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Magnitude of systolic blood pressure reduction following endovascular treatment and clinical outcomes in acute large artery occlusion stroke

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ABSTRACT

Background The impact of lowering systolic blood pressure (SBP) following endovascular treatment (EVT) in acute large vessel occlusion stroke (LVOS) patients remains unclear. We aimed to explore the effect of the magnitude of SBP reduction (SBPr) after EVT on outcomes in LVOS patients.

Methods We consecutively registered patients at three comprehensive stroke centres who had experienced EVT as a result of acute anterior circulation LVOS. SBPr was calculated as follows: (baseline SBP−mean SBP/baseline SBP)×100%. The 90-day modified Rankin Scale score ranging from 0 to 2 was defined as a favourable functional outcome. Based on CT scans obtained within 24 hours after procedure, symptomatic intracranial haemorrhage (sICH) was assessed according to the criteria of the European Cooperative Acute Stroke Study III.

Results We enrolled 1080 patients, of which 908 (84.1%) had successful recanalisation. In the overall cohort, SBPr was correlated with lower odds of sICH (SBPr±10% as a reference, 20%–30%: OR 0.460; 95% CI: 0.245 to 0.864; p=0.016; >30%: OR 0.304; 95% CI 0.123 to 0.749; p=0.010). In patients who achieved successful reperfusion, SBPr>30% was correlated with higher odds of a poor outcome (SBPr±10% as a reference, OR 2.150; 95% CI 1.268 to 3.645; p=0.004) and SBPr has a similar tendency towards reducing the incidence of sICH. In the subgroup analyses, baseline Alberta Stroke Programme Early CT (ASPECT) score ($p_{interact}$=0.024) modified the effect of SBPr on the 90-day outcome.

Conclusion Among patients with EVT, a significant drop in SBP may be related to a poor functional outcome and a reduced incidence of sICH. Baseline ASPECT score may be an important interacting factor in the association of SBPr with the 90-day outcome. This study provides new insights for individualised BP management in patients with EVT.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Blood pressure (BP) is a crucial, potentially modifiable factor that can improve favourable neurological outcomes in patients undergoing acute reperfusion therapy. However, the optimal BP management after the endovascular treatment (EVT) is currently unknown. A meta-analysis of recent randomised clinical trials showed that aggressive post-EVT BP reduction did not provide clinical benefits and may pose risks. However, how the magnitude of BP reduction determined high or low risk of harms was unclear.

WHAT THIS STUDY ADDS

⇒ Significant systolic BP reduction (SBPr) after EVT was related to the worse 90-day functional outcome in patients who achieved successful recanalisation, and there was a J-shaped relationship between SBPr and the 90-day outcome.

⇒ There is a negative relationship between SBPr and the incidence of symptomatic intracranial haemorrhage in patients with EVT.

⇒ Baseline Alberta Stroke Programme Early CT (ASPECT) score was an important interact factor in the relationship between outcomes after EVT and SBPr.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The main strength of this study was that it provides in-depth research on the impact of BP reduction on the prognosis after EVT. Several factors need to be considered in the periprocedural BP management, such as baseline ASPECT score. Our study provides new insights for individualised BP management in patients with EVT.

INTRODUCTION

Currently, endovascular treatment (EVT) has become the standard of treatment for patients experiencing acute large vessel occlusion stroke (LVOS) in both anterior and posterior circulation.[1 2] Moreover, with the development of thrombectomy technology, the indications for EVT are gradually expanding.[3 4] However, it should be noted that more than 50% of patients who receive EVT have not gained functional independence despite the achievement of successful vessel recanalisation.[5] Apart from the advancements in thrombectomy technology, improving periprocedural management may further enhance patient outcomes.

Blood pressure (BP) is a crucial, potentially modifiable factor that can improve favourable neurological outcomes in patients undergoing acute reperfusion therapy.[6] In the setting of acute ischaemic stroke, initial BP is often elevated to augment blood flow via collateral circulation to the ischaemic region.[7] However, higher systemic BP may worsen clinical outcomes through increased risks of intracerebral haemorrhage (ICH) or cerebral oedema after successful EVT.[8–10] Therefore, lowering BP following EVT has been recognised as an acceptable clinical practice, as shown by a survey conducted among StrokeNet institutions.[11] However, a meta-analysis of recent randomised clinical trials (RCTs) on early intensive BP management after successful reperfusion following EVT showed that aggressive post-EVT BP reduction did not provide clinical benefits and may pose risks.[12]

