Supplement Methods.

Graft decellularization. Until use, decellularized donor grafts were stored in phosphate-buffered saline-buffer (PBS) (0.1 M) at pH 7.4 at -70° C.

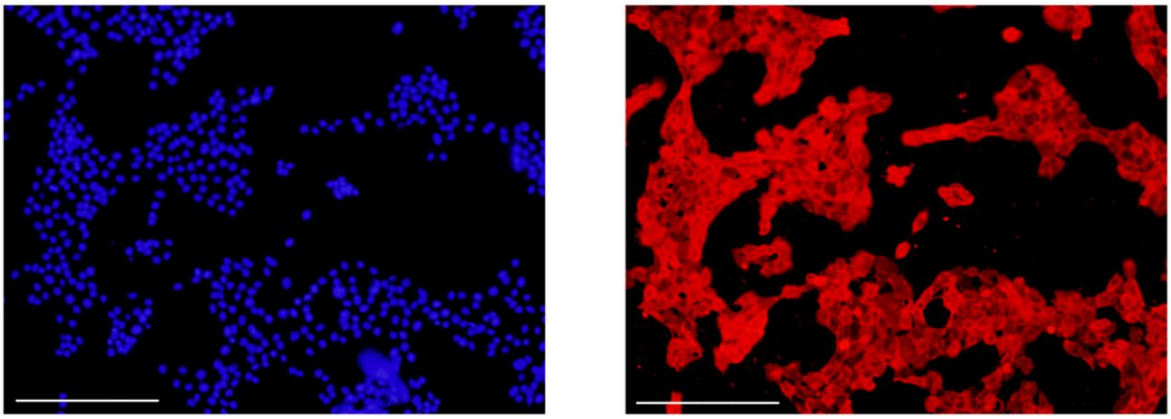
Anesthesia protocol. Briefly, anesthesia was induced using a balanced approach with fentanyl, medetomidine and midazolam. Anesthetic depth was checked and considered adequate for surgery by the absence of the pedal withdrawal reflex. At the end of surgery, anesthesia was reversed with a subcutaneous (SC) injection mixture of buprenorphine 0.05 mg/kg (Indivior, Switzerland), atipamezol 0.75 mg/kg (Arovet AG, Switzerland), and flumazenil 0.2 mg/kg (Labatec-Pharma, Switzerland). In the immediate postoperative phase, each animal was housed in a single cage for protection and then regrouped after 24 hours. Postsurgical, meloxicam 1 mg/kg (Boehringer Ingelheim, Switzerland) was administered four times daily SC, starting immediately at the end of surgery to ensure continuous analgesia.

For perianesthetic care, a sterile ophthalmic lubricant (Viscotears gel or Bepanthen ointment) was applied to the eyes, which were then covered with an opaque foil mask to prevent drying and damage from the surgical lamp. Throughout surgery, oxygen was supplied continuously via face mask, body temperature was monitored, and heat provided by a heating pad maintained normothermia (Homeothermic Control Unit, Harvard, Edenbridge, England). Other vital signs continuously monitored were pulse and breath distension, heart and breath rate, and oxygen saturation using MouseOx Plus® via an installed sensor on the right hind leg (Starr Life Sciences Corp., 333 Allegheny Ave, Oakmont, PA 15139, United States).

