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ORIGINAL RESEARCH

In-Hospital Mortality of Patients With Acute Type A Aortic Dissection Hospitalized on Weekends Versus Weekdays

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ABSTRACT

BACKGROUND In acute aortic dissection, weekend admissions are reported to be associated with increased mortality compared with weekday admissions.

OBJECTIVE This study aimed to determine whether patients with acute type A aortic dissection (ATAAD) admitted on weekends had higher in-hospital mortality than those admitted on weekdays in the Tokyo metropolitan area, where we developed a patient-transfer system for aortic dissection.

METHODS Data were collected during the first year after our transfer system began (cohort I) and in the subsequent years from 2013 to 2015 (cohort II).

RESULTS We studied 2,339 patients (500 in cohort I; 1,839 in cohort II) with ATAAD. Patients with weekend admissions had higher in-hospital mortality than those with weekday admissions in cohort I. In association with increased interfacility transfer during weekends and reduced mortality at non-high-volume centers, the in-hospital mortality in the weekend group improved from 37.2% in cohort I to 22.2% in cohort II ($P < 0.001$). After inverse probability weighting adjustment, weekend admission was associated with higher in-hospital mortality in cohort I (odds ratio: 2.28; 95% confidence interval: 1.48 to 3.52; $P < 0.001$), but not in cohort II (odds ratio: 0.96; 95% confidence interval: 0.75 to 1.22; $P = 0.731$). On multivariable analyses, weekend admission was associated with higher in-hospital mortality in combined cohort I+II; the associations between weekend admission and mortality were not significant in cohort II.

CONCLUSIONS We found a significant reduction in in-hospital mortality in patients with weekend admissions for ATAAD. No mortality difference between weekend and weekday admissions was observed in the later years of the study. (JACC: Asia 2022;2:369-381) © 2022 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. 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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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

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ABBREVIATIONS AND ACRONYMS

AAD = acute aortic dissection

ATAAD = acute type A aortic dissection

CCU = cardiovascular care unit

IMH = intramural hematoma

IPW = inverse probability weighting

TAAS = Tokyo Acute Aortic Super-network

Acute aortic dissection (AAD) is a life-threatening medical emergency associated with high mortality and morbidity. Immediate and intensive management following an early diagnosis of AAD is essential to preventing catastrophic complications. Treatment frequently requires urgent surgical repair, particularly in patients with acute type A aortic dissection (ATAAD). In local emergency medical services, the establishment of regional aortic networks plays a key role in proper triage and prompt transfer to specialized facilities for patients with suspected or confirmed AAD.[1-3] We recently developed an emergent patient-transfer system for AAD which consists of core and supportive hospitals and covers the entire Tokyo metropolitan area, the Tokyo Acute Aortic Super-network (TAAS).

Several studies have shown a higher mortality rate in patients hospitalized on weekends for acute cardiovascular diseases, such as acute myocardial infarction, acute heart failure, and pulmonary embolism, than in those hospitalized during weekdays.[4-7] Although some recent reports have shown a higher mortality rate in patients hospitalized for AAD or ruptured aortic aneurysm on weekends versus weekdays, it remains unclear whether such a "weekend effect" on mortality is uniformly observed in patients hospitalized for AAD.[8,9] The aim of the present study was to determine whether patients with ATAAD admitted on weekends had a higher mortality rate than those admitted on weekdays in our new aortic network system.

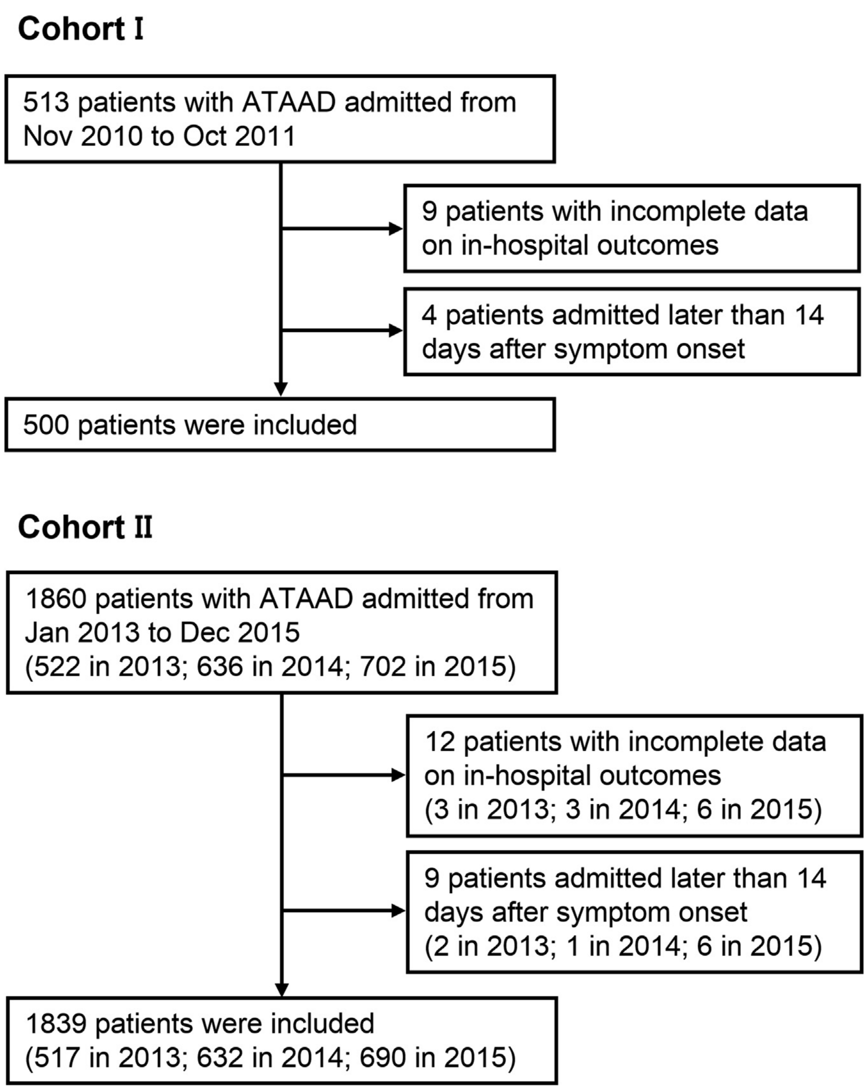
METHODS

AORTIC NETWORK SYSTEM AND DATABASE. The Tokyo Cardiovascular Care Unit (CCU) Network is an emergent transfer system for patients with all types of cardiovascular diseases that covers the entire Tokyo metropolitan region except the island areas.[10] Since November 2010, we have operated a regional aortic network system called the TAAS, which was established on the basis of the Tokyo CCU Network, with the aim of developing a safe and effective transfer system for patients with AAD and ruptured aortic aneurysm with the help of ambulance units through the control room of the Tokyo Fire Department.[11] In the first year, the TAAS consisted of 36 participating hospitals with specialized care for AAD and ruptured aortic aneurysm, comprising 11 core hospitals (high-volume centers with ≥40 patients admitted annually, available for emergency surgery 24 hours every day) and 25 supportive hospitals (intermediate-volume centers with ≥10 patients admitted annually, available with limitation but well prepared for emergency surgery); patients with suspected or confirmed AAD are first referred to such hospitals as reported elsewhere.[12,13] Based on the number of annual cases reported from each hospital, 2 supportive hospitals newly joined the TAAS and 1 supportive hospital was upgraded to core hospital during the study period (Supplemental Table 1). Detailed data on all patients treated in their Emergency Departments, Cardiovascular Surgery Departments, and CCUs were routinely recorded and submitted to the data management center on specific survey forms.

