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ABSTRACT

Introduction: Traumatic brain injury is a major public health problem worldwide, with higher incidence rates in low- and middle-income countries. In this context, the development of major complications has been evidenced, such as the formation of haemorrhages due to traumatic rupture of a cerebral aneurysm, which may threaten the patient's life and therefore require immediate medical and neurosurgical procedures.

Case: We present the case of a male patient in the fourth decade of life, who presented a closed head trauma with the consequent development of subarachnoid haemorrhage in the territory of the right middle cerebral artery secondary to traumatic aneurysmal rupture

Conclusion: One of the complications that can occur in the context of head trauma is the development of subarachnoid haemorrhage due to traumatic aneurysmal rupture. Despite therapeutic options, these scenarios continue to be a challenge in low- and middle-income countries due to the lack of specialized tools in neurosurgical and neurorehabilitation areas.

INTRODUCTION

Traumatic brain injury (TBI) is a major public health problem worldwide [1], representing a significant cause of disability and mortality in the population of all ages along with a great socioeconomic impact, its main causes being falls and traffic accidents [2,3]. Globally, it is estimated that

Keywords

traumatic brain injury,
subarachnoid haemorrhage,
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between 60 and 70 million new cases of TBI occur each year, with high incidence rates that varies considerably between different parts of the world and have been increasing especially in low- and middle-income countries [4,5]. It has also been shown that a large number of these cases will develop complications that can threaten the patient's life and therefore require immediate medical and neurosurgical procedures [6]. Among these complications is an increased risk of rupture of pre-existing cerebral aneurysms with the consequent formation of hemorrhages, due to the altered hemodynamics of cerebral blood flow in the context of neurotrauma [7].

The aim of this manuscript is to present a case of traumatic subarachnoid hemorrhage secondary to silent aneurysmal rupture and discuss aspects related to the limitations in the diagnosis and approach in low- and middle-income countries such as Colombia.

CASE DESCRIPTION

A 34-year-old male patient was admitted to the emergency department of a low-level hospital presenting closed head trauma secondary to a traffic accident as a motorcyclist, with scalp injury, headache, loss of consciousness, without convulsions, nausea or vomiting, muscle weakness, loss of sensation or visual disturbances. No personal or family medical pathological history.

On physical examination on admission, the patient had a blood pressure of 100/70 mmHg, heart rate of 93 beats per minute, respiratory rate of 21 breaths per minute, oxygen saturation of 98% while breathing ambient oxygen, weight of 85 kilograms and height of 1.82 meters. In addition, he presented alcoholic breath. On neurological examination there was evidence of temporal and spatial disorientation, ocular opening when called, Glasgow scale of 13, normal pupillary response, fundus without papilledema, normal venous and arterial pulses, normoreflexia, no muscle weakness and preserved sensation. Initial paraclinical tests showed hemoglobin within normal limits.

He did not present neurological deterioration, however, due to a history of alcohol consumption, a simple cerebral computed tomography was requested, which showed subarachnoid hemorrhage in the right middle cerebral artery territory in segment M2, with the presence of blood

in the interhemispheric cistern and in the perimesencephalic cisterns with intraparenchymal hematoma in the sylvian valley (**Figure 1**). Due to the location of bleeding, aneurysmal hemorrhage is suspected. It was decided to refer to the neurosurgery department, who indicated cerebral angiography with endovascular management of aneurysm, where a ruptured aneurysm of M2 segment of 6 mm in diameter was found (**Figure 2**). It is managed endovascularly with coils, no flow-diversifying stents were placed.

During his stay in the ICU, the patient showed no neurological deterioration, no evidence of rebleeding or vasospasm; however, he presented cough, deterioration of the ventilatory pattern with bilateral pulmonary rales and fever with a temperature of 39°C. Antibiotic management with ampicillin/sulbactam 3 grams intravenously every 8 hours is indicated. She presented positive RT-PCR for SARS-CoV-2. Patient died 3 days later due to COVID-19 pneumonia.

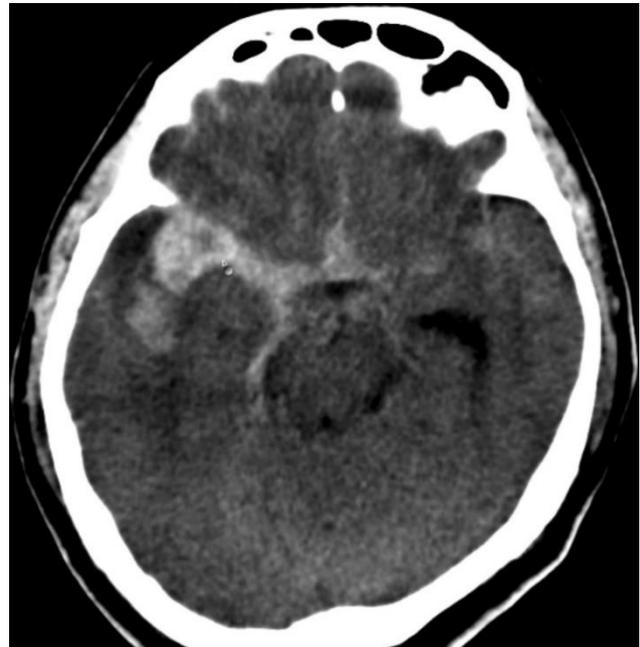


Figure 1. Computed axial tomography of the brain without contrast 2 hours after trauma.

