JMS 2023; Vol 6(3):135-139
UDC:617.53-001-073.75
https://doi.org/10.55302/JMS2363135j

TRAUMATIC NECK INJURIES IDENTIFIED BY CONVENTIONAL X-RAY IMAGING-AN AUTOPSY CASE REPORT

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Abstract

Traumatic injuries of the neck in violent death cases are not so common finding in autopsy examination such as traumatic head injuries that may have caused or contributed to death. Nevertheless, forensic examination of the neck structures must be done thoroughly as well as examination of other parts of the body, especially when there is a particular indication for suspected serious injury in the neck region such as fractures of the cervical vertebrae or dislocations due to ligamentous separation. External inspection of the neck is quite simple in comparison to internal examination.

Even after anterior and posterior preparation of the soft tissue layers of the neck region, all parts of the upper cervical vertebrae are not easily accessible for examination. In such cases, a radiographic examination is indicated for displaying and localizing possible dislocations or fractures of the neck.

In this paper we present an autopsy case where upper cervical vertebrae fractures detected by post mortem X-ray imaging were the clue for solving the cause and manner of death. An accurate forensic approach of the case is necessary since it has medico-legal importance in aspect of gathering all possible evidence to verify the injuries that may caused, or contributed to, death.

***Key words**:* post mortem examination, upper cervical vertebrae fractures, X-ray imaging.

Introduction

An autopsy cases where traumatic head injuries cause or contribute to death outcome represent a significant proportion in accidents or intentional assault cases. Based on the mechanisms that produce these injuries, they can be grouped in two broad categories: impact injuries and acceleration and deceleration injuries [1].

Impact injuries are described as the result of the impact of the object on the head. They produce local external injurieson the skin layer such as lacerations, abrasions and contusions, than fractures of the skull, contusions of the brain, epidural hematomas and intracranial hemorrhages.

Acceleration and deceleration injuries which are result of sudden movement of the head lead to changes of intracranial pressure gradients subjecting the brain to both shearing and tensile forces typically producing injuries subdural hematomas and diffuse axonal injury, but also can cause injuries of the osseos and ligamentous system. Isolated injuries of the neck structures are not an exception in accidents or other violent death cases, but more often injuries of the neck are combined with injuries of the head or other organ systems.

The cervical vertebrae can be divided into the upper, C1-C2 and the lower C3-C7, vertebrae.

The occiput and the upper vertebrae form a function unit bound together by ligaments. Between the occiput and C1 and between C1 and C2 there is no intervertebral disc. The vertebral arteries pass through the foramina of the transverse processes from the C6 to C1 and can be injured while lateral fractures of the vertebrae.

Injuries of the upper and lower cervical vertebrae can be of different severity. Most severe forms of each type of injury are of interest to the forensic pathologist. Atlanto-occipital (occipitocervical) dislocation [2] due to craniocervical ligamentous separation, than unstable fracture of the atlas (C1) or

fracture of the dens of the axis (C2) can be associated to death. The most common mechanism of traumatic atlanto-occipital dislocationis sudden deceleration after high energy-trauma such as in motor vehicle accidents, pedestrian versus automobile accidents or falls from a height [3] High energy trauma produces hyperextension of the atlanto-occipital joint [4,5] leading to severe injury of the bone and ligamentous structures that stabilizes the skull base to the spine cord, often with concurrent injuries of the head, spinal cord or other organ systems [6]. The mechanism of anterior arch injury of the C1 is usually due to hyperextension and may vary in severity while posterior arch fractures are caused by hyperextension together with axial loading[7]. Fractures of the dens of C2 may be caused from the falls on the head. The most common mechanism is axial loading with extension or flexion.

During the autopsy of the corpse by using standard autopsy procedures, injuries of this region, especially fractures of the upper cervical vertebrae are quite difficult to be completely examined because of their localization. Thorough examination of the upper cervical vertebrae is of great importance because severe injuries can be the cause of death. Also, injuries of different parts of these vertebrae and surrounding structures can indicate the mechanism of acquiring injuries. This can be of medico-legal importance in aspect of gathering all possible evidence about the case. In order to detect all possible injuries additional methods such as postmortem X-ray imaging for displaying and localizing possible dislocations or fractures of the neck should be used [8].

