Serum Amyloid A Protein as a Potential Biomarker in predicting acute onset and association with in-hospital death in acute aortic dissection

CURRENT STATUS: ACCEPTED

BMC Cardiovascular Disorders BMC Series

Yuchen He

Chinese Academy of Medical Sciences and Peking Union Medical College

Changcheng Ma

Shengjing Hospital of China Medical University

Jia Xing

China Medical University

Shiyue Wang

the First Hospital of China Medical University

Ji Chao

Shengjing Hospital of China Medical University

Yanshuo Han

Shengjing Hospital of China Medical University

✉ yanshuohan@cmu.edu.cn *Corresponding Author*
ORCID: <https://orcid.org/0000-0002-4897-2998>

Jian Zhang

the First Hospital of China Medical University

DOI:

10.21203/rs.2.17288/v1

SUBJECT AREAS

Cardiac & Cardiovascular Systems

KEYWORDS

Serum amyloid A, Acute aortic dissection, Biomarker, Inflammation

Abstract

Background: Acute aortic dissection (AAD) is a life-threatening disorder in vascular surgery with a high early mortality. Serum amyloid A (SAA) is a kind of acute-phase protein with a rapid diagnostic value in other diseases. However, the researches on the performance of SAA for the diagnosis of AAD is still lacking. This retrospective study aimed to evaluate the SAA levels and further explore its potential diagnostic role in AAD patients.

Methods: SAA levels were measured by enzyme-linked immunosorbent assay (ELISA) in 63 controls and 87 AAD patients. Laboratory examinations were also performed. And relative clinical information was collected from participants included in this study.

Results: SAA levels were significantly higher in AAD patients than those in healthy controls. SAA levels were independently associated with the risk of AAD. There was a positive significant correlation between SAA and C reactive protein ($R=0.442$, and $P=0.001$). Based on receiver-operating characteristic (ROC) analysis, the area under the curve (AUC) of SAA for the diagnosis of AAD were 0.942 with optimal cut-off points of 0.427mg/L. For in-hospital mortality, the AUC of SAA were 0.732 with optimal cut-off points of 0.500mg/L. According to logistic regression analysis, higher SAA levels represent a higher risk of in-hospital mortality ($OR=1.25$; 95%CI: 1.07-1.47; $P=0.005$).

Conclusion: Our findings demonstrated that SAA levels were significantly enhanced in AAD. SAA was closely correlated with inflammatory parameters and coagulation-related parameters in AAD.

Furthermore, SAA could be a potential bio-marker for identifying AAD in the early diagnosis. Finally, SAA >5.0 mg/L are independently related to AAD in-hospital mortality.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed.

However, the manuscript can be downloaded and accessed as a PDF.

Tables

Table 1 Demographic and laboratory parameters of participants included in this study

	Control (n=63)	Angina (n=20)	AAD (n=87)	P-value
Male	43 (68.25%)	15(75.00%)	65 (74.71%)	0.00
Hypertension	21 (33.33%)	8(40.00%)	54 (62.69%)	0.00
Smoking	19 (30.16%)	7(35.00%)	31 (35.63)	0.00
DM	10 (15.87%)	6(30.00%)	26 (29.89%)	0.00
Age	53.44 ± 11.52	57.80±2.11	53.87 ± 11.42	0.00
BMI	21.8 ± 3.68	23.70±0.73	22.87 ± 5.14	0.00
HR	78.06 ± 9.6	79.45±1.68	89.46 ± 12.68	<0.00
WBC	5.83 ± 0.77	6.39±0.40	10.74 ± 4.24	<0.00
HGB	150.98 ± 17.68	135.50±4.08	132.39 ± 20.97	<0.00
PLT	173.3 ± 43.14	201.35±13.27	190.59 ± 68.15	0.00
FPG	4.97 ± 4.87	5.54±0.24	7.21 ± 2.42	0.00
SAA	0.36 ± 0.08	0.72±0.40	4.43 ± 0.31	<0.00

Note, AAD-acute aortic dissection; TAAD-type A aortic dissection; TBAD-type B aortic dissection; BMI-body mass index; HR-platelet; FPG-fast plasma glucose; SAA-serum amyloid A

