



## Letter to the Editor

## The safety and long-term outcomes of angioplasty and stenting in symptomatic intracranial atherosclerotic stenosis<sup>☆</sup>



Yunyun Xiong<sup>a</sup>, Zhiming Zhou<sup>b</sup>, Hang Lin<sup>c</sup>, Min Lin<sup>c</sup>, Jianlin Liu<sup>d</sup>, Guozhong Niu<sup>e</sup>, Wei Wang<sup>f</sup>, Yi Jia<sup>g</sup>, Thomas W. Leung<sup>h</sup>, Dezhi Liu<sup>a</sup>, Wenhua Liu<sup>a</sup>, Xiaobing Fan<sup>a</sup>, Qin Yin<sup>a</sup>, Wusheng Zhu<sup>a</sup>, Minmin Ma<sup>a</sup>, Renliang Zhang<sup>a</sup>, Gelin Xu<sup>a</sup>, Xinfeng Liu<sup>a,\*</sup>

<sup>a</sup> Department of Neurology, Jinling Hospital, Nanjing University School of Medicine, Nanjing, Jiangsu Province, China

<sup>b</sup> Department of Neurology, Yijishan Hospital of Wannan Medical College, Anhui Province, China

<sup>c</sup> Department of Neurology, Fuzhou General Hospital of Nanjing Military Region, Fuzhou, Fujian Province, China

<sup>d</sup> Center of Cerebrovascular Diseases, The First Affiliated Hospital, Medical School of Xi'an Jiaotong University, Xi'an 710061, China

<sup>e</sup> Department of Neurology, The First People's Hospital of Hangzhou, Hangzhou, Zhejiang Province, China

<sup>f</sup> Department of Neurology, Yangzhou No.1 People's Hospital, Yangzhou, Jiangsu Province, China

<sup>g</sup> Department of Neurology, Xi'an Gaoxin Hospital, Shanxi Province, China

<sup>h</sup> Department of Medicine & Therapeutics, Prince of Wales Hospital, The Chinese University of Hong Kong, Shatin, Hong Kong

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Intracranial atherosclerotic stenosis (ICAS) is one of the most common causes of stroke worldwide, in particular in Chinese, Black and Hispanic populations compared with Caucasians [1,2]. In addition to the medical therapy, angioplasty and stenting are alternative surgical approaches. However, recent AHA/ASA guideline on stroke prevention recommended not to adopt stenting with the Wingspan stent system as an initial treatment for patients with stroke or transient ischemic attack attributable to severe (70%–99%) ICAS (class III, level C) [3]. This recommendation was formulated based on the only randomized clinical trial – Stenting and Aggressive Medical Management for Prevention Recurrent Stroke and Intracranial Stenosis (SAMMPRIS) trial, which demonstrated that stenting had higher risk for 30-day and long-term stroke and death than aggressive medical therapy in patients with severe ICAS [4,5]. However, this trial was performed in Caucasians [4]. Asians have more ICAS, and more diffuse lesions, whether the SAMMPRIS result validate in Chinese patients, also needs further investigation.

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\* Corresponding author at: Department of Neurology, Jinling Hospital, Nanjing University School of Medicine, Nanjing, China.

E-mail address: [xfliu2@vip.163.com](mailto:xfliu2@vip.163.com) (X. Liu).

In China, multicenter registry and long-term outcomes on stenting in ICAS are lacking. We aimed to illustrate the technical success, periprocedural complications, and long-term clinical outcomes for stenting of ICAS based on a multicenter China interventional stroke registry (CISR).

The CISR study is a prospective, multi-center, and observational study. The detail of the study design was published previously [6]. Our previous study has reported MCA data [7], and for this manuscript, we extracted data of patients undergoing angioplasty and stenting in all atherosclerotic intracranial large arteries (C2–C7 segment of internal cerebral artery [ICA], middle cerebral artery (MCA), V4 segment of vertebral artery [VA] and basilar artery [BA]). The authors of this manuscript have certified that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology. The details of medical therapy, clinical outcomes and follow-up were described in supplemental data.