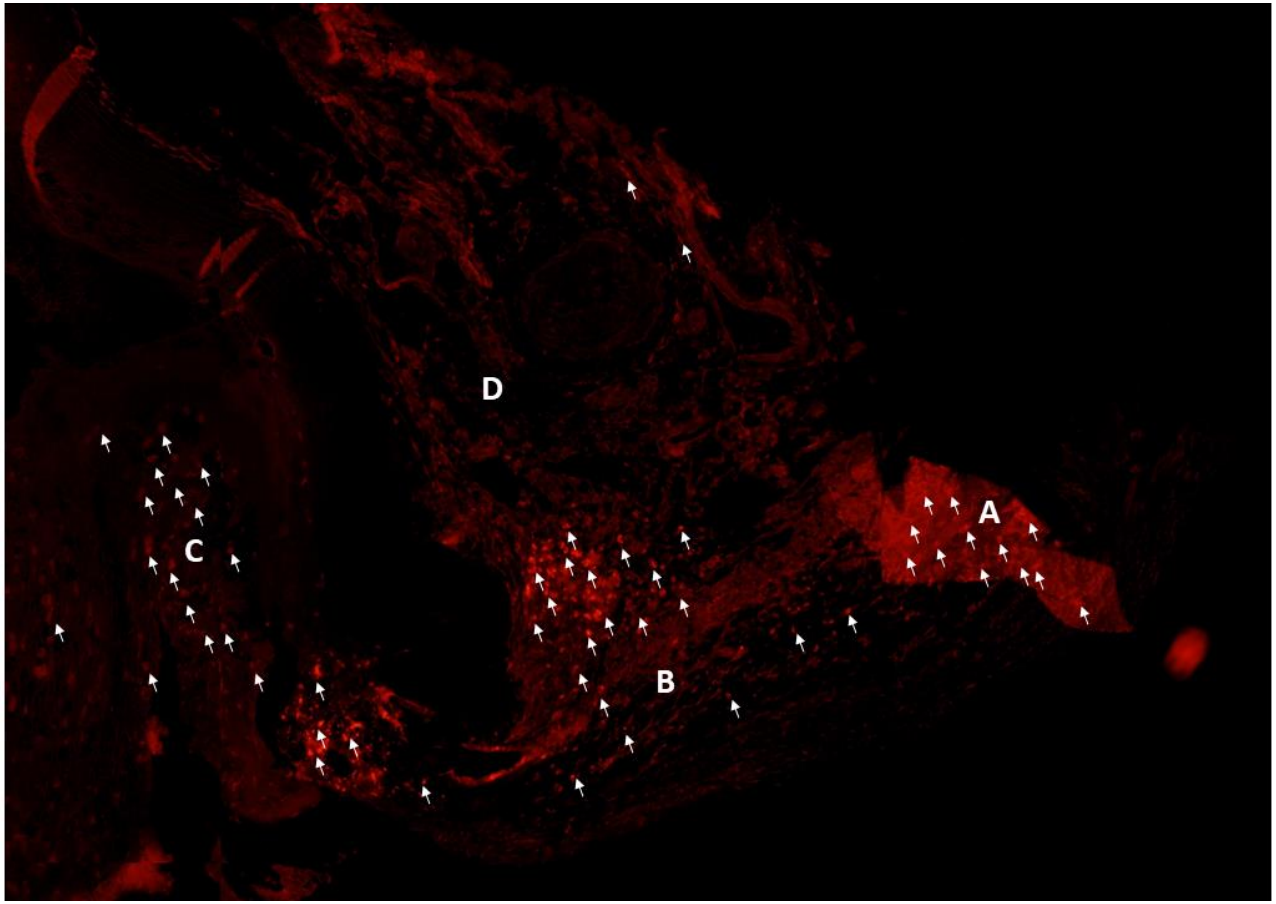
Considering the postoperative analgesia and care, animals recovered in clean cages until fully awake and warmed as needed by a heating lamp. For 3 days, 1 mg/kg meloxicam (one injection or oral application per day) and buprenorphine (0.05 mg/kg four times each day)

were administered SC. Overnight, buprenorphine was continuously provided in the drinking water with the same dosing as 6 ml Temgesic® (buprenorphine 0.3 mg/ml, 360 ml drinking water, 10 ml Glucose 5 %). If any rat showed distressed or aggressive behaviors after SC injection, buprenorphine was given during the day in the drinking water. Soft feed (Emeraid Omnivore) was provided on the cage floor to support feeding and recovery initial postoperatively. All animals were observed and cared for according to the wellbeing and pain score sheet by the scientists, veterinarians, and animal care takers. Rescue analgesia administered SC was 1 mg/kg meloxicam SC and 0.05 mg/kg buprenorphine.