The Outcome in Patients Treated With Intra-Arterial Thrombectomy–Optimal Blood Pressure Control (OPTIMAL-BP) trial[13] showed that intensive BP management (<140 mm Hg) was associated with worse functional outcomes than conventional BP management (140–180 mm Hg) in successful EVT patients, which is consistent with the results of the Enhanced Control of Hypertension and Thrombectomy Stroke Study (ENCHANTED2/MT).[14] The BP Target in Acute Stroke to Reduce Haemorrhage After Endovascular Therapy (BP-TARGET) trial[15] indicated that the intensive systolic BP (SBP) management of 100–129 mm Hg following successful recanalisation did not reduce the rate of ICH as compared with the conventional SBP management of 130–185 mm Hg. However, the level of intensive BP management in these RCTs was not unified, and how the magnitude of BP reduction determined high or low risk of harms was unclear.

In view of the former considerations, we performed an investigation to explore the effect of the magnitude of SBP reduction (SBPr) after EVT on outcomes in LVOS patients. We further analysed the association between BP drop and prognosis among different subgroups.

METHODS

Study design

We conducted a retrospective study using a multicentre registry data from three comprehensive stroke centres (Yijishan Hospital, Wannan Medical College; the Second Affiliated Hospital, Fujian Medical University; and Jinling Hospital, Nanjing University) between July 2015 and April 2023. We included patients who underwent EVT due to acute anterior circulation LVOS. Patients were excluded based on the following criteria: (1) baseline Alberta Stroke Programme Early CT (ASPECT) score within 0–2; (2) time from stroke onset to puncture (OTP)>24 hours; (3) prestroke modified Rankin Scale (mRS) score≥2; (4) technical failures, such as puncture failure or inability to establish pathways due to vascular tortuosity, etc; (5) multiple vessel occlusion; (6) lost to follow-up at the 90 days visit and (7) BP records less than 10 times.

Postprocedural BP parameters

BP was measured in the cath lab before EVT. Then, for the first 24 hours, we used noninvasive BP monitoring devices to measure BP every hour after EVT. According to the previous study, SBPr was calculated using the formula: (aSBP−mSBP/aSBP)×100%,[16] where aSBP is the SBP measured at the cath lab before EVT, and mSBP is the average SBP during the initial 24 hours postprocedure. Additionally, data regarding the usage of antihypertensive medications have also been collected for analysis.

Clinical data collection

We documented the baseline clinical data for all of the patients, including medical history and demographics. We also included the metric of workflow, the baseline National Institutes of Health Stroke Scale (NIHSS) and ASPECT score and the Trial of ORG 10172 in Acute Stroke Treatment (TOAST) classification.

The operators recorded the procedural data, including the metric of EVT, occlusion site, collateral score and recanalisation status. Occlusion site included internal carotid artery occlusion, the M1 segment of middle cerebral artery (MCA) occlusion and medium vessel occlusions (MeVO). MeVO was defined as the occlusion of MCA M2 segment or occlusion of the anterior cerebral artery.[17] We used the modified Thrombolysis in Cerebral Infarction (mTICI) grading system to evaluate the recanalisation status.[18] A score of 2b or 3 in mTICI indicated successful recanalisation. Collateral circulation status was evaluated by observing the backward flow of contrast in vessels within the occluded region on delayed digital subtraction angiography images. Good collaterals were characterised by more than 50% perfusion of the occluded area.[19]

Outcomes

Clinical outcomes were assessed using the 90-day mRS, with mRS 0–2 being defined as a favourable clinical outcome and mRS≥3 being defined as a poor outcome. According to the European Cooperative Acute Stroke Study III criteria, symptomatic intracranial haemorrhage (sICH) was characterised as any haemorrhage confirmed on CT imaging within 24 hours after thrombectomy, and accompanied by a ≥4-point increase in NIHSS score.[20]

Statistical analysis

Results are given for continuous variables as the mean±SD or the median (IQR). We using the Mann-Whitney U test to assess continuous variables. Results are given for categorical variables as percentages. We used Fisher's exact test or the χ^2 test, as warranted, to assess categorical variables.

