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ORIGINAL ARTICLE

Prognostic impact of shock in patients with type A acute aortic syndrome. Results of a nationwide multicenter study

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ABSTRACT

OBJECTIVE To evaluate the clinical characteristics, imaging findings, treatment, and prognosis of patients with type A acute aortic syndrome (AAS-A) presenting with shock. To assess the impact of surgery on this patient population.

METHODS The study included 521 patients with A-AAS enrolled in the Spanish Registry of Acute Aortic Syndrome (RESA-III) from January 2018 to December 2019. The RESA-III is a prospective, multicenter registry that contains AAS data from 30 tertiary-care hospitals. Patients were classified into two groups according to their clinical presentation, with or without shock. Shock was defined as persistent systolic blood pressure <80 mmHg despite adequate volume resuscitation.

RESULTS 97 (18.6%) patients with A-AAS presented with shock. Clinical presentation with syncope was much more common in the Shock group (45.4% vs 10.1%, $p = 0.001$). Patients in the Shock group had more complications at diagnosis and before surgery: cardiac tamponade (36.2% vs 9%, $p < 0.001$), acute renal failure (28.9% vs 18.2%, $p = 0.018$), and need for orotracheal intubation (40% vs 9.1%, $p < 0.001$). There were no significant differences in aortic regurgitation (51.6% vs 46.7%, $p = 0.396$) between groups. In-hospital mortality was higher among patients with shock (48.5% vs 27.4%, $p < 0.001$). Surgery was associated with a significant mortality reduction both in patients with and without shock. Surgery had an independent protective effect on mortality (OR 0.03, 95% CI (0.00-0.32)).

CONCLUSION Patients with AAS-A admitted with shock have a heavily increased risk of mortality. Syncope and pericardial effusion at diagnosis are strongly associated with shock. Surgery was independently associated with a mortality reduction in patients with AAS-A and shock. (Hellenic Journal of Cardiology 2025;86:27-35) © 2024 Hellenic Society of Cardiology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

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1. INTRODUCTION

Type A Acute aortic syndrome (AAS-A) is a serious condition associated with a high morbidity and mortality.[1,2] The standard medical care for patients with AAS-A is emergency surgery with a life-saving purpose.[3,4] Despite advances in diagnostic imaging and surgical treatment, in-hospital mortality of patients with AAS-A remains high, approximately 10-25%.[5-7] AAS-A surgery is, in many cases, a complex procedure, even for the most experienced surgical teams. Management of patients with AAS-A who present in shock at the time of diagnosis turns into a real clinical challenge. This hostile clinical scenario leads to denying surgery to many patients due to their a priori extremely high surgical risk.

The aim of the present study was to evaluate the clinical characteristics, imaging findings, treatment, and prognosis of patients with AAS-A presenting with shock. Specifically, we intended to assess the impact of surgery in this patient population. For this purpose, we analyzed data from the Spanish Registry of Acute Aortic Syndrome (RESA-III), which provides contemporary, real-world, precise data on the clinical characteristics, diagnosis, and management of AAS in Spain, as most of the country's tertiary-care hospitals participate in this registry.[8]

2. METHODS

The RESA-III is a prospective, protocol-based, observational, descriptive registry that contains AAS data supplied by tertiary-care hospitals that provide around-the-clock cardiovascular and hemodynamic imaging and heart surgery services.[8] The 30 participating hospitals agreed to prospectively collect data on consecutive patients with AAS diagnosed at their hospital or referred from another hospital over a 2-year period. The inclusion period was January 1, 2018 to December 31, 2019. There were two previous RESA: I (2005-2006) and II (2012-2013). Due to differences in AAS treatment and prognosis over time, only patients in the RESA-III were considered for this study.[8-10]

2.1. DATA COLLECTION AND DEFINITIONS. Data were collected and stored in a purpose-designed database built using the *REDCap* (Research Electronic Data Capture; Vanderbilt University Medical Center) software application. Each hospital appointed a registry coordinator, responsible for collecting and verifying all the data. Patients were identified by checking emergency and imaging department records and hospital discharge reports. Case inclusion form included 140 variables on demographics, clinical history, physical examination and imaging findings, treatment, in-hospital complications, and mortality. Only patients with diagnostic confirmation of AAS-A based on the imaging test or direct confirmation at surgery or autopsy were considered in this study.[8-10] Chronic aortic dissection, post-traumatic, and iatrogenic aortic dissection/rupture were not included in the study.

