多，指南综合分析了最新的研究成果并
提出了相关建议。

2 非复杂型TBAD管理指南概括

应按流程评估和治疗急性/亚急性非复杂型TBAD,包括确定主要破口位置,确定夹层的近端累及范围以及与距LSA开口的距离,测量最大主动脉直径,以及确认无复杂型TBAD的临床表现(I, B推荐,非随机的证据)。OMT是非复杂型TBAD患者的推荐治疗方法(I, B推荐,非随机的证据)。对于非复杂型TBAD,可考虑行预防性TEVAR治疗,以减少晚期主动脉相关不良事件和主动脉相关死亡(IIb, B推荐,非随机的证据)。建议急性TBAD患者出院后进行密切的临床随访(I, B推荐,非随机的证据)。

OMT仍然是非复杂型TBAD的一线治疗方法,推荐在控制血压和心率的同时,应降低收缩期早期左心室压力上升的最大速率(即最大 dp/dt)^[10-14]。推荐控制血压在120/80 mmHg(1 mmHg=0.133 kPa)水平,心率<70次/min。

然而,随访数据发现,随着时间的推移,高比例的OMT-TBAD患者最终仍需要手术干预或突发死亡^[15]。单中心、临床试验和数据登记研究表明,OMT-TBAD患者夹层动脉瘤的发生率超过70%^[16],3~5年病死率接近25%~30%^[16-19]。慢性期夹层动脉瘤样扩张是其需手术干预的最主要原因^[20]。研究^[21-24]发现某些形态学特征(如夹层破口大小和位置)以及OMT治疗的依从性,与是否需后续手术干预相关。

3 TEVAR与OMT在治疗非复杂型TBAD中的比较

3.1 INSTEAD临床随机对照试验

INSTEAD临床随机对照试验^[13](The INvestigation of STEnt Grafts in Aortic Dissection)前瞻性地比较了TEVAR+OMT($n=72$)与OMT($n=68$)在治疗非复杂型TBAD中的作用,纳入对象为发病2~52周之间的患者。主要终点为2年全因病死率,次要终点包括主动脉相关死亡、主动脉病变进展和主动脉重塑形态学证据(真腔恢复、假腔缩小、假腔血栓形成)。虽然TEVAR+OMT组具有更好的主动脉重塑结局(TEVAR+OMT vs. OMT: 91.3% vs. 19.4%),但是2年全因病死率或主动脉相关病死率并没有差异。统计效能不足、随访时间过短以及试验中OMT患者转变为TEVAR+OMT患者比例过高

(16.2%)是其存在的缺陷。尽管如此,5年随访结果发现(INSTEAD-XL研究^[17]),TEVAR+OMT治疗可减少主动脉相关病死率和延缓疾病的进展,尽管这些结果是事后归因的。提示TEVAR在非复杂型TBAD的治疗中优于OMT。

3.2 ADSORB临床随机对照试验

ADSORB临床随机对照试验^[25](Acute Dissection Stent Grafting or Best Medical Treatment)亦比较了30例TEVAR+OMT与31例OMT在治疗非复杂型TBAD中的作用。主要终点包括1年不完全/无假腔血栓形成、主动脉扩张或主动脉破裂。1年随访结果发现TEVAR支架置入可导致假腔血栓形成和直径缩小,但仍需长期随访结果进一步验证,目前尚未有长期随访结果的报道。

同时,指南也引用其他的大宗回顾性病例报道。例如,Iannuzzi等^[26]分析了8 717例OMT患者、266例TEVAR患者和182例开放手术患者的结局,发现OMT患者的5年生存率为59.8%,开放手术患者为66.7%,TEVAR患者为75.9%($OR=0.68$, 95% $CI=0.55\sim0.83$, $P<0.01$)。但该研究的缺陷在于TEVAR和手术患者明显比OMT患者更年轻、更健康。此外,TEVAR患者的平均随访时间仅为1.5年^[26]。Qin等^[27]通过比较分析154例OMT患者和184例TEVAR患者,发现TEVAR患者具有更高的5年生存率(89.2% vs. 85.7%; Log-rank $P=0.01$)。Shah等^[28]对4 706例患者进行安全性分析,显示组间30 d病死率无显著差异,但TEVAR患者卒中概率增加了61%(8.1% vs. 4.6%; $OR=1.61$, 95% $CI=1.14\sim2.27$, $P=0.0073$)。因为上述回顾性研究中治疗方法的选择是偏倚的,解释这些研究时仍需谨慎。

