Clinical presentation, management, and short-term outcome of patients with type A acute dissection complicated by mesenteric malperfusion: Observations from the International Registry of Acute Aortic Dissection

Marco Di Eusanio, MD, PhD,^a Santi Trimarchi, MD,^b Himanshu J. Patel, MD,^c Stuart Hutchison, MD, FACC, FRCPC,^d Toru Suzuki, MD, PhD,^e Mark D. Peterson, MD, PhD, FRCSC,^f Roberto Di Bartolomeo, MD,^a Gianluca Folesani, MD,^a Reed E. Pyeritz, MD, PhD,^g Alan C. Braverman, MD,^h Daniel G. Montgomery, BS,ⁱ Eric M. Isselbacher, MD,^j Christoph A. Nienaber, MD, FACC, FESC,^k Kim A. Eagle, MD, FACC,ⁱ and Rossella Fattori, MD^a

Background: Few data exist on clinical/imaging characteristics, management, and outcomes of patients with type A acute dissection and mesenteric malperfusion.

Methods: Patients with type A acute dissection enrolled in the International Registry for Acute Dissection (IRAD) were evaluated to assess differences in clinical features, management, and in-hospital outcomes according to the presence/absence of mesenteric malperfusion. A mortality model was used to identify predictors of in-hospital mortality in patients with mesenteric malperfusion.

Results: Mesenteric malperfusion was detected in 68 (3.7%) of 1809 patients with type A acute dissection. Patients with mesenteric malperfusion were more likely to be older and to have coma, cerebrovascular accident, spinal cord ischemia, acute renal failure, limb ischemia, and any pulse deficit. They were less likely to undergo surgical/hybrid treatment (52.9% vs 87.9%) and more likely to receive only medical (30.9% vs 11.6%) or endovascular (16.2% vs 0.5%) management ($P < .001$). Overall in-hospital mortality was 63.2% and 23.8% in patients with and without mesenteric malperfusion, respectively ($P < .001$). In-hospital mortality of patients with mesenteric malperfusion receiving medical, endovascular, and surgical/hybrid therapy was 95.2%, 72.7%, and 41.7%, respectively ($P < .001$). At multivariate analysis, male gender (odds ratio [OR], 1.7; $P = .002$), age (OR, 1.1/y; $P = .002$), and renal failure (OR, 5.9; $P = .020$) were predictors of mortality whereas surgical/hybrid management (OR, 0.1; $P = .005$) was associated with better outcome.

Conclusions: Type A acute aortic dissection complicated by mesenteric malperfusion is a rare but ominous complication carrying a high risk of hospital mortality. Surgical/hybrid therapy, although associated with 2-fold hospital mortality, appears to be associated with better long-term outcomes in the management of type A acute aortic dissection in this setting. (J Thorac Cardiovasc Surg 2013;145:385-90)

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From the Cardiovascular Surgery Department,^a Sant'Orsola-Malpighi Hospital, Bologna University, Bologna, Italy; the Cardiovascular Centre "E. Malan,"^b IRCCS Policlinico San Donato, San Donato, Italy; the Cardiac Surgery Department,^c University of Michigan, Ann Arbor, Mich; the Department of Cardiology,^d University of Calgary Medical Centre, Calgary, Alberta, Canada; Cardiovascular Medicine,^e University of Tokyo, Tokyo, Japan; the Division of Cardiac Surgery,^f St Michael's Hospital, Toronto, Ontario, Canada; the Division of Medical Genetics,^g University of Pennsylvania School of Medicine, Philadelphia, Pa; the Cardiovascular Division,^h Washington University School of Medicine, St Louis, Mo; the Cardiology Department,ⁱ University of Michigan, Ann Arbor, Mich; the Thoracic Aortic Center,^j Massachusetts General Hospital, Boston, Mass; and the Department of Internal Medicine,^k University Hospital Eppendorf-Rostock, Rostock, Germany.

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Address for reprints: Marco Di Eusanio, MD, PhD, Cardiac Surgery Department; Pad 25, Policlinico Sant'Orsola-Malpighi; Università di Bologna, Via Massarenti 9, 40128, Bologna, Italy (E-mail: marco.dieusanio2@unibo.it).