To facilitate comparisons, the study variables were defined using the same criteria as those used in the IRAD.[1] For analytical purposes, patients were divided into two groups according to the clinical presentation, i.e., with or without shock at the time of diagnosis. AAS-A was defined as any acute aortic syndrome involving the ascending aorta with symptoms onset within the previous 14 days. Shock was defined as persistent systolic blood pressure <80 mmHg with signs of organ hypoperfusion, despite adequate volume resuscitation.[8-12] An intermittent or transient drop in blood pressure with subsequent recovery was not considered as shock. Renal failure was defined as a new-onset creatinine level >1.5 min/100 mL or a glomerular filtration rate <30/min/1.73 m^2. Cardiac tamponade was defined by the presence of severe pericardial effusion with echocardiographic or clinical signs of hemodynamic impairment. Malperfusion was defined as diminished blood flow to an organ caused by arterial branch occlusion or stenosis secondary to the dissection, resulting in ischemia. Mesenteric malperfusion 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. Peripheral ischemia was defined clinically as a lack of peripheral pulses and concomitant limb symptoms such as pain and paresthesias. Surgery was defined as emergent when it was performed immediately after diagnosis and urgent if it was done within 24 h.

The study protocol complied with the principles of the 1975 Declaration of Helsinki and was approved by the ethics committees at the coordinating center (Hospital Universitario Vall d'Hebron) (code PR(AG) 115/2017) and the other participating hospitals. Informed consent was obtained from all patients.

2.2. STATISTICAL ANALYSIS. Quantitative variables are expressed as mean ± standard deviation or median and interquartile range in case of non-normality. The normality of the continuous variables was analyzed using Shapiro-Wilk's test. Categorical variables are presented as number and percentage. Categorical variables were compared using the chi-square test or Fisher's exact test, and quantitative

variables using the Student's *t*-test or Mann Whitney *U* test. To evaluate the clinical correlates and causes of shock, a multivariate logistic regression analysis was performed. Shock was considered as the dependent variable, and those variables that resulted statistically significant in the univariate analysis ($p < 0.05$) as well as those clinically relevant were included in the model.

A stratified analysis was performed to investigate the potential impact of surgery on mortality of patients with and without shock. To assess for potential prognostic factors in the group of patients with shock, a univariate analysis for mortality was initially performed. Then, those baselines characteristics and clinical variables at the time of diagnosis that resulted statistically significant ($p < 0.05$) in the univariate analysis, as well as those previously known to be associated with in-hospital mortality, were included in a multivariate logistic regression analysis.

All available data were analyzed for patients with missing data, none of whom were excluded. Any doubts on the data records were resolved by telephoning the registry coordinator at the corresponding hospital. Data were analyzed in STATA version 15.1 (StataCorp, USA). Statistical significance was set at a p value of less than 0.05.

3. RESULTS

During the two-year study period, a total of 754 patients were prospectively and consecutively included in the RESA-III registry.[8] Of them, 529 patients had an AAS-A and 225 an AAS-B.[8] Hemodynamic information at the time of diagnosis was available in 521 out of 529 AAS-A (98.5%), and they constitute our study population. Finally, patients were classified into two groups according to the hemodynamic status at diagnosis: patients presenting with shock (Shock group; N = 97) and those without shock (No-Shock group; N = 424).

3.1. BASELINE CHARACTERISTICS AND CLINICAL PRESENTATION. Baseline characteristics and comorbidities are shown in Table 1. Mean age was 63.8 ± 11.7 years, and 69.5% of patients were men. Patients presenting with shock were older (66.1 ± 11.4 vs 63.4 ± 11.7 years, p = 0.036), and there was a slightly higher proportion of women in this group (38.1% vs 29%, p = 0.079). Regarding comorbidities, there were no significant differences between groups except for a previous history of renal failure, which was more common among patients in the Shock group (28.9% vs 18.2%, p = 0.017).

