Original Article

Impact of the COVID-19 pandemic on epidemiology, treatment, and outcome of major trauma in Japan in 2020: a retrospective observational nationwide registry-based study

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Aim: The nationwide impact of the coronavirus disease (COVID-19) pandemic on major trauma in Japan is unknown. The nationwide registry-based data of the Japanese Trauma Data Bank were analyzed to elucidate the impact of COVID-19 on the epidemiology, treatment, and outcomes of major trauma patients.

Methods: Among patients transported directly from the injury site by ambulance with an Injury Severity Score of ≥16, we compared patients managed from April to December in 2019 to those managed from April to December in 2020.

Results: In total, 9792 patients were included in this study (2019, $n = 5194$; 2020, $n = 4598$). There were no significant differences in age or sex, but there were significant differences between 2019 and 2020 in the rates of "self-injury (suicide)", "motor vehicle accident", "fall from height", "fall down", and "fall to the ground", which are factors associated with patient age. Injury severity in 2019 and 2020 did not differ to a statistically significant extent, but the rate of major spinal injury increased. The time of prehospital care significantly increased in 2020 compared to 2019. There was no noticeable change in hospital treatment or in-hospital mortality between 2019 and 2020.

Conclusion: This study suggests that the COVID-19 pandemic might have altered the injuries of major trauma; however, medical services for major trauma were well supplied in Japan in 2020.

Key words: COVID-19, epidemiology, suicide, traffic accident, trauma

INTRODUCTION

THE OUTBREAK OF coronavirus disease (COVID-19) has placed an excessive burden on medical services. The Japanese government declared a state of emergency for the first time on April 7, 2020, and requested that people refrain from unnecessarily going out and that they avoid unnecessary person-to-person contact.[1] As a result, traffic accidents, labor-related accidents, and sports-related injuries decreased under the state of emergency.[2–5] In contrast, many hospitals in areas affected by the COVID-19 pandemic restricted their provision of emergency medical care due to the countermeasures against nosocomial infection or the redistribution of limited human resources, which made emergency transportation to hospitals more difficult.[3]

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Many studies have dealt with mild-to-moderate trauma patients under the COVID-19 pandemic, but few have addressed major trauma. Major trauma is any injury that has the potential to cause prolonged disability or death. A reduction in the number of victims experiencing motor vehicle-related major trauma and a consequent increase in the rate of fall injuries were reported in France and the UK.[6,7] The report from France[6] showed no change in the number of patients with major trauma due to suicide as a result of the COVID-19 pandemic. Furthermore, the report noted that the time for prehospital care and the in-hospital mortality of major trauma patients did not change either during the lockdown period or pre- and postlockdown. In contrast, reports in Japan showed that the overall number of suicide victims in Japan increased during the COVID-19 pandemic,[8–10] and the time required to deliver prehospital care to victims of traffic accidents, which included mild-to-severe patients, did not change in the early stage of the COVID-19 pandemic.[3] However, no reports examined the epidemiology, management, or mortality of major trauma patients during the COVID-19 pandemic in Japan, and clarifying these points will be informative for suitable provision of emergency medical care when a new infectious disease pandemic occurs in the future.

We hypothesized that the COVID-19 pandemic would affect the epidemiology and care of patients with major trauma in Japan in 2020. Thus, this study aimed to elucidate the following changes had occurred in Japan in 2020 under the COVID-19 pandemic: (i) the epidemiology of major trauma patients, (ii) the prehospital care for them, and (iii) in-hospital mortality or the in-hospital management of them.

METHODS

Study design and settings

THIS MULTICENTER RETROSPECTIVE nationwide observational study was based on data registered in the Japan Trauma Data Bank (JTDB). The JTDB is the largest trauma registry in Japan.[11] During the study period, 292 hospitals participated in this registry.[12] The JTDB registration system uses the Abbreviated Injury Scale (AIS) 2005, Update 2008[13] when coding injury site and severity. The JTDB consists of 92 elements, including patient information (age, sex), prehospital information (date and time of injury or transport, etiology of injury, mechanism of injury, transport method, prehospital care, blood pressure, heart rate, respiration rate, mental status according to Glasgow Coma Scale [GCS],[14] and comorbidities), and hospital information (blood pressure, heart rate, respiration rate, mental status by GCS, body temperature, blood lactate level, procedures performed in hospital, AIS code for each body site, Injury Severity Score (ISS),[15] probability of survival,[16] Revised Trauma Score,[17] complications during hospitalization, duration of mechanical ventilation and intensive care unit stay, date of discharge, and patient outcome).

