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AMBULANCE CRASH IN A RURAL AREA OF THAILAND

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☐ **Abstract—Background: Ambulance crashes delay patient transfer and endanger patients, ambulance crews, and other road users. In low- and middle-income countries, where motor vehicle crash rates are typically high, ambulances have a high risk of being involved in a crash. This case report describes an ambulance crash in Thailand to elucidate modifiable problems in current protocols and practices of emergency medical services. Case Report: In November 2016, a 28-year-old male driver of an ambulance died in a crash while transferring a female patient with dizziness to a rural hospital. The driver and another ambulance crew were sitting in the front seats unrestrained. The other occupants were in the patient compartment unrestrained. The driver was driving the ambulance within the speed limit. He made a sharp turn trying to evade a dog, and the ambulance crashed head-on into a roadside tree. The cabin sustained severe damage, and the occupants in the patient compartment were struck against the compartment wall and were struck by unsecured equipment and the stretcher. The driver sustained a severe brain injury. The other occupants, including the female patient, sustained minor injuries. Why Should an Emergency Physician be Aware of This?: This case raises safety issues concerning the following aspects of ambulance operations in low- and middle-income countries: speed limit, driver's health, safety device use, seatbelt use, securing equipment, and vehicle safety standards. Systematic measures to change protocols or even legislation, as well as data collection, are required to address these issues.** © **2017 Elsevier Inc. All rights reserved.**

☐ **Keywords—accidents; ambulances; developing countries; emergency medical services; injuries**

INTRODUCTION

Safety is the first priority of emergency medical services (EMS) (1). Ambulance crashes not only delay patient transfer but endanger ambulance occupants and other road users. Nevertheless, this important issue related to the safety of patients and providers has not been investigated often in high-income countries (HICs) (2–6). Investigation into EMS vehicle crashes is even less common in low- and middle-income countries (LMICs), where the risk of motor vehicle crashes is high and the conditions are quite different from those of HICs (7–9).

The EMS system in Thailand, formally established in 1994, consists of hospital-, municipality-, and volunteer-based ambulance teams, all of which are led by control command centers located at provincial hospitals or provincial health offices (10,11). The hospital-based teams, usually staffed with emergency medical technicians (EMTs) of advanced level, paramedics, nurses, or emergency physicians, provide advanced prehospital care; municipality- or volunteer-based teams, staffed with EMTs of basic level or emergency medical

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responders (EMRs) of first responder level, provide basic care. A control command center receiving an emergency call via the national emergency ambulance number (1669) dispatches an ambulance team with the appropriate skill level from the nearest location.

EMS in Thailand has implemented various safety measures, including ambulance speed limits, driver training, and establishment of a protocol for safety device use (Table 1). However, 61 ambulance crashes, with 130 injured occupants and 19 deaths, were reported in 2013 (8). To elucidate modifiable risk factors of ambulance crashes and subsequent injuries, this report presents the case of an ambulance crash in Thailand, a LMIC.

CASE REPORT

In November 2016, a 28-year-old male driver died in an ambulance crash during the emergency transport of a patient in the Haukae subdistrict in Thailand. The ambulance, which was dispatched from EMS of the subdistrict government, was transporting to the hospital a 53-year-old woman with dizziness. The subdistrict is in a rural area, and the road had no lights. The ambulance was running with its lights on but without the siren at under 80 km/h, as per protocol. The driver was sick with a fever at that time and had taken some medicine prescribed in a private clinic (detailed information is unavailable). There was no evidence indicating that the driver was under the influence of alcohol. The driver was sitting in the front-right seat and another EMR was sitting in the front-left seat; both were unrestrained. The patient was attended by her relative and one EMR, who were sitting on a bench unrestrained in the patient compartment; the patient was lying on a stretcher restrained.