4 非复杂型TBAD的演变

随着TBAD进入慢性期,主动脉撕裂的内膜片逐渐硬化增厚,TEVAR支架置入后扩张真腔压缩假腔的效能降低,提示慢性TBAD患者TEVAR促进主动脉重塑中的作用低于急性期和亚急性期TEVAR^[29-33]。但是,慢性TBAD较少发生灌注不良或逆撕A型夹层(retrograde type A dissection, RTAD)。进行性主动脉瘤样扩张是慢性期TBAD最常见并发症。因此,主张急性期和亚急性期行TEVAR治疗的研究者认为,早期干预可降低慢性期夹层动脉瘤的发生率^[22, 34]。

5 急性非复杂型TBAD的治疗策略

OMT是目前所有非复杂型TBAD患者的基本治疗,但对具有高危风险的TBAD患者,并且具有合适腔内治疗解剖条件情况下,可以考虑在OMT基础上行TEVAR改善晚期预后^[17]。

6 具有晚期预后不良高风险的形态学特征

指南同时指出以下形态学特征可能与TBAD患者晚期预后不良相关,提示具有相关形态学特征的非复杂型TBAD患者更有可能从TEVAR治疗中获益。第一破口位于主动脉远端弓大弯侧可能与灌注不良和远期瘤样扩张风险相关^[21-22]。第一破口与LSA开口距离过短可能与亚急性期的不良事件发生相关,距离越短风险越高^[8, 22, 35-36]。初始主动脉总直径>40 mm或者假腔直径>22 mm与远期瘤样扩张相关^[10, 21, 37]。主动脉破口的数量与大小与远期瘤样扩张相关。TEVAR术后支架远端残留的破口或再发破口返血至假腔,是远期瘤样扩张的危险因素^[38-39]。假腔部分血栓化是TBAD可能预后不良的独立危险因素^[40](表2)。

表2 可能晚期预后不良的形态学特征

Table 2 Morphological features with potential poor late outcomes

形态学特征
(1) 第一破口位于主动脉远端弓的大弯侧
(2) 第一破口与LSA开口距离过短
(3) 初始主动脉总直径>40 mm
(4) 初始假腔直径>22 mm
(5) 主动脉真假腔间破口的数量与大小
(6) 支架诱发的新发破口
(7) 假腔部分血栓化

除经济学因素外,RTAD风险是非复杂型TBAD行TEVAR治疗的主要争议点之一,其发生率在1.3%~11%之间^[41-45]。指南指出RTAD发生的危险因素包括主动脉支架的oversize、带近端裸金属花冠的支架的应用、主动脉弓直径的扩张、主动脉弓部破口、鸟嘴征、支架近端锚定于LSA前方。有研究者报道应用象鼻手术治疗RTAD高风险的TBAD患者,但目前仅应用于有近端I型内漏与RTAD高风险的患者。

7 干预时机

非复杂型TBAD患者的手术干预时机尚未有统一论。指南指出,对于具有高风险特征的急性非复杂型TBAD患者,考虑延迟TEVAR治疗(发病24 h以上至90 d)可能是合理的,以减少早期不良事件并改善晚期预后。

同时,指南亦强调,由于围手术期并发症的风险较低,对于没有明显破裂或破裂包裹、灌注不良综合征和/或其他高风险表现,且病情稳定,可以等待干预的TBAD患者,可从24 h以上至90 d不等的延迟TEVAR中获益^[46-48]。

8 总结

指南指出TBAD的临床管理策略制定是一个随着临床数据积累而不断改进的过程,目前仍然存在很多尚缺乏足够循证学证据的临床热点,例如急性期TBAD的手术干预时机、开放与腔内治疗在慢性TBAD中的对比、慢性TBAD手术干预的直径标准、急性期TEVAR在预防远期主动脉并发症中的作用。