The Ethics Committee of Osaka National Hospital approved this study (Approval No. 19-9). An informed consent form was not required from the patients as the JTDB data are anonymous.

Inclusion and exclusion criteria

To assess the impacts of the COVID-19 pandemic on prehospital and in-hospital management of major trauma, patients transported directly from the injury site by ambulance with an ISS of ≥16 and who were registered in the JTDB from April to December in 2019 and from April to December in 2020 were included in this study. An ISS of ≥16 was defined as major trauma in this study following previous research.[18] This study period was selected because: (i) the Japanese government first declared a state of emergency in major districts on April 7, 2020, due to the COVID-19 pandemic, and (ii) the JTDB registration system changed from using AIS 90 Update 1998 to AIS 2005 Update 2008 on April 1, 2019. No exclusion criteria were set in this study.

Data collection

To assess the hypothesis of this study, the following data were collected. Patient age, sex, date and time of injury, etiology of injury (accident, self-injury [suicide], other, and unknown), mechanism of injury (motor vehicle accident, train accident, machine accident, fall from height, fall down, fall to the ground, other, and unknown), transport method, systolic blood pressure and heart rate on arrival at hospital, GCS on arrival at hospital, and outcome were collected from JTDB data. The mechanisms of injury were defined as follows: “fall from height” was injury sustained by falling from a height with the patient’s body in midair, “fall down” was injury sustained by falling while the patient’s body was in contact with stairs or slopes, and “fall to the ground” was injury sustained due to any other means of falling and coming in contact with the ground or some lower level. The AIS code for each body site, ISS, and information on whether surgery was carried out during hospitalization or whether transfusion was carried out within 24 h after injury were also extracted from the JTDB data. An AIS of >2 for any part of the body was set as a new variable because AIS >2 is thought to reflect serious injury. Cardiac arrest was defined by a systolic blood pressure of 0 mmHg and/or a heart rate of 0 b.p.m. on hospital arrival.

Statistical analyses

Patient age, sex, blood pressure, heart rate, GCS, ISS, the time from emergency call to hospital arrival, the time spent at the injury site, and the time from hospital arrival to time of surgery start are presented as the median and interquartile range (25th–75th percentile). Other categorical variables are presented as the frequency and percentage.

The primary analysis was undertaken to determine the differences in the epidemiology of injuries, the management of patients, and patient mortality between 2019 and 2020. Eligible patients were classified into two groups according to whether they were managed in 2019 or 2020. The patients were also stratified into three groups by age (patients <20 years of age [young], 20–64 years of age [middle-aged], and >64 years of age [elderly]) and nine groups by month of injury (from April to December) for subgroup analysis to explore the effects of age or timing of injury on changes in the epidemiology of injuries and management of the patients.

Continuous variables were analyzed by the Mann–Whitney *U*-test, and categorical variables were compared between two groups (2019 group and 2020 group) using the χ^2-test or Fisher's exact test. To adjust for the repeated application of statistical tests, the Bonferroni correction was used in the subgroup analysis. All statistical inferences were made with a two-sided significance level of 5%. All statistical analyses were performed using the R software program (version 4.0.3).

RESULTS

Eligible patients

PATIENT flow is shown in Figure 1. During the study period, 40,179 patients were registered in the JTDB. Among them, 9792 patients with an ISS of ≥16 were transported from the injury site by ambulance and included in this study (2019 group: $n = 5194$; 2020 group: $n = 4598$).

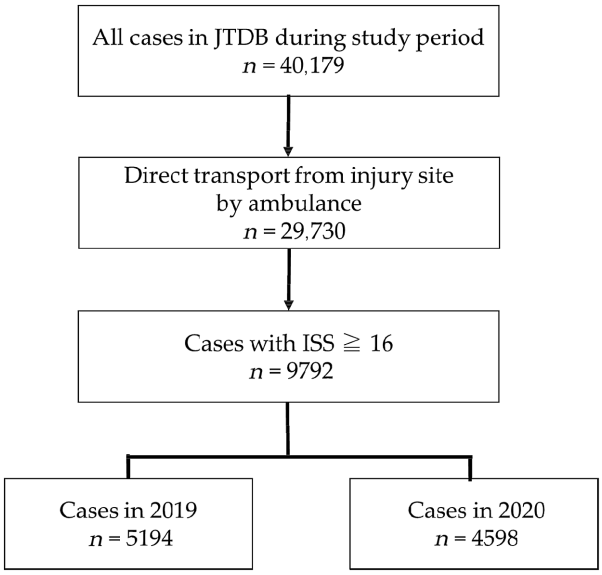

Fig. 1. Patient flow in this study to determine the impact of the COVID-19 pandemic on major trauma cases in Japan in 2020. ISS, Injury Severity Score; JTDB, Japan Trauma Data Bank.

