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# 1 Rescue Stenting versus Medical Care Alone in Refractory Large 2 Vessel Occlusions: a Systematic Review and Meta-Analysis

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28  
29 **Keywords:** Stroke, Thrombectomy, Endovascular Recanalization, Reperfusion

30 **ABSTRACT**

31

32 **Purpose:**

33 Mechanical thrombectomy (MT) failure is associated with very poor prognosis. Permanent intracranial stenting  
34 (PIS) may be useful in such refractory occlusions. However, this strategy requires an aggressive antithrombotic  
35 regimen that may be harmful in extended strokes. The aim of this study was to compare clinical outcomes  
36 between patients with refractory acute large vessel occlusions (LVO) treated by PIS versus patients for whom  
37 the procedure was stopped without recanalization.

38 **Methods:**

39 We conducted a systematic review by searching for articles in PubMed, the Cochrane Library and  
40 ClinicalTrials.gov from January 2015 to September 2019. Two reviewers independently selected studies  
41 comparing PIS after failed MT in addition to usual care versus usual care only. A comparative meta-analysis was  
42 performed using random-effects models to estimate odds ratios of favorable clinical outcome at 90 days, defined  
43 as a modified Rankin Scale 0-2, mortality and symptomatic intracranial haemorrhage (SICH).

44 **Results:**

45 Four comparative studies were included for a total of 352 patients: 149 in the PIS group versus 203 in the control  
46 group. PIS was associated with significantly higher rates of 90-day favorable clinical outcome (Odds Ratio  
47 [OR] : 2.87 [95% confidence interval (95% CI) : 1.77-4.66] ;  $p < 0.001$ ;  $I^2$ : 0%) and lower mortality (OR : 0.39  
48 [0.16-0.93] ;  $p = 0.03$ ;  $I^2$ : 43%), whereas SICH rates did not significantly differ (OR 0.68 [0.37-1.27] ;  $p = 0.23$ ;  $I^2$ :  
49 0%).

50 **Conclusion:**

51 From observational study results, attempting PIS after failed MT seems to improve clinical outcomes without  
52 increasing the risk of intracranial bleeding. Randomized trials are needed to confirm these results.

53

54 **INTRODUCTION**

55 Mechanical thrombectomy (MT) for acute ischemic stroke due to large-vessel occlusion (AIS-LVO) is now well  
56 established as one of the most efficient treatments in interventional medicine [1, 2]. Indications have greatly  
57 expanded in recent years [3, 4], allowing for more patients to benefit from this treatment. However, despite  
58 optimized triage and management, a substantial number of patients remains with occlusion or experiences early  
59 reocclusion. In randomized trials[1, 5], the rate of MT technical failure, defined as modified thrombolysis in  
60 cerebral infarction[6] (mTICI) score IIa or worse, ranges from 10% to 30%, with disastrous consequences in  
61 terms of clinical outcomes for these patients[7]. Reasons for MT failure include impossibility to access the target  
62 occlusion or, in most cases, failure of clot extraction despite multiple stent retriever or aspiration passes[8–10].

63 Intracranial atherosclerotic disease-related occlusions account for about 25%[11] to 47%[12] of all intracranial  
64 LVOs and seem to be particularly involved in MT failure[13]. Current thrombectomy devices may be excellent  
65 for embolectomy but less suitable for removing in situ plaque thromboses. They could even be harmful by  
66 causing more plaque activation, which may result in early reocclusion[14]. In interventional cardiology, in which  
67 this atherosclerotic mechanism is dominant, direct thromboaspiration has been found inefficient in such  
68 cases[15]. Thus, intracranial atherosclerotic acute occlusions could be managed like acute coronary occlusions,  
69 with early stenting and antithrombotic management. However, there is a potential risk of intracranial bleeding  
70 related to an aggressive antithrombotic regimen[16], which may counterbalance the benefit of vessel patency.

