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Efficacy of thoracic endovascular aortic repair versus medical therapy for treatment of type B aortic dissection

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Abstract

Background Techniques in endovascular therapy have evolved to offer a promising alternative to medical therapy alone for Type B aortic dissections (TBADs).

Aim The aim of this meta-analysis was to compare mortality and overall complications between thoracic endovascular aortic repair (TEVAR) and best medical therapy (BMT) in patients with TBADs.

Methods We included randomized control trials and prospective or retrospective cohort studies that compared TEVAR and BMT for the treatment of type B aortic dissection. Multiple electronic databases were searched.

Results Thirty-two cohort studies including 150,836 patients were included. TEVAR was associated with a significantly lower 30-day mortality rate than BMT (RR = 0.79, CI = 0.63, 0.99, $P = 0.04$), notably in patients ≥ 65 years of age (RR = 0.78, CI = 0.64, 0.95, $P = 0.01$). The TEVAR group had a significantly prolonged hospital stay (MD = 3.42, CI = 1.69, 5.13, $P = 0.0001$) and ICU stay (MD = 3.18, CI = 1.48, 4.89, $P = 0.0003$) compared to the BMT. BMT was associated with increased stroke risk (RR = 1.52, CI = 1.29, 1.79, $P < 0.00001$). No statistically significant differences in late mortality (1, 3, and 5 years) or intervention-related factors (acute renal failure, spinal cord ischemia, myocardial infarction, respiratory failure, and sepsis) were noted between the groups.

Conclusion Our meta-analysis revealed a significant association between the TEVAR group and a decreased mortality rate of TBAD compared to the medical treatment group, especially in patients aged 65 years or older. Further randomized controlled trials are needed to confirm our findings.

Keywords Thoracic endovascular aortic repair, Medical therapy, Type B aortic dissection

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Introduction

Aortic dissection (AD) is a known component of acute aortic syndrome, in conjunction with intramural hematoma and a penetrating aortic ulcer. It develops when the intimal layer of the aorta tears, allowing blood to leak into the wall and creating a dissection plane along the medial layer. Uncontrolled hypertension and trauma are the frequent causes of dissection. Occasionally, an underlying connective tissue condition predisposes the patient to its pathogenesis [1].

The majority of the 43,000 to 47,000 aortic disease-related deaths that occur annually in the United States are linked to dissection [2]. Type B aortic dissection (TBAD) has a 30-day mortality rate of 10%–20%. When patients with ascending aortic dissection underwent surgery instead of medical care, mortality was dramatically reduced; however, this effect was not observed in patients with descending aortic dissection. For the past 50 years, treatment has been guided by the Stanford classification, which is based on this finding. As a result, type B dissections that are considered complicated, such as those with aortic rupture, neurologic sequelae, hypotension or shock, end-organ malperfusion, recurrent or refractory pain, early aortic dilation, hypertension resistant to medical treatment, or propagation of the dissection, have been saved for surgical intervention [3, 4].

Thoracic endovascular aortic repair (TEVAR) has been a successful alternative to surgery for acute complex TBAD since it was first emerged by DeBakey et al. [5] and Daily et al. [6] in the late 1960s and has a lower perioperative mortality rate. TEVAR's overall effectiveness of TEVAR in treating patients with acute, uncomplicated TBAD is still under discussion. Medical or conservative treatment is used for individuals with uncomplicated TBAD. This involves the management of hypertension and close monitoring [7]. The long-term outcomes of the best medical treatment (BMT) in patients with uncomplicated TBAD, however, tend to be less than desirable, with a recorded false-lumen expansion of 20% to 50% after 4 years and cumulative mortality of 30% to 50% at 5 years [8–10].

In terms of hospital mortality, TEVAR has shown high efficacy in reducing mortality rates, as reported by several studies [11–13]. In contrast, other studies found no significant difference between TEVAR and medical management (MM) in terms of mortality rate [14–16]. Therefore, we aimed to compare MM and TEVAR in the management of TBAD and to resolve these conflicting results.

Methods

Data sources and search strategy

A systematic search of Cochrane Library, PubMed, Scopus and Web of Science up to February 2023 was conducted for appropriate studies using the following search strategy "("Thoracic Endovascular Aortic Repair" OR "Endovascular Stent Grafting" OR "Fenestrated Endovascular Aneurysm Repair" OR "Branched Endovascular Aneurysm Repair" OR "Thoracic Endovascular Aneurysm Repair") AND ("Aortic Dissection" OR "Dissecting Aortic Aneurysm"). We included only articles published in English.

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed in this meta-analysis.

Study selection

Pre-defined PICOS criteria were followed to select relevant studies (P: acute or chronic type B aortic dissection patients; I: thoracic endovascular aortic repair; C: medical therapy; O: in-hospital mortality and adverse event outcomes). Studies were included in the meta-analysis if they were randomized control trials and prospective or retrospective cohorts that compared thoracic endovascular aortic repair (TEVAR) versus medical therapy for the treatment of acute or chronic type B aortic dissection. Case reports, case series and animal studies were excluded. Awe followed these criteria to perform title and abstract screening of the publications to assess their eligibility for inclusion. Studies that passed this initial screening were then evaluated in full text screening. Each stage involved a duplicate review of the publications, with any disagreements resolved through consensus or by a third reviewer.

Data extraction and assessment of study quality

Data extraction of the baseline characteristics and outcomes were done using a standardized method. Baseline characteristics that were extracted included study year, country, sample size, number of patients in each group, sex, age, length of hospital or ICU stay, extent of dissection at admission, baseline diseases, and baseline medications. Two authors performed title and abstract screening and two authors performed full-text screening. Five authors extracted the Data and another author examined data accuracy. We used The Newcastle Ottawa scale tool to assess quality of the observational studies.

Statistical analysis

Statistical analysis was performed using RevMan software (version 5.4). For continuous outcomes, such as

length of hospital stay, the mean difference (MD) and the associated 95% confidence interval (CI) were used. For dichotomous outcomes, such as mortality, the risk ratio (RR) and its corresponding 95% CIs were used. The overall effect of the meta-analysis was estimated using a Z-test. If no heterogeneity was detected, a fixed effects model was used to present the results. If significant heterogeneity was present, a random effects model was applied. Heterogeneity was estimated using the chi-squared test.

Results

Literature search

After conducting an extensive literature search, 1,966 studies were identified. Following the removal of duplicates, 1,673 studies were deemed eligible for title and abstract screening. Of these, 1,607 were found to be irrelevant, leaving 66 studies that were suitable for full-text screening. Ultimately, 32 studies [11, 17–47] were included in the meta-analysis after review of the full-text, (Fig. 1).

The overall quality of the included studies was found good in 23 studies, fair in one study, and poor in seven studies (Table 1).

The total number of included participants in the study was 150,836, 19,512 patients in TEVAR group, and 131,324 patients in medical treatment group, Table 2 shows other baseline data.

Outcomes

In hospital / 30-day Mortality Rate analysis

The overall effect estimate showed a statistically significant association between the TEVAR group and decreased hospital/ 30-day mortality rate compared with the medical treatment group (RR = 0.79, CI = 0.63, 0.99, $P = 0.04$). Significant heterogeneity was found among studies that wasn't resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 76\%$), as shown in Fig. 2.

