BMC Cardiovascular Disorders

SYSTEMATIC REVIEW

Open Access

Comparisons of open surgical repair, thoracic endovascular aortic repair, and optimal medical therapy for acute and subacute type B aortic dissection: a systematic review and meta-analysis

Jianping Liu[1†], Xiaohong Chen[2†], Juan Xia[3], Long Tang[1], Yongheng Zhang[1*], Lin Cao[4] and Yong Zheng[1]

Abstract

Background Various treatments have been employed in managing type B aortic dissection (TBAD), encompassing open surgical repair (OSR), thoracic endovascular aortic repair (TEVAR), and optimal medical therapy (OMT). Nonetheless, the determination of the most efficacious treatment protocol remains a subject of debate. We aim to compare the treatments in patients with acute and subacute TBAD using a meta-analytic approach.

Methods A systematic search was conducted across databases including PubMed, EmBase, and the Cochrane Library for relevant studies published from their inception up to September 2024. Studies comparing OSR, TEVAR, and OMT for TBAD through controlled or direct comparative designs were incorporated. Pairwise comparison meta-analyses were performed employing odds ratios (OR) alongside 95% confidence intervals (CIs) to quantify intervention effects by using the random-effects model.

Results Thirty-one studies involving 34,681 patients with TBAD were included in the final meta-analysis. We noted OSR were associated with an increased risk of in-hospital mortality (OR: 2.41; 95%CI: 1.67–3.49; $P<0.001$), paraplegia (OR: 3.60; 95%CI: 2.20–5.89; $P<0.001$), limb ischemia (OR: 7.80; 95%CI: 2.39–25.49; $P=0.001$) and bleeding (OR: 9.54; 95%CI: 6.57–13.85; $P<0.001$) as compared with OMT. Moreover, OSR versus TEVAR showed an increased risk of in-hospital mortality (OR: 2.67; 95%CI: 1.92–3.72; $P<0.001$), acute renal failure (OR: 1.98; 95%CI: 1.61–2.42; $P<0.001$), myocardial infaraction (OR: 2.76; 95%CI: 1.64–4.65; $P<0.001$), respiratory failure (OR: 2.19; 95%CI: 1.73–2.76; $P<0.001$), or bleeding (OR: 1.88; 95%CI: 1.33–2.67; $P<0.001$), and lower risk of reintervention (OR: 0.30; 95%CI: 0.10–0.89; $P=0.030$). Finally, TEVAR was associated with an increased risk of stroke (OR: 1.77; 95%CI: 1.41–2.21; $P<0.001$), limb ischemia (OR: 13.00; 95%CI: 4.33–39.06; $P<0.001$), and bleeding (OR: 3.65; 95%CI: 2.40–5.55; $P<0.001$) as compared with OMT.

Conclusions This study systematically compared various treatments and showed their safety and efficacy for acute and subacute TBAD. The results require further large-scale randomized controlled trials.

†Jianping Liu and Xiaohong Chen contributed equally to this work.

*Correspondence:
Yongheng Zhang
18928939@qq.com
Full list of author information is available at the end of the article

Keywords Open surgical repair, Thoracic endovascular aortic repair, Optimal medical therapy, Type B aortic dissection, Systematic review, Network meta-analysis

Introduction

Aortic dissection is attributed to blood entering the media layer due to aortic intimal tearing. It is a life-threatening emergency, and it is associated with a high mortality rate [1, 2]. Type B aortic dissection (TBAD) does not involve the ascending aorta, and its prognosis is relatively better [3, 4]. However, the optimal treatment of TBAD remains unclear. Most patients with TBAD use antihypertensive medications as standard care, while emergency surgical interventions are performed for patients with acute TBAD presenting with severe complications, and the prognosis is poor for patients treated with surgical procedures [5–7].

Surgical interventions for TBAD include open surgical repair (OSR) and thoracic endovascular aortic repair (TEVAR). OSR is an effective treatment for TBAD in the aorta at adjacent or remote sites; however, treated patients remain at risk for aneurysm formation after surgery [8]. Thus, TEVAR is more favorable than OSR for patients presenting with complications and is associated with better aortic remodeling and prevention of subsequent aortic rupture [9]. A prior systematic review and meta-analysis identified 18 studies and found that TEVAR showed a lower risk of in-hospital mortality, cardiac and pulmonary complications, and shorter length of hospital stay than OSR. Moreover, TEVAR is associated with a reduced risk of long-term mortality, an elevated risk of paraplegia, higher complete thrombosis of the false lumen, and a longer length of hospital stay than the optimal medical therapy (OMT) [10]. However, several included studies reported the same population and the results may have been overestimated. Thus, this systematic review and meta-analysis were performed to compare the treatment effects of OSR, TEVAR, and OMT in patients with acute and subacute TBAD.

Methods

Search strategy and selection criteria

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used to perform this systematic review and meta-analysis [11]. Studies that had assessed treatment strategies for acute or subacute TBAD were eligible for inclusion, and the publication language and status were not restricted. The electronic databases PubMed, Embase, and the Cochrane Library were systematically searched from their inception to September 2024, and the searched keywords included ("aortic dissection" AND "type B" OR "DeBakey III") AND ("stent" OR "endovascular" OR "surgery" OR "medical" OR "medication"). We also reviewed the reference lists of original and review articles to identify any new eligible studies that met the inclusion criteria.

Literature search and study selection were independently performed by two reviewers, and conflicts were resolved through group discussion until a consensus was reached. The inclusion criteria were as follows: (1) patients: all patients diagnosed with acute or subacute TBAD; (2) intervention and control: OSR, TEVAR, or OMT; (3) outcomes: at least one in-hospital mortality, long-term mortality, acute renal failure, stroke, paraplegia, myocardial infarction (MI), mesenteric ischemia, limb ischemia, reintervention, respiratory failure, and bleeding; and (4) study design: randomized controlled trials (RCTs), prospective or retrospective cohort studies. Articles that reported the most informative and complete data were selected when data were published more than once. Studies were excluded if they: (1) used alternative interventions or controls; (2) did not report investigated outcomes; and (3) were case reports or review articles.

Data collection and quality assessment

Two reviewers applied a standardized flow to extract all relevant information from the included studies, and any inconsistencies between the data collected by reviewers were resolved by discussion until a consensus was reached. The following data were collected: first author's surname; publication year; study design; region; sample size; mean age; male proportion; hypertension proportion; coronary artery disease (CAD) proportion; Marfan syndrome proportion; prior aortic dissection proportion; diabetes mellitus (DM) proportion; aneurysm proportion; disease status; intervention; follow-up duration; and reported outcomes. The methodological quality of the RCTs was assessed using the risk of bias described by the Cochrane Collaboration [12], and the quality of observational studies was assessed using the Newcastle-Ottawa Scale (NOS) [13]. Inconsistent results regarding quality assessment were resolved by an additional reviewer who referred to the full text of the article.

Statistical analysis

The treatment effects of OSR, TEVAR, or OMT for TBAD were assigned as categorical data, and odds ratios (ORs) with 95% confidence intervals (CIs) were calculated before data pooling. Subsequently,

a random-effects model was used to calculate the pooled effect estimates, which considered the underlying variations across the included studies [14, 15]. Heterogeneity among the included studies for specific outcomes was assessed using I^2 and Q statistics, and significant heterogeneity was defined as $I^2 > 50{\cdot}0\%$ or $P < 0{\cdot}10$ [16, 17]. The robustness of the pooled conclusion was assessed using sensitivity analysis through the sequential removal of single studies [18]. Subgroup analyses were performed for in-hospital mortality and long-term mortality on the basis of country, sample size, mean age, male proportion, and disease status, while the difference between subgroups were assessed using the interaction P test [19]. Publication bias was assessed using both qualitative and quantitative methods, including funnel plots and Egger-Begg tests [20, 21]. All reported P values were 2-sided, and the inspection level was 0.05. All analyses were performed using the STATA software (version 14.0; Stata Corporation, College Station, TX, USA).

Results

Literature search and study selection

Overall, 6,832 publications were identified through the literature searches; of these, 2,016 were excluded because of duplication. Further, 4,719 articles were excluded because of irrelevant titles or abstracts. The remaining 97 studies were retrieved for full-text evaluation, and five articles were identified from manual reviews of reference lists. Of the 102 full-text evaluations, 71 were excluded for the following reasons: other interventions ($n=29$), studies reporting the same population ($n=20$), no appropriate controls ($n=18$), and insufficient data ($n=4$). Finally, the remaining 31 studies were selected for meta-analysis [22–52], and Fig. 1 shows the details regarding the literature search and study selection.