STUDY POPULATION AND DESIGN. During the first year after the TAAS began (cohort I), we collected data from a total of 513 consecutive patients with ATAAD who were admitted to institutions belonging to the TAAS and the Tokyo CCU network from November 2010 to October 2011. We validated and analyzed these baseline data collected during the reference year. We then resumed the AAD registry in January 2013, prospectively collected data using the same survey forms, and acquired the annual cohort data from a total of 1,860 patients with ATAAD in the subsequent 3 years (cohort II). Patients with incomplete data on in-hospital outcomes and those who were admitted later than 14 days after symptom onset were excluded from this study. Finally, we enrolled a total of 2,339 patients with ATAAD, including 500 patients in cohort I and 1,839 patients in cohort II (**Figure 1**).

Patient admission day was categorized into weekend and weekday. Weekend admission was defined as admission on weekends, national holidays, or the end and beginning of the year (December 29 through January 3). We compared the demographics, clinical characteristics, and in-hospital mortality of patients admitted on weekdays and those admitted on weekends. Daytime and nighttime admissions were defined as hospital arrival from 8:00 AM to 5:59 PM and one from 6:00 PM to 7:59 AM, respectively. Interfacility transfer, which was defined as transfer from a referring clinic or hospital where patients visited or were transferred initially, was assessed to investigate a role of the TAAS in the local emergency medical services. We also assessed the proportions of transfer to high-volume centers, or core hospitals of the TAAS, because they have had abundant experience in emergency surgery for patients with AAD regardless of day of the week or time of admission. Altered consciousness level was defined as a Glasgow Coma Scale score of ≤14 or a Japan Coma Scale score of >1.[14,15] We classified an AAD

FIGURE 1 Flow Chart of Patient Selection



ATAAD = acute type A aortic dissection.

with nonthrombosed or partial thrombosed false lumen as a classic aortic dissection, whereas an AAD with completely thrombosed false lumen as an intramural hematoma (IMH)-type according to the computed tomography imaging.

ETHICAL STATEMENTS. The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki and the Ethical Guidelines for Epidemiological Research by the Japanese government. The study was approved by the institutional review board of Tokyo CCU Network Scientific Committee. According to the guidelines, the study satisfied the conditions for waiving the requirement for informed consent from individual participants.

STATISTICAL ANALYSES. Categorical variables are expressed as the number of patients (%). Continuous data are presented as mean ± SD if the data followed a normal distribution. Otherwise, data are shown as median (interquartile range). The Fisher exact test or the chi square test was used to compare categorical variables, and an unpaired Student *t*-test or Mann-Whitney U test was used to compare continuous variables between patients with weekday admissions and those with weekend admissions. Multiple

TABLE 1 Baseline Characteristics in Cohort I and Cohort II

	Cohort I				Cohort II			
	Total (N = 500)	Weekday (n = 363)	Weekend (n = 137)	*P* Value[a]	Total (N = 1,839)	Weekday (n = 1,294)	Weekend (n = 545)	*P* Value[b]
Demographics								
Age, y	67.9 ± 13.5	67.9 ± 13.7	68.1 ± 13.1	0.891	68.8 ± 14.1	69.1 ± 13.9	68.3 ± 14.7	0.299
Male	249 (49.8)	185 (51.0)	64 (46.7)	0.397	938 (51.0)	664 (51.3)	274 (50.3)	0.684
Comorbidities								
Hypertension	327 (65.4)	241 (66.4)	86 (62.8)	0.448	1,219 (66.3)	842 (65.1)	377 (69.2)	0.089
Hyperlipidemia	81 (16.2)	58 (16.0)	23 (16.8)	0.826	261 (14.2)	185 (14.3)	76 (13.9)	0.844
Diabetes mellitus	32 (6.4)	20 (5.5)	12 (8.8)	0.185	100 (5.4)	74 (5.7)	26 (4.8)	0.413
Previous myocardial infarction	15 (3.0)	9 (2.5)	6 (4.4)	0.255	31 (1.7)	23 (1.8)	8 (1.5)	0.638
Previous stroke	29 (5.8)	20 (5.5)	9 (6.6)	0.651	120 (6.5)	78 (6.0)	42 (7.7)	0.183
End-stage renal disease on HD	12 (2.4)	10 (2.8)	2 (1.5)	0.526	29 (1.6)	19 (1.5)	10 (1.8)	0.565
Transfer settings								
Time from onset to admission				0.032				0.024
<24 h	441 (88.2)	311 (85.7)	130 (94.9)		1,674 (91.0)	1,161 (89.7)	513 (94.1)	
1-6 d	35 (7.0)	30 (8.3)	5 (3.6)		112 (6.1)	89 (6.9)	23 (4.2)	
7-14 d	8 (1.6)	8 (2.2)	0 (0)		27 (1.5)	23 (1.8)	4 (0.7)	
Undetermined	16 (3.2)	14 (3.9)	2 (1.5)		26 (1.4)	21 (1.6)	5 (0.9)	
Nighttime admission	214 (43.0)	159 (44.0)	55 (40.1)	0.433	813 (44.4)	549 (42.6)	264 (48.6)	0.018
Interfacility transfer	252 (50.4)	194 (53.4)	58 (42.3)	0.027	1,006 (54.7)	722 (55.8)	284 (52.1)	0.147
Transfer to high-volume centers	314 (62.8)	226 (62.3)	88 (64.2)	0.687	1,063 (57.8)	716 (55.3)	347 (63.7)	0.001
Presenting symptoms								
Chest pain	275 (55.0)	193 (53.2)	82 (59.8)	0.180	1013 (55.1)	709 (54.8)	304 (55.8)	0.697
Back pain	217 (43.4)	160 (44.1)	57 (41.6)	0.619	787 (42.8)	544 (42.0)	243 (44.6)	0.313
Abdominal pain	27 (5.4)	21 (5.8)	6 (4.4)	0.535	110 (6.0)	83 (6.4)	27 (5.0)	0.228
Severe conditions[c]	210 (42.0)	139 (38.3)	71 (51.4)	0.006	690 (37.5)	479 (37.0)	211 (38.7)	0.492
Altered consciousness level	122 (24.4)	79 (21.8)	43 (31.4)	0.025	451 (24.5)	315 (24.3)	136 (25.0)	0.781
Cardiac arrest	55 (11.0)	34 (9.4)	21 (15.3)	0.057	184 (10.0)	133 (10.3)	51 (9.4)	0.548
Shock/hypotension	180 (36.0)	120 (33.1)	60 (43.8)	0.026	563 (30.6)	389 (30.1)	174 (31.9)	0.428
Status of false lumen				0.117				0.243
Classic aortic dissection	325 (65.0)	238 (65.6)	87 (63.5)		1191 (64.8)	847 (65.5)	344 (63.1)	
IMH-type	124 (24.8)	94 (26.7)	30 (21.9)		487 (26.5)	329 (25.4)	158 (29.0)	
Undetermined	51 (10.2)	31 (8.5)	20 (14.6)		161 (8.8)	118 (9.1)	43 (7.9)	
DeBakey classification				0.078				0.384
Type I	397 (79.4)	281 (7.4)	116 (84.7)		1,518 (82.5)	1,061 (82.0)	457 (83.9)	
Type II	96 (19.2)	78 (21.5)	18 (13.1)		274 (14.9)	196 (15.1)	78 (14.3)	
Undetermined	7 (1.4)	4 (1.1)	3 (2.2)		47 (2.6)	37 (2.9)	10 (1.8)	
Treatment				0.207				0.361
Aortic repair surgery	358 (71.6)	266 (73.3)	92 (67.2)		1,357 (73.8)	967 (74.7)	390 (71.6)	
Medical therapy alone	139 (27.8)	96 (26.4)	43 (31.4)		462 (25.1)	313 (24.2)	149 (27.3)	
TEVAR alone	1 (0.2)	0 (0)	1 (0.7)		20 (1.1)	14 (1.1)	6 (1.1)	
EVT for malperfusion alone	2 (0.4)	1 (0.3)	1 (0.7)		0 (0)	0 (0)	0 (0)	