需要认识到的是,虽然新的指南肯定了TEVAR在预防远期TBAD主动脉并发症中的作用,但与2014年欧洲指南^[2]相比,对于非复杂型TBAD行TEVAR治疗的推荐级别并未改变,仍是IIb, B类推荐。

根据最新指南推荐,笔者团队制作了急性TBAD诊治策略,供同行参考(图1)。同时,与西方国家临床实践不同的是,国内学界一直推荐早期TEVAR治疗非复杂型TBAD,我国拥有大量的TEVAR治疗术后随访数据,但因我国发表数据大部分为单中心回顾性研究,缺乏最高循证学等级的多中心临床随机对照试验,大部分我国发表数据并未被指南引用。因此,讲规范、重质控、规律随访、持续创新和多中心合作,应是我国TBAD临床管理的改进方向,并继续为全球主动脉夹层指南制定提供“中国经验”。虽然今年我国血管外科学界亦发布了最新的TBAD诊治专家共识^[49],但仍以借鉴国外指南为主,期待我国自主制定的临床指南的发布。

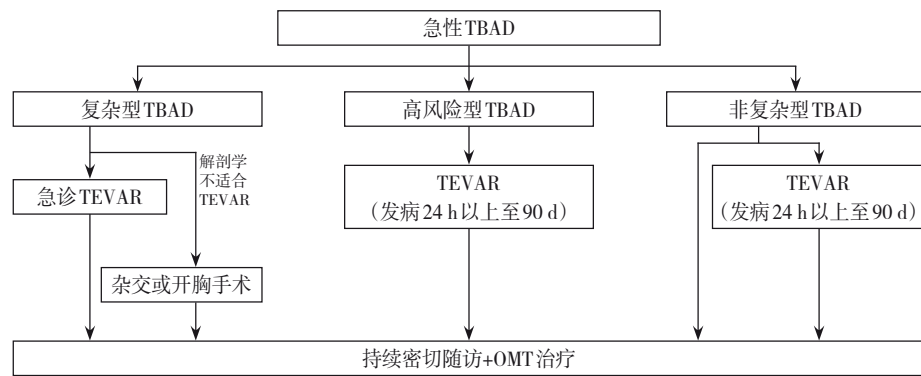


图1 急性TBAD诊治策略（对于复杂型TBAD，推荐急诊TEVAR手术，对于解剖学不合适TEVAR的患者可考虑杂交或开胸手术；对于高风险型TBAD，推荐限期行TEVAR手术；对于非复杂型TBAD，推荐OMT治疗，其中解剖学合适的患者，可考虑行TEVAR治疗减少远期主动脉并发症；对于所有TBAD患者，均建议需长期持续密切随访+OMT治疗）

Figure 1 Strategies for diagnosis and treatment of acute TBAD (for complicated TBAD, emergency TEVAR surgery is recommended, and for patients who are anatomically inappropriate to perform TEVAR, hybrid or thoracotomy surgery can be considered; for high-risk TBAD, TEVAR surgery is recommended within a limited time; OMT treatment is recommended for non-complicated TBAD, and TEVAR treatment can be considered for anatomically appropriate patients to reduce long-term aortic complications; for all TBAD patients, long-term and continuous close follow-up plus OMT therapy is recommended)

利益冲突：所有作者均声明不存在利益冲突。

参考文献

[1] Hiratzka LF, Bakris GL, Beckman JA, et al. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM guidelines for the diagnosis and management of patients with Thoracic Aortic Disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine[J]. Circulation, 2010, 121(13): e266–369. doi: 10.1161/CIR.0b013e3181d4739e.

[2] Erbel R, Aboyans V, Boileau C, et al. 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult. The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC)[J]. Eur Heart J, 2014, 35(41): 2873–2926. doi: 10.1093/eurheartj/ehu281.