Study characteristics

Table 1 shows the baseline characteristics of the included studies and patients. Of the 31 included studies, 3 were RCTs, and the remaining 28 were retrospective cohort

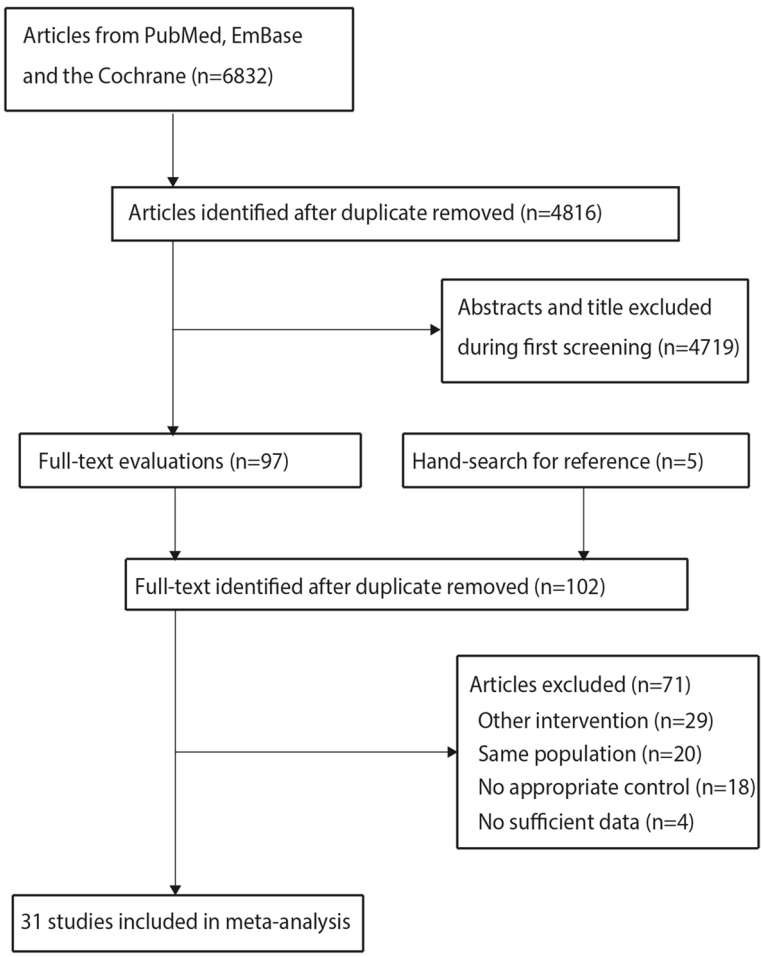

Fig. 1 Details of the literature search and the study selection processes

Table 1 The baseline characteristics of identified studies and involved patients

Study	Study design	Region	Sample size	Mean age (years)	Male (%)	Hypertension (%)	CAD (%)	MS (%)	Prior AD (%)	DM (%)	Aneurysm (%)	Disease status	Treated aortic segments	Intervention	Follow-up (months)
Dialetto 2005 [22]	Retro	Italy	56	58.7	83.9	80.4	NA	NA	1.8	NA	NA	Acute	Unclear	TEVAR; OMT	18.1
Hsu 2005 [23]	Retro	China	107	58.4	82.0	NA	NA	2.8	NA	NA	NA	Acute	Unclear	OSR; OMT	36.1
Tsai 2006 [24]	Retro	11 countries	242	62.1	69.0	70.2	NA	3.3	7.0	5.0	15.3	Acute	Arch involvement: 12	OSR; TEVAR; OMT	27.6
Nienabler 2009 [25]	Pro	Germany, Italy, France	140	60.2	84.3	12.9	NA	1.4	NA	7.9	NA	Acute and subacute	Descending thoracic aorta: 13	TEVAR; OMT	24.0
Patel 2009 [26]	Retro	USA	69	65.9	59.4	73.9	26.1	NA	13.0	11.6	31.9	Acute	Arch aorta: 46; descending aorta: 33	OSR; TEVAR	37.4
Chemelli-Steingruber 2010 [27]	Retro	Austria	88	64.6	75.0	78.4	23.9	NA	NA	8.0	NA	Acute	Unclear	TEVAR; OMT	33.0–36.0
Garbade 2010 [28]	Retro	Germany	135	65.0	74.8	94.1	NA	NA	NA	19.3	73.3	Acute	Arch involvement: 5; descending aorta: 131	OSR; TEVAR; OMT	36.9
Mastroroberto 2010 [29]	Retro	Italy	24	72.4	62.5	79.2	8.3	NA	8.3	12.5	NA	Acute	Unclear	OSR; TEVAR	47.2
Zeeshan 2010 [30]	Retro	USA	77	59.6	70.1	79.2	16.9	NA	NA	13.0	18.2	Acute	Unclear	OSR; TEVAR; OMT	37.0
Sachs 2010 [31]	Retro	USA	50,00	60.7	65.6	67.7	3.7	NA	NA	7.6	NA	Acute and subacute	Unclear	OSR; TEVAR	36.0
Conrad 2010 [32]	Retro	USA	2,701	70.9	57.8	NA	NA	NA	NA	NA	NA	Acute and subacute	Descending aorta	OSR; TEVAR	60.0
Narayan 2011 [33]	Retro	UK	84	56.7	75.0	50.0	8.3	4.8	NA	2.4	48.8	Acute and subacute	Descending aorta	OSR; TEVAR	24.4

Table 1 (continued)

Study	Study design	Region	Sample size	Mean age (years)	Male (%)	Hypertension (%)	CAD (%)	MS (%)	Prior AD (%)	DM (%)	Aneurysm (%)	Disease status	Treated aortic segments	Intervention	Follow-up (months)
Nozdrzykowski 2013 [34]	Retro	Germany	80	63.0	73.7	98.8	21.3	5.0	27.5	20.0	66.2	Acute	Descending aorta	OSR; TEVAR; OMT	42.0
Wilkinson 2013 [35]	Retro	USA	73	66.2	63.0	80.8	26.0	NA	24.7	11.0	100.0	Acute and subacute	Arch aorta: 57; descending aorta: 32	OSR; TEVAR	27.7
Shah 2014 [36]	Retro	USA	4,706	67.0	55.0	NA	NA	NA	NA	NA	NA	Acute	Unclear	TEVAR; OMT	24.0–60.0
Brunkwall 2014 [37]	Pro	UK	61	63.0	78.7	NA	NA	NA	NA	NA	NA	Acute	Descending aorta	TEVAR; OMT	12.0
Afifi 2015 [38]	Retro	USA	442	60.2	62.0	NA	NA	NA	NA	NA	NA	Acute	Descending aorta	OSR; TEVAR; OMT	55.2
Chou 2015 [39]	Retro	China	1,661	58.5	70.3	71.8	NA	NA	NA	8.8	NA	Acute and subacute	Descending aorta	OSR; TEVAR	48.0
Qin 2016 [40]	Retro	China	338	60.7	89.3	47.0	11.5	NA	NA	10.4	NA	Acute	Descending aorta: 34; extended to abdominal aorta: 304	TEVAR; OMT	29.9–39.5
Song 2016 [41]	Retro	China	252	53.6	81.7	76.6	3.6	0.8	NA	6.7	2.8	Acute	Descending aorta	TEVAR; OMT	60.0
Zhu 2016 [42]	Retro	China	118	52.7	72.9	93.2	30.5	NA	NA	9.3	NA	Acute and subacute	Descending aorta: 63; arch aortic: 43	OSR; TEVAR	56.0
Iannuzzi 2018 [43]	Retro	USA	9,165	66.0	60.8	66.6	NA	NA	NA	12.4	NA	Acute	Unclear	OSR; TEVAR; OMT	18.0–27.6
Lou 2018 [44]	Retro	USA	318	57.7	67.3	92.8	NA	1.6	NA	15.7	NA	Acute	Unclear	OSR; TEVAR; OMT	27.6
Xiang 2021 [45]	Retro	China	357	54.4	79.6	64.7	7.6	NA	NA	4.5	NA	Acute	Descending aorta	TEVAR; OMT	38.4–45.6
Wei 2022 [46]	Pro	China	90	49.7	66.7	54.4	4.4	NA	NA	7.8	NA	Acute	Descending aorta	TEVAR; OMT	24.0

Table 1 (continued)