Here, we present an autopsy case where the upper cervical vertebrae fractures detected by post mortem X-ray imaging were the clue for solving the cause and manner of death. An accurate forensic approach of the case is necessary with using complementary analysis methods determined by the case itself.

Case presentation

A deceased 69 years old man was brought to the Institute of Forensic medicine with the order from a Prosecutor for post-mortem examination of the body. The story about the case which we got from the authorities was that the man died in the yard of the house of his wife's brother where he was as a guest, soon after he went out from the house. The man was found dead in the yard by the brother of his wife, five to ten minutes after he left house. The deceased man was immediately prepared for the funeral by his wife who thought that he died from a heart attack. When the doctor who inspected the body in the chapel noticed that there was a bleeding injury on the head of the deceased, the case became a subject of medico-legal investigation.

During the post-mortem examination of the body, few injuries were found on the extremities such as contusion on the distal part of the palmar side of the right forearm, then few reddish-brown abrasions on the back of the right hand surrounded by small blue color bruises, one abrasion above the thumb on the left hand with already formed dark brown scrub and a scratch or linear reddish abrasion on the right knee. The skin on the right knee around the scratch was superficially abraded, pale, with many pale pinkish superficial abrasions.

One small abrasion was found in the middle part on the skin of the upper lip. On the head in the middle part between the forehead and the parietal region there was an abrasion with linear longitudinally placed superficial laceration of the skin.

On the vertex of the head, in the same line with the previous injury, there was a horizontally placed, deep laceration with abraded, contused and slightly ragged margins. The laceration was deep almost to the bone surface with many bridges of tissue in the depth running from side to side. Underneath bone of the skull was intact.

After internal examination of the body there wasn't any brain injuries or injuries of any other organ system except small intercostal bruises between third and fourth rib on the left side of the chest. What took our attention was the bruise (hemorrhage) in the space between foramen of the skull base and C1noticed after dissection of the dura. With inspection of this region, we suspected atlanto-occipital dislocation (figure1). After examining of the frontal side of the cervical vertebrae, there was a hemorrhage on the anterior side of the upper cervical vertebrae (figure2).

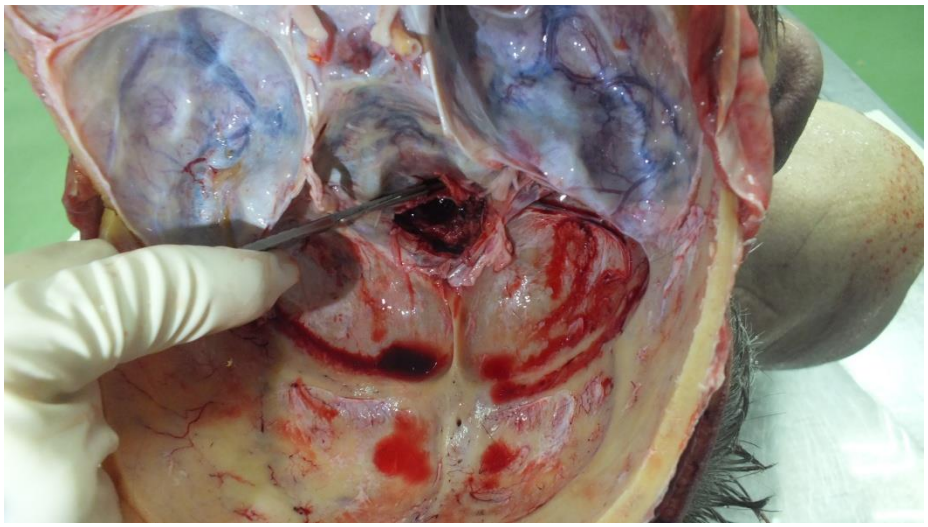

Figure 1. A hemorrhage in the space between the base of the skull and spinal cord, visible after dissection of the dura

