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STATE-OF-THE-ART PAPER

Interdisciplinary Expert Consensus Document on Management of Type B Aortic Dissection

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An expert multidisciplinary panel in the treatment of type B aortic dissection reviewed available literature to develop treatment algorithms using a consensus method. Data from 63 studies published from 2006 to 2012 were retrieved for a total of 1,548 patients treated medically, 1,706 patients who underwent open surgery, and 3,457 patients who underwent thoracic endovascular repair (TEVAR). For acute (first 2 weeks) type B aortic dissection, the pooled early mortality rate was 6.4% with medical treatment and increased to 10.2% with TEVAR and 17.5% with open surgery, mostly for complicated cases. Limited data for treatment of subacute (2 to 6 weeks after onset) type B aortic dissection showed an early mortality rate of 2.8% with TEVAR. In chronic (after 6 weeks) type B aortic dissection, 5-year survival of 60% to 80% was expected with medical therapy because complications were likely. If interventional treatment was applied, the pooled early mortality rate was 6.6% with TEVAR and 8.0% with open surgery. Medical treatment of uncomplicated acute, subacute, and chronic type B aortic dissection is managed with close image monitoring. Hemodynamic instability, organ malperfusion, increasing periaortic hematoma, and hemorrhagic pleural effusion on imaging identify patients with complicated acute type B aortic dissection requiring urgent aortic repair. Recurrence of symptoms, aortic aneurysmal dilation (>55 mm), or a yearly increase of >4 mm after the acute phase are predictors of adverse outcome and need for delayed aortic repair ("complicated chronic aortic dissections"). The expert panel is aware that this consensus document provides proposal for strategies based on nonrobust evidence for management of type B aortic dissection, and that literature results were largely heterogeneous and should be interpreted cautiously. (J Am Coll Cardiol 2013;61:1661–78)

Aortic dissection has one of the highest mortality rates of the cardiovascular diseases, and the complexities of management remain a challenge. Since the first description of thoracic endovascular repair (TEVAR), type B acute and chronic dissection of the thoracic aorta has increasingly been treated by the endovascular route (1–3). However, several controversies continue to exist on the optimal treatment strategy (2,3) for type B aortic dissection. To date, only 1 randomized trial of TEVAR versus medical management for chronic type B aortic dissection has been completed (4,5). Most published reports describing TEVAR for type B aortic dissection consist of uncontrolled prospective or retrospective cohorts or case series. Furthermore, the timing of intervention after dissection onset and complications are not uniformly reported and defined. Patients assigned to medical treatment, TEVAR, or open surgery often significantly differ in baseline comorbidity illnesses and severity of the disease, making direct comparisons among treatment strategies difficult.

The objective of this paper is to present a consensus of cardiovascular, vascular, and interventional specialists in an attempt to define reliable criteria for definitions and treatment of type B aortic dissection. As part of this objective, a comprehensive review of available literature regarding medical, surgical, and endovascular treatment of type B aortic dissection has been conducted. The experts' panel is aware that this consensus document can provide a proposal for strategies, but that the final decision about when an intervention is justified

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JACC Vol. 61, No. 16, 2013
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Abbreviations and Acronyms

CI = confidence interval

CT = computed tomography

MDCT = multidetector computed tomography

MRI = magnetic resonance imaging

OR = odds ratio

TEVAR = thoracic endovascular repair

and what type of intervention should be used may vary among individual cases.

Methods

Literature search. The review of the available literature was planned in accordance with current guidelines for performing comprehensive systematic reviews (MOOSE [Meta-analysis of Observational Studies in Epidemiology]) (6). The literature search was implemented to identify studies through a comprehensive search of computerized databases including PubMed, Ovid Medline, and the Cochrane Library. The search was inclusive to June 2012 and limited to the past 6 years. Search strings included "type B aortic dissection" combined with the terms "medical treatment," "endovascular treatment," and "surgical treatment." Subheadings for the search were the terms "acute," "chronic," and "subacute." The search was limited to studies on humans and adults only, with at least an abstract available in English. After potentially relevant studies were identified, additional tangential searches were conducted using related study links within PubMed or within a reference list of published papers.

For the analysis, studies evaluating medical, open surgical, and/or TEVAR management were eligible if they included at least 20 patients with type B aortic dissection for each timing (acute, subacute, chronic) and treatment category, and reported at least 1 clinically relevant outcome or provided data on morphological predictors of outcomes. Type A dissection and combined hybrid endovascular and open thoracic aorta repairs were excluded.

In evaluating multiple publications of overlapping patient populations, studies were evaluated by the center(s) and patient enrollment dates, and the most recent and/or most complete series was selected to extract as many relevant outcomes as possible. To define the timing of type B aortic dissection, acute presentation had to be within 14 days of onset of symptoms and chronic presentation beyond 6 weeks. An interval between 2 and 6 weeks from onset of pain was used as the most appropriate time to define a subacute type B aortic dissection (3). The major endpoint was early (in-hospital and 30 days) mortality. Secondary endpoints included early (in-hospital/30 days) stroke and spinal cord ischemia, and long-term survival and aortic event-free survival. For "aortic event free," definitions provided by study investigators were generally used and detailed as provided. An ancillary analysis was conducted to investigate morphological outcome predictors.

Expert panel. An expert panel in the treatment of type B aortic dissection was organized by convening 7 thought leaders from the multidisciplinary fields of cardiology, cardiothoracic surgery, vascular surgery, and interventional radiology. All panel members represented the Western European geographical area and were from centers recognized for aortic dissection referral. The members of the panel convened and participated in workshops to review the best available literature and to provide a consensus document with suggestions for those treatments that were shown to have sufficient evidence of clinical benefit for treatment of type B aortic dissection. Efforts were also made to standardize definitions (e.g., complicated type B aortic dissection).

Consensus method. The panel highlighted current topics of debate regarding treatment of type B aortic dissection, discussed specific results from the literature, and identified evidence gaps. Treatment algorithm was drafted only when general agreement among panelists was reached and was based on the best-published evidence. In case of initial disagreement, re-review of literature information and further discussion were performed before unanimous approval.

Statistical analysis. Literature data were stratified by the timing of dissection (acute [first 2 weeks] and chronic; subacute [2 to 6 weeks] when available) (3,4) and type of treatment (medical, TEVAR, open surgery). Meta-analysis was conducted using specific statistical packages: Comprehensive meta-analysis package; Biostat (Borenstein M, Hedges L, Higgins J, Rothstein H. Comprehensive Meta-analysis Version 2, Biostat, Englewood, New Jersey, 2005); and Review Manager (RevMan) Version 5.1 (The Nordic Cochrane Centre, Copenhagen, Denmark). Event rates, ranges, and corresponding 95% confidence intervals (CIs) were used to summarize outcome data pooled from all eligible identified studies. Comparisons of outcomes among different treatments (medical vs. TEVAR vs. open surgery) were combined only when treatments were applied in the same population (same study) to make outcomes comparable. Results from pooled comparisons were expressed as pooled odds ratios (OR) with 95% CI for dichotomous variables.

Statistical heterogeneity was measured using the Q statistic ($p < 0.10$ was considered indicative of statistically significant heterogeneity) and I^2 test. A fixed-effects model was used when no heterogeneity existed among studies. Otherwise, the random effects model was used. Long-term data were reported with Kaplan-Meier rates as by study investigators. No pooled analyses of long-term results were performed because of inconsistency in follow-up lengths. Results from ancillary analysis on morphology predictors were similarly systematically analyzed but not pooled in a meta-analytical model.