Classic aortic dissection was the most frequent form of AAS-A in the whole cohort (464 patients, 89.1%), without differences between groups. Median time from symptoms to diagnosis was 3.2 h (interquartile range (IQR) 2-8.03). A significantly greater proportion of shock patients were directly admitted to the referral center (59.8% vs 42.8%, p = 0.002), and the time from symptoms onset to diagnosis was shorter in this group (2.2 h vs 4 h, p = 0.001) (Table 2). Anterior chest pain was the most frequent symptom

TABLE 1 Baseline characteristics

Variable	No shock (N = 424)	Shock (N = 97)	p
Age (years)	63.4 ± 11.7	66.1 ± 11.4	0.036
Sex (female)	123 (29%)	37 (38.1%)	0.079
Hypertension	297 (70%)	69 (71.1%)	0.832
Diabetes	43 (10.1%)	8 (8.2%)	0.571
COPD	43 (10.1%)	12 (12.4%)	0.519
CRF	77 (18.2%)	28 (28.9%)	0.017
Previous aortic aneurysm	112 (26.4%)	24 (24.7%)	0.735
Aortic valve disease	61 (14.4%)	16 (16.5%)	0.598
Previous cardiac surgery	15 (3.5%)	2 (2.1%)	0.750
Previous AAS	11 (2.6%)	1 (1.1%)	0.704
Direct admission to tertiary-care hospital	181 (42.8%)	58 (59.8%)	0.002
Current AAS diagnosis			0.428
Aortic dissection	374 (88.2%)	90 (92.8%)	
Intramural hematoma	43 (10.1%)	6 (6.2%)	
PAU	7 (1.7%)	1 (1%)	
Treatment			
Medical	59 (13.9%)	21 (21.6%)	0.057
Surgery	365 (86.1%)	76 (78.4%)	0.057

COPD: chronic obstructive pulmonary disease; CRF: chronic renal failure; PAU: penetrating aortic ulcer.

TABLE 2 Clinical presentation

Variable	No Shock (N = 424)	Shock (N = 97)	p
Symptoms-diagnosis time (hours)	4 (2-8.5)	2.2 (1.7-4.3)	0.001
Anterior chest pain	310 (73.1%)	62 (63.9%)	0.071
Posterior chest pain	136 (32.1%)	30 (30.9%)	0.826
Syncope	43 (10.1%)	44 (45.4%)	<0.001
Peripheral ischemia	54 (12.7%)	12 (12.4%)	0.922
Mesenteric ischemia	23 (5.4%)	6 (6.2%)	0.768
Acute renal failure	77 (18.2%)	28 (28.9%)	0.017
Neurological deficit	67 (15.8%)	34 (35.1%)	<0.001
Stroke	31 (7.4%)	16 (16.7%)	0.005
Coma	12 (2.9%)	10 (10.4%)	0.003
Myocardial infarction	26 (6.1%)	13 (13.4%)	0.014
Left ventricular failure	22 (5.2%)	34 (36.2%)	<0.001
Cardiac tamponade	38 (9%)	34 (36.2%)	<0.001
Need for OTI	38 (9.1%)	38 (40%)	<0.001

OTI: orotracheal intubation.

in both groups. Syncope and acute neurological deficits were much more common in patients with shock (45.4% vs 10.1%, $p < 0.001$; 35.1% vs 15.8%, $p < 0.001$, respectively).

Patients in the Shock group had more complications at diagnosis, specifically cardiac tamponade (36.2% vs 9%, $p < 0.001$) and acute renal failure (28.9% vs 18.2%, $p = 0.017$). The need for intubation was more frequent in this group (40% vs 9.1%, $p < 0.001$). As expected, myocardial infarction and acute left ventricular dysfunction were more commonly present in patients with shock (Table 2: 13.4% vs 6.1%, $p = 0.014$; 36.2% vs 5.2%, $p < 0.001$, respectively). Peripheral and mesenteric ischemia at diagnosis and before surgery did not significantly differ between groups (Table 2).

3.2. IMAGING FINDINGS. Imaging techniques showed pericardial effusion in a higher proportion of patients in the Shock group (53.1% vs 36.1%, $p = 0.002$), whereas pleural effusion and hemothorax were equally present in both groups (Table 3). There were no differences in the presence of significant (moderate-to-severe) aortic regurgitation complicating the AAS-A among groups. Mean maximum ascending aorta diameter (including true and false lumen) was 51.9 ± 10.5 mm, without significant differences between patients.