Table 2 Comparison of SAA levels between AAD and control group, AAD and angina group stratified by cardiovascular risk factors

Variables		Control SAA(ng/mg)	Angina SAA(ng/mg)	AAD SAA(ng/mg)
Age	<60y	0.418±0.113	0.661±0.333	4.4
	≥60y	0.263±0.084	0.632±0.323	6.8
Gender	male	0.375±0.093	0.697±0.295	5.5
	female	0.332±0.146	0.446±0.244	5.2
BMI	<25	0.300±0.067	0.652±0.301	5.8
	≥25	0.652±0.316	0.630±0.364	4.3
Hypertension	Yes	0.445±0.164	0.808±0.204	4.8
	No	0.319±0.085	0.535±0.342	6.3
Smoking history	Yes	0.510±0.215	0.728±0.326	7.6
	No	0.297±0.063	0.516±0.278	4.2
DM	Yes	0.232±0.093	0.566±0.356	8.1
	No	0.385±0.093	0.677±0.311	4.3

Note, AAD-acute aortic dissection; BMI-body mass index; DM-diabetes mellitus; SAA-serum amyloid A

Table 3 Comparisons of blood parameters between different sub-groups in AAD patient group

Parameters	TAAD	TBAD	P value	less than 6h	more than 6h	P value	commu fa lun
WBC, $\times 10^9/L$	11.54 ± 4.5	10.06 ± 3.92	0.198	10.73 ± 4.75	10.75 ± 3.78	0.917	12.1
BA/WBC, %	0.20 ± 0.23	0.28 ± 0.34	0.646	0.24 ± 0.3	0.25 ± 0.30	0.723	0.3 $\pm$
EO/WBC, %	1.37 ± 1.65	0.89 ± 1.51	0.139	0.95 ± 1.37	1.26 ± 1.76	0.409	1.04 :
MO/WBC, %	13.29 ± 14.10	8.48 ± 9.03	0.002**	9.29 ± 7.37	11.96 ± 14.7	0.909	15.02 :
LY/WBC, %	14.87 ± 9.26	15.98 ± 9.1	0.462	14.76 ± 8.5	16.1 ± 9.72	0.596	14.24
NE/WBC, %	69.92 ± 15.24	74.31 ± 12.97	0.198	74.49 ± 12.41	70.31 ± 15.41	0.275	69.4 $\pm$
RBC, $\times 10^{12}/L$	4.26 ± 0.64	4.52 ± 0.76	0.014*	4.36 ± 0.65	4.43 ± 0.77	0.730	4.32 :
HGB, g/L	128.63 ± 17.86	135.61 ± 23.03	0.052	134.92 ± 18.44	130.13 ± 23	0.328	126.73
MCH, pg	30.45 ± 3.12	30.49 ± 1.94	0.373	31.06 ± 2.15	29.94 ± 2.75	0.015*	29.89
MCV, fL	91.66 ± 8.00	92.11 ± 5.52	0.696	93.2 ± 5.67	90.74 ± 7.43	0.181	90.10 :
MCHC, g/L	331.77 ± 11.11	331.12 ± 11.83	0.731	333.17 ± 9.78	329.85 ± 12.65	0.348	330.8 :
HCT, L/L	0.38 ± 0.06	0.41 ± 0.07	0.083	0.41 ± 0.06	0.39 ± 0.08	0.428	0.38 :
RDW, %	13.73 ± 2.43	13.25 ± 1.3	0.864	13.38 ± 1.47	13.51 ± 2.17	0.753	14.26
PLT, $\times 10^9/L$	199.34 ± 67.05	183.12 ± 69	0.196	177.75 ± 64.26	202.15 ± 70.25	0.218	166.07
MPV, fL	9.48 ± 1.13	9.93 ± 1.67	0.158	9.95 ± 1.43	9.52 ± 1.46	0.380	9.51 :
PCT, L/L	1.02 ± 2.26	0.36 ± 1.11	0.076	0.80 ± 1.99	0.56 ± 1.54	0.264	1.22 :
PDW, 10GSD	14.51 ± 2.72	14.4 ± 2.90	0.657	14.9 ± 3.00	14.06 ± 2.59	0.260	15.26
TP, g/L	63.93 ± 7.68	63.78 ± 10.34	0.540	64.76 ± 8.76	63.05 ± 9.56	0.410	61.72
PA, mg/dL	15.96 ± 6.67	17.71 ± 6.29	0.231	14.18 ± 6.55	18.88 ± 5.74	0.005**	16.94
ALB, g/L	35.75 ± 6.12	36.84 ± 6.93	0.341	37.03 ± 6.36	35.75 ± 6.74	0.470	34.45
ALP, U/L	106.79 ± 81.75	99.61 ± 43.41	0.583	104.84 ± 59.66	100.79 ± 66.18	0.793	102.42
ALT, U/L	140.94 ± 407.11	57.24 ± 61.02	0.151	91.74 ± 203.78	98.2 ± 333.43	0.210	119.07 :
AST, U/L	94 ± 364.89	60.56 ± 101.49	0.249	59.69 ± 101.85	91.36 ± 346.71	0.502	43.86 :
GGT, U/L	128.38 ± 212.94	94.02 ± 122.55	0.766	139.77 ± 181.81	83.2 ± 154.87	0.057	127.2 $\pm$
CHE, 1000U/L	6.02 ± 1.65	5.96 ± 1.71	0.666	5.70 ± 1.54	6.22 ± 1.74	0.247	5.48 :

