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Corresponding author(s): Zhenhua Zhou, Wen Zeng

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Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our Editorial Policies and the Editorial Policy Checklist.

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed
☐	☒ The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☒	☐ A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒ The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☐	☒ A description of all covariates tested
☐	☒ A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒ A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☒ For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐ For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐ For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐ Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	Illumina NovaSeq 6000 (Berry Genomics Corporation, Beijing, China) was used for bulk RNA sequencing.
Data analysis	ZEN2 Viewer、ImageJ(win64)、SPSS(ver 26), clusterProfiler, origin 2021, FlowJo_v10.8.1、Kuant analysis software

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our policy

Source data are provided with this paper. All RNA-sequencing data has been uploaded into the GEO database under accession code GSE254810.

Research involving human participants, their data, or biological material

Policy information about studies with human participants or human data. See also policy information about sex, gender (identity/presentation), and sexual orientation and race, ethnicity and racism.

Reporting on sex and gender	A total of 10 thrombi from AIS patients (30%male; 70%female) were analyzed in this study. Gender information is available in Supplementary Data1.
Reporting on race, ethnicity, or other socially relevant groupings	Asian. To rule out the effect of heterogeneity among clinical thrombus samples, the thrombi were evenly divided into four groups according to the treatments to which they were subjected.
Population characteristics	We included 10 patients who fulfill the following criteria: (1) clinical indication for mechanical thrombectomy of acutelarge-vessel occlusion and (2) successfully retrieved thrombi for histological analysis. The clinical characteristics are shown in Supplementary Data 1
Recruitment	Participants are patients with AIS from Southwest Hospitalal, Third Military Medical University, who underwent thrombectomy. Participating in this study will provide the patients with a free blood routine and coagulation function test.
Ethics oversight	The study was approved by the Ethics Committee of the First Affiliated Hospital of Army Medical University [(A) KY2021023]. Written informed consents were obtained from the patients. No compensation was given.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	All the sample sizes used for statistical analysis were at least 3, which met the statistical requirements. Most of our in vivo experiments were n=7-8.
Data exclusions	No animals or samples were excluded from the analysis.
Replication	In order to improve the repeatability of experimental results, we try to ensure that the conditions of each operation are the same, such as time control, quantitative tools using the same company's products, using the same instrument to collect images, and animal weight or age requirements when carrying out animal experiments. It should be noted that for animal therapy, the patency rate of the four groups per repetition has the same trend, but it is not guaranteed that the recurrence rate is exactly the same each time. We analyzed that the possible reason is the individual differences of rats, whose sensitivity to ferric chloride is different, which leads to the different degree of blood vessel blockage during thrombus induction or the difference between the components of blood clots, and then affects the targeting efficiency of nanomaterials and the final vascular recirculation rate.
Randomization	The samples or animals were random allocated into experimental group.
Blinding	The investigators were blinded to group allocation during data collection.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☐	☒ Antibodies
☐	☒ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☐	☒ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Antibodies

Antibodies used: mouse anti-MPO (1:100, Proteintech, 66177-1)?rabbit anti-histone H4 (citrulline 3) (1:200, Millipore, 3517971), rabbit anti-N epsilon gamma glutamyl Lysine antibody (1:200, abcam, ab424), and mouse anti-fibrinogen (1:100, abcam, ab34269), SytoxGreen (1:10, Beyotime, C1070S), Hoechst 33342 (1:10000, Beyotime, C1028), rabbit anti-CD31(1:100, abcam, ab281583), mouse anti-α-SMA (1?200?Boster?BM0002)? rabbit anti-ZO-1 (1:200?Proteintech?21773-1-AP) , rabbit anti-eNOS (1:50, abcam, ab300071) and anti-mouse/rat CD62P-PE (1:30, BioLegend, 148305)

Validation: All antibodies are commercially available. Specific validation information and usage information can be found on their respective websites: https://www.ptgcn.com/?https://www.sigmaaldrich.cn/CN/zh/life-science/millipore?https://www.abcam.com/;https://www.biolegend.com/en-gb

Eukaryotic cell lines

Policy information about cell lines and Sex and Gender in Research

Cell line source(s): Red blood cells (RBCs) were obtained from fresh blood of male rats by centrifugation at 3000 rpm for 10 min; Peripheral neutrophils were isolated from the whole blood of male rats using a separation kit; The human umbilical vein endothelial cells (HUVECs) were used after several passages from the primary cell line purchased by the company (https://www.rjmart.cn/#/detail?productId=200244627521&suppId=47&source=2).

Authentication: Neutrophils were authenticated by Diff-Quik Staining. Red blood cells and HUVECs were not authenticated.

Mycoplasma contamination: HUVECs was tested negative for mycoplasma by the supplier at the time of purchase. The other cell lines were not tested for mycoplasma contamination.

Commonly misidentified lines (See ICLAC register): Not involved.

Animals and other research organisms

Policy information about studies involving animals; ARRIVE guidelines recommended for reporting animal research, and Sex and Gender in Research

Laboratory animals: SPF-grade SD rats aged 6-8 weeks approximately 200 g?Domestic pigs weighing 60-80 kg

Wild animals: The study did not involve wild animals.

Reporting on sex: To better control variables, SPF-grade SD male rats aged 6-8 weeks and male domestic pigs weighing 60-80 kg were purchased from the experimental animal center of the Third Military Medical University (license No. scxk (Yu) 2017-0002).

Field-collected samples: All rats were raised in SPF animal room with 12h light/dark cycle and provided ad libitum access to a standard rodent diet (Jiangsu Xietong Pharmaceutical Bio-engineering Co., Ltd, 1010088).
All pigs were raised in single cage under conditions of 22 °C, 40-50% humidity with a 12h light/dark cycle and had free access to water and food.
Pentobarbital sodium (100-200 mg/kg) was given for euthanasia in all animals.

Ethics oversight: All animal experiments were approved by the animal ethics committee of the Third Military Medical University (approval No.SYXK(Yu) 20170002 approval time: 2020.4.20).

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Plants

Seed stocks	*Report on the source of all seed stocks or other plant material used. If applicable, state the seed stock centre and catalogue number. If plant specimens were collected from the field, describe the collection location, date and sampling procedures.*
Novel plant genotypes	*Describe the methods by which all novel plant genotypes were produced. This includes those generated by transgenic approaches, gene editing, chemical/radiation-based mutagenesis and hybridization. For transgenic lines, describe the transformation method, the number of independent lines analyzed and the generation upon which experiments were performed. For gene-edited lines, describe the editor used, the endogenous sequence targeted for editing, the targeting guide RNA sequence (if applicable) and how the editor was applied.*
Authentication	*Describe any authentication procedures for each seed stock used or novel genotype generated. Describe any experiments used to assess the effect of a mutation and, where applicable, how potential secondary effects (e.g. second site T-DNA insertions, mosiacism, off-target gene editing) were examined.*