In hospital / 30-day Mortality Rate age subgroup analysis

More than or equal to 65 years old

The overall effect estimate showed no statistically significant difference between TEVAR and Medical treatment

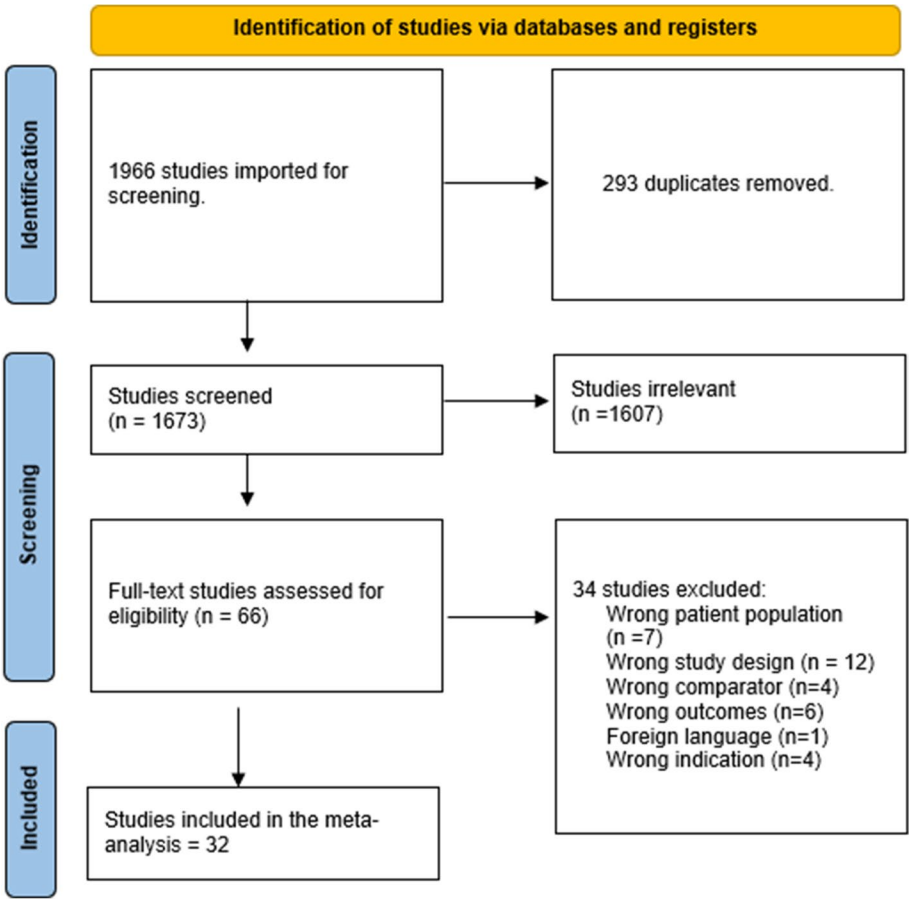

Fig. 1 PRISMA flow diagram

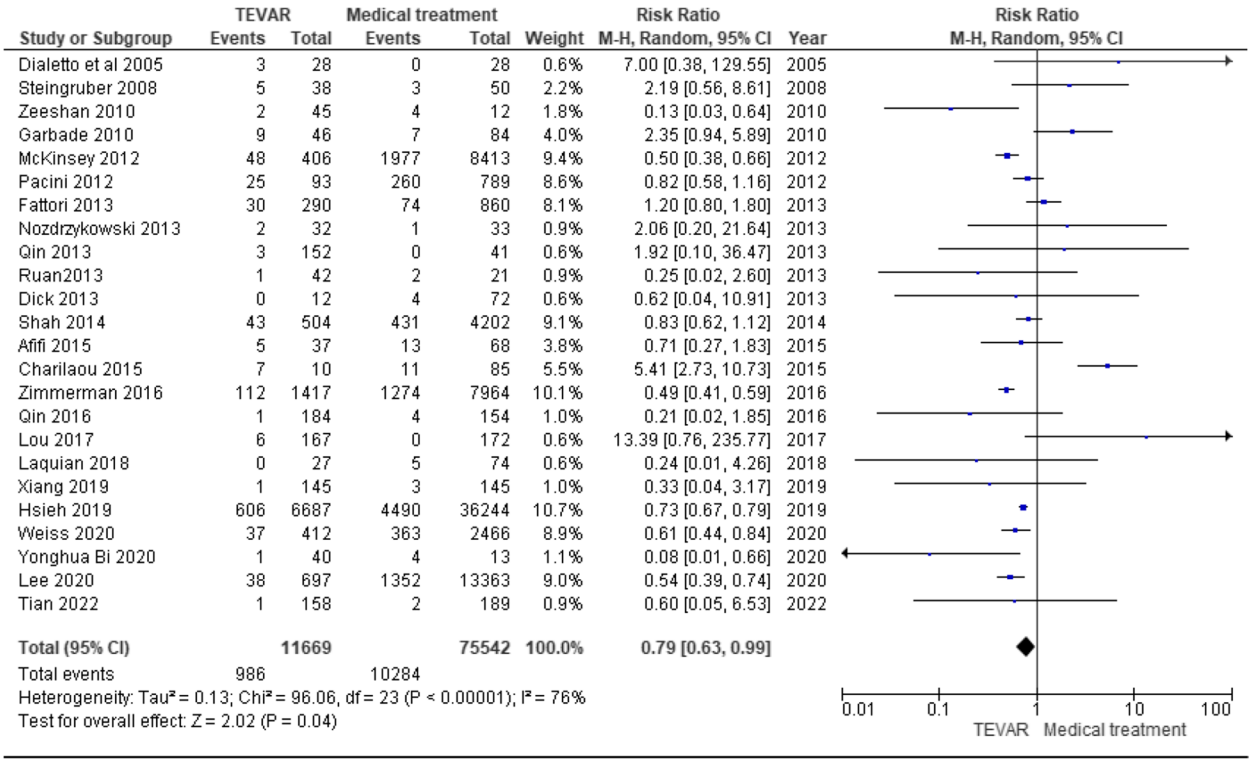

Fig. 2 In hospital / 30-day Mortality Rate

group in patients more than or equal to 65 years old (RR = 1.41, CI 0.75, 2.68, $P = 0.29$). Significant heterogeneity was found among the studies ($P < 0.00001$, $I^2 = 91\%$), Fig. 3. So, leave one out test was done by removing the study (Charilaou 2015) and the heterogeneity was solved ($P = 0.21$, $I^2 = 35\%$) and the overall effect estimate showed a statistically significant association between TEVAR group and decreased in hospital/ 30-day mortality rate in patients more than or equal to 65 years old (RR = 0.78, CI = 0.64, 0.95, $P = 0.01$).

Less than 65 years old

The overall effect estimate showed no statistically significant difference between the TEVAR and Medical treatment group in patients aged < 65 years (RR = 0.74, CI 0.32, 1.67, $P = 0.46$). Significant heterogeneity was found among studies that was not not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 84\%$), Fig. 3.

In hospital / 30-day Mortality Rate age subgroup analysis

Complicated AD

The overall effect estimate showed no statistically significant difference between the TEVAR and Medical treatment group in complicated AD patients (RR = 0.87, CI 0.29, 2.62, $P = 0.81$). Significant heterogeneity was found among studies that wasn't resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 87\%$), as shown in Fig. 4.

Uncomplicated AD

The overall effect estimate showed a statistically significant association between the TEVAR group and decreased hospital/ 30-day mortality rate in uncomplicated AD patients compared to the medical treatment group (RR = 0.74, CI = 0.68, 0.80, $P < 0.00001$). No significant heterogeneity was found among the studies ($P = 0.68$, $I^2 = 0\%$), as shown in Fig. 4.

