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Original Article

Is emergent cervical radiological evaluation mandatory in isolated cranial gunshot injury?

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Abstract

Aim: The aim of this study was to evaluate the accompanied cervical injuries of the patients presenting to the emergency department (ED) because of penetrating, perforating or tangential cranial gunshot injuries (CGI).

Material and Methods: The retrospective study included 137 patients that presented to the EDs at Mustafa Kemal and Ataturk University due to penetrating, perforating or tangential CGI between 2014 and 2018. Patients younger than 12 years old and had insufficient radiological records were excluded from the study and thus 115 patients were included in the study.

Results: 115 patients included 105 (91%) men and 10 (9%) women with a mean age of 27 (range, 12-65) years. Of the 115 injuries, 84 (73%) were high-velocity and 31 (27%) were low-velocity gunshot injuries. The injuries included 92 (80%) penetrating or perforating and 23 (20%) tangential injuries. No cervical dislocation injury was accompanied by CGI in any patient. Unilateral lamina fracture of the cervical vertebra was observed in one patient.

Conclusion: Our results support the opinion that isolated penetrating, perforating or tangential CGI did not cause to cervical spinal injuries, the intubation or tracheostomy procedures should not be postponed after radiological evaluation of cervical spinal stability.

Keywords: Cranial Gunshot Injury; Cervical Injury; High-Velocity; Penetrating; Perforating; Tangential.

INTRODUCTION

Cranial gunshot injuries (CGI) are highly critical since they are associated with significant morbidity and mortality, although they do not cause surgical emergencies as frequent as closed traumas (1-5). In such injuries, death occurs in almost 90% of patients during emergency ambulance transportation and in 50% patients after reaching the emergency department (ED) (6). CGI are divided into three categories based on the mechanism of injury: (I) penetrating, (II) perforating, and (III) tangential (7,8). In CGI, the most important factor determining the severity of the wound is the velocity of the penetrating projectile; a projectile with a velocity of <300 m/sec is classified as low-velocity, 300-600 m/sec as medium-velocity, and 600-1000 m/sec as high-velocity projectile (9-11).

Cervical spinal injuries coexisting with CGI may result from another gunshot injury to the cervical region or can be a result of flexion, extension, or rotational forces to the cervical spinal cord caused by the CGI (12,13). In addition to, it has been reported that 4% of blunt head trauma is accompanied by cervical spinal injuries (13-15).

The primary step in the management of patients with CGI like all cranial injuries is to keep the airway open and to ensure adequate cerebral oxygenation (16,17). It has been reported that 45% of the patients who were brought to the emergency department due to the CGI were need to urgent intubation without any radiological study. In such cases, postponement of intubation to after cervical radiological evaluation may lead to worsening clinical results because of the prolonged hypoxia. (12,18). Therefore, the aim of this study was to shed light on this controversy by retrospectively evaluating the accompanied cervical injuries of the patients presenting to the ED because of penetrating, perforating or tangential CGI.

MATERIAL and METHODS

The retrospective study included patients that presented to the EDs at Mustafa Kemal University and Ataturk University due to penetrating, perforating or tangential CGI between 2014 and 2018.

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Inclusion criteria:

- Above 12 years of age
- Penetrating, perforating or tangential CGI.

Exclusion criteria:

- Younger than 12 years of age,
- Insufficient radiological records.

RESULTS

The study reviewed 137 patients that presented to the two EDs due to penetrating, perforating or tangential CGI (Figure 1,2).

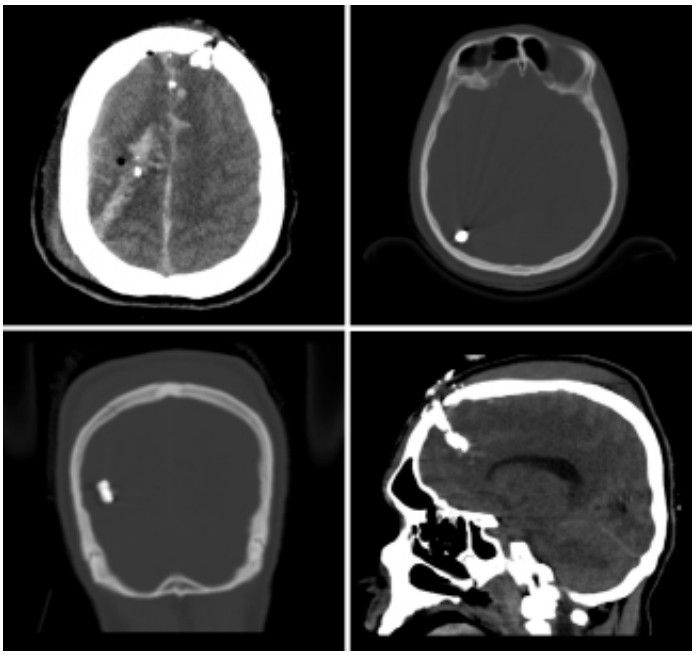

Figure 1. Axial, sagittal and coronal cranial CT images of a patient with high-velocity cranial gunshot injury

