

Table S1. Details of endovascular interventions (82 patients treated for mesenteric malperfusion syndrome)

Level of aortic fenestration/stenting	Aortic Fenestration	Aortic Stenting	Branch Vessel Thrombolysis	Branch Vessel Suction Embolectomy	Branch Vessel Stenting
Descending Thoracic	0	1	-	-	-
Supraceliac	14	20	-	-	-
Celiac	16	0	0	0	3
Supramesenteric	30	44	-	-	-
Mesenteric	10	0	3	1	42
Suprarenal	3	3	-	-	-
Transrenal	12	5	-	-	-
Infrarenal	28	46	-	-	-

Table S2. Comorbidities and clinical condition on admission of patients with mesenteric malperfusion syndrome or no malperfusion syndrome (only patients who underwent open aortic repair)

	All patients (n=466)	MesMPS (n=47)	Non-MPS (n=419)	p value
Time Period				< 0.001
First Decade (1996-2007)	181 (39)	31 (66)	150 (36)	
Second Decade (2008-2017)	285 (61)	16 (34)	269 (64)	
<u>Demographics and chronic comorbidities</u>				
Age on admission (years)	59 (49, 68)	57 (51, 67)	59 (49, 68)	0.68
Gender (female)	140 (30)	11 (23)	129 (31)	0.29
NYHA class				0.28
I or II	344 (74)	40 (85)	304 (73)	
III or IV	98 (21)	7 (15)	91 (22)	
CAD	81 (17)	10 (21)	71 (17)	0.46
History of MI	24 (4.9)	4 (8.5)	20 (4.6)	0.29
Previous cardiac surgery	45 (9.7)	8 (17)	37 (8.8)	0.11
Hypertension	326 (70)	40 (85)	289 (68)	0.017
COPD	41 (8.8)	4 (8.5)	37 (8.8)	1.0
Smoking status				0.81
Never smoker	217 (47)	21 (45)	196 (47)	

Former smoker	120 (26)	14 (30)	106 (25)	
Current smoker	127 (27)	12 (26)	115 (27)	
Diabetes	27 (5.8)	2 (4.3)	25 (6.0)	1.0
Chronic kidney disease	16 (3.4)	5 (11)	11 (2.6)	0.016
History of CVA	14 (3.0)	3 (6.4)	11 (2.6)	0.16
PVOD	55 (12)	7 (15)	48 (11)	0.49
Connective tissue disorder	27 (5.8)	1 (2.1)	26 (6.2)	0.50
<u>Clinical condition on admission</u>				
Cardiogenic shock	35 (7.5)	0 (0)	35 (8.4)	0.038
Acute MI	0 (0)	0 (0)	0 (0)	
Tamponade	40 (8.6)	1 (2.1)	39 (9.3)	0.16
Aortic Insufficiency				0.99
None	123 (26)	14 (30)	109 (26)	
Trace/trivial	50 (11)	6 (13)	44 (11)	
Mild	87 (19)	8 (17)	79 (19)	
Moderate	77 (17)	8 (17)	69 (16)	
Severe	100 (21)	11 (23)	89 (21)	
Acute stroke	3 (0.6)	1 (2.1)	2 (0.5)	0.27
Acute paralysis	3 (0.6)	3 (6.4)	0 (0)	0.001
Creatinine on admission (mg/dL)	1.0 (0.8, 1.3)	1.4 (1.0, 2.6)	1.0 (0.8, 1.2)	<.0001
AKI	53 (11)	35 (74)	18 (4.3)	<.0001
Requiring new dialysis pre-operatively	4 (0.9)	4 (8.5)	0 (0)	<.0001

Renal MPS	30 (6.4)	30 (64)	0 (0)	< 0.001
Lower extremity MPS	35 (7.5)	35 (74)	0 (0)	< 0.001
Initial management				
IR	47 (10)	47 (100)	0 (0)	< 0.001

Data presented as median (interquartile range) for continuous variables and number (percentage) for categorical variables. AKI = acute kidney injury; CAD = coronary artery disease; COPD = chronic obstructive pulmonary disease; CVA = cerebrovascular accident; IR = endovascular procedure by interventional radiology; MI = myocardial infarction; MPS = malperfusion syndrome; Non-MPS = no malperfusion syndrome; NYHA = New York Heart Association; PVOD = peripheral vascular occlusive disease.

