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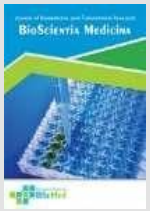

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# A 56-Year-Old Man with an Unusual Projectile Trajectory of Gunshot Wound at Head and Neck Region: A Rare Case Report

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**A B S T R A C T**

**Background:** Gunshot injuries to the neck are linked to a substantial risk of high mortality and morbidity due to the presence of critical vascular and vital structures. However, there are rare instances where a bullet trajectory through the neck region avoids damaging these vital structures. In this context, we report a specific case involving a 56-year-old male who presented to the emergency department with a gunshot wound to the right maxilla through the left anterior neck region. **Case presentation:** During the examination, a hematoma was observed in the left neck without an apparent entrance wound. The occurrence of a bullet injury to the neck without affecting any vital structures is exceptionally uncommon. Effectively managing patients with high-velocity penetrating injuries to the head and neck entails prioritizing tasks such as securing the airway, controlling hemorrhage, and promptly addressing any residual traumatic deformities for optimal outcomes. The presented case involves a gunshot injury to the head and neck, and a comprehensive review of the literature is provided. **Conclusion:** Gunshot injuries to the head and neck are complex and serious, demanding swift and thorough medical attention. The case emphasizes the significance of post-surgery monitoring for potential complications, contributing valuable insights to the ongoing discourse on managing such injuries.

## 1. Introduction

Gunshot wounds can lead to substantial morbidity and mortality, often with immediate consequences. When the head and neck are affected, the impact can be particularly devastating, especially when vital structures are compromised, posing challenging surgical scenarios. These injuries are encountered in both military and civilian contexts.[1,2] The degree of damage incurred is contingent upon various factors, such as the amount of energy transferred, the distance covered by the projectile, the bullet type, and the encountered anatomical structures. Gunshots with high-energy transfer, particularly at close range, result in the most severe damage. Tissue damage is influenced by factors like internal lacerations, tissue compression, and the temporary cavitations occurring along the projectile's trajectory. Secondary injuries may also arise from collisions with bones, propelling bone fragments along distinct paths and causing additional harm.[1–3]

The facial and neck region contains crucial structures within a relatively confined space. Even slight movements caused by a penetrating projectile can result in simultaneous damage to major veins, arteries, and the primary nerve trunk. The primary cause of death in cases of penetrating neck trauma is

often a severe vascular injury leading to uncontrollable hemorrhage. Managing such injuries poses a considerable challenge, particularly when the bullet or its fragments are lodged near vital structures. Many bullets or fragments carry significant contamination, with potentially severe consequences, especially in the presence of associated tissue loss. Tissue damage occurs both directly and as a consequence of the energy dissipated from the inherent kinetic energy transferred to the tissues.[1,4]

Missile injuries are categorized as penetrating (25%), perforating (38%), and avulsing (37%). While some gunshot wounds result in through-and-through injuries, in numerous cases, the bullet enters without leaving a visible exit wound. In such instances, predicting the bullet's trajectory and final location becomes challenging. There could be an uncertain extent of bony damage and associated consequences, posing a potential threat to the patient's airway due to hematoma or edema.[1,5,6]

The optimal timing and approach to treatment remain subjects of debate. Some surgeons argue that, given the nature of the injury, early aggressive primary reconstruction may not be the most suitable option. They prefer an initial conservative management approach, followed by a staged secondary reconstruction to achieve satisfactory functional and aesthetic outcomes. Conversely, there are proponents of early intervention for facial deformities. This involves securing the airway, controlling hemorrhage, identifying additional injuries and preventing further harm, followed by the repair and/or reconstruction of traumatic facial deformities.[1,5] This study was aimed to report a gunshot wound case at the head and neck region.