According to the EMR in the front seat, at 2:44 AM, the driver made a sharp turn trying to evade a dog that had dashed into the road, and the ambulance swerved, crashing head-on into a roadside tree (Figures 1 and 2). The driver was found unconscious in the cabin with no visible wounds. The other occupants in the patient compartment were struck against the compartment wall and by unsecured equipment and the stretcher. All 5 occupants, including the patient, were helped by other EMS teams and sent to the nearest district hospital. The driver remained unconscious during the transfer and developed cardiac arrest after arriving at the hospital. He was intubated and resuscitated in the emergency department; he then regained spontaneous circulation. No abnormalities in the airway were detected during the intubation. Subsequent investigation revealed crepitation in his neck but no other injuries. The driver was transferred to XX Provincial Hospital by ground ambulance. Three other occupants were also transferred to XX Hospital. The EMR sitting in the patient compartment had a minor laceration wound and was treated in the district hospital. A 48-year-old male EMR sitting in the front seat had a mild head injury and a mild facial injury with periorbital ecchymosis. A 58-year-old male relative had a left femur fracture. The patient, who had been transported in the ambulance, had a blunt abdominal injury and mild head injury.

On the day of his admission to XX Hospital, the driver underwent computed tomography, which revealed severe brain swelling with a small subdural hematoma on the

Table 1. Current Safety Measures in Emergency Medical Services in Thailand with Proposed Measures

	Current Safety Measures	Proposed Safety Measures
Driver's ability	All drivers should attend an ambulance driving course and pass an examination for driving skills and behaviors	Additional training and education regarding safe transfer to raise awareness of the risk of high-speed transfer
Categorization of emergency response	Priority 1—Life-threatening emergency equivalent to Emergency Severity Index 1–3 (an ambulance runs with lights and sirens) Priority 2—Non–life-threatening emergency equivalent to Emergency Severity Index 4 (an ambulance runs with only lights) Priority 3—Minor conditions (an ambulance runs with no lights or sirens)	Emergency transfer with lights and sirens should be restricted to life-threatening conditions
Speed limit	In all categories, 80 km/hour	The speed limit for all vehicles, including ambulances, should be set to a lower speed
Safety devices	According to traffic law, front occupants should wear seatbelts	All occupants should wear seatbelts and helmets whenever possible
Alcohol/drugs/health conditions	Driving under the influence of alcohol/drugs is prohibited by traffic law	Daily health check should be done before starting the shift and driving after certain medications should also be restricted
Securing equipment	Emergency Medical Services protocol stipulates that all things in the patient compartment should be fixed to avoid their projection	Higher safety standards for ambulance vehicle and equipment should be introduced

Figure 1. The ambulance crashed into a roadside tree.

right frontal lobe, suggesting severe traumatic brain injury with diffuse hypoxic brain damage and fractures of the thyroid and cricoid cartilages. A second computed tomography on day 3 showed aggravated brain swelling. He remained unconscious throughout the course. On day 7 of hospitalization, he became hypotensive; however, based on Thai culture, his family refused further treatment and took him back home in hopes that he would die at home rather than in the hospital.

Figure 2. The wrecked driver's cabin.

The 48-year-old male EMR underwent a computed tomography scan of the head that revealed a closed fracture of the left frontal skull with a thin subdural hematoma and an open fracture of the left zygoma. The zygoma fracture required open reduction and internal fixation, and the skull fracture with hematoma required conservative observation. He was discharged to home after a 6-day observation period.

The 58-year-old man underwent a computed tomography scan of the abdomen that revealed minimal subcapsular hematoma of the right kidney. The kidney injury required observation for several days. The left femur facture required open reduction and internal fixation. Because of the long waiting list for orthopedic surgery, the operation was performed on the day 10, and he was referred to the district hospital for rehabilitation after a 12-day hospitalization.

The 53-year-old woman who had been transported by the ambulance underwent a computed tomography scan that revealed minimal hemoperitoneum in the perisplenic region and pelvic cavity. Her dizziness resolved without any treatment. She underwent 8 days of observation and was discharged home.

