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Leading Clinical Paper
Trauma

Gun orientation in self-inflicted craniomaxillofacial gunshot wounds: risk factors associated with fatality☆

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Abstract. The purpose of this study was to evaluate whether orientation of a firearm predicts survival, and to identify risk factors associated with fatality in subjects with self-inflicted craniomaxillofacial gunshot wounds. A retrospective cohort study design was used. The primary predictor variable was orientation of the weapon, defined as in the coronal (lateral) or sagittal (anterior–posterior) trajectory pattern. The primary outcome variable was death for subjects on arrival or during their hospital stay. Other covariates measured include demographic, firearm-related, and psychosocial variables. Risk factors for fatality were identified using multivariate logistic regression. Of the 92 subjects that met study inclusion criteria, 47 (67.2) held the firearm in the coronal position. In the full multivariate model, coronal gun orientation (OR = 7.7, 95% CI: 2.0, 30.1, $p = 0.003$) and the absence of a psychiatric diagnosis were associated with an increased risk of fatality (OR = 0.1, 95% CI: 0.04, 0.5, $p = 0.002$). Coronal firearm orientation was associated with an increased risk of fatality following self-inflicted craniomaxillofacial gunshot injuries. A patient with a documented psychiatric disorder was not found to be more likely to succumb to this type of injury.

Keywords: craniocerebral trauma; wounds and injuries; trauma centres; head injuries; penetrating; gunshot; maxillofacial injuries.

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Treatment of gun-shot wounds to the craniomaxillofacial complex (CMF) is one of the most challenging clinical scenarios. There is an abundance of literature regarding the classification of propellants, projectiles and level of energy and their effect on the craniofacial structures.[1,2] Mortality and morbidity have been shown to be increased with involvement of gunshot wounds to the head compared with other anatomic locations.[3,4] In these reports, the head is usually noted as a single anatomic unit, which gives the impression that all wounds to this area are equal. Alternatively, various patterns of facial fractures resulting from blunt trauma have been linked to neurologic mortality.[5] These studies do not reveal which type of penetrating craniofacial injury, if any, is related to mortality.

It has been reported that anterior facial injuries are more likely to be associated with self-inflicted gunshot wounds (SIGWs).[6,7] This observation has been linked to the extent of neck flexion necessary to accommodate a long barreled gun

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if it were placed under the chin.[8] This point has been debated. Some found that subjects who suffered wounds from a long-barreled gun that was fired from a position in the mouth or under the chin were able to survive because that position spared the fatal shot to the neurocranium.[8,9] In a counter argument it was found that the length of the barrel for a typical rifle or shotgun would easily be within the reach of an average adult, particularly for men, who are statistically more likely to attempt suicide in this manner.[9]

Neglected in this discussion is whether or not a self-inflicted wound to the CMF region from a short barreled gun would have any effect on the likelihood of a mortal outcome. Many studies that address this type of injury usually focus on facial injury and ignore SIGW to the head that spare the face. Subsequently, published outcomes may not accurately reflect the full spectrum of injuries to the head, face and neck that a subject can self-inflict with a firearm. The purpose of this study is to evaluate the outcomes of subjects with a SIGW to this region based on orientation of the projectile.

This study was undertaken to answer the following clinical question: 'Among subjects with self-inflicted CMF gunshot wounds, do those who shot themselves in a coronal, compared to those who shot themselves in a sagittal, orientation have an increased risk of fatality?' The authors also wanted to identify risk factors associated with fatality in subjects with self-inflicted CMF gunshot wounds. The investigators hypothesized that: coronal gun orientation was associated with a higher fatality rate than sagittal gun orientation; and there exist one or more variables associated with fatality in those with self-inflicted CMF gunshot wounds. The specific aims were: to estimate and compare the odds of fatality in subjects with coronally and sagittally oriented self-inflicted CMF gunshot wounds; and to identify risk factors associated with fatality in subjects with self-inflicted CMF gunshot wounds.