TBA, $\mu\text{mol/L}$	4.76 ± 4.87	4.16 ± 5.86	0.312	5.84 ± 7.11	3.36 ± 2.95	0.170	4.19 :
DBIL, $\mu\text{mol/L}$	8.93 ± 9.78	5.77 ± 2.84	0.493	9.7 ± 10.4	5.66 ± 3.36	0.122	8.72 :
TBIL, $\mu\text{mol/L}$	17.95 ± 14.17	16.75 ± 8.70	0.568	20.2 ± 14.67	14.81 ± 6.88	0.103	18.37 :
CK, U/L	186.1 ± 220.13	382 ± 1184.96	0.865	217.87 ± 314.36	360.08 ± 1186.69	0.940	287.88 :
CKMB, U/L	17.95 ± 9.85	22.39 ± 22.55	0.343	18.16 ± 8.53	21.32 ± 21.17	0.930	18.23
Urea, mmol/L	7.56 ± 3.99	7.94 ± 8.41	0.127	7.84 ± 6.95	7.7 ± 6.56	0.640	8.29 :
Uric, mmol/L	273.5 ± 159.03	352.75 ± 214.01	0.280	332.93 ± 185.1	277.47 ± 184.43	0.213	314.57 :
Crea mmol/L	91.22 ± 43.83	111.17 ± 82.2	0.789	110.42 ± 66.54	88.13 ± 55.74	0.083	99.33 :
CYSC, mg/L	1.30 ± 0.53	1.42 ± 0.95	0.990	1.38 ± 0.79	1.34 ± 0.73	0.654	1.54 :
Clq, mmol/L	182.2 ± 35.56	200.05 ± 38.89	0.172	177.55 ± 36.91	198.33 ± 35.83	0.074	181.63
Na, mmol/L	138.48 ± 4.85	141.52 ± 6.29	0.037*	140.08 ± 7.12	140.15 ± 4.48	0.731	139.35
K, mmol/L	3.63 ± 0.87	4.27 ± 0.66	0.015*	3.92 ± 0.62	3.84 ± 1.02	0.724	4.18 :
CL, mmol/L	103.36 ± 5.92	111.18 ± 7.39	0.000***	104.75 ± 8.74	108 ± 5.91	0.052	105.88
HCO ₃ , mmol/L	24.15 ± 2.41	23.98 ± 2.95	0.767	24.37 ± 2.47	23.76 ± 2.92	0.236	23.71
PH value	6.93 ± 0.69	6.49 ± 1.08	0.106	7.06 ± 0.6	6.44 ± 1.02	0.021*	6.5 ±
TC, mmol/L	4.19 ± 0.83	4.59 ± 1.17	0.255	4.62 ± 1.32	4.3 ± 0.84	0.589	4.92 :
TG, mmol/L	1.34 ± 0.56	1.34 ± 0.67	0.834	1.24 ± 0.47	1.41 ± 0.71	0.677	1.5 ±
ApoA1, mmol/L	1.14 ± 0.18	1.21 ± 0.22	0.469	1.18 ± 0.17	1.18 ± 0.22	0.938	1.14 :
ApoB, mmol/L	0.85 ± 0.22	0.76 ± 0.13	0.674	0.75 ± 0.22	0.83 ± 0.13	0.277	0.85 :
LDL-C, mmol/L	2.58 ± 0.78	2.87 ± 1.06	0.246	2.87 ± 1.04	2.68 ± 0.92	0.620	3.23 :
HDL-C, mmol/L	1.08 ± 0.34	1.22 ± 0.31	0.139	1.18 ± 0.25	1.16 ± 0.37	0.649	1.09 :
LDH, U/L	451.88 ± 779.15	487.03 ± 489.75	0.138	505.85 ± 538.16	444.28 ± 694.87	0.171	410.67 :
INR	1.14 ± 0.22	1.08 ± 0.11	0.446	1.13 ± 0.21	1.09 ± 0.13	0.172	1.09 :
PT, s	13.11 ± 2.41	13.28 ± 1.33	0.149	13.51 ± 2.27	12.96 ± 1.51	0.119	12.9 :
PTA, %	85.87 ± 17.42	89.28 ± 12.04	0.615	85.62 ± 16.02	89.38 ± 13.59	0.198	88.54 :
APTT, s	32.28 ± 5.28	35.79 ± 5.86	0.008**	34.39 ± 6.11	34.04 ± 5.69	0.948	34.42
FPG, mmol/L	7.61 ± 2.84	6.92 ± 2.05	0.355	7.2 ± 1.92	7.22 ± 2.81	0.281	6.38 :