[3] MacGillivray TE, Gleason TG, Patel HJ, et al. The Society of Thoracic Surgeons/American Association for Thoracic Surgery clinical practice guidelines on the management of type B aortic dissection[J]. J Thorac Cardiovasc Surg, 2022, 163(4): 1231–1249. doi: 10.1016/j.jtcvs.2021.11.091.

[4] Lombardi JV, Hughes GC, Appoo JJ, et al. Society for vascular surgery (SVS) and society of thoracic surgeons (STS) reporting standards for type B aortic dissections[J]. Ann Thorac Surg, 2020, 109(3):959–981. doi: 10.1016/j.athoracsur.2019.10.005.

[5] Trimarchi S, Eagle KA, Nienaber CA, et al. Importance of refractory pain and hypertension in acute type B aortic dissection: insights from the International Registry of Acute Aortic Dissection (IRAD) [J]. Circulation, 2010, 122(13): 1283–1289. doi: 10.1161/CIRCULATIONAHA.109.929422.

[6] Song C, Lu QS, Zhou J, et al. The new indication of TEVAR for uncomplicated type B aortic dissection[J]. Medicine (Baltimore), 2016, 95(25):e3919. doi: 10.1097/MD.0000000000003919.

[7] Schwartz SI, Durham C, Clouse WD, et al. Predictors of late aortic intervention in patients with medically treated type B aortic dissection[J]. J Vasc Surg, 2018, 67(1): 78–84. doi: 10.1016/j.jvs.2017.05.128.

[8] Evangelista A, Salas A, Ribera A, et al. Long-term outcome of aortic dissection with patent false lumen: predictive role of entry tear size and location[J]. Circulation, 2012, 125(25): 3133–3141. doi: 10.1161/CIRCULATIONAHA.111.090266.

[9] Evangelista A, Galuppo V, Gruosso D, et al. Role of entry tear size in type B aortic dissection[J]. Ann Cardiothorac Surg, 2014, 3(4): 403–405. doi: 10.3978/j.issn.2225-319X.2014.07.03.

[10] Fattori R, Cao P, De Rango P, et al. Interdisciplinary expert consensus document on management of type B aortic dissection[J]. J Am Coll Cardiol, 2013, 61(16): 1661–1678. doi: 10.1016/j.

