

Experimental murine arteriovenous fistula model to study restenosis after transluminal angioplasty

Chuanqi Cai^{1,2}, Chenglei Zhao^{2,3}, Sreenivasulu Kilari², Amit Sharma², Singh Avishek K², Simeon Michael L², Avanish Misra², Yiqing Li¹ and Sanjay Misra^{2,4,5}

¹Department of Vascular Surgery, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

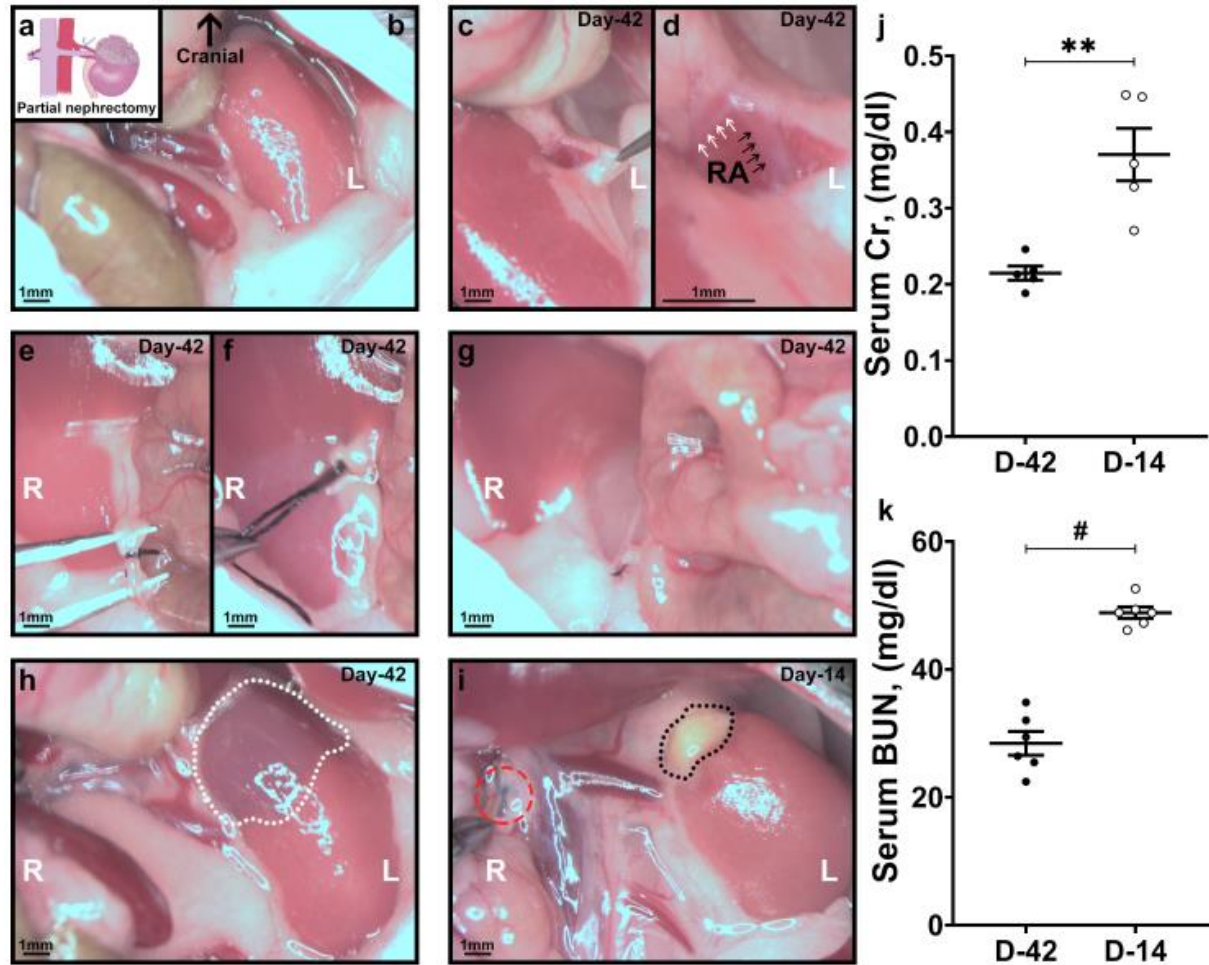
²Vascular and Interventional Radiology Translational Laboratory, Department of Radiology, Mayo Clinic, Rochester, MN, USA