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Over the past 2 decades, knowledge of natural history, diagnosis, and management of acute type A aortic dissection has markedly improved. Despite this, hospital mortality in patients with aortic dissection remains substantial, ranging from 7% to 30%.¹⁻³ Preoperative patients' characteristics mostly affect hospital outcomes, with the worst results being reported in patients with hypotension, tamponade, and organ malperfusion.⁴

Although several studies have assessed outcomes of patients with type A aortic dissection complicated by end-organ malperfusion syndromes, few have focused on mesenteric malperfusion. The International Registry of Acute Dissection (IRAD) represents a unique opportunity to study a large group of patients with aortic dissection collected in 18 referral centers worldwide.

Abbreviations and Acronyms

CI	= confidence interval
IRAD	= International Registry of Acute Dissection
NS	= not significant
OR	= odds ratio

Aims of the present study were to compare clinical/imaging characteristics, management, and outcome of patients with type A acute dissection with and without mesenteric malperfusion and to assess outcomes of patients with mesenteric malperfusion according to different therapeutic strategies (surgical/hybrid, endovascular, and exclusively medical).

METHODS**Study Population and Data Collection**

The rationale and methodology of IRAD have been published previously.^{5,6} At the time of our study, we examined 1809 consecutive patients with type A acute dissection enrolled at 18 institutions between December 1995 and August 2010. Acute type A dissection was defined as any dissection that involved the ascending aorta and/or aortic arch appearing within 14 days of the onset of symptoms. The diagnosis of aortic dissection was based on history, imaging studies, direct visualization at surgery, and/or postmortem findings. Patients were categorized according to presence/absence of mesenteric malperfusion, which was defined as any radiologic evidence of decreased perfusion through the celiac trunk, superior mesenteric artery, and inferior mesenteric artery with decreased viability or necrosis of the gut, with or without lactic acidosis, pain, or abdominal distention.

All patients were classified according to 3 different therapeutic strategies: surgical/hybrid, endovascular, and exclusively medical therapy. A surgical/hybrid procedure was defined as a planned central aortic operation (ascending aorta/arch replacement) possibly associated with any percutaneous aortic or branch artery procedure (fenestration, stenting) performed simultaneously or within the same hospitalization. Endovascular treatment was defined as any percutaneous aortic or branch artery procedure (fenestration, stenting) in which any other central surgical procedure was not performed.

IRAD data forms were used to collect 290 clinical variables, including patient demographics, history, clinical presentation, physical findings, imaging studies, therapeutic management, in-hospital mortality, and adverse events. Completed data forms were forwarded to the coordinating center at the University of Michigan and reviewed for faced validity and completeness.

Statistical Analysis

Continuous variables were expressed as the mean $\pm$ 1 standard deviation or median and Q1-Q3 and categorical variables as percentages. In all cases, missing data were not defaulted to negative, and denominators reflect only cases reported.

Univariate analyses between groups were done using χ^2 tests (or Fisher exact tests) and Student *t* tests where appropriate. All *P* values are 2-sided.

Preoperative and intraoperative variables were first analyzed using univariate analysis to determine whether any single factor was related to therapeutic strategy and hospital mortality in all patients and in those with mesenteric malperfusion. Variables that achieved *P* values less than .15 in the univariate analysis were examined using gender-adjusted multivariate analysis by forward stepwise logistic regression to estimate the independent odds ratios (ORs) of factors related to nonsurgical/hybrid management (all patients and patients with mesenteric malperfusion) and hospital mortality in patients with mesenteric malperfusion.

Statistical analysis was performed by SPSS version 18.0 (SPSS, Inc, Chicago, Ill).

RESULTS**Clinical Characteristics of Patients With and Without Mesenteric Malperfusion (Tables 1, 2, and 3)**

Of 3099 consecutive patients with acute aortic dissection enrolled between December 1995 and August 2010, 1967 (63.5%) had type A dissection. Sixty-eight (3.8%) of 1809 patients with available data had mesenteric malperfusion.

Compared with those who did not have mesenteric malperfusion, those who did were older (61.8 ± 14.4 vs 57.9 ± 14.4 years; *P* = .028) and more likely to have abdominal (58.5% vs 24.2%; *P* < .001), leg (35.9% vs 12.0%; *P* < .001), and migrating (21.3% vs 12.1%; *P* = .032) pain. Patients with mesenteric malperfusion more frequently had coma (10.0% vs 3.1%; *P* = .003), ischemic spinal cord damage (6.8% vs 0.8%; *P* = .002), acute renal failure (52.2% vs 7.2%; *P* < .001), limb ischemia (38.5% vs 9.9%; *P* < .001), and any pulse deficit (45.8% vs 29.8%; *P* = .009).