71 Before the technological breakthrough of stent retrievers in MT, permanent intracranial stenting (PIS) was  
72 regularly used as a first-line technique for AIS-LVO, with an acceptable level of safety[17]. Recently, PIS has  
73 been increasingly used as a rescue technique for failed recanalization and opened a new path to improve  
74 reperfusion rates and clinical outcomes.[18–24] Recent meta-analysis of proportions suggested that PIS could be  
75 a safe and effective rescue technique after failed MT[17, 25], however the level of evidence provided by meta-  
76 analysis of proportions is low, as they only focus on the experimental group and thus, do not allow direct  
77 comparison to a control group. Yet, whether PIS is superior to medical management alone, in refractory LVO  
78 remains unknown. Moreover, a large multicenter propensity-score matched cohort study, which was not  
79 integrated in previous meta-analyses, has been recently published[26]. Incorporating this study should strengthen  
80 the results that may have game-changing implications for this subset of patients.

81 The aim of this work was to systematically review the literature evaluating the effect of PIS in improving the  
82 clinical outcome for patients with refractory LVO in comparison to patients for whom no PIS was attempted and  
83 who remained without recanalization.

84

## 85 MATERIAL AND METHODS

86 This systematic review and meta-analysis was reported according to the Preferred Reporting Items for  
87 Systematic Reviews and Meta-Analyses (PRISMA) guidelines[27]. The protocol was registered at PROSPERO  
88 (CRD42019133434).

### 89 Search strategy

90 We conducted an electronic search of MEDLINE via PubMed and the Cochrane Library with the search  
91 algorithm reported in **Electronic Supplementary Material**. The search was initially conducted in April 2019,  
92 then updated in September 2019. The search was restricted from January 2015, when endovascular treatment for  
93 AIS was generally accepted and routinely performed. We also manually searched the table of contents of the 10  
94 most implicated journals in endovascular stroke medicine (*Stroke*, *JAMA Neurology*, *Journal of*  
95 *Neurointerventional Surgery*, *Journal of Neurosurgery*, *Clinical Neuroradiology*, *Journal of Neuroradiology*,  
96 *Interventional Neuroradiology*, *International Journal of Stroke*, *Journal of Stroke Cerebrovascular Diseases*  
97 *and European Journal of Neurology*) for any additional reference. A search in ClinicalTrials.gov was also  
98 performed and the reference lists of eligible full-text manuscripts were checked for additional references.

### 99 Eligibility criteria and selection process

100 The following inclusion criteria were defined before reviewing: 1) studies comparing patients who underwent  
101 PIS in the 48 hr after an ischemic stroke with LVO and after at least one MT attempt to patients receiving only  
102 usual care for refractory occlusions; 2) peer-reviewed publication as stated by the journal; 3) minimum of 5  
103 patients included; and 4) available modified Rankin Scale (mRS) score at 90 days. Exclusion criteria were 1)  
104 lack of a control group, 2) tandem (extracranial + intracranial) occlusions, 3) non-English language, 4) non-  
105 human study, and 5) inclusion period before the standard use of stent retrievers in MT. When several articles  
106 originated from the same center and included overlapping populations, only the most relevant article with the  
107 largest population was retained. Two reviewers independently evaluated eligibility criteria for all references  
108 retrieved by the search. Any disagreements were discussed to achieve consensus.

### 109 Data extraction

110 Two investigators independently extracted data for each included study from full texts, figures, tables and  
111 supplemental materials if available. Any disagreements were discussed to achieve consensus. The following data  
112 were extracted:

- 113 • Publication characteristics: year of publication and journal.
- 114 • Study design: randomized trial, prospective or retrospective cohort, case-control study and sample size.
- 115 • Patient baseline characteristics: sex, age, past medical history, National Institute of Health Stroke Scale  
116 (NIHSS) score at admission, initial Alberta Stroke Program Early Computed Tomography (ASPECT)  
117 score and use of intravenous tissue plasminogen activator (IV-tPA).

- 118 • Procedural parameters: number of MT attempts (with a stent retriever or direct thromboaspiration),  
119 antithrombotic management and other rescue interventions besides stenting.
- 120 • Outcomes of interest: favorable clinical outcome defined as a mRS score 0 to 2 at 90 days, defined as  
121 the primary outcome; successful reperfusion; mortality; and SICH as defined in the European  
122 Cooperative Acute Stroke Study[28]. For each outcome of interest, we collected the corresponding  
123 number of events in each group and the number of patients analyzed in each group.

#### 124 **Risk of bias assessment**

125 Risk of bias was evaluated by both reviewers by using the Newcastle–Ottawa Quality Assessment Form for  
126 Cohort and Case-control Studies[29]. Any disagreements were discussed to achieve consensus.

