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Being a neighbor to Syria: A retrospective analysis of patients brought to our clinic for cranial gunshot wounds in the Syrian civil war

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ABSTRACT

Objective: Toward the end of 2010, the Arab spring, the waves of revolutionary demonstrations and protests influenced also Syria, where violent clashes turned into a civil war. Hundreds of thousands of people became refugees. The use of excessive force unfortunately culminated in numerous deaths and injuries in many cities. Being the closest city to Aleppo, Damascus and Homs, the biggest cities of Syria, Antioch/Hatay has been the city where initial emergency treatments were performed. For this reason, we examined and retrospectively analyzed the medical records of the patients treated in the clinics of our hospital due to cranial gunshot wounds during the war.
Material and methods: The medical records of 186 patients who were injured in the Syrian War and brought to, followed up and treated in the Neurosurgery Clinic of Mustafa Kemal University, Faculty of Medicine in Hatay, a Turkish city on the Syrian border, between April 2011 and June 2013.
Results: A total of 186 patients were evaluated in a period of more than 2 years. Of all 91.4% of the patients were adults (male/female: 152/18) and 8.6% of them were pediatric patients (male/female: 14/2). The average age of the patients was 31 years, with an age range of between 2 months and 67 years. According to Glasgow coma score (GCS) of the patients at the time of admission, GCS was 3 in 32 patients (17.2%), between 4 and 7 in 70 patients (37.6%), and between 8 and 15 in 84 patients (45.1%). We observed that the patients with GCS of 4–7 had a significantly lower mortality among the 56 patients treated surgically compared with the 14 patients treated medically.
Discussion: Cranial gunshot wounds are responsible for high mortality and morbidity. A multiplicity of factors plays a role on morbidity and mortality. These are the duration of transport, the injury pattern, the velocities of the weapons used, and the Glasgow Coma Scales of the patients at the time of admission.
Conclusion: The authors recommend that the patients with cranial gunshot wounds who has GCS of 4–7 should be aggressively treated including surgery as well. We do not recommend surgical treatment for patients with GCS of 3. All our experiences show that treatment of gunshot wounds will continue to be a matter of debate, about which there is more to learn. The data presented in this study will once again demonstrate the seriousness of the event, and will, perhaps, contribute to the peace negotiations to end the war.

1. Introduction

As war injuries do not only affect soldiers but also civilians, it continues to be a common social problem. Since 1945, more than 100 million people were affected and more than 25 million people were killed in military conflicts worldwide. Considerable developments have been recorded as regard the basic principles for the management of gunshot wounds and neurotraumas caused by wars since the beginning of this century. The experiences from the Korea, Vietnam, Israel and Gulf wars have been the basis of treatment management of patients as a result of conflicts in different parts of the world. Cranial gunshot wounds are again a matter of discussion due to high mortality and morbidity rates which still prevail today.

Tissue damages caused by craniocerebral gunshot wounds generally occur in 3 ways: direct effect or crush, shock waves and transient cavitation [1]. The energy that comes out in injuries caused by low-velocity bullets generally causes compression and

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laceration with direct impact on tissues adjacent to the bullet course. In case of injuries caused by high velocity and very high velocity bullets, shock waves and cavitation occur. The damage caused by bone fragments like a second bullet is heavier than the damage caused by the bullet itself [2]. When the bullet hits and enters the tissue, it forms pressure in the site and spreads transient shock waves, causes damage in the distant tissues along the bullet course, and may form temporary neurological deficits which may recover in time. Shock waves are reflected just like the sound waves. When the bullet enters a tissue, the tissue moves both forward and sideways. Hence, a transient cavitation occurs in the site. The volume of this cavitation is correlated with the velocity, mass and shape of the bullet. The cavitation may be approximately 20–30 times wider than the diameter of the bullet. The limited intracranial elasticity increases the injury that occurs in the tissues during the formation of cavitation. The cerebral tissue is squeezed between the tentorium and the falx, and an effect similar to the compartment syndrome occurs. The injury is aggravated with the penetration of bone fragments into the cavitation, but these bone fragments are rather a source infection [3].

Military gunshot wounds involve a higher velocity than civilian injuries (>2500 ft/s). The degree of the primary damage that occurs is related to the velocity and mass of the object ($E = 1/2mV^2$). The amount of energy is the entry velocity and mass of the bullet minus the exit velocity and mass of the bullet divided by 2, i.e. $E = M_1V_1 - M_2V_2$; in this calculation, the configuration, design and composition of the bullet or missile has been ignored. The spin of the bullet is related to kinetic energy [4]. Because cranial gunshot wounds in civilian life are caused by small caliber and low velocity bullets, they do not result in wide scalp destruction. As a result, most surgeons rather prefer the conservative approach in low velocity injuries [5,6].

