Penetrating neck trauma

Epidemiology

Penetrating neck injuries are variable with respect to the occurrence of injury (GSWs 50%, stab wounds 10%–20%). As with torso trauma, the approach to penetrating trauma of the neck is based on regional anatomy.

The modern division of the anterior neck comprises 3 zones:

zone 3 above the angle of the mandible

zone 2 between the angle of the jaw and the cricothyroid membrane

zone 1 between the cricothyroid membrane and the clavices/manubrium

Anatomical structures involved

Zone 1

Great vessels Esophagus Trachea Phrenic nerve Vagus nerve

Zone 2

Carotid and vertebral arteries Esophagus Airway

Zone 3

Base of skull Carotid and vertebral arteries Oropharynx

Penetrating injuries to zones 1 and 3 parlay notorious difficulty in obtaining emergent surgical access and therefore require an urgent CT screening examination to rule out injury in the presence of any abnormality detected on physical examination or chest radiograph.

In cases of penetrating injury occurring in zones I and III of the neck, the direct control of blood vessels is difficult. The intrathoracic or extracorporeal presence of hemorrhage may lead to fatal injuries. Accordingly, unlike the situation in zone II of the neck, where the proximal and distal control of blood vessels can be easily achieved, angiography should be performed in cases of penetrating injury occurring in zones I and III [1)].

The increased incidence of penetrating neck injury is a reflection of more interpersonal violence rather than a consequence of the larger South East London trauma centre catchment area. Tackling this problem requires focus on wider issues of community prevention. Sharing of data between the four London trauma centres and the police is needed to help prevent interpersonal violence and develop a universal treatment algorithm for other institutions to follow [2)].

Penetrating neck injuries are commonly related to stab wounds and gunshot wounds in the United

States.

Classification

The injuries are classified by penetration site in terms of the three anatomical zones of the neck. Based on this zonal classification system, penetrating injuries to the head and neck have traditionally been evaluated by conventional angiography and/or surgical exploration. Multidetector-row computed tomography (CT) angiography has significantly improved detectability of vascular injuries and extravascular injuries in the setting of penetrating injuries. CT angiography is a fast and minimally invasive imaging modality to evaluate penetrating injuries of the head and neck for stable patients. The spectrum of penetrating neck injuries includes vascular injury (extravasation, pseudoaneurysm, dissection, occlusion, and arteriovenous fistula), aerodigestive injury (esophageal and tracheal injuries), salivary gland injury, neurologic injury (spinal canal and cerebral injuries), and osseous injury, all of which can be evaluated using CT angiography. Familiarity with the complications and imaging characteristics of penetrating injuries of the head and neck is essential for accurate diagnosis and optimal treatment [3].

Penetrating intracranial injury and penetrating neck trauma could cause significant mortality because of many important structures located in the brain and neck. Although high-velocity penetrating brain injury is often reported, reports of low-velocity, combined head and neck penetrating injury are rare [4].

Diagnosis

Vascular injury in particular can be studied with CT angiography, percutaneous angiography or duplex ultrasonography [5].

Complications

Clinically significant cervical spine injury caused as a result of penetrating trauma are rare. If a patient arrives with an intact neurologic examination despite GSW or stab wounds to the neck, the incidence of a cervical spine injury that requires a therapeutic intervention is minute. As a result, in a neurologically intact and examinable patient, a cervical collar should be immediately removed to facilitate the remaining components of the diagnostic evaluation [6].

A penetrating trauma occurring in the neck can cause severe complications such as hemorrhage as the result of vascular injury, spinal cord injury, respiratory obstruction, and sepsis from esophageal injury. Prompt diagnosis and treatment is essential [7] [8] [9] [10] [11]. [12].

Penetrating neck injuries (PNI) can result in simultaneous lesions in the aerodigestive and respiratory tracts, vertebral column and calvarium, blood vessels and lymphatic ducts.

Treatment

For several years, especially due to the military experience in the World War II, penetrating neck injuries were treated with exploratory surgery and this was recognized as the optimal management [13] [14].

Improvements in imaging technology, particularly computed tomographic angiography (CTA), have altered the management of patients with penetrating neck trauma. Although some centers still advocate routine exploration for all zone 2 neck injuries penetrating the platysma, many civilian centers in the United States have adopted a policy of selective exploration based on clinical and radiographic examination.

In patients without hard signs of vascular trauma and a normal CT/CTA of the neck, there is no evidence to support mandatory surgical neck explorations or further immediate diagnostic studies to exclude cervical vascular injury [15)]

Because of fatal complications associated with penetrating neck trauma, Mahmoodie et al recommend early neck exploration in unstable cases or when injuries are deeper than the platysma [16)].

Carotid artery repair is the method of choice in carotid artery injury. Temporary shunts (TS) use does not result in a decreased mortality rate or neurologic deficit reduction in patients with severe injuries [17)].

Case series

2012

A retrospective, descriptive, analytical study, penetrating neck trauma cases admitted to Alzahra Hospital between April 2000 and April 2010 were analyzed for epidemiology, mechanism of trauma, zone of trauma, therapeutic method, injuries to other organs, complications, and mortality.

Among 192 penetrating neck injuries, the mean age at the time of injury was 25.08 ± 15.02 years. Of these cases, 96.4% occurred in men. The most common mechanisms of trauma was stab wounds (85.93%). In 56.3% of penetrating neck injuries, zone 2 was involved. Neck exploration was positive in 84.4% of cases, and 52.1% of patients underwent surgery. Vascular exploration was the most common cause of surgery (67.2% of patients). The most common surgical intervention was vein ligation (50.8% of cases). In 11.98% of cases, another organ injury occurred simultaneously, and chest injury was the most common coexisting problem (65.2%). Complications were reported in 9.3% of patients, and the need for intubation was the most common complication (5.2% of patients). Mortality rate was 1.5%.

According to the findings of this study, the most common cause of penetrating neck injuries was stab wounds, and the majority of patients were young men, therefore, preventive measures should be implemented. Because of fatal complications associated with neck injuries, we recommend early neck exploration in unstable cases or when injuries are deeper than the platysma [18)].

2011

The medical registries of 39 patients were analyzed retrospectively from 2001 to 2009. Penetrating wounds were defined as injuries that penetrated beyond the platysma muscle. Age, gender, etiology, wound site, injured structures, treatment, and outcome were analyzed. Fisher's exact test was adopted to establish the link between these variables and the outcome (discharge or death).

Of 39 patients, 33 (84.62%) were men with a mean age of 28 years. The main cause was firearm projectiles - 19 (48.72%) cases; the most frequently affected zone was zone II - 29 (74.36%). Thirteen (33.3%) cases of hemodynamic instability were observed, and the average hospital stay was 14 (1-99) days. The main indication for surgical intervention was the presence of profuse hemorrhage, in eight (20.5%) cases. The main structures affected were the cervical veins (20.5%). There were eight (20.51%) deaths. Younger patients had a better prognosis.

The mortality rate was 20.51%. Patients below age 26 years had a better prognosis [19].

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