Except for the left subclavian artery, supra-aortic vessels were more frequently involved in patients with shock (brachiocephalic trunk: 50.5% vs 35.4%, $p = 0.006$; right carotid: 29.9% vs 17.2%, $p = 0.005$; left carotid: 35.1% vs 21.5%, $p = 0.005$). There were no significant differences in the involvement of the remaining aortic branches between the two groups (Table 3). Considering the most proximal and distal

TABLE 3 Imaging test

Variable	No Shock (N = 424)	Shock (N = 97)	p
Maximum aortic diameter	51.8 ± 10.8	52.3 ± 9.1	0.707
Pericardial effusion	152 (36.1%)	51 (53.1%)	0.002
Pleural effusion	43 (10.3%)	10 (10.6%)	0.914
Hemothorax	21 (5%)	4 (4.3%)	>0.999
Moderate to severe AR	194 (46.7%)	48 (51.6%)	0.396
Aortic root involvement	292 (69%)	66 (68%)	0.874
Iliac artery involvement	192 (45.3%)	40 (41.2%)	0.832
Aortic branch involvement			
RCA	29 (6.8%)	7 (7.2%)	0.895
LCA	17 (4%)	8 (8.2%)	0.109
Brachiocephalic trunk	150 (35.4%)	49 (50.5%)	0.006
Right carotid	73 (17.2%)	29 (29.9%)	0.005
Left carotid	91 (21.5%)	34 (35.1%)	0.005
Left subclavian	104 (24.5%)	24 (24.7%)	0.965
Celiac trunk	46 (10.8%)	14 (14.4%)	0.319
SMA	55 (13%)	13 (13.4%)	0.910
IMA	22 (5.2%)	8 (8.2%)	0.243
RRA	50 (11.8%)	17 (17.5%)	0.128
LRA	68 (16%)	21 (21.6%)	0.185
RIA	77 (18.2%)	22 (22.7%)	0.306
LIA	91 (21.5%)	20 (20.6%)	0.855

AR: aortic regurgitation; IMA: inferior mesenteric artery; LCA: left coronary artery; LIA: left iliac artery; LRA: left renal artery; RCA: right coronary artery; RIA: right iliac artery; RRA: right renal artery; SMA: superior mesenteric artery.

involved aortic segment, the length of the aortic injury was similar in both groups.

3.3. SURGICAL TREATMENT. In this series, surgery in patients with shock was often performed (78.4%). However, it was more frequently done in patients without shock (86.1% vs 78.4%, p = 0.057). Among patients who underwent surgery, time from diagnosis to surgery was shorter in patients with shock (Table 4: 2.79 vs 4.14 h, p = 0.008). Emergent surgery was more frequently done in patients with shock (75% vs 66.8%, p = 0.033). Regarding the surgical technique, Bentall-De Bono procedure was more common in patients with shock (41.8% vs 29.2%, p = 0.043), whereas more complicated procedures such as the frozen elephant trunk technique were more frequently done in patients without shock (Table 4). In this series, axillary cannulation was the most commonly used cannulation site (76.2%). However, femoral artery cannulation was chosen more frequently for patients in shock (30.2% vs 16.1%, p = 0.009). Circulatory arrest time during surgery was similar between groups (Table 4).

3.4. CLINICAL CORRELATES AND CAUSES OF SHOCK. The multivariate logistic regression analysis to assess for independent clinical correlates and causes of shock revealed that stroke (OR 3.7, p < 0.001), cardiac tamponade (OR 5.32, p < 0.001), and left ventricular failure (OR 3.6, p = 0.002) were strongly associated with shock (Table 5). Among them, cardiac tamponade was the most important predictor of shock in patients with AAS-A.

3.5. IN-HOSPITAL EVOLUTION. Myocardial infarction was more common in patients with shock (14.3% vs 7%, p = 0.040). Acute renal failure (50% vs 35.8%, p = 0.025) and paraplegia (8.6% vs 2.5%, p = 0.021) after surgery were also more frequent in this group. However, other severe complications, such as mesenteric ischemia and bleeding occurred similarly in both groups (Table 6).

Overall mortality for the entire cohort was 31.3% and was higher in patients with shock (Table 6: 48.5% vs 27.4%, p < 0.001). Nevertheless, when analyzing the impact of surgery on patients with AAS-A, surgery was associated with a mortality reduction in both groups (Fig. 1).