In hospital / 30-day Mortality Rate study quality subgroup analysis

Good quality

The overall effect estimate showed a statistically significant association between the TEVAR group and decreased hospital/ 30-day mortality rate compared to the medical treatment group in good-quality studies (RR = 0.67, CI 0.53, 0.84, $P = 0.0006$). Significant heterogeneity was found among the studies ($P = 0.0004$, $I^2 = 59\%$), Fig. 5. We performed leave-one-out test by removing the study (Qin 2016) and the heterogeneity was solved ($P = 0.02$, $I^2 = 45\%$), and the overall effect estimate showed a statistically significant association between AD type B patients who were treated with TEVAR and

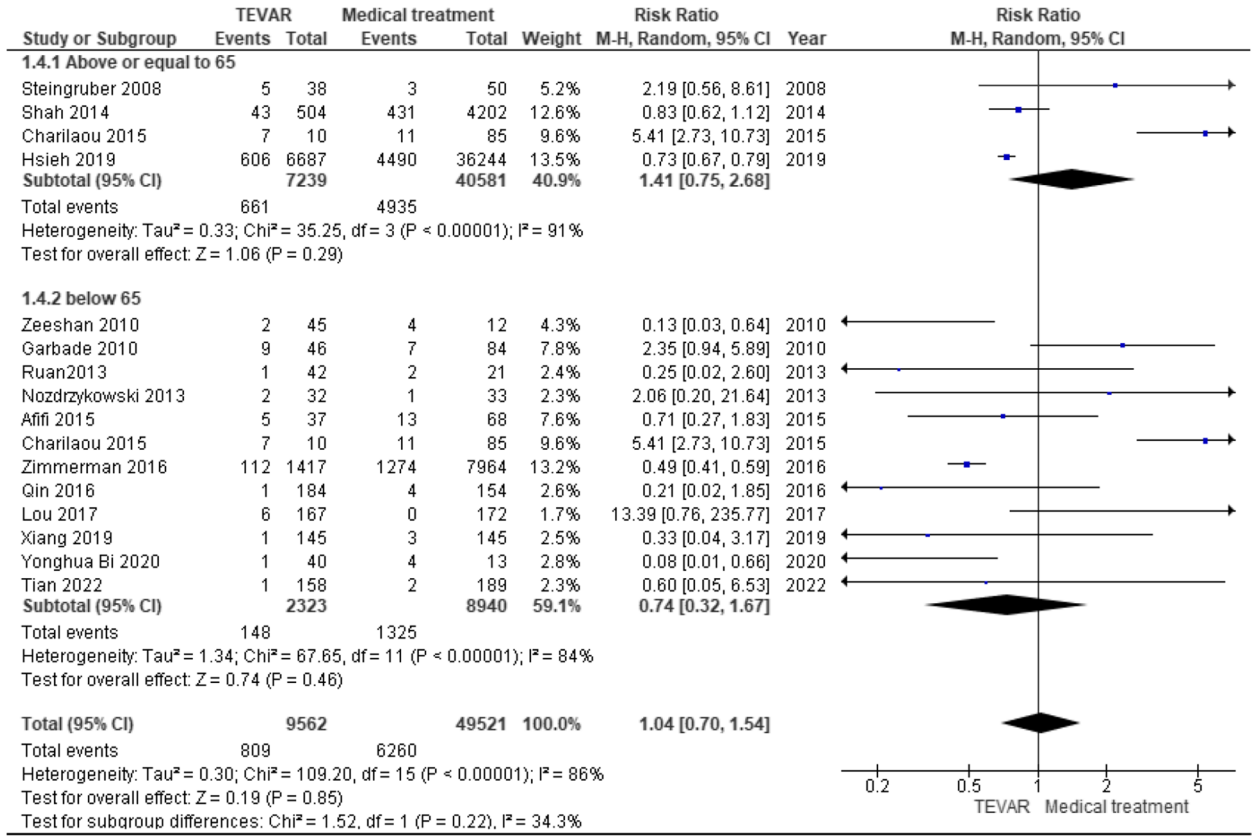

Fig. 3 In hospital / 30-day Mortality subgroup analysis according to age

decreased hospital/ 30-day mortality rate in good quality studies (RR = 0.71, CI = 0.55, 0.91, $P = 0.006$).

Poor quality

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group in poor quality studies (RR = 1.43, CI 0.44, 4.67, $P = 0.56$). Significant heterogeneity was found among studies that wasn't resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 96\%$), Fig. 5.

Late mortality rate (MR) analysis

1 year mortality rate (MR)

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 1.42, CI = 0.60, 3.37, $P = 0.42$). Significant heterogeneity was found among studies that was not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 98\%$), Fig. 6.

3 year mortality rate (MR)

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 1.37, CI = 0.71, 2.63, $P = 0.35$). Significant heterogeneity was found among studies that was not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 98\%$), Fig. 6.

5 year mortality rate (MR)

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 1.01, CI = 0.86, 1.18, $P = 0.93$). Significant heterogeneity was found among studies that was not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 89\%$), Fig. 6.

Length of hospital stay analysis

The overall effect estimate showed a statistically significant association between the TEVAR group and an increased length of hospital stay compared to the medical treatment group (RR = 3.42, CI = 1.69, 5.13, $P = 0.0001$). Significant heterogeneity was found among studies that was not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 96\%$), Fig. 7.

Length of ICU stay analysis

The overall effect estimate showed a statistically significant association between the TEVAR group and an

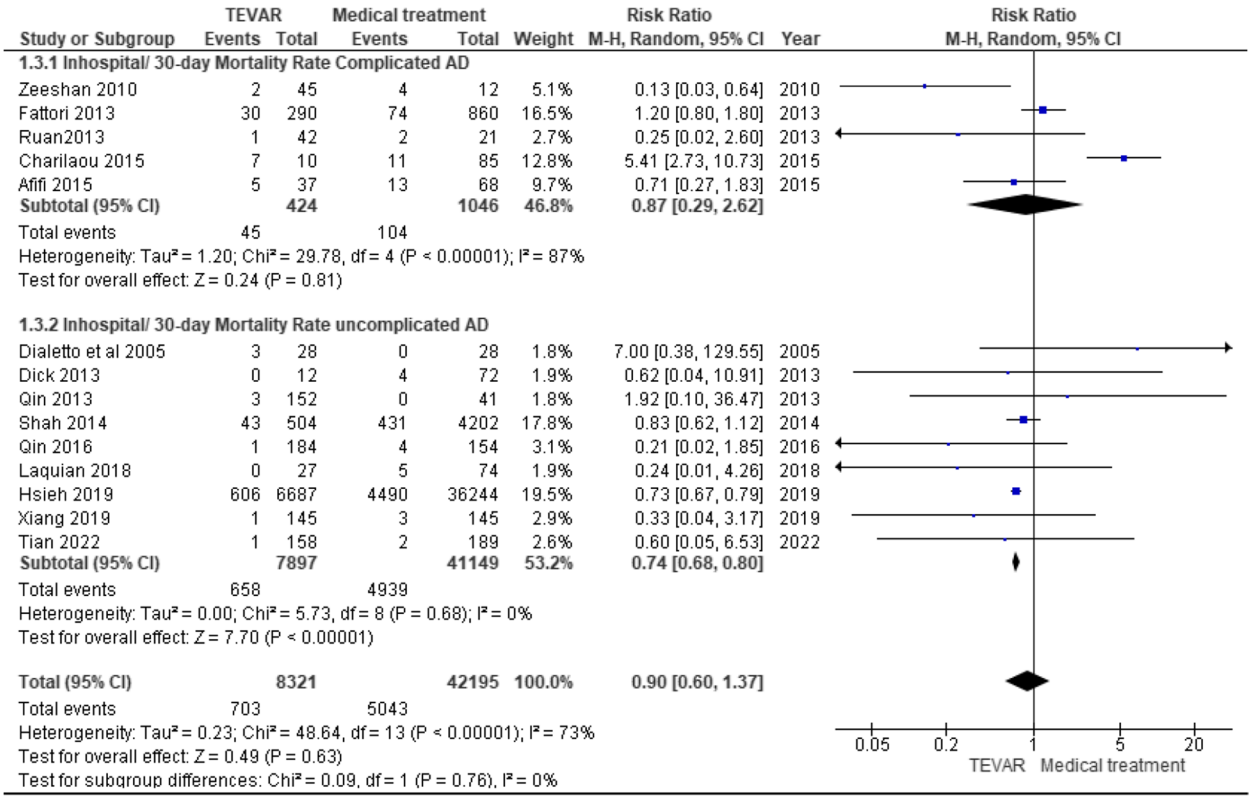

Fig. 4 In hospital / 30-day Mortality subgroup analysis according to complicated or uncomplicated AD

increased length of ICU stay compared to the medical treatment group (RR = 3.18, CI = 1.48, 4.89, $P = 0.0003$). No significant heterogeneity was found between the two studies ($P = 0.48$, $I^2 = 0\%$), Fig. 8.