## 2. Case Presentation

A 56-year-old man was transferred from a regional hospital of Bangkinang to the Emergency Department of Regional Hospital of Arifin Achmad, Pekanbaru, Riau after sustaining a gunshot injury to his face. The patient was riding a motorcycle when suddenly robber appeared from the right side and fired a shot while driving. The injury resulted from bullet fired from a distance of about two meters. The bullet did not penetrate to the opposite body. He reported intense pain on the right side of his face. The bleeding was occurred from the wound. After bystanders applied improvised bleeding-control measures, he was promptly taken to the local regional hospital of Bangkinang. After receiving the first treatments, he was referred to the Arifin Achmad General Hospital for further treatments. The patient arrived to our hospital at two hours later after the incident.

A primary survey was clear. He remained fully conscious and hemodynamically stable. A notable two centimeters laceration was observed at the right maxilla area with swollen, pain, difficulty of opening his mouth and chewing. He also felt shortness of breath that was felt gradually and accompanied by swelling (Figure 1). At his left neck was palpable solid mass without laceration or excoriated wound. There was no active bleeding or subcutaneous emphysema. He did not experience of weakness of limbs, seizures, bleeding or discharge from the nose and ears. There was no other injury at the body parts.

A cervical X-ray was conducted, revealing the presence of narrowing of the trachea with surrounded by soft tissue swelling. A bullet was identified at the left side of the neck about 2,5 mm from the skin (figure 2). A non-contrast CT scan of head and neck were conducted, revealing the presence of a comminuted maxilla and zygoma fractures (Figure 3). A bullet was located at the left side of 3rd cervical vertebrae.

We give ceftriaxone 2 gr, antitetanic and analgetic to the patient. During observation, the patient presented a stridor. We planned to perform emergency operation for tracheostomy, bullet evacuation and maxillofacial reconstruction. Surgical informed consent was obtained for a procedure conducted under general anesthesia. Tracheostomy was conducted first for securing the airway and continued with bullet exploration. Transvers incision was conducted at two centimeters below left mandible. Obtained the single bullet. The last, maxillofacial reconstruction were conducted by transvers incision

below right orbital. Obtained comminuted fracture of zygoma and maxilla bones. Fixation, used mini plate and screw, was conducted to stabilize the bone in its proper position and ensure sufficient occlusion. Following the surgical procedure, the patient remained hospitalized for a duration of 10 days to oversee appropriate wound dressing and monitor the progression of wound healing. The patient was discharged and periodic review appointment was organized on a weekly basis at the head and neck clinic.

Figure 1. Clinical presentations of the patient. Red arrows: entrance wound of bullet. Yellow arrow: swelling at the right neck.

Figure 2. Cervical X-ray.

Figure 3. Head CT scan with facial bone 3D.

Figure 4. Intra-operative pictures of tracheostomy, bullet removal and maxillofacial reconstruction.

## 3. Discussion

The extent of damage is intricately linked to the energy generated by the mass and impact velocity of the projectile, encapsulated by a formula denoted as kinetic energy (KE), with a notable emphasis on velocity over mass.

$$KE = \frac{1}{2} \text{ mass} \times \text{velocity}^2$$

In such instances, the objective is to offer fundamental vital assistance, stabilize the patient, and reinstate both continuity and functionality while addressing facial aesthetics.[4,7]

There is no standardized consensus for categorizing these projectiles based on velocity. In U.S. literature, high speed is defined within the range of 610-914 m/s, while the United Kingdom designates anything exceeding 335 m/s as high speed. Sherman and Parrish adopt a classification system, categorizing velocities as lesser than 330 m/s (minor), between 330-600 m/s (medium), and in excess of 600 m/s (major).[4,8,9]

Demetriades et al., in their study, advocate for the examination of dissecting hematomas or hematomas obstructing the airway even in cases of minor injuries. They highlight that up to 35% of individuals injured by firearms may necessitate initial airway stabilization. In our case, the patient was experience of hematoma at the left neck that compressed the trachea become narrowing. We conducted a tracheostomy for secure the airway patency.[4,10,11]