In the multivariate logistic regression for mortality performed in the Shock group, surgery remained independently associated with a lower mortality (OR 0.03, p = 0.003), while the need for intubation before surgery (OR 3.02, p = 0.043) resulted an independent risk factor for mortality (Table 7).

4. DISCUSSION

This study explores the clinical characteristics, diagnosis, and management of AAS-A patients presenting with shock in a contemporary multicenter cohort. This nationwide cohort of patients with AAS-A provides important information on the management of such a dreadful complication. The main findings of our study are: 1) syncope and neurological deficits are serious warning symptoms in the clinical presentation of patients with AAS-A and are strongly associated with shock. 2) Cardiac tamponade and left ventricular dysfunction were the most important predictors of shock in patients with AAS-A. 3) Patients with shock at the time of diagnosis of AAS-A have a significantly higher risk of mortality despite being diagnosed earlier and admitted directly to the referral center in a greater proportion than patients without

TABLE 4 Surgical treatment

Variable	No Shock (N = 424)	Shock (N = 97)	p
Diagnosis to surgery time (h)	4.14 (2.3-8.1)	2.79 (1.5-5.4)	0.008
Delayed surgery (>24 h)	36 (9.9%)	2 (2.6%)	0.041
Surgical conditions			
Urgent	95 (27.7%)	13 (19.1%)	0.033
Emergent	229 (66.8%)	51 (75%)	
CPR before anesthetic induction	6 (1.7%)	4 (5.9%)	
Bentall-De Bono	94 (29.2%)	28 (41.8%)	0.043
David procedure	11 (3.5%)	5 (7.8%)	0.164
Aortic arch surgery	108 (33.3%)	20 (30.3%)	0.633
FET	36 (11.5%)	1 (1.6%)	0.017
Axillary cannulation	246 (77.1%)	49 (72.1%)	0.374
Femoral cannulation	48 (16.1%)	19 (30.2%)	0.009
Circulatory arrest time (min)	33 (20-77)	38 (23-07)	0.352

CPR: cardiopulmonary resuscitation; FET: frozen elephant trunk.

TABLE 5 Multivariate logistic regression analysis for clinical correlates and causes of shock

Variable	OR (95% CI)	p
Age (year)	1.01 (0.99-1.04)	0.224
Sex (female)	1.30 (0.77-2.21)	0.327
Chronic renal failure	1.35 (0.76-2.40)	0.308
Moderate to severe AR	1.28 (0.78-2.12)	0.319
Stroke	3.70 (1.81-7.55)	<0.001
Left ventricular failure	3.60 (1.60-8.06)	0.002
Cardiac tamponade	5.32 (3.00-9.40)	<0.001

AR: aortic regurgitation.

shock. 4) Surgery is associated with a substantial mortality reduction in patients with and without shock. However, the potential benefit of surgery on survival is even more remarkable in the shock population with an absolute risk reduction of 59.7%.

Hypotension has been previously associated with an increased risk of mortality of AAS-A.[11] Moreover, prolonged hypotension and shock is an independent risk factor for in-hospital mortality and perioperative mortality.[12,13] Early recognition of risk markers for the development of shock in AAS patients is essential for a quick initiation of medical treatment and emergent surgical repair in order to change the course of events.[2,14] Our results showed that 45.4% of patients in the Shock group made their clinical debut with syncope, as compared to 10% in the No-Shock group. According to the IRAD results, 13-21% of patients with AAS-A present with syncope.[15] Syncope is a well-recognized predictor of adverse events in patients with AAS.[16,17] Similarly, neurological deficits were present in a significant proportion of patients with shock. Although chest pain remains the most frequent symptom in patients with AAS,[15] combination of chest pain and syncope, chest paint with neurological deficit, and also syncope itself in a particular patient with other risk factors for AAS should activate the alarms for a quick assessment, early echocardiography and CT, blood pressure monitoring, and rapid transfer to the operating room once the AAS diagnosis is established.