Development of Retrograde A dissection analysis

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 0.87, CI = 0.68, 1.11, $P = 0.27$). No significant heterogeneity was found between the two studies ($P = 0.08$, $I^2 = 37\%$), as shown in Fig. 9.

Reintervention / dissection related admission analysis

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 1.20, CI = 0.96, 1.49, P = 0.12). Significant heterogeneity was found among studies that was not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 80\%$), Fig. 10.

Aortic remodeling analysis

False lumen (FL) obliteration / thrombosis analysis

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 1.79, CI = 0.89, 3.60, P = 0.10). Significant heterogeneity was found among studies that was not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 88\%$), Fig. 11.

True lumen (TL) expansion analysis

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 1.46, CI = 0.33, 6.46, $P = 0.62$). Significant heterogeneity was found ($P < 0.00001$, $I^2 = 90\%$), Fig. 11. Therefore, we performed a leave-one-out test by removing the study (Laquian 2018) and the heterogeneity was resolved ($P = 0.40$, $I^2 = 0\%$), and the overall effect estimate showed a statistically significant association between the TEVAR group and decreased true lumen expansion (RR = 0.56, CI = 0.36, 0.89, $P = 0.01$).

Respiratory failure analysis

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 1.18, CI = 0.58, 2.40, $P = 0.65$). Significant heterogeneity was found among studies that was not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 94\%$), Fig. 12.

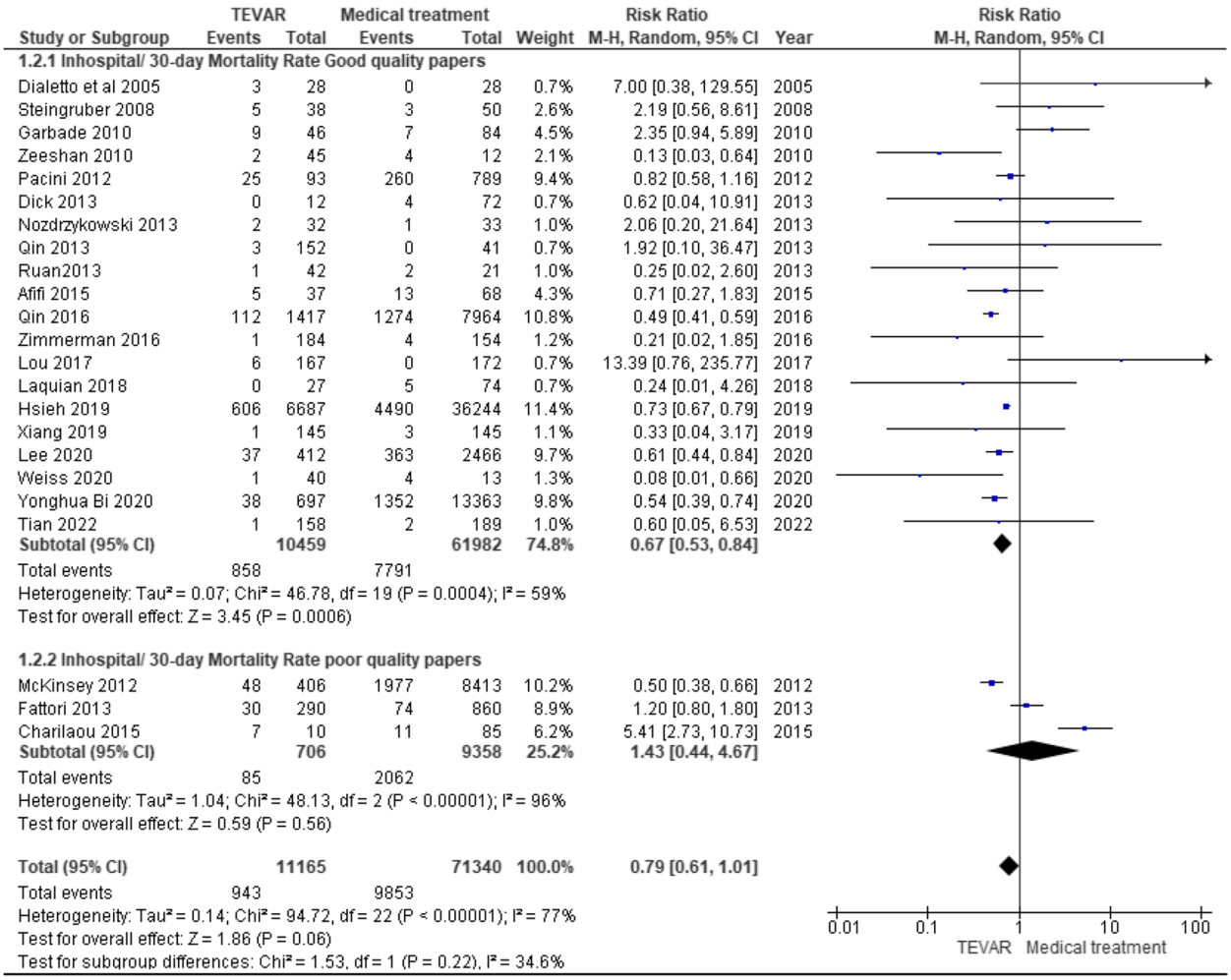

Fig. 5 In hospital / 30-day Mortality subgroup analysis according to quality

Extension or dilatation of dissection / new dissection analysis

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 0.93, CI = 0.38, 2.25, $P = 0.87$). Significant heterogeneity was found among studies that was not resolved by the leave-one-out test ($P < 0.00001$, $I^2 = 95\%$), Fig. 13.

Aortic rupture analysis

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 0.64, CI = 0.39, 1.04, $P = 0.07$). No significant heterogeneity was found between the two studies ($P = 0.16$, $I^2 = 34\%$), Fig. 14.

Sepsis

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 1.22, CI = 0.33, 4.46, $P = 0.76$). Significant heterogeneity among the studies was found ($P < 0.0001$, $I^2 = 91\%$), Fig. 15. Therefore, we performed leave-one-out test by removing the study (Williamson 2022) and the heterogeneity was resolved ($P = 0.69$, $I^2 = 0\%$), and the overall effect estimate showed a statistically significant association between TEVAR and increased incidence of sepsis (RR = 2.48, CI = 1.41, 4.35, $P = 0.002$).

Chest pain

The overall effect estimate showed no statistically significant difference between the TEVAR group and medical treatment group (RR = 0.95, CI = 0.30, 2.97, $P = 0.92$). Significant heterogeneity was found among the studies ($P = 0.04$, $I^2 = 68\%$), Fig. 16. Therefore, we performed leave -one- out test by removing the study (Afifi 2015) and the heterogeneity was resolved ($P = 0.31$, $I^2 = 2\%$), and the overall effect estimate showed no statistically significant difference between the TEVAR group and the medical treatment group (RR = 0.68, CI = 0.42, 1.10, $P = 0.11$).