Study	Study design	Region	Sample size	Mean age (years)	Male (%)	Hypertension (%)	CAD (%)	MS (%)	Prior AD (%)	DM (%)	Aneurysm (%)	Disease status	Treated aortic segments	Intervention	Follow-up (months)
Tang 2023 [47]	Retro	China	729	54.6	85.5	79.7	9.6	0.6	NA	7.5	NA	Acute and subacute	Unclear	TEVAR; OMT	58.9
Tian 2023 [48]	Retro	China	105	46.0	82.9	94.3	4.8	NA	NA	2.9	1.9	Acute and subacute	Unclear	OSR; TEVAR	12.0
Lou 2023 [49]	Retro	USA	146	57.1	67.1	91.1	NA	NA	NA	11.6	NA	Acute	Descending aorta, abdominal aorta	TEVAR; OMT	51.6
Weissler 2023 [50]	Retro	USA	7,105	75.7	44.2	35.7	17.9	NA	NA	8.6	NA	Acute	Unclear	TEVAR; OMT	60.0
Ahmad 2024 [51]	Retro	Germany	53	61.1	58.5	92.5	11.3	NA	NA	0.0	NA	Acute and subacute	Unclear	TEVAR; OMT	26.0
Krebs 2024 [52]	Retro	USA	159	59.0	77.0	82.0	6.0	NA	NA	18.0	NA	Acute	Unclear	TEVAR; OMT	36.0

Abbreviation: *AD* Aortic dissection, *CAD* Coronary artery disease, *COPD* Chronic obstructive pulmonary disease, *DM* Diabetes mellitus, *MS* Marfan syndrome, *NA* Not available, *OMT* Best medical therapy, *OSR* Open surgical repair, *Pro*, Prospective, *Retro* Retrospective, *TEVAR* Thoracic endovascular aortic repair

studies. Overall, 34,681 patients with acute and subacute TBAD were identified in 31 studies, with sample sizes ranging from 24 to 9,165. Moreover, the follow-up duration ranged from in-hospital to 60.0 months. Twenty-one studies included patients with acute TBAD, and the remaining 10 studies included patients with acute and subacute TBAD. Tables S1 and S2 presents the methodological quality of the included studies; the included trials were of low to moderate quality, while the included observational studies were of moderate to high quality.

In-hospital mortality

The number of studies reported the comparisons of OSR versus OMT, OSR versus TEVAR, and TEVAR versus OMT on the risk of in-hospital mortality were 6, 9, and 12 studies, respectively. The summary results indicated OSR were associated with an increased risk of in-hospital mortality as compared with OMT (OR: 2.41; 95%CI: 1.67–3.49; $P<0.001$) and TEVAR (OR: 2.67; 95%CI: 1.92–3.72; $P<0.001$) (Fig. 2). However, there was no significant difference between TEVAR and OMT for the risk of in-hospital mortality (OR: 1.09; 95%CI: 0.52–2.32; $P=0.817$). There was no evidence of heterogeneity for OSR versus OMT ($I^2=0.0\%$; $P=0.444$), while potential significant heterogeneity for OSR versus TEVAR ($I^2=40.7\%$; $P=0.096$) and TEVAR versus OMT ($I^2=71.2\%$; $P<0.001$). Sensitivity analyses found the pooled conclusions were stability and not altered by sequential removing single study (Figs. S1-S3). Subgroup analyses found OSR was associated with an increased risk of in-hospital mortality as compared with OMT and TEVAR in mostly subgroups. Moreover,

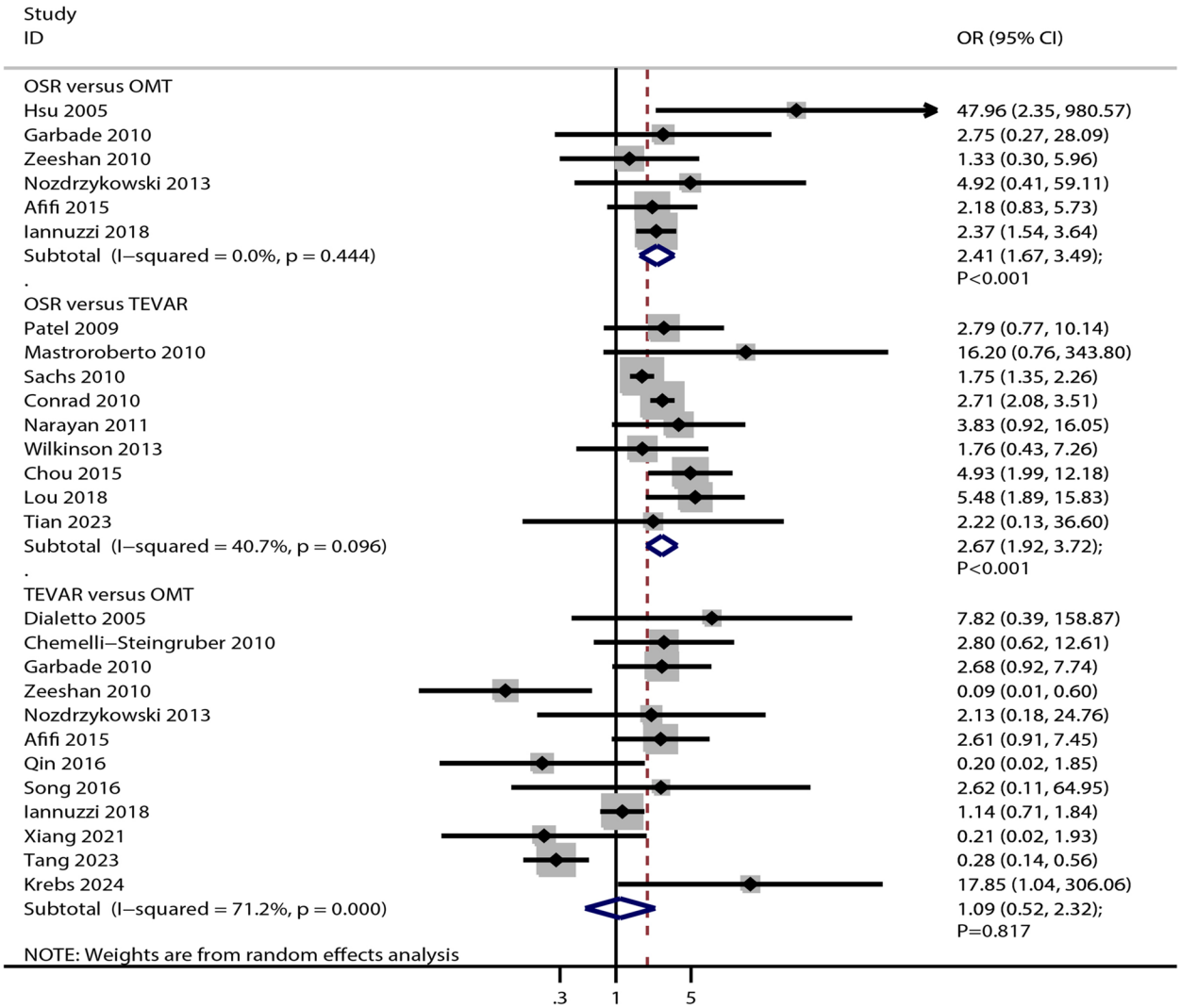

Fig. 2 The risk of in-hospital mortality when comparisons of OSR, TEVAR, and OMT

TEVAR versus OMT was associated with a reduced risk of in-hospital mortality if pooled studies conducted in Eastern countries and patients with acute and subacute TBAD (Table 2). Concerning potential biases in the published literature related to in-hospital mortality, neither the Egger's test nor Begg's test detected statistically significant evidence of publication bias when comparisons of, OSR versus OMT, OSR versus TEVAR, and TEVAR versus OMT, thus adding credibility to our findings (Figs. S4-S6).

Long-term mortality

The number of studies reported the comparisons of OSR versus OMT, OSR versus TEVAR, and TEVAR versus OMT on the risk of long-term mortality were 6, 9, and 19 studies, respectively. There were no significant differences for long-term mortality, irrespective comparisons of OSR versus OMT (OR: 1.81; 95%CI: 0.83–3.95; $P=0.138$), OSR versus TEVAR (OR: 1.29; 95%CI: 0.94–1.78; $P=0.113$), and TEVAR versus OMT (OR: 0.78; 95%CI: 0.58–1.05; $P=0.104$) (Fig. 3). There were significant heterogeneity among included studies when comparisons of OSR versus OMT ($I^2=63.4\%$; $P=0.018$), OSR versus TEVAR ($I^2=66.1\%$; $P=0.003$) and TEVAR versus OMT ($I^2=75.3\%$; $P<0.001$). Sensitivity analysis found OSR might associated with an increased risk of long-term mortality as compared with TEVAR, and TEVAR versus OMT might showed lower risk of long-term mortality (Figs. S7-S9). Subgroup analyses found OSR versus OMT was associated with an increased risk of long-term mortality when pooling studies conducted in Eastern countries, and sample size < 100. OSR versus TEVAR showed an elevated risk of long-term mortality when pooled studies conducted in Western countries, mean age ≥ 65.0 years, and male proportion < 70.0%. TEVAR versus OMT was associated with a reduced risk of long-term mortality when pooled studies conducted in Eastern countries (Table 2). Regarding potential publication biases in the long-term mortality data, neither Egger's test nor Begg's test detected statistically significant evidence of such biases (Figs. S10-S12).