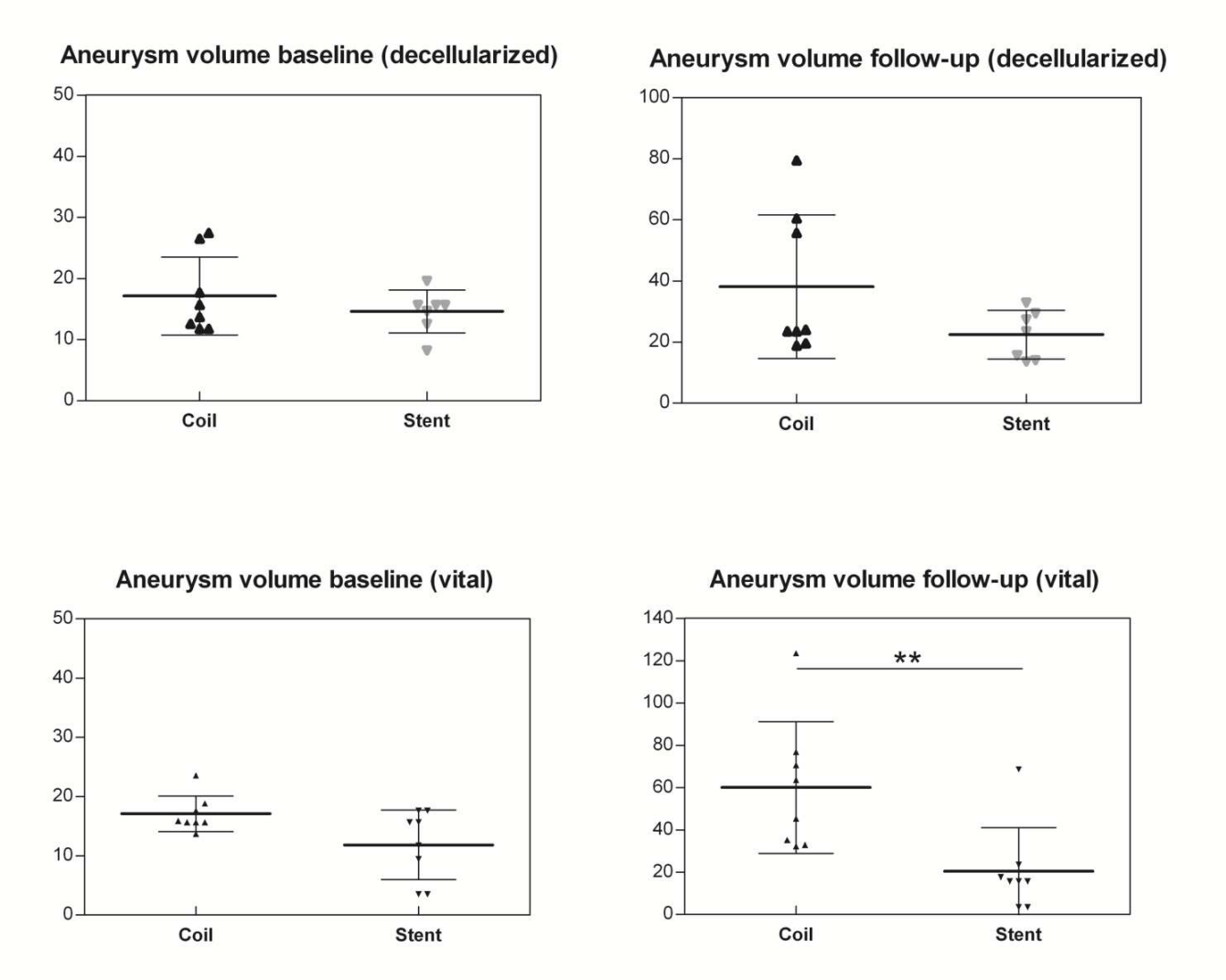
Supplement Figure 1. ***Pretesting of CM-Dil-Dye***. Figure shows rBCEC4 cell-labeled with Cm-Dil-Dye (right) and counterstained with 4', 6'-diamidino-2-phenylindole (left). Initially, cells were plated on 0.1% gelatin-coated glass slides (50k cells/well) in DMEM + 5% FBS. After 48 hours, Cm-Dil-Dye preparation followed with cell incubation. For the working solution, the 50 mcg vial was dissolved in 50 mcl DMSO (1 mg/ml). Concentrations with 1 mcg/ml (0.5 mcl/well) and 2 mcg/ml (1 mcl/well) were tested. Incubation followed for 5 minutes at 37°C, and later for 15 minutes at 4°C. Cells were washed twice with PBS. Day 0 cells (2 mcg/ml), as shown in the line above, were fixed for 20 minutes with 4% PFA, washed with PBS, and mounted with PBS/glycerol (scale bar 100 um).



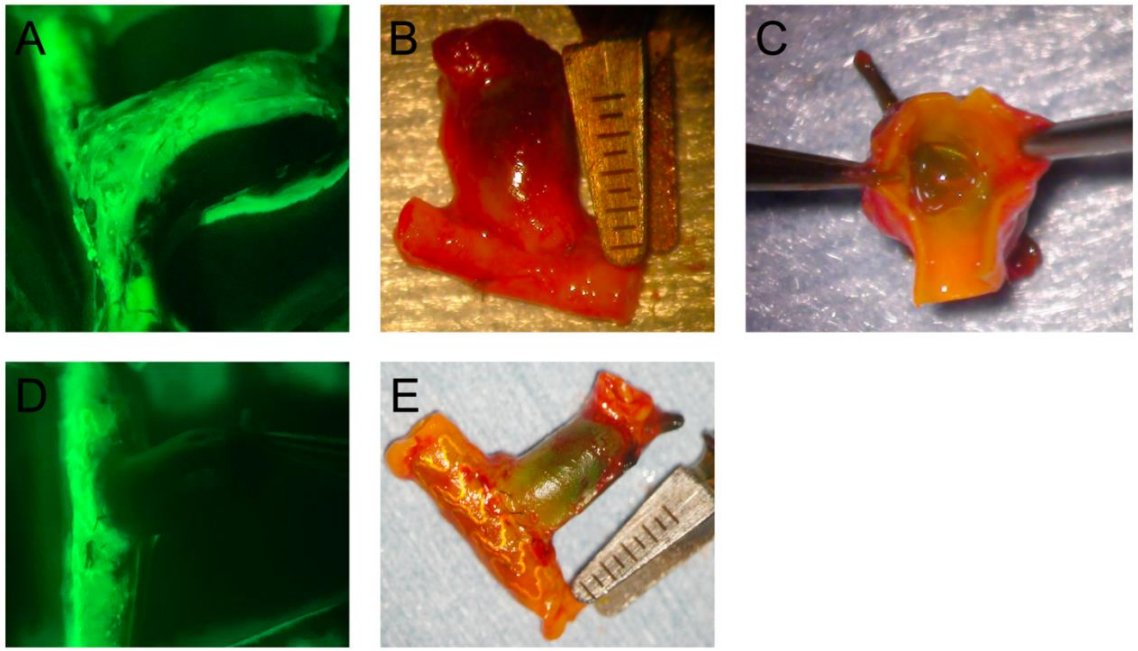
Supplement Figure 2. 2-fold magnification of the aneurysm complex from an animal directly euthanatized after cell-tracer injection, aneurysm suturing and finishing the operation. Please note the homogeneous distribution in (A) the parent artery, (B) neointima, (C) vital aneurysm wall and (D) single cells in the rising thrombus.