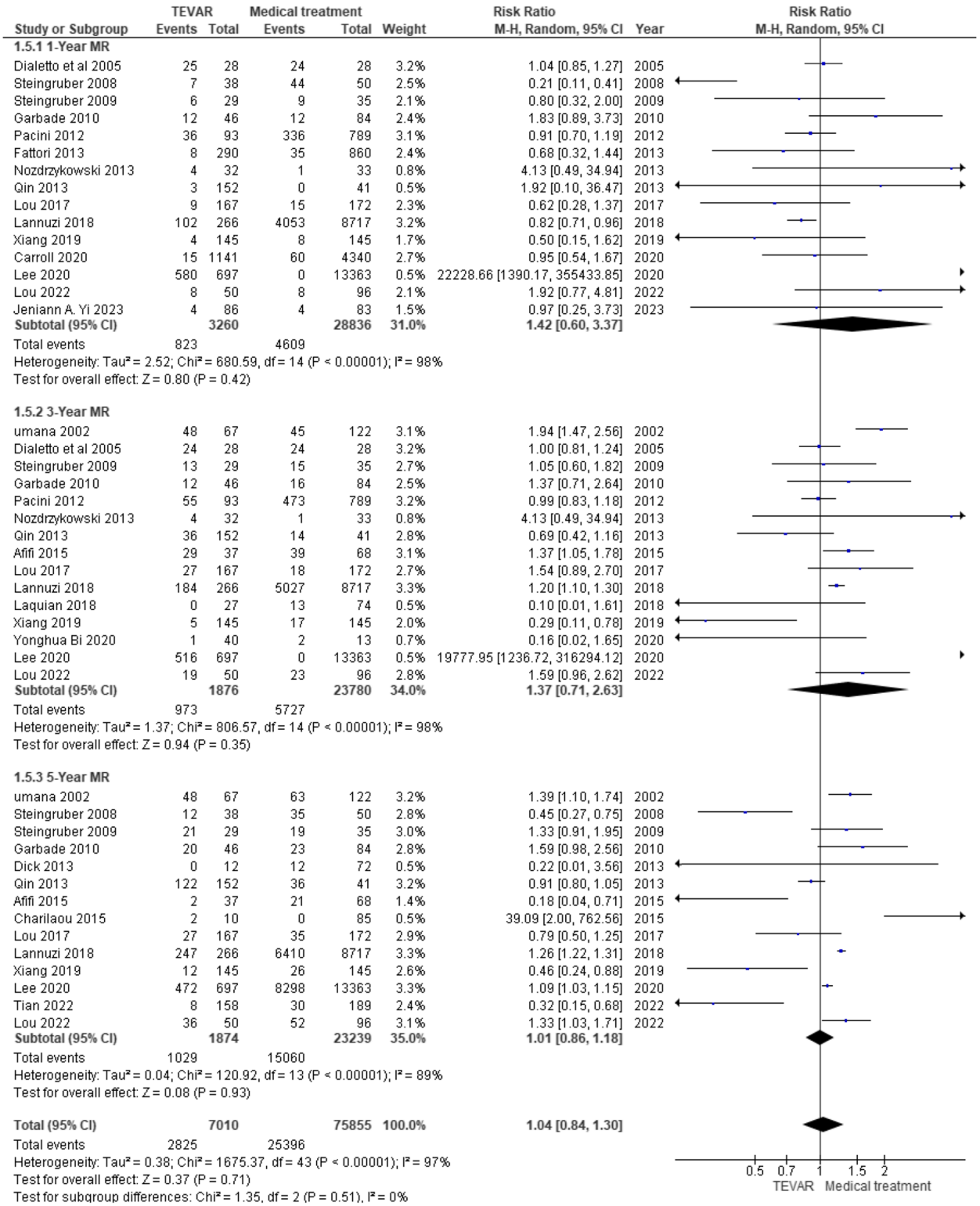

Fig. 6 Late mortality rate analysis

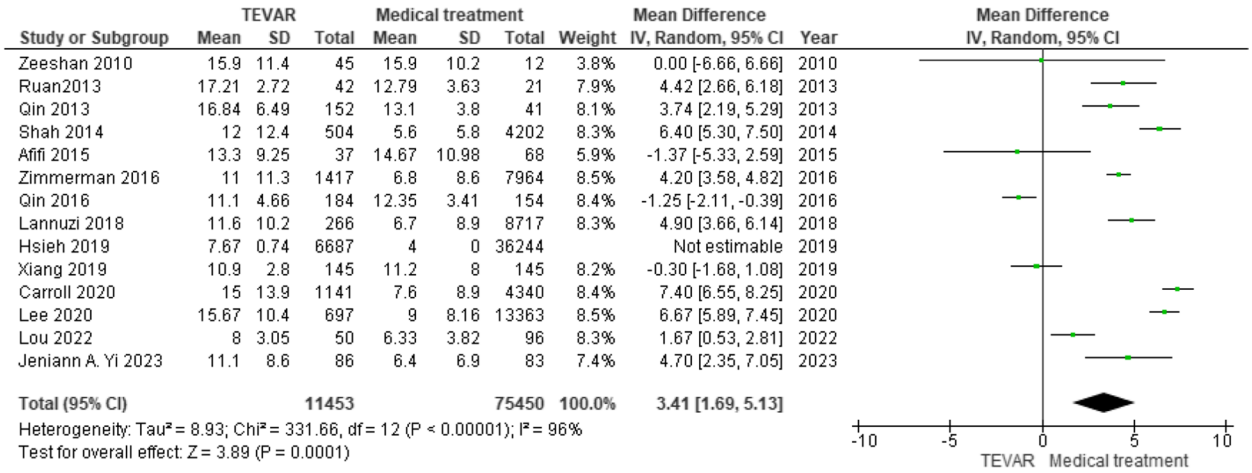

Fig. 7 Length of hospital stay analysis

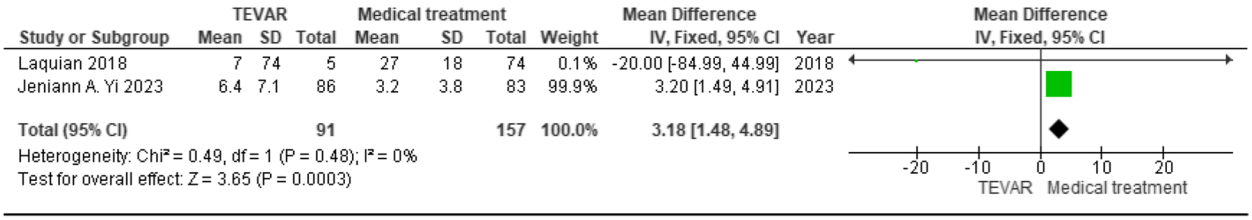

Fig. 8 Length of ICU stay analysis

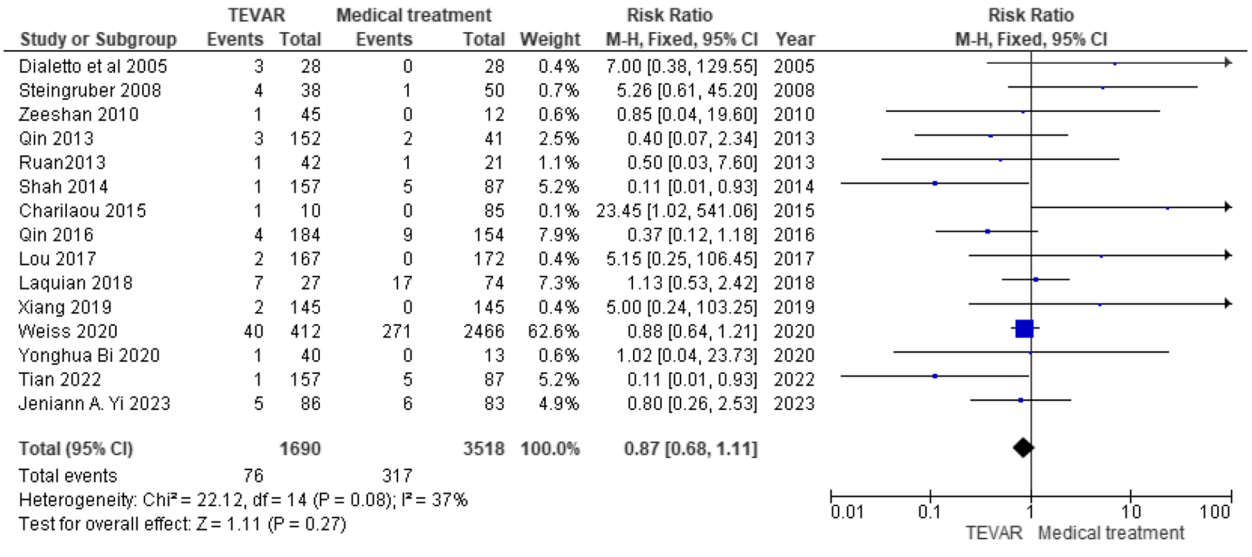

Fig. 9 Retrograde type A dissection analysis

Discussion

Our meta-analysis compared TEVAR and medical treatment in TBAD treatment and revealed a significant association between the TEVAR group and decreased in-hospital or 30-day mortality rate compared with the medical treatment group. Further subgroup analysis of in-hospital or 30-day mortality rates was performed according to age, which was divided into two subgroups:

