SVN Stroke & Vascular Neurology

Mass effect, aneurysms and flow diverters: Is the pipeline embolization device the Lone Virtuoso? Commentary on 'Pipeline embolization device for intracranial aneurysms presenting with mass effect: a large Chinese cohort' by Zhao *et al*

Alexander Sirakov,[1,2] Georgi Vladev,[1] Kristina Sirakova,[2] Kristian Ninov,[2] Krasimir Minkin,[2] Vasil Karakostov,[2] Stanimir Sirakov [1,2]

To cite: Sirakov A, Vladev G, Sirakova K, *et al*. Mass effect, aneurysms and flow diverters: Is the pipeline embolization device the Lone Virtuoso? Commentary on 'Pipeline embolization device for intracranial aneurysms presenting with mass effect: a large Chinese cohort' by Zhao *et al*. *Stroke & Vascular Neurology* 2024;**9**: e002783. doi:10.1136/svn-2023-002783

Received 16 August 2023
Accepted 17 August 2023
Published Online First 28 August 2023

[1]Interventional Radiology, University Hospital St Ivan Rilski, Sofia, Bulgaria
[2]Medical University of Sofia, Sofia, Bulgaria

Correspondence to
Dr Stanimir Sirakov; ssirakov@bsunivers.com

In the treatment of symptomatic intracranial aneurysms, the study by Zhao *et al* stands as a notable addition to the growing body of literature.[1] Their investigation regarding the Pipeline Embolisation Device's (PED, Covidien/Medtronic, Irvine, California, USA) efficacy in alleviating mass effect offers valuable insights that further contribute to the evolving landscape of neurointerventional therapy. We applaud the authors for their dedicated efforts in tackling an essential facet of aneurysm management. Engaging with studies involving extensive cohorts is always enlightening, as they ignite discussions and open avenues for fresh research opportunities.

The research findings reaffirm the reign of the 'good old' PED in the realm of flow diversion therapy. Notably, the study showcases an impressive mass effect relief rate of 71.6% among patients treated with PED. This article highlights the practicality and validity of the well-known flow diverter (FD) in ameliorating the often debilitating symptoms caused by aneurysmal mass effect. While the potential for symptom alleviation was already hinted at in many previous studies, this large-scale, multicentre investigation lends further weight to the utility of PED in real-world clinical settings.[2]

What is a commentary without a hint of critical analysis? Discerning the specific symptoms that flow diversion therapy aims to alleviate is crucial. A substantial number of the analysed aneurysms in this study come to light incidentally during imaging for what appear to be unrelated concerns, often presenting with common complaints such as nausea and vomiting. However, it remains uncertain whether the multimodal imaging of these patients has demonstrated any parenchymal damage, oedematous changes, gliosis or contrast enhancement. Could this introduce a source of methodological or selection bias?

On the other end of the spectrum, ruptured intracranial aneurysms present themselves as a reactive challenge, and their therapy could be described as salvaging what is left undamaged. Treatment of symptomatic aneurysms is the pinnacle in the endovascular practice. It stands as a middle ground between the two scenarios above. In these cases, we are not left wondering what would the clinical course be—focal symptoms tend to progress and hamper the quality of life in a non-insignificant way.

Speaking of flow diversion therapy, it is worth acknowledging the historical significance of the PED. Often considered one of the pioneering flow diverters, PED has traversed the journey from conceptual innovation to the stent commonly regarded as the most frequently employed in clinical settings. The Buenos Aires experience, as described by Lylyk *et al*., marked a pivotal moment that sparked a wave of research into the potential of this device.[3] Over the years, PED has evolved—modifications after modifications, surface coatings, but still standing as a testament to the progress achieved in neurointerventional techniques.