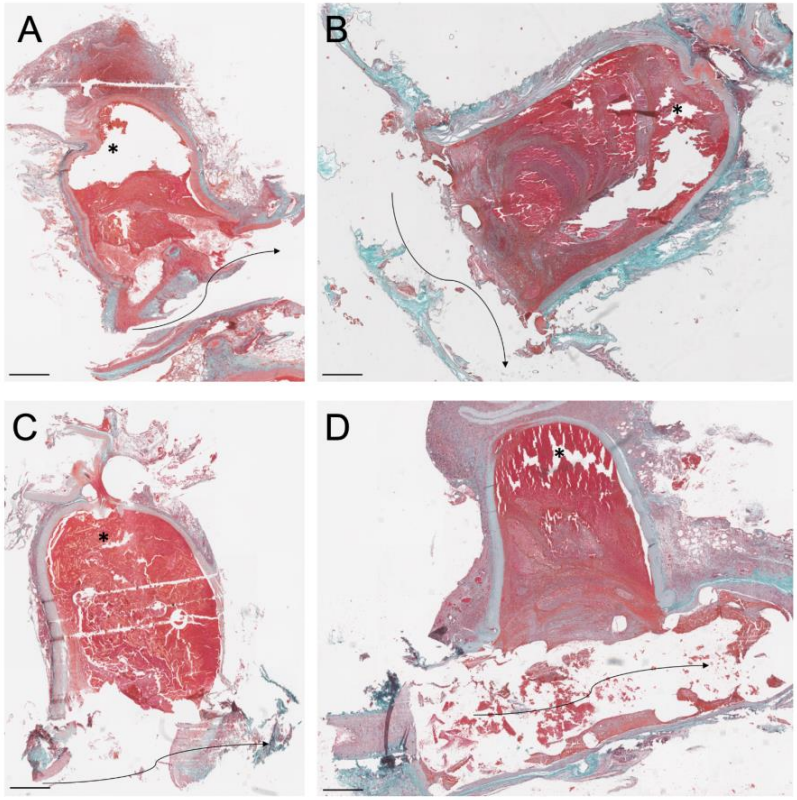
Supplement Figure 3. ***Post-mortem macroscopically measurements.*** Aneurysm volume (mm^3) was documented in each case before implantation (baseline) and at harvest (follow-up). Day 7 and Day 21 data are pooled. ** $p < 0.01$.


Aneurysm volume baseline (decellularized)
50
40
30
20
10
0
Coil
Stent
Aneurysm volume follow-up (decellularized)
100
80
60
40
20
0
Coil
Stent
Aneurysm volume baseline (vital)
50
40
30
20
10
0
Coil
Stent
Aneurysm volume follow-up (vital)
140
120
100
80
60
40
20
0
**
Coil
Stent

Supplement Figure 4. ***Intraoperative and post-mortem macroscopically aspects.*** Figure depicts vital aneurysms sutured on wild-type animals, either coil-treated or stent-embolized at 21-day follow up. Note the intraoperatively performed fluorescence angiography in coil-embolized (images above: A - C) or stent-treated (images below: D - E) rats on the left side. In the middle, the macroscopic situs after aneurysm harvesting is documented, showing incomplete aneurysm healing with reperfusion in the upper and complete thrombus organization in the lower and. Right sided, the aneurysm orifice of an incomplete healed aneurysm after coil-embolization is shown.