Manson employs a four-component assessment, considering soft tissue damage, bone alteration, soft tissue loss, and bone loss. The wound undergoes cleansing with a physiological solution, encompassing the removal of contaminant material, necrotic tissue, and foreign bodies. Majority of gunshot injury at the head and neck were identified the projectile's entry and exit wounds, along with the lesions incurred during its trajectory. In instances where entry wound without exit wound were like our case, we determine regarding the potential space or tissue where the projectile might be lodged. We also obtained, a swelling at the left neck without exit wound. So, we conducted a cervical X-ray and complemented by computerized tomography with 3-D reconstruction.[11–13]

Preceding World War II, a policy of watchful waiting was the established medical approach for stable patients with gunshot wounds to the neck, resulting in a mortality rate of approximately 15%. However, during World War II, the shift to mandatory exploration for all penetrating neck wounds contributed to reduced mortalities but resulted in a high incidence of negative explorations, reaching around 60%. Presently, the majority of experts endorse a strategy of selective exploration, resulting in a decline in negative explorations, reduced medical costs, and no concurrent increase in morbidity or mortality.[14–16]

In developing a protocol for treating gunshot wounds to the head and neck, it's crucial to take into

account the principles of wound ballistics. Wounds caused by high-velocity missiles should be explored surgically, involving thorough cleaning and examination of all nearby structures affected by the missile's trajectory. It's essential to consider the specific zone of the neck that is injured. For clinically stable patients with a gunshot wound in zone II, regular examinations are highly effective in detecting any potential complications. Additionally, if there are indications of hemodynamic instability or clear indicators, commonly known as 'hard signs,' of injury to crucial neck structures, surgical exploration is recommended. In our case, the gunshot patient was considered at the zone II and III with high velocity bullet and there was appear stridor as hard sign. So, we conducted an exploration the wound (Figure 5).[17–20]

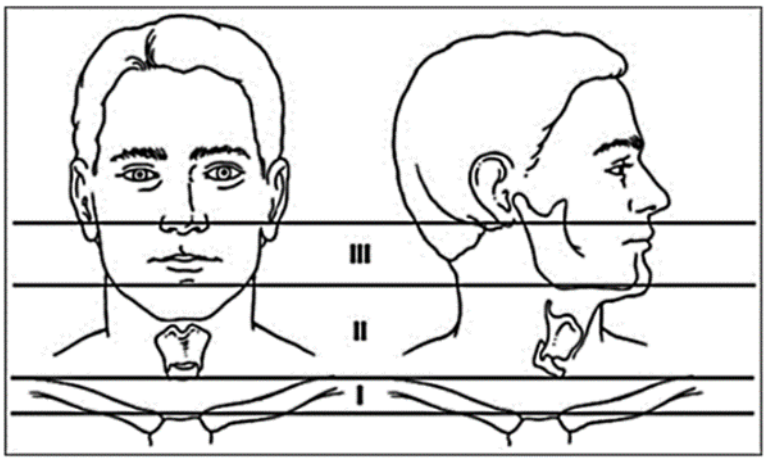


Figure 5. Anatomical zone of neck.[21]

Patient post-operation should be carefully monitored. Effective post-operative management is vital considering the intricacy of the surgical procedure and substantial tissue manipulation. There exists a risk of significant edema formation, which could lead to wound dehiscence and subsequent infections despite antibiotic coverage.[20] We monitored the patient in ICU room for two day and then continued at ward. Diligent supervision during the initial two weeks post-surgery is crucial. During his progress in the inpatient ward, the patient experienced significant improvement. Therefore, he was discharged to the outpatient clinic for further evaluation.

## 4. Conclusion

Gunshot injuries to the head and neck are complex and serious, demanding swift and thorough medical attention. The case of a 56-year-old man illustrates the need for immediate surgical intervention to address airway issues, remove the bullet, and reconstruct facial damage. The optimal treatment approach remains debated. The case emphasizes the significance of post-surgery monitoring for potential complications, contributing valuable insights to the ongoing discourse on managing such injuries.

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