Results

Search results. The assessment of studies for inclusion and data extraction was conducted by 1 independent reviewer (P.D.R.), and validated by the panelists during the first meeting. The literature search identified 126 potentially of interest publications from 2006 to 2012. Main data from the studies finally included in this review are provided in Tables 1 to 4 (4,5–78). Twenty-four publications included

Table 1 Result Summary for Medical Treatment in Type B Aortic Dissection

Author and Year (Ref. #)	n	Pathology	Early Mortality n (%)	Early CVA n (%)	Early SCI n (%)	Mean Follow-Up (months)	Survival Rate (%)	Aortic Event Freedom Rate (%)
Case series								
Winnerkvist 2006 (7)	66	66 acute (14 chronic excluded)	0	2 (3)	3 (4.5)	79 (22–179)	1 yr (100.0) 5 yrs (82.0) 10 yrs (69.0)	Any dissection death, new dissection, aneurysm free: 5 yrs: (75.0) 10 yrs: (67.0) Dissection death free: 5 yrs (85.0) 10 yrs (82.0)
Hata 2007 Niino 2009 (8,9)	210	Acute not complicated (5 complicated excluded)	6 (2.8)	NA	1 (0.5)	on 180 patients 50.5 ± 37.8	on 180 patients 1 yr (97.0) 5 yrs (89.4) 10 yrs (71.8)	on 180 patients Reintervention free: 1 yr (93.0) 5 yrs (83.9) 10 yrs (76.0)
Estrera 2006, 2007 (10,11)	159	85 acute not complicated 74 acute complicated including 136 medical and 23 early repair	10/136 (7.3)	NA 8 (5.0)/159 overall	NA 13 (8.2)/159 overall	20 (0–67)	Overall 1 yr (83.0) 5 yrs (75.0)	NA 11 reinterventions at 6 months
Kitada 2008 (12)	74	Acute	0	NA	NA	12	1 yr (97.0)	1 yr (82.0)
Sakakura 2009 (13)	215	Acute	8 (3.7)	NA	1 (0.5)	NA		NA
Chemelli-Steingruber 2009, 2010 (14,15)	50	Acute	3 (6.0)	1 (2.0)	NA	36 (0–122)	1 yr (88.5) 5 yrs (70.2)	on 35 patients Dissection death free: 1 yr (88.0) 5 yrs (74.9) Rupture free survival: 1 yr (93.4) 5 yrs (88.5)
Dick 2010 (16)	72	Acute	4 (5.6)	NA	NA	36 ± 19	NA	NA
Garbade 2010 (17)	84	63 acute not complicated 21 acute complicated	7 (8.3)	12 (14.3)		1,107 days	1 yr (86.2) 3 yrs (80.9) 5 yrs (72.1)	NA Reintervention: 22
Miyahara 2011 (18)	160	Acute	0	NA	NA	33.5 (2–88)	1 yr (98.7) 3 yrs (92.2) 5 yrs (87.2)	Rupture, reintervention free: 1 yr (92.2) 3 yrs (84.2) 5 yrs (71.0)
Registries								
Fattori IRAD 2006, 2008, 2010 (19–22)	390	Acute	34 (8.7)	NA	NA	NA	on 189 patients 1 yr (90.3) 3 yrs (77.6)	NA
Cumulative	1,480		6.4%	4.2%	5.3%			
Neurologic complications				10.1%				
Chronic dissection								
Nienaber INSTEAD 2009, 2010 (4,5)	68	Subacute/chronic not complicated	0	0	NA	2 yrs	1 yr (97.0)	Aorta-related death, reintervention, expansion free: 1 yr (82.5) Aorta related death free: 1 yr (97.0)

CVA = cerebrovascular accident; INSTEAD = Investigation of Stent Grafts in Aortic Dissection; IRAD = International Registry of Acute Aortic Dissection; SCI = spinal cord ischemia.

Table 2 Result Summary for TEVAR in Acute Type B Aortic Dissection*

Author and Year (Ref. #)	n	Pathology	Early Mortality n (%)	Early CVA n (%)	Early SCI n (%)	Mean Follow-up (months)	Survival Rate (%)	Aortic Event Freedom Rate (%)
Case series								
Böckler 2006, 2009 (28,29)	23	Acute complicated	6 (26.0)	0	0	24 (0–56)	1 yr (62.0) 5 yrs (62.0)	Aortic event free: 1 yr (64.0) 5 yrs (45.0) Reintervention free: 1 yr (82.0) 5 yrs (73.0)
Chen 2006 (30)	23	Acute complicated	1 (4.3)	1 (4.3)	0	27.5 ± 14.2	NA	NA
Di Tommaso 2006 (31)	26	Acute complicated	0	NA	0	29 ± 14 (8–58)	NA 3 deaths	NA 2 aortic deaths 2 late ruptures 2 redo TEVARs
Yang 2006 (32)	36	Acute complicated	1 (2.8)	0	0	15 (2–48)		
Jing 2008 (33)	32	Acute complicated	1 (3.1)	0	0	18 ± 16 (1–65)	4 yrs (86.4)	4 yrs (73.9)
Rodriguez 2008 (34)	59	Acute complicated	1 (1.7)	3 (5.1)	3 (5.1)	15.6	NA	NA
Sayer 2008 (35)	38	Acute complicated	1 (2.6)	2 (5.3)	0	30	(93 at 30 months)	Reintervention free: (55 at 30 months)
Alves 2009 (36)	45	Acute complicated	3 (6.7)	NA	NA	35.9 ± 28.5	NA (78 at 35.9 months)	NA Reinterventions free: (79 at 35.9 months)
Chemelli-Steingruber 2009, 2010 (14,15)	38	Acute complicated	5 (13.2)	1 (2.6)	0	33 (0–97)	1 yr (81.5) 5 yrs (69.0)	on 29 patients Dissection death survival: 1–5 yrs (82.6) Rupture free survival: 1–5 yrs (93.1)
Conrad 2009 (37)	33	Acute complicated	4 (12)	4 (12)	2 (6)	1 yr	NA 8 deaths at 1 yr	NA
Feezor 2009 (38)	33	Acute complicated	7 (21.2)	4 (12.1)	5 (15.1)	5	NA	NA
Guanqi 2009 (39)	72	Acute complicated	1 (1.4)	3 (4.2)	0	14.4 ± 11 acute	1 yr (98.6) 3 yrs (75.0)	FL thrombosis 1 yr (51.4) 2 yrs (53.8)
Khoynezhad 2009 Kim, 2011 (40,41)	41	Acute complicated	4 (9.8)	5 (12.2) 2 major (4.9) 3 minor (7.3)	0	on 28 patients 36 ± 27 (1–88)	on 28 patients 1 yr (82.0) 5 yrs (78.0)	NA on 28 patients 5 endoleaks 2 reinterventions
Manning 2009 (42)	45	Acute complicated	5 (11.1)	2 (4.4)	4 (8.9)	30 ± 9 for IIIa 29 ± 18 for IIIb	NA	NA
Sze 2009 (43)	23	Acute complicated	4 (17.4)	2 (8.7)	1 (4.3)	22.3 (0–92)	NA	NA 11 endoleaks
Botsios 2010 (44)	32	Acute complicated	3 (9.3)	NA	1 (3.1)	32.1 ± 18.7 (2–60)		
Ehrlich 2010 (45)	32	Acute complicated	4 (12.5)	NA	3 (9.4)	26 ± 23	1 yr (81.0) 5 yrs (76.0)	1 yr (78.0) 5 yrs (61.0)

Continued on the next page

Table 2 Continued

Author and Year (Ref. #)	n	Pathology	Early Mortality n (%)	Early CVA n (%)	Early SCI n (%)	Mean Follow-up (months)	Survival Rate (%)	Aortic Event Freedom Rate (%)
Garbade 2010 (17)	46	27 acute complicated 19 acute uncomplicated	9 (19.6)	11 (23.9)	1,107 days	1 yr (80.0) 3 yrs (73.3) 5 yrs (56.3)	NA	
Parsa 2010 (46)	22	Acute complicated	1 (4.5)	0	1 (4.5)	7.1 (1–38)	NA Cumulative acute/chronic	NA Cumulative acute/chronic
Zeeshan 2010 (47)	45	Acute complicated	2 (4.4)	3 (6.7)	6 (13.3)	37 (2 months–7 yrs)	1 yr (82.0) 5 yrs (79.0)	NA 2 deaths 3 retrodissections 7 reinterventions
Tang 2011 (48)	30	Acute complicated	1 (3.3)	NA	0	12 ± 8 (1–19)	NA	1 death
O'Donnell 2011 (49)	28	27 acute complicated	2 (7.2)	3 (10.7) 1 major 2 minor	1 (3.6)	21 (1–45)	NA 85% overall	NA 2 reinterventions
Shu 2011 (50)	45	Acute complicated	2 (4.4)	0	0	13 (1–36)	1 yr (95.6) 3 yrs (96.6)	
Steuer 2011 (51)	60	50 acute complicated 10 subacute complicated	2 (3.3)	3 (5.0)	1 (1.7)	3.7 yrs	3 yrs (90.0) 5 yrs (87.0)	Reintervention freedom: 3 yrs (68.0) 5 yrs (65.0)
Registries								
Fattori IRAD 2008, 2006 (19,20)	43	Acute complicated	5 (11.6)	NA	1 (2.3)	2.3 yrs median	on 29 patients 1 yr (88.9) 3 yrs (76.2)	
Torsello 2010 TRAVIATA (23)	32	Acute complicated	0	0	0	23.1 ± 10.1	NA	NA
VIRTUE 2011 (24)	50	Acute complicated	4 (8.0)	4 (8.0)	1 (2.0)	23.1		
Zipfel 2011 (25)	25	Acute complicated	5 (20.0)	NA	NA	NA	NA	NA
Ehrlich 2012 Talent Thoracic Registry (26)	29	Acute complicated	5 (17.2)	2 (6.9)	0	53 ± 41	1 yr (79.0) 5 yrs (61.0)	Treatment failure (rupture, device-related complications, aortic death, sudden death, reintervention) freedom: 1 yr (82.0) 5 yrs (77.0)
Administrative†								
Brunt 2011 NIH (27)	991	Acute emergent	107 (10.8)	37 (3.7)	32 (3.2)	NA	NA	NA
Brunt 2011 NIH (27)	282	Acute elective	9 (3.2)	10 (3.5)	0	NA	NA	NA
Cumulative	2,359		10.2%	4.9%	4.2%			

