

# Out-of-hospital cardiac arrest due to cervical spine injury by uncertain trauma: A study of two cases

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## ABSTRACT

Cervical spinal cord injury is a well-known cause of cardiac arrest in trauma victims. Unless trauma is definitively suspected, emergency medical services teams perform resuscitation in the pre-hospital stage without cervical spine immobilization. During advanced cardiovascular life support (ACLS), intubation with cervical spinal immobilization causes difficulty in accessing the airway, thus, immobilization tends to not be performed, unless the patient is a clear case of trauma. We report two patients with out-of-hospital cardiac arrests (OHCA) due to cervical fractures that have occurred without clear trauma. In these cases, pre-existing cervical spine lesions was additional informed and identification of the cervical spine fractures was delayed. Emergency medical physicians tend to neglect cervical spine injury when the likelihood of trauma is unclear in a patient presenting with OHCA. These cases urge physicians to consider the possibility of cervical spinal injuries, even in cases of minor trauma. If there is a possibility of cervical spinal injury, imaging should not be delayed and should be followed by appropriate treatment.

**Keywords:** Cervical vertebrae; out of hospital cardiac arrest; spinal injury.

## INTRODUCTION

Cervical spinal cord injury is a disease that is often seen in the emergency department (ED), and it can be fatal if the level of injury affects respiration. Therefore, patients suspected of cervical spinal cord injury in the ED should be carefully investigated and promptly managed. Cervical spine immobilization is essential for patients suspected of spinal cord injury, so in most cases, the cervical collars are applied through the transport stage of emergency medical service. However, this immobilization strategy is not actively performed on some patients whose history of trauma is not clear or who were found collapsed with unwitnessed. In this report, two cases of out-of-hospital cardiac arrest (OHCA) due to cervical injury were described.

## CASE REPORT

**Case 1**– A 52-year-old man was found in a state of unwitnessed cardiac arrest and was transported to ED. After 30 min of cardiopulmonary resuscitation (CPR), the patient exhibited return of spontaneous circulation (ROSC), his blood pressure was 140/60 mmHg, and heart rate was 112 beats/minute. In the 12 lead ECG, ST elevation was noted on leads aVR, V1, and V2; however, there was no regional wall motion abnormality noted on a bedside echocardiography. A cardiologist was consulted to rule out ST elevation myocardial infarction (STEMI). Coronary angiography was accordingly contemplated. Before coronary angiography, brain computed tomography (CT) was performed, revealing global hypoxic brain injury.