#### 127 **Statistical analysis**

128 All continuous data are described with means (SD) or medians (quartile 1 [Q1]–Q3 or range) and qualitative data  
129 with frequencies (%). Associations between PIS and outcomes are expressed as odds ratios (ORs) and 95%  
130 confidence intervals (CIs). We first evaluated characteristics of included studies to assess whether they were  
131 sufficiently close to allow meta-analyses We conducted random-effects meta-analyses considering the presumed  
132 heterogeneity of the included studies. However, a sensitivity analysis with fixed-effect models was performed.  
133 For each meta-analysis, heterogeneity was evaluated with the Cochran Q and I<sup>2</sup> statistics and the between-study  
134 variance  $\tau^2$ . We planned to perform evaluation of small study effects including publication bias using funnel  
135 plots and Egger tests but this was not possible because of the low number of identified studies. For all analyses,  
136  $p < 0.05$  was considered statistically significant. Meta-analyses were performed with Review Manager (RevMan)  
137 v5.3 (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). For zero events, Revman  
138 automatically applies a correction for trials with 0 in one arm only. The correction consists in adding 0.5 to each  
139 of the cells of the 2x2 table to calculate odds ratios.

## 140 RESULTS

### 141 Selection process

142 In total, 1168 records were identified by the search and were screened for eligibility. After initial screening, 25  
143 were considered for full-text review (**Figure 1**) and finally, 4 comparative studies (352 patients) were included.

### 144 Study characteristics

145 **Table 1** summarizes the characteristics of each included study. Briefly, the Baracchini et al.[19] study was a  
146 prospective single-center cohort study performed from 2014 to 2016 that included 109 patients who underwent  
147 stent retriever thrombectomy and were divided into 4 groups: 1) successful reperfusion, 2) successful reperfusion  
148 after rescue intra-arterial tirofiban infusion only, 3) PIS after failed MT, and 4) no successful reperfusion. Only  
149 data from groups 3 and 4 were considered for this meta-analysis. The Chang et al.[20] study was a large  
150 multicenter prospective cohort study including 148 patients with MT failure who received rescue stenting or no  
151 rescue stenting. The Cornelissen et al.[21] study was a retrospective single-center cohort study that compared  
152 outcomes in 26 patients included after failed clot extraction attempts with the Embotrap device, who received  
153 PIS or remained with persistent LVO. Finally, the Peng et al.[26] study was a multicenter retrospective cohort  
154 study that initially included 90 consecutive patients in the rescue stenting group and 117 patients in the control  
155 group. However, considering that both groups were not exactly comparable, and especially for crucial  
156 parameters such as baseline NIHSS and ASPECT scores, authors performed a propensity score matching in  
157 order to obtain the best balance possible. After propensity score matching, 66 patients were included in each  
158 group; and we used the data from this matched population in this meta-analysis.

159 The methodological quality of included studies was judged “fair” and “good” according to the Newcastle–  
160 Ottawa Quality Assessment Form.

### 161 Baseline characteristics

162 Of the 352 patients included in analysis, 149 underwent PIS after failed MT attempts (PIS group) and 203 did  
163 not undergo rescue stenting (control group). All recorded baseline characteristics, including major confounding  
164 factors such as NIHSS score at admission, use of IV-tPA or site of occlusion, were similar between the two  
165 groups (**Table 1**). Only one study included patients with posterior circulation occlusions. The 4 studies used a  
166 wide variety of antithrombotic protocols and different types of interventions before and after stenting, that were  
167 summarized in **Table 2**. Of note, only the studies of Chang et al.[20] and Peng et al.[26] gave detailed  
168 informations regarding additional interventions during the procedures for the PIS and the control groups  
169 altogether.

### 170 Outcomes

171 Favorable clinical outcome at 90 days was significantly more frequent in the PIS than control group (OR, 2.87;  
172 95% CI, 1.77-4.66), with low heterogeneity across studies ( $p_{\text{het}}=0.41$ ,  $I^2 = 0\%$ ,  $\tau^2 = 0.00$ ) (**Figure 2**). Mortality  
173 was significantly lower in the PIS group (OR, 0.39; 95% CI, 0.16-0.93;  $I^2 = 43\%$ ) but SICH rates did not

174 significantly differ between the groups (OR, 0.68; 95% CI, 0.37-1.27;  $I^2 = 0\%$ ). Sensitivity analyses with fixed-  
175 effects models gave consistent results, except for mortality. Successful mTICI $\geq$ IIb reperfusion rates after rescue  
176 stenting ranged from 64.6% to 91.7%.