Patient characteristics

The patient characteristics in each group are shown in Table 1. There were no significant differences in age or sex between the two groups. Regarding the etiology of injury, the rate of "accidents" decreased (2019: 87.6%; 2020: 85.7%) and that of "self-injury (suicide)" increased (2019: 8.8%; 2020: 10.3%) in the 2020 group in comparison to the 2019 group ($p = 0.012$). Regarding the mechanism of injury, the rate of "motor vehicle accident" decreased (2019: 40.9%; 2020: 36.7%), and the rates of "fall from height (self-injury)", "fall from height (not self-injury)", "fall down", "fall to the ground", and "other" increased (2019: 5.6%, 8.9%, 14.2%, 16.6%, 9.8%; 2020: 6.6%, 9.8%, 15.2%, 18.0%, 11.1%, respectively) in the 2020 group in comparison to the 2019 group ($p < 0.001$).

Injury severity

Vital signs data on arrival at hospital and the scores for trauma are shown in Table 1. There were no significant differences in systolic blood pressure, heart rate, or GCS on arrival at hospital, or in ISS, between the two groups. The rate of AIS >2 for spinal injuries was significantly increased in the 2020 group in comparison to the 2019 group (2019: 21.6%; 2020: 23.6%, $p = 0.018$); however, the rate of AIS >2 for other body parts did not differ between the two groups.

Prehospital time, in-hospital treatment, and in-hospital mortality

The prehospital time, in-hospital treatments, and in-hospital mortality are also shown in Table 1. The time from emergency call to hospital arrival (2019: 37.0 [28.0, 48.0] min; 2020: 38.0 [30.0, 50.0] min, $p < 0.001$) and the time spent at the injury site (2019: 24.0 [18.0, 31.0] min; 2020: 24.0 [19.0, 32.0] min, $p < 0.001$) were significantly increased in the 2020 group compared to the 2019 group. The time from hospital arrival to time of surgery start within 24 h was not significantly different between the two groups. There were no significant differences between the two groups regarding the

Table 1. Characteristics, injury severity, hospital treatment, and in-hospital mortality of patients with of major trauma in Japan, 2019 and 2020