- jacc.2012.11.072.
- [11] Mussa FF, Horton JD, Moridzadeh R, et al. Acute aortic dissection and intramural hematoma: a systematic review[J]. JAMA, 2016, 316(7):754–763. doi: 10.1001/jama.2016.10026.
- [12] Kodama K, Nishigami K, Sakamoto T, et al. Tight heart rate control reduces secondary adverse events in patients with type B acute aortic dissection[J]. Circulation, 2008, 118(14 Suppl): S167–170. doi: 10.1161/CIRCULATIONAHA.107.755801.
- [13] Nienaber CA, Rousseau H, Eggebrecht H, et al. Randomized comparison of strategies for type B aortic dissection: the INvestigation of STEnt Grafts in Aortic Dissection (INSTEAD) trial[J]. Circulation, 2009, 120(25): 2519–2528. doi: 10.1161/CIRCULATIONAHA.109.886408.
- [14] Martin G, Patel N, Grant Y, et al. Antihypertensive medication adherence in chronic type B aortic dissection is an important consideration in the management debate[J]. J Vasc Surg, 2018, 68(3):693–699. doi: 10.1016/j.jvs.2017.12.063.
- [15] Pape LA, Awais M, Woznicki EM, et al. Presentation, diagnosis, and outcomes of acute aortic dissection: 17-year trends from the international registry of acute aortic dissection[J]. J Am Coll Cardiol, 2015, 66(4):350–358. doi: 10.1016/j.jacc.2015.05.029.
- [16] Fattori R, Montgomery D, Lovato L, et al. Survival after endovascular therapy in patients with type B aortic dissection: a report from the International Registry of Acute Aortic Dissection (IRAD) [J]. JACC Cardiovasc Interv, 2013, 6(8): 876–882. doi: 10.1016/j.jcin.2013.05.003.
- [17] Nienaber CA, Kische S, Rousseau H, et al. Endovascular repair of type B aortic dissection: long-term results of the randomized investigation of stent grafts in aortic dissection trial[J]. Circ Cardiovasc Interv, 2013, 6(4): 407–416. doi: 10.1161/CIRCINTERVENTIONS.113.000463.
- [18] Tsai TT, Fattori R, Trimarchi S, et al. Long-term survival in patients presenting with type B acute aortic dissection: insights from the International Registry of Acute Aortic Dissection[J]. Circulation, 2006, 114(21): 2226–2231. doi: 10.1161/CIRCULATIONAHA.106.622340.
- [19] Garbade J, Jenniches M, Borger MA, et al. Outcome of patients suffering from acute type B aortic dissection: a retrospective single-centre analysis of 135 consecutive patients[J]. Eur J Cardiothorac Surg, 2010, 38(3):285–292. doi: 10.1016/j.ejcts.2010.02.038.
- [20] Zeeshan A, Woo EY, Bavaria JE, et al. Thoracic endovascular aortic repair for acute complicated type B aortic dissection: superiority relative to conventional open surgical and medical therapy[J]. J Thorac Cardiovasc Surg, 2010, 140(6 Suppl): S109–115. doi: 10.1016/j.jtcvs.2010.06.024.
- [21] Ante M, Mylonas S, Skrypnik D, et al. Prevalence of the computed tomographic morphological DISSECT predictors in uncomplicated stanford type B aortic dissection[J]. Eur J Vasc Endovasc Surg, 2018, 56(4):525–533. doi: 10.1016/j.ejvs.2018.06.033.
- [22] Trimarchi S, Jonker FH, van Bogerijen GH, et al. Predicting aortic enlargement in type B aortic dissection[J]. Ann Cardiothorac Surg, 2014, 3(3):285–291. doi: 10.3978/j.issn.2225–319X.2014.05.01.
- [23] Melby SJ, Zierer A, Damiano RJ Jr, et al. Importance of blood pressure control after repair of acute type a aortic dissection: 25-year follow-up in 252 patients[J]. J Clin Hypertens (Greenwich), 2013, 15(1):63–68. doi: 10.1111/jch.12024.
- [24] Zierer A, Voeller RK, Hill KE, et al. Aortic enlargement and late reoperation after repair of acute type A aortic dissection[J]. Ann Thorac Surg, 2007, 84(2): 479–486. doi: 10.1016/j.athoracsur.2007.03.084.
- [25] Brunkwall J, Kasprzak P, Verhoeven E, et al. Endovascular repair of acute uncomplicated aortic type B dissection promotes aortic remodelling: 1 year results of the ADSORB trial[J]. Eur J Vasc Endovasc Surg, 2014, 48(3): 285–291. doi: 10.1016/j.ejvs.2014.05.012.
- [26] Iannuzzi JC, Stapleton SM, Bababekov YJ, et al. Favorable impact of thoracic endovascular aortic repair on survival of patients with acute uncomplicated type B aortic dissection[J]. J Vasc Surg, 2018, 68(6):1649–1655. doi: 10.1016/j.jvs.2018.04.034.
- [27] Qin YL, Wang F, Li TX, et al. Endovascular repair compared with medical management of patients with uncomplicated type B acute aortic dissection[J]. J Am Coll Cardiol, 2016, 67(24):2835–2842. doi: 10.1016/j.jacc.2016.03.578.
- [28] Shah TR, Rockman CB, Adelman MA, et al. Nationwide comparative impact of thoracic endovascular aortic repair of acute uncomplicated type B aortic dissections[J]. Vasc Endovascular Surg, 2014, 48(3):230–233. doi: 10.1177/1538574413518122.
- [29] Moulakakis KG, Mylonas SN, Dalainas I, et al. Management of complicated and uncomplicated acute type B dissection. A systematic review and meta-analysis[J]. Ann Cardiothorac Surg, 2014, 3(3):234–246. doi: 10.3978/j.issn.2225–319X.2014.05.08.
- [30] Kuo EC, Veranyan N, Johnson CE, et al. Impact of proximal seal zone length and intramural hematoma on clinical outcomes and aortic remodeling after thoracic endovascular aortic repair for aortic dissections[J]. J Vasc Surg, 2019, 69(4): 987–995. doi: 10.1016/j.jvs.2018.06.219.
- [31] Scali ST, Feezor RJ, Chang CK, et al. Efficacy of thoracic endovascular stent repair for chronic type B aortic dissection with aneurysmal degeneration[J]. J Vasc Surg, 2013, 58(1):10–17. doi: 10.1016/j.jvs.2012.12.071.
- [32] Tang JH, Lo ZJ, Wong J, et al. Effect of thoracic endovascular aortic repair on aortic remodeling in patients with type B aortic

