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Median Suboccipital Craniotomy caused by Arnold Chiari I Malformation

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ABSTRACT

30-year-old female patient's report diagnosed with Arnold Chiari type I malformation, who was scheduled for a midline suboccipital craniotomy surgery handled with total intravenous anesthesia (TIVA). The patient was treated with Fentanyl and supported with propofol and dexmedetomidine. Brain monitoring was based on Entropy with ranges between 40-60 during all the intraoperative. It was proved the patient's safety when submitted to a craniotomy with Arnold Chiari type I malformation with (total intravenous anesthesia) TIVA related to an adequate brain monitoring support and hemodynamic stability.

Keywords

Arnold-Chiari malformation, TIVA anesthesia, Brain monitoring.

Introduction

Arnold Chiari malformation (CM) is a structural defect in the skull and cerebellum, featured by brain tissue presence that stands out towards the spinal canal, with tonsils stretching and the medial divisions of the lower lobe from the cerebellum towards conical projections, which join the medulla oblongata in the spinal canal to the cerebellum bottom. Normally the cerebellum and parts of the brain stem are placed above a hole in the skull that allows the spinal cord to pass through. It is estimated that the prevalence of CM is in a range from 1 per 1,000 to 1 per 5,000 human beings, it can happen due to autosomal recessive inheritance or autosomal dominant inheritance [1]. Its pathophysiological mechanism is explained by the obstruction of the cerebrospinal fluid flow because of the Luschka and Magendie foramina blockage, as well as the Silvio aqueduct [2-4]. In patients with Arnold Chiari malformations, anesthetic management should begin with a deep and careful investigation of the medical history and a complete physical examination of the patient's respiratory, cardiovascular, and neurological pathways. General anesthesia should be used with greater care throughout laryngoscopy and tracheal intubation, since it could lead to a ICP increase or cerebrospinal fluid pressure gradient, difficulty in airway management, autonomic dysfunction, and abnormal sensitivity to neuromuscular blocking. As a result of their pathology, these patients are usually associated with a difficult airway, so it is always advisable to have the difficult airway equipment [4].

Clinical Case Presentation

30-year-old female patient from Veracruz, Veracruz where she currently lives since her birth. She does not have significant family hereditary history. She lives in her own house, which has all basic services. It is denied smoking, alcoholism, and drug addiction. Surgical history: at the age of 19 she had a cesarean section under regional anesthesia without complications. She denies transfusions. She is allergic to sulfas and metamizole. Pathological history: polycystic ovary.

She began with her current condition a year ago, by manifesting headache in the cervical and occipital region predominantly. The patient is referred to Neurosurgery service, where an MRI is indicated. The results confirmed Chiari malformation type the patient is conscious, oriented, cooperative, Glasgow 15, reactive on physical examination. Normocephalic skull, isochoric and normoreactive pupils, well hydrated mucosa in the oral cavity, Mallampati I, interincisive distance II, cylindrical neck, Patil Aldreti I, bellhouse doré II, sternum chin distance I. Lung fields with good air flow, as well as good heart tones and intensity. Soft

and depressible abdomen, with no palpable masses. Extremities with an acceptable capillary refill, without evidence of edema. Leukocytes 7.1, Hb 12.5, Hto 36.8, platelets 286,000, TP 12.6, TTP 34.6, INR 0.9, glucose 88, urea 24, Cr 0.88, Ca 8.93, Mg 1.93, Na 142, Cl 104. The MRI depicts 16 mm from the cerebellar tonsils to the spinal canal, central fiscal profusion in C2-C3 touching and displacing the dural sac posteriorly (Figure 1), ASA II risk patient.

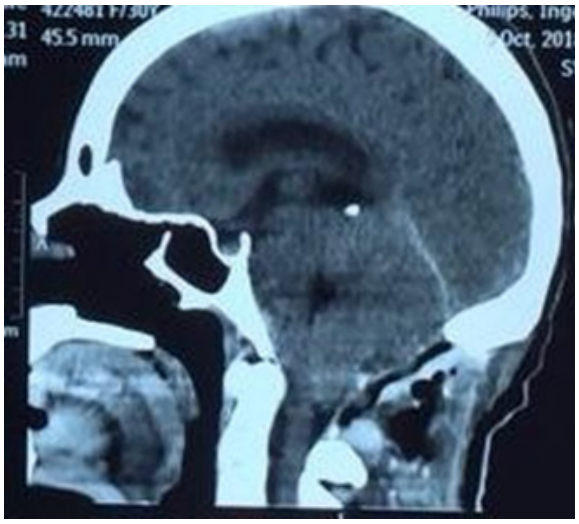

Figure 1: Preoperative sagittal CT showing herniation of the cerebellar tonsil into the spinal canal.

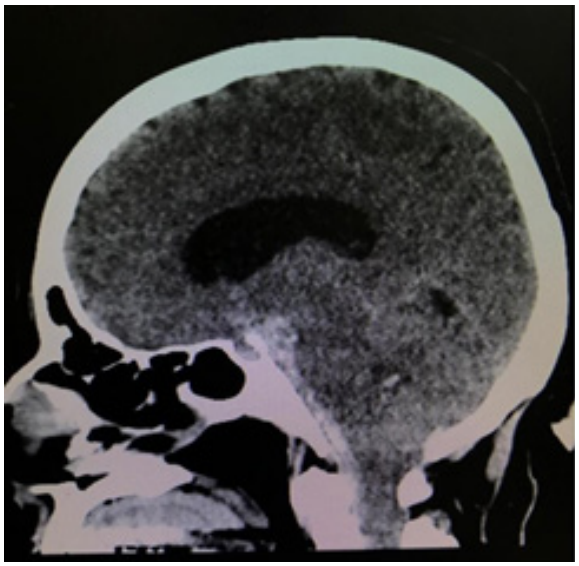

Figure 2: Suboccipital craniotomy postoperative sagittal section, cranio-cervical decompression.