Three hundred seventy-six patients with 387 intracranial stenoses being treated were included in our study. Procedures were performed at a median (interquartile range) of 20 (11–57) days from the index ischemic events. Table S1 shows the baseline characteristics of these patients. Table S2 summarizes the pre- and post-procedure parameters of the intracranial stenosis. The two most commonly used stents were Apollo and Wingspan, accounting for 45.7% and 20.4%, respectively.

Among 387 procedures, 2 patients could not be placed stents and 9 patients had residual stenosis which yielded a technical success rate of 97.2%. Table 1 listed the periprocedural events. The frequency of stroke or death within 30 days was 7.8% (30/387). The results of risk factor control, restenosis and subgroup analyses were presented in the supplemental data.

Thirty-three patients lost follow-up, 27 of them rejected follow-up, other 6 patients can't be contacted through telephone, the corresponding lost follow-up procedures were 33. Follow-up rate was 91.5% (354/387). With a median follow-up duration of 12 months (range: 1–105 months), 11 patients with 11 procedures had ipsilateral recurrent stroke or death beyond 30 days, and the frequency of stroke or death

**Table 1**  
Major neurologic events within 30 days.

Events	Number N = 30
Non-fatal ischemic stroke	17 (56.7%)
In territory of stented artery	13 (43.3%)
Out of territory of stented artery	4 (13.3%)
Non-fatal SAH	3 (10.0%)
Non-fatal ICH	1 (0.3%)
Death	9 (3.0%)
ICH	6 (2.0%)
SAH	3 (1.0%)

SAH, subarachnoid hemorrhage; ICH, intracerebral hemorrhage.

within 30 days or ipsilateral stroke beyond 30 days was 11.6% (41/354). Multivariate Cox regression analysis revealed that both NIHSS at discharge (HR 1.060, 95% CI: 1.018–1.104  $P = 0.004$ ) and diffuse lesions (HR 2.276, 95% CI: 1.202–4.308,  $P = 0.012$ ) were independent predictors for any stroke or death within 30 days and ipsilateral stroke beyond 30 days.

Previous intracranial registries using Wingspan stent [8,9] and clinical trials [4,10,11] on ICAS have shown that the periprocedural stroke or death rate was 6.1%–9.6% with technical success rate 90%–99%. As compared with previous studies, the technical success rate in our registry was also high, the periprocedural stroke or death rate was within the range. However, in the subgroup analyses, the periprocedural rate in patients with Wingspan stents and severe stenosis was also significantly lower than that of the SAMMPRIS trial, which may be explained by the following points: first, the SAMMPRIS trial included all symptomatic patients with symptoms <30 days, whereas in our study, among 64 patients with severe stenosis and Wingspan stents, only 28 patients had symptoms <30 days, the high proportion of recent symptomatic patients in the SAMMPRIS trial may be an important factor for the high periprocedural events rate; second, the higher proportion of vascular risk factors (hypertension, hyperlipidemia, and diabetes mellitus) in the SAMMPRIS trial may be another reason; and third, the rigorous protocol for evaluating events in the SAMMPRIS trial (i.e., evaluation of all potential end points by neurologists, the adjudication process, and site monitoring visits) could have resulted in the detection of some milder strokes that may not have been detected in our registry.

With respect to the predictors for long-term outcomes, the NIHSS score at discharge and diffuse lesions were two independent predictors. The NIHSS score was used to evaluate the stroke severity and a low NIHSS score at discharge may be a biomarker for a good outcome of angioplasty and stenting. Diffuse lesion is a reflection of atherosclerotic burden in cerebral arteries, the prevalence of diffuse lesions in our study reached as high as 39%, and 15% (58/376) of patients had stenting in at least two arteries, which possibly increased the complexity of

procedure and the periprocedural risk as well as the stroke or death in the long-term.

Our study revealed that relatively low periprocedural events rate and long-term clinical outcomes in ICAS stenting in Chinese patients, and the predictors may help patient selection for further randomized control trials in intracranial artery stenting in China.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.ijcard.2014.10.081>.

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