The effect of BP reduction on clinical outcomes was analysed by a binary logistic regression. To evaluate the magnitude and direction of change in BP, we categorised BP reduction for the logistic regression as follows: <−10%, −10% to 10% (reference), 10% to 20%, 20% to 30% and >30%. To prevent multicollinearity, we did not adjust for mean SBP or baseline BP. Regression coefficients and ORs

with two-sided 95% CIs for each of the variables included in the model were finally calculated. In order to visualise the trend, we also examined the shape of the relationship between SBPr and the 90-day functional outcome or sICH by using a regression curve of ORs (95% CI).

According to the history of hypertension, use of antihypertensive medications following EVT, baseline ASPECT score (3–5 vs 6–10), collateral circulation status, occlusion site and baseline BP (≥140 mm Hg vs <140 mm Hg). we conducted subgroup analyses. We adjusted the regression models using an interaction term between BP reduction and the subgroup to stratify the significance of the tested subgroups.

Finally, a sensitivity analysis was performed using the BP in the emergency room as the baseline BP. We set a two-tailed value of $p<0.05$ to denote statistical significance. All statistical analyses were computed by using SPSS V.25 (IBM) and R-studio (V.4.0.4, R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

During the study period, a total of 1323 patients receiving EVT treatment were registered. Of this total, 1080 patients were analysed in this study. The flow chart of inclusion of the study population is shown in figure 1. The median

