

# Gunshot Injuries Due to Celebratory Gun Shootings

## Kutlama Atışı Yaralanmaları

### ABSTRACT

Traditional shooting with guns often occurs and leads to unwanted gunshot injuries in areas where celebrations are held. Such injuries have been classified as celebratory gun shooting injury in the international disease classification system.

**CASE:** An 8-year-old female patient presented with respiratory arrest. The heartbeats normalized upon cardiopulmonary resuscitation. On physical examination, the only pathological finding was a skin defect measuring 1x1 cm on the midline and located 2 cm in front of the coronal suture. Cranial CT revealed a bone defect of 0.5 cm in the area 2 cm in front of the coronal suture on the midline, tetraventricular and extensive subarachnoid hemorrhage and parenchymal hematoma in the frontal area. It was initially thought to be a gunshot injury; however, on cranial CT, no bullet fragments or bullet exit hole was observed. A cervicothoracic direct graph was obtained and an image that might have been compatible with a bullet core was detected at Th 2-3 vertebra level.

**CONCLUSION:** Although gunshot injuries are generally well-known, this may not be a very familiar topic for neurosurgeons. The primary aim of this report is to emphasize that a bullet round randomly fired into the air ascends in reverse direction to gravity and after reaching a zero point, it returns to the ground at a high velocity that facilitates its penetration into the skull according to a principal physics law.

**KEYWORDS:** Brain death, Celebration shooting, Gunshot injury, Parenchymal hematoma, Ventricular hematoma

### ÖZ

İnsanlar kutlama anlarında sıklıkla havaya ateş etmektedir ve istemeden de olsa yaralanmalara neden olmaktadır. Bu tür ateşli silah yaralanmaları uluslararası hastalık sınıflandırmasına göre kutlama atışı yaralanmaları olarak isimlendirilmektedir.

**OLGU:** 8 yaşında, kız, hasta acil servise solunum arresti olarak getirildi, kardiyopulmoner resusitasyon yapıldı, kalp atımları geri döndü. Fizik muayenede: Orta hatta koronal süturun 2 cm önünde 1x1 cm boyutlarında cilt defekti haricinde patolojik bir bulguya rastlanmadı. Çekilen kranial CT'de orta hatta koronal süturun 2 cm önünde 0,5 cm çapında kemik defekti, frontal bölgede parankimal hematoma ve tetraventriküler hemoraji tespit edildi. Öncelikli olarak ateşli silah yaralanması olabileceği düşünüldü ancak kranial görüntüleme buna neden olabilecek herhangi bir kurşun çekirdeği veya çıkış deliği gözlenemedi. Bunun üzerine çekilen servikotorakal direkt grafide Th 2-3 vertebra seviyesinde kurşun çekirdeği ile uyumlu olabilecek görüntü tespit edildi.

**TARTIŞMA:** Ateşli silah yaralanmalarını çok iyi biliyor olmamıza rağmen kutlama atışı yaralanmaları biz nöroşirürjiyenler tarafından dahi çok az bilinmektedir. Bu yazının yazılma amacı temel bir fizik kuralı uyarınca havaya sıkılan bir merminin yerçekimine zıt yönde yükselip sıfır noktasına ulaştıktan sonra tekrar geri dönerek kafatasını penetre edebilecek kuvvete ulaşabileceği konusunda bilgi vermektir.

**ANAHTAR SÖZCÜKLER:** Ateşli silah yaralanması, Beyin ölümü, Kutlama atışı yaralanmaları, Parankimal hematoma, Ventriküler hematoma

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**INTRODUCTION**

The cranial area is the most commonly involved site in gunshot injuries. The rate of mortality from cranial injury with a gunshot has been reported to be 51%-84% (2, 3, 4). The difference in mortality rate depends largely on the course of the bullet. The most important factor in prognosis is the Glasgow Coma Score (GCS) of the patient at the time of initial evaluation and clinical reflection of brain damage. Other factors that affect the prognosis are the respiratory and circulatory status of the patient upon presentation, the diameter and reactivity of the pupils, and the presence of coagulopathy. The mortality rate among patients with a bihemispheric and transventricular bullet course on CT is high. Intraventricular hemorrhage suggests a poor prognosis. The most important cause of death in gunshot injury is the hernia associated with increased intracranial pressure (1,6,7).