CRP, mg/L	95.73 ± 60.92	70.53 ± 76.14	0.115	90.4 ± 83.01	71.92 ± 61.85	0.597	79.43 :
D-Dimer, µg/mL	2.02 ± 3.57	4.10 ± 5.73	0.187	3.25 ± 4.94	3.09 ± 5.02	0.234	1.81 :
SAA, µg/mL	4.22 ± 0.33	4.58 ± 0.48	0.595	4.61 ± 0.42	4.21 ± 0.45	0.582	5.28 :

Note,

BMI, Body Mass Index; HR, heart rate; WBC, white blood cells; RBC, red blood cells; HGB, hemoglobin; PLT, Platelet; BA, ba corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; MCV, mean corpuscular Volume; MPV, mear distribution width; RDW, red blood cell volume distribution width; APTT, activated partial thromboplastin time; PT, prothror kinase; CKMB, creatine kinase isoenzyme MB; CRP, C-reactive protein; ALB, albumin; ALP, alkaline phosphatase; ALT, alani total bilirubin; CHE, cholinesterase; GGT, gamma glutamyl transpeptidase; TBA, total bile acid; TP, total protein; PA, pre-al Creatinine; CYSC, Cystatin C; K, serum kalium; ApoA1, apolipoprotein A-1; ApoB, apolipoprotein B; FPG, fasting plasma glu triglycerides; LDL-C, low-density lipoprotein-cholesterol.

*P<0.05; **P<0.01; ***P<0.001

Table 4 The correlations between SAA levels and clinical features in AAD patients