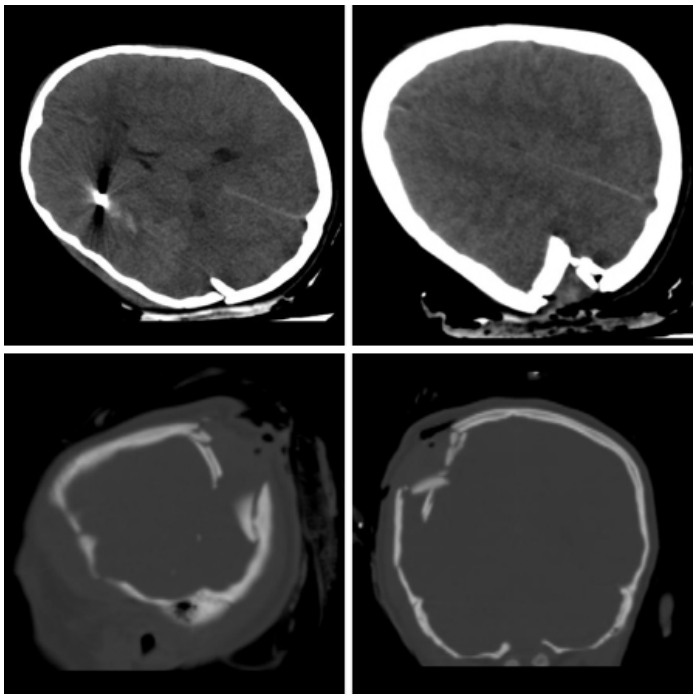

Figure 2. Axial, sagittal and coronal cranial CT images of a patient with high-velocity cranial gunshot injury

Of these, 22 patients were excluded from the study since they were either younger than 12 years or had insufficient radiological records. As a result, 115 patients comprising 105 men (91%) and 10 women (9%) were included in the study, who had a mean age of 27 (range, 12-65) years. The admission Glasgow coma scale (GCS) was 3 in 33 patients (28.7%), between 4 and 7 in 33 patients (28.7%), and between 8 and 15 in 49 patients (42.6%). Fifty-four of the 115 patients (46.9%) died (Table 1).

Table 1. The admission Glasgow Coma Scales (GCS) of the patients'

GCS	3	4-7	8-15
n	33	33	49

Of the 115 injuries, 84 (73%) were high-velocity and 31 (27%) were low-velocity gunshot injuries, 92 (80%) penetrating or perforating and 23 (20%) tangential injuries (Table 2). No cervical dislocation injury was accompanied by CGI in any patient. Unilateral lamina fracture of the cervical vertebra was observed in one patient.

Table 2. The injury types of the patients

Injury Type	Male	Female
High Velocity injury	80	4
Low Velocity injury	25	6

DISCUSSION

Although isolated CGI usually do not lead to cervical instability, previous studies suggest that unless there is a life-threatening airway obstruction, patients presenting with such injuries should be followed up with cervical collar fixation and the intubation or tracheostomy procedures should be postponed until proven that there is no cervical pathology (19). Nevertheless, in cases of CGI, since the highest mortality occurs within the first 3 hours after the trauma, achieving hemodynamic stability and ensuring adequate oxygenation within this period is of paramount importance (20).

Kennedy et al. evaluated 157 patients presenting to ED due to cranial and cervical spinal gunshot injuries and reported that 105 (67%) patients with isolated CGI had no concomitant cervical spinal injury and the remaining 52 (33%) patients had various cervical spinal injuries, among whom 5 (10%) patients had cervical injury only. The authors specifically emphasized that the patients with isolated CGI had no concomitant cervical spinal injury (12). Similarly, Chong et al. conducted a study in 1998 and reported that the 53 patients who presented with CGI had no concomitant cervical injuries (21). Moreover, both of these studies suggested that in such patients there is no consensus regarding the necessity of cervical radiologic evaluation before respiratory and hemodynamic management. Similarly, in our study, no cervical spinal dislocation injury was accompanied to the isolated CGI patients. Unilateral lamina fracture of the cervical vertebra was observed in one patient but this patient admission GCS was 5 and the fracture maybe related with unconscious falling or another trauma.

The patients evaluated by these two studies were injured by only low-velocity projectiles. High-velocity projectiles normally lead to greater impact and may be thought to be more likely to cause accompanying cervical spinal injuries; but our findings indicated that both low- and high-velocity CGI did not cause to any spinal injury in our patients.

On the other hand, Medzon et al. evaluated 81 patients presenting to ED with cranial or cervical spinal gunshot injuries and reported that 19 (23%) patients were present with both cranial and cervical spinal injuries, all of whom had either neurologic deficits or an altered mental status. The authors noted that emergent life-saving airway procedures should not be postponed after radiological evaluation of cervical spinal stability, particularly in conscious patients without the neurological deficit (19). However, it is worth noting that most of the patients presenting to ED due to high-velocity CGI are unconscious during presentation.

Study Limitations

The main limitation of this study is that no MRI scan was performed in our patients and thus no evaluation was performed for the injuries to the cervical soft tissues and ligaments since the patients were in an emergency state during presentation and most of them had intracerebral foreign bodies. Additionally, no neurological examination was performed in the patients with CGI since all of them had varying degrees of clouding of consciousness.

CONCLUSIONS

Isolated CGI rarely cause cervical spinal injuries. Our study support the studies that advocate that in patients with such injuries, if they are in a critical condition, the intubation or tracheostomy procedures should not be postponed after radiological evaluation of cervical spinal stability. Further studies with larger patient series are needed to contribute to the literature.

Competing interests: The authors declare that they have no competing interest.
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