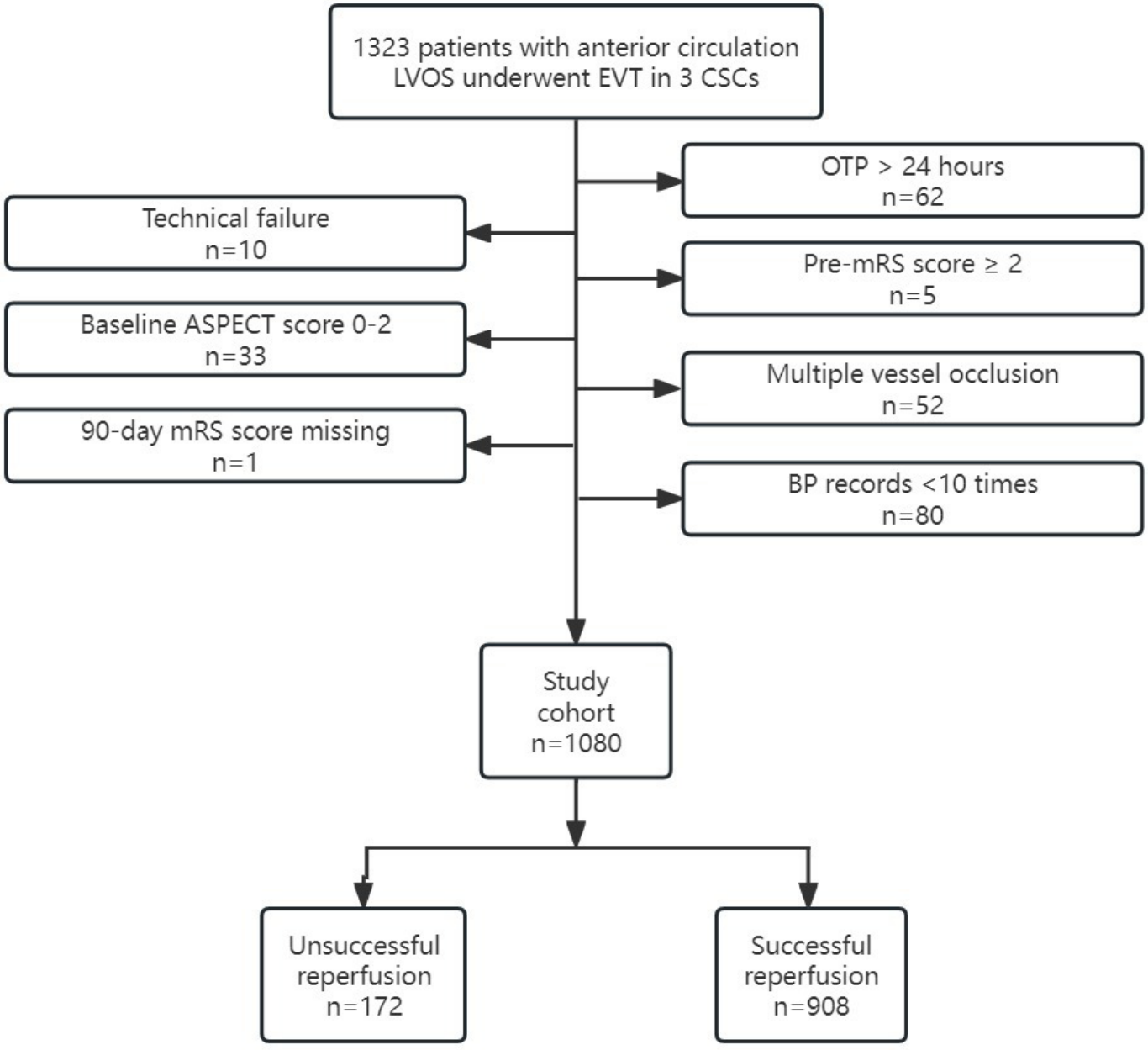

Figure 1 Study population. ACA, anterior cerebral artery; ASPECT, Alberta Stroke Programme Early CT; BP, blood pressure; CSCs, comprehensive stroke centres; EVT, endovascular treatment; LVOS, large vessel occlusion stroke; mRS, modified Rankin score; OTP, symptoms onset to groin puncture time.

age was 70 (IQR 60–76) years and 630 (58.3%) were men. The median baseline NIHSS score was 15 (12–18), the median baseline ASPECT was 9 (7–10), the median OTP was 290 (220–360) min, 908 (84.1%) patients achieved successful recanalisation (TICI scores of 2b or 3), 534 (49.4%) patients achieved 90-day mRS 0–2 and 86 patients (7.9%) developed sICH.

Relationship between outcomes and BP reduction

In the overall cohort, the median SBP reduction (SBPr) was 17.3% (8.2%, 25.9%) and the diastolic BP reduction (DBPr) was 15.9% (5.8%, 25%). SBPr and DBPr were not significantly different between the 90 d mRS 0–2 group and the 90 d mRS 3–6 group. However, compared with patients with sICH, patients with non-sICH had higher SBPr (17.5% vs 11.7%, p=0.001). Online supplemental table S1 lists the baseline characteristics and demographics of the overall cohort. After adjusting for potential confounders, SBPr>20% was associated with lower odds of sICH (SBPr±10% as a reference, 20%–30%: OR 0.460; 95% CI 0.245 to 0.864; p=0.016; >30%: OR 0.304; 95% CI 0.123 to 0.749; p=0.010, online supplemental table S2).

In patients with successful reperfusion, patients with poor outcomes had a significant reduction in SBP (19.2% vs 17.5%, p=0.029). Patients with non-sICH also had a significant reduction in SBP (18.3% vs 14.5%, p=0.013). The baseline characteristics and patient demographics for those who had successful reperfusion are shown in table 1. In the multivariate analysis (table 2), SBPr>30% was associated with higher odds of a poor outcome (SBPr±10% as a reference, OR 2.150; 95% CI 1.268 to 3.645; p=0.004). Figure 2A illustrates a J-shaped relationship between SBPr and poor outcomes. In addition, SBPr has a similar tendency towards reducing the incidence of sICH, however, a significant statistical difference was not achieved. We observed a linear relationship between SBPr and sICH (figure 2B). The distribution of the 90-day mRS scores and the incidence of sICH in the different SBPr categories is shown in figure 3.

Additionally, in patients with unsuccessful reperfusion, no significant differences were found in SBPr, regardless of in the subgroup for 90d mRS or sICH (online supplemental table S3).

Relationship between outcomes and BP reduction in the subgroup analysis

Figure 4 illustrates the subgroup analyses for patients who experienced successful reperfusion. We found that a large magnitude of SBPr (SBPr>30%) was correlated with significantly higher odds of poor outcome than minimal SBPr (±10%). However, the baseline ASPECT score ($p_{interact}$=0.024) modified the effect of SBPr on the 90-day outcome.

Although a tendency of SBPr associated with lower odds of sICH was found in most subgroups, a significant statistical difference was found only in those patients who had poor collateral circulation. There may be an interaction between collateral circulation status and SBPr for the incidence of sICH ($p_{interact}$=0.092). In addition, there may be an interaction between baseline BP and SBPr for the incidence of sICH ($p_{interact}$=0.031), however, a significant statistical difference was not achieved in the subgroup analyses.

Sensitivity analysis

While SBP in the emergency room was defined as aSBP (n=731), we also found that SBPr after EVT was related to the worse functional outcomes at 90 days in patients with successful reperfusion, and SBPr was associated with lower odds of sICH (online supplemental table S4).

