Isolated brainstem edema in a pediatric patient with head trauma: a case report

K. BASARSLAN, F. BASARSLAN, A. KARAKUS, C. YILMAZ

Department of Neurosurgery, Department of Pediatrics, Department of Emergency Medicine, Department of Pediatric Neurology; Faculty of Medicine, Mustafa Kemal University, Hatay, Turkey

Abstract. – Brain stem is the most vital part of our body and is a transitional region of the brain that connects the cerebrum with the spinal cord. Though, being small in size, it is full of indispensable functions such as the breathing, heart beat. Injury to the brain stem has similar effects as a brain injury, but it is more fatal. Use of the Glasgow Coma Score as a prognostic indicator of outcome in patients with head injuries is widely accepted in clinical practice. Traumatic brain stem edema in children is rare, but is associated with poor outcome. The question is that whether it is being aware of computerized tomography appearance of the posterior fossa when initial evaluating pediatric patients with head trauma at emergency clinics. Normal and edematous brain stem without an additional pathology are slightly different and not distinguished easily. On the other hand, brain stem edema should be promptly identified and appropriately treated in a short time.

Key Words: Brainstem, Edema, Trauma.

Introduction

The lower part of the human brain that connects the brain to the spinal cord is defined as the brainstem. Though, being small in size it is full of totally indispensable vital functions such as the breathing, heart beat. The structure will be hosted by a narrow and very mobile area, which is referred to craniocervical junction. This articulation is a very mobile transitional region of the cranium. It both provides the movement of the head and carries its weight. Therefore, it is highly susceptible to injury.

A variety of conditions are known to cause brain stem edema such as trauma or cancer. The prevalence of traumatic brain stem injury varied 8.8% to 52%. It is a life-threatening situation because it raises the pressure inside the skull. This gradually impairs the brain stem perfusion, which is necessary for the brain stem that is very delicate to hypoxia. So it should be promptly identified and appropriately treated.

The finding of the most common computerized tomography (CT) in head injury is bilateral diffuse cerebral edema. Almost all parts of the brain are usually injured by a severe trauma, but in very rare cases, only the brain stem may be affected. The case, whose brain edema is prominent in the brainstem, is difficult either to diagnose or to treat. Because ventricles and hemispheres may be evaluated well enough, but the brain stem at lower sections can be easily overlooked on CT scan. This leads to the missing of the period just in this time can be contributed for the treatment. We aimed to present here a case which is required not only a knowledge but also being prepared and quick in treatment and to discuss the situation.

Case Report

Six years old, a boy was followed up at an outside center due to linear fracture and pneumocephalus after falling a television on his head. He was referred to the Hospital because of deterioration of the neurological status. On initial neurological examination, he was unconscious, localizing to pain, opening eyes in response to pain with inappropriate words. Glasgow Coma Score (GCS) was considered as 10 point. On the CT scanning, there was nearly intact supratentorial structures with no brain hemorrhage, but was a marked edema in the brain stem at lower sections infratentorially (Figures 1, 2). He was bound the mechanic ventilation and deeply slept. Although aggressive anti-edema treatment was started immediately, he was died of sudden cardiac arrest a day after the induction of anesthesia.

Corresponding Author: Kagan Basarslan, MD; e-mail: kaganbasarslan@hotmail.com
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Figure 1. A-B, This axial CT image of the brain through certain levels of the brain supratentorially show no difference compared with a normal patient appearance. C-D, But levels of infratentorial reveal a marked hypodensity in the brain stem with edema. The appearance of upper brain stem and 4. Venticle on axial plans like a kite shape are not detected easily due to excessive brain edema, compared with a normal patient with same age.

Discussion

The brain stem is located on a region that connects the cerebrum with the spinal cord. It anatomically consists of midbrain, medulla oblongata and pons. Motor and sensory neurons travel through the brain stem allowing for the relay of signals between the brain and the spinal cord. The brain stem coordinates autonomic nervous system that controls involuntary muscles, such as smooth and cardiac muscle. In this way, it controls life supporting autonomic functions such as the breathing and heart beat. In case of the pressure on brainstem, sudden the cardiac or respiratory arrest develops.

A variety of conditions are known to cause brain stem edema, including trauma, infections, stroke, tumors, certain toxic substances and chemical imbalances. Traumatic lesions are considered to result from the shearing mechanism in and around the brain stem very close to the tentorial edge. However, an injury of lower brain stem could be caused by hyperextension of the cervical vertebrae or reciprocal actions of fracture of the clivus and the direct effect on the brain stem by acceleration or rotational forces. Then the edema gradually begins and raises the pressure inside the skull. The skull is a thick chamber and has not compliance, which means it does not allow the expansion of brain in case of brain edema. The danger from brain stem edema comes from the fact that it will actually compress the brain stem and can push it out of the bottom of the skull, causing death. Brain stem edema causes ongoing damage to the neural tissue; therefore, it needs to be treated as quickly as possible to save as much neural function as possible. For this reason, the case was considered to have a hyperextension injury and deeply slept immediately, giving anti-edema treatment with proper head positioning. Adequate cerebral perfusion pressure was achieved initially with the fluid support.

This case will focus on the evaluation of the appearance of brain stem edema on CT scan, which may often coexist with the fractures of cranio cervical junction in addition to head trauma. The presence of brain stem edema, fractures and dislocations of the region should also be distinguished with a meticulous investigation. The case was an isolated brain stem edema with an occipital linear fracture and intact cranio cervical alignment (Figure 3).

Brain stem is the most vital part of our body. Injury to the brain stem has similar effects as a brain injury, but it is more fatal. Use of the GCS as a prognostic indicator of outcome in patients

Figure 2. A-D, The CT image of a normal brain appereance with same levels left for comparing.
with head injuries is widely accepted in clinical practice. However, the prognostic value of GCS has been questioned\(^3\) because outcome has not always correlated with GCS. The brain stem edema is a rapidly progressive process. Therefore, we suggest that the treatment modalities should be started quickly, regardless of GCS. Although patients with GCS of those under 9 at intensive care practice have proposed to be slept, even the current case was 10, he was euthanatized for expecting to diminish brain stem edema and necessity of oxygen.

We believe that CT is a common and sufficient in the diagnostic evaluation of patients with brain stem edema due to head injuries, but its low sensitivity for detecting diffuse axonal injuries limits its usefulness. The question is that whether it is being aware of CT appearance of the posterior fossa when evaluating patients at emergency clinics. Normal and edematous brainstem, without an additional pathology, are slightly different. Emergency physicians should be accustomed to its appearance and quick enough to start the treatment\(^5\).

## Conclusions

The achievement is reserved behind ensuring brain stem perfusion and the suppression of the edema. The most important parameter is a quick implementation of treatment options. So, it is necessary to clarify the patient’s condition immediately. No delay seems to be the best treatment option.

## Conflict of Interest

The Authors declare that there are no conflicts of interest.

## References