177

#### 178 **Delays**

179 Times from symptoms' onset to arterial puncture were similar between both groups across studies and ranged  
180 from an average of 196.1 (+/- 48.1) to 289 minutes (+/- 90.9). Two studies specifically evaluated the delays from  
181 arterial puncture to successful recanalization after stenting and found an average of 113 (+/- 53) minutes in the  
182 Chang et al.[20] study and 83.3 (+/- 50.1) minutes in the study of Cornelissen et al.[21]

183



## 184 DISCUSSION

185 The interest over PIS as a rescue technique after failed MT is rapidly growing[17, 19–21, 25], owing to the  
186 positive clinical findings in everyday practice. Even though, no randomized controlled trials have been  
187 conducted so far, several comparative observational studies have been published. Of note, a recent and the  
188 largest one to date, is a multicenter Chinese cohort study[26] that performed a propensity-score matching, which  
189 is the most robust pairing method for observational studies, that limits indication bias to its minimum and  
190 provides top-level comparability. The results of this study were in line with previous comparative studies and  
191 were incorporated in this meta-analysis. Our current meta-analysis includes studies comparing clinical outcomes  
192 of rescue PIS to no additional endovascular interventions. PIS was associated with improved clinical outcome at  
193 90 days and lower mortality as compared with no recanalization. Although PIS requires an aggressive  
194 antiplatelet regimen (**Table 2.**) to ensure stent patency, it did not seem to result in increased rates of SICH.

195 Refractory LVO remains a major concern in the era of MT because it is associated with an unfavorable  
196 prognosis as confirmed by data from the control groups in our included studies. After an average of 3.5  
197 intracranial MT passes, successful reperfusion could never be achieved, and persistent occlusion was confirmed  
198 at the end of procedures in all studies (0% of mTICI $\geq$  IIB in the control groups). Rates of functional  
199 independence at 90 days ranged from 17.4% to 22% and mortality rates from 19% to 43.9%. These rates are  
200 consistent with data from patients included in the control arms of the 5 first randomized trials evaluating MT[1].  
201 In comparison, attempting PIS permitted successful reperfusion of most refractory LVOs, resulting in an  
202 increased rate of favorable clinical outcome, more in line with those expected in the general setting of MT. The  
203 more MT is attempted, the less probability of achieving reperfusion, which leads to deteriorated clinical  
204 outcomes. Some observational studies have even suggested that beyond 5 attempts, the probability of achieving  
205 reperfusion decreases drastically and that, even when achieved, does not result in improved outcomes when  
206 compared to patients without recanalization. [30] This finding suggests that if PIS is considered, it should be  
207 promptly initiated to avoid futile recanalization that could be detrimental to patients under dual antiplatelet  
208 therapy.

209 As expected, SICH rates in these studies were high, about three-fold higher than in the HERMES pooled  
210 population[1]. Indeed, MT failure is a well-known risk factor for SICH[31] and in many PIS cases,  
211 antglycoprotein IIb/IIa agents were used before stenting, which also have known risks for haemorrhagic  
212 transformations, especially in extended stroke. Even though the level of evidence is low, we did not observe an  
213 additional risk in patients receiving PIS as compared with the control group. However, this observation should  
214 be carefully interpreted since additional IA antithrombotics were also used in the control groups which may have  
215 overestimated the rates of SICHs. Moreover, the included studies mostly used CT-based protocols when AIS was  
216 suspected, which may not be the best way to evaluate the extent of infarctions, especially at the hyperacute  
217 phase. The two largest studies provided an estimation of the infarction volume using the ASPECT score; and  
218 these ASPECTs were rather high in patients included. This suggests that patients from these studies were  
219 selected for rescue stenting with special attention to this parameter; and that if PIS was to be performed in lower  
220 ASPECT groups, SICHs would probably be more frequent. As such, the initial volume of infarction should be  
221 viewed as a critical factor to consider before placing a patient under strong antiplatelet therapy in the setting of