However, it is prudent to acknowledge that the landscape of flow diverters is no longer solely defined by PED. The market now boasts

a plethora of devices, each with its own tiny but unique attributes, advantages and disadvantages.[4] While advertised as slightly diverse, these devices share the common goal of flow modulation and biological vessel reconstruction. In light of this, it becomes essential to consider that the effectiveness of mass effect relief may not be exclusive to PED. Frankly, all other flow diverters would also achieve comparable results. As we mark PED's success, as documented in the study by Zhao *et al*, it is crucial to recognise the collective advancement of flow diversion therapy in general.[1]

An intriguing facet of aneurysm volume reduction lies in the interplay between device mechanisms and biological processes that allow the endothelial cells to seal and cure the aneurysm. While the current study underscores the success of PED in alleviating mass effects, it reminds us to reflect on the role of the body's physiological response. Thrombotic transformation, fibrous tissue reorganisation and retraction, a fundamental biological process, are pivotal in the phenomenon behind aneurysm shrinkage. This process is not dictated by the 'brand' of the stent but rather by the intrinsic physiological response triggered by the metallic scaffold. Not too far back, braided stents earned a humorous moniker as 'semi-flow diverters', attributed to their potential to emulate the effects of FDs in smaller vessels.[5] Many authors even promoted them as the workhorses of coil-assisted aneurysm embolisation. Yet, let us stay grounded in the reality that the volume reduction effect is a common thread among all flow diverters, even if it is a tough pill to swallow. As we applaud the success of PED, it is essential to acknowledge that the body's biological dynamics are fundamental drivers of therapeutic outcomes.

It is indeed a valid inquiry, encouraging us to consider the broader implications of such affirmations. While the biological basis for aneurysm shrinkage more or less mirrors the body's wound-healing mechanisms, this study stands as a testament to the collective impact of the neurointerventional community. It highlights the ongoing research and the incremental steps taken to consolidate our understanding of these therapies.

As we orbit the unexplored trajectory of neurointerventional care, the study by Zhao *et al* shines a light on a crucial aspect: the prevention of post-treatment aneurysm enlargement.[1] The issue of post-treatment enlargement and clinical worsening affects nearly 30% of cases, warranting attention and collaborative response. The study paves the way for a crucial shift in focus from competition among devices to formulating comprehensive post-treatment protocols. Applying patient-tailored medical protocols, including corticosteroids, non-steroidal anti-inflammatory drugs and anticoagulants, emerges as a potential avenue to mitigate post-treatment enlargement, often fatal delayed aneurysmal ruptures and bolster therapeutic outcomes.[6]

In conclusion, the study by Zhao *et al* signifies a valuable addition to the readers of the *SVN* journal.[1] The efficacy of PED in alleviating mass effects serves as a testament but a reminder of the potential of the FDs in general, as we must also acknowledge the shared evolution of flow diversion therapy as a whole. The study serves as a reminder for readers to resist the allure of marketing and maintain a strict scientific approach. It prompts us to acknowledge the bond between the device and biological responses while highlighting the significance of collaborative endeavours in enhancing post-treatment protocols. Through such holistic approaches, we continue advancing the field and ensuring optimal care.

X Stanimir Sirakov @SirakovStanimir

Contributors AS and GV: writing the original draft. KS, KN and KM: conceptualisation. SS and VK: final review and approval.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; internally peer reviewed.

ORCID iD

Stanimir Sirakov http://orcid.org/0000-0001-6034-5340

REFERENCES

1 Zhao Y, Lu J, Zhang H, *et al*. Pipeline Embolization device for intracranial aneurysms presenting with mass effect: a large Chinese cohort. *Stroke Vasc Neurol* 2023:svn-2022-002213.
2 Szikora I, Marosfoi M, Salomváry B, *et al*. Resolution of mass effect and compression symptoms following Endoluminal flow diversion for the treatment of intracranial aneurysms. *AJNR Am J Neuroradiol* 2013;34:935–9.
3 Lylyk P, Miranda C, Ceratto R, *et al*. Curative Endovascular reconstruction of cerebral aneurysms with the pipeline Embolization device: the Buenos Aires experience. *Neurosurgery* 2009;64:632–42.
4 Dandapat S, Mendez-Ruiz A, Martínez-Galdámez M, *et al*. Review of current intracranial aneurysm flow diversion technology and clinical use. *J NeuroIntervent Surg* 2021;13:54–62.
5 Aydin K, Barburoglu M, Sencer S, *et al*. Flow diversion with low-profile braided Stents for the treatment of very small or Uncoilable intracranial aneurysms at or distal to the circle of Willis. *AJNR Am J Neuroradiol* 2017;38:2131–7.
6 Sirakova K, Penkov M, Matanov S, *et al*. Progressive volume reduction and long-term aneurysmal collapse following flow diversion treatment of giant and symptomatic cerebral aneurysms. *Front Neurol* 2022;13:972599.