**CASE**

An 8-year-old female patient presented with respiratory arrest. The heartbeats normalized upon cardiopulmonary resuscitation. (Figures 1,2,3)

According to the history obtained from the family, the patient fell from her chair without any known reason while sitting at a wedding party held outdoors, in an open area. On neurological examination, the patient was unconscious. She did

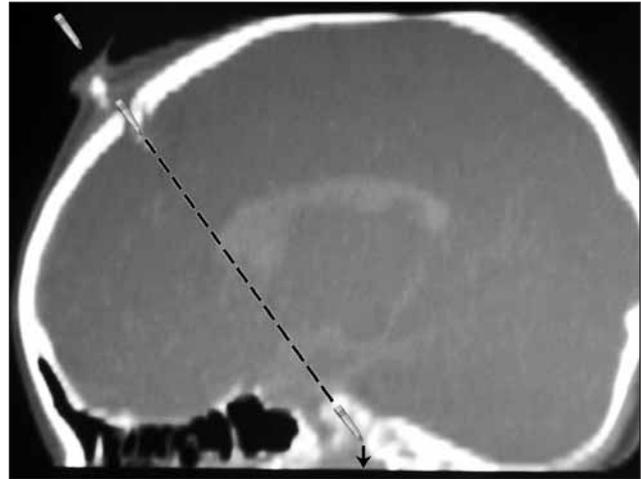


Figure 2. The course of the bullet from entry hole to the foramen magnum.

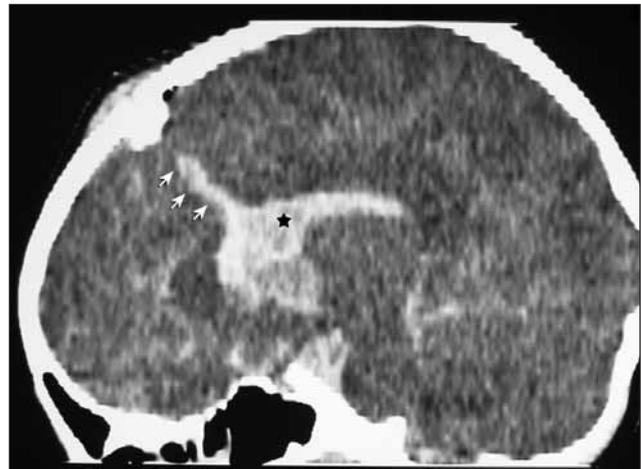


Figure 3. The star shows the ventricular hematoma and the white arrows show the bullet trace; extensive subarachnoid hemorrhage is observed.

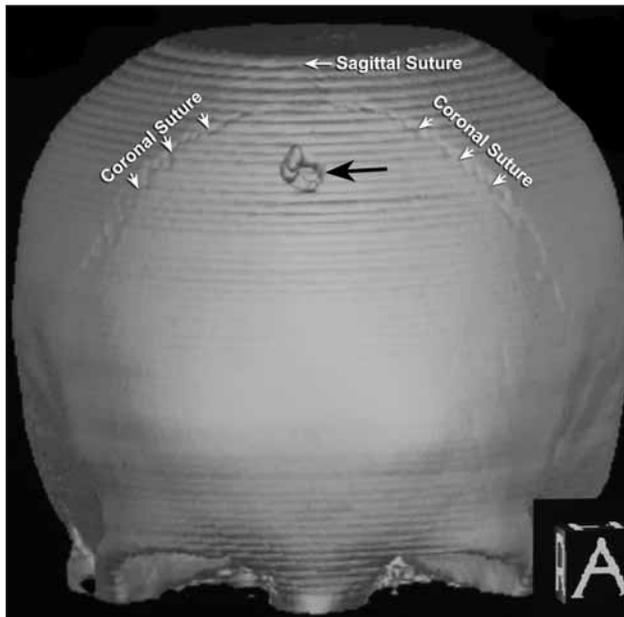


Figure 1. The black arrow shows the penetration hole of the bullet.