Values are mean ± SD or n (%). [a]Compared between weekday and weekend admissions in cohort I. [b]Compared between weekday and weekend admissions in cohort II. [c]Severe conditions include altered consciousness level, cardiac arrest, and shock/hypotension at presentation.

HD = hemodialysis; IMH = intramural hematoma; TEVAR = thoracic endovascular aortic repair; EVT = endovascular therapy.

comparisons were performed by post hoc tests with Bonferroni correction.

Inverse probability weighting (IPW) was used to account for baseline differences between patients with weekday and weekend admissions.[16,17] All measured baseline variables were included in the logistic regression model with weekend admission as the dependent variable to calculate the propensity score for each patient. Stabilized weights were then estimated by multiplying the marginal probability of weekend admission by the inverse of the probability of the actual designated group (weekend group weights: [proportion of weekend patients]/probability of weekend admission; weekday group weights: [1 − proportion of weekend patients]/[1 − probability of weekend admission]). The balance between the

TABLE 2 Comparative Data Between Cohort I and Cohort II According to Weekday or Weekend Admissions

	Weekday			Weekend		
	Cohort I	Cohort II	*P* Value[a]	Cohort I	Cohort II	*P* Value[b]
In-hospital mortality	77/363 (21.2)	280/1,294 (21.6)	0.861	51/137 (37.2)	121/545 (22.2)	<0.001
At high-volume centers	32/226 (14.2)	136/716 (19.0)	0.098	24/88 (27.3)	76/347 (21.9)	0.285
At non-high-volume centers	45/137 (32.8)	144/578 (24.9)	0.058	27/49 (55.1)	45/198 (22.7)	<0.001
Aortic repair surgery	266/363 (73.3)	967/1,294 (74.7)	0.575	92/137 (67.2)	390/545 (71.6)	0.311
At high-volume centers	192/226 (85.0)	571/716 (79.7)	0.082	68/88 (77.3)	268/347 (77.2)	0.994
At non-high-volume centers	74/137 (54.0)	396/578 (68.5)	0.001	24/49 (49.0)	122/198 (61.6)	0.107
Surgical in-hospital mortality	24/266 (9.0)	101/967 (10.4)	0.496	20/92 (21.7)	45/390 (11.5)	0.010
At high-volume centers	16/192 (8.3)	48/571 (8.4)	0.975	10/68 (14.7)	33/268 (12.3)	0.598
At non-high-volume centers	8/74 (10.8)	53/396 (13.4)	0.545	10/24 (41.7)	12/122 (9.8)	<0.001
Interfacility transfer	193/363 (53.2)	722/1,294 (55.8)	0.374	58/137 (42.3)	284/545 (52.1)	0.041
Transfer to high-volume centers	226/363 (62.3)	716/1,294 (55.3)	0.019	88/137 (64.2)	347/545 (63.7)	0.902
Time from symptom onset to hospital arrival (min)[c]	183 (88-323) (n = 104)	160 (60-264) (n = 656)	0.052	140 (58-210) (n = 35)	143 (63-250) (n = 301)	0.476
Time from symptom onset to surgery (min)[c]	356 (255-563) (n = 108)	320 (241-455) (n = 661)	0.092	260 (231-332) (n = 35)	305 (240-432) (n = 302)	0.084

Values are n/N (%) or median (IQR). [a]Compared between cohort I and cohort II in patients admitted on weekdays. [b]Compared between cohort I and cohort II in patients admitted on weekends. [c]Patients who were admitted within 24 hours from symptom onset and underwent emergency surgery were included for the analysis of time intervals. Patients were excluded if data on exact time of surgery were not available.

comparison groups was assessed with the standardized mean differences. A standardized mean difference <0.1 represents acceptable balance. After applying IPW, we compared in-hospital mortality between the weekday and weekend groups of patients from both cohorts I and II (combined cohort I+II). We further compared in-hospital mortality for those with aortic repair surgery or those with classic aortic dissection. Subgroup analyses were then conducted separately in cohorts I and II.

Multivariable logistic regression analyses were performed to assess the effect of weekend admissions and identify independent predictors of overall and surgical in-hospital mortality in combined cohort I+II and separately in cohort II. Because IMH is shown to be associated with more favorable outcomes compared with aortic dissection, we assessed the weekend effect on mortality in a subset of patients with classic aortic dissection.[18] Age, sex, weekend admission, and other clinically relevant variables that had $P < 0.20$ on univariable analysis were entered in the multivariable models.

Statistical significance was defined as $P < 0.05$. All statistical analyses were performed using SPSS version 24 (IBM Corp).

RESULTS

BASELINE CHARACTERISTICS IN COHORT I AND COHORT II. As presented in Table 1, 137 (27.4%) of 500 patients and 545 (29.6%) of 1,839 patients with ATAAD were admitted on weekends in cohort I and cohort II, respectively. More patients were admitted within 24 hours from symptom onset on weekends than on weekdays in both cohorts (cohort I: $P = 0.025$; cohort II: $P = 0.015$, by post hoc tests). Interfacility transfer was less common on weekends than on weekdays in cohort I (42.3% vs 53.4%; $P = 0.027$), but not in cohort II. Nighttime admission was more common on weekends than on weekdays (48.6% vs 42.6%; $P = 0.018$); the proportions of transfer to high-volume centers were higher on weekends than on weekdays in cohort II (63.7% vs 55.3%; $P = 0.001$). Patients with weekend admissions were more likely to present with severe conditions, including altered consciousness level, cardiac arrest, and shock/hypotension, than those with weekday admissions in cohort I (51.4% vs 38.3%; $P = 0.006$), but not in cohort II.

When comparing the baseline characteristics between cohort I and cohort II, the proportions of transfer to high-volume centers were lower in cohort II than in cohort I (57.8% vs 62.8%; $P = 0.044$). Although the interfacility transfer rates were similar in both cohorts, those on weekends increased from 42.3% in cohort I to 52.1% in cohort II ($P = 0.041$) (Table 2).