DISCUSSION

In the current study, three main findings were as follows: (1) significant SBPr after EVT was related to the worse 90-day functional outcome in patients who achieved successful recanalisation, and there was a J-shaped relationship between SBPr and the 90-day outcome; (2) there is a negative relationship between SBPr and the incidence of sICH in patients with EVT and (3) baseline ASPECT score was an important interact factor in the relationship between outcomes after EVT and SBPr.

In theory, persistently elevated BP after successful EVT may have worse clinical outcomes by increasing the risk of cerebral oedema and intracerebral haemorrhage. Moreover, previous retrospective studies showed that SBPr in the first 24 hours after successful EVT was inversely associated with poor outcomes.[16 21] However, recent RCTs have reached the opposite conclusion, which was that intensive BP management was associated with poorer functional outcomes than conventional BP management.[13–15] An important issue was how the magnitude of BP reduction determined high or low risk of harms was unclear. In this study, we found that a large magnitude of SBPr after EVT was related to a poorer functional outcome at 90 days in patients who achieved successful recanalisation, and this relationship was J-shaped. Nevertheless, these results seem to contradict that of the Blood Pressure Management After Endovascular Therapy for Acute Ischaemic Stroke (BEST-II) trial and previous observational studies.[16 22 23] The BEST-II trial was a phase II study to evaluate the futility of lower SBP targets after EVT (<140 mm Hg or 160 mm Hg) compared with a higher target (≤180 mm Hg).[23] However, this study did not show that lower SBP targets of less than 140 mm Hg and less than 160 mm Hg meet prespecified criteria for futility compared with a target of 180 mm Hg or less.

Several reasons could explain the above conflicting results. First, the intensive BP management in the previous RCTs did not consider baseline BP. In our study, the SBPr is an interesting clinical parameter that taken into account the patient's baseline BP and attempts to reduce the intragroup variability of patients with widely varied baseline BP. Second, the selection of different baseline BPs also affects the magnitude of BP reduction.

Table 1 Baseline characteristics and demographics in patients who had successful reperfusion

	mRS 0–2 n=494	mRS 3–6 n=414	P value	sICH* n=56	Non-sICH n=847	P value
Age, median (IQR), year	67 (57–74)	72 (64–78)	<0.001	69 (60–77)	69 (60–76)	0.983
Male, n (%)	316 (64)	227 (54.8)	0.005	36 (64.3)	503 (59.4)	0.469
Hypertension	303 (61.3)	288 (69.6)	0.010	34 (60.7)	554 (65.4)	0.475
Diabetes mellitus	66 (13.4)	93 (22.5)	<0.001	12 (21.4)	147 (17.4)	0.438
Clinical characteristics, median (IQR)						
Baseline NIHSS scores	13 (11–17)	16 (13–20)	<0.001	16 (13–19)	14 (12–18)	0.010
Baseline ASPECT scores	9 (8–10)	8 (6–9)	<0.001	8 (7–9)	9 (8–10)	0.008
IVT, n (%)	91 (18.4)	67 (16.2)	0.376	14 (25)	144 (17)	0.127
Blood pressure parameters, median (IQR)						
Baseline SBP, mm Hg	150 (131–164)	154 (139–170)	<0.001	149 (130–160)	150 (135–168)	0.140
Baseline DBP, mm Hg	83 (74–92)	84 (75–95)	0.392	84 (74–92)	83 (74–93)	0.562
Mean SBP (24 hours), mm Hg	121 (115–128)	123 (117–130)	0.001	126 (116–133)	122 (116–129)	0.073
Mean DBP (24 hours), mm Hg	70 (65–75)	69 (63–75)	0.181	69 (65–78)	70 (64–75)	0.440
SBPr, %	17.5 (8.6–25.7)	19.2 (10.9–28.1)	0.029	14.5 (2.7–20.8)	18.3 (9.9–26.7)	0.013
DBPr, %	16 (6.2–24.2)	17.8 (7.8–27.1)	0.059	13.2 (3.9–25.1)	17.1 (7.1–26)	0.132
Continuous intravenous antihypertensive agents, n (%)	246 (49.8)	260 (62.8)	<0.001	37 (66.1)	466 (55)	0.107
TOAST classification, n (%)			<0.001			0.473
LAA	164 (33.2)	106 (25.6)		13 (23.2)	257 (30.3)	
Cardioembolic	256 (51.8)	278 (67.1)		37 (66.1)	492 (58.1)	
Others	74 (15)	30 (7.2)		6 (10.7)	98 (11.6)	
Occlusion site, n (%)			<0.001			0.786
ICA	162 (32.8)	189 (45.7)		24 (42.9)	324 (38.3)	
MCA M1	281 (56.9)	193 (46.6)		27 (48.2)	445 (52.5)	
MeVO	51 (10.3)	32 (7.7)		5 (8.9)	78 (9.2)	
OTP, mean (IQR), min	300 (225–370)	300 (220–390)	0.486	300 (221–360)	300 (225–390)	0.849
OTR, mean (IQR), min	349 (278–438)	352 (288–470)	0.087	360 (288–440)	350 (282–455)	0.695
Collateral score†, n (%)			<0.001			0.008
Poor	158 (32.1)	255 (61.7)		35 (62.5)	373 (44.2)	
Good	334 (67.9)	158 (38.3)		21 (37.5)	471 (55.8)	

