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We investigated the clinical picture of non-traumatic acute aortic dissection (AAD) occurring behind the wheel. Between 1990 and 2014, AAD had occurred in 11 patients while driving (nine men, mean age: 58.3 years, seven commercial drivers). The symptoms included chest and/or back pain (n = 9) and syncope (n = 2). One patient with syncope caused a traffic accident. Ten patients had type A dissection (DeBakey type I) and 1 type B dissection. In-hospital mortality was 9.9% (1/11). Our data showed if affected drivers are transported to a hospital in a timely fashion, a good surgical outcome can be expected.

Keywords: aortic dissection, motor vehicle driving, traffic accident

Introduction

Motor vehicle accidents resulting from natural disease are relatively rare, with a reported incidence of 1–2 per 1000 traffic accidents.1 Reported driver deaths resulting from motor vehicle accidents caused by natural sudden illness range from 8%–24%.1,2 Traditionally, cardiovascular disease, especially coronary artery disease (CAD), has been the main culprit in terms of natural deaths that occur to drivers “behind the wheel.”1,3–5

Acute aortic dissection (AAD) remains a life-threatening cardiovascular emergency, and post-treatment morbidity and mortality rates are high.6 AAD can and does occur in persons while they are driving. Because AAD is a less common cause of natural death for drivers than is CAD, the clinical picture of AAD when it occurs behind the wheel is not fully known. Any sudden natural illness that occurs to a person who is driving a motor vehicle can cause a serious traffic accident, and this becomes a social issue because other vehicles, the occupants of all vehicles, property, and even pedestrians can be affected. We conducted a retrospective study to investigate perioperative characteristics and surgical outcomes of patients who underwent emergency surgery for AAD that occurred while they were driving a four-wheeled vehicle.

Case Report

Six hundred sixty-six consecutive patients who underwent emergency surgery for AAD (type A, n = 634; type B, n = 32) at Saitama Medical Center, Jichi Medical University, Saitama, Japan or IMS Fujimi General Hospital, Fujimi, Japan between January 1990 and September 2014. We searched these patients’ clinical records to identify those who suffered AAD while behind the wheel of a motor vehicle. This patient cohort comprised 364 men and 302 women with a mean age of 63.7 years. AAD had been diagnosed on the basis of enhanced computed tomography (CT) or transthoracic echocardiography findings. The overall in-hospital mortality was 9.6% (61/634) for type A AAD and 15.6% (5/32) for type B AAD.

Of the 666 patients, 11 suffered AAD (type A, n = 10; type B, n = 1) while driving a four-wheeled motor vehicle. There were no traumatic aortic dissections. The clinical records of these 11 patients’ were reviewed for the following information: age and sex, type of vehicle the patient was driving (whether commercial or non-commercial), onset symptoms, time between symptom onset and hospital admission, comorbidities and smoking status, Stanford and DeBakey classifications, organ malperfusion and hemodynamic status, type of surgery performed, and in-hospital outcomes. The ethics committee of Saitama Medical Center, Jichi Medical University, and IMS Fujimi General Hospital granted approval for the study, and the need for individual informed consent was waived. Data are shown as mean ± standard deviation values or as the number and percentage of patients.
Characteristics of each of the 11 cases are shown in Table 1. Patients ranged in age from 42 to 74 years (mean: 58.3 ± 10.7 years), and the male/female sex ratio was 9:2. Seven of the 11 patients were driving a commercial vehicle at the time of symptom onset. Onset symptoms were sudden chest and/or back pain (n = 9) and syncope (n = 2). In all patients, preoperative physical and radiologic evaluation at the time of admission confirmed that no patients had blunt chest and abdominal injury, traumatic neurological injury, and bone fractures. Two patients lost consciousness: Patient 6 (Fig. 1) was a 59-year-old shuttle van driver who lost consciousness while driving on the highway. His foot remained on the gas pedal, and the vehicle crashed into a guardrail. A backseat passenger moved to driver’s seat and successfully stopped the vehicle. The patient survived. Patient 11 was a 74-year-old man who lost consciousness while driving alone. His car left the road and crashed into property. No other vehicle and no pedestrians were involved in the collision. After the collision, he regained consciousness and was transported to a local hospital. The nine patients who did not experience syncope managed to stop their vehicles successfully and were transported to a local hospital or to one of our hospitals by ambulance. The mean time from symptom onset to hospital admission was 1.4 ± 0.6 hours. All patients who were transferred to one of our hospitals for aortic repair were transferred within 48 h of symptom onset. Two patients (Patients 2 and 6) were comatose (Glasgow Coma Scale: E1V1M1) at the time of admission to our hospital; the others were awake and alert. CT was performed upon admission to local hospital or our hospitals, and 10 patients were diagnosed with type A AAD (DeBakey class I), and one patient (Patient 10) was diagnosed with type B AAD (DeBakey class IIIb) with massive periaortic hematoma and left pleural effusion. Organ malperfusion included cerebral (n = 3), coronary (n = 2), kidney (n = 1), and mesenteric (n = 1) malperfusion. Preoperatively, nine patients were hemodynamically stable. One patient (Patient 10) was in shock due to hemorrhage. The remaining patient (Patient 2) was in a state of profound shock due to left coronary artery malperfusion, and this patient underwent extracorporeal membrane oxygenation therapy preoperatively. In all patients, including two with syncope, preoperative physical and radiologic evaluation at the time of admission confirmed that there were no blunt chest and abdominal injury, traumatic brain damage, and bone fractures.