When analyzed only in patients who underwent aortic repair surgery, diabetes mellitus and DeBakey type I were more prevalent in the weekend group than in the weekday group in cohort I. Hypertension and transfer to high-volume centers were more common in the weekend group than in the weekday group in cohort II (Supplemental Table 2).

TABLE 3 In-Hospital Complications in Cohort I and Cohort II

	Cohort I				Cohort II			
	Total	Weekday	Weekend	*P* Value[a]	Total	Weekday	Weekend	*P* Value[b]
Overall, n	500	363	137		1,839	1,294	545	
In-hospital death	128 (25.6)	77 (21.2)	51 (37.2)	<0.001	401 (21.8)	280 (21.6)	121 (22.2)	0.789
Cardiac tamponade	102 (20.4)	67 (18.5)	35 (25.5)	0.079	314 (17.1)	212 (16.4)	102 (18.7)	0.225
Aortic rupture	48 (9.6)	36 (9.9)	12 (8.8)	0.695	106 (5.8)	63 (4.9)	43 (7.9)	0.011
Vital organ malperfusion	93 (18.6)	70 (19.3)	23 (16.8)	0.522	274 (14.9)	194 (15.0)	80 (14.7)	0.863
Cerebral ischemia	46 (9.2)	34 (9.4)	12 (8.8)	0.834	131 (7.1)	91 (7.0)	40 (7.3)	0.815
Myocardial ischemia	26 (5.2)	19 (5.2)	7 (5.1)	0.955	75 (4.1)	52 (4.0)	23 (4.2)	0.842
Renal ischemia	12 (2.4)	8 (2.2)	4 (2.9)	0.758	36 (2.0)	23 (1.8)	13 (2.4)	0.390
Mesenteric ischemia	7 (1.4)	6 (1.7)	1 (0.7)	0.680	30 (1.6)	20 (1.5)	10 (1.8)	0.655
Limb ischemia	19 (3.8)	15 (4.1)	4 (2.9)	0.527	58 (3.2)	44 (3.4)	14 (2.6)	0.351
Aortic regurgitation	35 (7.0)	23 (6.3)	12 (8.8)	0.344	41 (2.2)	32 (2.5)	9 (1.7)	0.276
Surgically treated, n	358	266	92		1,357	967	390	
In-hospital death	44 (12.3)	24 (9.0)	20 (21.7)	0.001	146 (10.8)	101 (10.4)	45 (11.5)	0.556
Cardiac tamponade	59 (16.5)	42 (15.8)	17 (18.5)	0.549	212 (15.6)	151 (15.6)	61 (15.6)	0.991
Aortic rupture	23 (6.4)	15 (5.6)	8 (8.7)	0.290	48 (3.5)	27 (2.8)	21 (5.4)	0.019
Vital organ malperfusion	77 (21.5)	60 (22.6)	17 (18.5)	0.412	211 (15.5)	154 (15.9)	57 (14.6)	0.547
Cerebral ischemia	36 (10.1)	28 (10.5)	8 (8.7)	0.615	99 (7.3)	69 (7.1)	30 (7.7)	0.721
Myocardial ischemia	23 (6.4)	18 (6.8)	5 (5.4)	0.653	51 (3.8)	38 (3.9)	13 (3.3)	0.601
Renal ischemia	10 (2.8)	7 (2.6)	3 (3.3)	0.721	26 (1.9)	16 (1.7)	10 (2.6)	0.269
Mesenteric ischemia	5 (1.4)	4 (1.5)	1 (1.1)	0.999	23 (1.7)	15 (1.6)	8 (2.1)	0.518
Limb ischemia	19 (5.3)	15 (5.6)	4 (4.3)	0.791	54 (4.0)	41 (4.2)	13 (3.3)	0.439
Aortic regurgitation	30 (8.4)	19 (7.1)	11 (12.0)	0.151	39 (3.1)	30 (3.1)	9 (2.3)	0.418
Medically treated, n	139	96	43		462	313	149	
In-hospital death	84 (60.4)	53 (55.2)	31 (72.1)	0.060	254 (55.0)	178 (56.9)	76 (51.0)	0.236
Cardiac tamponade	43 (30.9)	25 (26.0)	18 (41.9)	0.062	100 (21.6)	59 (18.8)	41 (27.5)	0.034
Aortic rupture	25 (18.1)	21 (21.9)	4 (9.3)	0.083	57 (12.3)	35 (11.2)	22 (14.8)	0.274
Vital organ malperfusion	15 (10.8)	9 (9.4)	6 (14.0)	0.555	59 (12.8)	38 (12.1)	21 (14.1)	0.557
Cerebral ischemia	10 (7.2)	6 (6.3)	4 (9.3)	0.499	31 (6.7)	21 (6.7)	10 (6.7)	0.999
Myocardial ischemia	3 (2.2)	1 (1.0)	2 (4.7)	0.336	22 (4.8)	14 (4.5)	8 (5.4)	0.672
Renal ischemia	2 (1.4)	1 (1.0)	1 (2.3)	0.525	9 (1.9)	6 (1.9)	3 (2.0)	0.999
Mesenteric ischemia	2 (1.4)	2 (2.1)	0 (0)	0.999	7 (1.5)	5 (1.6)	2 (1.3)	0.999
Limb ischemia	0 (0)	0 (0)	0 (0)	-	4 (0.9)	3 (1.0)	1 (0.7)	0.999
Aortic regurgitation	5 (3.6)	4 (4.2)	1 (2.3)	0.999	2 (0.4)	2 (0.6)	0 (0)	0.999

Values are n (%). [a]Compared between weekday and weekend admissions in cohort I. [b]Compared between weekday and weekend admissions in cohort II.

The medically managed patients with weekend admissions were more likely to have severe conditions than those with weekday admissions in cohort I (n = 32 of 43 [74.4%] vs n = 54 of 96 [56.3%]; $P = 0.042$). In cohort I, the medically managed patients had severe conditions more frequently than the surgically treated patients in the weekday group (56.3% vs 32.0%; $P < 0.001$) and weekend group (74.4% vs 42.4%; $P < 0.001$).

IN-HOSPITAL OUTCOMES IN COHORT I AND COHORT II. In cohort I, patients with weekend admissions had higher in-hospital mortality than those with weekday admissions (37.2% vs 21.2%; $P < 0.001$) (Table 3). In contrast, in-hospital mortality did not differ between patients with weekend and weekday admissions in cohort II (Table 3). The annual in-hospital mortality rates did not differ between patients with weekend and weekday admissions in cohort II (Figure 2A). The in-hospital mortality of patients admitted on weekends improved from 37.2% in cohort I to 22.2% in cohort II ($P < 0.001$), although there was no difference in in-hospital mortality of patients admitted on weekdays between cohort I and cohort II (21.2% vs 21.6%; $P = 0.861$) (Table 2, Central Illustration).