*Data on endovascular treatment of type B dissection included use of a number of different types of stent grafts. †In-hospital data.

FL = false lumen; NIH = National Institutes of Health; TEVAR = thoracic endovascular aortic repair; TRAVIATA = Treatment of Thoracic Aortic Disease with the Valiant Stent Graft; VIRTUE = VALIANT Thoracic Stent Graft Evaluation For the Treatment of Descending Thoracic Aortic Dissections- Post Marketing Surveillance Registry; other abbreviations as in Table 1.

JACC Vol. 61, No. 16, 2013
April 23, 2013:1661–78

Table 3 Result Summary for Open Surgery in Type B Aortic Dissection*

Author and Year (Ref. #)	n	Pathology	Early Mortality n (%)	Early CVA n (%)	Early SCI n (%)	Mean Follow-Up (months)	Survival Rate (%)	Aortic Event Freedom Rate (%)
Case series								
Estrera 2007 (11)	23	Acute complicated	4 (17.4)	NA	NA	20 (0–67)	NA	NA
Bozinovski 2008 (64)	76	Acute complicated	17 (22.4)	5 (6.6)	5 (6.6)	NA	NA	NA
Shimokawa 2008 (65)	24	Acute complicated	2 (8.3)	NA (0)	1 (4.2)	28.1 ± 14.8 (10.3–68.1)	5 yrs (82.6)	Reintervention, aortic death free: 1 yr (95.2) 5 yrs (68.0)
Zeeshan 2010 (47)	20	Acute complicated	8 (40)	0	2 (10.0)	37 (2 months–7 yrs)	1 yr (58.0) 3 yrs (52.0) 5 yrs (44.0)	NA
Murashita 2012 (66)	31	Acute complicated	6 (19.4)	2 (6.5)	2 (6.5)	11.5 (1–77)	1 yr (74.1) 5 yrs (64.8)	Rupture, reintervention, expansion free: 1 yr (83.0) 5 yrs (58.7)
Registries								
Trimarchi, IRAD 2006 (22)	82	Acute complicated	24 (29.3)	8 (9.8)	4 (4.9)	NA	NA	NA
Administrative†								
Brunt NIS† 2011 (27)	991	Acute emergent	173 (17.5)	61 (6.2)	25 (2.5)	NA	NA	NA
Brunt NIS† 2011 (27)	282	Acute elective	16 (5.6)	5 (1.8)	0	NA	NA	NA
Cumulative acute		1,529		17.5%	5.9%	3.3%		
Chronic dissection								
Miyamoto 2008 (67)	40	Chronic complicated	0	2 (5)	0	9.8 ± 5.1 yrs (4–23)	5 yrs (92.0) 10 yrs (64.0)	Reintervention, dissection, aneurysm, free: 5 yrs (85.0) 10 yrs (78.0)
Mutsuga 2010 (68)	33	Chronic complicated	0	2 (6.1)	3 (9.1)	NA	NA	NA
Zoli 2010 (69)	104	Chronic complicated	10 (9.6)	6 (5.8)	5 (4.8)	5.7 ± 4.5 yrs	1 yr (78.0) 5 yrs (68.0) 10 yrs (59.0)	Reintervention free: 1 yr (99.0) 5 yrs (93.0) 10 yrs (83.0)
Cumulative chronic		177		8.0%	5.7%	5.5%		

*Data on endovascular treatment of type B dissection included use of a number of different types of stent grafts. †In-hospital data.
NIS = National Institutes of Science; other abbreviations as in Tables 1 and 2.

duplicative or overlapping data and were excluded (Online Refs. 79–102). Of the remaining 102, another 19 were excluded because of small numbers (<20 cases for type of treatment or timing of disease) (Online Refs. 103–121). Most retrieved studies were retrospective or observational studies without controls, and often had mixed populations. Only 2 identified studies were randomized (4,5) (Online Ref. 122), but published outcomes were available only for 1 study (4,5). Nine registries were identified, but data could be included only for 5 (19–26). In the remaining studies (Online Refs. 123–126), no detailed information was retrievable according to the inclusion criteria for search. Reasons for exclusions of major registries are shown in Table 5. Data from administrative codes were retrievable from 3 studies, but only 1 (27) could be included for completeness in reporting (Online Refs. 127,128). Only in-hospital data were available for this study. Overall, 15 studies were excluded because no detailed information on outcomes could be retrieved (Online Refs. 123–126,129–137). Finally, 2 studies were excluded because of reporting on complex stent grafts (Online Refs. 138,139), and another 2 were excluded because of meta-analysis of included studies (Online Refs. 140,141).

The remaining studies included data on 1,548 patients treated medically (1,480 for acute [7–22] and 68 patients for chronic or subacute aortic dissection [4,5]); 1,706 patients treated with open surgery (1,529 for acute [11,22,27,47,64–66] and 177 for chronic aortic dissection [67–69]); and 3,457 patients treated with TEVAR (2,359 for acute [14,15,17,19,20,23–51] and 1,098 for chronic or subacute aortic dissection [4,5,24,25,29,32–36,39,52–63]). Nine additional studies were included because of reporting on morphology predictors of outcome in type B aortic dissection (70–78), for a total of 63 studies finally included in the present review. Only a few studies reported on subacute dissections (4,5), but there were no clear distinction in reporting outcomes for dissections assessed at 2 to 6 weeks from onset and those assessed later; therefore, it was not possible to separately analyze and report cumulative data.

Figure 1 outlines the results of the search strategy. Multiple references for the same study, if providing additional details, were retained. A complete list of references of excluded studies are shown in the Online Appendix.

The identified available literature was found to have numerous limitations, including high heterogeneity in

terms of study cohort definition, disparate sample size, indications, and timing for treatment and outcome data.

Literature Results and Panelists Suggestions

Acute type B aortic dissection. DEFINITION OF COMPLICATIONS IN ACUTE TYPE B AORTIC DISSECTION. There were no uniform criteria to define "complicated" acute type B aortic dissection usually justifying a more aggressive treatment approach. According to the published literature, approximately 25% of patients presenting with acute type B aortic dissection are complicated at admission by malperfusion syndrome or hemodynamic instability, resulting in a high risk of early death if untreated (19–21).

Severe hypertension, a typical finding associated with dissection onset, usually recedes with expectant management. Refractory hypertension (hypertension persisting despite ≥3 different classes of antihypertensive therapy at maximal recommended or maximal tolerated doses), if not present in the clinical history before the onset of dissection, is considered a sign of instability or of renal malperfusion (3) (Online Ref. 142). International Registry of Acute Aortic Dissection (IRAD) trial data showed that in-hospital mortality after medical management was significantly increased in average-risk patients with type B aortic dissection under medical therapy with refractory hypertension/pain compared with those without these features (35.6% vs. 1.5%; p = 0.0003) (21).