*5 patients missing.
†3 patients missing.
ASPECT, Alberta Stroke Programme Early CT; DBP, diastolic blood pressure; DBPr, DBP reduction; ICA, internal carotid artery; IVT, intravenous thrombolysis; LAA, large-artery atherosclerosis; MCA, middle cerebral artery; MeVO, medium vessel occlusions; NIHSS, National Institutes of Health Stroke Scale; OTP, symptoms onset to groin puncture time; OTR, symptoms onset to reperfusion; SBP, systolic blood pressure; SBPr, SBP reduction; sICH, symptomatic intracranial haemorrhage; TOAST, the Trial of ORG 10172 in Acute Stroke Treatment.

In the post hoc analysis of the BP-TARGET trial,[22] the baseline BP was the end of procedure BP. Both intraoperative procedures and anaesthesia can affect the postoperative BP.[24] In this study, the cath lab BP before EVT was used as the baseline BP. No patients underwent sedation or anaesthesia before the first baseline BP measurement. Third, the relationship between BP and prognosis in acute ischaemic stroke is complex. In the study, we found a J-shaped relationship between SBPr and the 90-day outcome (figure 2), which may explain that elevated SBP after successful reperfusion by EVT was harmful in most previous retrospective studies.[8–10] Last, the different study designs and the imbalanced patients' baseline characteristics likely contributed to the differences in the results.

The mechanism by which BP reduction leads to adverse outcomes may be that a significant BP lowering might further reduce blood flow to the oligemic zone and exacerbate ischaemic injury.[25] Despite successful reperfusion after EVT, patients might exhibit persistent venous postcapillary thrombosis, a phenomenon also known as no-reflow.[26] In this situation, the prognosis of the acute ischaemic lesion may be affected negatively by the

Table 2 Relationship of SBP reduction following successful reperfusion with outcomes

SBPr	Incidence, n (%)	OR	95% CI	P value
Poor outcome* (n=414)				
±10% (n=206)	80 (38.8)		Reference	
<–10% (n=32)	15 (46.9)	1.249	0.511 to 3.048	0.626
10%–20% (n=272)	125 (46)	1.492	0.973 to 2.288	0.066
20%–30% (n=263)	114 (43.3)	1.158	0.749 to 1.790	0.509
>30% (n=135)	80 (59.3)	2.150	1.268 to 3.645	0.004
sICH† (n=56)				
±10% (n=206)	17 (8.3)		Reference	
<–10% (n=32)	4 (12.5)	1.531	0.473 to 4.955	0.477
10%–20% (n=271)	20 (7.4)	0.917	0.465 to 1.809	0.803
20%–30% (n=260)	10 (3.8)	0.476	0.212 to 1.069	0.072
>30% (n=134)	5 (3.7)	0.419	0.150 to 1.172	0.098

*Adjusted for age, sex, baseline NIHSS and ASPECT, history of hypertension and diabetes mellitus, antihypertensive treatment, TOAST classification, collateral circulation and occlusion site.
†Adjusted for baseline NIHSS, ASPECT and collateral circulation.
ASPECT, Alberta Stroke Programme Early CT; NIHSS, National Institutes of Health Stroke Scale; SBP, systolic blood pressure; SBPr, SBP reduction; sICH, symptomatic intracranial haemorrhage; TOAST, Trial of ORG 10172 in Acute Stroke Treatment.

intensive BP reduction even after successful EVT. Further analysis of the perfusion imaging data or using short-term imaging endpoints in the future may provide evidence for a potential mechanism leading to worse outcomes associated with BP reductions. It is worth noting that there is a significant dose–response relationship between SBPr and the 90-day outcome (figure 2). These results may contribute to the design of future research.