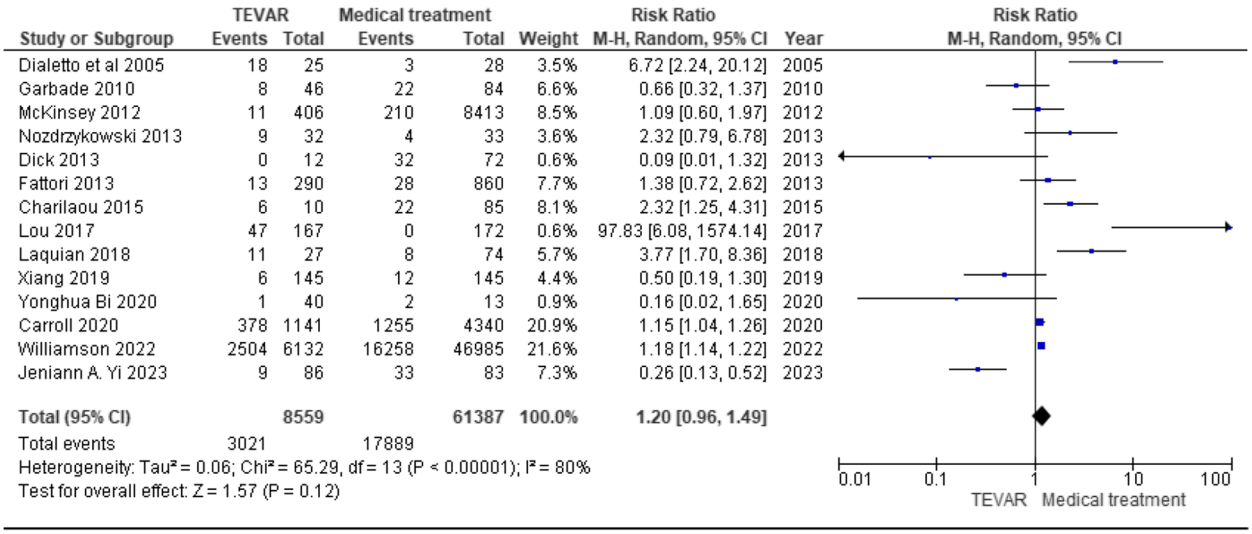

Fig. 10 Reintervension / dissection related admission analysis

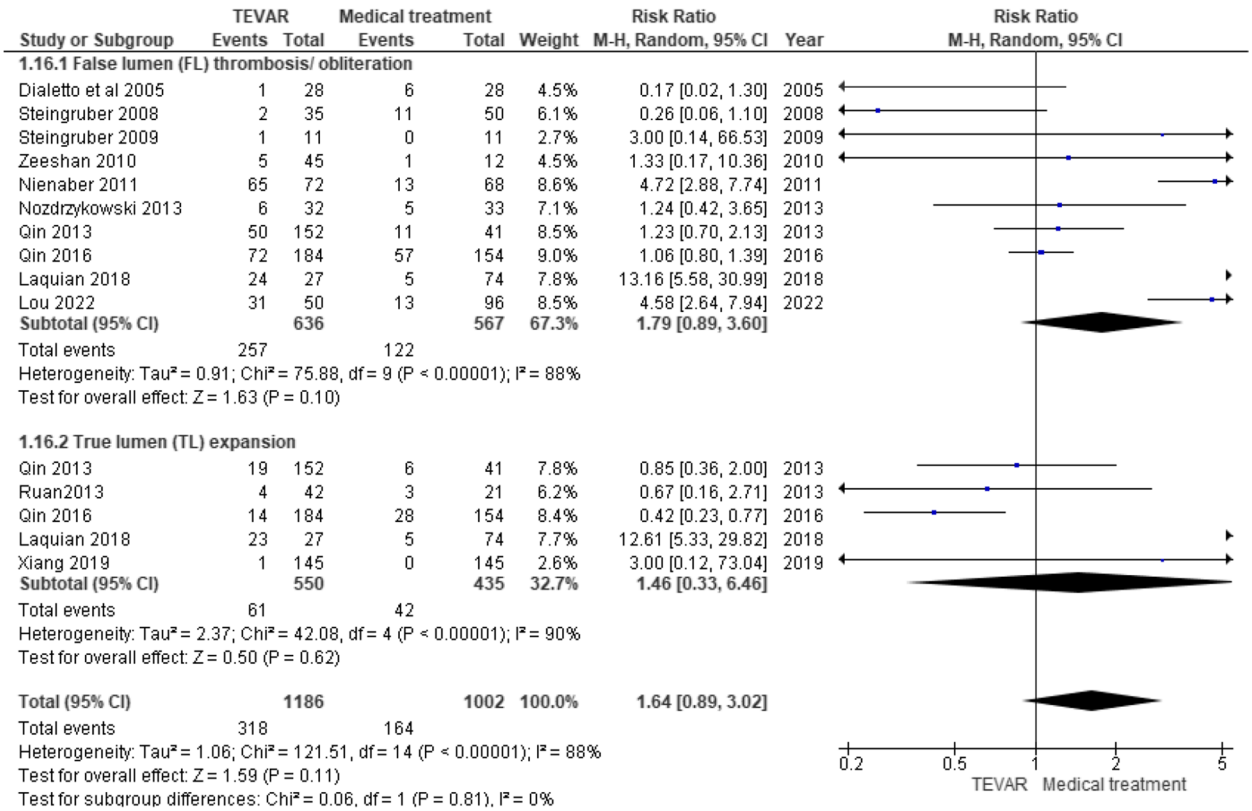

Fig. 11 Aortic remodeling analysis

(more than or equal to 65 years old) and (less than 65 years old). Complications were divided into two subgroups: (complicated) and (uncomplicated). Study quality was divided into two subgroups: (good quality) and (poor quality). In age subgroups, there was a significant association between TEVAR group and decreased in-hospital or 30-day mortality rate in patients more than or equal to 65 years old; however, there was no significant difference between TEVAR and Medical treatment group in patients less than 65 years old. Similarly, in the