Malperfusion syndrome is reported in about 10% of patients with type B aortic dissection due to decreased perfusion of aortic branches (spinal, iliac, or visceral arteries) that typically leads to paraparesis or paraplegia, lower limb ischemia, abdominal pain, nausea, and diarrhea. However, clinical signs of organ malperfusion may be too subtle to be detected early. Mesenteric and celiac artery malperfusion may be associated with an increase in laboratory markers (bilirubin, amylases, hepatic, and intestinal enzymes). Multidetector computed tomography (MDCT) or magnetic resonance imaging (MRI) findings, such as true lumen compression, or an intimal flap inside the renal, celiac, or mesenteric arteries, carry a high suspicion of visceral malperfusion. Delay or absence of nephrographic effect during the late phase of contrast-enhanced CT scan, often accompanied by an increase in serum creatinine and/or refractory hypertension, indicates renal malperfusion (19–21).

An increase in perioaortic hematoma and hemorrhagic pleural effusion in 2 subsequent CT examinations have been shown as findings of impending rupture and might have particular relevance if associated with symptoms (19–21).

Patients with severe hypotension (<90 mm Hg systolic) or shock at presentation should be considered at high risk of death (19–21).

PANELISTS' SUGGESTIONS FOR DEFINITION OF COMPLICATED TYPE B ACUTE AORTIC DISSECTION.

- Malperfusion is indicative of impending organ failure and must be recognized early. Diagnosis of static or dynamic organ malperfusion is corroborated by laboratory markers (bilirubin, amylases, enzymes, creatinine) and imaging data.
- Hypertension is indicative of complications in acute type B aortic dissection only when associated with malperfusion or persisting with uncontrolled high values despite full medical therapy.
- Increases in perioaortic hematoma and hemorrhagic pleural effusion in 2 subsequent CT examinations during medical expectant management of acute type B aortic dissection are findings suggestive of impending rupture.

ACUTE TYPE B AORTIC DISSECTION. OUTCOME DATA FROM MEDICAL THERAPY. There are no completed randomized data on comparison of TEVAR versus open surgery or versus medical therapy published results in acute type B aortic dissection (Online Ref. 122), and unfortunately many studies do not make a clear distinction between patients presenting with complicated and uncomplicated patterns. Outcome data of medical therapy were available for 1,480 patients who underwent conservative medical management for acute type B aortic dissection, as indicated in Table 1 (7–22). In the majority of cases, patients who underwent medical therapy presented with uncomplicated dissection, although a percentage required early interventions for complications that developed during hospital stay. A minority of patients with complications was treated with medical therapy only, either due to the lack of appropriate facilities or due to the presence of comorbidities or morphology that made open surgery or TEVAR not feasible. Complications of medical therapy were reported by investigators as "developing" or "occurring" in dissections under medical management, thereby excluding those that occurred on admission or after a different strategy of treatment (TEVAR, open surgery) was applied after initial medical expectant policy. However, this was not always specified by investigators and might represent a source of bias. For acute aortic dissections treated medically, the pooled early mortality rate was 6.4% (95% CI: 5.1% to 7.9%). The pooled rates of stroke and spinal cord ischemia developing early during medical management alone were 4.2% (95% CI: 2.3% to 7.4%) and 5.3% (95% CI: 3.4% to 8.4%), respectively, with a combined early neurological complication event rate of 10.1% (95% CI: 7.5% to 13.5%). Long-term survival ranged from approximately 70.2% to 89% at 5 years (7–12,14,15,17–22). Aortic adverse event freedom (including aortic death, rupture, new dissection, enlargement, reintervention) ranged from 75% to 88.5% at 5 years, but there were variable event definitions among studies (Table 1).

Table 4 Result Summary for TEVAR in Chronic Type B Aortic Dissection*

Author and Year (Ref. #)	n	Pathology	Early Mortality n (%)	Early CVA n (%)	Early SCI N (%)	Mean Follow-Up (months)	Survival Rate (%)	Aortic Event Freedom Rate (%)
Case series								
Thompson 2007 (52)	52	Chronic complicated (including 2 valiant potential overlapping with Mani 2012)	1 (1.9)	2 (3.8)	0	5	NA	NA
Suzuki 2006 (53)	45*	*43 chronic complicated +2 acute	0	1/45 (2.2)	0	62 (18–101)	NA 5 late deaths	NA
Yang 2006 (32)	40	Chronic complicated	0	0	0	15 (2–48)	NA	NA
Yuan 2007 (54)	27	Chronic	0	0	0	48 (7–87)	NA	NA
Flecher 2008 (55)	28	Chronic complicated	4	0	0	20.8 (1–80)	NA	NA
Jing 2008 (33)	35	Chronic complicated	0	0	0	17 ± 14 (1–65)	NA 1 late death	NA
Rodriguez 2008 (34)	47	Chronic complicated	7	2	1	15.6	NA	NA
Sayer 2008 (35)	40	Chronic complicated	3 (7.5) chronic	0	0	30	(66.5) at 30 months	Reintervention free: (62) at 30 months
Alves 2009 (36)	61	Chronic complicated	2 (3.3) chronic	NA	NA	35.9 ± 28.5	NA	NA
							(93) at 35.9 months	Reintervention free: (78) at 35.9 months
Böckler 2009 (29)	31	Chronic complicated	0	0	0	32.1 ± 25 (1–95)	NA	NA
Chaikof 2009 (56)	33	Chronic complicated	NA	1 (3.0) chronic	0	11	(73) at 1 yr	NA
Kim 2009 (57)	72	Chronic	0	0	0	64.4 ± 38.8 (5–97)	NA	Dissection mortality free: 5 yrs (98.3)
							5 deaths 1 aorta related	
Guanqi 2009 (39)	49	Chronic complicated	4 (8.2) chronic	1 (2.0) chronic	0	22.1 ± 20.8 chronic	NA	NA
Ohtake 2010 (58)	23	Chronic	0	NA	NA	37 (4–80)	NA	NA
Xu 2010 (59)	84	Chronic	1 (1.2)	0	0	33.2 (6–86)	5 yrs (84.4)	5 yrs (75.2)
Parsa 2011 (60)	51	Chronic complicated	0	0	0	27 ± 16 (2–60)	5 yrs (77.7)	Aortic survival: 5 yrs (98)
								Reintervention free: 5 yrs (77.3)
Kang 2011 (61)	76	Chronic complicated	4 (5)	1	0	34	1 yr (86)	Death, reintervention free: 1 yr (72)
							3 yrs (80)	3 yrs (59)
								Reintervention free: 1 yr (83)
								3 yrs (73)
Andacheh 2012 (62)	73	Chronic complicated	10 (14)	1	1	18	1 yr (81)	Aortic death survival: 1 yr (86)

Continued on the next page

Table 4 Continued

Author and Year (Ref. #)	n	Pathology	Early Mortality n (%)	Early CVA n (%)	Early SCI N (%)	Mean Follow-Up (months)	Survival Rate (%)	Aortic Event Freedom Rate (%)
Mani 2012 (63)	58	Chronic complicated (including 2 valiant potential overlapping with Taylor 2007)	3 (5.2)	0	1 (1.7)	NA	1 yr (89.0)	Reintervention free: 1 yr (85.0) 3 yrs (71.0)
							3 yrs (64.0)	
Randomized controlled trials								
Nienaber INSTEAD 2009, 2010 (4,5)	72	Subacute/chronic not complicated	2 (2.8)	1 (1.4)	2 (2.9)	2 yrs	1 yr (91.3)	Aorta related death, reintervention, expansion free: 1 yr (83.3) Aorta-related death free: 1 yr (94.2)
Registries								
Virtue registry 2011 (24)	50	24 subacute complicated 26 chronic complicated	0	0	1 (3.8) chronic	NA	NA	NA
Zipfel 2011 (25)	51	Chronic	0	NA	NA	NA	NA	NA
Cumulative	1,098		6.6%	1.9%	1.5%			

*Data on endovascular treatment of type B dissection included use of a number of different types of stent grafts.
Abbreviations as in Tables 1 and 2.

