Case Report

J Trauma Inj 2024;37(3):224-227
https://doi.org/10.20408/jti.2023.0080

Journal of Trauma and Injury JTI

pISSN 2799-4317 • eISSN 2287-1683

Use of helicopter emergency medical services with a physician on board in severe pediatric trauma in Korea: a case report

Yoonsuk Lee, MD[1,2], Gunwoo Kim, MD[1], Pil Young Jung, MD[2,3]

[1]Department of Emergency Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea
[2]Regional Trauma Center, Wonju Severance Christian Hospital, Yonsei University Wonju College of Medicine, Wonju, Korea
[3]Department of Acute Care Surgery, Yonsei University Wonju College of Medicine, Wonju, Korea

Received: November 11, 2023
Revised: January 21, 2024
Accepted: May 8, 2024

Correspondence to
Pil Young Jung, MD
Department of Acute Care Surgery, Yonsei University Wonju College of Medicine, 20 Ilsan-ro, Wonju 26426, Korea
Tel: +82-33-741-0882
Email: surgery4trauma@yonsei.ac.kr

In Korea, helicopter emergency medical services (HEMS) with a physician on board were introduced in September 2011, funded by both central and regional governments. HEMS was integrated into the Korean emergency medical system to address the need for EMS in remote rural areas. The present report describes 16-month-old twins who fell from the fifth floor of an apartment building, located approximately 100 km from the nearest level I trauma center. Utilizing HEMS along with initial emergency management by an emergency physician, the patients were transported to the level I trauma center within the critical "golden hour." The children had sustained multiorgan injuries. Without intervention at the scene by an emergency physician, a fatal outcome was anticipated for both children. With the use of HEMS, one patient died, but the other survived with a good prognosis. The use of HEMS flights with an emergency physician on board may improve outcomes for pediatric patients with severe trauma in medically underserved rural areas.

Keywords: Emergency helicopters; Pediatric emergency medicine; Trauma centers; Case reports

INTRODUCTION

The concept of the "golden hour" is critical for trauma patients, as prolonged prehospital time can result in poor functional outcomes [1]. Air transport represents a means to preserve this crucial time frame. Korea's official hospital-based helicopter emergency medical services (HEMS) were launched in September 2011. HEMS was integrated into the Korean emergency medical system to address the demand for EMS in the country's remote mountainous regions. We present two cases of patients with severe trauma who were transported to the hospital by helicopter within the golden hour, one of whom survived after emergency intervention.

CASE REPORT

EMS received a report of 16-month-old twins (patient A, male; patient B, female), with no specific medical history, who had accidentally fallen from the fifth floor of an apartment window at 13:30 on May 24, 2021. The initial pulse oxygen saturation for

patient B was 87% with a pediatric nasal prong delivering 3 L/min of oxygen and 70% with a pediatric mask and reservoir bag delivering 15 L/min of oxygen. The EMS dispatch control center requested the support of an emergency physician-staffed HEMS. The HEMS team transferred the patients to a level I trauma center, which was located over 2 hours from the accident site by ground transportation. The patients arrived at the trauma center at 14:38, approximately 1 hour after the accident. Patient A (the first patient) was stuporous upon arrival, with an initial blood pressure of 119/78 mmHg, a pulse rate of 84 beats/min, a respiratory rate of 30 breaths/min, and a body temperature of 37.0 ℃. Patient B (the second patient) was also stuporous, with an initial blood pressure of 71/30 mmHg, a pulse rate of 120 beats/min, a respiratory rate of 34 breaths/ min, and a body temperature of 36.0 ℃. At 15:07, an extended focused assessment with sonography for trauma was performed for both patients. Positive signs were observed in the Morrison pouch, splenorenal view, and perivesical areas in both children.