The rates of aortic repair surgery were similar in the weekend and weekday groups (cohort I: 67.2% vs 73.3%; $P = 0.176$; cohort II: 71.6% vs 74.7%; $P = 0.158$). Patients with weekend admissions had higher surgical in-hospital mortality than those with weekday admissions in cohort I (21.7% vs 9.0%; $P = 0.001$), although the surgical in-hospital mortality were similar in both groups in cohort II (Table 3). The annual surgical in-hospital mortality rates were similar between patients with weekend and weekday admissions in cohort II (Figure 2B). The surgical in-hospital mortality of patients admitted on weekends improved from 21.7% in cohort I to 11.5% in cohort II (P = 0.010), although there was no difference in in-hospital mortality of patients admitted on weekdays between both cohorts (9.0% vs 10.4%; P = 0.496) (Table 2).

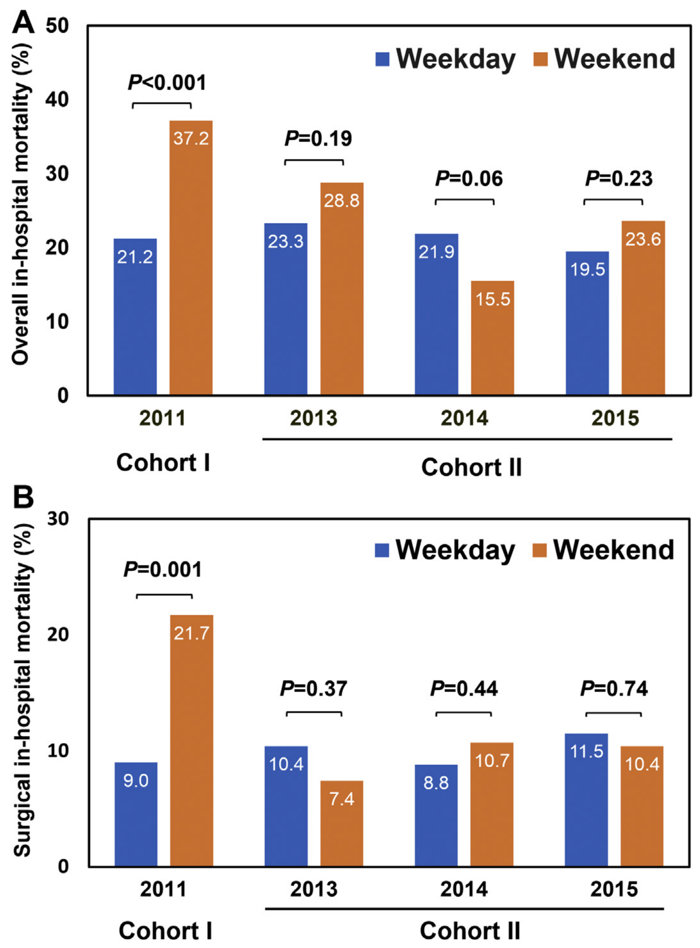
The in-hospital mortality was not statistically significant among those treated with medical therapy alone (cohort I: 72.1% vs 55.2%; P = 0.060; cohort II: 51.0% vs 56.9%; P = 0.236) (Table 3). The in-hospital mortality of the medically managed patients admitted on weekends improved from 72.1% in cohort I to 51.0% in cohort II (P = 0.014), although there was no difference in in-hospital mortality of patients admitted on weekdays between both cohorts (55.2% vs 56.9%; P = 0.774).

IMPACT OF WEEKEND ADMISSION ON IN-HOSPITAL MORTALITY AFTER IPW ADJUSTMENT. Table 4 shows baseline characteristics before and after IPW in combined cohort I+II. After applying IPW, all the baseline characteristics were well balanced with standardized mean differences of <0.1. In cohort I+II, there were no significant differences in overall in-hospital mortality between the weekday and weekend groups in crude analysis (Supplemental Table 3) and after IPW adjustment (Table 5). After IPW adjustment, a subgroup analysis showed that weekend admission was associated with higher in-hospital mortality in cohort I (odds ratio [OR]: 2.28; 95% confidence interval [CI]: 1.48 to 3.52; P < 0.001), but not in cohort II (OR: 0.96; 95% CI: 0.75 to 1.22; P = 0.731). The associations between weekend admission and higher in-hospital mortality for those with aortic repair surgery or those with classic aortic dissection were significant in cohort I+II; these associations remained significant in cohort I, but not in cohort II (Table 5).

IN-HOSPITAL MORTALITY AT NON-HIGH-VOLUME VERSUS HIGH-VOLUME CENTERS. Patients transferred to non-high-volume centers had higher in-hospital mortality than those transferred to high-volume centers (cohort I: n = 72 of 186 [38.7%] vs n = 56 of 314 [17.8%]; P < 0.001; cohort II: n = 189 of 776 [24.4%] vs n = 212 of 1,063 [19.9%]; P = 0.024). The in-hospital mortality at non-high-volume centers was reduced from 38.7% in cohort I to 24.4% in cohort II (P < 0.001).

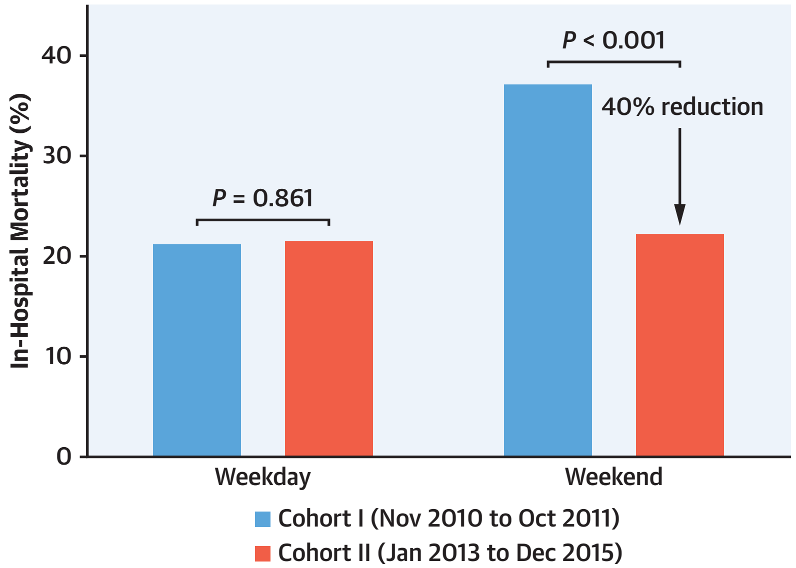
Patients transferred to high-volume centers had higher rates of surgery than those transferred to non-high-volume centers (cohort I: n = 260 of 314 [82.8%] vs n = 98 of 186 [52.7%]; P < 0.001; cohort II: n = 839 of 1,063 [78.9%] vs n = 518 of 776 [66.8%]; P < 0.001). Patients transferred to high-volume centers had lower surgical in-hospital mortality in cohort I (n = 26 of 260 [10.0%] vs n = 18 of 98 [18.4%]; P = 0.032); however, there was no significant difference in surgical in-hospital mortality between both groups in cohort II (n = 65 of 518 [12.5%] vs n = 81 of 839 [9.7%]; P = 0.095). The surgical in-hospital mortality of patients hospitalized on weekends was higher at non-high-volume centers than at high-volume centers in cohort I (41.7% vs 14.7%; P = 0.006). Despite no significant difference in surgical in-hospital mortality of patients admitted to non-high-volume centers on weekdays between both cohorts, the surgical in-hospital mortality of patients admitted to non-high-volume centers on weekends was reduced from 41.7% in cohort I to 9.8% in cohort II (P < 0.001) (Table 2).