Variable	2019 (n = 5194)	2020 (n = 4598)	Cases with missing data in 2019 and 2020	p value
Age, years	66 (45, 78)	67 (45, 79)	9 (0.1)	0.101
Age group				
<20 years	337 (6.5)	313 (6.8)	0 (0.0)	0.797
20–64 years	2142 (41.2)	1863 (40.5)		
>64 years	2711 (52.2)	2417 (52.6)		
Unknown	4 (0.1)	5 (0.1)		
Sex				
Male	3528 (67.9)	3166 (68.9)	0 (0.0)	0.530
Female	1641 (31.6)	1407 (30.6)		
Unknown	25 (0.5)	25 (0.5)		
Etiology of injury				
Accident	4550 (87.6)	3941 (85.7)	0 (0.0)	0.012
Self-injury (suicide)	458 (8.8)	474 (10.3)		
Other	160 (3.1)	168 (3.7)		
Unknown	26 (0.5)	15 (0.3)		
Mechanism of injury				
Motor vehicle accident	2122 (40.9)	1689 (36.7)	0 (0.0)	<0.001
Train accident	54 (1.0)	35 (0.8)		
Machine accident	27 (0.5)	26 (0.6)		
Fall from height (self-injury)	290 (5.6)	305 (6.6)		
Fall from height (not self-injury)	460 (8.9)	449 (9.8)		
Fall down	736 (14.2)	699 (15.2)		
Fall to the ground	864 (16.6)	826 (18.0)		
Other	508 (9.8)	510 (11.1)		
Unknown	133 (2.6)	59 (1.3)		
Systolic blood pressure on arrival, mmHg	128.5 (98.0, 156.0)	130.0 (100.0, 156.0)	269 (2.7)	0.373
Heart rate on arrival, min^{-1}	82.0 (68.0, 100.0)	82.0 (68.0, 100.0)	349 (3.6)	0.402
GCS on arrival	14.0 (6.0, 15.0)	14.0 (6.0, 15.0)	332 (3.4)	0.794
Serious body part injury				
AIS >2 Head injury	2466 (47.5)	2125 (46.2)	0 (0.0)	0.219
AIS >2 Face injury	73 (1.4)	53 (1.2)	0 (0.0)	0.309
AIS >2 Neck injury	38 (0.7)	38 (0.8)	0 (0.0)	0.676
AIS >2 Chest injury	2076 (40.0)	1797 (39.1)	0 (0.0)	0.381
AIS >2 Abdominal injury	447 (8.6)	368 (8.0)	0 (0.0)	0.298
AIS >2 Spine injury	1121 (21.6)	1085 (23.6)	0 (0.0)	0.018
AIS >2 Upper extremity injury	54 (1.0)	59 (1.3)	0 (0.0)	0.302
AIS >2 Lower extremity injury	1162 (22.4)	996 (21.7)	0 (0.0)	0.411
AIS >2 Body surface injury	288 (5.5)	281 (6.1)	0 (0.0)	0.249
ISS	22.0 (17.0, 27.0)	22.0 (17.0, 27.0)	0 (0.0)	0.261
Cardiac arrest on hospital arrival	454 (8.7)	386 (8.4)	438 (4.5)	0.542
Time from emergency call to hospital arrival, min	37.0 (28.0, 48.0)	38.0 (30.0, 50.0)	332 (3.4)	<0.001
Time spent at injury site, min	24.0 (18.0, 31.0)	24.0 (19.0, 32.0)	584 (6.0)	<0.001
Time from hospital arrival to time of surgery start within 24 h, min	165.0 (93.0, 274.5)	168.0 (98.8, 290.0)	1273 (13.0)	0.283
Operation during hospitalization				
Yes	2357 (45.4)	2097 (45.6)	4 (0.1)	0.821

Table 1. (Continued)

Variable	2019 (n = 5194)	2020 (n = 4598)	Cases with missing data in 2019 and 2020	p value
Transfusion within 24 h after injury				
Yes	1458 (28.1)	1281 (27.9)	301 (3.0)	0.816
In-hospital mortality	1263 (24.3)	1084 (23.6)	0 (0.0)	0.391

Data are presented as the median (interquartile range [IQR]) or number (percentage).
AIS, Abbreviated Injury Scale; GCS, Glasgow Coma Scale; ISS, Injury Severity Score.

rates of surgical interventions during hospitalization, transfusion within 24 h after injury, and in-hospital mortality.

Differences between age groups

A subgroup analysis was undertaken to investigate the differences in the etiology of injury, the mechanism of injury, the rate of AIS >2 for spinal injuries, and the time required for prehospital care by age group (Table 2). There were no significant differences in the etiology of injury between the 2019 groups and the 2020 groups for each age subgroup. Regarding the mechanism of injury, the rate of "motor vehicle accident" decreased (2019: 47.2%; 2020: 43.5%), whereas the rates of "fall from height (self-injury)", "fall from height (not self-injury)", "fall down", "fall to the ground", and "other" increased (2019: 9.3%, 10.2%, 10.1%, 6.7%, 11.3%; 2020: 11.4%, 12.0%, 10.6%. 7.6%, 12.5%, respectively) in the 20–64 years of age subgroup of the 2020 group in comparison to the 2019 group (adjusted $p < 0.001$). The rate of "motor vehicle accident" decreased (2019: 34.0%; 2020: 28.9%), whereas the rates of "fall down", "fall to the ground", and "other" increased (2019: 18.5%, 26.2%, 8.4%; 2020: 20.1%, 27.8%, 10.5%, respectively) in the >64 years of age subgroup of the 2020 group in comparison to the 2019 group (adjusted $p = 0.007$).

There were no significant differences in the rate of AIS >2 for spinal injuries between the 2019 and 2020 groups for any age group. The time from emergency call to hospital arrival was significantly increased in the 2020 group compared to the 2019 group of the 20–64 years of age subgroup (2019: 36.0 [28.0, 48.0] min; 2020: 38.0 [29.0, 51.0] min, adjusted $p = 0.003$). The time from emergency call to hospital arrival and the time spent at the injury site were significantly increased in the 2020 group compared to the 2019 group of the >64 years of age subgroup (2019: 38.0 [29.0, 49.0] min, 24.0 [19.0, 31.0] min; 2020: 39.0 [31.0, 51.0] min, 25.0 [19.0, 33.0] min, adjusted $p = 0.031$ and 0.031, respectively).