The anesthetic technique is decided: TIVA total intravenous anesthesia. After a non-invasive monitoring, the patient was treated with fentanyl 250 mcg, Midazolam 1.5 mg, Propofol 120 mg, and Rocuronium 40 mg. Intubation with Glidescope video laryngoscopy. Maintenance under infusion with propofol 4-5 mg/mL plasma concentration, dexmedetomidine 0.4-0.5 ug/kg/hr, lidocaine 1 mg/kg/hr, magnesium sulphate 10 mg/kg/hr. She was maintained with a thermal mattress, and normocapnia was kept with a maximum pressure of 25 mmHg. Entropy with values between 40-60 and temperature control throughout the hemodynamically stable anesthetic maintenance. Surgical procedure ends without changes, the patient is extubated with no incidents. She goes to the ICU where was closely observed for 2 days, later she goes to the neurosurgery department where a follow-up CT scan is carried out. The results show post-surgical changes with a skull free of collections (Figure 2). She tolerates a normal diet and walking, so she is discharged to have control as an outpatient.

Discussion

Arnold Chiari's disease is considered one of the biggest challenges in the anesthesiology field. Chiari malformation is a group of congenital malformations that affect the brainstem, cerebellum, and upper part of the spinal cord, frequently identified in both young adults and children [5-7]. Symptoms typically appear during adolescence or adulthood, and it does not usually come with hydrocephalus. Generally, patients have frequent headache, neck pain, and progressive lower extremity spasticity. It affects both genders, being slightly predominant in women and all ethnic groups. The first symptoms can develop at any age, although they usually appear between the ages of 25 and 30, and they are less frequent among those over 60 years old [2]. Chiari is classified in five subtypes: type 0 malformation where there is hydrodynamic alteration of the cerebrospinal fluid at the level of the foramen magnum, type I where there is caudal herniation of the cerebellar tonsils bigger than 5 mm below the foramen magnum. CSF obstruction in the foramen magnum has a role in cerebellar atrophy, with compartmental hypertension of the posterior fossa exerting direct pressure on the cerebellum, this mechanism causes a potential atrophy [2,8].

It is diagnosed through neuroimaging techniques. The diagnosis of Chiari type I in patients with or without symptoms is carried out using the chosen technique: magnetic resonance imaging (MRI). In this malformation, the diagnosis is established by the fall of 5 mm of the cerebellar tonsils below the foramen magnum [3,9,10]. Surgical treatment indications are still a matter of debate, especially in those oligosymptomatic or asymptomatic cases casually detected. Currently, diagnosis is higher due to the population's greater access to neuroradiological diagnostic methods. This has made this disease has an outstanding place in both neurologists and neurosurgeons' daily clinical practice. The objective of surgical treatment must be aimed to effectively unblock the subarachnoid spaces from the foramen magnum, and especially from the cisterna magna. Ideally, and regardless the etiopathogenic factors involved in tonsillar herniation. The surgical treatment objectives in this type of anomaly should be the following: a) improving or overriding the existing craniospinal pressure gradient in the foramen magnum; b) restoring the subarachnoid spaces normal anatomy; c) eliminating the syringomyelic cavity in cases which it coexists with Chiari malformation, and d) relieving compression on the brainstem [11].

As it is a congenital disease, an adequate pre-anesthetic assessment must be made, as well as the patient's perinatal history

investigated. Rodríguez-Zepeda and Monzon-Falconi state that so far the chosen technique is the balanced general anesthesia as long as hemodynamic stability is maintained, without sudden changes in blood pressure and, therefore, in CSF pressure. The surgical treatment objectives for this type of anomaly should be as follows: a) improving or overriding the existing craniospinal pressure gradient in the foramen magnum; b) restoring the subarachnoid spaces normal anatomy; c) eliminating the syringomyelic cavity in cases where it coexists with Chiari malformation, and d) relieving compression on the brainstem. The spectrum of malformations in a classification system is composed of types I Displaced and herniated cerebellar tonsils, posterior fossa recruitment, and syringomyelia [2,3].

The intraoperative period is essential to keep an adequate hemodynamic stability, which is why an infusion of dexmedetomidine was maintained as an adjuvant and a narcosis with Fentanyl at a 0.005-0.01 mcg/kg/min plasmatic concentration. Keeping an adequate hemodynamics throughout perioperative. Our patient was treated based on total intravenous anesthesia, in this case with maintenance based on propofol with concentrations 4-5 mg/kg/min, with an entropy-guided cerebral monitoring where values kept between 40-60 without difficulties. The patient was extubated with no complications and was successfully taken to the ICU service. The patient was discharged after a 5-day hospital stay with an open medical appointment with Neurosurgery.

Conclusions

So far, balanced general anesthesia has been the chosen technique since no special technique has been established. TIVA has shown that it can be used for trans anesthetic management, paying attention thoroughly to anesthetic risks associated to protocol patients for craniotomy caused by Arnold Chiari disease type I.

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