The negative association between SBPr and the incidence of sICH has been proven in previous studies.[21 22] Similarly, we also found that SBPr>20% was correlated with reduced odds of sICH. In the BP-TARGET trial,[13] an intensive SBP target of 100–129 mm Hg following successful EVT did not reduce the rates of radiographic ICH. A possible explanation was that the BP reduction was only 17% in the intensive SBP target group. Additionally, an important finding in our study was that the relationship between SBPr and sICH was mainly in patients with poor collateral circulation, which explained why, in the ENCHANTED2/MT trial, more intensive BP treatment did not decrease the incidence of sICH.[14] In the ENCHANTED2/MT trial, the two groups all had a small core infarction and a large mismatch of perfusion deficits before EVT, which is a representative of good collateral circulation.[14] It is worth noting that the decrease in sICH caused by SBPr cannot offset the adverse prognosis brought about by SBPr. Therefore, it is particularly important to continue exploring the impact of BP changes on the perioperative pathophysiological mechanisms of EVT in acute ischaemic stroke.

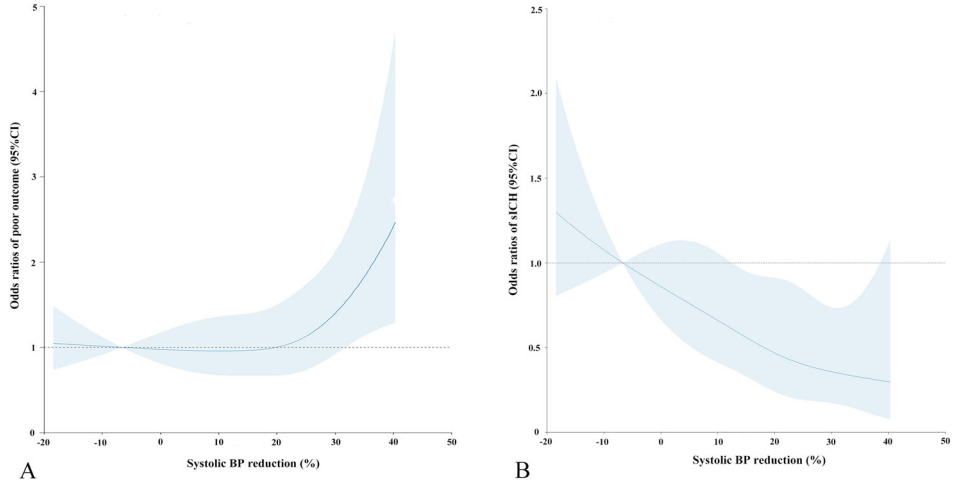

Figure 2 Shape of the relationship between systolic blood pressure (SBP) reduction following successful reperfusion and outcomes. (A) 90-day outcome. (B) Symptomatic intracerebral haemorrhage.

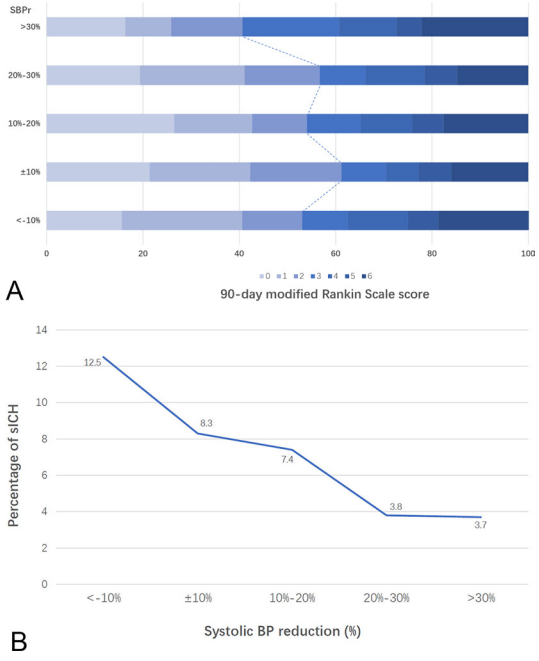

Figure 3 Distribution of modified Rankin Scale (mRS) scores at 90 days (A) and the incidence of symptomatic intracerebral haemorrhage (sICH) (B) according to the categories of systolic blood pressure (SBP) reduction (SBPr).