Differences between months

A subgroup analysis based on monthly data was carried out to elucidate when differences between the two groups occurred (Table 3). There were no significant differences in the etiology or mechanism of injury between the 2019 and 2020 groups for any month.

The rate of AIS >2 for spinal injuries did not show a significant difference between the two groups in any month. The time from emergency call to hospital arrival increased in August in the 2020 group in comparison to the 2019 group (2019: 36.0 [26.0, 47.0] min; 2020: 39.0 [30.0, 52.0] min, adjusted $p = 0.007$).

DISCUSSION

IN THIS RETROSPECTIVE nationwide observational registry-based study in Japan on the impact of the COVID-19 pandemic on major trauma, the rate of injuries by motor vehicle accidents decreased, the rate of injuries due to suicide attempts increased, and the rate of fall injuries increased in 2020 compared to 2019. The rate of serious spinal injuries also increased in 2020 compared to 2019. This study also found that the time of prehospital care increased significantly; however, the management of in-hospital care and in-hospital mortality did not change in 2020.

Motor vehicle accidents decreased in 2020 especially for patients over 20 years of age and tended to decrease throughout the period in 2020. Katayama *et al*. reported that the number of cases transported for traffic accidents decreased after the first state of emergency declaration in April 2020 compared to 2019 in Osaka City.[3] The Ministry of Internal Affairs and Communications of Japan also reported that the total number of emergency cases across Japan decreased by 16.8% for traffic accidents in 2020 in comparison to 2019.[2] Although these data included cases of mild or moderate trauma, our study reveals, for the first time, that the number of cases of severe trauma similarly declined during the

Table 2. Characteristics, injury severity, and time needed for prehospital care in each age subgroup of patients with major trauma in Japan, 2019 and 2020

Variable	Age <20 years			Age 20–64 years			Age >64 years		
	2019 (*n* = 337)	2020 (*n* = 313)	Adjusted *p* value	2019 (*n* = 2142)	2020 (*n* = 1863)	Adjusted *p* value	2019 (*n* = 2711)	2020 (*n* = 2417)	Adjusted *p* value
Etiology of injury									
Accident	263 (78.0)	242 (77.3)	1.000	1746 (81.5)	1475 (79.2)	0.156	2537 (93.6)	2219 (91.8)	0.327
Self-injury (suicide)	65 (19.3)	61 (19.5)		315 (14.7)	324 (17.4)		78 (2.9)	89 (3.7)	
Other	5 (1.5)	9 (2.9)		68 (3.2)	59 (3.2)		87 (3.2)	100 (4.1)	
Unknown	4 (1.2)	1 (0.3)		13 (0.6)	5 (0.3)		9 (0.3)	9 (0.4)	
Mechanism of injury, *n* (%)									
Motor vehicle accident	187 (55.5)	179 (57.2)	0.182	1010 (47.2)	811 (43.5)	<0.001	923 (34.0)	698 (28.9)	0.007
Train accident	12 (3.6)	4 (1.3)		37 (1.7)	21 (1.1)		5 (0.2)	10 (0.4)	
Machine accident	0 (0.0)	0 (0.0)		19 (0.9)	15 (0.8)		8 (0.3)	11 (0.5)	
Fall from height (self-injury)	44 (13.1)	50 (16.0)		199 (9.3)	213 (11.4)		47 (1.7)	42 (1.7)	
Fall from height (not self-injury)	22 (6.5)	30 (9.6)		219 (10.2)	224 (12.0)		219 (8.1)	194 (8.0)	
Fall down	17 (5.0)	14 (4.5)		216 (10.1)	198 (10.6)		502 (18.5)	487 (20.1)	
Fall to the ground	9 (2.7)	12 (3.8)		144 (6.7)	141 (7.6)		711 (26.2)	671 (27.8)	
Other	38 (11.3)	22 (7.0)		241 (11.3)	233 (12.5)		228 (8.4)	254 (10.5)	
Unknown	8 (2.4)	2 (0.6)		57 (2.7)	7 (0.4)		68 (2.5)	50 (2.1)	
Serious body part injury									
AIS >2 Spine injury	39 (11.6)	35 (11.2)	1.000	434 (20.3)	410 (22.0)	0.568	647 (23.9)	640 (26.5)	0.101
Time from emergency call to hospital arrival, min	34.0 (27.8, 44.2)	35.0 (27.0, 46.0)	0.308	36.0 (28.0, 48.0)	38.0 (29.0, 51.0)	0.003	38.0 (29.0, 49.0)	39.0 (30.0, 51.0)	0.031
Time spent at injury site, min	21.0 (16.0, 27.2)	22.0 (17.0, 29.0)	0.932	23.0 (18.0, 31.0)	24.0 (19.0, 32.0)	0.055	24.0 (19.0, 31.0)	25.0 (19.0, 33.0)	0.031