Electrocardiographic evidence of new myocardial infarction (8.5% vs 7.2%; *P* = not significant [NS]), left ventricular hypertrophy (24.1% vs 20.9%; *P* = NS), and low voltage (5.2% vs 4.5%; *P* = NS) were similar in patients with and without mesenteric malperfusion. On imaging studies, widened mediastinum (52.0% vs 54.1%; *P* = NS), pleural effusion (20.8% vs 12.4%; *P* = NS), aortic regurgitation (65.5% vs 53.5%; *P* = NS), and coronary artery compromise (16.7% vs 12.4%; *P* = NS) were equally present in patients with and without mesenteric malperfusion.

Computed tomographic angiography, magnetic resonance imaging, and transesophageal echocardiography were used with similar frequency to assess characteristics of dissection in patients with and without mesenteric malperfusion. Angiography was more frequently performed in patients with mesenteric malperfusion (33.3% vs 11.0%; *P* < .001), in whom an overall higher number of imaging tests were required to complete the diagnostic process (2.0 ± 0.8 vs 1.6 ± 0.6 ; *P* < .001). Despite that, the time delay (hours) between symptom onset and diagnosis was similar in patients with and without mesenteric malperfusion (6.5 vs 5.8; *P* = NS).

The intimal-medial flap originated more frequently at the aortic root (62.7% vs 45.2%; *P* = .005) in patients with mesenteric malperfusion and at the ascending aorta (36.5% vs 23.9%; *P* = .035) in patients without mesenteric malperfusion. Patients with mesenteric malperfusion were more likely to have arch vessel involvement (52.9% vs 35.7%; *P* = .012) and any renal artery (70.6% vs 18.0%; *P* < .001) involvement by the dissection.

TABLE 1. Demographics and history of patients with and without mesenteric malperfusion

Variable	Mesenteric malperfusion (n = 68)	No mesenteric malperfusion (n = 1741)	P value
Age, mean ($\pm$ SD), y	61.8 $\pm$ 14.4	57.9 $\pm$ 14.4	.028
Male (%)	47/68 (69.1)	1171/1741 (67.3)	.749
White (%)	54/62 (87.1)	1461/1629 (89.7)	.512
Atherosclerosis (%)	16/66 (24.2)	377/1676 (22.5)	.739
Diabetes (%)	3/66 (4.5)	96/1669 (5.8)	.796
Hypertension (%)	47/66 (71.2)	1208/1693 (71.4)	.980
Aortic valve disease (AS + AR) (%)	8/65 (12.3)	63/1672 (12.1)	.956
Bicuspid aortic valve (%)	3/53 (5.7)	202/1669 (12.1)	.668
Marfan (%)	2/66 (3.0)	74/1687 (4.4)	.767
Peripartum (%)	—	4/1653 (0.2)	1.000
Cocaine abuse (%)	—	19/1656 (1.1)	.643
Known aortic aneurysm (%)	5/66 (7.6)	210/1683 (12.5)	.260
Prior aortic dissection (%)	—	72/1684 (4.3)	.110
Iatrogenic dissection (%)	2/65 (3.1)	55/1665 (3.3)	1.000
Prior cardiac surgery (%)	15/65 (23.1)	245/1660 (14.8)	.066
History of catheterization/angiography	9/53 (17.0)	155/1390 (11.2)	.189

SD, Standard deviation; AS, aortic stenosis; AR, aortic regurgitation.

Therapeutic Strategies for Patients With and Without Mesenteric Malperfusion

All patients. Overall, 86.7% (1567 of 1809) of patients with acute type A dissection underwent surgical/hybrid procedures and 1.0% (19 of 1809) and 12.3% (223 of 1809) received endovascular and medical management, respectively.

On binary logistic regression, preoperative mesenteric malperfusion (OR, 7.9; 95% confidence interval [CI], 3.229-19.521; $P < .001$), age more than 70 years (OR, 2.9; 95% CI, 1.782-4.884; $P < .001$), and female gender (OR, 2.1; 95% CI, 1.317-3.557; $P = .002$) were the strongest independent predictors of receiving medical/endovascular management.