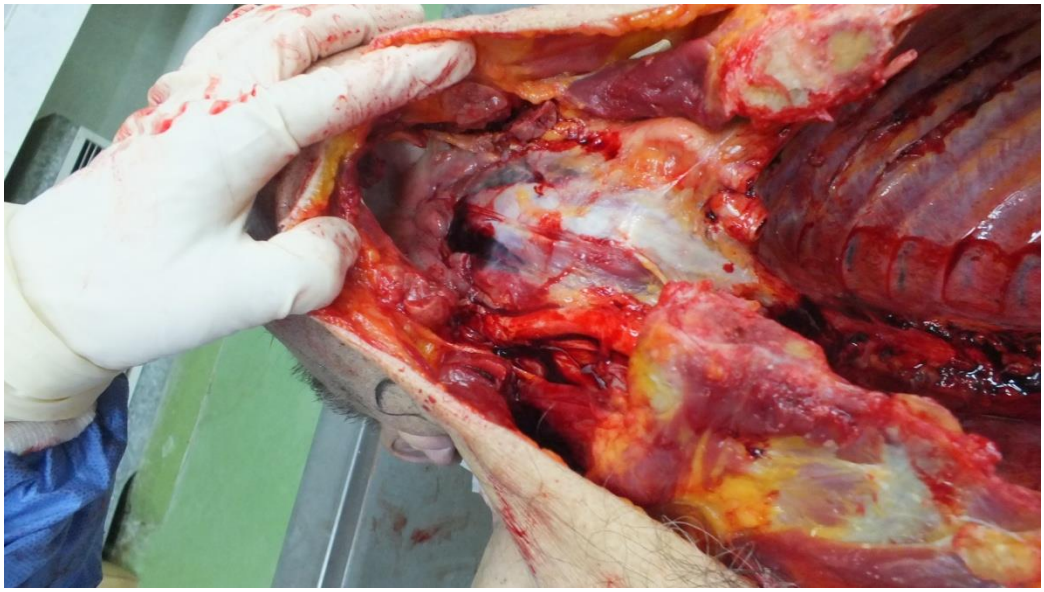

Figure 2. A hemorrhage on the anterior part of the upper cervical vertebrae

After this finding the neck was further examined with complementary postmortem X-ray analysis. Fractures of the C1 with atlanto-occipital dislocation and fracture of the odontoid structure of the C2 were detected (figure 3).

Figure 3. Profile X-ray image of the skull base and cervical spine showing fracture of the posterior arch of the C1 and fracture of the dens of C2

After an autopsy examination and post mortem X-ray analysis it was obvious that the manner of death is violent. The cause of death was lesion of the upper cervical spine and adjacent medulla oblongata. Toxicological analysis of the blood of the deceased showed an alcohol intoxication.

Discussion

Post-mortem examination using standard or specific autopsy procedures provides evidences that verify the injuries that may caused, or contributed to, death. Morphological changes of the body of the deceased including injuries of the body can be easily determined, so in most cases the autopsy finding is sufficient for establishing the correct cause and manner of death and to explain the mechanism of death. Some findings are directly evident during the autopsy, but some details cannot be apparent until further investigations are conducted. Except standard laboratory analysis such as toxicological, histological and criminalistic examinations, in some cases, post mortem imaging findings is also of great importance for medico-legal reconstruction [9].

X-ray analysis is often used to visualize the presence of foreign body in gunshot wounds, it is also useful for age determination [10-12], for analysis of highly putrefied and charred bodies, in analysis of infant corpses and unidentified bodies, as well as for evaluation of the osseous system in cases of trauma such as the case we presented in this paper.

Fractured upper vertebrae with found dislocation led to immediate death. Other autopsy findings corresponded to immediate death. The manner of death in this case is violent. By determining the exact location of the fractures of the upper cervical vertebrae in correlation to determined external injuries of the body it becomes possible to reconstruct the mechanism of acquiring injuries which further deconvolute the case with more precise categorization toward accident or homicide.

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