DISCUSSION

This case raises the issue of ambulance safety, which is particularly important in LMICs with a high crash incidence (8). In Thailand, where the mortality rate caused by motor vehicle crashes is estimated to be 36.2 per 100,000 population per year—the highest in southeast Asia—ambulances are at high risk of being involved in fatal crashes (9). This case teaches valuable lessons regarding improving safety for patients and ambulance workers in LMICs.

First, ambulance emergency responses involving high speeds, lights, and sirens might increase the risk of being involved in crashes (5,12,13). Studies indicate that high speed, whether individual vehicle speed or average speed at road section level, increases the risk of vehicle crashes in general (14–16). In addition, higher impact speeds aggravate damage once a crash occurs, causing more severe injuries to vehicle occupants as well as crash counterparts (e.g., pedestrians and cyclists) (14,16,17). Vehicle speeds are quite high throughout Thailand: the maximum speed limits in urban and rural roads are 80 and 90 km/h, respectively. Although the speed limit for ambulances is 80 km/h regardless of the emergency level, the use of lights and sirens depends on the level of emergency (Table 1).

To reduce the risk of ambulance crashes, lowering the speed limit of ambulances and other vehicles might be considered. A lower ambulance speed would not influence the outcomes of most patients except for critical

cases, because high-speed emergency driving does not significantly decrease transport time (18). Protocols and regulations regarding ambulance operations should be changed to lower the speed limit. To ensure speed limit compliance, ambulance drivers should be made aware of the risks and benefits of emergency high-speed transport. In addition, speed monitoring devices, which have been shown to be effective in reducing speed violations by ambulance drivers, should be introduced (19). More importantly, the public expectation of a rapid response and high-speed transfer, even for moderate conditions, should change (20).

Second, safety devices, such as seatbelts and helmets, could have prevented some of the injuries sustained by the occupants in both the patient compartment and front seat (5,6,21). Patient care might preclude constant seatbelt use in life-threatening conditions, and reports show that in HICs, EMS providers in the patient compartment have a very low utilization of seatbelts (20,22,23). However, most patients in mild or moderate condition can be observed while providers are sitting and restrained in a seat. In Thailand, traffic laws mandate seatbelt use only in the front seats, and helmets are never used by ambulance personnel. The use of safety devices whenever possible in the patient compartment should be mandated by protocol.

Third, safety features in the patient compartment, including rounded corners and a firmly secured stretcher and equipment, could have reduced the injuries and damage (24). The National Institute of Emergency Medicine of Thailand simply recommends that all things in the patient compartment should be fixed in place (Table 1). A more specific protocol and regular checks of the patient compartment should be introduced.

Admittedly, higher ambulance safety standards are needed, particularly in LMICs (20,23,24). In the present case, the stretcher was fixed to the base; however, the fixation system was not strong enough to prevent the stretcher from being projected. Incorporating the safety standards of HICs into LMICs, such as the European Standard, would help to improve the mounting systems to secure equipment, occupant seats and seatbelts in the patient compartment, and a stretcher fixation system (19,25). In reality, most ambulances in LMICs are outdated and only satisfy lower safety standards. Many of the ambulances are donated from HICs and might no longer meet the standards of the donating countries.

Because of their greater exposure to risk factors, EMS providers are at higher risk of diseases, injuries, and mortality compared to those in other occupations. The occupational mortality rate among EMS providers in the U.S. in the late 1990s was estimated to be 12.7 per 100,000 EMS workers per year, whereas the national average was 5.0 per 100,000 workers per year (3). The mortality rate was even higher in Turkey (21.4/100,000 workers) (7). To address safety issues of both patients and providers, more rigorous data collection and analyses regarding ambulance crashes are required.

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?

This case raises some safety issues of EMS particularly in LMICs. Systematic measures to change protocols or even legislation is required to address these issues. Additional studies and data collection should be performed to determine solutions and to monitor their effectiveness in LMICs as well as in HICs.

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