Characterization	Indices	R	P value	Characterization	Indices
Baseline Data				Liver function	
	Age, Yr	-0.045	0.584		ALB, g/L
	BMI	0.126	0.123		ALP, U/L
	HR, bmp	0.333	<0.001***		ALT, U/L
Blood routine					AST, U/L
	WBC, $\times 10^9/L$	0.614	<0.001***		DBIL, $\mu\text{mol/L}$
	RBC, $\times 10^{12}/L$	-0.111	0.354		TBIL, $\mu\text{mol/L}$
	HGB, g/L	-0.395	<0.001***		CHE, 1000U/L
	PLT, $\times 10^9/L$	0.091	0.285		GGT, U/L
	BA, $\times 10^9/L$	-0.101	0.385		TBA, $\mu\text{mol/L}$
	EO, $\times 10^9/L$	-0.243	0.035*		TP, g/L
	LY, $\times 10^9/L$	-0.168	0.147		PA, mg/dL
	MO, $\times 10^9/L$	0.085	0.468		LDH, U/L
	NE, $\times 10^9/L$	0.257	0.025*	Renal function and serum electrolyte	
	MCH, pg	-0.065	0.574		Na, mmol/L
	MCHC, g/L	-0.202	0.080		C1q, mmol/L
	MCV, fL	0.015	0.898		HCO ₃ , mmol/L
	MPV, fL	-0.098	0.405		CL, mmol/L
	HCT, L/L	-0.198	0.148		Crea, mmol/L
	PCT, L/L	-0.011	0.930		CYSC, mg/L
	PDW, 10GSD	0.158	0.189		PH value
	RDW, %	0.171	0.166		K, mmol/L
Blood coagulation function					Urea, mmol/L
	APTT, s	-0.241	0.051		Uric, mmol/L
	PT, s	0.03	0.811	Serum lipid profile	
	PTA, %	-0.258	0.037*		ApoA1, mmol/L
	INR	0.251	0.042*		ApoB, mmol/L
	D-Dimer, $\mu\text{g/ml}$	0.206	0.097		FBG, mmol/L
Cardiovascular injury-related parameters					HDL-C, mmol/L
	CK, U/L	-0.039	0.756		TC, mmol/L
	CKMB, U/L	0.213	0.198		TG, mmol/L
Inflammatory response					LDL-C, mmol/L
	CRP, mg/L	0.442	0.001***		

Note,

BMI, Body Mass Index; HR, heart rate; WBC, white blood cells; RBC, red blood cells; HGB, hemoglobin; PLT, Platelet; BA, basophil; EO, eosinophil; LY, lymphocyte; MO, monocyte; NE, neutrophil; MCH, mean

corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; MCV, mean corpuscular Volume; MPV, mean platelet volume; HCT, hematocrit; PCT, platelet hematocrit; PDW, platelet distribution width; RDW, red blood cell volume distribution width; APTT, activated partial thromboplastin time; PT, prothrombin time; PTA, prothrombin activity, INR, international normalized ratio; CK, creatine kinase; CKMB, creatine kinase isoenzyme MB; CRP, C-reactive protein; ALB, albumin; ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransferase; DBIL, direct bilirubin; TBIL, total bilirubin; CHE, cholinesterase; GGT, gamma glutamyl transpeptidase; TBA, total bile acid; TP, total protein; PA, pre-albumin; LDH, lactate dehydrogenase; Na, serum sodium; CL, serum chlorine; Crea, Creatinine; CYSC, Cystatin C; K, serum kalium; ApoA1, apolipoprotein A-1; ApoB, apolipoprotein B; FPG, fasting plasma glucose; HDL-C, high-density lipoprotein-cholesterol; TC, total cholesterol; TG, triglycerides; LDL-C, low-density lipoprotein-cholesterol.

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Table 5 Diagnostic value of SAA and its combinations with CRP and D-Dimer for AAD patients

	AUC	95%CI	P-value	cut-off	Sensitivity (%)	Specificity (%)
AAD	0.942	0.902-0.981	<0.001	0.427	0.908	0.937
TAAD	0.939	0.873-1.004	<0.001	0.427	0.919	0.937
TBAD	0.937	0.883-0.990	<0.001	0.462	0.881	0.937
Combination						
SAA+CRP	0.977	0.955-0.999	<0.001	-	0.944	0.938
SAA+D-Dimer	0.9	0.838-0.963	<0.001	-	0.848	0.938
Death						
SAA (death v.s. survival)	0.732	0.612-0.853	0.001	4.998	0.739	0.625
CRP (death v.s. survival)	0.826	0.709-0.942	<0.001	82.55	0.789	0.771
D-Dimer (death v.s. survival)	0.715	0.562-0.869	0.006	1.945	0.7	0.739
NE% (death v.s. survival)	0.678	0.549-0.808	0.017	72.976	0.857	0.491

Note, AAD-acute aortic dissection; TAAD-type A aortic dissection; TBAD-type B aortic dissection; SAA-serum amyloid A; CRP-C reactive protein; AUC-area under the curve; NE%- neutrophil to lymphocyte ratio.