Patient A underwent endotracheal intubation at 15:09, followed by the establishment of an intraosseous infusion in the tibia at 15:15. Emergency transfusion of nonmatched red blood cells was initiated. At 16:33, computed tomography (CT) scans were acquired from the head to the pelvic area. Brain CT revealed a left frontal base and occipital bone skull fracture, as well as subdural hemorrhage in the left middle cranial fossa. Chest CT showed lung contusion, while abdominopelvic CT displayed spleen laceration and hematoma, laceration with hematoma in segment 7 of the liver, and hemoperitoneum (Fig. 1). At 17:45, the patient underwent embolization of the splenic branch and segment 4 of the hepatic artery. On the 1st day of hospitalization, despite ventilatory support, the patient's oxygen requirement increased, and respiratory acidosis developed. As acute respiratory distress syndrome progressed, she was transferred again by helicopter to a hospital equipped with venovenous extracorporeal membrane oxygenation (ECMO) capabilities (Fig. 2).

For patient B, endotracheal intubation was performed at 15:11, and intravenous infusion was initiated at 15:10. Blood transfusion was started at 15:30, and all CT scans were completed by 16:00. Brain CT revealed no specific findings. However, chest CT confirmed a right lung contusion and multiple rib fractures. Abdominopelvic CT showed liver lacerations and hematomas with active bleeding throughout the entire right hemiliver (Fig. 3). The

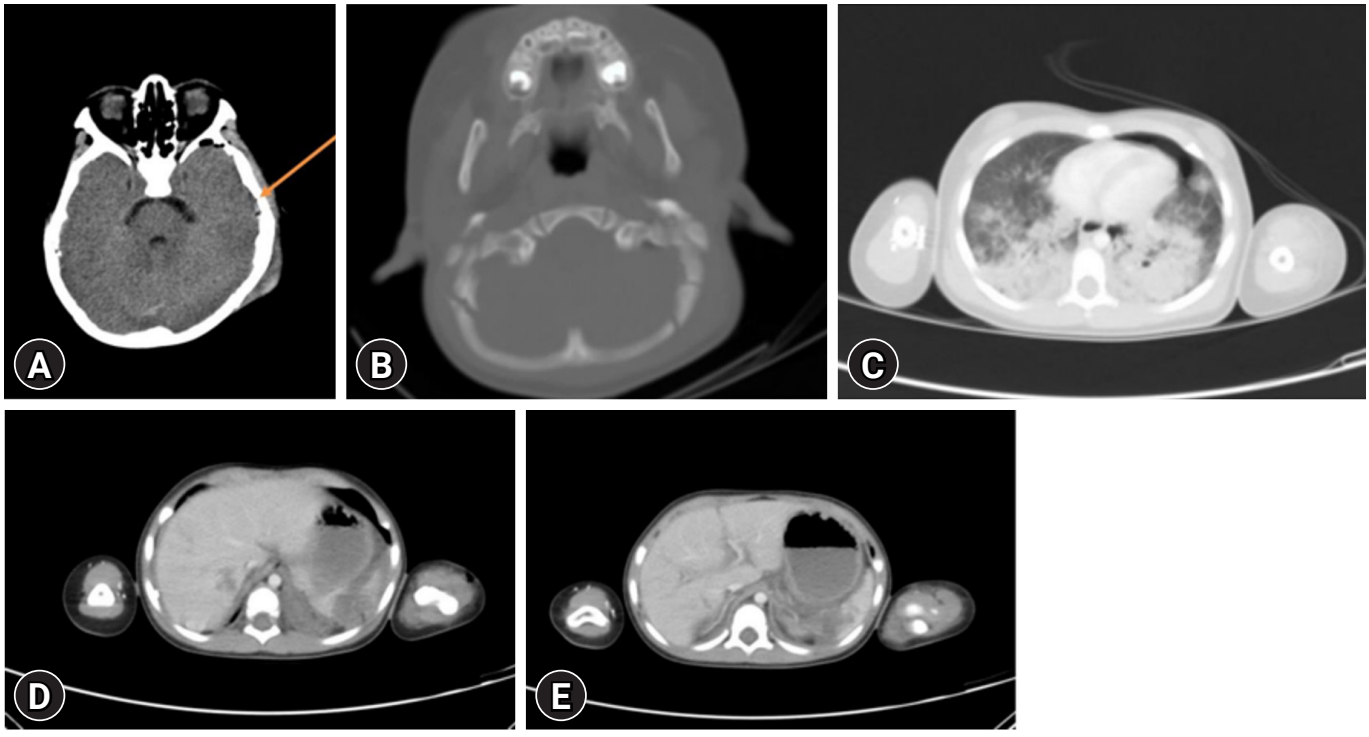

Fig. 1. Computed tomography scans of patient A. (A) Subdural hemorrhage in the left middle cranial fossa (arrow). (B) Skull fracture at the base of the left frontal and occipital bones. (C) Lung contusion. (D) Laceration with hematoma in segment 7 of the liver. (E) Laceration and hematoma of the spleen.