FIGURE 2 Annual In-hospital Mortality of Patients Admitted on Weekends Versus Weekdays



(A) Overall in-hospital mortality. **(B)** Surgical in-hospital mortality. During the first year (cohort I), in-hospital mortality was significantly higher in the patients with weekend admissions than in those with weekday admissions. In-hospital mortality did not differ between patients with weekend and weekday admissions during each year in cohort II.

CENTRAL ILLUSTRATION Temporal Changes of In-Hospital Mortality in Patients Admitted on Weekends Versus Weekdays



Takahashi T, et al. JACC: Asia. 2022;2(3):369–381.

The in-hospital mortality of patients with acute type A aortic dissectioin admitted on weekends improved from 37.2% in cohort I to 22.2% in cohort II ($P < 0.001$), although there was no difference in in-hospital mortality of patients admitted on weekdays between cohort I and cohort II.

PREDICTORS OF IN-HOSPITAL MORTALITY FOR PATIENTS WITH CLASSIC AORTIC DISSECTION. In combined cohort I+II, a multivariable logistic regression analysis showed that male sex, altered consciousness level, cardiac arrest, shock/hypotension, vital organ malperfusion, and no aortic surgery were associated with higher overall in-hospital mortality; hypertension, interfacility transfer, and transfer to high-volume centers were inversely associated with overall in-hospital mortality in patients with classic aortic dissection (**Table 6**). Weekend admission was associated with higher in-hospital mortality (overall mortality: OR: 1.47; 95% CI: 1.04 to 2.06; $P = 0.028$; surgical mortality: OR: 1.80; 95% CI: 1.23 to 2.63; $P = 0.002$). The associations between weekend admission and mortality were not significant when multivariable logistic regression analyses were performed separately in cohort II (overall mortality: OR: 1.20; 95% CI: 0.81 to 1.76; $P = 0.362$; surgical mortality: OR: 1.39; 95% CI: 0.90 to 2.15; $P = 0.135$) (**Table 7**).

TIME FROM SYMPTOM ONSET TO SURGERY AND TRANSFER TIME. To assess whether patients with weekend admissions had more delayed surgery compared to those with weekday admissions, we conducted an additional analysis in a subset of patients who were admitted within 24 hours from symptom onset and underwent emergency surgery. Contrary to our expectation, the time from symptom onset to surgery and the time from symptom onset to hospital arrival were shorter in the weekend group than in the weekday group in cohort I (Supplemental Table 4). In this subset, the in-hospital mortality remained to be higher in the weekend group. In contrast, in cohort II, the time from symptom onset to surgery and the time from symptom onset to hospital arrival were similar in the weekday and weekend groups (Supplemental Table 4). There was no difference in in-hospital mortality between both groups. We then assessed the transfer time, which was defined as time from receipt of an emergency call to hospital arrival, in patients who were transferred by ambulance in cohort I and cohort II. There was no significant difference in the transfer time between both cohorts (Supplemental Table 5).

DISCUSSION

In the current study, we assessed the clinical features and outcomes, especially in-hospital mortality, in patients with ATAAD admitted on weekends and

TABLE 4 Baseline Characteristics in Combined Cohort I+II Before and After Inverse Probability Weighting

	Before IPW				After IPW			
	Weekday (n = 1657)	Weekend (n = 682)	*P* Value[a]	SMD[a]	Weekday (n = 1,654.1)	Weekend (n = 683.8)	*P* Value[b]	SMD[b]
Demographics								
Age, y	68.8 ± 13.8	68.3 ± 14.4	0.396	0.038	68.7 ± 13.9	68.8 ± 14.2	0.820	0.011
Male	849 (51.2)	338 (49.6)	0.489	0.034	838.9 (50.7)	344.8 (50.4)	0.903	0.006
Comorbidities								
Hypertension	1,083 (65.4)	463 (67.9)	0.260	0.054	1,092.2 (66.0)	449.5 (65.7)	0.898	0.006
Hyperlipidemia	243 (14.7)	99 (14.5)	0.977	0.004	241.1 (14.6)	99.6 (14.6)	0.998	<0.001
Diabetes mellitus	94 (5.7)	38 (5.6)	0.999	0.004	94.2 (5.7)	36.7 (5.4)	0.756	0.014
Previous myocardial infarction	32 (1.9)	14 (2.1)	0.977	0.009	33.0 (2.0)	13.9 (2.0)	0.955	0.003
Previous stroke	98 (5.9)	51 (7.5)	0.189	0.063	105.6 (6.4)	44.4 (6.5)	0.925	0.004
End-stage renal disease on HD	29 (1.8)	12 (1.8)	0.999	0.001	28.5 (1.7)	11.7 (1.7)	0.994	<0.001
Transfer settings								
Time from onset to admission			0.001	0.203			0.978	0.025
<24 hours	1,472 (88.8)	643 (94.3)			1,495.7 (90.4)	618.2 (90.4)		
1-6 days	119 (7.2)	28 (4.1)			104.2 (6.3)	45.2 (6.6)		
7-14 days	31 (1.9)	4 (0.6)			24.8 (1.5)	10.0 (1.5)		
Undetermined	35 (2.1)	7 (1.0)			29.5 (1.8)	10.4 (1.5)		
Nighttime admission	708 (42.7)	319 (46.9)	0.188	0.083	726.9 (43.9)	304.2 (44.5)	0.975	0.011
Interfacility transfer	915 (55.2)	342 (50.1)	0.028	0.102	889.8 (53.8)	370.2 (54.1)	0.882	0.007
Transfer to high-volume centers	942 (56.8)	435 (63.8)	0.002	0.142	971.9 (58.8)	395.7 (57.9)	0.707	0.018
Presenting symptoms								
Chest pain	902 (54.4)	386 (56.6)	0.363	0.044	911.3 (55.1)	383.3 (56.1)	0.679	0.019
Back pain	704 (42.5)	300 (44.0)	0.535	0.030	711.3 (43.0)	291.8 (42.6)	0.886	0.007
Abdominal pain	104 (6.3)	33 (4.8)	0.212	0.063	97.0 (5.9)	39.9 (5.8)	0.975	0.002
Severe conditions[c]	618 (37.3)	282 (41.3)	0.074	0.083	635.3 (38.4)	259.2 (37.9)	0.825	0.010
Altered consciousness level	394 (23.8)	179 (26.2)	0.227	0.057	405.3 (24.5)	167.2 (24.4)	0.979	0.001
Cardiac arrest	167 (10.1)	72 (10.6)	0.785	0.016	168.2 (10.2)	68.5 (10.0)	0.911	0.005
Shock/hypotension	509 (30.7)	234 (34.3)	0.099	0.077	524.0 (31.7)	213.8 (31.3)	0.845	0.009
Status of false lumen			0.552	0.049			0.996	0.004
Classic aortic dissection	1,085 (65.5)	431 (63.2)			1,072.9 (64.9)	444.9 (65.1)		
IMH-type	423 (25.5)	188 (27.6)			432.5 (26.1)	177.7 (26.0)		
Undetermined	149 (9.0)	63 (9.2)			148.8 (9.0)	61.2 (8.9)		
DeBakey classification			0.216	0.081			0.987	0.008
Type I	1,342 (81.0)	573 (84.0)			1,353.8 (81.8)	557.6 (81.5)		
Type II	274 (16.5)	96 (14.1)			261.8 (15.8)	109.7 (16.0)		
Undetermined	41 (2.5)	13 (1.9)			38.6 (2.3)	16.5 (2.4)		
Treatment			0.286	0.087			0.963	0.020
Aortic repair surgery	1,233 (74.4)	482 (70.7)			1,213.2 (73.3)	498.4 (72.9)		
Medical therapy alone	409 (24.7)	192 (28.2)			426.1 (25.8)	178.3 (26.1)		
TEVAR alone	14 (0.8)	7 (1.0)			13.9 (0.8)	6.8 (1.0)		
EVT for malperfusion alone	1 (0.1)	1 (0.1)			1.0 (0.1)	0.3 (0.0)		

Values are mean ± SD or n (%). [a]Compared between weekday and weekend admissions before IPW. [b]Compared between weekday and weekend admissions after IPW. [c]Severe conditions include altered consciousness level, cardiac arrest, and shock/hypotension at presentation.