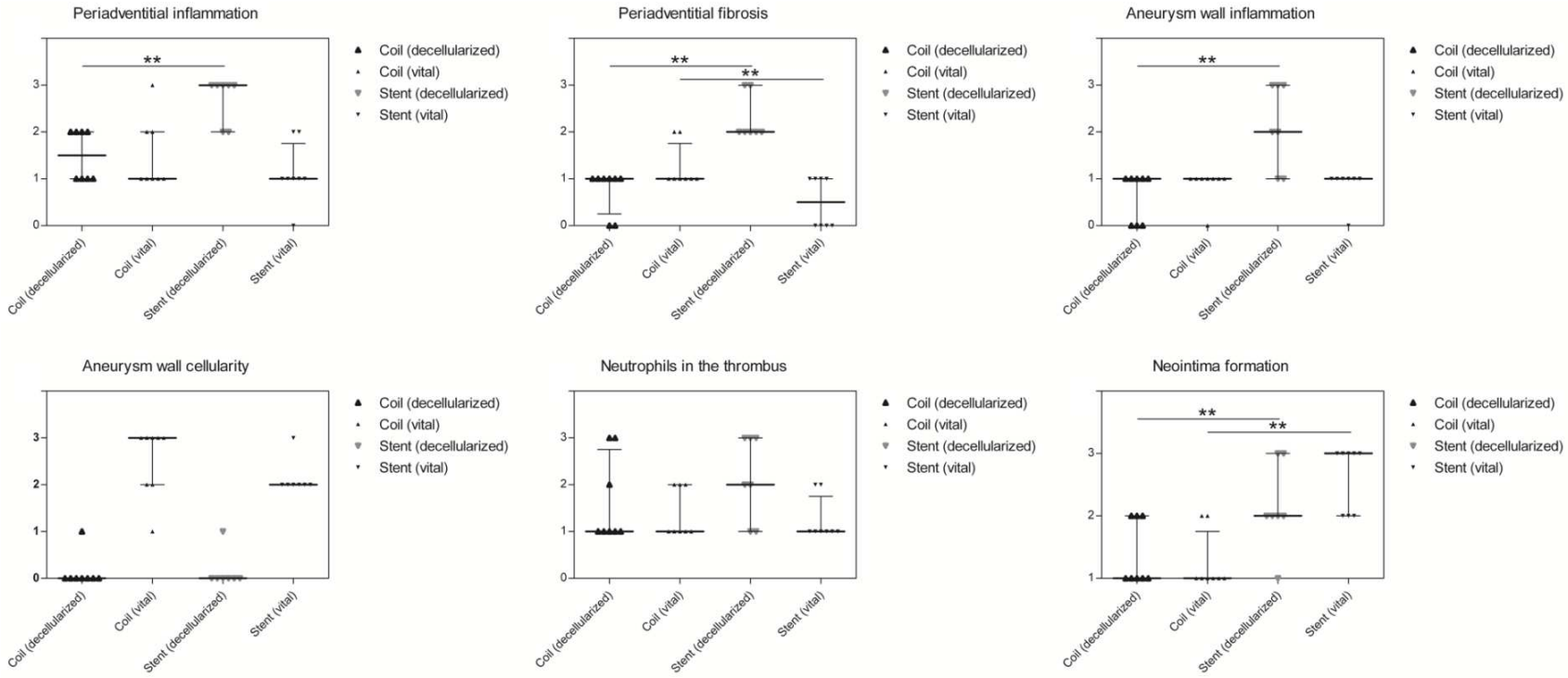


Supplement Figure 5. ***Timely evolution of aneurysm healing.*** Coil treatment on day 7 (A) and day 21 (B). Stent-treatment on day 7 (C) and day 21 (D). * aneurysm dome; arrow, direction of blood flow through the parent artery. Note the histologically confirmed gradually advancing thrombus organization over time and with progressively growing neointima from the periphery of the aneurysm toward the center (scale bar 375 um).

