LETTER

Pre-endovascular therapy change in blood pressure is associated with outcomes in patients with stroke

INTRODUCTION

The American Heart Association/American Stroke Association guideline recommends maintaining blood pressure (BP) below 185/110 mm Hg in acute stroke patients prior to initiating any form of reperfusion therapy.[1] However, the evidence supporting this recommendation is not strong for patients undergoing endovascular treatment (EVT). Higher BP at presentation in these patients is associated with worse outcomes and haemorrhagic complications.[2] However, BP-lowering prior to EVT for avoidance of hyperperfusion as well as induced hypertension for penumbral sustenance have been proposed to improve patient outcomes.[2 3] Prior to further testing of these strategies, whether changes in BP in either direction prior to EVT are associated with functional outcomes needs to be assessed. Because any changes in pre-EVT BP may affect ultimate functional outcome through an effect on cerebral perfusion, we aimed to determine the association of the change in pre-EVT mean arterial BP (MAP) with 90-day functional outcomes.

METHODS

We conducted a post-hoc analysis of the 'Blood pressure after Endovascular Stroke Therapy (BEST)' study, which prospectively enrolled consecutive adult patients treated with EVT for an anterior (Internal Carotid Artery/M1/M2) acute ischaemic stroke at 12 comprehensive stroke centres across the USA from November 2017 to May 2018.[4]

Study variables included change in MAP from admission to immediately pre-EVT. MAP was calculated using the following formula: (2×diastolic BP+systolic BP)/3. The primary outcome was dichotomous 90-day modified Rankin score of 0–2 (good outcome) vs 3–6 (poor outcome). We considered a 15% change in MAP from baseline as clinically meaningful and potentially intervenable . We compared the rates of poor outcomes among groups of patients with >15% increase, >15% decrease and <15% change in MAP. We also determined the association between any decrease or increase in MAP (continuous and dichotomised to >15% change in one direction) and poor outcome using univariate and multivariable logistic regression. Multivariable analysis included adjustment for the following variables: model 1: age and National Institutes of Health Stroke Scale (NIHSS) score; model 2: age, NIHSS score and Alberta Stroke Program Early CT (ASPECTS) score; and model 3: age, NIHSS score, ASPECTS score, modified Thrombolysis in Cerebral Ischemia score and time from last known well to recanalisation. All analyses and graphical depictions were generated using SPSS V.25.0 and R V.3.5 (Vienna, Austria). Statistical significance was set at $\alpha=0.05$, and all p values were two-sided.

RESULTS

Of the 485 patients included in the BEST study, 388 had an immediate pre-EVT BP documented, of whom 353 had a 90-day follow-up. Baseline characteristics of these 353 patients are provided in online supplementary table-e1. Patients with good outcome had lower MAP on admission (107.7±18) compared to those with poor outcome (113.1±20.3) (p=0.008). Patients with >15% increase or decrease in MAP from baseline had a higher rate of poor outcome (online supplementary table-e2; online supplementary figure-e1). Additionally, an overall shift towards poor outcome was noted in patients with >15% increase or decrease in MAP from baseline compared with those with <15% change (p=0.049; figure 1). The results of logistic regression analysis are outlined in online supplementary table-e1. Overall, a trend towards worse outcome was observed in patients with >15% increase, >15% decrease, any continuous increase, any continuous decrease and any continuous change in MAP. In the subgroup of patients presenting with systolic BP >185 mm Hg, a trend towards higher rate of death was