Table S3. Intra-operative variables of patients with mesenteric malperfusion syndrome or no malperfusion syndrome (only patients who underwent open aortic repair)

	All patients (n=466)	MesMPS (n=47)	Non-MPS (n=419)	p value
Previous cardiac surgery (reoperation)	45 (9.7)	8 (17)	37 (8.8)	0.11
Aortic root procedure				0.60
None	36 (7.7)	5 (11)	31 (7.4)	
Root replacement	156 (33)	14 (30)	142 (34)	
Root repair	265 (57)	28 (60)	237 (57)	
AVR only	9 (1.9)	0 (0)	9 (2.2)	
Aortic arch procedure				0.66
None	29 (6.2)	1 (2.1)	28 (6.7)	
Transverse arch (0 branch vessels)	275 (59)	27 (57)	248 (59)	
Zone 1 arch (1-2 branch vessel(s))	36 (7.7)	3 (6.4)	33 (7.9)	
Zone 2 arch (2-3 branch vessels)	90 (19)	12 (26)	78 (19)	
Zone 3 arch (3-4 branch vessels)	36 (7.7)	4 (8.5)	32 (7.6)	
Frozen elephant trunk	28 (6.0)	2 (4.3)	26 (6.2)	1.0

Concomitant Procedures

CABG	24 (5.2)	0 (0)	24 (5.7)	0.15
MV procedure	2 (0.4)	0 (0)	2 (0.5)	1.0
TV procedure	4 (0.9)	0 (0)	4 (0.9)	1.0
CPB time (minutes)	219.5 (179, 272)	222 (185, 261)	219 (177, 275)	0.77
Cross clamp time (minutes)	154 (115, 199)	156 (127, 191)	154 (114, 201)	0.91
HCA performed	439 (94)	46 (98)	393 (94)	0.50
HCA time (minutes)	35 (28, 45)	38 (30, 46)	35 (28, 45)	0.2
Type of cerebral perfusion				0.65
ACP only	142 (30)	12 (26)	130 (31)	
RCP only	174 (37)	18 (38)	156 (37)	
Both ACP and RCP	119 (26)	15 (32)	104 (25)	
Neither ACP nor RCP	30 (6.4)	2 (4.3)	28 (6.7)	
Intraoperative PRBC transfusion, yes	350 (75)	43 (91)	307 (73)	0.006
Intraoperative PRBC units	4 (1, 8)	7 (5, 10)	4 (1, 7)	<.0001
0	94 (21)	3 (6.5)	91 (23)	<.0001
1-2	69 (16)	3 (6.5)	66 (17)	
3-4	81 (18)	4 (8.7)	77 (19)	

≥ 5

200 (45)

36 (78)

164 (41)

Data presented as median (interquartile range) for continuous variables and number (percentage)

for categorical variables. Missing data points were excluded. ACP = antegrade cerebral perfusion; AVR = aortic valve replacement; CABG = coronary artery bypass graft; CPB = cardiopulmonary bypass; HCA = hypothermic circulatory arrest; MesMPS = mesenteric malperfusion syndrome; MPS = malperfusion syndrome; MV = mitral valve procedure; Non-MPS = no malperfusion syndrome; PRBC = packed red blood cell; RCP = retrograde cerebral perfusion; TV = tricuspid valve procedure.

Table S4. Detailed cause of death in patients with organ failure following endovascular fenestration/stenting by interventional radiology (IR), but before open repair or discharge

Case	Age	Year of Treatment	Additional Sites of Malperfusion	Cause of Death
			<u>First Decade</u>	
1	76	2000	Renal, Lower Extremity	Renal failure, lower extremity necrosis
2	48	2002	Renal, Lower Extremity	Extensive necrotic bowel
3	51	2003	Cerebral, Renal, Lower Extremity	Neurologic, renal failure, respiratory failure, shock
4	38	2003	Celiac/hepatic, Renal, Lower Extremity	Necrotic lower extremity, shock, acidosis, renal failure, respiratory failure, hepatic failure
5	56	2005	Spinal, Renal, Lower Extremity	Shock; withdrawal of care
6	74	2006	Isolated Mesenteric	Inoperable necrotic bowel
7	69	2006	Cerebral	Stroke, arrhythmia
8	36	2006	Lower Extremity	Extensive bowel necrosis, severe acidosis and hyperkalemia, not compatible with life
9	80	2007	Celiac/hepatic, Renal	Renal failure, respiratory failure, pneumonia, withdrawal of care
10	41	2007	Cerebral, Celiac/hepatic, Renal, Lower Extremity	Large cerebral infarction, cerebral edema, brain herniation, withdrawal of care
			<u>Second decade</u>	
11	68	2008	Cerebral, Spinal, Renal, Lower Extremity	Large stroke, withdrawal of care
12	67	2008	Cerebral, Renal	Extensive stroke, withdrawal of care
13	35	2009	Celiac/hepatic	Renal failure, liver failure, shock
14	55	2011	Renal, Lower Extremity	Respiratory failure, renal failure, sepsis, necrotic bowel, shock
15	60	2011	Cerebral, Renal	Severe large stroke, necrotic bowel, renal failure, brain herniation, withdrawal of care
16	53	2012	Cerebral, Renal	Liver injury, sepsis, shock, diffuse brain infarction
17	90	2015	Isolated Mesenteric	Shock, acidosis, renal failure
18	73	2016	Renal, Lower Extremity	Respiratory failure, renal failure, liver failure, necrotic bowel
19	43	2016	Cerebral, Renal	Necrotic bowel, lower extremity ischemia, arrhythmia
20	74	2016	Renal, Lower Extremity	Bilateral lower extremity necrosis, refused amputation

Figure S1