Patients with and without mesenteric malperfusion (Table 4). Patients with mesenteric malperfusion were less likely to undergo surgical/hybrid treatment (52.9% vs 87.9%; $P < .001$) and more likely to receive medical (30.9% vs 11.6%; $P < .001$) or endovascular (16.2% vs 0.5%; $P < .001$) management, when compared with patients without mesenteric malperfusion.

In surgically managed patients, the extent of aortic replacement, rate of associated cardiac procedures (8.6% vs 12.6%; $P = \text{NS}$), and rate of open aortic anastomosis (84.0% vs 94.1%; $P = \text{NS}$) were equally distributed in patients with and without mesenteric malperfusion. Patients with mesenteric malperfusion were more likely to require an associated peripheral vascular surgical procedure (11.1% vs 3.5%; $P = .018$) (Table E1).

Patients with mesenteric malperfusion. Preoperatively, clinical and dissection imaging features were similar in patients receiving surgical/hybrid, endovascular, or medical treatment, except for older age being more frequent in patients receiving medical management (medical vs

surgical/hybrid: 65.0 $\pm$ 15.9 vs 54.1 $\pm$ 13.1 years; $P = .007$; medical vs endovascular: 65.0 $\pm$ 15.9 vs 56.6 $\pm$ 11.1 years; $P = \text{NS}$; surgical/hybrid vs endovascular: 54.1 $\pm$ 13.1 vs 56.6 $\pm$ 11.1 years; $P = \text{NS}$). Severe comorbid illness was reported as a contraindication to surgical repair in all cases and, on logistic regression, age greater than 70 years (OR, 5.2; 95% CI, 0.741-36.526; $P = .097$) emerged as the only independent predictor of medical/endovascular management.

Hospital Results

Patients with and without mesenteric malperfusion (Table 5). Hospital mortality was 63.2% (43 of 68) and 23.8% (414 of 1741) in patients with and without mesenteric malperfusion, respectively ($P < .001$).

On multiple logistic regression, mesenteric malperfusion (OR, 2.520; 95% CI, 1.127-5.633), age greater than 70 years (OR, 2.327; 95% CI, 1.680-3.222), migrating pain (OR, 1.747; 95% CI, 1.126-2.710), hypotension/shock/tamponade (OR, 2.636; 95% CI, 1.915-3.629), renal failure (OR, 2.076; 95% CI, 1.466-2.940), and abnormal electrocardiogram (OR, 1.568; 95% CI, 1.113-2.210) emerged as independent predictors of in-hospital mortality.

Postoperative occurrence of new major brain injuries (stroke or coma), myocardial ischemic complications, and cardiac tamponade were equally observed in patients with and without mesenteric malperfusion. Patients with mesenteric malperfusion were more likely to have postoperative renal failure (44.4% vs 16.8%; $P < .001$) and limb ischemia (9.6% vs 3.1%; $P = .009$).

Patients with mesenteric malperfusion. In patients with mesenteric malperfusion, hospital mortality was 95.2% (20 of 21) after medical management, 72.7% (8 of 11) after endovascular treatment, and 41.7% (15 of 36) after

TABLE 2. Clinical presentation of patients with and without mesenteric malperfusion