222 PIS. Furthermore, the featured studies included AIS within 6 hours from symptoms' onset to puncture; therefore  
223 these results may only be applicable to this subset of patients and not to late-onset strokes. Studies that disclosed  
224 the times from puncture to reperfusion when PIS was performed showed that these procedures were rather long,  
225 which is a natural consequence of the refractory nature of these occlusions. Longer procedures did not result in  
226 worse outcomes or increased SICHs in the PIS group; however one must consider that beyond 6 hours from  
227 symptoms onset, PIS has not yet been sufficiently studied, and could arguably be harmful by promoting SICHs  
228 in late infarcts.

229 Within each study, baseline characteristics of patients did not differ between those with PIS and those without  
230 recanalization. These populations also seemed quite comparable to the population included in the 5 main  
231 randomized trials of MT[1]. Although the reports lacked information regarding the AIS etiology, a fair  
232 proportion probably resulted from intracranial atherosclerotic disease, especially considering the over-  
233 representation of the Asian patient population in this meta-analysis[20, 26].

234 This study has several limitations. First, the small sample size of included studies and the observational design  
235 intrinsically limit the level of evidence. Although the groups were comparable, we cannot exclude confounding  
236 or indication bias because the decision to undergo PIS was solely at the operator's discretion and was not  
237 protocol-based. No information was available regarding the parameters used for patient selection and specifically  
238 infarct size and how this was integrated in decision-making for intracranial stenting. Another limitation is related  
239 to the high heterogeneity in antithrombotic management across studies and other interventions besides PIS such  
240 as balloon angioplasty.

241 Nevertheless, this comparative meta-analysis of observational studies provides additional evidence to answer the  
242 question of whether the benefit of vessel patency through rescue stenting outweighs the risk of intracranial  
243 haemorrhage in refractory LVOs.

244

245 **CONCLUSION**

246 Although the prevalence of refractory LVO is decreasing in the modern era of MT with improved techniques, the  
247 prognosis remains unfavorable. PIS may be an efficient rescue technique, allowing for important improvements  
248 in clinical outcome in this subgroup of patients. Although PIS requires strong antithrombotic therapy, no  
249 differences in SICHs were found between groups. However, given the level of evidence, decisions to undergo  
250 the procedure should be carefully evaluated and on a patient-level basis, with special attention to the extent of  
251 infarction before stenting as well as the delay from symptoms' onset. This work warrants randomized studies to  
252 confirm these assumptions and identify the patients who could benefit most from these findings.

253

254 **COMPLIANCE WITH ETHICAL STANDARDS**

255

256 **Funding:** None

257

258 **Conflict of Interest:** The author declares conflicts of interests.

259 Dr. Sourour reports a conflict of interest with Medtronic, Balt Extrusion, Microvention (consultant), Stock/Stock

260 Options: Medina. Prof. Clarençon reports a conflict of interest with Medtronic, Guerbet, Balt Extrusion

261 (payment for readings), Codman Neurovascular (core lab). The other authors report no conflicts of interest.

262

263 **Ethical approval:** For this type of study formal consent is not required.

264

265 **Informed consent:** Not required

266

267

268

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363 **TABLE AND FIGURE LEGENDS**

364 **Figure 1.** Flowchart of the selection of articles.

365 MT: mechanical thrombectomy; mRS: modified Rankin Scale

366

367 **Figure 2.** Forest plots for favorable clinical outcome (modified Rankin Scale score 0–2) at 90 days, mortality  
368 and symptomatic intracranial haemorrhage (SICH)

369 Barrachini 2017[19] ; Chang 2018[20] ; Cornelissen[21] ; Peng[26] ; 95% CI : 95% Confidence Interval ; M-H :  
370 Mantel-Haenszel

371

372 **Table 1.** Summary of the included study characteristics and main baseline characteristics of included patients  
373 with permanent intracranial stenting (PIS group) or usual care (control group)

374 SD: standard deviation ; NIHSS: National Institute of Health Stroke Scale ; ICA: internal carotid artery ; IQR:  
375 interquartile range ; MCA: middle cerebral artery ; M1: first segment of the MCA ; M2: second segment of the  
376 MCA ; IV-tPA: intravenous tissue plasminogen activator ; ASPECT: Alberta Stroke Program Early Computed  
377 Tomography Score ; mL: milliliter.