Regarding the underlying mechanisms of shock in patients with AAS-A, acute aortic valvular regurgitation, cardiac tamponade, and myocardial infarction due to coronary malperfusion have been described as main causes of shock in this patient population.[12] Among them, cardiac tamponade emerges as one of the most important mechanisms of shock and perioperative death in AAS-A.[18,19] Our results agree with previously reported series, and cardiac tamponade was present in 36.2% of patients with shock. Pericardial effusion was found in more than half of the patients in the Shock group. Moreover, the risk of shock increases 5-fold in presence of cardiac tamponade. In this sense, early recognition of pericardial effusion in patients with AAS-A and prompt initiation of intravenous fluids are crucial to prevent cardiac tamponade. The role of pericardial drainage in patients with AAS remains controversial.[20-22] Although pericardial drainage is not routinely recommended in the management of AAS-related cardiac tamponade, an emergent pericardiocentesis withdrawing just enough fluid to temporarily stabilize the patient might be an option in selected patients with refractory shock and cardiac tamponade to restore organ perfusion before surgery.[21,22] However, the mere presence of pericardial effusion in a patient with AAS-A is a marker of worse prognosis and increased risk of death and should lead us to urgent surgery.

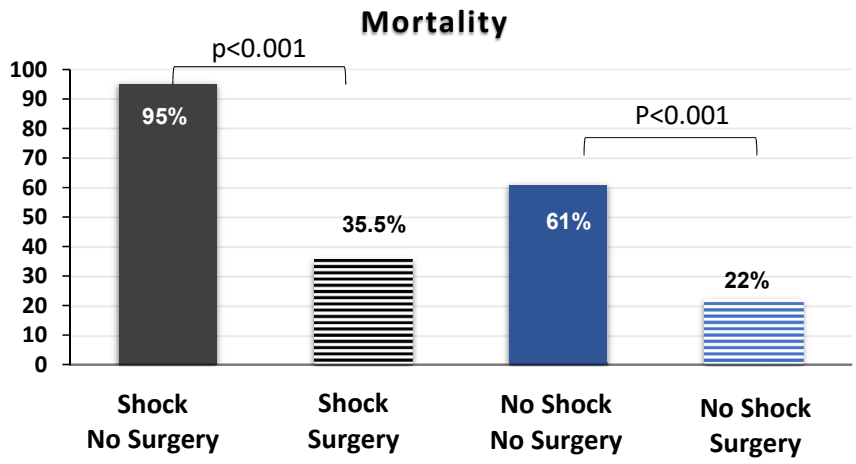
Interestingly enough, the presence of significant aortic regurgitation did not differ between patients with and without shock. Severe aortic regurgitation may result in acute heart failure and shock.[12,22]

TABLE 6 In-hospital evolution after surgery

Variable	No Shock (N = 424)	Shock (N = 97)	p
Myocardial infarction	26 (7%)	10 (14.3%)	0.040
Left ventricular dysfunction	54 (14.6%)	13 (18.3%)	0.424
Cardiac tamponade	27 (7.2%)	5 (7.1%)	0.982
Mesenteric ischemia	29 (7.8%)	9 (13%)	0.156
Renal failure	133 (35.8%)	35 (50%)	0.025
Stroke	39 (10.6%)	12 (17.1%)	0.118
Paraplegia	9 (2.5%)	6 (8.6%)	0.021
Bleeding[a]	41 (12.6%)	6 (10.5%)	0.659
Respiratory failure	95 (28.5%)	21 (35.6%)	0.2732
Mortality	116 (27.4%)	47 (48.5%)	<0.001

[a]Bleeding requiring surgical reintervention.

FIGURE 1 **Impact of surgery in patients with type A AAS with and without shock.**



Differences in mortality of patients with and without shock according to the treatment strategy. AAS: acute aortic syndrome

However, this complication does not seem to be the leading cause of shock in our series. In addition, moderate-to-severe aortic regurgitation was not associated with mortality in the Shock-cohort. Acute aortic regurgitation in AAS-A is the result of different mechanisms such as valve leaflet tearing, aortic root dilation, or flap prolapse.[2,4,8] Surgical repair effectively achieves correction of the damage, either with valve-sparing procedures or prosthetic valve implantation.[23] Thus, in this study, composite valve tube was used more frequently in patients with shock. This result is not surprising, as valve-sparing procedures are usually more complex, time-consuming techniques that require a higher level of expertise, and emergent conditions of surgery in patients with shock prevent these types of procedures.