Materials and methods

The investigators initiated a retrospective cohort study and a sample of subjects was derived from a population of subjects treated by the Oral and Maxillofacial Surgery and Neurosurgery Services at Legacy Emanuel Medical Center (LEMC) in Portland, Oregon between 1999 and 2009. It is important to note that all facial trauma calls are managed by the Oral and Maxillofacial Surgery service and that the departments of otolaryngology and plastic surgery do not take primary trauma calls at LEMC. This hospital is a level 1 trauma centre that serves Oregon, southern Washington, Idaho and northern California but draws most of its patients from the metropolitan Portland area. Institutional

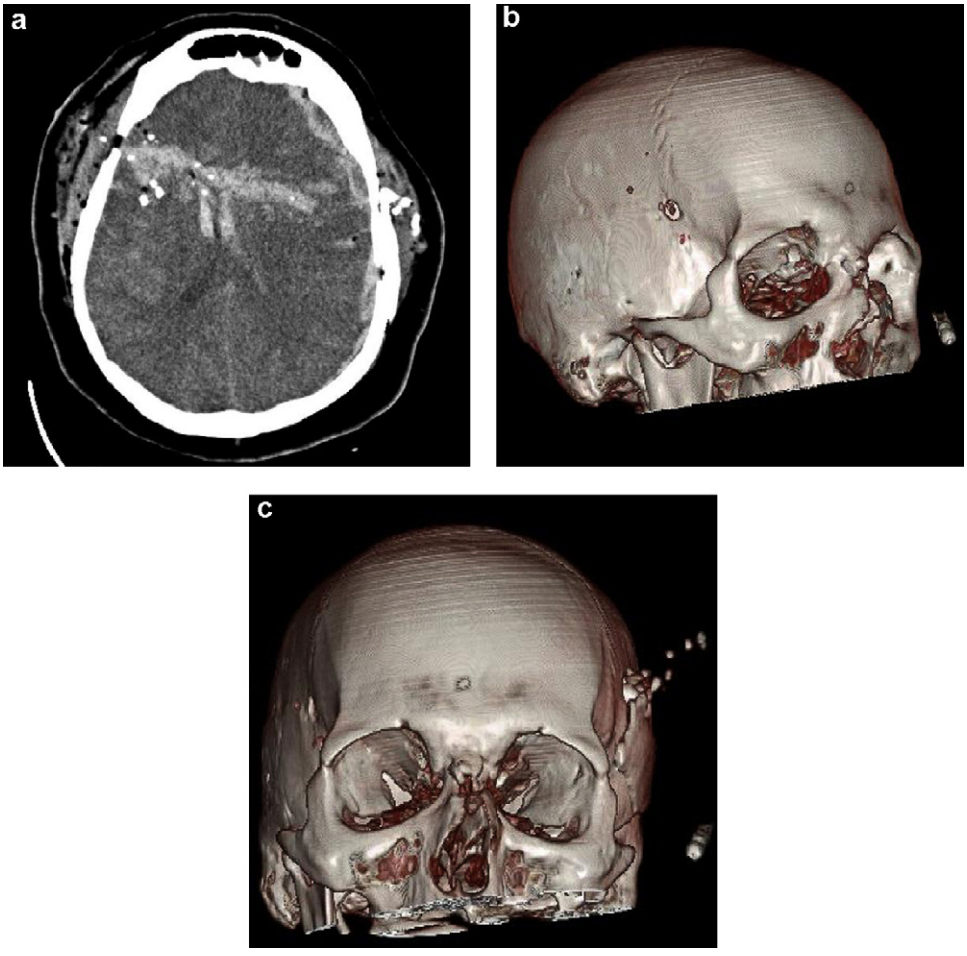

Fig. 1. Computed tomography (CT) image of a coronally oriented gunshot wound showing devastating neurologic injury (A). (B) Three-dimensional (3D) CT rendering of the same patient. (C) 3D reconstruction displaying the left-sided bullet exit wound with sparing of the facial skeleton.

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