Acute renal failure

The number of studies reported the comparisons of OSR versus OMT, OSR versus TEVAR, and TEVAR versus OMT on the risk of acute renal failure were 6, 6, and 11 studies, respectively. We noted OSR was associated with an increased risk of acute renal failure as compared with TEVAR (OR: 1.98; 95%CI: 1.61–2.42; $P<0.001$), whereas OSR versus OMT (OR: 1.45; 95%CI: 0.60–3.49; $P=0.411$), and TEVAR versus OMT (OR: 1.15; 95%CI: 0.78–1.70; $P=0.476$) were not associated with statistically significant (Fig. 4). There was no evidence of heterogeneity for OSR versus TEVAR ($I^2=0.0\%$; $P=0.681$), whereas potential significant heterogeneity for comparisons of OSR versus OMT ($I^2=77.5\%$; $P<0.001$) and TEVAR versus OMT ($I^2=49.0\%$; $P=0.033$). The summary results for comparisons of OSR versus TEVAR, and TEVAR versus OMT on the risk of acute renal failure were stability, whereas OSR might associated with an increased risk of acute renal failure as compared with OMT (Figs. S13-S15). There were no significant publication bias for acute renal failure (Figs. S16-S18).

Stroke

The number of studies reported the comparisons of OSR versus OMT, OSR versus TEVAR, and TEVAR versus OMT on the risk of stroke were 5, 8, and 13 studies, respectively. We noted TEVAR versus OMT was associated with an increased risk of stroke (OR: 1.77; 95%CI: 1.41–2.21; $P<0.001$), whereas OSR versus OMT (OR: 0.96; 95%CI: 0.29–3.15; $P=0.942$) and OSR versus TEVAR (OR: 1.40; 95%CI: 0.75–2.63; $P=0.294$) on the risk of stroke were not associated statistically significant (Fig. 5). There were no significant heterogeneity across included studies when comparisons of OSR versus OMT ($I^2=15.6\%$; $P=0.315$), OSR versus TEVAR ($I^2=31.8\%$; $P=0.174$), and TEVAR versus OMT ($I^2=3.4\%$; $P=0.412$). Sensitivity analysis found OSR might associated with an increased risk of stroke as compared with TEVAR, whereas the conclusions for comparisons of OSR versus OMT and TEVAR versus OMT on the risk of stroke were stability (Figs. S19-S21). No significant publication bias was observed for stroke (Figs. S22-S24).

Other adverse events

Table 3 shows the summary results of the effects of OSR, TEVAR, and OMT on the risk of other adverse events. We observed that OSR versus OMT was associated with an increased risk of paraplegia (OR: 3.60; 95%CI: 2.20–5.89; $P<0.001$), limb ischemia (OR: 7.80; 95%CI: 2.39–25.49; $P=0.001$) and bleeding (OR: 9.54; 95%CI: 6.57–13.85; $P<0.001$). Moreover, OSR versus TEVAR showed elevated risks of MI (OR: 2.76; 95%CI: 1.64–4.65; $P<0.001$), respiratory failure (OR: 2.19; 95%CI: 1.73–2.76; $P<0.001$), and bleeding (OR: 1.88; 95%CI: 1.33–2.67; $P<0.001$), and lower risk of reintervention (OR: 0.30; 95%CI: 0.10–0.89; $P=0.030$). Furthermore, we observed that TEVAR versus OMT was associated with an increased risk of limb ischemia (OR: 13.00; 95%CI: 4.33–39.06; $P<0.001$), and bleeding (OR: 3.65; 95%CI: 2.40–5.55; $P<0.001$).

Table 2 Subgroup analyses for in-hospital mortality and long-term mortality

Outcomes	Comparisons	Factors	Subgroups	No. of studies	OR and 95%CI	*P* value	I^2 (%)	Q statistic	Interaction *P* value
In-hospital mortality	TEVAR versus OMT	Country	Eastern	4	0.29 (0.15-0.54)	< 0.001	0.0	0.572	< 0.001
			Western	8	1.80 (0.83-3.87)	0.135	58.9	0.017	
		Sample size	≥ 100	8	1.06 (0.45-2.50)	0.894	74.9	< 0.001	0.724
			< 100	4	1.26 (0.18-8.88)	0.814	70.6	0.017	
		Mean age	≥ 65.0	2	1.52 (0.69-3.35)	0.294	51.1	0.153	0.060
			< 65.0	10	1.00 (0.35-2.87)	0.998	72.5	< 0.001	
		Male proportion	≥ 70.0	10	1.00 (0.35-2.91)	0.994	72.8	< 0.001	0.075
			< 70.0	2	1.50 (0.70-3.22)	0.293	49.3	0.160	
		Disease status	Acute	11	1.36 (0.66-2.77)	0.406	56.1	0.012	< 0.001
			Acute and subacute	1	0.28 (0.14-0.56)	< 0.001	-	-	
	OSR versus OMT	Country	Eastern	1	47.96 (2.35-980.57)	0.012	-	-	0.050
			Western	5	2.30 (1.59-3.34)	< 0.001	0.0	0.921	
		Sample size	≥ 100	4	2.62 (1.44-4.76)	0.002	22.4	0.276	0.717
			< 100	2	1.89 (0.52-6.81)	0.331	0.0	0.378	
		Mean age	≥ 65.0	2	2.38 (1.56-3.64)	< 0.001	0.0	0.902	1.000
			< 65.0	4	2.98 (1.00-8.88)	0.050	37.2	0.189	
		Male proportion	≥ 70.0	4	3.72 (0.94-14.66)	0.060	34.2	0.207	0.659
			< 70.0	2	2.34 (1.58-3.46)	< 0.001	0.0	0.875	
		Disease status	Acute	6	2.41 (1.67-3.49)	< 0.001	0.0	0.444	-
			Acute and subacute	0	-	-	-	-	
	OSR versus TEVAR	Country	Eastern	2	4.57 (1.93-10.81)	0.001	0.0	0.592	0.111
			Western	7	2.49 (1.77-3.51)	< 0.001	43.7	0.099	
		Sample size	≥ 100	5	2.70 (1.79-4.08)	< 0.001	64.3	0.024	0.524
			< 100	4	2.98 (1.38-6.44)	0.005	0.0	0.601	
		Mean age	≥ 65.0	4	2.70 (2.11-3.47)	< 0.001	0.0	0.642	0.107
			< 65.0	5	3.14 (1.62-6.08)	0.001	56.6	0.056	
		Male proportion	≥ 70.0	3	4.36 (2.08-9.12)	< 0.001	0.0	0.845	0.082
			< 70.0	6	2.45 (1.70-3.55)	< 0.001	50.7	0.071	
		Disease status	Acute	3	4.57 (2.07-10.08)	< 0.001	0.0	0.513	0.089
			Acute and subacute	6	2.42 (1.72-3.41)	< 0.001	46.0	0.099	

Table 2 (continued)

Outcomes	Comparisons	Factors	Subgroups	No. of studies	OR and 95%CI	*P* value	I^2 (%)	Q statistic	Interaction *P* value
Long-term mortality	TEVAR versus OMT	Country	Eastern	5	0.33 (0.24-0.44)	< 0.001	13.4	0.329	< 0.001
			Western	14	1.00 (0.87-1.15)	0.979	4.4	0.402	
		Sample size	≥ 100	13	0.75 (0.54-1.05)	0.097	81.8	< 0.001	0.961
			< 100	6	0.93 (0.45-1.92)	0.841	26.9	0.232	
		Mean age	≥ 65.0	3	0.98 (0.73-1.32)	0.914	58.0	0.092	< 0.001
			< 65.0	16	0.73 (0.48-1.10)	0.132	72.8	< 0.001	
		Male proportion	≥ 70.0	12	0.80 (0.50-1.27)	0.348	83.6	< 0.001	0.805
			< 70.0	7	0.86 (0.68-1.08)	0.193	0.0	0.464	
		Disease status	Acute	16	0.81 (0.60-1.10)	0.174	72.1	< 0.001	< 0.001
			Acute and subacute	3	0.70 (0.23-2.11)	0.531	70.9	0.032	
	OSR versus TEVAR	Country	Eastern	3	0.66 (0.14-3.07)	0.592	88.6	< 0.001	0.133
			Western	6	1.47 (1.29-1.67)	< 0.001	0.0	0.587	
		Sample size	≥ 100	5	1.17 (0.78-1.76)	0.452	81.7	< 0.001	0.707
			< 100	4	1.57 (0.92-2.70)	0.101	0.0	0.662	
		Mean age	≥ 65.0	4	1.37 (1.17-1.61)	< 0.001	0.0	0.667	0.473
			< 65.0	5	1.08 (0.56-2.08)	0.825	81.4	< 0.001	
		Male proportion	≥ 70.0	4	0.87 (0.28-2.64)	0.799	83.8	< 0.001	0.215
			< 70.0	5	1.46 (1.28-1.67)	< 0.001	0.0	0.464	
		Disease status	Acute	2	1.74 (0.58-5.18)	0.319	31.0	0.229	0.800
			Acute and subacute	7	1.25 (0.88-1.77)	0.213	72.8	0.001	

Discussion

This comprehensive quantitative systematic review and network meta-analysis were based on 31 studies involving 34,681 patients with acute and subacute TBAD who were treated with OSR, TEVAR, or OMT. These findings extend those previous systematic reviews [10] and provide exploratory results. This analysis revealed OSR versus OMT showed elevated risk of in-hospital mortality, paraplegia, limb ischemia, and bleeding; OSR versus TEVAR was associated with an increased risk of in-hospital mortality, acute renal failure, MI, respiratory failure, or bleeding, and lower risk of reintervention; TEVAR versus OMT showed an elevated risk of stroke, limb ischemia, and bleeding.