patient was transferred to the operating room for emergency laparotomy at 17:17. Following the decision to proceed with damage control surgery to address the lethal triad, tape packing was performed, and patient B was admitted to the intensive care unit (ICU) after surgery. Cardiac arrest occurred, and cardiopulmonary resuscitation (CPR) was initiated at 18:19. Return of spontaneous circulation was achieved at 18:27, but persistent bradycardia continued. Cardiac arrest recurred at 18:47. With the consent of the patient's parents, CPR was discontinued at 18:59 due to the futility of further resuscitation efforts.

Ethics statement

Written informed consent for publication of the research details and clinical images was obtained from the patients' parents.

DISCUSSION

This accident occurred in Jeongseon County (Jeongseon-gun), Korea. The accident site was at least 94 km from the nearest level I trauma center, requiring approximately 2 hours of travel by ground. The patients displayed Injury Severity Scores of 15 or higher and were diagnosed with multiple solid organ injuries, corresponding to an elevated risk of mortality [2,3]. Prior research indicates that air transport yields better outcomes for severely injured patients compared to ground transport [4]. Both patients were transported to the hospital within 1 hour by HEMS, accompanied by an emergency physician. Initial resuscitation was completed within 4 hours, and the patients were admitted to the ICU. The level I trauma center had one key limitation: it could not provide ECMO for pediatric patients due to the lack of a pediatric specialist experienced in ECMO and the unavailability of pediatric ECMO catheters. Consequently, we had to arrange for a secondary transfer to a pediatric specialty hospital, again utilizing HEMS for transport. Had the patients not been delivered to the hospital within the golden hour, death would have been more likely. The use of air transportation with

Fig. 2. Image of patient A, who underwent secondary transfer via helicopter emergency medical services to a facility with pediatric extracorporeal membrane oxygenation capabilities. The patient's parent provided written informed consent for publication of the clinical image.

Fig. 3. Computed tomography scans of patient B. (A) Liver lacerations/hematomas with active bleeding throughout the entire right hemiliver. (B) Right lung contusion. (C) Rib fracture.

https://doi.org/10.20408/jti.2023.0080

an emergency physician present may profoundly impact the survival of pediatric trauma patients.

ARTICLE INFORMATION

Author contributions

Conceptualization: YL, PYJ; Formal analysis: PYJ; Investigation: GK, PYJ; Methodology: GK; Project administration: PYJ; Writing–original draft: all authors; Writing–review & editing: YL, PYJ. All authors read and approved the final manuscript.

Conflicts of interest

The authors have no conflicts of interest to declare.

Funding

The authors received no financial support for this study.

Data availability

Data sharing is not applicable as no new data were created or analyzed in this study.

REFERENCES

1. Chen CH, Shin SD, Sun JT, et al. Association between prehospital time and outcome of trauma patients in 4 Asian countries: a cross-national, multicenter cohort study. PLoS Med 2020;17:e1003360.
2. Heuer M, Taeger G, Kaiser GM, et al. Prognostic factors of liver injury in polytraumatic patients: results from 895 severe abdominal trauma cases. J Gastrointestin Liver Dis 2009;18:197–203.
3. Schnüriger B, Inderbitzin D, Schafer M, Kickuth R, Exadaktylos A, Candinas D. Concomitant injuries are an important determinant of outcome of high-grade blunt hepatic trauma. Br J Surg 2009;96:104–10.
4. Palmer C. Major trauma and the injury severity score: where should we set the bar? Annu Proc Assoc Adv Automot Med 2007;51:13–29.