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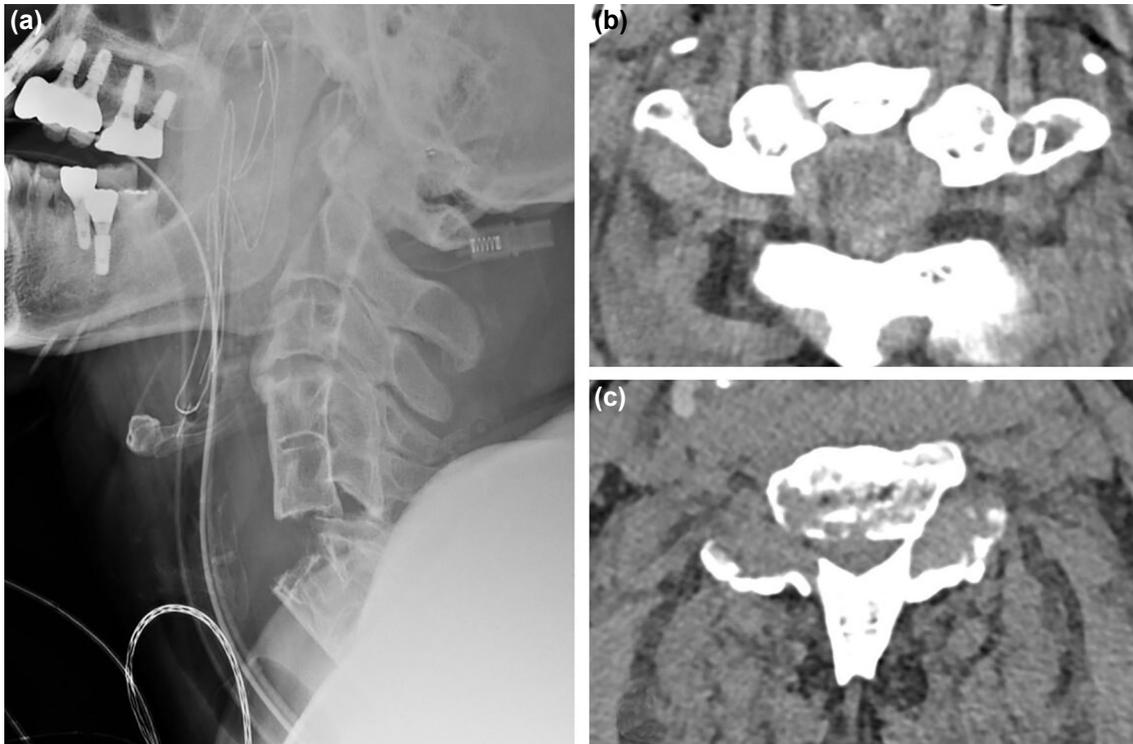
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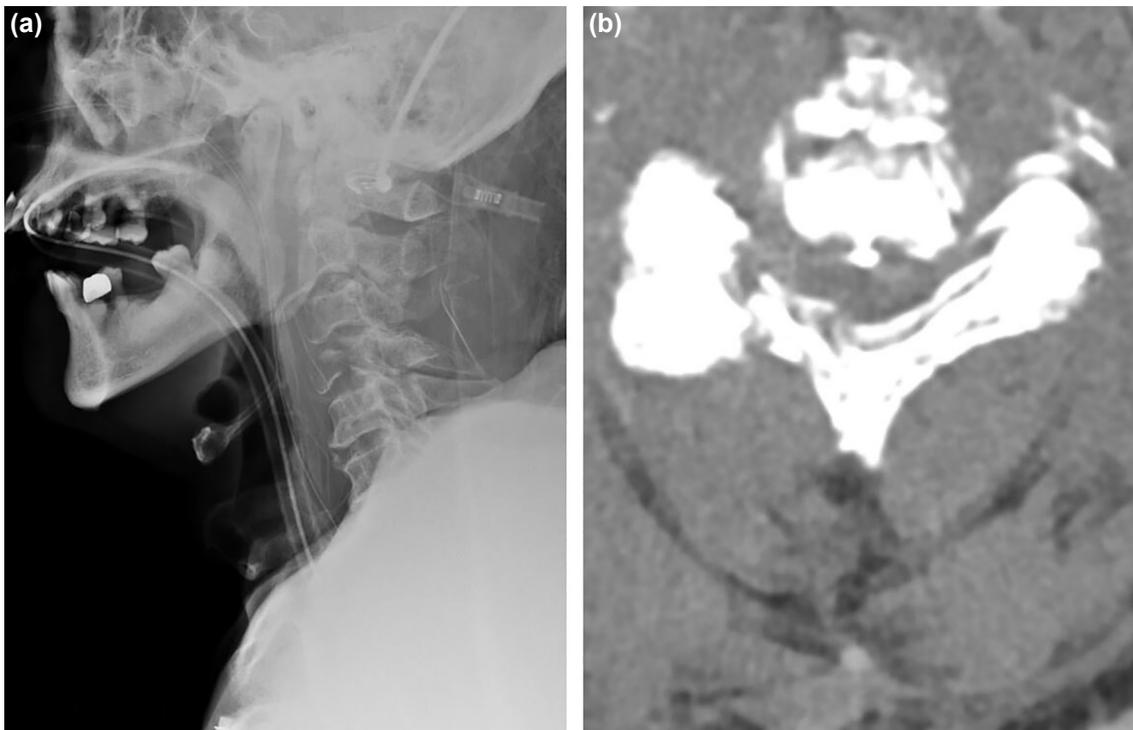


According to his family, the patient had hypertension, diabetes mellitus, and ankylosing spondylitis. A colleague who followed hospital late further stated that he found the patients at the

stairs after a thumping sound. Moreover, the height of the stairs was estimated by 50 cm. Cervical lateral radiography was additionally performed as the trauma cannot be ruled



**Figure 1.** Cervical spine radiography and computed tomography (CT) of the cervical spine. C5-6 fracture-dislocation and syndesmophytosis, consistent with ankylosing spondylitis (a) Cervical spine CT revealed an odontoid process fracture (b) C5-6 fracture-dislocation with central canal compromise (c).



**Figure 2.** Cervical spine radiography and computed tomography (CT) of the cervical spine. C4 vertebral body fracture (a) Cervical spine CT showing burst fracture with retropulsion in C4 vertebral body with spinal canal stenosis (b).

out, and a fracture-dislocation of the C5-C6 spinal segments was visualized (Fig. 1a). On a cervical spine CT, a fracture of the odontoid process, central canal compromise, and prevertebral hematoma were seen at the C2-C6 levels (Fig. 1b and c). We decided not to perform coronary angiography and the patient was admitted to the neurosurgery department for cervical spine fracture management. The patient's family refused targeted temperature management (TTM), and the patient died 15 days after hospitalization.

**Case 2**— A 62-year-old man who had previously been diagnosed with lung cancer collapsed while eating breakfast, with his face down on the table. The patient underwent medical conduction and received BLS en route to ED. After one cycle of CPR in the ED, the patient gained ROSC, after which an ECG revealed atrial fibrillation. Pneumonia was observed on chest radiography. A brain CT revealed no signs of cerebral hemorrhage. CO<sub>2</sub> retention and respiratory acidosis were revealed on arterial blood gas analysis. An elevation of D-dimer levels was also noted, and we performed a chest CT to confirm the presence of pulmonary thromboemboli (PTE). Imaging revealed no evidence of PTE. A diagnosis of cardiac arrest secondary to respiratory failure due to pneumonia and lung cancer was made. The patient's family informed us that the patient's lung cancer had been metastasized to the cervical spine. Subsequent additional cervical spine radiography revealed a burst fracture of the C4 segment (Fig. 2a), and cervical spine CT revealed central canal stenosis (Fig. 2b). TTM was not implemented per the patient's guardian's request. After conservative management, the patient died 12 days after admission.