378

379 **Table 2.** Summary of additional interventions and antithrombotic protocols used in included studies.

380 IA: intra-arterial; IV: intravenous; †: Timing of additional interventions (before or after stenting) not disclosed;  
381 rtPA: recombinant tissue plasminogen activator, \*No information regarding these additional interventions were  
382 available for the control group

383



384 **Table 1.** Summary of the included study characteristics and main baseline characteristics of included patients with permanent intracranial  
 385 stenting (PIS group) or usual care (control group)

Study	Country	Period of inclusion	Study design	Number of patients in each group	Main baseline characteristics of patients in the PIS and control groups
Baracchini et al. 2017	Italy	2014-2016	Prospective single-center cohort study	PIS group: 23 Control group: 23	Mean age, years (SD): 70 (16.9) vs 74 (8.3) Median NIHSS score (range): 16 (4-26) vs 18 (5-20) Occlusion site: intracranial ICA and/or MCA in all cases IV-tPA, No. (%): 4/23 (17.4%) vs 10/23 (43.5%)
Chang et al. 2018	South Korea	2010-2015	Prospective multicenter cohort study	PIS group: 48 Control group: 100	Mean age, years (SD): 63.7 (16.8) vs 68.0 (12.1) Median NIHSS score (IQR): 14 (8) vs 15 (6) Median ASPECT score (+/-IQR): 8 (1.75) vs 8 (2) Occlusion site: intracranial ICA and/or MCA in all cases IV-tPA, No. (%): 22/48 (45.8%) vs 46/100 (46.0%)
Cornelissen et al. 2018	Sweden	2013-2017	Retrospective single-center cohort study	PIS group: 12 Control group: 14	Mean age, years (SD): 65.2 (13.9) vs 67.3 (9.5) Median NIHSS score (range): 16.5 (5–22) vs 16.5 (8–22) Infarct volume, mL (SD): 14.9 (22.3) vs 30.1 (36)

					<p>Occlusion site: No. (%):</p> <ul style="list-style-type: none"> <li>• PIS group: basilar: 2/12 (16.7%), vertebral: 1/12 (8.3%), ICA: 1/12 (8.3%), M1: 8/12 (66%)</li> <li>• Control group: basilar: 4/14 (28.6%), M1: 9/14 (64.3%), M2: 1/14 (7.1%)</li> </ul> <p>IV-tPA, No. (%): 3/12 (25%) vs 6/14 (42.9%)</p>
Peng et al. 2019	China	2015-2018	Retrospective multicenter case-control study	PIS group: 66 Control group: 66	<p>Median age, (IQR): 66 (55-76) vs 67 (56-75)</p> <p>Median NIHSS score (IQR): 16 (12-21) vs 18 (13-21)</p> <p>Median ASPECT score (IQR): 9 (8-10) vs 9 (8-10)</p> <p>Occlusion site: intracranial ICA and/or MCA in all cases</p> <p>IV-tPA, No. (%): 20/66 (30.3%) vs 22/66 (33.3%)</p>

386 SD: standard deviation ; NIHSS: National Institute of Health Stroke Scale ; ICA: internal carotid artery ; IQR: interquartile range ; MCA: middle  
387 cerebral artery ; M1: first segment of the MCA ; M2: second segment of the MCA ; IV-tPA: intravenous tissue plasminogen activator ; ASPECT:  
388 Alberta Stroke Program Early Computed Tomography Score ; mL: milliliter.