ACUTE TYPE B AORTIC DISSECTION. OUTCOME DATA FROM TEVAR. Thirty studies were identified with outcome data of TEVAR for acute type B aortic dissection (14,15,17,19,20,23–51). Nineteen included only acute dissections, whereas 11 reported acute and chronic dissection cases in separate groups. In most of the papers, indication for TEVAR was complicated acute type B dissection; however, this finding was not always specified (27), and criteria for defining complicated were variable. As a consequence, the exact number of complicated versus uncomplicated cases could not be accurately determined. Analysis of data was performed with the understanding that this discrepancy might create some bias. A summary of pertinent results for TEVAR of acute type B aortic dissection is shown in Table 2, reporting available data from 2,359 patients. The early pooled mortality rate was 10.2% (95% CI: 9.0% to 11.6%). Pooled rates of early stroke and spinal cord ischemia after treatment were 4.9% (95% CI: 4.0% to 6.0%) and 4.2% (95% CI: 3.3% to 5.2%), respectively. Survival rates ranged from 56.3% to 87% at 5 years. Freedom from aortic events (as a variable reported in Table 2) ranged from 45% to 77% at 5 years.

ACUTE TYPE B AORTIC DISSECTION. OUTCOME DATA FROM OPEN SURGERY. Outcome data on 1,529 patients with acute complicated type B aortic dissection submitted to open surgical repair were analyzed for this consensus document (Table 3) (11,22,27,47,64–66). The pooled early mortality rate was 17.5% (95% CI: 15.6% to 19.6%). The pooled mean rates of early stroke and spinal cord ischemia after treatment were 5.9% (95% CI: 4.8% to 7.3%) and 3.3% (95% CI: 2.4% to 4.5%), respectively. Five-year survival rates ranged from 44% to 64.8%. Freedom from aortic events and reintervention ranged from 58.7% to 68% at 5 years (Table 3).

COMPARISON OF MEDICAL THERAPY VERSUS TEVAR AND OPEN SURGERY VERSUS TEVAR FOR ACUTE TYPE B AORTIC DISSECTION. In the published literature, direct comparison between TEVAR, open surgery, and medical therapy was likely invalidated by unbalanced populations (unmatched illness conditions and rates of complicated vs. uncomplicated cases of patients assigned to each treatment). This might produce a too optimistic interpretation of the results, with an overestimation of low mortality and complication rates in populations at lower risks (uncomplicated cases) usually assigned to medical therapy with respect to worse populations (more often complicated) treated by TEVAR and open surgery. One unpublished randomized controlled trial, which compared medical therapy versus TEVAR in clearly uncomplicated acute type B dissections, recently released data that showed no early mortality among 31 patients randomized to best medical treatment and 30 patients assigned to TEVAR, but had 10% treatment crossovers that occurred a few days after

Table 5 Excluded Registries in Type B Aortic Dissection

Author and Year (Ref. #)	n	Pathology	Early Mortality n (%)	Early CVA n (%)	Early SCI n (%)	Mean Follow-Up (months)	Reasons for Exclusions
Excluded registries*							
Buth EUROSTAR† 2007 (123)	215 TEVAR	102 acute 113 chronic, including undefined number with aortic arch involvement (Type A?)	NA	7 (3.3) 4 acute 3 chronic	3 (1.4) 3 acute 0 chronic	NA	Including 78 involvement of aortic arch or ascending aorta, 606 total TEVAR repairs (291 aneurysms, 215 dissections, 67 ruptures, 24 false aneurysms and 9 infections)
Day New Zealand 2009 (124)	39 TEVAR	NA	7 (18.0)	NA	NA	NA	No details on type and timing of dissection
Eggebrecht ERAR European Registry on Endovascular Aortic Repair Complications 2009 (125)	26 retrodissection	NA	NA	NA	NA	NA	Focused on repairs for retrograde dissection after TEVAR
Jakob E-vita Registry hybrid 2011 (126)	88 TEVAR	88 acute	16 (18.0)	NA	NA	NA	Specific designed complex endograft for hybrid repairs
Excluded administrative studies*							
Sachs 2010 NIH† (127)	1,381 TEVAR 3,619 open	NA	146 (10.6) in TEVAR 688 (19.0) in open	NA	NA	NA	No details on type of dissection
Conrad Medicare† 2010 (128)	833 TEVAR 1,868 Open	NA	76 (9.0) in TEVAR 399 (21.0) in open survival: 5 yrs (58.2) in TEVAR 5 yrs (50.6) in open	NA	NA	NA	No details on type and timing of dissection

*See the Online Appendix for the excluded references. †In-hospital data.
EUROSTAR = European Cobalt Stent with Antiproliferative for Restenosis Trial; other abbreviations as in Tables 1 and 2.

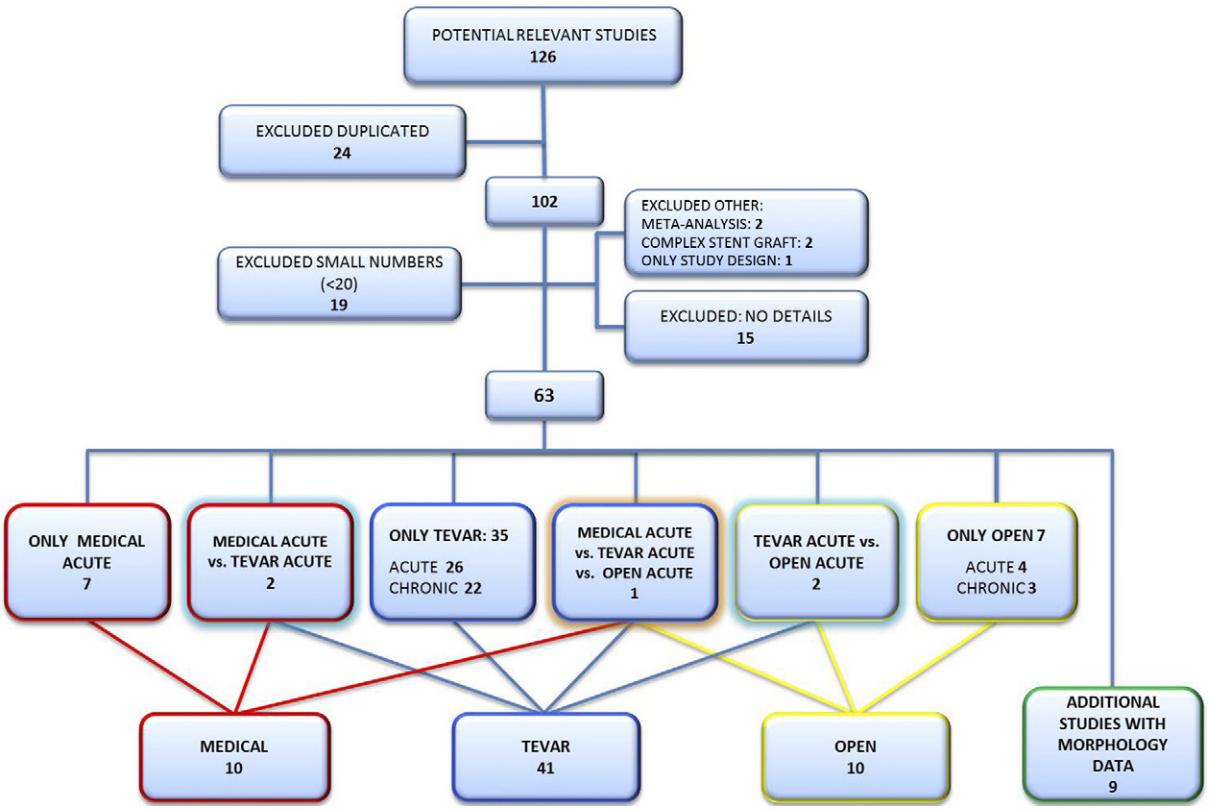

Figure 1 **Results from Literature Search**

TEVAR = thoracic endovascular repair.

randomization in the medical arm (Online Ref. 122). One-year data supported higher efficacy of TEVAR in allowing true lumen expansion and false lumen decrease (Brunkwall ESVS, personal communication, 2012).