Considering the methodological quality of the included studies, most (28/31) were retrospective cohort studies. Of the three included RCTs, all reported a high risk of blinding of participants, personnel, and other biases. Moreover, a trial conducted by Brunkwall et al. reported a high or unclear risk of bias, according to the Cochrane Collaboration [37]. Furthermore, the methodological quality of observational studies is restricted by the representativeness of the exposed cohort, selection of the non-exposed cohort, and comparability based on the design or analysis. Thus, the conclusions of this study should be cautiously recommended in clinical practice, and further parallel comparisons of randomized controlled trials should be performed to verify the results of this study.

The summary results indicated that OSR was associated with an elevated risk of in-hospital mortality as compared with TEVAR and OMT. Several reasons could explained the results of our study: (1) the severity of TBAD between groups are differing, and the subacute phase would be the optimal time for intervention, and suggested that there might be differences in the efficacy of TEVAR based on timing (hyperacute, acute, subacute, and chronic) in TBAD [53]; (2) OSR is always used for complicated TBAD, whereas patients with uncomplicated patients are always treated with OMT,

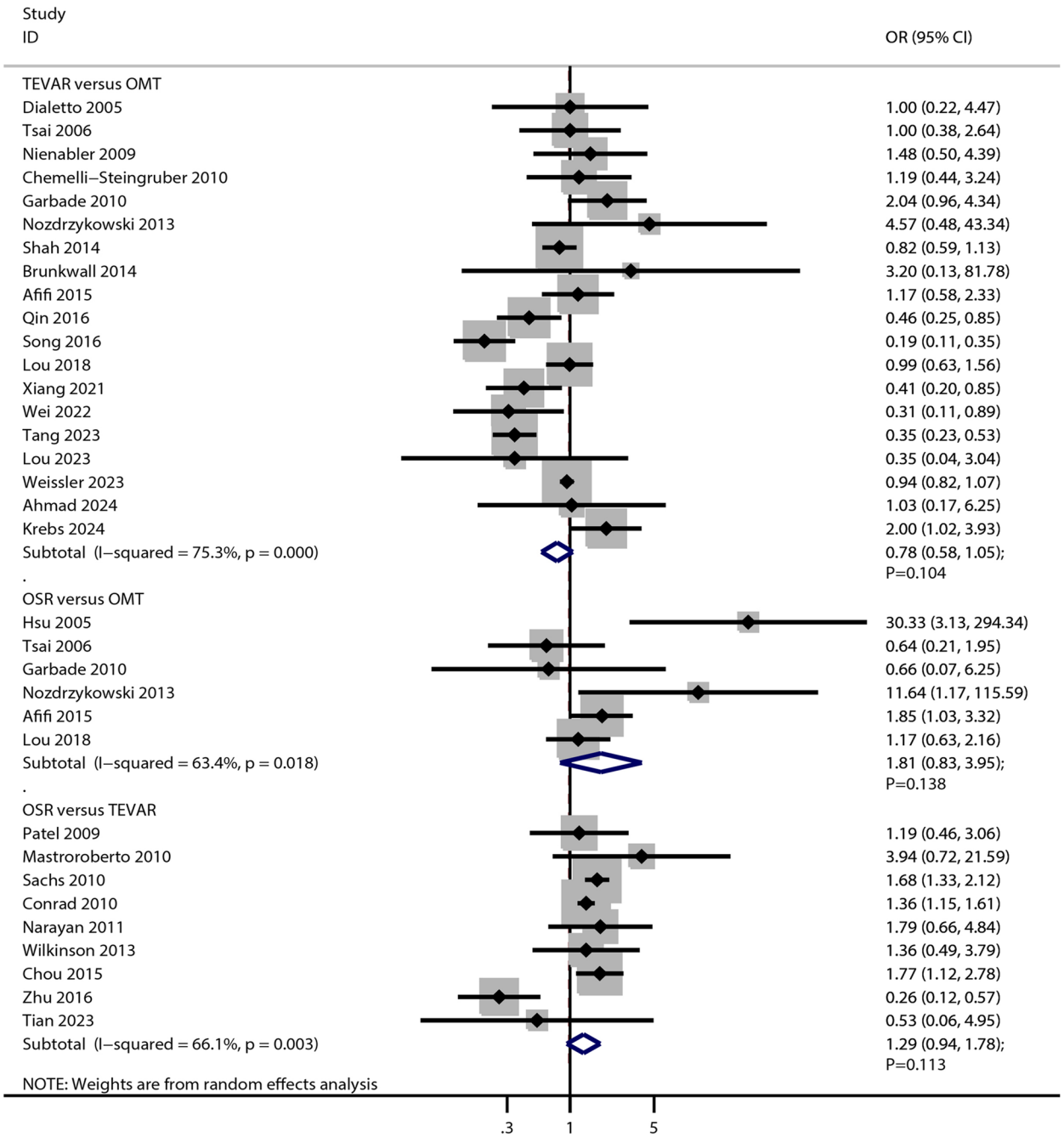

Fig. 3 The risk of long-term mortality when comparisons of OSR, TEVAR, and OMT

which could affect the in-hospital mortality [54]; and (3) OSR is a more invasive surgical procedure that requires opening the chest and direct manipulation of the aorta, which not only increases the risk of bleeding and other complications during the surgery but also elevates the short-term mortality risk. However, no significant differences for the risk of long-term mortality when comparisons of OSR, TEVAR, and OMT, which was not consistent with previous meta-analyses [55, 56]. These results could explained by OSR can more thoroughly address the underlying issues causing TBAD, such as completely replacing the diseased vascular segment or reconstructing the blood flow pathway, which reduces the risk of future recurrent dissections or other cardiovascular events. Additionally, with improved postoperative care and adjustments to the patient's lifestyle after

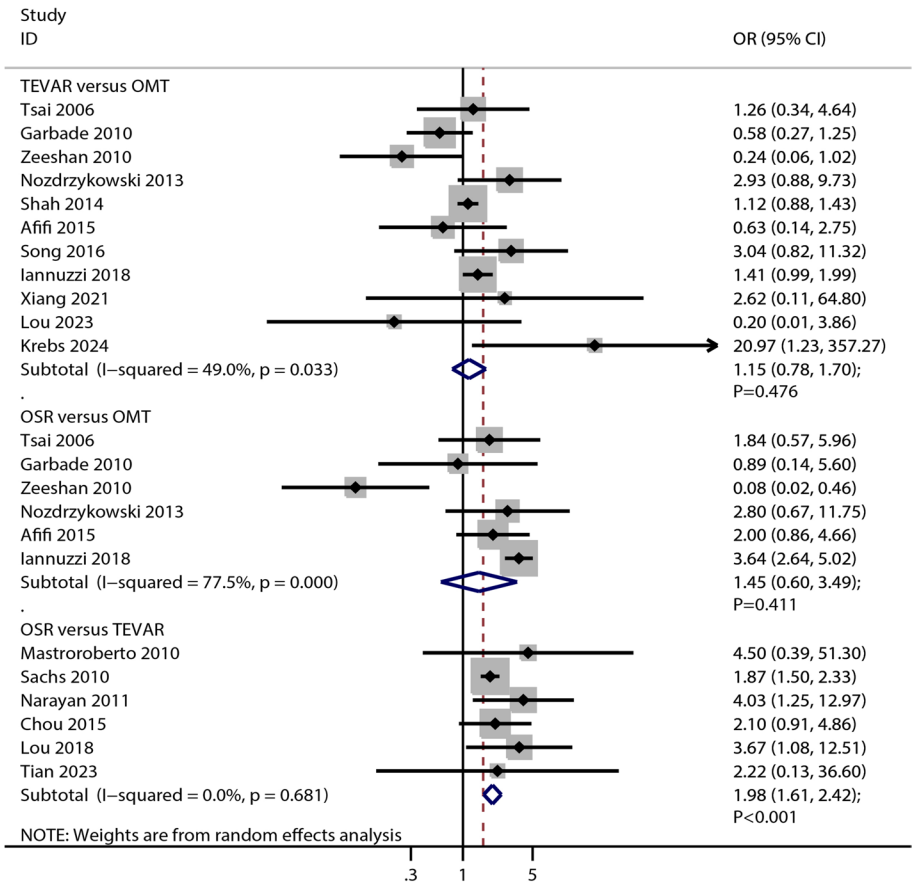

Fig. 4 The risk of acute renal failure when comparisons of OSR, TEVAR, and OMT

recovery, those who successfully navigate the perioperative period often achieve better long-term outcomes. Finally, although using TEVAR could increase the true lumen diameter and reduce the false lumen diameter, aortic remodeling does not immediately translate into the prognosis of TBAD [57].