Data are presented as the median (interquartile range) or number (percentage).
AIS, Abbreviated Injury Scale.

Table 3. Patient characteristics, injury severity, and time needed for pre-hospital care of major trauma cases in Japan, April–December 2019 and 2020

Variables	April			May			June			July			August		
	2019 ($n = 558$)	2020 ($n = 462$)	Adjusted p value	2019 ($n = 524$)	2020 ($n = 489$)	Adjusted p value	2019 ($n = 557$)	2020 ($n = 494$)	Adjusted p value	2019 ($n = 520$)	2020 ($n = 506$)	Adjusted p value	2019 ($n = 512$)	2020 ($n = 501$)	Adjusted p value
Etiology of injury															
Accident	484 (86.7)	398 (86.1)	1.000	438 (83.6)	420 (85.9)	1.000	470 (84.4)	410 (83.0)	1.000	450 (86.5)	431 (85.2)	1.000	441 (86.1)	426 (85.0)	1.000
Self-injury (suicide)	56 (10.0)	50 (10.8)		64 (12.2)	53 (10.8)		62 (11.1)	67 (13.6)		53 (10.2)	60 (11.9)		55 (10.7)	49 (9.8)	
Other	17 (3.0)	14 (3.0)		18 (3.4)	15 (3.1)		18 (3.2)	17 (3.4)		15 (2.9)	12 (2.4)		14 (2.7)	24 (4.8)	
Unknown	1 (0.2)	0 (0.0)		4 (0.8)	1 (0.2)		7 (1.3)	0 (0.0)		2 (0.4)	3 (0.6)		2 (0.4)	2 (0.4)	
Mechanism of injury															
Motor vehicle accident	221 (39.6)	162 (35.1)	1.000	198 (37.8)	178 (36.4)	0.071	225 (40.4)	183 (37.0)	0.094	184 (35.4)	164 (32.4)	0.172	218 (42.6)	191 (38.1)	1.000
Train accident	6 (1.1)	4 (0.9)		9 (1.7)	3 (0.6)		7 (1.3)	2 (0.4)		8 (1.5)	7 (1.4)		6 (1.2)	3 (0.6)	
Machine accident	3 (0.5)	2 (0.4)		2 (0.4)	2 (0.4)		4 (0.7)	1 (0.2)		3 (0.6)	5 (1.0)		3 (0.6)	4 (0.8)	
Fall from height (self-injury)	33 (5.9)	33 (7.1)		38 (7.3)	38 (7.8)		38 (6.8)	53 (10.7)		34 (6.5)	41 (8.1)		39 (7.6)	31 (6.2)	
Fall from height (not self-injury)	35 (6.3)	48 (10.4)		46 (8.8)	50 (10.2)		45 (8.1)	51 (10.3)		59 (11.3)	49 (9.7)		39 (7.6)	51 (10.2)	
Fall down	76 (13.6)	72 (15.6)		73 (13.9)	77 (15.7)		83 (14.9)	64 (13.0)		67 (12.9)	92 (18.2)		66 (12.9)	67 (13.4)	
Fall to the ground	101 (18.1)	86 (18.6)		81 (15.5)	80 (16.4)		86 (15.4)	90 (18.2)		95 (18.3)	89 (17.6)		91 (17.8)	95 (19.0)	
Other	70 (12.5)	52 (11.3)		48 (9.2)	56 (11.5)		45 (8.1)	43 (8.7)		48 (9.2)	54 (10.7)		40 (7.8)	47 (9.4)	
Unknown	13 (2.3)	3 (0.6)		29 (5.5)	5 (1.0)		24 (4.3)	7 (1.4)		22 (4.2)	5 (1.0)		10 (2.0)	12 (2.4)	
Serious body part injury															
AIS >2 Spine injury	133 (23.8)	99 (21.4)	1.000	113 (21.6)	123 (25.2)	1.000	129 (23.2)	130 (26.3)	1.000	105 (20.2)	120 (23.7)	1.000	116 (22.7)	130 (25.9)	1.000
Time from emergency call to hospital arrival, min	37.0 (29.0, 49.0)	36.0 (29.0, 48.0)	1.000	36.0 (29.0, 48.0)	38.0 (29.0, 50.0)	1.000	35.0 (27.0, 48.0)	38.0 (29.0, 50.0)	0.207	36.0 (29.0, 46.0)	39.0 (29.0, 50.0)	0.777	36.0 (26.0, 47.0)	39.0 (30.0, 52.0)	0.007
Time spent at injury site, min	24.0 (19.0, 32.0)	23.0 (19.0, 30.0)	1.000	23.0 (18.0, 31.0)	24.0 (19.0, 31.0)	1.000	23.0 (18.0, 31.0)	24.0 (19.0, 32.0)	0.774	24.0 (19.0, 30.0)	25.0 (19.0, 33.0)	1.000	24.0 (17.0, 32.0)	25.0 (19.0, 32.0)	0.384