Emergency aortic repair was performed in all patients. Surgical procedures included ascending aorta or hemiarch replacement (n = 8), partial arch replacement (reconstruction of 1 or 2 supra-aortic branches) (n = 2), and descending aorta replacement (n = 1). The primary intimal tear was resected in 10 patients. Coronary artery bypass...
been no reported studies of the clinical presentations and treatment outcomes of AAD occurring behind the wheel. To the best of our knowledge, ours is the first to describe in detail AAD occurring behind the wheel, including onset symptoms and the short- and late outcomes of aortic repair.

The most common natural cause of sudden death of drivers is CAD. This disease represents a reported 77.8%–93.0% of all natural behind-the-wheel deaths.3–5) The other major causes of behind-the-wheel death are cerebrovascular disease (3.3%–32.9%),3,4,7) bronchial asthma (4.7%), and pneumonia (2.7%). Less common causes include, pulmonary embolism, diabetes, epilepsy, gastrointestinal haemorrhage, and esophageal varix.1,4)

Antecol et al. reported the clinical features of CAD leading to the sudden death of 24 drivers.3) Mean age of these drivers was 54 years, and 22 (92%) were men.3) Buttnar et al. reported six patients, including two with cystic medial necrosis, who died of aortic rupture while driving; mean age of these patients was 50.3 years.4) None of the 11 patients in our series had syndromic aortic disease, and their mean age was 58.3 years. Age-wise, the 11 patients in

grafting was additionally performed in two patients with coronary malperfusion. Mean operation time and cardiopulmonary bypass time were 397 ± 137 and 168 ± 43 min, respectively. In-hospital mortality was 9.1% (1/11). The patient who died (Patient 2) had suffered coronary malperfusion, and he died of heart failure on postoperative day 2. Complications included the need for prolonged mechanical ventilation (more than 48 h after surgery) in three patients, the need for tracheostomy in one patient, and new-onset postoperative cerebral infarction in one patient. Two patients with cerebral malperfusion suffered cerebral infarction postoperatively. The ten surviving patients were discharged or transferred to another hospital for rehabilitation.

Discussion

Previous studies have investigated sudden natural illnesses occurring behind the wheel.1,3–5,7) Aortic diseases, including AAD, have been reported to account for 4.1%–6.7% of the natural deaths of drivers.3,4) To date, however, there have been no reported studies of the clinical presentations and treatment outcomes of AAD occurring behind the wheel. To the best of our knowledge, ours is the first to describe in detail AAD occurring behind the wheel, including onset symptoms and the short- and late outcomes of aortic repair.

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Fig. 1 Representative computed tomography images of a patient (Patient 6) in whom acute aortic dissection occurred while he was driving a vehicle. Preoperative images showing cervical artery dissection (A, B) and dissection in the sinus and the descending aorta (C). Postoperative cerebral infarction resulting from preoperative cerebral ischemia (D). Postoperative 3-dimensional image showing hemiarch replacement (E).
whom AAD occurred while they were driving fell below the average age of our total cohort (n = 666, 63.7 years). Seven (63.6%) of our 11 patients had been treated or untreated for hypertension preoperatively, consistent with our reported 72% prevalence of hypertension among patients with type A AAD.9 Preoperative shock and organ malperfusion occurred in 18.2% (2/11) and 45.4% (5/11) of our patients, respectively, and these incidences are similar to those reported previously among patients with AAD.9 Further, the 9.1% in-hospital mortality we documented are acceptable.

Seven (63.6%) of our 11 patients were commercial drivers. Occupational drivers tend to work for long periods, and many are required to work a rotating shift that includes nights. Previous study reported that the prevalence of CAD is higher among occupational drivers than among persons of other occupations.10 However, few previous studies have investigated whether a relationship exists between occupational driving and the development of aortic disease. Some specific sports activities, including weight lifting, can trigger the onset of AAD due to a rapid increase in hemodynamic stress.11 In these cases, the underlying cause is a sports-induced mechanism. Driving a vehicle is probably not directly related to the pathogenesis of AAD. Kurosaka et al. reported a greater prevalence of obesity, diabetes, dyslipidemia, and habitual smoking among Japanese taxi drivers than in other occupational workers.10 We believe that similar health status trends may increase the incidence of AAD among Japanese commercial drivers. Regular health check-ups and improvements in the work environment are important for prevention of aortic disease. In addition, physicians should advise commercial drivers to stop their vehicle when they detect even slight discomfort while driving.7

Two (18%) of our 11 patients experienced syncope preoperatively. Syncope is a well-known symptom of AAD. A large-scale study documented syncope in 13% of AAD patients, and outcomes were worse for these patients than for patients without syncope.12 Although no systemic traumatic injuries resulted from AAD in this study, AAD occurring during driving can cause collision and subsequent traumatic injury in the other parts of the body. The optimal treatment order for AAD patients with concomitant traumatic injury should be determined based on a balance between severity of traumatic injury and general condition, including hemodynamics and organ ischemia, caused by AAD.

Conclusion

We have outlined the clinical presentations and surgical outcomes of AAD occurring specifically behind the wheel in patients treated at either of our hospitals. AAD represents one of several sudden natural illnesses that can lead to death behind the wheel or to a serious traffic accident. Analysis of our patients showed that good outcomes can be expected if drivers suffering AAD are transported to the hospital before circulatory collapse. Prompt diagnosis is of critical importance in the management of AAD that occurs behind the wheel.

Disclosure Statement

The authors have no conflict of interest to disclose.

Author Contributions

Study conception: NK, data collection: TY, NK, TH, Writing: TY, NK, critical review and revision: all authors, final approval of the article: all authors.

References