OSR versus OMT increased the risk of paraplegia, limb ischemia, and bleeding. OSR is a highly invasive surgical procedure. During the operation, it requires opening the chest and directly manipulating the aorta, which can lead to inadequate blood supply to the spinal cord, thereby increasing the risk of paralysis. Additionally, direct manipulation of the vessels during surgery may damage surrounding vascular branches, leading to limb ischemia. Furthermore, the act of opening the chest itself increases the risk of intraoperative and postoperative bleeding, as this type of surgery involves extensive tissue incision and vascular exposure, making it more prone to hemorrhagic complications.

OSR versus TEVAR showed an elevated risk of acute renal failure, MI, respiratory failure, or bleeding, and lower risk of reintervention. During OSR, the procedure requires opening the chest and directly manipulating the aorta, which can lead to prolonged hypotension and hemodynamic instability, thereby increasing the risk of acute kidney injury and MI. Additionally, the direct impact of the open-chest surgery on the lungs, along with postoperative pain and the need for mechanical ventilation, increases the likelihood of respiratory failure. Furthermore, the extensive tissue incision and vascular exposure during the surgery elevate the risk of intraoperative and postoperative bleeding. However, because OSR can more thoroughly address the underlying issues, completely replacing the diseased vascular segment or reconstructing the blood flow pathway, thus the risk of re-intervention is lower [58].

We noted TEVAR was associated with an increased risk of stroke, limb ischemia, and bleeding as compared with OMT. During the TEVAR procedure, stent placement may be necessary to isolate ruptures or false lumens, which can occasionally compress or impact branch vessels, reducing blood flow to the limbs or

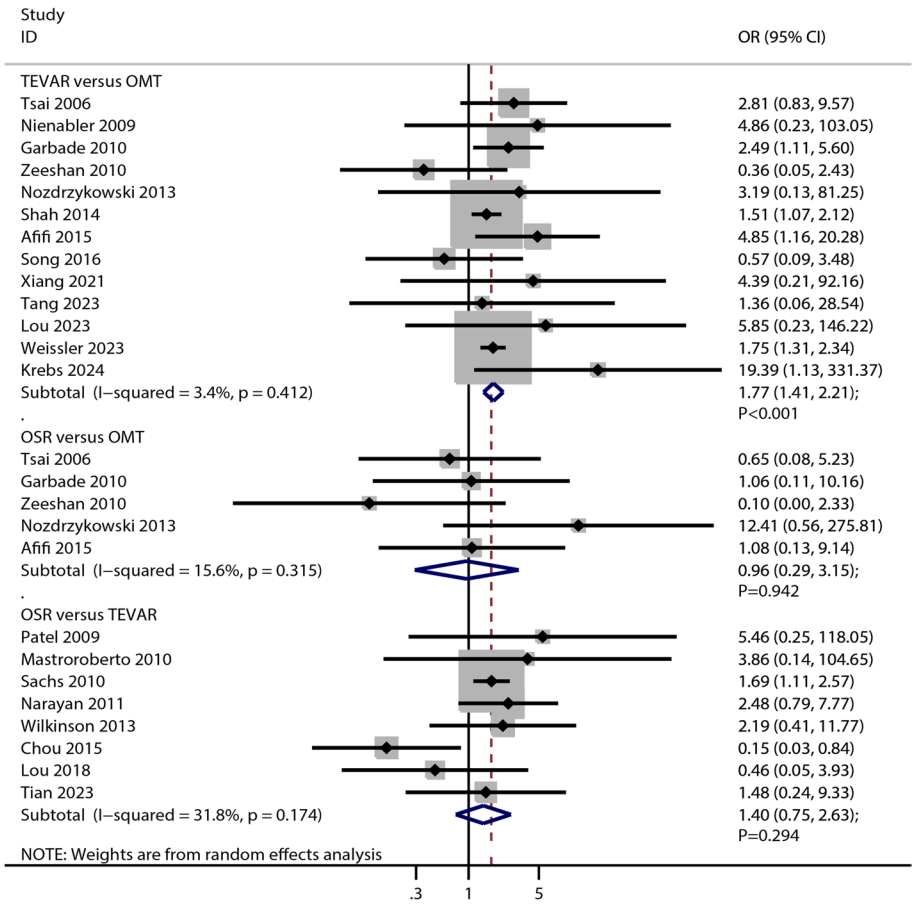

Fig. 5 The risk of stroke when comparisons of OSR, TEVAR, and OMT

vital organs and thereby increasing the risk of peripheral ischemia. Moreover, TEVAR, as a minimally invasive procedure, reduces the size of surgical incisions, it still carries risks of bleeding from the puncture site, vessel wall injury due to stent migration, and increased bleeding potential from subsequent anticoagulation therapy. Finally, the insertion of catheters and stents can disturb plaques or thrombi on the vessel walls, causing these materials to dislodge and travel to the brain via the bloodstream, leading to ischemic stroke. Additionally, the surgical procedure itself may generate small air bubbles, which can enter the circulation and cause cerebral vascular occlusion. Although TEVAR is a less invasive surgical method, these potential risk factors contribute to a relatively higher incidence of stroke.

This study has some limitations. Firstly, our analysis encompassed data drawn from both RCTs and retrospective cohort studies, which might have introduced recall and selection biases that impacted the overall evidence quality. Secondly, a handful of outcomes were documented in a limited number of studies included, with low event frequencies, potentially undermining our statistical power to discern meaningful differences between diverse treatment modalities. Thirdly, disparities in the severity of TBAD across the OSR, TEVAR, and OMT cohorts could have skewed patient prognoses, complicating comparative interpretations. Lastly, reliance solely on published literature for our analysis may have obscured nuanced insights due to unavailable details and potentially introduced publication bias, skewing the aggregate findings.

Conclusions

This study systematically comparisons the effects of OSR, TEVAR, and OMT for treating acute and subacute TBAD. We noted OSR was associated with an increased risk of in-hospital mortality when compared with TEVAR and OMT. OSR versus OMT showed an

Table 3 The summary results for other adverse events

Outcomes	Comparisons	No. of studies	OR and 95%CI	*P* value	I^2 (%)	Q statistic
Paraplegia	TEVAR versus OMT	6	2.06 (0.88–4.80)	0.096	25.0	0.246
	OSR versus OMT	4	3.60 (2.20–5.89)	< 0.001	0.0	0.492
	OSR versus TEVAR	4	0.90 (0.55–1.47)	0.681	0.0	0.489
Myocardial infraction	TEVAR versus OMT	6	1.20 (0.60–2.39)	0.603	50.2	0.074
	OSR versus OMT	2	2.13 (0.17–27.26)	0.562	38.2	0.203
	OSR versus TEVAR	4	2.76 (1.64–4.65)	< 0.001	0.0	0.811
Mesenteric ischemia	TEVAR versus OMT	2	3.96 (0.40–39.46)	0.241	64.4	0.094
	OSR versus OMT	2	3.25 (0.17–62.38)	0.435	70.3	0.067
	OSR versus TEVAR	2	1.14 (0.36–3.56)	0.827	0.0	0.453
Limb ischemia	TEVAR versus OMT	1	13.00 (4.33–39.06)	< 0.001	-	-
	OSR versus OMT	1	7.80 (2.39–25.49)	0.001	-	-
	OSR versus TEVAR	1	0.59 (0.17–1.98)	0.389	-	-
Reintervention	TEVAR versus OMT	7	0.92 (0.43–1.94)	0.825	82.4	< 0.001
	OSR versus OMT	2	0.46 (0.08–2.74)	0.391	0.0	0.523
	OSR versus TEVAR	5	0.30 (0.10–0.89)	0.030	0.0	0.529
Respiratory failure	TEVAR versus OMT	2	2.11 (0.37–12.09)	0.401	81.0	0.022
	OSR versus OMT	2	2.22 (0.05–89.95)	0.672	92.8	< 0.001
	OSR versus TEVAR	6	2.19 (1.73–2.76)	< 0.001	0.0	0.419
Bleeding	TEVAR versus OMT	2	3.65 (2.40–5.55)	< 0.001	0.0	0.838
	OSR versus OMT	1	9.54 (6.57–13.85)	< 0.001	-	-
	OSR versus TEVAR	5	1.88 (1.33–2.67)	< 0.001	17.6	0.303

increased risk of paraplegia, limb ischemia, and bleeding, whereas OSR versus TEVAR showed an elevated risk of acute renal failure, MI, respiratory failure, or bleeding, and lower risk of reintervention. Finally, TEVAR was associated with an increased risk of stroke, limb ischemia, and bleeding when compared with OMT. Further large-scale RCTs should be performed to verify the findings of this study owing to it could eliminate imbalances in patient characteristics.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12872-025-04478-1.