Table 3. (Continued)

Variable	September			October			November			December		
	2019 (n = 586)	2020 (n = 540)	p value	2019 (n = 613)	2020 (n = 597)	p value	2019 (n = 660)	2020 (n = 486)	p value	2019 (n = 664)	2020 (n = 523)	p value
Etiology of injury												
Accident	525 (89.6)	465 (86.1)	1.000	545 (88.9)	512 (85.8)	1.000	593 (89.8)	418 (86.0)	1.000	604 (91.0)	461 (88.1)	1.000
Self-injury (suicide)	43 (7.3)	56 (10.4)		46 (7.5)	57 (9.5)		44 (6.7)	45 (9.3)		35 (5.3)	37 (7.1)	
Other	17 (2.9)	16 (3.0)		19 (3.1)	26 (4.4)		20 (3.0)	20 (4.1)		22 (3.3)	24 (4.6)	
Unknown	1 (0.2)	3 (0.6)		3 (0.5)	2 (0.3)		3 (0.5)	3 (0.6)		3 (0.5)	1 (0.2)	
Mechanism of injury												
Motor vehicle accident	255 (43.5)	220 (40.7)	1.000	248 (40.5)	230 (38.5)	1.000	279 (42.3)	186 (38.3)	1.000	294 (44.3)	175 (33.5)	0.256
Train accident	1 (0.2)	5 (0.9)		4 (0.7)	8 (1.3)		9 (1.4)	1 (0.2)		4 (0.6)	2 (0.4)	
Machine accident	5 (0.9)	5 (0.9)		1 (0.2)	2 (0.3)		4 (0.6)	3 (0.6)		2 (0.3)	2 (0.4)	
Fall from height (self-injury)	29 (4.9)	30 (5.6)		31 (5.1)	28 (4.7)		26 (3.9)	31 (6.4)		22 (3.3)	20 (3.8)	
Fall from height (not self-injury)	58 (9.9)	48 (8.9)		66 (10.8)	55 (9.2)		64 (9.7)	48 (9.9)		48 (7.2)	49 (9.4)	
Fall down	91 (15.5)	71 (13.1)		74 (12.1)	99 (16.6)		100 (15.2)	71 (14.6)		106 (16.0)	86 (16.4)	
Fall to the ground	82 (14.0)	90 (16.7)		117 (19.1)	103 (17.3)		106 (16.1)	81 (16.7)		105 (15.8)	112 (21.4)	
Other	58 (9.9)	66 (12.2)		62 (10.1)	63 (10.6)		62 (9.4)	58 (11.9)		75 (11.3)	71 (13.6)	
Unknown	7 (1.2)	5 (0.9)		10 (1.6)	9 (1.5)		10 (1.5)	7 (1.4)		8 (1.2)	6 (1.1)	
Severe body part injury												
AIS >2 Spine injury	120 (20.5)	128 (23.7)	1.000	132 (21.5)	141 (23.6)	1.000	127 (19.2)	96 (19.8)	1.000	146 (22.0)	118 (22.6)	0.868
Time from emergency call to hospital arrival, min	35.0 (29.0, 47.0)	37.0 (29.0, 51.0)	0.300	37.0 (28.0, 49.0)	38.0 (30.0, 52.0)	0.309	38.0 (30.0, 50.0)	38.0 (30.0, 48.0)	1.000	38.0 (29.0, 50.0)	40.0 (31.0, 51.0)	0.348
Time spent at injury site, min	23.0 (18.0, 29.0)	24.0 (19.0, 33.0)	0.144	23.0 (18.0, 31.0)	24.0 (19.0, 31.8)	1.000	24.0 (18.0, 31.0)	24.0 (19.0, 32.0)	1.000	24.0 (19.0, 31.0)	25.0 (19.0, 32.0)	1.000