Variable	Mesenteric malperfusion (n = 68)	No mesenteric malperfusion (n = 1741)	P value
Time from symptom onset to diagnosis (h)	6.5 (1.3-23.8)	5.8 (1.9-24.0)	.325
Time from diagnosis to surgical/hybrid or endovascular treatment (h)	9.0 (2.3-24.0)	4.8 (2.1-18.1)	.193
Time from symptom onset to surgical/hybrid or endovascular treatment (h)	19.1 (8.8-65.0)	14.8 (6.8-40.5)	.743
Chest pain (%)	48/68 (70.6%)	1348/1672 (80.6%)	.042
Anterior (%)	43/55 (78.2)	1075/1378 (78.0)	.976
Posterior (%)	15/44 (34.1)	487/1274 (38.2)	.579
Back pain (%)	32/66 (48.5)	682/1622 (42.0)	.299
Abdominal pain (%)	38/65 (58.5)	389/1610 (24.2)	<.001
Leg pain (%)	23/64 (35.9)	191/1593 (12.0)	<.001
Quality of pain			
Migrating (%)	13/61 (21.3)	189/1563 (12.1)	.032
Radiating (%)	24/63 (38.1)	560/1583 (35.4)	.658
Pain severity (%)			
Mild (%)	—	117/1350 (8.7)	.304
Severe (%)	40/52 (76.9)	1008/1350 (74.7)	.713
Worst ever (%)	12/52 (23.1)	225/1350 (16.7)	.226
Abrupt onset of pain (%)	59/65 (90.8)	1335/1619 (82.5)	.082
Febrile	4/54 (7.4)	34/1319 (2.6)	.059
Hypotension/shock/tamponade (%)	18/64 (28.1)	449/1628 (27.6)	.924
Hypertension (%)	22/64 (34.4)	493/1628 (30.3)	.485
Syncope (%)	8/67 (11.9)	297/1644 (18.1)	.199
Cerebrovascular accident (%)	6/63 (9.5)	84/1624 (5.2)	.132
Coma (%)	6/60 (10.0)	50/1626 (3.1)	.003
Ischemic spinal cord damage (%)	4/59 (6.8)	13/1628 (0.8)	.002
Myocardial ischemia/infarction (%)	12/66 (18.2)	193/1733 (11.1)	.077
Cardiac heart failure (%)	9/63 (14.3)	127/1670 (7.6)	.053
Acute renal failure (%)	35/67 (52.2)	124/1729 (7.2)	<.001
Limb ischemia (%)	25/65 (38.5)	171/1728 (9.9)	<.001
Any pulse deficit (%)	27/59 (45.8)	394/1321 (29.8)	.009

surgical/hybrid treatment ($P < .001$). In the 43 patients with mesenteric malperfusion who died, causes of death were visceral ischemia ($n = 15$; 34.9%), neurologic ($n = 2$; 7.0%), multiorgan failure ($n = 5$; 11.6%), cardiac ($n = 2$; 4.7%), tamponade ($n = 2$; 4.7%), and not specified ($n = 15$; 44.9%).

At binary logistic regression, surgical/hybrid management (OR, 0.1; 95% CI, 0.028-0.539; $P = .005$) resulted as a protective factor for hospital mortality, whereas male gender (OR, 1.7; 95% CI, 0.338-7.397; $P = .484$), age (OR, 1.112; 95% CI, 1.041-1.188; $P = .002$), and preoperative renal failure (OR, 5.989; 95% CI, 1.328-26.182; $P = .020$) were associated with increased hospital mortality.

DISCUSSION

Aortic dissection remains one of the most lethal cardiovascular diseases, and end-organ malperfusion syndromes, which occur in approximately in one-third of patients,⁴ are associated with elevated mortality and dismal postoperative outcomes.⁷⁻⁹

Among different ischemic end-organ complications occurring at the onset of dissection, mesenteric malperfusion is one of the most insidious and therefore challenging for diagnostic and management decision making.¹⁰

Our data show that mesenteric malperfusion is a rare complication of acute dissection and that, very commonly, is associated with clinical or imaging signs of other organ injury or malperfusion. In our series of 1809 patients with type A acute dissection, only 68 (3.8%) met our definition of mesenteric malperfusion and approximately 30% of them showed clinical symptoms or signs of neurologic complications, 52.2% had acute renal failure, and 30% had limb ischemia. Although the mentioned associated complications may not involve malperfusion as the only underlying pathogenetic mechanism, imaging data, showing extremely high rates of arch vessel (52.9%) and any renal artery involvement (70.6%) by the dissection, support the idea that malperfusion plays an important role and that, when it occurs, it is likely to involve more than one vascular territory. Interestingly, the observation that about 40% of patients with mesenteric ischemia did not have abdominal pain, whereas about 20% of patients without mesenteric malperfusion had pain, confirms that abdominal pain is a nonspecific symptom of acute mesenteric ischemia.^{11,12} Moreover, the typically progressive nature of both the aortic dissecting disease and malperfusory complication, in addition to the potential different times of patients' presentation with different degrees of bowel ischemia, may

TABLE 3. Characteristics of dissection in patients with and without mesenteric malperfusion