Additional file 1: Table S1. Quality scores of observational studies using Newcastle-Ottawa Scale. Table S2. Methodological quality assessment using the Cochrane Risk of bias tool of randomized controlled trials describing outcomes. Figure S1. Sensitivity analysis for TEVAR versus OMT on the risk of in-hospital mortality. Figure S2. Sensitivity analysis for OSR versus OMT on the risk of in-hospital mortality. Figure S3. Sensitivity analysis for OSR versus TEVAR on the risk of in-hospital mortality. Figure S4. Funnel plot for TEVAR versus OMT on the risk of in-hospital mortality. Figure S5. Funnel plot for OSR versus OMT on the risk of in-hospital mortality. Figure S6. Funnel plot for OSR versus TEVAR on the risk of in-hospital mortality. Figure S7. Sensitivity analysis for TEVAR versus OMT on the risk of long-term mortality. Figure S8. Sensitivity analysis for OSR versus OMT on the risk of long-term mortality. Figure S9. Sensitivity analysis for OSR versus TEVAR on the risk of long-term mortality. Figure S10. Funnel plot for TEVAR versus OMT on the risk of long-term mortality. Figure S11. Funnel plot for OSR versus OMT on the risk of long-term mortality. Figure S12. Funnel plot for OSR versus TEVAR on the risk of long-term mortality. Figure S13. Sensitivity analysis for TEVAR versus OMT on the risk of acute renal failure. Figure S14. Sensitivity analysis for OSR versus OMT on the risk of acute renal failure. Figure S15. Sensitivity analysis for OSR versus TEVAR on the risk of acute renal failure. Figure S16. Funnel plot for TEVAR versus OMT on the risk of acute renal failure. Figure S17. Funnel plot for OSR versus OMT on the risk of acute renal failure. Figure S18. Funnel plot for OSR versus TEVAR on the risk of acute renal failure. Figure S19. Sensitivity analysis for TEVAR versus OMT on the risk of stroke. Figure S20. Sensitivity analysis for OSR versus OMT on the risk of stroke. Figure S21. Sensitivity analysis for OSR versus TEVAR on the risk of stroke. Figure S22. Funnel plot for TEVAR versus OMT on the risk of stroke. Figure S23. Funnel plot for OSR versus OMT on the risk of stroke. Figure S24. Funnel plot for OSR versus TEVAR on the risk of stroke.

Acknowledgements
Not applicable.

Authors' contributions
Concept/design: ZYH, Data analysis/interpretation: LJP and CXH, Drafting article: LJP and CXH, Critical revision of article: XJ, TL and ZY, Statistics: LC, Data collection: TL, Approval of article: ZYH.

Funding
The authors received no specific funding for this work.

Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Department of Cardiovascular Surgery, Suining Central Hospital, 27 Dong Ping Street, Suining, Sichuan 629000, P.R. China. [2]Department of Anesthesiology, Suining Central Hospital, Suining, Sichuan, China. [3]Department of Hospital-Acquired Infection Control, Suining Central Hospital, Suining, Sichuan, China. [4]Department of Intensive Care Unit, Suining Central Hospital, Suining, Sichuan, China.

Received: 10 July 2024 Accepted: 3 January 2025
Published online: 07 February 2025

References

1. Braverman AC. Acute aortic dissection: clinician update. Circulation. 2010;122(2):184–8.
2. Evangelista A, Isselbacher EM, Bossone E, Gleason TG, Eusanio MD, Sechtem U, et al. Insights from the International Registry of Acute Aortic dissection: a 20-Year experience of collaborative clinical research. Circulation. 2018;137(17):1846–60.
3. Hagan PG, Nienaber CA, Isselbacher EM, Bruckman D, Karavite DJ, Russman PL, et al. The International Registry of Acute Aortic dissection (IRAD): new insights into an old disease. JAMA. 2000;283(7):897–903.
4. Lempel JK, Frazier AA, Jeudy J, Kligerman SJ, Schultz R, Ninalowo HA, et al. Aortic arch dissection: a controversy of classification. Radiology. 2014;271(3):848–55.
5. Erbel R, Aboyans V, Boileau C, Bossone E, Bartolomeo RD, Eggebrecht H, 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). Eur Heart J. 2014;35(41):2873–926.
6. Hiratzka LF, Bakris GL, Beckman JA, Bersin RM, Carr VF, Casey DE Jr., 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. Circulation. 2010;121(13):e266–369.
7. Tian DH, De Silva RP, Wang T, Yan TD. Open surgical repair for chronic type B aortic dissection: a systematic review. Ann Cardiothorac Surg. 2014;3(4):340–50.
8. Goodney PP, Travis L, Lucas FL, Fillinger MF, Goodman DC, Cronenwett JL, et al. Survival after open versus endovascular thoracic aortic aneurysm repair in an observational study of the Medicare population. Circulation. 2011;124(24):2661–9.
9. Huptas S, Mehta RH, Kühl H, Tsagakis K, Reinsch N, Kahlert P, et al. Aortic remodeling in type B aortic dissection: effects of endovascular stent-graft repair and medical treatment on true and false lumen volumes. J Endovasc Ther. 2009;16(1):28–38.
10. Liu D, Luo H, Lin S, Zhao L, Qiao C. Comparison of the efficacy and safety of thoracic endovascular aortic repair with open surgical repair and optimal medical therapy for acute type B aortic dissection: a systematic review and meta-analysis. Int J Surg. 2020;83:53–61.
11. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097.
12. Higgins J, Green S. Cochrane handbook for systematic reviews of interventions version 5.1.0 (updated March 2011). Cochrane Collaboration. 2011.
13. Wells G, Shea B, O'Connell D. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa (ON): Ottawa Hospital Research Institute; 2009.
14. DerSimonian R, Laird N. Meta-analysis in clinical trials. Control Clin Trials. 1986;7(3):177–88.
15. Ades AE, Lu G, Higgins JP. The interpretation of random-effects meta-analysis in decision models. Med Decis Mak. 2005;25(6):646–54.
16. Deeks JJ, Higgins JPT, Altman DG. Analyzing data and undertaking meta-analyses. In: Higgins J, Green S, editors. Cochrane Handbook for Systematic Reviews of Interventions 5.0.1. Oxford, UK: The Cochrane Collaboration; 2008.
17. Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. BMJ. 2003;327(7414):557–60.
18. Tobias A. Assessing the influence of a single study in meta-analysis. Stata Tech Bull. 1999;47:15–7.
19. Altman DG, Bland JM. Interaction revisited: the difference between two estimates. BMJ. 2003;326(7382):219.
20. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. BMJ. 1997;315(7109):629–34.
21. Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. Biometrics. 1994;50(4):1088–101.
22. Dialetto G, Covino FE, Scognamiglio G, Manduca S, Della Corte A, Giannolo B, et al. Treatment of type B aortic dissection: endoluminal repair or conventional medical therapy? Eur J Cardiothorac Surg. 2005;27(5):826–30.
23. Hsu RB, Ho YL, Chen RJ, Wang SS, Lin FY, Chu SH. Outcome of medical and surgical treatment in patients with acute type B aortic dissection. Ann Thorac Surg. 2005;79(3):790–4. author reply 4–5.
24. Tsai TT, Fattori R, Trimarchi S, Isselbacher E, Myrmel T, Evangelista A, et al. Long-term survival in patients presenting with type B acute aortic dissection: insights from the International Registry of Acute Aortic Dissection. Circulation. 2006;114(21):2226–31.
25. Nienaber CA, Rousseau H, Eggebrecht H, Kische S, Fattori R, Rehders TC, et al. Randomized comparison of strategies for type B aortic dissection: the INvestigation of STEnt grafts in aortic dissection (INSTEAD) trial. Circulation. 2009;120(25):2519–28.
26. Patel HJ, Williams DM, Upchurch GR Jr., Dasika NL, Deeb GM. A comparative analysis of open and endovascular repair for the ruptured descending thoracic aorta. J Vasc Surg. 2009;50(6):1265–70.
27. Chemelli-Steingruber I, Chemelli A, Strasak A, Hugl B, Hiemetzberger R, Jaschke W, et al. Endovascular repair or medical treatment of acute type B aortic dissection? A comparison. Eur J Radiol. 2010;73(1):175–80.
28. Garbade J, Jenniches M, Borger MA, Barten MJ, Scheinert D, Gutberlet M, et al. Outcome of patients suffering from acute type B aortic dissection: a retrospective single-centre analysis of 135 consecutive patients. Eur J Cardiothorac Surg. 2010;38(3):285–92.
29. Mastroroberto P, Onorati F, Zofrea S, Renzulli A, Indolfi C. Outcome of open and endovascular repair in acute type B aortic dissection: a retrospective and observational study. J Cardiothorac Surg. 2010;5:23.
30. Zeeshan A, Woo EY, Bavaria JE, Fairman RM, Desai ND, Pochettino A, et al. Thoracic endovascular aortic repair for acute complicated type B aortic dissection: superiority relative to conventional open surgical and medical therapy. J Thorac Cardiovasc Surg. 2010;140(6 Suppl):S109-15 discussion S42-S46.
31. Sachs T, Pomposelli F, Hagberg R, Hamdan A, Wyers M, Giles K, et al. Open and endovascular repair of type B aortic dissection in the Nationwide Inpatient Sample. J Vasc Surg. 2010;52(4):860–6. discussion 6.
32. Conrad MF, Ergul EA, Patel VI, Paruchuri V, Kwolek CJ, Cambria RP. Management of diseases of the descending thoracic aorta in the endovascular era: a Medicare population study. Ann Surg. 2010;252(4):603–10.
33. Narayan P, Wong A, Davies I, Angelini GD, Bryan AJ, Wilde P, et al. Thoracic endovascular repair versus open surgical repair - which is the more cost-effective intervention for descending thoracic aortic pathologies? Eur J Cardiothorac Surg. 2011;40(4):869–74.
34. Nozdrzykowski M, Etz CD, Luehr M, Garbade J, Misfeld M, Borger MA, et al. Optimal treatment for patients with chronic Stanford type B aortic dissection: endovascularly, surgically or both? Eur J Cardiothorac Surg. 2013;44(3):e165–74. discussion e74.
35. Wilkinson DA, Patel HJ, Williams DM, Dasika NL, Deeb GM. Early open and endovascular thoracic aortic repair for complicated type B aortic dissection. Ann Thorac Surg. 2013;96(1):23–30. discussion 230.
36. Shah TR, Rockman CB, Adelman MA, Maldonado TS, Veith FJ, Mussa FF. Nationwide comparative impact of thoracic endovascular aortic repair of acute uncomplicated type B aortic dissections. Vasc Endovascular Surg. 2014;48(3):230–3.
37. Brunkwall J, Kasprzak P, Verhoeven E, Heijmen R, Taylor P, Alric P, et al. Endovascular repair of acute uncomplicated aortic type B dissection