The fast development in the weapon technology brings together a diversity of mortality rates and injury patterns. There is more to learn about this issue since it is not possible to make a comparison of the information received from regions of conflict. Today, a true consensus has not been reached yet because of different opinions and policies about the treatment algorithm of cranial gunshot wounds, whether civilian or military.

In this study, our objective is to carry out a retrospective analysis of the patients admitted to our hospital for cranial gunshot wounds during the Syrian civil war and to share our experience.

2. Material and methods

2.1. Patient population

The evaluation was carried out on 186 patients who were injured in the Syrian War and brought to, followed up and treated in the Neurosurgery Clinic of Mustafa Kemal University, Faculty of Medicine in Hatay, a Turkish city on the Syrian border, between April 2011 and June 2013.

The physiopathology of the injuries, clinical findings, injury patterns (penetrating, perforating, tangential and superficial) and injury types (blunt trauma, bullet injury, shell fragment injury, mine injury, bomb, missile and blast) were investigated. For all patients, age, gender, Glasgow Coma Score (GCS), time to arrival at the hospital, Glasgow Outcome Score (GOS), CT images, cranial pathologies, postoperative complications, mortality and morbidity rates and surgical methods were evaluated.

2.2. Statistical analysis

SPSS software program version 13.0 was used for statistical analyses. Descriptive statistics were stated as percentage, mean ± SD (standard deviation) and number. Chi-square/Fischer's test was used for comparisons between categorical variables. Significance was accepted if p value was less than 0.05.

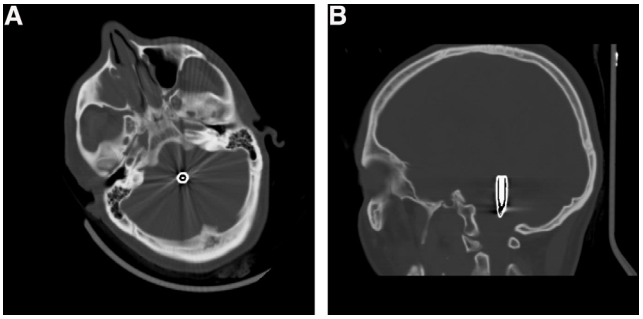

Fig. 1. (a and b) Axial and sagittal CT image showing penetrating injury due to a gunshot wound in a 26-year-old man.

3. Results

A total of 186 patients were evaluated in a period of more than 2 years. Of these, 91.4% were adults (male/female: 152/18) and 8.6% of them were pediatric patients (M/F: 14/2). The age of victims ranged from 2 months to 67 years with an average of 31 years. The pathologies seen in the pediatric group of patients were injuries caused by bombs that exploded nearby. In terms of injury types, 126 patients (67.7%) had shell fragment injuries and 60 patients (32.3%) had suffered from bullet injuries (Fig. 1). In terms of injury patterns, 83 patients (44.6%) showed penetrating injuries, 45 patients (24.1%) had injuries crossing both hemispheres at any plain, 28 patients (15%) had tangential injuries, 12 (6.4%) had perforating injuries, 4 (2.1%) patients had injuries from ricocheting bullets, and 14 (7.%) had superficial injuries (Table 1). According to admission GCS of the patients, GCS was 3 in 32 patients (17.2%), between 4 and 7 in 70 patients (37.6%), and between 8 and 15 in 84 patients (45.1%). In terms of the duration from time from injury up to admission by our center, 22 patients (11.8%) arrived in the first 2 h, 135 patients (72.5%) arrived in between 2 and 24 h, and 29 (15.5%) patients arrived in between 24 h and 5 days. The reason why the arrival of the patients delayed up to 5 days was to wait for a safe time to cross the border.

3.1. Radiological findings

Cranial CTs of all patients were taken, and were classified according to cranial pathologies (Table 1). The cranial pathologies of the patients were more than one when evaluated according to lesion type. For that reason, when surgery was performed on a patient, different lesions were also treated. The lesions shown in Table 1 are not purely a single type of lesion, but a combination of more than one type of lesion. There were intraparenchymal bone fragments in 80 patients (43%), compression fractures in 58 patients (31%), and hemorrhage on the transventricular bullet course in 45 (24%) patients. While these pathologies represented the highest rate, there were also subdural hematoma, epidural hematoma, intraventricular hemorrhage and combination of these lesions in our patients. There was a blast effect in 1 patient, for whom GCS was taken as 7 due to the effect of the bomb which exploded at a very close distance. No pathologic lesions were found in the cranial CT and MRI of this patient. The patient died 24 h later. No intracranial pathology was detected in the autopsy and pathological examination of this case.