Table 6. Associations of parameters with the upper stratum of the SAA levels when compared with the lower stratum

	SAA lower	SAA upper OR (95%CI)	P value		SAA lower	SAA upper OR (95%CI)
Age, Yr	1 Reference	0.98 (0.92; 1.04)	0.5343	ALB, g/L	1 Reference	0.94
Hypertension, n	1 Reference	3.12 (0.76; 12.84)	0.1141	ALP, U/L	1 Reference	1.01
Smoker, n	1 Reference	1.64 (0.31; 8.54)	0.5579	ALT, U/L	1 Reference	1.01
D-Dimer, µg/mL	1 Reference	1.72 (0.79; 3.75)	0.1752	AST, U/L	1 Reference	1.00
CRP, mg/L	1 Reference	1.05 (1.00; 1.09)	0.0385	GGT, U/L	1 Reference	1.00
CAD, n	1 Reference	1.49 (0.17; 13.14)	0.7188	DBIL, µmol/L	1 Reference	1.77
Type01, n	1 Reference	1.11 (0.28; 4.50)	0.8787	TBIL, µmol/L	1 Reference	1.02
WBC, ×10 ⁹ /L	1 Reference	1.74 (1.18; 2.56)	0.0049	PA, mg/dL	1 Reference	0.83
RBC, ×10 ¹² /L	1 Reference	0.55 (0.18; 1.66)	0.2869	TP, g/L	1 Reference	0.97
HGB, g/L	1 Reference	0.96 (0.92; 1.00)	0.0711	TBA, µmol/L	1 Reference	0.97
PLT, ×10 ⁹ /L	1 Reference	1.00 (0.99; 1.01)	0.9735	K, mmol/L	1 Reference	3.1
FPG, mmol/L	1 Reference	1.17 (0.80; 1.70)	0.4191	CL, mmol/L	1 Reference	0.98
BA, ×10 ⁹ /L	1 Reference	0.18 (0.03; 1.20)	0.0764	Na, mmol/L	1 Reference	0.95
EO, ×10 ⁹ /L	1 Reference	0.79 (0.01; 114.81)	0.9253	HDL-C, mmol/L	1 Reference	1.06
LY, ×10 ⁹ /L	1 Reference	0.85 (0.77; 0.93)	0.0004	LDL-C, mmol/L	1 Reference	1.27
MO, ×10 ⁹ /L	1 Reference	1.02 (0.94; 1.10)	0.7075	TC, mmol/L	1 Reference	1.40
NE, ×10 ⁹ /L	1 Reference	1.97 (1.24; 3.11)	0.0039	TG, mmol/L	1 Reference	0.50
CKMB, u/L	1 Reference	1.01 (0.89; 1.15)	0.8363	Urea, mmol/L	1 Reference	1.17
MCH, pg	1 Reference	0.83 (0.56; 1.21)	0.3320	Uric, mmol/L	1 Reference	1.01
MCHC, g/L	1 Reference	0.97 (0.91; 1.04)	0.4322	Crea, mmol/L	1 Reference	1.09
MCV, fL	1 Reference	0.95 (0.84; 1.08)	0.4593	C1q, mmol/L	1 Reference	1.03
MPV, fL	1 Reference	0.77 (0.47; 1.27)	0.3056	HCO ₃ , mmol/L	1 Reference	0.77
PCT, L/L	1 Reference	0.51 (0.01; 3.93)	0.9060	PH value	1 Reference	0.08
PDW, 10GSD	1 Reference	1.03 (0.80; 1.32)	0.8293	APTT, s	1 Reference	0.90
RDW, %	1 Reference	2.43 (0.99; 5.97)	0.0535	PT, s	1 Reference	1.08
LDH, U/L	1 Reference	1.01 (1.00; 1.02)	0.0634	PTA, s	1 Reference	0.96