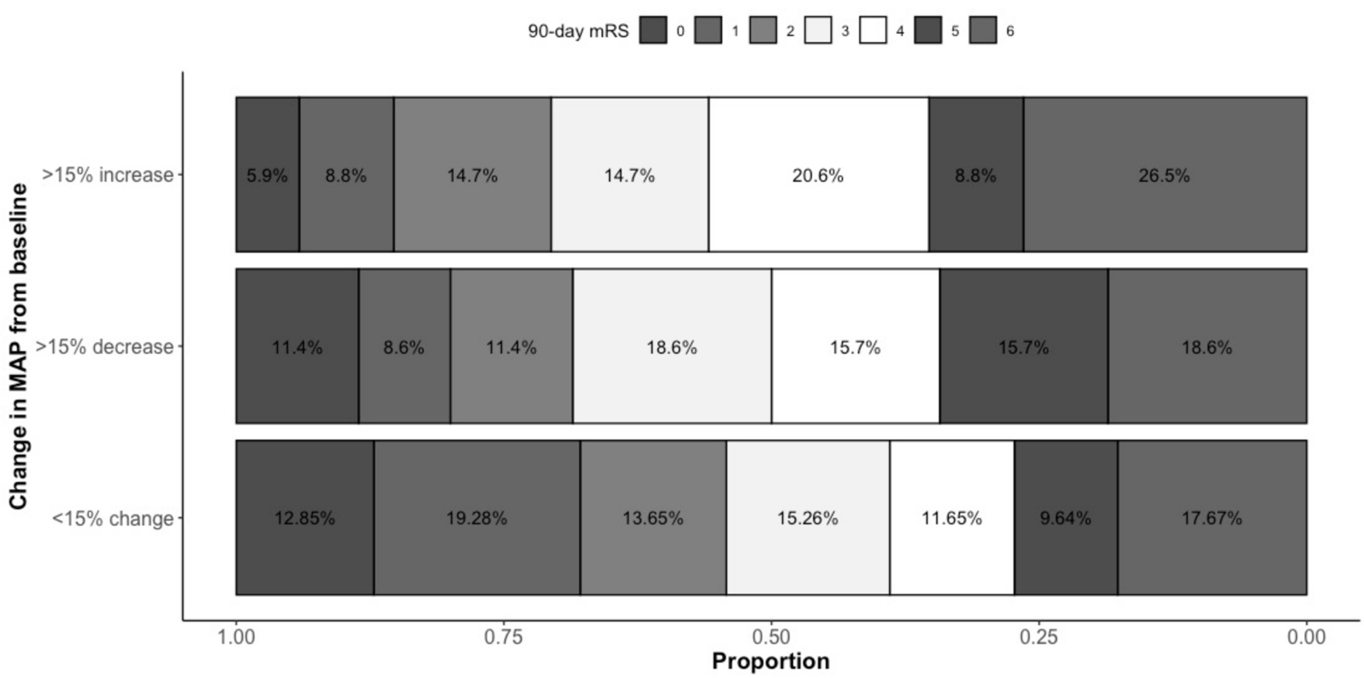

Figure 1 Distribution of 90-day modified Rankin score (mRS) in patients with >15% increase, >15% decrease and <15% change in mean arterial blood pressure (MAP) from baseline to immediate pre-endovascular treatment.

observed in those with >15% decrease compared with those with <15% change (12% (n=4) vs 32% (n=7), p=0.09), without a significant difference in poor outcome.

DISCUSSION

We found that both an increase and a decrease in MAP from baseline to pre-EVT are associated with worse outcomes without concurrent increase in haemorrhagic complications. The trend towards worse outcomes in >15% changes in MAP as well as any change in continuous MAP remained after adjustment for known confounders.

Since any increase in BP in this study was likely spontaneous and not induced, we posit that it was merely a marker of higher infarct volume or worsening ischaemia leading to worse outcomes.[5] On the contrary, a decrease in BP prior to recanalisation may have been induced or spontaneous. In either case, we hypothesise that it may have led to failure of collaterals and infarct growth, resulting in poorer outcomes.

The following clinical inferences can be drawn from our study: (1) A substantial decrease in BP in the pre-EVT setting should be avoided, underscoring the importance of careful antihypertensive and anaesthetic selection. (2) Given that drastic decreases in BP prior to EVT are associated with worse outcomes in this study and that prior studies have shown that the benefit of EVT persists across all ranges of admission BP,[6] it may be reasonable to avoid aggressive BP-lowering in patients being considered for EVT. For patients concurrently treated with intravenous thrombolysis, however, the standard guideline of keeping BP <185/110 mm Hg should apply.[1] (3) Because increases in BP were likely not induced in this study, our data cannot refute the utility of induced hypertension in patients with acute stroke with a large salvageable penumbra.

This study is limited by the inherent biases of an observational study and lacking data on collateral scores. Moreover, we only used two BP recordings (baseline and immediately preprocedure) and therefore did not account for changes in BP between the two readings and during the procedure. The strength of our study is that it is a large, multicentre, prospective observational study, which makes our findings generalisable.

CONCLUSIONS

This study shows a 'U'-shaped relationship between pre-EVT change in BP and functional outcomes (online supplementary figure-e1). Further research into the effects of induced BP changes prior to EVT is needed.

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