Direct comparison of outcomes between medical therapy and TEVAR for acute aortic dissection was available from 3 published studies (Fig. 2, Table 6); 1 was a registry (15,17,19). According to meta-analysis of these studies, the early mortality rate was lower with medical therapy alone (Fig. 2A) (odds ratio [OR]: 0.50; 95% CI: 0.27 to 0.95), whereas the risk of early neurologic complications (stroke and spinal cord ischemia) was comparable (Fig. 2B) (OR: 0.55; 95% CI: 0.23 to 1.32). Three studies (19,27,47) were available for direct comparisons of outcomes between TEVAR and open surgery for acute type B aortic dissection (Fig. 3, Table 6); 1 was a registry (19,20), and another was based on administrative codes that did not specify whether dissections were complicated or not (47). Pooled early mortality rate was significantly higher after open surgery (OR: 2.66; 95% CI: 1.37 to 5.17) (Fig. 3A). There were no significant differences in rates of early stroke (OR: 0.90; 95% CI: 0.30 to 0.95) or spinal cord ischemia (OR: 0.82; 95% CI: 0.50 to 1.33) after repair (Figs. 3B and 3C).

PANELISTS' SUGGESTIONS FOR TREATMENT OF ACUTE TYPE B AORTIC DISSECTION.

- Patients with uncomplicated acute type B aortic dissection should be treated with medical therapy. At present, there is no evidence of advantage with TEVAR or open surgery.
- TEVAR, when feasible, should be considered the first-line treatment in complicated acute type B dissection. A survival benefit is achieved by TEVAR in comparison with open surgery. A recommended treatment algorithm is shown in Figure 4.
- Aneurysmal evolution and eventual rupture may occur even in the absence of warning symptoms, and imaging follow-up must be performed at regular intervals. MDCT or MRI scan should be used to monitor uncomplicated dissections and should be performed at admission, 7 days, discharge, and 6 weeks (3), because the risk of instability is higher in the early phase (Fig. 4).
- Despite reasonably low early operative morbidity and mortality, there is the likelihood of aortic adverse events after TEVAR, and all patients need to be followed with imaging after treatment.

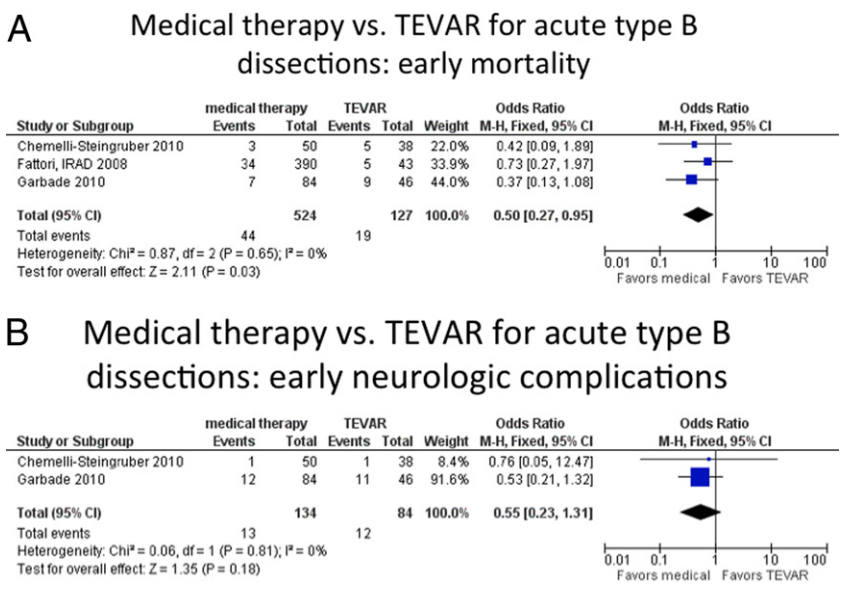

Figure 2 **Comparison of Early (30 Days/In-Hospital) Outcomes With Medical Therapy and TEVAR in Acute Type B Aortic Dissections**

(A) Mortality: TEVAR versus medical therapy. **(B)** Neurological complications: TEVAR versus medical therapy. CI = confidence interval; df = degrees of freedom; IRAD = International Registry of Acute Aortic Dissection; other abbreviation as in Figure 1.

Subacute type B aortic dissection. SUBACUTE TYPE B AORTIC DISSECTION. OUTCOME DATA. Very limited outcome data are available for patients with subacute aortic dissection, either complicated or uncomplicated. The largest series of patients, with subacute and chronic (between 2 and 54 weeks from onset) uncomplicated type B aortic dissection came from the INSTEAD (Investigation of Stent Grafts in Aortic Dissection) trial (4,5). This prospective randomized trial included 72 patients managed with TEVAR and reported a primary success rate of 95.7%, an early mortality of 2.8%, a stroke rate of 1.4%, and a 2.9% rate of spinal ischemia. Eighteen percent of patients required secondary procedures.

The data from the VIRTUE (VALIANT Thoracic Stent Graft Evaluation For the Treatment of Descending Thoracic Aortic Dissections- Post Marketing Surveillance Registry) Registry (24), including 24 patients with complicated subacute type B aortic dissections treated with TEVAR, showed a 100% primary procedural success rate, an early mortality rate of 1.8%, and no late deaths. No strokes or cases of spinal cord ischemia were recorded. Change in aortic morphology (expanding diameter >4 mm, new onset of periaortic hematoma, and/or pleural hemorrhagic effusion), refractory hypertension (according to previous definition), recurrent thoracic pain, and malperfusion were found to be associated with negative prognosis in the subacute phase (4,5).

PANELISTS' SUGGESTIONS FOR MANAGEMENT OF TYPE B SUBACUTE AORTIC DISSECTION.

- The subacute phase in aortic dissection (>2 to 6 weeks from onset) may sometimes reveal signs of instability, such as changes in aortic morphology (expanding diameter >4 mm, new onset of periaortic hematoma, and/or pleural hemorrhagic effusion), refractory hypertension, recurrent thoracic pain, and recurrent malperfusion. In these cases, TEVAR may be considered. However, data to support prognosis and complication rates in subacute type B aortic dissection are very limited. An algorithm for treatment of subacute type B aortic dissection suggested by this consensus document is shown in Figure 5.

Chronic type B aortic dissection. DEFINITION OF COMPLICATIONS IN CHRONIC TYPE B AORTIC DISSECTION. Long-term prognosis of chronic type B dissection is sobering, with just 60% to 80% survival estimates at 5 years using conservative management because complications and aneurysm expansion are likely. Once the aortic diameter exceeds 55 to 60 mm, the risk of rupture is estimated at 30% per annum (3). Even if medical therapy is considered the best option for uncomplicated type B aortic dissection, the effect of medical therapy may delay the expansion of the descending aorta, but would hardly enhance the remodeling process. Late interventions are often performed in chronic type B aortic dissection for development of complications, such as for aneurysm expansion, progressive/new dissection, and other related adverse events from the unresolved dissection process. Recurrence of symptoms, aneurysmal dilation (>55 mm), or an aortic yearly increase of >4 mm are all indicative of "chronic complicated aortic dissections" because of higher risk without treatment. A maximum aortic diameter >40 mm at admission and the presence of a patent false lumen have the most clinical data to evaluate

Table 6 Direct Comparison of TEVAR Versus Medical Therapy and TEVAR Versus Open Surgery in Acute Type B Aortic Dissection