Imaging test showed that a significantly higher proportion of shock patients had extension of the dissection to the supra-aortic trunks. Left ventricular dysfunction and acute renal failure were also more frequent in the cohort of patients with shock. Both the presence of stroke and left ventricular dysfunction were independently associated with the development of shock. All them indicate a higher risk of organ malperfusion associated with shock, either static as in those cases of dissecting flap extension to the aortic branches, or dynamic due to low cardiac output and severe hypotension. Malperfusion syndrome, particularly when the supra-aortic vessels are involved, leads to an increase in morbidity and mortality of AAS-A.[5,24] Maintenance of systolic blood pressure around 90 mmHg minimum should be pursued during preoperative management in the acute cardiovascular care unit to ensure an adequate organ perfusion.[11]

The benefit of surgery on mortality of patients with AAS-A has been confirmed in large studies covering different patient populations.[1,15,24,25] Hemodynamically unstable patients may raise doubts about the

TABLE 7 **Multivariate logistic regression analysis for mortality in the Shock group**

	Univariate		Multivariate	
Variable	OR (95% CI)	p	OR (95% CI)	p
Surgery	0.03 (0.00-0.22)	<0.001	0.03 (0.00-0.32)	0.003
Posterior chest pain	0.41 (0.17-1.00)	0.049	0.29 (0.08-1.06)	0.068
Cardiac tamponade	0.58 (0.25-1.36)	0.212	0.46 (0.15-1.44)	0.184
Moderate to severe AR	1.36 (0.60-3.07)	0.462	0.56 (0.13-4.79)	0.434
Age (years)	1.03 (0.93-1.09)	0.640	1.01 (0.96-1.06)	0.640
Direct admission to tertiary-care hospital	2.83 (1.22-6.60)	0.016	1.75 (0.62-4.9)	0.291
Stroke	2.04 (0.68-6.14)	0.207	1.21 (0.31-4.79)	0.784
Need for OTI	2.73 (1.17-6.37)	0.020	3.02 (1.04-8.82)	0.043

OTI: orotracheal intubation.

potential benefit of surgery and the suitability of the procedure in such adverse conditions.[12,22,26] However, as shown in this study, the potential benefit of emergent surgery among patients presenting with shock is even greater than in those who remain hemodynamically stable at the time of diagnosis. In fact, surgery was the only independent protective factor in the Shock group after multivariate adjustment. In this contemporary series, surgical mortality was similar to that reported by Bossone et al.[12] It is important to note that the results of the present study reflect real-world data, as it includes consecutive patients from most tertiary-care centers in a country. As previously mentioned above, the underlying mechanisms of shock in AAS-A patients, namely cardiac tamponade, myocardial ischemia, and aortic regurgitation, can only be properly corrected with a surgical repair. In some patients, the presence shock may be the result of an already-present aortic rupture.[27] In such circumstances, emergent surgery is the only effective treatment to save patients' life. Therefore, all AAS-A patients with shock should be considered for surgery unless absolute contraindications are present.

4.1. LIMITATIONS. Although it includes a large patient population from multiple tertiary-care referral centers across the country, this is an observational study with the limitations that this type of studies entails. Information about inotropic and vasopressors agents was not available. As the RESA-III is a general multicenter registry of AAS, classifications of the shock severity, such as recent SCAI classification, were not routinely measured and collected.[28] Information about medications previous to the AAS was not recorded. The use of extracorporeal membrane oxygenation and other circulatory support devices in patients with AAS presenting with shock is not currently widespread in Spain. Therefore, data on these therapies were not available in this study. Information about additional procedures during surgery, such as coronary artery bypass grafting or mitral valve surgery, was not recorded. Patients who die before hospital admission without a confirmation of AAS diagnosis were not included in the registry. Thus, an inclusion bias is inevitable with this study design. Biomarkers such as NT-proBNP and troponins were not systematically measured.

4.2. CONCLUSIONS. Shock is a dreadful form of presentation of AAS-A, associated with a high risk of ischemic complications and mortality. Syncope and pericardial effusion at the time of AAS diagnosis are strongly associated with shock. Emergent surgical repair entails a significant mortality reduction, both in patients with and without shock at diagnosis. The potential benefit of a surgical intervention is even higher in patients with shock. Thus, surgery should be considered in all patients unless formal contraindications, as it is independently associated with lower mortality even in such an adverse condition.

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DATA AVAILABILITY STATEMENT

The data underlying this article will be shared, on reasonable request, with the corresponding author.

CONFLICT OF INTEREST STATEMENT

There are no potential conflicts of interest to declare.

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