IPW = inverse probability weighting; SMD =, standardized mean difference; other abbreviations as in Table 1.

those admitted on weekdays. The main findings from our multicenter registry study included: 1) in-hospital mortality for ATAAD was higher in patients with weekend admissions than in those with weekday admissions in cohort I; 2) there was no difference in in-hospital mortality between the weekend and weekday groups in cohort II; 3) the in-hospital mortality of patients admitted on weekends improved from 37.2% in cohort I to 22.2% in cohort II; and 4) severe clinical conditions related to AAD, including altered consciousness level, shock/hypotension, cardiac arrest at presentation, and vital organ malperfusion were consistently associated with higher in-hospital mortality; however, weekend admission was not associated with mortality in the later years of the study.

TABLE 5 Subgroup Analyses for Inverse Probability Weighting-Adjusted In-hospital Mortality

	Weekday	Weekend	OR	95% CI	*P* Value	*P* Value for Interaction[a]
Overall patients	363.3/1,654.1 (22.0)	168.6/683.8 (24.7)	1.16	0.94–1.43	0.158	
Cohort I	77.4/364.1 (21.2)	50.2/131.8 (38.1)	2.28	1.48–3.52	<0.001	<0.001
Cohort II	286.0/1,290.0 (22.2)	118.4/552.0 (21.4)	0.96	0.75–1.22	0.731	
Patients with aortic surgical repair	122.6/1,213.2 (10.1)	69.5/498.4 (13.9)	1.44	1.05–1.97	0.029	
Cohort I	24.0/265.5 (9.0)	20.6/91.4 (22.6)	2.93	1.54–5.59	0.001	0.016
Cohort II	98.5/947.7 (10.4)	48.8/407.0 (12.0)	1.17	0.82–1.69	0.387	
Patients with classic aortic dissection	221.7/1,072.9 (20.7)	116.2/444.9 (26.1)	1.36	1.05–1.76	0.020	
Cohort I	42.0/236.9 (17.7)	32.7/86.6 (37.8)	2.82	1.63–4.87	<0.001	0.003
Cohort II	179.6/836.0 (21.5)	83.5/358.3 (23.3)	1.11	0.83–1.49	0.488	

Values are n/N (%). [a]Interactions between the effect of weekend admissions on mortality and the study period (cohort I vs. cohort II) are calculated.
CI = confidence interval; OR = odds ratio.

Hospitalization for AAD or aortic aneurysm rupture on weekends was reported to be associated with a higher mortality rate than hospitalization on weekdays.[8,9] However, such an effect of weekend admissions on the outcome of patients with acute cardiovascular diseases has not been consistently documented.[19-21] A recent study has shown a negative result with respect to the weekend effect on outcomes in patients who underwent aortic surgery for ATAAD.[21] These conflicting results might be explained by geographical differences in terms of local medical care and transfer systems for medical emergencies. Our findings from the analysis of cohort I, which showed the result of the first year of the TAAS, suggest a significant weekend effect on in-hospital mortality for ATAAD. Weekend admission was significantly associated with a higher risk of in-hospital death for ATAAD even after IPW adjustment. One would assume understaffing could be a problem, including keeping experienced physicians and surgeons scheduled in hospitals during weekends compared with weekdays. Although there was a trend toward increased in-hospital mortality in the medically managed patients with weekend admissions compared with those with weekday admissions in cohort I, the group difference in mortality did not reach statistical significance. In contrast, in-hospital mortality was markedly higher in the surgically treated patients with weekend admissions compared with those with weekday admissions. Weekend admission was associated with higher surgical in-hospital mortality after IPW adjustment in cohort I. These data suggest that increased in-hospital mortality in patients with weekend admissions was affected by some factors regarding surgical treatment quality. The exact reason for poorer outcomes in patients with weekend admissions remains unclear, but it could be due partly to less expertise in surgery, including manpower and staff skills during weekends at the beginning of the TAAS establishment. Patients transferred to non-high-volume centers had higher overall and surgical in-hospital mortality than those transferred to high-volume centers. These mortality differences were more prominent among those admitted on weekends. Another plausible explanation is that in-hospital mortality is affected by more severe clinical presentation during weekends because patients admitted on weekends had either altered consciousness level, cardiac arrest, or shock/hypotension more frequently than those admitted on weekdays. Interfacility transfer rates were lower on weekends than on weekdays, suggesting that more critically ill patients with ATAAD were directly admitted to aortic centers on weekends. Our subgroup analysis in cohort I showed that the time from symptom onset to surgery was shorter in the weekend group than in the weekday group. This unexpected finding suggests that poorer outcomes in patients admitted on weekends could not be explained by later presentation and delayed time to surgery. It could be possible that more critically ill patients with ATAAD were transferred to aortic centers in shorter time even during weekends in the first year of the TAAS.

Such a weekend effect on outcomes for ATAAD was no longer found in the later years of the study (cohort II). Our results indicated a significant improvement of in-hospital mortality rates in patients with ATAAD admitted on weekends over the several years after the establishment of TAAS, whereas the in-hospital mortality rates of those with weekday admissions were unchanged. Although acute aortic syndrome includes both aortic dissection and IMH, IMH is shown to be associated with more favorable outcomes compared with aortic dissection.[18] Therefore, we assessed the weekend effect on mortality in a subset

TABLE 6 Univariable and Multivariable Analyses in Patients With Classic Aortic Dissection in Combined Cohort I+II