- dissection in an Asian population[J]. *Ann Vasc Surg*, 2020, 69:352–359. doi: [10.1016/j.avsg.2020.05.058](https://doi.org/10.1016/j.avsg.2020.05.058).
- [33] Tolenaar JL, Kern JA, Jonker FH, et al. Predictors of false lumen thrombosis in type B aortic dissection treated with TEVAR[J]. *Ann Cardiothorac Surg*, 2014, 3(3):255–263. doi: [10.3978/j.issn.2225-319X.2014.05.17](https://doi.org/10.3978/j.issn.2225-319X.2014.05.17).
- [34] Melissano G, Bertoglio L, Rinaldi E, et al. Satisfactory short-term outcomes of the STABILISE technique for type B aortic dissection[J]. *J Vasc Surg*, 2018, 68(4): 966–975. doi: [10.1016/j.jvs.2018.01.029](https://doi.org/10.1016/j.jvs.2018.01.029).
- [35] Weiss G, Wolner I, Folkmann S, et al. The location of the primary entry tear in acute type B aortic dissection affects early outcome[J]. *Eur J Cardiothorac Surg*, 2012, 42(3):571–576. doi: [10.1093/ejcts/ezs056](https://doi.org/10.1093/ejcts/ezs056).
- [36] Codner JA, Lou XY, Duwayri YM, et al. The distance of the primary intimal tear from the left subclavian artery predicts aortic growth in uncomplicated type B aortic dissection[J]. *J Vasc Surg*, 2019, 69(3):692–700. doi: [10.1016/j.jvs.2018.05.245](https://doi.org/10.1016/j.jvs.2018.05.245).
- [37] Song JM, Kim SD, Kim JH, et al. Long-term predictors of descending aorta aneurysmal change in patients with aortic dissection[J]. *J Am Coll Cardiol*, 2007, 50(8): 799–804. doi: [10.1016/j.jacc.2007.03.064](https://doi.org/10.1016/j.jacc.2007.03.064).
- [38] Czerny M, Eggebrecht H, Rousseau H, et al. Distal stent graft-induced new entry after TEVAR or FET: insights into a new disease from EuREC[J]. *Ann Thorac Surg*, 2020, 110(5): 1494–1500. doi: [10.1016/j.athoracsur.2020.02.079](https://doi.org/10.1016/j.athoracsur.2020.02.079).
- [39] Lou XY, Duwayri YM, Jordan WD Jr, et al. The safety and efficacy of extended TEVAR in acute type B aortic dissection[J]. *Ann Thorac Surg*, 2020, 110(3): 799–806. doi: [10.1016/j.athoracsur.2019.12.036](https://doi.org/10.1016/j.athoracsur.2019.12.036).
- [40] Tsai TT, Evangelista A, Nienaber CA, et al. Partial thrombosis of the false lumen in patients with acute type B aortic dissection[J]. *N Engl J Med*, 2007, 357(4):349–359. doi: [10.1056/NEJMoa063232](https://doi.org/10.1056/NEJMoa063232).
- [41] Yamine H, Briggs CS, Stanley GA, et al. Retrograde type A dissection after thoracic endovascular aortic repair for type B aortic dissection[J]. *J Vasc Surg*, 2019, 69(1): 24–33. doi: [10.1016/j.jvs.2018.04.047](https://doi.org/10.1016/j.jvs.2018.04.047).
- [42] Ma T, Dong ZH, Fu WG, et al. Incidence and risk factors for retrograde type A dissection and stent graft-induced new entry after thoracic endovascular aortic repair[J]. *J Vasc Surg*, 2018, 67(4): 1026–1033. doi: [10.1016/j.jvs.2017.08.070](https://doi.org/10.1016/j.jvs.2017.08.070).