not have a motor response to painful stimuli and had fixed dilated pupils. On physical examination, the only pathological finding was a skin defect measuring 1x1 cm on the midline and located 2 cm in front of the coronal suture. Cranial CT revealed a bone defect of 0.5 cm in the area 2 cm in front of the coronal suture on the midline, tetraventricular and extensive subarachnoid hemorrhage and parenchymal hematoma in the frontal area. It was initially thought to be a gunshot injury but no bullet fragments or bullet exit hole was observed on cranial CT. A cervicothoracic direct graph was obtained. An image that might have been compatible with a bullet core was detected at Th 2-3 vertebra level. Cervicothoracic tomography images of the patient were obtained and reconstructed in three

dimensions. The bullet core was observed in the spinal column. Considering the entrance hole and the trace of the bullet within the brain parenchyma, it was assumed that the bullet had entered through the cranium, and after passing the lateral ventricle, had hit the foramen magnum and continued its course into the spinal column. The patient was transferred to the intensive care unit, where general supportive therapy was started. She died 48 hours later due to cardiac arrest.

**DISCUSSION**

Traditional shooting with guns often occurs and leads to unwanted gunshot injuries in areas where celebrations are held. Such injuries have been classified as celebratory gun shooting injury in the international disease classification system (8) During celebrations, a bullet round shot randomly into the air with a firearm ascends and returns to earth, penetrating the ground at a velocity of more than 200ft/sec (5). This occurrence has been explained by parabolic free fall law in physics where a vertical velocity component directed upwards gradually reduces under the effect of gravity, finally becoming zero. Afterwards, the matter returns and ascends freely while at the same time, its vertical velocity component gradually increases. Its velocity at the final height is the same as that of the vertical component of the shot point velocity but in a reverse direction. The velocity of the bullet in descending is high enough to penetrate into the skull and may cause severe brain damage and even mortality. (Figure 4)

Celebratory gunshots are often encountered in big cities and crowded areas. Generally, there are findings suggesting that gunshot injuries were accidental. The determination depends on the differentiation of whether the shooting was performed at close range or long range. (Figure 5)

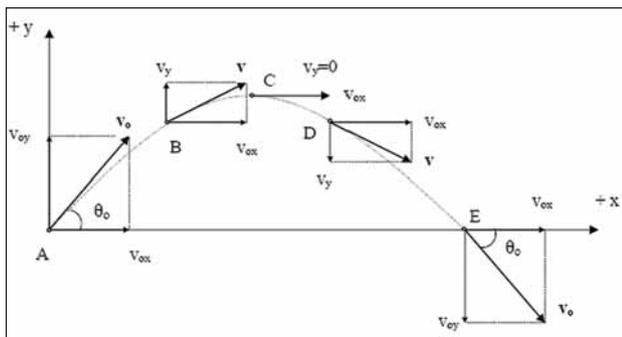


Figure 4. Parabolic free fall law.



Figure 5. The course of the bullet towards thoracic level is seen.

In close-range shooting, in which the barrel of the gun is tightly pressed on the skin, the skin is pushed towards the barrel due to the enlargement caused by gases penetrating under the skin. Thus, a trace similar to the shape of the barrel may form around the penetration hole of the bullet. This is named a stamper trace. In close-range shootings, small burns inflicted by incandescent gunpowder particles and unburned gunpowder particles form a tattoo-like trace around the penetration hole on the skin. This is named tattoo. In adjacent shootings, the exit hole of the bullet is usually smaller than the penetration hole, while in close-range and long-range shootings, the exit hole is larger than the penetration hole. Thus, it is possible to determine whether the gunshot injury was accidental or not considering the range of a particular gunshot in light of this information. The literature lacks reliable and detailed information on celebratory gun shooting injuries. The information compiled in this report is based on legal records and newspaper reports. Celebratory gunshot injury is more common among men. However, it is not a rare occasion among children and women. The injury usually occurs in the head, followed by the feet, shoulders, chest, arms, and legs. Celebratory gunshot injury is an important public health

concern. These kinds of practices may take place during new year celebrations as well as various ceremonies, after football games, or wedding parties. They cause considerable rates of morbidity and mortality. Although , gunshot injuries are generally well known, it may not be a very familiar topic for neurosurgeons and emergency physicians. This primarily aim of this report is to emphasize that a bullet round randomly fired into the air ascends in reverse direction to gravity and after reaching a zero point, it returns to the ground at a high velocity that facilitates its penetration into the skull according to a principal physics law.

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