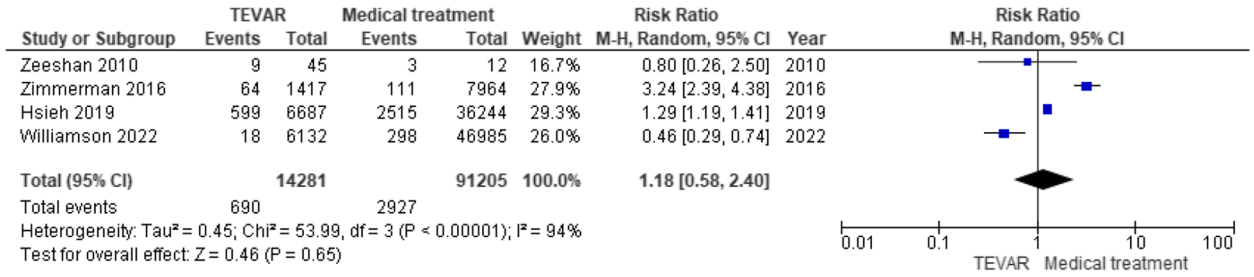

Fig. 12 Respiratory failure analysis

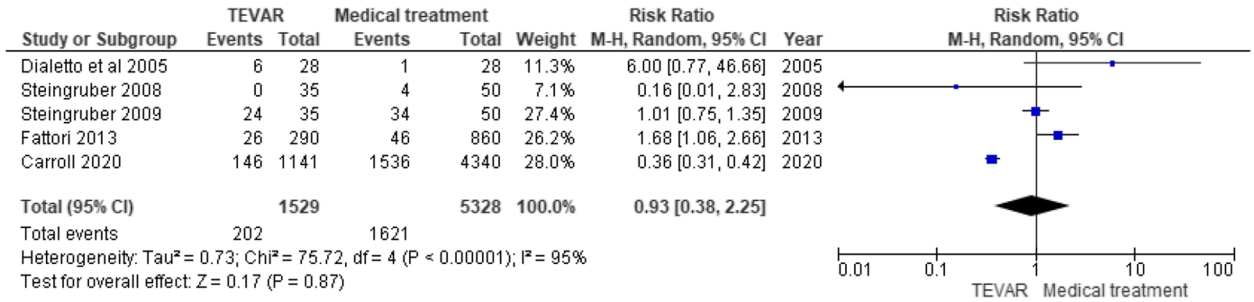

Fig. 13 Extension or dilatation of dissection / new dissection

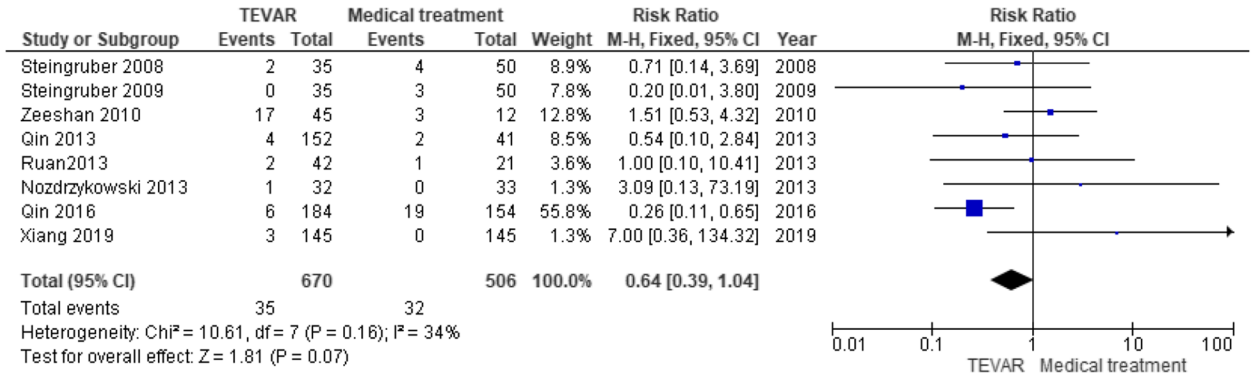

Fig. 14 Aortic rupture

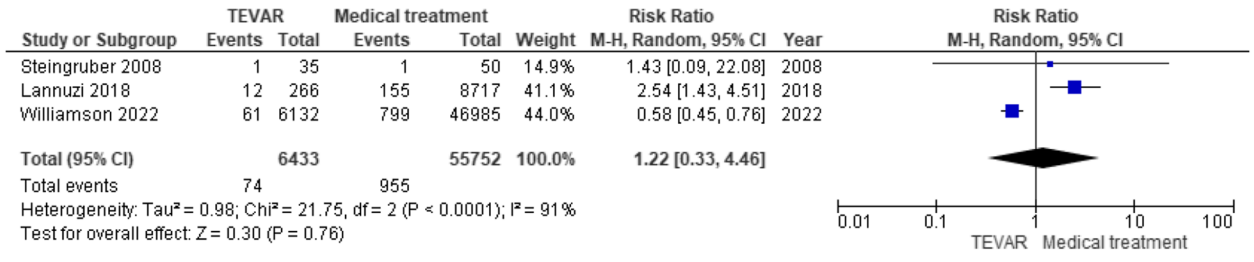

Fig. 15 Sepsis analysis

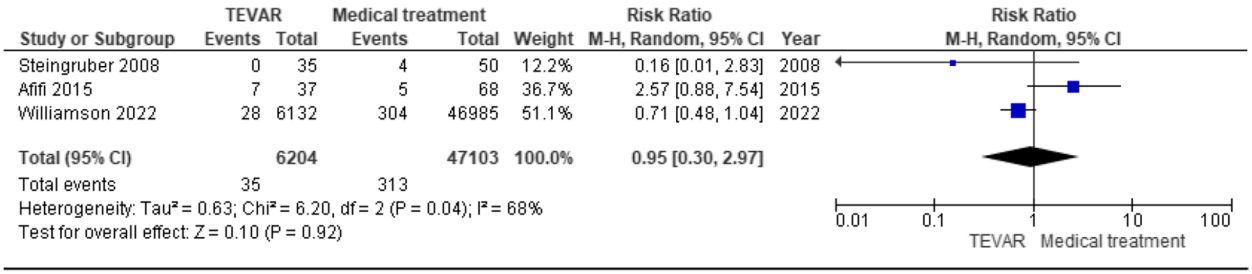

Fig. 16 Chest pain analysis

complication subgroups, there was no significant difference between the TEVAR and Medical treatment groups in patients with complicated TBAD; however, there was a significant association between the TEVAR group and decreased in-hospital or 30-day mortality rate in patients with uncomplicated TBAD compared with the medical treatment group. Similarly, in the study quality subgroups, there was a significant association between the TEVAR group and decreased in-hospital or 30-day mortality rates in good-quality studies; however, there was no significant difference between TEVAR and Medical treatment groups in poor-quality studies. In contrast, we found no significant difference between the TEVAR and Medical treatment groups in the late mortality rate at 1,3, and 5 years. In addition, the TEVAR group was associated with an increased length of hospital stay and ICU stay compared with the medical treatment group. However, no significant difference was observed between the TEVAR and Medical treatment groups in other complications, such as acute renal failure, paralysis or spinal cord ischemia, myocardial infarction, development of Retrograde A dissection, respiratory failure, extension or dilatation of dissection or new dissection, aortic rupture, sepsis, and chest pain. Further analysis of true lumen (TL) expansion was performed, and a significant association between the TEVAR group and decreased true lumen expansion compared with the medical treatment group was found; however, no difference in FL obliteration or thrombosis was found between the TEVAR and medical treatment groups in False lumen (FL) obliteration or thrombosis. We found no difference between the two groups in terms of reintervention or dissection-related admission rates.