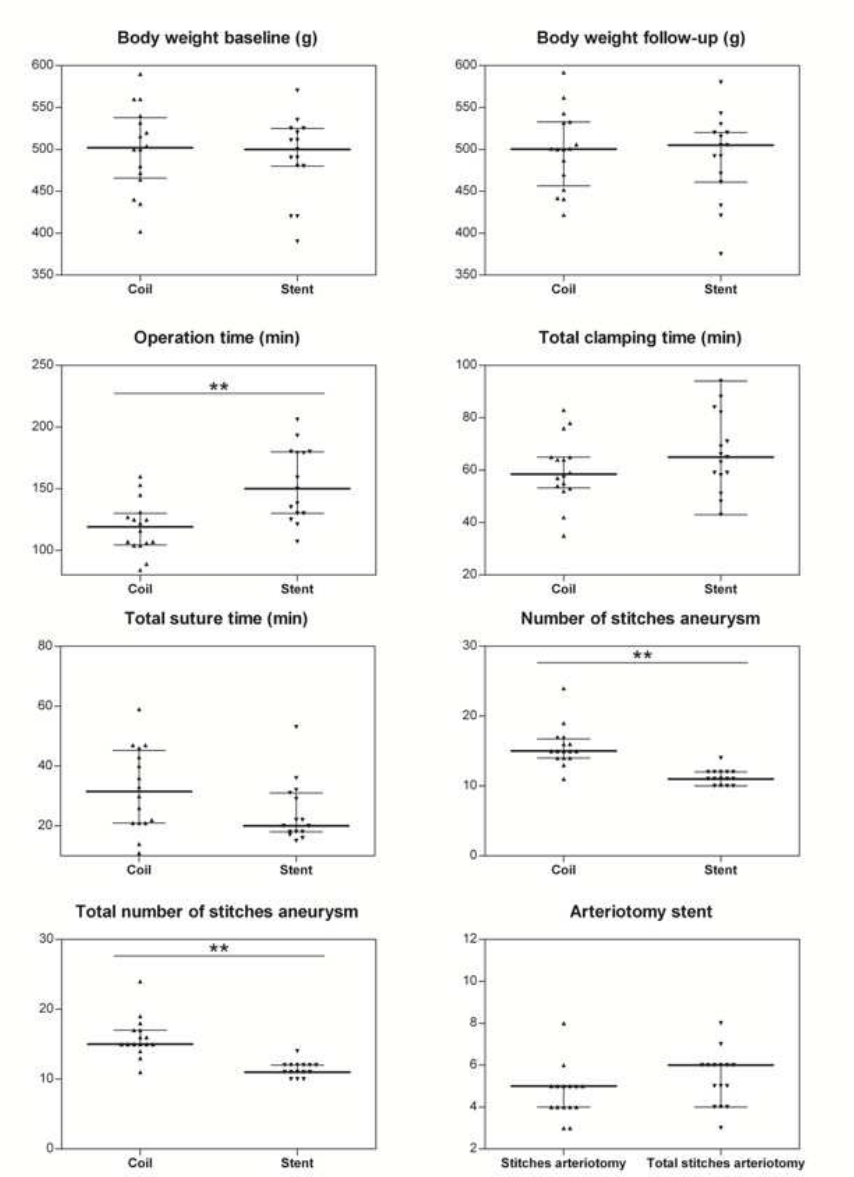


Supplement Figure 6. ***Four Scale Histological Grading System.*** Neointima formation (0 = none, 1 = organizing thrombus, 2 = organizing thrombus and neointima formation, 3 = mature neointima). Neutrophils in the thrombus (0 = none, 1 = mild, 2 = moderate, 3 = severe). Aneurysm wall inflammation (0 = none, 1 = few (1-3 spots), 2 = many (>4 spots), 3 = ubiquitous). Aneurysm wall cellularity (0 = none, 1 = few (1-3 spots), 2 = many (>4 spots), 3 = ubiquitous). Periadventitial inflammation thrombus (0 = none, 1 = mild, 2 = moderate, 3 = severe). Periadventitial fibrosis thrombus (0 = none, 1 = mild, 2 = moderate, 3 = severe). Scores were dichotomized as (none/mild versus moderate/severe and none/organizing thrombus versus organizing thrombus and neointima formation/mature neointima).

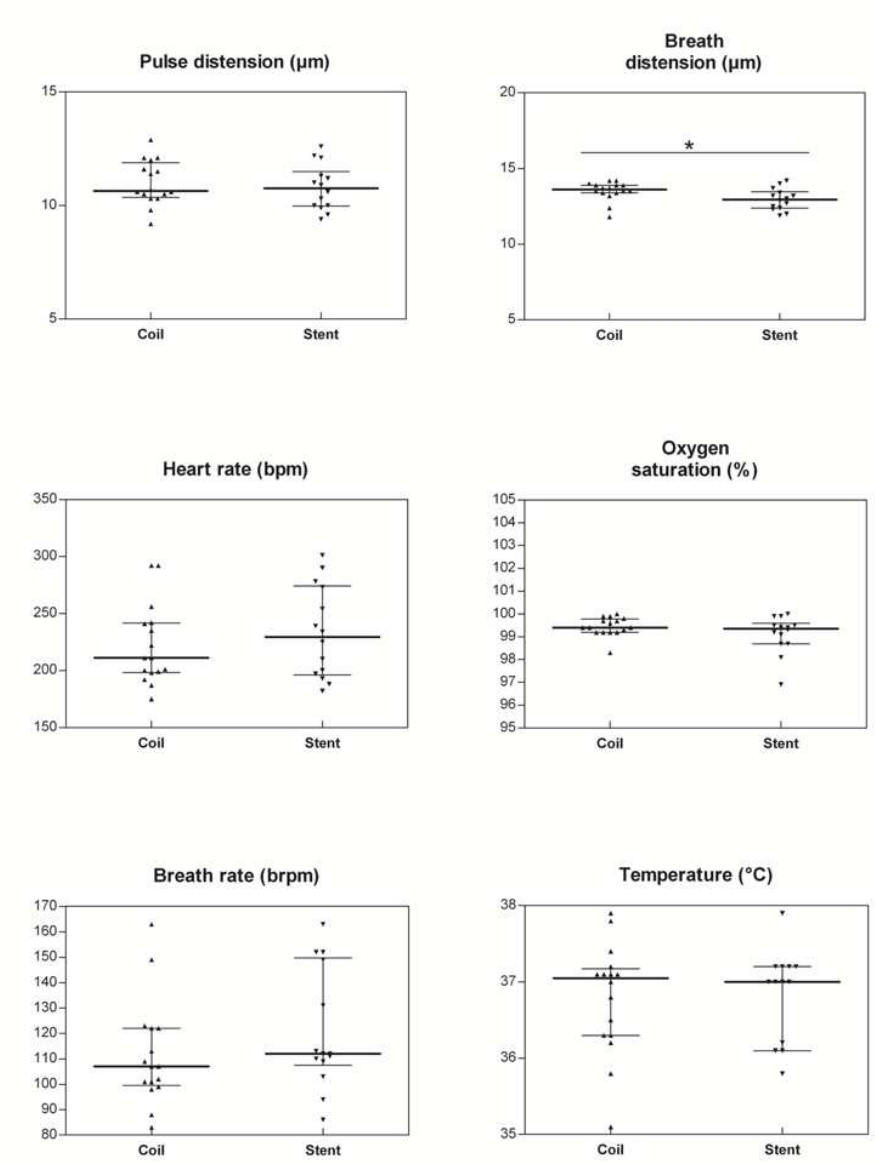
* $p < 0.05$, ** $p < 0.01$.


