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Reply

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for the ENDOSTROKE Study Group

We thank Drs Strbian and Lindsberg for their comments regarding one of our findings analyzing a series of 148 patients with angiographically proven basilar artery occlusion (BAO), that the probability of good clinical outcome was not related to the presence or absence of revascularization, pointing to the potential importance of pretreatment imaging selection.¹ They report their experience with standardized imaging assessment in posterior circulation strokes (pcASPECTS), recommend a similar approach to the data of our case series, and opt for a more thorough patient selection prior to invasive therapies.

We agree with Strbian and Lindsberg concerning the importance of thorough patient selection and have performed a detailed analysis of factors associated with futile recanalization (poor long-term outcome despite recanalization) in a large data set from the Endostroke registry of 362 patients with angiographically confirmed proximal middle cerebral artery or distal internal carotid artery occlusion.² Even in this rather homogeneous patient population in which the assessment of early ischemic changes (EIC) is by far more straightforward as compared to BAO, we did not detect a significant impact either of the use of magnetic resonance imaging (MRI; compared to computed tomography [CT]) or of the extent of EIC on clinical outcome. In contrast, we found similar predictors (initial stroke severity, quality of collateral blood supply, but also age and grade of recanalization) for clinical outcome, as in our extensive BAO series with core laboratory adjudication of reperfusion at cerebral angiography. Among others, this finding may be explained by the time delay between initial imaging and reperfusion, which is (due to the complex nature of endovascular stroke treatment) substantially longer than in patients experiencing reperfusion after systemic thrombolysis. Therefore, infarct evolution may progress with different speed due to collateral status between imaging and reperfusion reducing the informative value of EIC. In BAO, the assessment of EIC is far more complex and less well standardized than in anterior circulation stroke, and similar lesion sizes may lead to dramatically disparate clinical sequelae. Furthermore, EIC assessment using CT is often hampered by streak artifacts within pivotal brainstem regions (pons, midbrain). These known factors in routine clinical practice prompted us during this multicenter endovascular registry to use a rather rough and dichotomized score for EIC in BAO focusing on the presence or absence of EIC within pontine and midbrain structures, areas of indisputable functional impact on clinical outcome. The 10-point pcASPECTS score that considers these areas with 2 points each (2 for midbrain, 2 for pontine lesions) in contrast construes that lesions in

other areas of lesser importance for clinical outcome (posterior territory artery, cerebellum [1 point for each side]) may numerically equate with similar reductions in pcASPECTS score. Furthermore, it is of note that in their own publication cited by Strbian and Lindsberg, recanalization had a dramatic impact on mortality, irrespective of pcASPECTS scores.³ In the same vein, we urge our colleagues to modernize imaging methods in stroke studies to provide established core laboratory adjudication of Thrombolysis in Cerebral Infarction (TICI) reperfusion, not recanalization based on Thrombolysis in Myocardial Infarction as cited. Such incomplete data metrics on revascularization are outdated.

We do, however, acknowledge the potential of MRI-guided patient selection in BAO, and several findings in our BAO series indicate such utility. The use of MRI was independently associated with significantly better outcomes as compared to CT (in contrast to the abovementioned larger case series in anterior circulation stroke), which is best explained by improved patient selection, excluding patients with severe damage to important brainstem structures. This interpretation is corroborated by the finding that in our study 55% of MRI-selected patients without EIC of pontine or midbrain structures had a favorable clinical outcome (irrespective of collateral status or revascularization success), as compared to only 33% of CT-selected patients without EIC (unpublished data), an indirect sign of the low sensitivity of CT-based EIC assessment in brainstem structures.

That recanalization itself was not a significant predictor for clinical outcome is primarily explained by the high rate of reperfusion (TICI = 2b–3; 79%), leaving only 30 patients in the “no recanalization” group, reducing thereby the statistical power. Second, within this “no recanalization” group, recanalization status was heterogeneous, with 15 patients experiencing TICI 0 and 15 patients TICI 2a reperfusion.

We appreciate the recent overwhelming evidence concerning the clinical impact of endovascular stroke therapy in anterior circulation stroke. However, the large randomized trials used very different imaging criteria (from noncontrast CT to fully automated mismatch imaging analysis) for inclusion or exclusion of patients, indicating the absence of an optimal imaging-based patient selection strategy even in this rather homogenous patient population. Given the heterogeneity of clinical, imaging, and angiographic findings in BAO, it is important to define robust predictors for clinical outcome in these patients. Our study is the first one establishing angiographically assessed collateral status as an independent predictor of technical (revascularization success) and clinical outcome in BAO. Now we must combine this knowledge with other (imaging-based) predictors to better characterize patients who may ideally benefit from this invasive and complex intervention.

Potential Conflicts of Interest

Nothing to report.

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