Variable	Mesenteric malperfusion (n = 68)	No mesenteric malperfusion (n = 1741)	P value
Origin of dissection flap			
Sinotubular junction (%)	5/67 (7.5)	195/1628 (12.0)	.262
Aortic root (%)	42/67 (62.7)	736/1628 (45.2)	.005
Ascending (%)	16/67 (23.9)	594/1628 (36.5)	.035
Arch (%)	3/67 (4.5)	66/1628 (4.1)	.863
False lumen patency			
Patent (%)	38/50 (76.0)	753/1063 (70.8)	.431
Partial thrombosis (%)	10/50 (20.0)	208/1063 (19.6)	.940
Complete thrombosis (%)	2/50 (4.0)	102/1063 (9.6)	.184
Distal communication (%)	17/44 (38.6)	243/1015 (23.9)	.027
Arch vessel involvement (%)	27/51 (52.9)	429/1203 (35.7)	.012
Any renal artery involvement (%)	48/68 (70.6)	309/1716 (18.0)	<.001
Coronary arteries compromised (%)	8/48 (16.7)	156/1262 (12.4)	.376
Aortic regurgitation (%)	36/55 (65.5)	773/1445 (53.5)	.081
Aortic measurements			
Aortic annulus (cm)	2.6 (2.3-2.9)	2.5 (2.3-2.9)	.878
Aortic root (cm)	4.5 (3.8-5.9)	4.2 (3.7-5.0)	.511
Ascending aorta (widest) (cm)	4.9 (4.5-5.5)	5.0 (4.4-5.8)	.539
Aortic arch (cm)	4.0 (3.5-4.4)	3.6 (3.2-4.1)	.252
Descending aorta (widest) (cm)	3.3 (3.0-4.2)	3.4 (3.0-3.8)	.875

justify our rate of patients without abdominal pain of 40%, which is slightly superior to the 25% reported in literature.¹²

In IRAD, patients with mesenteric malperfusion were less likely to undergo surgical treatment and more likely to receive a recognized suboptimal therapeutic management, namely, medical or endovascular therapy. Moreover, such a difference in therapeutic management was striking: about 50% of patients with mesenteric malperfusion did not receive surgical therapy against 12% of patients without. Accordingly, binary logistic regression confirmed these observations by indicating mesenteric malperfusion as the strongest predictor of medical therapy in the overall series (OR, 7.9).

These data clearly reflect surgeons' attitudes to avoid surgery in patients with severe preoperative comorbidities and indicate that mesenteric malperfusion, among all preoperative dissection-related complications, is considered as (one of) the most threatening.

Almost two-thirds of patients with mesenteric malperfusion died during hospitalization, almost 3 times the number of those patients without the mentioned complication (63.2% vs 23.8%).

However, when assessing hospital mortality according to different therapeutic management, in patients with mesenteric malperfusion an interesting scenario becomes evident: medical and endovascular therapies were associated with dismal mortality rates (95.2% and 72.7%, respectively), whereas surgical/hybrid therapy was associated with a significantly higher survival of 41.7%.

Accordingly, our binary logistic regression indicated that surgical/hybrid therapy for patients deemed operable by the treating facility was associated with the best survival in patients with mesenteric malperfusion, even after adjusting for gender, age, and renal failure. This is likely due to both patient selection and the potential benefit of definitive repair.

When surgical treatment is used, operative timing and potential use of percutaneous procedures (fenestration/stenting) to address branch artery obstruction still represent greatly debated issues.

Some authors,^{13,14} given the unpredictable nature of acute type A dissection and its ever-present potential for rupture, advocate immediate correction of malperfusion syndromes by replacing the ascending and/or transverse aortic arch, thus

TABLE 4. Therapeutic strategies for patients with and without mesenteric malperfusion

Therapeutic strategies	Mesenteric malperfusion (n = 68)	No mesenteric malperfusion (n = 1741)	P value
Surgical/Hybrid (%)	36/68 (52.9)	1531/1741 (87.9)	<.001
Open surgery + aortic fenestration (%)	0/4 (0.0)	1/14 (7.1)	1.000
Open surgery + aortic stenting (%)	2/4 (50.0)	12/14 (85.7)	.197
Open surgery + aortic stenting and fenestration	2/4 (50.0)	1/14 (7.1)	.108
Endovascular (%)	11/68 (16.2)	8/1741 (0.5)	<.001
Aortic fenestration (%)	2/11 (18.2)	2/8 (25.0)	1.000
Aortic stenting (%)	2/11 (18.2)	2/8 (25.0)	1.000
Aortic stenting and fenestration (%)	7/11 (63.6)	4/8 (50.0)	.658
Exclusively medical (%)	21/68 (30.9)	202/1741 (11.6)	<.001