	Univariable Analysis (n = 1,516)			Multivariable Analysis for Overall In-Hospital Mortality (n = 1,516)			Multivariable Analysis for Surgical In-Hospital Mortality (n = 1,270)		
	OR	95% CI	*P* Value	OR	95% CI	*P* Value	OR	95% CI	*P* Value
Age, per y	1.03	1.02–1.04	<0.001	1.01	1.00–1.03	0.064	1.02	1.00–1.03	0.043
Male	1.00	0.80–1.30	0.872	1.68	1.17–2.42	0.005	1.86	1.23–2.80	0.003
Hypertension	0.51	0.40–0.65	<0.001	0.59	0.42–0.82	0.002	0.54	0.37–0.78	0.001
Hyperlipidemia	0.75	0.52–1.07	0.115	1.34	0.86–2.10	0.200	1.40	0.86–2.26	0.175
Diabetes	1.33	0.79–2.23	0.279						
Previous myocardial infarction	1.59	0.69–3.70	0.278						
Previous stroke	0.93	0.56–1.57	0.796						
Weekend admission	1.45	1.12–1.88	0.005	1.47	1.04–2.06	0.028	1.80	1.23–2.63	0.002
Interfacility transfer	0.30	0.23–0.39	<0.001	0.59	0.42–0.82	0.002	0.58	0.40–0.83	0.003
Transfer to high-volume centers	0.50	0.39–0.64	<0.001	0.71	0.51–0.99	0.005	0.71	0.48–1.03	0.069
Altered consciousness level	6.07	4.65–7.94	<0.001	1.83	1.26–2.67	0.002	1.64	1.06–2.54	0.027
Cardiac arrest	19.6	12.4–31.1	<0.001	5.15	2.85–9.29	<0.001	3.97	2.00–7.89	<0.001
Shock/hypotension	4.91	3.80–6.35	<0.001	2.19	1.54–3.10	<0.001	1.75	1.17–2.60	0.006
DeBakey type I	1.00	1.00–1.00	0.669						
Vital organ malperfusion	2.29	1.73–3.03	<0.001	2.30	1.60–3.30	<0.001	2.01	1.36–2.99	0.001
No aortic surgery	16.4	11.9–22.6	<0.001	9.27	6.20–13.9	<0.001			

Abbreviations as in Table 5.

of patients with classic aortic dissection. After IPW adjustment, weekend admission was associated with higher in-hospital mortality in combined cohort I+II, but this association was not significant in cohort II. On multivariable analyses, greater severity of clinical conditions, such as altered consciousness level, shock/hypotension, cardiac arrest at presentation, and vital organ malperfusion, were consistently associated with higher in-hospital mortality, in accordance with previous reports.[22-25] Weekend admission was associated with higher overall and surgical in-hospital mortality in cohort I+II, but not in cohort II. To explore the plausible reasons why the weekend effect diminished in cohort II, we then assessed the temporal changes in the triage and transfer system of the TAAS during the study period. The time from symptom onset to hospital arrival and the transfer time by ambulance were similar between cohort I and cohort II. However, the interfacility transfer rates on weekends increased in cohort II, indicating the possibility of increased referral cases due to more availability of the TAAS during weekends. We also found that interfacility transfer and emergency surgery cases were increased in the later years both during weekdays and weekends (Supplemental Figures 1 and 2). The development of TAAS could have resulted in more proper triage and efficient transfer to aortic centers during weekends. In addition, we found a significant reduction of the in-hospital mortality at non-high-volume centers in cohort II, particularly in surgically treated patients admitted on weekends. In cohort II, no significant difference in surgical in-hospital mortality was observed between patients treated at high-volume centers and those at non-high-volume centers, although it is reported that the surgical treatment at high-volume centers was associated with reduced mortality in patients with ATAAD.[26,27] Admissions to non-high-volume centers as well as high-volume centers were increased both during weekdays and weekends (Supplemental Figure 3). We speculated that improved outcomes in patients admitted to non-high-volume centers, presumably through the effort of those hospitals contributing to the TAAS, could partly explain the reason why the weekend effect disappeared.

STUDY LIMITATIONS. There were several limitations in our study. First, this is a multicenter observational study using the retrospective analysis of a prospectively collected database that included nearly all patients with AAD hospitalized within the TAAS in the urban Tokyo metropolitan area. Because geographic differences in management and outcomes for ATAAD exist, our results might not be extrapolated to other regions.[28] Second, there were some incomplete or missing data on demographics and time variables in our database created at the core center of the Tokyo CCU Network. For some patients transferred from another hospital, no detailed data were obtained at the initial hospital. In such cases, we used only the clinical data obtained at the hospital where patients were treated last. Third, symptom and complication rates could be underestimated because of underreporting, which was unavoidable in our system.

TABLE 7 Multivariable Analyses in Patients With Classic Aortic Dissection in Cohort II

	For Overall In-Hospital Mortality (n = 1,191)			For Surgical In-Hospital Mortality (n = 1,001)		
	OR	95% CI	*P* Value	OR	95% CI	*P* Value
Age, per y	1.01	0.99-1.02	0.225	1.01	1.00-1.03	0.157
Male	1.52	1.01-2.29	0.042	1.70	1.08-2.69	0.023
Hypertension	0.58	0.40-0.84	0.004	0.52	0.34-0.78	0.002
Hyperlipidemia	1.52	0.93-2.47	0.093	1.61	0.97-2.71	0.073
Weekend admission	1.20	0.81-1.76	0.362	1.39	0.90-2.15	0.135
Interfacility transfer	0.60	0.42-0.87	0.007	0.56	0.37-0.85	0.006
Transfer to high-volume centers	0.80	0.55-1.15	0.226	0.79	0.52-1.20	0.270
Altered consciousness level	1.98	1.30-3.01	0.001	1.73	1.06-2.80	0.027
Cardiac arrest	4.12	2.17-7.82	<0.001	2.92	1.35-6.32	0.006
Shock/hypotension	2.04	1.37-3.06	0.001	1.60	1.01-2.52	0.045
Vital organ malperfusion	1.93	1.26-2.95	0.003	1.70	1.06-2.71	0.027
No aortic surgery	9.52	6.06-15.0	<0.001			

Abbreviations as in Table 5.

Fourth, patients with known cardiac arrest and those who died before undergoing emergency surgery, who had been excluded in most previous studies, were included in our analysis. This inclusion could have influenced the higher prevalence and mortality rates of the medically managed patients with ATAAD in this study. Fifth, there were no specific data on the different surgical techniques, which could affect outcomes in surgically treated patients. Further studies are needed to clarify the relationship between the surgical type and the outcomes in patients with ATAAD. Sixth, we compared the mortality rates between the high-volume and non-high-volume centers of the TAAS, which were preclassified according to the clinical performance of each center including the reported number of admissions for acute aortic emergency during the preceding years and availability of emergency surgery for 24 hours every day. Institution-level mortality differences between the weekday and weekend groups and the relationship between institutional case volume and outcomes remain to be determined. Finally, no significant change in mortality was observed in patients with weekday admissions. This may suggest that there is still room for improvement in our transfer system, although interfacility transfer and emergency surgery cases were increased during the study period.

CONCLUSIONS

We found a significant reduction in in-hospital mortality in patients with weekend admissions for ATAAD since the establishment of the TAAS. No mortality difference between weekend and weekday admissions was observed in the later years of the study.

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PERSPECTIVES

COMPETENCY IN SYSTEM-BASED PRACTICE: The association of weekend admissions with poor outcomes in patients with AAD has been reported, but this weekend effect is not uniformly observed. The development of a reginal aortic network system may result in improved in-hospital outcomes in patients with ATAAD hospitalized on weekends.

TRANSLATIONAL OUTLOOK: Additional studies are needed to assess whether the delayed time to surgery affects the outcomes in patients with ATAAD.

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KEY WORDS acute aortic dissection, mortality, network, transfer, weekend effect

APPENDIX For a list of participating hospitals of the Tokyo CCU Network as well as supplemental tables and figures, please see the online version of this paper.