promotes aortic remodelling: 1 year results of the ADSORB trial. Eur J Vasc Endovasc Surg. 2014;48(3):285–91.
38. Afifi RO, Sandhu HK, Leake SS, Boutrous ML, Kumar V 3rd, Azizzadeh A, et al. Outcomes of patients with Acute Type B (DeBakey III) aortic dissection: a 13-Year, single-center experience. Circulation. 2015;132(8):748–54.
39. Chou HP, Chang HT, Chen CK, Shih CC, Sung SH, Chen TJ, et al. Outcome comparison between thoracic endovascular and open repair for type B aortic dissection: a population-based longitudinal study. J Chin Med Assoc. 2015;78(4):241–8.
40. Qin YL, Wang F, Li TX, Ding W, Deng G, Xie B, et al. Endovascular repair compared with Medical Management of patients with uncomplicated type B Acute Aortic Dissection. J Am Coll Cardiol. 2016;67(24):2835–42.
41. Song C, Lu Q, Zhou J, Yu G, Feng X, Zhao Z, et al. The new indication of TEVAR for uncomplicated type B aortic dissection. Med (Baltim). 2016;95(25):e3919.
42. Zhu Y, Wang B, Meng Q, Liu J, Zhai S, He J. Long-term efficacy of endovascular vs open surgical repair for complicated type-B aortic dissection: a single-center retrospective study and meta-analysis. Braz J Med Biol Res. 2016;49(6):e5194.
43. Iannuzzi JC, Stapleton SM, Bababekov YJ, Chang D, Lancaster RT, Conrad MF, et al. Favorable impact of thoracic endovascular aortic repair on survival of patients with acute uncomplicated type B aortic dissection. J Vasc Surg. 2018;68(6):1649–55.
44. Lou X, Chen EP, Duwayri YM, Veeraswamy RK, Jordan WD Jr, Zehner CA, et al. The impact of thoracic endovascular aortic repair on long-term survival in type B aortic dissection. Ann Thorac Surg. 2018;105(1):31–8.
45. Xiang D, Kan X, Liang H, Xiong B, Liang B, Wang L, et al. Comparison of mid-term outcomes of endovascular repair and medical management in patients with acute uncomplicated type B aortic dissection. J Thorac Cardiovasc Surg. 2021;162(1):26–e361.
46. Wei L, Meng Y, Zhang G, Qin H. Endovascular repair of the thoracic aorta combined with drug therapy in acute uncomplicated type B aortic dissection. Dis Markers. 2022;2022:3021599.
47. Tang QH, Chen J, Long Z, Su XA, Wang YL, Qiu JY, et al. Long-term survival and risk analysis of thoracic endovascular aortic repair for type B aortic dissection. iScience. 2023;26(12):108359.
48. Tian C, Chen D, Zhao J, Zhang Y, Luo M, Fang K, et al. Surgical treatment patterns and clinical outcomes of type B aortic dissection involving the aortic arch. J Vasc Surg. 2023;77(4):1016–e10279.
49. Lou X, Chen EP, Duwayri YM, Jordan WD, Keeling WB, Leshnower BG. Early results of thoracic endovascular aortic repair for the management of Acute uncomplicated type B aortic dissection. Semin Thorac Cardiovasc Surg. 2023;35(2):289–97.
50. Weissler EH, Osazuwa-Peters OL, Greiner MA, Hardy NC, Kougias P, O'Brien SM, et al. Initial thoracic endovascular aortic repair vs Medical Therapy for Acute uncomplicated type B aortic dissection. JAMA Cardiol. 2023;8(1):44–53.
51. Ahmad W, Brunkwall J, Bunck AC, Dorweiler B, Mylonas S. Favorable remodeling after TEVAR in uncomplicated Acute and Subacute Type B aortic dissection in comparison to conservative treatment: a Midterm Analysis. J Endovasc Ther. 2024;31(5):964–74.
52. Krebs JR, Filiberto AC, Fazzone B, Jacobs CR, Anderson EM, Shahid Z, et al. Outcomes of patients with Acute Type B aortic dissection and high-risk features. Ann Vasc Surg. 2024;106:99–107.
53. Sá MP, Jacquemyn X, Brown JA, Ahmad D, Serna-Gallegos D, Arnaoutakis GJ, et al. Thoracic endovascular aortic repair for hyperacute, acute, subacute and chronic type B aortic dissection: Meta-analysis of reconstructed time-to-event data. Trends Cardiovasc Med. 2023;34(7):479–85.
54. Loewe C, Czerny M, Sodeck GH, Ta J, Schoder M, Funovics M, et al. A new mechanism by which an acute type B aortic dissection is primarily complicated, becomes complicated, or remains uncomplicated. Ann Thorac Surg. 2012;93(4):1215–22.
55. Hossack M, Patel S, Gambardella I, Neequaye S, Antoniou GA, Torella F. Endovascular vs. Medical Management for uncomplicated Acute and Sub-acute Type B aortic dissection: a Meta-analysis. Eur J Vasc Endovasc Surg. 2020;59(5):794–807.
56. Sá MP, Jacquemyn X, Van den Eynde J, Chu D, Serna-Gallegos D, Singh MJ, et al. Midterm Outcomes of Endovascular vs. Medical Therapy for uncomplicated type B aortic dissection: Meta-Analysis of Reconstructed Time to Event Data. Eur J Vasc Endovasc Surg. 2023;66(5):609–19.
57. Nienaber CA, Kische S, Rousseau H, Eggebrecht H, Rehders TC, Kundt G, et al. Endovascular repair of type B aortic dissection: long-term results of the randomized investigation of stent grafts in aortic dissection trial. Circ Cardiovasc Interv. 2013;6(4):407–16.
58. Liu J, Xia J, Yan G, Zhang Y, Ge J, Cao L. Thoracic endovascular aortic repair versus open chest surgical repair for patients with type B aortic dissection: a systematic review and meta-analysis. Ann Med. 2019;51(7–8):360–70.

Publisher's Note