³Department of Vascular Surgery, The Second Xiangya Hospital, Central South University, Changsha, Hunan, China

⁴Department of Biochemistry and Molecular Biology, Mayo Clinic, Rochester, MN, USA

⁵Department of Radiology, Vascular and Interventional Radiology, Mayo Clinic Rochester, MN, USA.

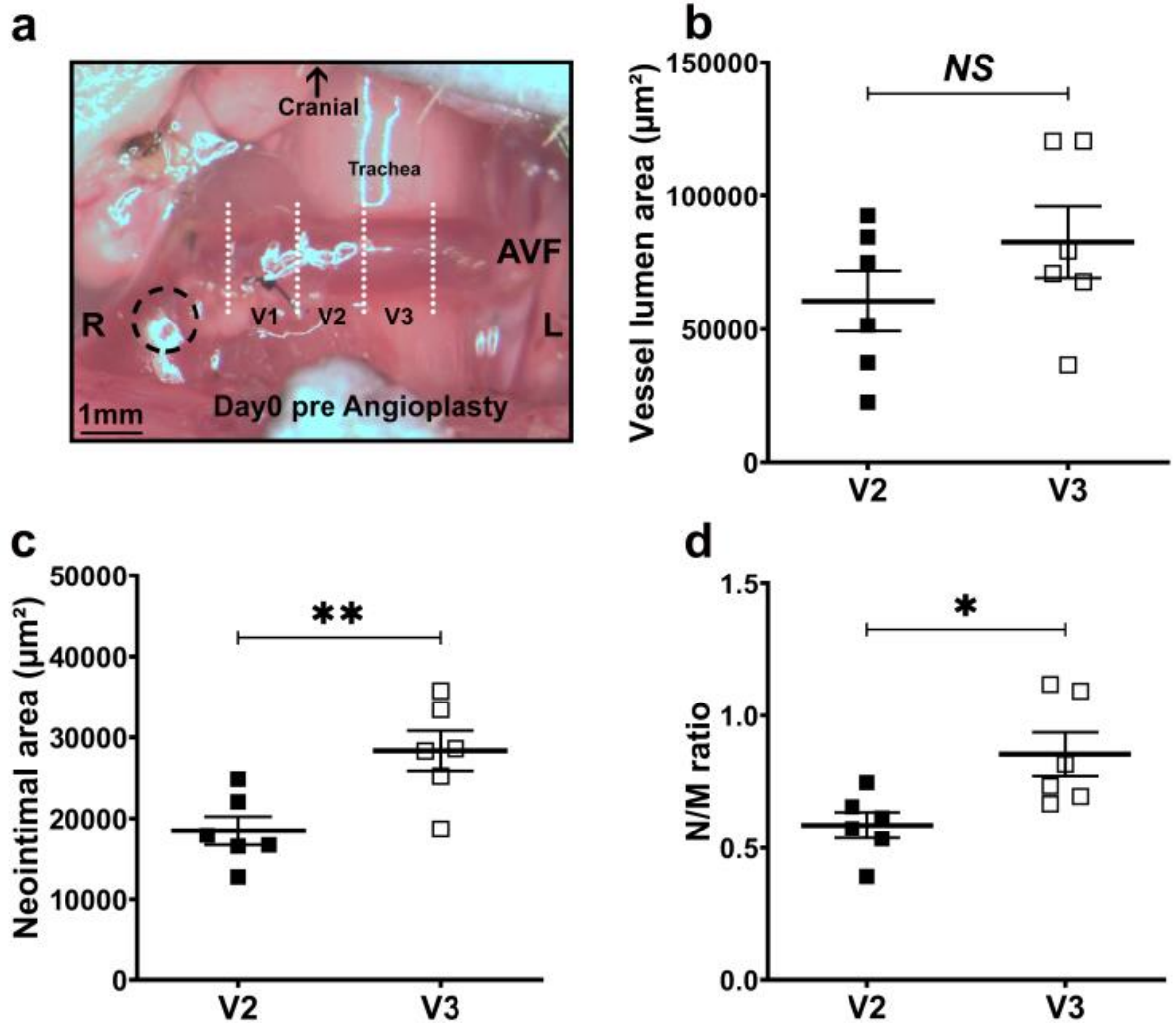
*email: misra.sanjay@mayo.edu



Supplementary Figure 1| Partial nephrectomy surgery for chronic kidney disease.

a, Schematic of partial nephrectomy surgery for chronic kidney disease model. **b**, Normal kidney before partial nephrectomy surgery. (**c-d**) Flip and dissect left common renal artery. Ligate left upper branch renal artery (white arrow). (**e-f**) Ligate right ureter and renal portal vessels. **g**, Remove the whole right kidney. **h**, Obvious ischemia can be seen in the upper pole of left kidney after arterial ligation. **i**, Four weeks after partial nephrectomy surgery, necrosis can be seen in the upper pole of left kidney. **j**, At day-14 there is significant increase in serum Cr compared to D-42 baseline ($P=0.0024$); **k**, as well as a significant increase in serum BUN ($P<0.0001$). Each scatter bar represents the mean \pm SEM of 5-6 animals. Unpaired t test was performed by Graph Pad Prism version 8 (GraphPad Software Inc., La Jolla, CA). Significant differences are indicated $*p<0.05$, $**p<0.01$, $***p<0.001$, $\#p<0.0001$. White arrow indicates the upper branch renal artery; black arrow indicates the lower branch renal artery; white dashed line indicates the ischemia in the upper pole of left kidney after partial nephrectomy; black dashed line indicated necrosis four weeks after surgery; red dashed circle indicates the ligation of right renal portal area. BUN: blood urea