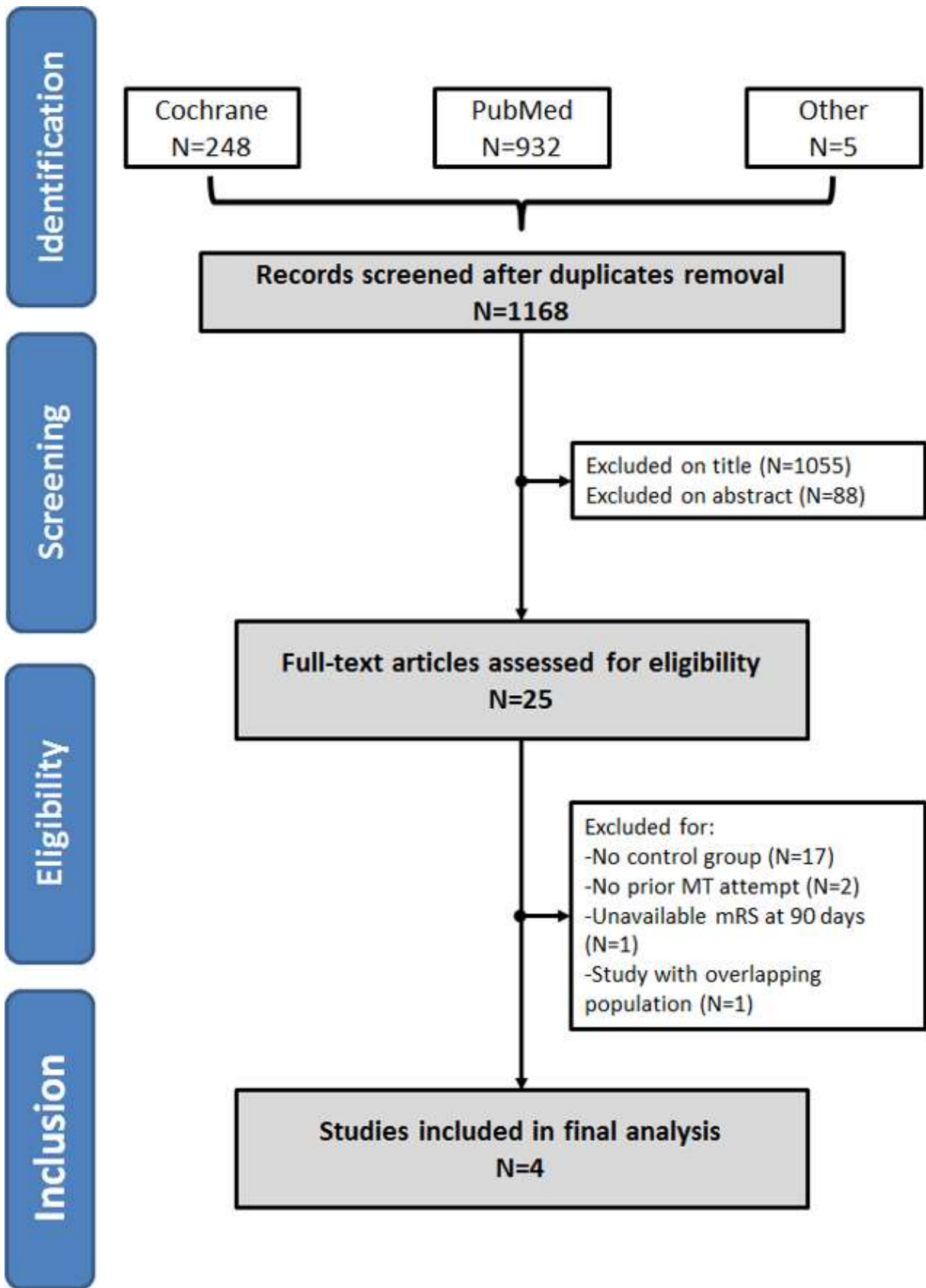
389 **Table 2.** Summary of additional interventions and antithrombotic protocols used in included studies.

<b>Study names</b>	<b>Additional interventions before stenting</b>	<b>Antithrombotic protocol before stenting</b>	<b>Additional interventions after stenting</b>	<b>Antithrombotic regimen after stenting</b>
Baracchini et al. 2017*	Balloon angioplasty IA antiglycoprotein IIb/IIIa	IA bolus (25 µg/kg in 3 min) of antiglycoprotein IIb/IIIa (tirofiban)	Balloon angioplasty for residual stenosis	12-hr IV infusion (0.1 µg/kg/min) of tirofiban then switch to dual antiplatelet therapy for 3 months
Chang et al. 2018	†Balloon angioplasty: 15/48 (31.3%) in PIS group versus 4/100 (4%) in control group IA antiglycoprotein IIb/IIIa: 34/48 (70.8%) in PIS group versus 14/100 (14%) in control group IA urokinase : 7/48 (14.6%) in PIS group versus 16/100 (16%) in control group			Not available
Cornelissen et al. 2018*	None	IV bolus of antiglycoprotein IIb/IIIa (abiximab) or aspirin	Balloon angioplasty	Dual antiplatelet therapy for 3–6 months then aspirin for life
Peng et al. 2019	†Balloon angioplasty: 18/66 (27.3%) in PIS group versus 20/66 (30.3%) in control group IA Tirofiban: 18/66 (27.3%) in PIS group versus 16/66 (24.2%) in control group IA urokinase or rtPA: 7/66 (10.6%) in PIS group versus 5/66 (7.6%) in control group			Not available; At the operator's discretion