DISCUSSION

TBI is a major cause of morbidity and mortality worldwide [1]. Incidence rates vary significantly in different parts of the world, with a greater burden in low- and middle-income countries [2,4]. Likewise, the highest incidence occurs in adolescents and young

adults and in the population over 65 years of age, with the most frequent responsible events being traffic accidents and falls, respectively [3].

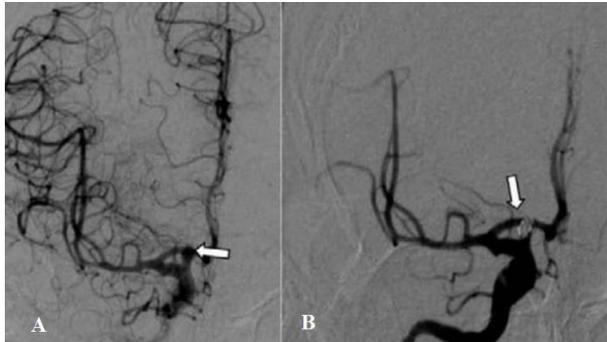


Figure 2. Angiography showing right middle cerebral artery aneurysm. A: Before endovascular management. B: Aneurysm with total occlusion (100%).

Most of the patients with TBI will develop serious complications that demand immediate medical and surgical measures in order to safeguard the patient's life [6]. Traumatic aneurysmal rupture is one of the complications to be taken into account since trauma can cause various cerebrovascular damages that can affect the integrity of a pre-existing cerebral aneurysm, leading to subsequent hemorrhage formation [7].

Aneurysmal subarachnoid hemorrhage, as described in our case, represents a serious and complex phenomenon in which there is extravasation of blood into the subarachnoid space as a consequence of an aneurysm rupture [8]. In this context, it is extremely important to provide an adequate and timely multidisciplinary approach in order to achieve satisfactory results [9].

Considering the above, early management, during the first 24 hours, of aneurysmal subarachnoid hemorrhage, will be directly related to a better prognosis, reduction of neurological involvement, and possible complications associated with this medical emergency, such as rebleeding, cerebral vasospasm, arrhythmias, pulmonary edema, among many others [10,11].

The initial approach to patient management should consist first of support and monitoring of vital signs, assessing the need for airway intervention to protect oxygen saturation [12] and then establishing the appropriate treatment to stop bleeding, through two options, either by placing clips at the neck of the aneurysm in a craniotomy or through endovascular

treatment consisting of embolization of the lesion by means of platinum coils, as in our case [11].

Clipping surgery is indicated in patients with large intraparenchymal hematomas, middle cerebral artery aneurysms, wide neck aneurysms, and in patients who are unlikely to comply with long-term follow-up [13]. While endovascular treatment is preferred in patients older than 70 years, in severe aneurysmal subarachnoid hemorrhages and basilar artery aneurysms [14].

In order to establish the differences between endovascular treatment and clipping surgery, several studies have shown a lower percentage of mortality and disability at one-year follow-up in those patients managed with endovascular therapy compared to clipping surgery [15], while on the other hand, the latter has shown a slightly lower rebleeding rate. Because of this evidence, both procedures are considered valid and the choice of one or the other goes hand in hand with the individualization of each patient [16].

However, it should be noted that, although low- and middle-income countries, especially in Latin America, have the highest mortality and disability figures associated with trauma, it is in these countries where neurosurgical interventions, as well as scientific studies and advances in the areas of neurology and neurorehabilitation, continue to be a challenge for the future [17].

The prognosis of a patient suffering an aneurysmal subarachnoid hemorrhage depends on multiple factors such as the patient's comorbidities, age, bleeding volume, early management, and above all the state of consciousness, in fact 15-25% of patients are left with neurological sequelae [9]. The rehabilitation process is very dynamic, motor and psychomotor recovery often occurs after the first six months, but verbal memory and other cognitive aspects may require much more time, even after the first year [18]. According to the Pan American Health Organization, only 3% of people with neurological disabilities in Latin America have access to neurorehabilitation services, as a consequence of a significant lack of resources due to underfunding and poor infrastructure of the health systems in these countries [19,20].

Thus, based on this problem, it is of vital importance to establish support and funding strategies that allow the advancement of neuroeducation and neurorehabilitation in low- and

middle-income countries, in order to maintain and rehabilitate the patient's functionality and thereby reduce the high percentages of disability caused by neurotrauma [19,21,22]. As an example, it would be of great importance the implementation of robotic neurosurgery in these countries, being an innovative tool that has allowed a great advance in developed countries in the context of diagnostic and therapeutic approaches, providing great satisfactory neurosurgical results along with the consequent reduction of patients with disabilities due to greater ease in the course of neurorehabilitation [17].

CONCLUSIONS

Aneurysmal subarachnoid hemorrhage is one of the complications that can occur after traumatic brain injury. This entity leads to a rather late recovery process of psychomotor and cognitive abilities of patients, so early diagnosis and management are the fundamental basis for achieving more satisfactory results. However, despite the different therapeutic options currently available, high morbidity and mortality rates continue to occur, especially in low- and middle-income countries, as a consequence of deficits in access to adequate neurosurgical and neurorehabilitation tools.

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