nitrogen; Cr: creatinine; R, right side; L, left side; RA, renal artery. Scale bar is 1mm.



Supplementary Figure 2| Heterogeneity of this novel AVF model.

a, Representative AVF vessel at day 0 before angioplasty procedure. V1 segment is near the angioplasty puncture site (dashed circle), and angioplasty treatment mainly affects the V2 and V3 segments. To reduce the heterogeneity we analyzed the V2 segment for each mouse. **b**, At day 0 before angioplasty procedure, no significant difference is observed in the vessel lumen area ($P=0.2373$) between the V1 and V2 segments. **(c-d)** At day 0 before angioplasty procedure, neointimal area ($P=0.0088$) and N/M ratio ($P=0.0189$) are decreased in V2 segment compared to V3 segment, respectively. Each scatter bar represents the mean \pm SEM of 6 animals. Unpaired t test was performed by Graph Pad Prism version 8 (GraphPad Software Inc., La Jolla, CA). Significant differences are indicated * $p<0.05$, ** $p<0.01$, *** $p<0.001$. R, right side; L, left side; AVF, arteriovenous fistula; dashed circle indicates the angioplasty puncture point closed to V1 segment. Scale bar is 1mm.

Supplementary Video 1

Technique for AVF creation by anastomosing the end of the right external jugular vein to the side of the left common carotid artery in a mouse. All animal experiments were approved by the Institutional Animal Care and Use Committee of Mayo Clinic.

Supplementary Video 2

Technique for the angioplasty procedure in a stenotic arterialized external jugular vein using a 1.25 mm × 6 mm coronary artery balloon catheter in a mouse. All animal experiments were approved by the Institutional Animal Care and Use Committee of Mayo Clinic.