## DISCUSSION

Approximately 50% of OHCA are unwitnessed, and most patients who undergo unwitnessed cardiac arrest are found on the floor.<sup>[1]</sup> Unless trauma is definitively suspected, most emergency medical services teams perform resuscitation without cervical spine immobilization. Intubation with cervical spinal immobilization causes difficulty in accessing the airway, resulting in a higher incidence of failure to secure the airway;<sup>[2]</sup> thus, immobilization tends to not be performed even after arriving at the hospital or during ACLS, unless the patient is a clear case of trauma.

The National Institute for Health and Clinical Excellence defines dangerous mechanism of injury as one involving a fall from a height of >1 m or five steps of stairs.<sup>[3]</sup> Although there are frequent cases of cardiac arrest due to cervical spinal cord injuries, only a few case reports have been documented in the context of low-impact trauma or even non-traumatic conditions.<sup>[4]</sup>

We reported two cases of OHCA from non-cardiac causes involving cervical spine injury. In these cases, identification of the cervical spine fractures was delayed. In the first case,

ECG after ROSC, showed ST elevation. Cardiac arrest due to STEMI was accordingly diagnosed. However, additional information of patients-ankylosing spondylitis, we determined that ankylosing spondylitis affects the musculoskeletal system and increases the risk of vertebral fracture.<sup>[5]</sup> Thus, additional cervical spine radiography was performed and spinal injury was found. The second case, the patient was found lying face-down on a table while eating. In this case, the magnitude of the impact could not be ascertained. Usually, cervical spine fractures occur with high-energy trauma, such as motor vehicle accidents, violence, or falls.<sup>[6]</sup> Non-traumatic causes of spinal fractures involving spinal lesions are heterogeneous in etiology, such as genetic, metabolic, infectious, ischemic, and rheumatologic diseases, tumors.<sup>[6]</sup> These involve disease entities that can affect the structural integrity of the spinal cord. The patient had lung cancer with spinal metastasis, which typically results fractures and elicits spinal cord injuries.

In OHCA, emergency medical physicians tend to neglect cervical spine injury when the likelihood of trauma is unclear. However, cervical spine injury should be considered in patients with pre-existing cervical spine lesions.

## Conclusion

Most emergency medical physicians perform resuscitation with limited information. These cases urge physicians to consider the possibility of cardiac arrest associated with cervical spinal injuries, with pre-existing cervical spine lesions, and imaging should not be delayed and should be followed by appropriate treatment.

**Informed Consent:** Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

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**Authorship Contributions:** Concept: D.H.L.; Supervision: Y.H.C.; Data: K.K.; Literature search: S.J.B.; Writing: H.C.; Critical revision: Y.H.C.

**Conflict of Interest:** None declared.

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## OLGU SUNUMU - ÖZ

### Sebebi belirsiz travma nedenli servikal omurga yaralanmasına bağlı hastane dışı kardiyak arrest: İki olgunun incelenmesi

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Servikal omurilik yaralanması, travma hastalarında iyi bilinen bir kardiyak arrest nedenidir. Travmadan kesin olarak şüphelenilmedikçe, acil sağlık hizmetleri ekipleri hastane öncesi aşamada servikal immobilizasyon olmadan resüsitasyon gerçekleştirir. İleri kardiyovasküler yaşam desteği (Advanced cardiovascular life support-ACLS) sırasında, servikal immobilizasyon ile entübasyon hava yoluna erişimde zorluğa neden olur, bu nedenle hasta açık bir travma vakası olmadıkça immobilizasyon yapılmaz. Açık bir travma olmadan meydana gelen servikal kırıklar nedeniyle hastane dışı kardiyak arrest (Out-of-hospital cardiac arrest-OHCA) olan iki hastayı sunuyoruz. Bu vakalarda, önceden var olan servikal omurga lezyonları ek olarak bilgilendirildi ve servikal omurga kırıklarının tanımlanması gecikti. Acil tıp doktorları, OHCA ile başvuran bir hastada travma olasılığı belirsiz olduğunda servikal omurga yaralanmasını ihmal etme eğilimindedir. Bu vakalar, doktorları minör travma olgularında bile servikal yaralanma olasılığını düşünmeye sevk edebilir. Servikal spinal yaralanma olasılığı varsa görüntüleme geciktirilmemeli ve ardından uygun tedavi uygulanmalıdır.

**Anahtar sözcükler:** Hastane dışı kardiyak arrest; servikal vertebra; spinal yaralanma.

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