Periadventitial inflammation
Periadventitial fibrosis
Aneurysm wall inflammation
Aneurysm wall cellularity
Neutrophils in the thrombus
Neointima formation
Coil (decellularized)
Coil (vital)
Stent (decellularized)
Stent (vital)
**

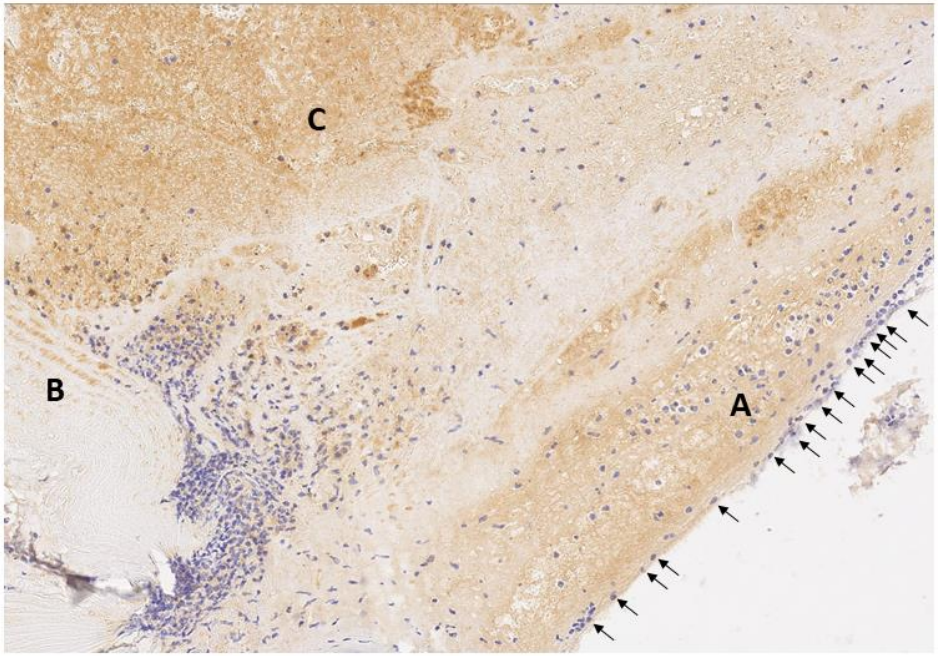
Supplement Figure 7. ***Surgical characteristics***. Characteristics included body weight (gram) and times (minutes) for clamping, operation, and suture. No relevant differences between stent and coil treatment groups occurred related to body weight or key procedural steps. Operative time with stenting lasts longer than without necessitating an additional microsurgical suture at the puncture site. * $p < 0.05$, ** $p < 0.01$.


Body weight baseline (g)
600
550
500
450
400
350
Coil
Stent
Body weight follow-up (g)
600
550
500
450
400
350
Coil
Stent
Operation time (min)
250
200
150
100
**
Coil
Stent
Total clamping time (min)
100
80
60
40
20
Coil
Stent
Total suture time (min)
80
60
40
20
Coil
Stent
Number of stitches aneurysm
30
20
10
0
**
Coil
Stent
Total number of stitches aneurysm
30
20
10
0
**
Coil
Stent
Arteriotomy stent
12
10
8
6
4
2
Stitches arteriotomy
Total stitches arteriotomy

Supplement Figure 8. Baseline variables measured continuously during surgery included pulse distension, breath distension, heart rate, oxygen saturation, breath rate, and temperature. * $p < 0.05$.


Pulse distension (µm)
15
10
5
Coil
Stent
Breath distension (µm)
20
15
10
5
*
Coil
Stent
Heart rate (bpm)
350
300
250
200
150
Coil
Stent
Oxygen saturation (%)
105
104
103
102
101
100
99
98
97
96
95
Coil
Stent
Breath rate (brpm)
170
160
150
140
130
120
110
100
90
80
Coil
Stent
Temperature (°C)
38
37
36
35
Coil
Stent

Supplement Figure 9. **20-fold magnification of a part of the aneurysm complex with F8 staining.** (A) depicts the neointima, arrows the endoluminal layer of the endothelium. (B) shows the decellularized aneurysm wall, and (C) the intraluminal thrombus after 21 days.



Supplement Table 1. ***Aneurysm healing and growth status in recipient male Lewis rats***. Tabular values of 31 aneurysms treated via coil or stent application.