TABLE 5. In-hospital mortality and complications for patients with type A acute dissection with and without mesenteric malperfusion

	Mesenteric malperfusion (n = 68)	No mesenteric malperfusion (n = 1741)	P value
Mortality (%)	43/68 (63.2)	414/1741 (23.8)	<.001
Major brain injury (coma+stroke) (%)	5/42 (11.9)	129/1532 (8.4)	.575
Spinal cord injury (%)	1/45 (2.2)	13/1551 (0.8)	.331
Myocardial infarction/ischemia (%)	4/59 (6.8)	96/1689 (5.7)	.772
Acute renal failure (%)	20/45 (44.4)	286/1701 (16.8)	<.001
Limb ischemia (%)	5/52 (9.6)	52/1695 (3.1)	.025
Cardiac tamponade (%)	5/57 (8.8)	91/1659 (5.5)	.370

restoring blood flow into the true lumen. Others,^{9,10,15-17} in selected patients showing clinical deterioration owing to established end-organ ischemic dysfunction, suggest alternative management strategies such as delayed central aortic operation after percutaneous end-organ blood flow restoration. This approach, which certainly takes into account the potential for aortic rupture before ascending aortic repair has been accomplished, finds its rationale in the predominant prognostic weight of the end-organ dysfunction and in the suboptimal surgical outcomes reported in this setting.

Our analysis does not allow us to distinguish the best therapeutic option between the aforementioned approaches. However, IRAD data show that hybrid management (central aortic operation plus percutaneous treatment of mesenteric malperfusion) was applied in only a very few cases and that immediate surgical repair of the proximal dissected aorta still represents the most common therapeutic approach for patients with type A acute dissection complicated by mesenteric malperfusion.

Limitations and Strengths

Our definition of mesenteric malperfusion does not allow distinguishing patients with different degrees of intestinal ischemic injury. As a consequence, differences in clinical features, management, and outcomes of patients according to the presence/absence of intestinal infarction could not be captured, and the comparison between surgical/hybrid, endovascular, and medical management might have been influenced by a selection bias in the therapeutic referral process.

Data on intestinal surgical procedures are not available in the IRAD registry. Thus, the clinical relevance and prognostic implications of concomitant abdominal surgery could not be evaluated.

Current knowledge about mesenteric malperfusion is based on case studies with an extremely limited number of patients, or extrapolated by larger reports including different organ malperfusion syndromes. Our study, analyzing the largest series of patients with mesenteric malperfusion, may help shed light on this high-risk group of patients.

CONCLUSIONS

Our data showed that patients with mesenteric malperfusion are older and frequently have associated neurologic, renal, and limb dissection-related complications. Mesenteric

malperfusion is a rare but ominous complication carrying a 3-fold higher risk of hospital mortality. When compared with different therapeutic treatments, surgical/hybrid therapy appears to be associated with better outcomes.

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TABLE E1. Surgical procedures for patients with type A acute dissection with and without mesenteric malperfusion

	Mesenteric malperfusion (n = 68)	No mesenteric malperfusion (n = 1741)	P value
Extent of aortic replacement			
Root (%)	10/30 (33.3)	482/1339 (36.0)	.764
Ascending aorta (%)	28/36 (77.8)	1380/1483 (93.1)	.001
Partial arch (%)	10/37 (27.0)	564/1426 (39.6)	.123
Complete arch (%)	5/37 (13.5)	204/1435 (14.2)	1.000
Open procedure (%)	21/25 (84.0)	866/920 (94.1)	.061
Associated procedures (%)			
AVR (%)	8/34 (23.5)	394/1456 (27.1)	.647
CABG (%)	3/35 (8.6)	173/1446 (12.0)	.791
MVR (%)	—	10/1449 (0.7)	1.000
Reoperation (%)	5/34 (14.7)	189/1429 (13.2)	.797
Peripheral vessels replaced	4/36 (11.1)	51/1440 (3.5)	.018

AVR, Aortic valve replacement; CABG, coronary artery bypass grafting; MVR, mitral valve repair/replacement.