Data are presented as the median (interquartile range) or number (percentage).
AIS, Abbreviated Injury Scale.

COVID-19 pandemic in Japan. Furthermore, it was suggested that the registry-based JTDB data could have a good correlation with other population-based data in Japan.

The COVID-19 pandemic caused major restrictions on social and economic activities. These rapidly increased the mental load on people, which led to an increase in suicides. Such an increase was seen in the population younger than 70 years of age 5 months after the first wave of the COVID-19 pandemic in a Japanese nationwide study.[8] Several studies in Japan also reported that suicides in Japan increased in the second half of 2020.[8–10] The results of the present study were consistent with those of other studies, indicating that the data from the JTDB might also reflect trends in suicide in Japan.

Lifestyle changes due to the COVID-19 pandemic have been shown to increase the risk of developing sarcopenia, especially in the elderly. In the COVID-19 pandemic situation, decreased muscle mass and weakness or a decline in physical function were observed in elderly with underlying illnesses or in a state of economic poverty. These findings were also reported to be associated with social detachment.[19–21] Sarcopenia has been reported to be associated with the risk of injury by falling.[22] The increase in the incidence of "fall to the ground" or "fall down" and in major spinal injury as shown in this study could be associated with sarcopenia caused by the COVID-19 pandemic in Japan.

Under the COVID-19 pandemic, several studies in Japan reported that the time for prehospital care increased for patients with out-of-hospital cardiac arrest, acute myocardial infarction, and stroke.[23–25] However, a study dealing with the victims of traffic accidents in the early stage of the COVID-19 pandemic found no change in the time for prehospital care.[3] In the present study dealing with major trauma, the time for prehospital care increased significantly in 2020 compared to 2019. The administration of prehospital care for endogenous diseases faced difficulties from the early phase of the COVID-19 pandemic in Japan, but in regard to trauma patients, the effect appeared to be minor in the early phase of the pandemic because the number of traffic accidents decreased. However, as the number of COVID-19 cases climbed during 2020, the burden on medical care increased, which could have had a strong impact on prehospital care for trauma patients. The impact of the pandemic was particularly strong in August 2020 during the second wave of the COVID-19 pandemic (from July to October) in the present study.

Despite this, there was no change in injury severity and no remarkable change in hospital treatment or in the in-hospital mortality rate. This was also shown in studies carried out in other countries.[6,26] Although the medical care for the treatment of major trauma was restricted due to the reallocation or reorganization of medical resources, the Japanese medical system was resistant to the burden of the COVID-19 pandemic and continued to provide high-quality care for major trauma patients.

This study has several limitations. First, there were regional differences in the prevalence of COVID-19 between metropolitan and rural areas. There could be differences in the impact of the COVID-19 pandemic on trauma care between metropolitan and rural areas. Second, the JTDB is not a population-based database, and data registration is voluntary, which might limit the generalizability of the results. Finally, this study only dealt with the early waves of COVID-19 in Japan. Several waves of COVID-19 infection have occurred since 2020, so it will be possible to investigate the impact on major trauma in more detail by examining the data after 2021 in the future.

CONCLUSIONS

THE COVID-19 pandemic in Japan caused an alternation in the epidemiology of patients with major trauma in 2020. It also burdened prehospital care but did not affect in-hospital management or in-hospital mortality of patients with major trauma in 2020.

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DISCLOSURE

APPROVAL OF THE research protocol: The study was conducted in accordance with the Declaration of Helsinki and approved by the institutional review board of Osaka National Hospital (approval number: 19-9).

Informed consent: The requirement for patient consent was waived due to the anonymous nature of the data.

Registry and registration no. of the study/trial: N/A.

Animal studies: N/A.

Conflict of interest: None.

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