Note,

HR, heart rate; WBC, white blood cells; RBC, red blood cells; HGB, hemoglobin; PLT, Platelet; BA, basophil; EO, eosinophil; LY, lymphocyte; MO, monocyte; NE, neutrophil; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; MCV, mean corpuscular Volume; MPV, mean platelet volume; HCT, hematocrit; PCT, platelet hematocrit; PDW, platelet distribution width; RDW, red blood cell volume distribution width; APTT, activated partial thromboplastin time; PT, prothrombin time; PTA, prothrombin activity; CKMB, creatine kinase isoenzyme MB; CRP, C-reactive protein; ALB, albumin; ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransferase; DBIL, direct bilirubin; TBIL, total bilirubin; CHE, cholinesterase; GGT, gamma glutamyl transpeptidase; TBA, total bile acid; TP, total protein; PA, pre-albumin; LDH, lactate

dehydrogenase; Na, serum sodium; CL, serum chlorine; Crea, Creatinine; CYSC, Cystatin C; K, serum kalium; ApoA1, apolipoprotein A-1; ApoB, apolipoprotein B; FPG, fasting plasma glucose; HDL-C, high-density lipoprotein-cholesterol; TC, total cholesterol; TG, triglycerides; LDL-C, low-density lipoprotein-cholesterol.

Table 7 Univariate and multivariate logistic regression analyses for in-hospital mortality

	Model 1		Model 2	
	OR (95%CI)	P-value	OR (95%CI)	P-value
Type of AAD	0.47 (0.16; 1.32)	0.152	0.48 (0.17; 1.36)	0.167
HR, bmp	1.01 (0.97; 1.05)	0.584	1.01 (0.97; 1.05)	0.536
Hypertension, %	1.22 (0.41; 3.64)	0.724	1.13 (0.37; 3.40)	0.832
Smoker, %	0.63 (0.20; 1.96)	0.421	0.63 (0.20; 2.00)	0.432
D-Dimer, µg/mL	1.19 (0.98; 1.43)	0.074	1.20 (0.99; 1.46)	0.065
CRP, mg/L	1.02 (1.01; 1.03)	0.000	1.03 (1.01; 1.04)	0.000
WBC, ×10 ⁹ /L	1.17 (1.03; 1.32)	0.013	1.17 (1.03; 1.33)	0.015
EO, ×10 ⁹ /L	0.68 (0.40; 1.15)	0.148	0.68 (0.40; 1.16)	0.161
LY, ×10 ⁹ /L	0.92 (0.85; 0.99)	0.030	0.92 (0.85; 0.99)	0.031
NE, ×10 ⁹ /L	1.05 (1.00; 1.11)	0.040	1.06 (1.00; 1.11)	0.041
HCO ₃ , mmol/L	0.69 (0.53; 0.89)	0.004	0.67 (0.51; 0.88)	0.004
LDH, U/L	1.00 (0.99; 1.00)	0.097	1.00 (0.99; 1.00)	0.151
FPG, mmol/L	1.17 (0.95; 1.44)	0.133	1.16 (0.95; 1.43)	0.149
SAA, µg/dL	1.22 (1.05; 1.42)	0.011	1.25 (1.07; 1.47)	0.005

Note,
AAD, acute aortic dissection; HR, heart rate; CRP, C reactive protein; WBC, white blood cell; EO, eosinophil; LY, lymphocyte; NE, neutrophil; LDH, lactate dehydrogenase; FPG, fasting plasma glucose; SAA, serum amyloid A, CI: confidence interval, Model 1: no adjustments, Model 2: adjusted for age, gender, BMI

Figures

Figure 1

Flowchart of AAD patients selection and blood sample recovered from the First Hospital of CMU Aortic Dissection Blood sample Biobank (1H-ADBB/CMU) and Shengjing Hospital of CMU Aortic Dissection Blood sample Biobank (SJH-ADBB/CMU).

Figure 2

Analysis of SAA levels in different groups. (A) Comparison of SAA levels among controls, TAAD and TBAD. And sub-group analysis of SAA levels in AAD patients: (B) comparison of SAA levels between AAD with high-risk pain features that persisted less than six hours and more than six hours, and (C) comparison of SAA levels between AAD with communicating and non-communicating false lumen (C and NC), and (D) comparison of SAA levels between death cases and survival cases. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, ns, no significance.

Figure 3

Correlations between SAA levels and clinical features in AAD patients. The horizontal axis represents SAA levels in mg/L and the vertical axis represents (A)heart rate, bmp, (B)Fast plasma glucose, mmol/L, (C)white blood cell, $10^9/L$, and (D)C-reactive protein, mg/L.

Figure 4

ROC analysis of SAA levels for the evaluation of TAAD, TBAD, and AAD. The vertical axis represents the sensitivity and the horizontal axis represents the 1-specificity