Author and Year (Ref. #)	n	Pathology	Early Mortality n (%)	Early CVA n (%)	Early SCI n (%)	Mean Follow-Up (months)	Survival Rate (%)
TEVAR vs. medical							
Chemelli-Steingruber TEVAR 2010 (15)	38	Acute complicated	5 (13.2)	1 (2.6)	0	33 (0–97)	Dissection-death survival: 1–5 yrs (82.6) Rupture free survival: 1–5 yrs (93.1)
Chemelli-Steingruber medical 2010 (15)	50	Acute	3 (6.0)	1 (2.0)	NA	36 (0–122)	Dissection death free: 1 yr (88.0) 5 yrs (74.9) Rupture free survival: 1 yr (93.4) 5 yr (88.5)
Garbade TEVAR 2010 (17)	46	27 acute complicated 19 acute uncomplicated	9 (19.6)	11 (23.9)		1,107 days	1 yr (80) 3 yrs (73.3) 5 yrs (56.3)
Garbade medical 2010 (17)	84	63 acute uncomplicated 21 acute complicated	7 (8.3)	12 (14.3)		1,107 days	1 yr (86.2) 3 yrs (80.9) 5 yrs (72.1)
Fattori IRAD TEVAR 2008 (19,20)	43	Acute complicated	5 (11.6)	NA	1 (2.3)	2.3 yrs median	on 27 patients 1 yr (88.9) 3 yrs (76.2)
Fattori IRAD medical 2008 (19)	390	Acute	34 (8.7)	NA	NA	2.3 yrs median	on 189 patients 1 yr (90.3) 3 yrs (77.6)
TEVAR vs. open							
Zeeshan Open 2010 (47)	20	Acute complicated	8 (40.0)	0	2 (10.0)	37 (2 months–7 yrs)	1 yr (58.0) 3 yrs (52.0) 5 yrs (44.0)
Zeeshan TEVAR 2010 (47)	45	Acute complicated	2 (4.4)	3 (6.7)	6 (13.3)	37 (2 months–7 yrs)	1 yr (82.0) 5 yrs (79.0)
Fattori Open 2008 (19)	59	Acute complicated	20 (33.9)	4 (6.8)	3 (5.1)	NA	NA
Fattori TEVAR 2008, 2006 (19, 20)	43	Acute complicated	5 (11.6)	NA	1 (2.3)	2.3 yrs median	Over 29 patients: 1 yr (88.9) 3 yrs (76.2)
Brunt NIS* Open 2011 (27)	991	Acute emergent	173 (17.5)	61 (6.2)	25 (2.5)	NA	NA
Brunt NIS* TEVAR 2011 (27)	991	Acute emergent	107 (10.8)	37 (3.7)	32 (3.2)		
Brunt NIS* Open 2011 (27)	282	Acute elective	16 (5.7)	5 (1.8)	0	NA	NA
Brunt NIS* TEVAR 2011 (27)	282	Acute elective	9 (3.2)	10 (3.5)	0		

*In-hospital data.
Abbreviations as in Tables 1 to 3.

predictability of the development of dissection-related events (70–78). Patients without these findings were reported to have the highest freedom from aortic enlargement rates, ranging from 97% to 100% at 1 year and from 84% to 89.2% at 10 years (70–78). For patients with only partially thrombosed false lumen, the 1- and 3-year freedom from mortality ranged from 68.4% to 84.6% (73). Based on these observations, many investigators recommended more frequent follow-up and possible early intervention in patients with these adverse predictors. Additional predictors of outcome are shown in the Online Table.

PANELISTS' SUGGESTIONS FOR DEFINITION OF COMPLICATIONS IN CHRONIC TYPE B AORTIC DISSECTION.

- In patients under medical management after the acute phase, recurrence of symptoms, aneurysmal dilation (>55 mm), or a aortic yearly increase of >4 mm are indicative of higher worse prognosis without additional treatment (chronic complicated type B aortic dissections). An algorithm for treatment of chronic type B aortic dissections is shown in Figure 6.

CHRONIC TYPE B AORTIC DISSECTION. OUTCOME DATA FROM TEVAR. In the present literature search, 22 studies with data regarding TEVAR of chronic type B aortic dissection were identified; 11 included both acute and chronic cases in separated groups (4,5,24,25,29,32–36,39,52–63). Most publications identified indications for treatment of complicated chronic dissection; however, 2 included uncomplicated cases (4,5,25), and 4 (54,57,58,59) did not provide further information on the coexisting complications. Furthermore, most studies did not specify whether treatment was performed during the subacute phase; therefore, analysis was performed on all available patient data with the understanding that pooling of subacute and true chronic dissections and complicated and uncomplicated patients might create some bias. A summary of

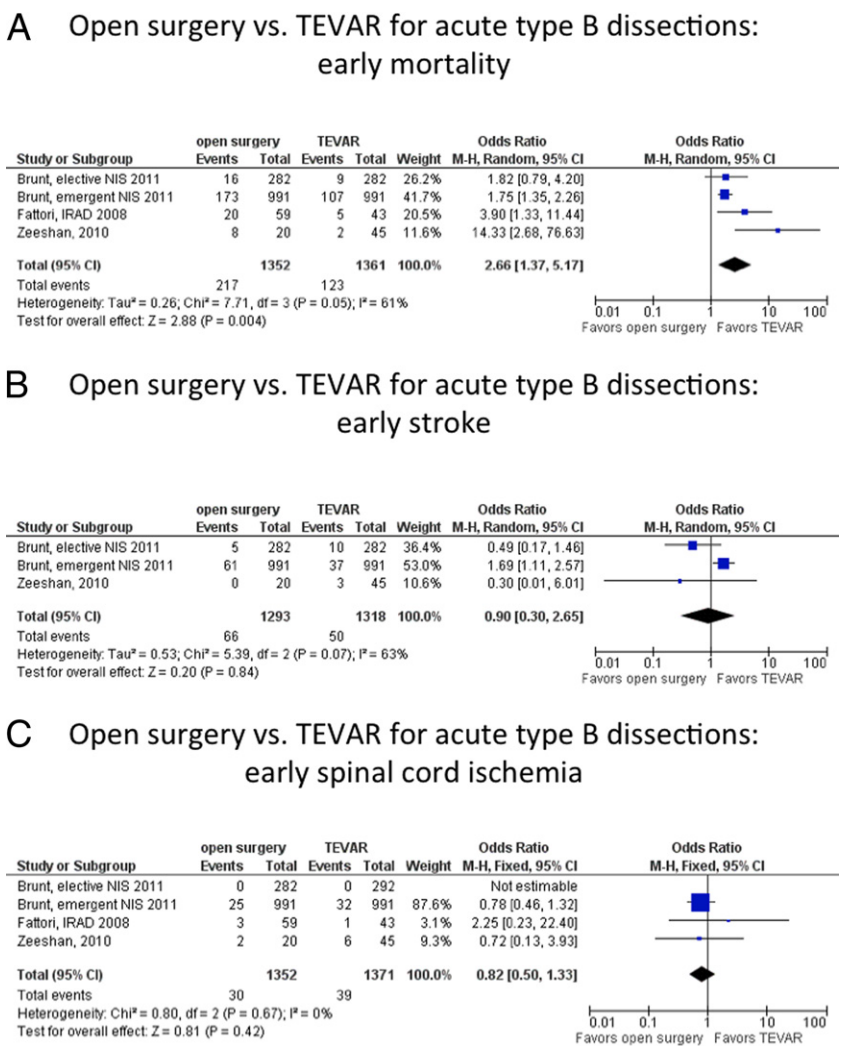

Figure 3 **Comparison of Early (30 Days/In-Hospital) Outcomes With Open Surgery and TEVAR in Acute Type B Aortic Dissections**

(A) Mortality: TEVAR versus open surgery. **(B)** Stroke: TEVAR versus open surgery. **(C)** Spinal cord ischemia: TEVAR versus open surgery. Abbreviations as in Figures 1 and 2.

pertinent morbidity and mortality information for TEVAR of 1,098 patients with chronic type B aortic dissection is shown in Table 4. The pooled early mortality rate for TEVAR of chronic aortic dissection was 6.6% (95% CI: 5.0% to 8.7%). Pooled rates of early stroke and spinal cord ischemia were 1.9% (95% CI: 1.1% to 3.0%) and 1.5% (95% CI: 0.0% to 2.5%), respectively. Five-year survival rates were reported as ranging from 77.7% to 84.4%. Freedom from reintervention was around 83% at 1 year and 72% at 3 years (Table 4).

CHRONIC TYPE B AORTIC DISSECTION. OUTCOME DATA FROM OPEN SURGERY. Only 3 publications including 177 patients were found in the literature with contemporary data on open surgical outcomes of treatment of chronic type B aortic dissection (67–69). The pooled early mortality rate was 8.0% (95% CI: 4.5% to 13.9%), and pooled rates of early stroke and spinal cord ischemia were 5.7% (95% CI: 3.1% to 10.2%) and 5.5% (95% CI: 2.8% to 10.5%), respectively (Table 3). The 1- (78%) and 5-year (68% to 92%) survival rates were similar to the rates following TEVAR, whereas rates of reintervention were much lower in the first year (freedom 99%) according to the few available data.

PANELISTS' SUGGESTIONS FOR TREATMENT OF CHRONIC TYPE B AORTIC DISSECTION.