#	Recipient animal	Aneurysm type	Aneurysm Dimensions at Creation			Treatment	Follow-up (days)	Relevant Residual Perfusion	Aneurysm Dimensions at Follow-up		
			Length	Width	Depth				Length	Width	Depth
1	Lewis	Decellularized	3	2.5	2	Coil	7	Yes	5	3	2
2	Lewis	Decellularized	4.5	2.5	3	Coil	7	Yes	5	2.5	2
3	Lewis	Decellularized	4	2	2.5	Coil	21	Yes	4	3	2
4	Lewis	Decellularized	4	2	2	Coil	21	Yes	5.5	4	3.5
5	Lewis	Decellularized	3.5	2.5	2	Coil	21	Yes	5.5	4.3	3
6	Lewis	Decellularized	4	2.5	2	Coil	21	Yes	4	2.5	3
7	Lewis	Decellularized	4.5	2	2.5	Coil	7	Yes	5	4.5	4.5
8	Lewis	Decellularized	3	2.5	2	Coil	7	Yes	3.5	3.5	2.5
9	Lewis	Vital	4	3	2	Coil	7	Yes	7.5	4	3
10	Lewis	Vital	4.5	3	1.5	Coil	7	Yes	4.5	4	2.5

11	Lewis	Decellularized	3.5	1.5	2	Stent	7	No	3.5	2.5	2
12	Lewis	Decellularized	4	2	2.5	Stent	7	No	4	2.5	2
13	Lewis	Decellularized	4	2.5	2.5	Stent	7	No	4	3	2.5
14	Lewis	Decellularized	3.75	2.5	2	Stent	7	No	4	3.5	2.5
15	Lewis	Decellularized	4	2	2	Stent	21	No	5	3	2.5
16	Lewis	Decellularized	4	2.5	2	Stent	21	No	4	3.5	3
17	Lewis	Vital	4	2.5	2	Coil	7	No	7	4	3.5
18	Lewis	Vital	4	3	2.5	Coil	7	No	4.5	4.5	5
19	Lewis	Decellularized	4	2.5	2	Stent	21	No	3	3	2
20	Lewis	Vital	4	2.5	2	Stent	7	Yes	4	2.5	2
21	Lewis	Vital	4.5	2.5	2	Stent	7	No	4.5	2	2.5
22	Lewis	Vital	4.5	2.5	2	Stent	7	No	4	2.5	2
23	Lewis	Vital	4	1.5	2	Stent	7	No	4	2.5	2
24	Lewis	Vital	4	2	2.5	Coil	21	No	4	3.5	3

25	Lewis	Vital	4	2.5	2	Coil	21	No	5.5	3	2.5
26	Lewis	Vital	4.5	2	2.5	Coil	21	Yes	5.5	3.5	3
27	Lewis	Vital	3.5	2.5	2	Coil	21	Yes	7	4.5	5
28	Lewis	Vital	4	2.5	2	Stent	21	No	5	5	3.5
29	Lewis	Vital	3	2.5	2	Stent	21	No	4	3	2.5
30	Lewis	Vital	3	1	1.5	Stent	21	No	3	1	1.5
31	Lewis	Vital	3	1	1.5	Stent	21	No	3	1	1.5

Supplement Table 2. ***Proportion of CM-Dil+ cells for all aneurysms sutured in Lewis rats are*** depicted in percentages for neointima, thrombus, aneurysm wall, and parent artery.

#	Aneurysm type	Treatment	Follow-up (days)	CM-Dil+ Neointima	CM-Dil+ Thrombus	CM-Dil+ Aneurysm Wall	CM-Dil+ Parent Artery
1	Decellularized	Coil	7	69 %	0 %	14 %	67 %
2	Decellularized	Coil	7	74 %	0 %	15 %	91 %
3	Decellularized	Coil	21	5 %	6 %	9 %	1 %
4	Decellularized	Coil	21	10 %	5 %	11 %	38 %
5	Decellularized	Coil	21	0 %	7 %	4 %	3 %
6	Decellularized	Coil	21	10 %	5 %	11 %	38 %
7	Decellularized	Coil	7	41 %	12 %	12 %	79 %
8	Decellularized	Coil	7	88 %	18 %	8 %	65 %
9	Vital	Coil	7	56 %	82 %	15 %	52 %
10	Vital	Coil	7	59 %	90 %	13 %	67 %
11	Decellularized	Stent	7	73 %	23 %	18 %	83 %
12	Decellularized	Stent	7	68 %	23 %	14 %	73 %
13	Decellularized	Stent	7	66%	30 %	15 %	78 %
14	Decellularized	Stent	7	84 %	25 %	0 %	72 %
15	Decellularized	Stent	21	29 %	6 %	7 %	22 %

16	Decellularized	Stent	21	16 %	8 %	11 %	44 %
17	Vital	Coil	7	53 %	62 %	14 %	59 %
18	Vital	Coil	7	59 %	63 %	11 %	62 %
19	Decellularized	Stent	21	58 %	11 %	9 %	41 %
20	Vital	Stent	7	79 %	69 %	16 %	81 %
21	Vital	Stent	7	48 %	69 %	14 %	80 %
22	Vital	Stent	7	62 %	75 %	11 %	81 %
23	Vital	Stent	7	44 %	72 %	13 %	84 %
24	Vital	Coil	21	11 %	17 %	11 %	27 %
25	Vital	Coil	21	10 %	28 %	16 %	63 %
26	Vital	Coil	21	29 %	36 %	7 %	3 %
27	Vital	Coil	21	17 %	24 %	7 %	4 %
28	Vital	Stent	21	11 %	25 %	11 %	4 %
29	Vital	Stent	21	13 %	22 %	16 %	46 %
30	Vital	Stent	21	21 %	24 %	8 %	28 %
31	Vital	Stent	21	21 %	24 %	8 %	28 %