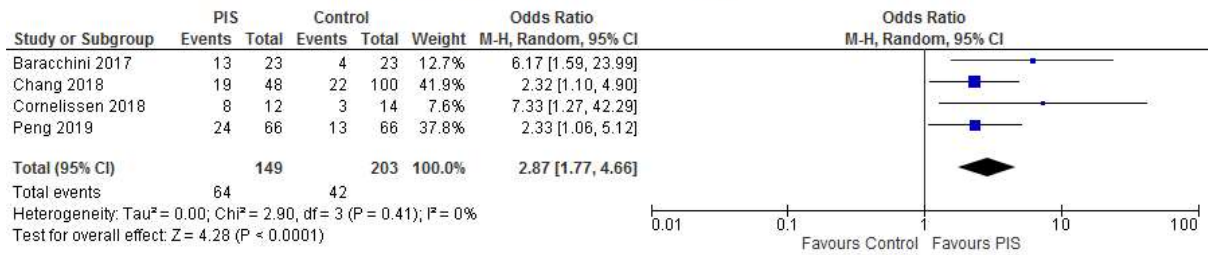
390 IA: intra-arterial; IV: intravenous; †: Timing of additional interventions (before or after stenting) not disclosed; rtPA: recombinant tissue

391 plasminogen activator; \*No information regarding these additional interventions were available for the control group

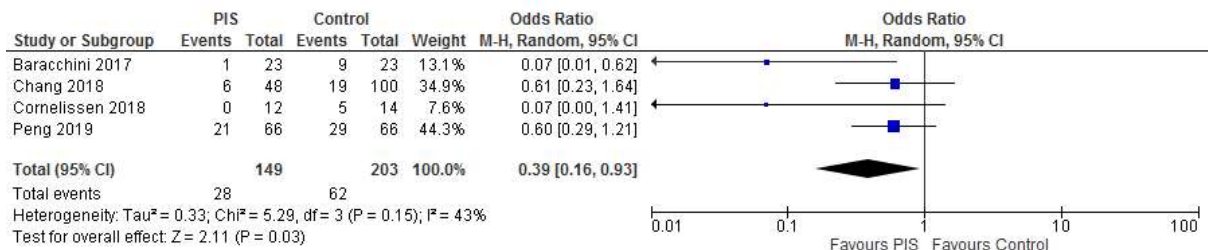
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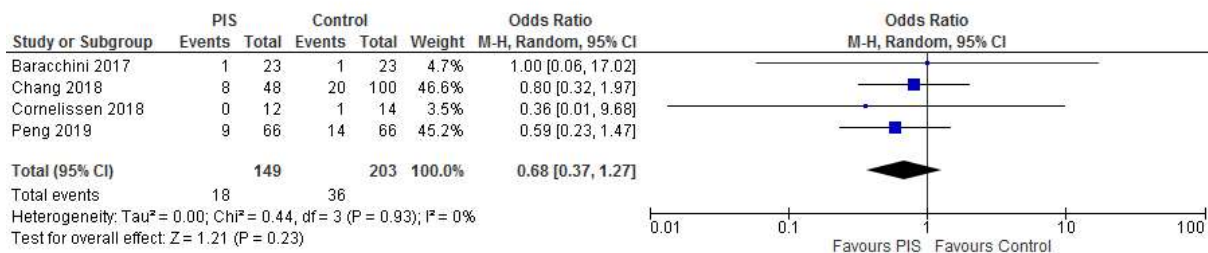
### modified Rankin Scale 0-2 at 90 days



### Mortality



### Symptomatic Intracranial Haemorrhage



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