- [43] Liu L, Zhang SM, Lu QS, et al. Impact of oversizing on the risk of retrograde dissection after TEVAR for acute and chronic type B dissection[J]. *J Endovasc Ther*, 2016, 23(4):620–625. doi: [10.1177/1526602816647939](https://doi.org/10.1177/1526602816647939).
- [44] Canaud L, Ozdemir BA, Patterson BO, et al. Retrograde aortic dissection after thoracic endovascular aortic repair[J]. *Ann Surg*, 2014, 260(2):389–395. doi: [10.1097/SLA.0000000000000585](https://doi.org/10.1097/SLA.0000000000000585).
- [45] Eggebrecht H, Thompson M, Rousseau H, et al. Retrograde ascending aortic dissection during or after thoracic aortic stent graft placement: insight from the European registry on endovascular aortic repair complications[J]. *Circulation*, 2009, 120(11 Suppl): S276–281. doi: [10.1161/CIRCULATIONAHA.108.835926](https://doi.org/10.1161/CIRCULATIONAHA.108.835926).
- [46] Desai ND, Gottret JP, Szeto WY, et al. Impact of timing on major complications after thoracic endovascular aortic repair for acute type B aortic dissection[J]. *J Thorac Cardiovasc Surg*, 2015, 149(2 Suppl):S151–156. doi: [10.1016/j.jtcvs.2014.10.105](https://doi.org/10.1016/j.jtcvs.2014.10.105).
- [47] Mid-term outcomes and aortic remodelling after thoracic endovascular repair for acute, subacute, and chronic aortic dissection: the VIRTUE registry[J]. *Eur J Vasc Endovascular Surg*, 2014, 48(4):363–371. doi: [10.1016/j.ejvs.2014.05.007](https://doi.org/10.1016/j.ejvs.2014.05.007).
- [48] Miyairi T. Influence of timing after thoracic endovascular aortic repair for acute type B aortic dissection[J]. *Ann Thorac Surg*, 2018, 105(5):1392–1396. doi: [10.1016/j.athoracsur.2017.11.054](https://doi.org/10.1016/j.athoracsur.2017.11.054).
- [49] 中华医学会外科学分会血管外科学组. Stanford B 型主动脉夹层诊断和治疗中国专家共识(2022 版)[J]. *中国血管外科杂志: 电子版*, 2022, 14(2): 119–130. doi: [10.3969/j.issn.1674-7429.2022.02.007](https://doi.org/10.3969/j.issn.1674-7429.2022.02.007).
- Chinese Society for Vascular Surgery, Chinese Society of Surgery, Chinese Medical Association. Chinese expert consensus on the diagnosis and treatment of type B aortic dissection(2022 edition) [J]. *Chinese Journal of Vascular Surgery: Electronic Version*, 2022, 14(2): 119–130. doi: [10.3969/j.issn.1674-7429.2022.02.007](https://doi.org/10.3969/j.issn.1674-7429.2022.02.007).
- (本文编辑 姜晖)
- 本文引用格式:**舒畅. TEVAR 在非复杂型 B 型主动脉夹层中的作用——2022 年 STS/AATS B 型主动脉夹层管理临床实践指南解读[J]. *中国普通外科杂志*, 2022, 31(12):1557–1563. doi: [10.7659/j.issn.1005-6947.2022.12.001](https://doi.org/10.7659/j.issn.1005-6947.2022.12.001)
- Cite this article as:** Shu C. Role of TEVAR in non-complex type B aortic dissection—interpretation of 2022 STS/AATS clinical practice guidelines on the management of type B aortic dissection[J]. *Chin J Gen Surg*, 2022, 31(12): 1557–1563. doi: [10.7659/j.issn.1005-6947.2022.12.001](https://doi.org/10.7659/j.issn.1005-6947.2022.12.001)