Another important finding was that the association of SBPr with the 90-day outcome showed a significant interaction with the baseline ASPECT score. Recently, patients with large core infarction have been confirmed to be effective with EVT by increasing evidence.[3 4] The results

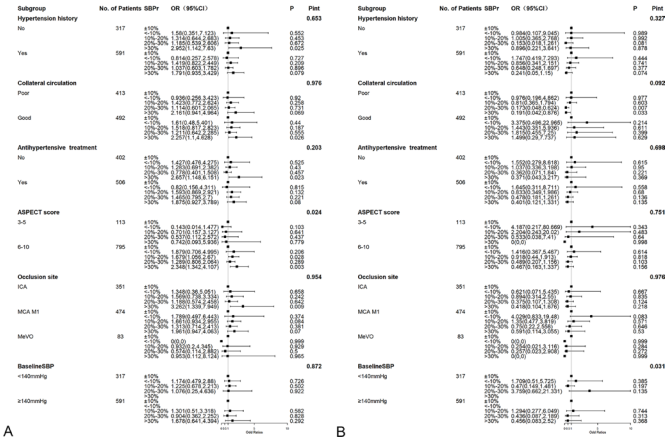

Figure 4 Relationship of levels of systolic blood pressure (SBP) following successful reperfusion according to different subgroups. (A) Relationship between SBP reduction (SBPr) and poor outcome; fully adjusted indicates ORs adjusted for age, sex, history of hypertension, diabetes mellitus, antihypertensive treatment, TOAST, baseline NIHSS and ASPECT, occlusion site and collateral circulation analysed using a multivariable logistic regression model. (B) Symptomatic intracerebral haemorrhage; adjusted for baseline NIHSS, ASPECT and collateral circulation. ASPECT, Alberta Stroke Programme Early CT; NIHSS, National Institutes of Health Stroke Scale; TOAST, Trial of ORG 10172 in Acute Stroke Treatment.

of our study, however, did not find a correlation in these patients between SBPr and poor outcomes. Furthermore, according to the OR value, moderate BP reduction might have partial protective effects. Unfortunately, because of our small sample, the association was not statistically significant. Further trials targeting patients with large core infarctions may elucidate the role of moderate BP reduction.

To prevent reperfusion injury, antihypertensive treatment is very common in clinical practice after EVT. A recent study from South Korea shows that a medication-induced BP decrease during the first 24 hours after successful EVT may be harmful for patients with acute ischaemic stroke.[27] Additionally, a subgroup analysis of the OPTIMAL-BP trial[13] showed that in the conventional management group, the lower the mean 24-hour BP was, the better the outcome. Unexpectedly, in our study, the association between SBPr and poor outcomes was also found in the no-antihypertensive treatment group (spontaneous BP decreases). However, in the no-antihypertensive treatment group, we found that the relationship is only shown in populations with significant SBP drop (>30%). Moreover, a sensitive analysis for with or without antihypertensive treatment showed the similar results (online supplemental figure S1). Further research needs to be guaranteed.

The results of our study emphasise the complexity of managing BP after EVT. The main strength of this study was that it provides in-depth research on the impact of BP reduction on the prognosis after EVT. Furthermore, the subgroup analysis provides new insights for individualised BP management in patients with EVT. Nevertheless, several limitations need to be acknowledged in the study. First, due to inherent limitation of the retrospective design, the BP management protocols between different centres have not been uniformly formulated, and the emergency room antihypertensive treatment data was not obtained. However, we included the use of continuous intravenous antihypertensive treatment after EVT as an independent variable in the statistical analysis and further conducted a subgroup analysis. Second, we did not obtain detailed information on BP variability and intraoperative BP during the perioperative period of EVT, which have also been proven to be associated with functional outcomes after EVT. Third, we could not obtain the infarct volume to assess the relation between BP reduction and infarct extension, which could provide a potential mechanism leading to worse outcomes associated with BP reductions.

CONCLUSIONS

Among patients who received EVT due to LVOS in the anterior circulation, a significant drop in SBP might be related to a poor functional outcome and a reduced incidence of sICH. Several factors need to be considered in the periprocedural BP management, such as baseline ASPECT score. Our study provides new insights

for individualised BP management. A further study with a prospective design investigating the optimisation of periprocedural BP management in EVT is needed.

Contributors XH, XD, ZZ and JX: study design. HW, JX, ZL and QY: data acquisition. ZL and QY image analysis. XH, XD and HW wrote the primary manuscript. ZZ and JX: critical revision. ZZ and JX are responsible for the overall content as guarantors.

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