- Most chronic type B aortic dissections are managed medically until complications develop. A tight control of systemic pressure with best medical treatment is of utmost importance to limit false lumen aneurysmal dilation over time.
- Recurrence of symptoms, aneurysmal dilation (total aortic diameter >55 mm), or a yearly increase (>4

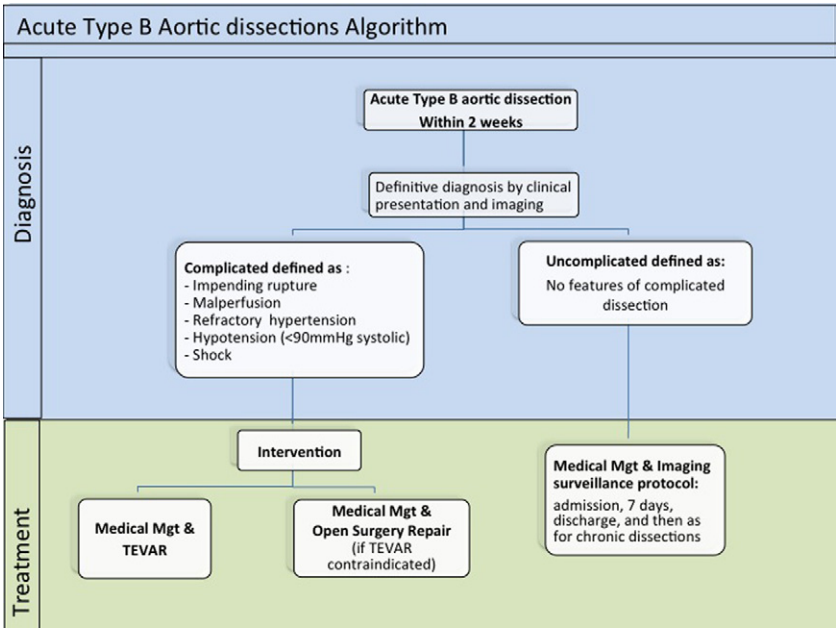

Figure 4 **Algorithm for Management of Acute Type B Aortic Dissection**

Abbreviation as in Figure 1.

mm) of aortic diameter should be considered signs of instability in the chronic phase and indication for TEVAR, or in unsuitable anatomy, indication for open surgery (Fig. 6). Early mortality in complicated chronic type B aortic dissection is lower for TEVAR compared with open surgery.

- In uncomplicated chronic type B aortic dissection, yearly clinical and imaging follow-up is recommended, irrespec-

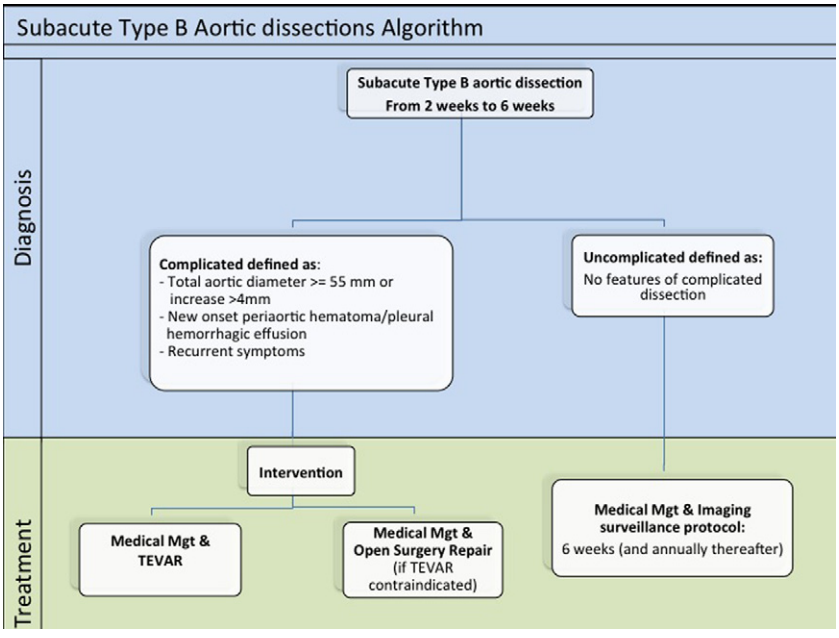

Figure 5 **Algorithm for Management of Subacute Type B Aortic Dissection**

Abbreviation as in Figure 1.

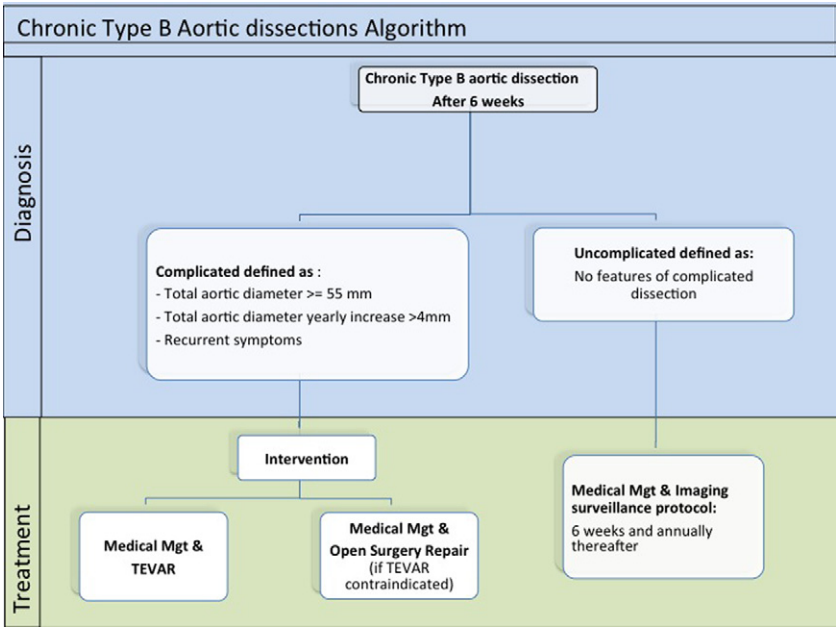

Figure 6 Algorithm for Management of Chronic Type B Aortic Dissection

Abbreviation as in Figure 1.

tive of diameter and treatment applied (TEVAR/medical/open surgery).

Discussion

A definition of different clinical patterns of type B aortic dissection and corresponding algorithms of treatment has been made possible for this consensus document with the analysis of the mortality and complications rates of more than 6,700 patients reported in the available literature. This may substantially help the operating physician in selecting different modalities of treatment for type B aortic dissection. However, stratification of type B aortic dissection outcome by timing (i.e., acute first 2 weeks, subacute 2 to 6 weeks, and chronic [after 6 weeks from symptoms onset]) might not be representative of the entire clinical scenario and needs to be standardized. Proposed strategies suggest that medical management with close imaging follow-up is the best strategy for uncomplicated type B aortic dissections with acute subacute and chronic presentation, whereas TEVAR should be applied to complicated cases and suitable anatomy, to decrease the mortality risk of open surgery.

Nevertheless, the strength of proposals provided by this consensus document is limited, especially for aortic dissections in the subacute phase, because of the large heterogeneity among studies and the lack of high-quality data; most results were from uncontrolled, nonrandomized retrospective trials or registries.

Study limitations. This consensus document analysis should be interpreted cautiously in light of shortcomings of the available data. 1) The major evidence gap in reporting on type B aortic dissection was identified by panelists in the combination of complicated and uncomplicated dissections with variable criteria to define complicated cases and subjective indication for applying different types of treatments. This discrepancy might create some relevant selection bias, such as in the comparison of medical therapy (most uncomplicated cases with larger numbers) and invasive treatment with TEVAR/open surgery. 2) Another important shortcoming is the absence of a consistent number of randomized trials comparing TEVAR with open surgery and medical therapy, and the risks of systematic bias inherent to observational studies, because the investigators were more prone to publish studies with good results than studies in which mortality and complications rates were high. 3) The criteria for determining patient suitability for TEVAR versus open surgery were not explicitly declared in many studies. 4) Most studies had limited samples (also because of the limited prevalence of the disease). Despite the requirement for studies to have included a minimum of 20 type B aortic dissections for each category, larger numbers would have provided more powerful data. 5) Even with extensive efforts to systematically address the risk of including overlapping patient populations in this analysis, we acknowledge that there may be some remaining undetected duplication and overlapping data that could not be identified.

Further higher-level studies on type B aortic dissection stratified by type and timing, with long-term assessment of outcomes are required to provide optimal treatment strategy directives on the disease.

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Key Words: consensus ■ endovascular treatment ■ type B dissection.

APPENDIX

For an expanded list of references and a supplemental table, please see the online version of this article.