Historically, medical treatment rather than surgical techniques have been used to treat TBADs [9, 10]. The benefits of TEVAR include stabilizing the dissected aorta, causing aortic remodeling processes, and encouraging false lumen thrombosis [48]. A thrombosed false lumen is associated with better survival and fewer late adverse TBAD events [49]. The efficacy of TEVAR in dissected aortic remodeling in the acute phase can be explained by the advantageous mechanical characteristics of the dissection flap (pliable and dynamic). Aortic endograft coverage of the primary intimal tear stops antegrade FL flow, which depressurizes the FL. FL thromboses, contracts, and in a considerable portion of patients is eliminated as a result, allowing the true lumen (TL) to enlarge. [14] According to the hypothesis of Lou et al. [14], enhanced FL thrombosis or obliteration will result in a reduced need for distal aortic re-intervention, reduced FL aneurysm formation, and improved long-term survival. Therefore, preemptive TEVAR has additionally been carried out in patients with acute, uncomplicated TBAD in an effort to lower late mortality [15, 49–51]. TEVAR's overall effectiveness of TEVAR in treating patients with acute, uncomplicated TBAD is still under discussion. Medical or conservative treatment is used for individuals with uncomplicated TBAD. However, the long-term outcomes tend to be less than desirable. Additionally, it frequently requires many antihypertensive drugs to achieve blood pressure and heart rate targets in outpatients, and this treatment is ineffective in younger and obese patients [52]. Sustainable medical management is further complicated by lack of access to care, particularly for low-income families. Our meta-analysis found that TEVAR was associated with better results and reduced mortality in uncomplicated TBAD; however, no difference was found between TEVAR and medical treatment in managing complicated TBAD.

Our results are also consistent with those of Qin et al. [15], who reported that TEVAR was linked to a reduction in aortic-related adverse events and a lower mortality compared to BMT for uncomplicated type B aortic dissection. The early mortality rates were 0.5% with TEVAR and 2.6% with BMT. The early adverse event rates in their study were 10.3% in the TEVAR group and 4.5% in the BMT group, but the difference was not statistically significant. Although TEVAR was associated with more frequent early events, it was not a major complication of MM. Aortic rupture (32.2%) and aortic enlargement (47.5%) were the main causes of late adverse events in the MM group. In line with earlier studies [53], in patients with uncomplicated TBAD treated with only medical therapy, aortic enlargement was associated with aortic

rupture and was therefore a significant late adverse event. Fattori et al. [49] reported similar in-hospital mortality rates for TEVAR and MM in patients with complicated TBAD. Additionally, a similar one-year mortality was observed in both groups. According to the 5-year Kaplan–Meier estimates, aortic growth or new aneurysm was the most frequent adverse event during follow-up, occurring in 73.3% of patients receiving medicinal therapy and in 62.7% of patients receiving TEVAR. However, Kaplan–Meier survival estimates reported that patients who underwent TEVAR had a decreased death rate at 5 years.

Zeeshan et al. [13] found an association between TEVAR and lower in-hospital or 30-day mortality than MM in managing complicated TBAD. The TEVAR group demonstrated markedly improved survival at 1, 3, and 5 years. Patients who underwent TEVAR had a 79% 5-year survival rate. This is in line with recent research published by Khoynezhad et al. [54], which showed a 78% 5-year survival rate and is consistent with a larger series that accessed the International Registry of Acute Aortic Dissection (IRAD) database [55, 56].

The potential benefit of TEVAR in aortic remodeling accounts for the lower mortality and higher survival rates. In the majority of patients who underwent TEVAR, the false lumen in the thoracic aorta at the endograft level was completely thrombosed and obliterated. In spite of complete remodeling in the proximal thoracic aorta, the majority of patients continue to have a patent false lumen in the distal thoracic and abdominal aortas. Interestingly, the Investigation of STEnt grafts in Aortic Dissection (INSTEAD) trial also showed positive aortic remodeling with TEVAR, similar to Zeeshan findings, despite being a study assessing the efficacy of TEVAR in uncomplicated type B aortic dissection [57]. However, in most cases, medical treatment alone did not cause any false lumen shrinkage or thrombus formation. When compared to individuals treated with conventional treatment, larger trials using IRAD have shown that patients treated with TEVAR have a lower 5-year mortality rate [49]. According to Lee et al. [11], the TEVAR and MM groups had in-hospital mortality rates of 5.45% and 10.12%, respectively, and 30-day mortality rates of 8.18% and 12.51%, respectively. The TEVAR group had a 1-year survival rate of 83.2%. The acute phase for patients with type TBAD undergoing surgical treatment has a significant risk of morbidity and mortality due to catastrophic situations such as aortic rupture or impending rupture. Older age was the most significant predictor of in-hospital mortality across all treatment groups, including the entire population. Naturally, age can affect a patient's general health or underlying disorders, which can affect treatment. Other risk factors associated with in-hospital mortality include female sex, hypertension, and chronic kidney disease. According to Lou et al. [17], there was no significant difference in mortality rates between the TEVAR and MM groups, with both groups showing a 0% in-hospital mortality rate. The mean age of the MM group (58.6 years) was slightly higher than that of the TEVAR group (54.4 years); however, this difference was not significant ($p=0.055$). The MM group also had a significantly higher proportion of males compared to the TEVAR group ($p=0.005$). However, there were no statistically significant differences between the groups in terms of comorbidities, such as hypertension, diabetes, end-stage renal disease, history of stroke, and chronic obstructive pulmonary disease. The TEVAR group did, however, show a trend towards improved survival at 1 and 3 years, but there was no difference in overall survival [14] TEVAR group had a 91% five-year survival, but with MM, it was 82% [14]. Additionally, Complete false lumen (FL) thrombosis was observed in 72.1% of patients with TEVAR and 20.0% with MM, which provided superior aortic remodeling to MM in TBAD, resulting in increased long-term survival [17]. Likewise, Xiang et al. [58] reported that 30-day mortality, stroke, acute renal failure, and retrograde type A dissection rates between the TEVAR and BMT groups were not significantly different, but the early adverse event rates were significantly higher in the TEVAR group than in the BMT group. Although TEVAR was associated with higher complications in the early stage, patients in the TEVAR group had lower late aortic and lower risk of late death than those with MM in uncomplicated acute TBAD.

Future implications

Our study revealed a significant association between the TEVAR group and decreased mortality rate compared to the medical treatment group, mainly in patients aged 65 years and older and patients with uncomplicated TBAD. Randomized controlled trials are warranted to confirm our results and further assess the efficacy of TEVAR for complicated and non-complicated TBAD.

Strengths and limitations

The overall quality of most of the studies included in our analysis was good. The large sample size is an additional strength, as 150,836 patients were included in our study. Additionally, a high number of studies [32] were included in our analysis. Patients categorized under MM in the original primary studies were included because they lacked procedure codes indicating treatment with TEVAR. This suggests a potential bias owing to the likelihood that these patients may have died before receiving any form of treatment. The main limitation was that all of the included studies were observational rather than

randomized controlled trials. Therefore, randomized controlled trials are needed to confirm our results and further evaluate the role of TEVAR in TBAD.

Conclusion

Our study revealed a significant association between the TEVAR group and decreased mortality rate compared with the medical treatment group, mainly in patients aged 65 years and older and patients with uncomplicated TBAD. Randomized controlled trials are warranted to confirm our results and further assess the efficacy of TEVAR in complicated and non-complicated TBAD in terms of the incidence of mortality.

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Declarations

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Competing of interests
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