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Anesthesia for patients with traumatic brain injury☆

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ABSTRACT

Traumatic Brain Injury (TBI) is a complex disease with a high social burden because of its high mortality and high rate of sequelae. Outcome after TBI is related to early management, including anesthetic management. In this article we review up to date concepts for anesthetic management of TBI patients; from pre-anesthetic evaluation to different aspects of surgical management: induction of anesthesia, airway control, mechanical ventilation, intravenous fluid management, maintenance of anesthesia during neurological and non-neurological surgery, and the treatment of brain edema, coagulopathy, electrolyte balance and temperature. We think the treatment must be directed to goals in order to offer the patient the best conditions for recovery and to avoid secondary brain injury.

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Anestesia para pacientes con trauma cráneo encefálico

Palabras clave:
Trauma cráneo encefálico
Manejo anestésico
Control de daños
Coagulopatía del trauma
Edema cerebral
Manejo orientado a metas

RESUMEN

El Trauma Cráneo Encefálico (TCE) es una enfermedad compleja, con gran repercusión social por su alta mortalidad y alta tasa de secuelas. El desenlace que tenga nuestro enfermo está relacionado con el manejo temprano que reciba, incluido el manejo anestésico. En este escrito se revisan los conceptos actuales de manejo anestésico de enfermos con TCE, desde su evaluación preanestésica hasta los diferentes aspectos del manejo quirúrgico: inducción de anestesia, control de la vía aérea, ventilación mecánica, manejo de líquidos intravenosos, mantenimiento anestésico en cirugía neurológica y no neurológica, manejo del edema

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cerebral, de la coagulopatía, de los electrolitos y de la temperatura. Nuestro enfoque se basa en el manejo orientado a metas de manera que ofrezcamos al paciente las mejores condicionesde recuperación y evitemos la lesión secundaria.

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Introduction

Traumatic Brain Injury (TBI) is a complex condition affecting not just the encephalon, but also the function of other body systems with multiple clinical presentations. 20% of the patients that arrive at the hospital die as a result of TBI.[1]

Primary brain injury is the direct consequence of the impact and may include intra-parenchymal concussions, bleeding from vascular lesions and hematomas. The evolution progresses to an inflammatory process, development of edema and persistent bleeding that result and major brain involvement. The key prognostic factor is the severity of the primary injury, in addition to other factors that contribute to a worse outcome such as secondary insults – listed in Table 1 – that are amenable to manipulation by the anesthesiologist.

Damage control

In the last few years the suggested initial approach has been to focus on dealing with the life-threatening injuries, rather than trying to correct all the lesions. Then continue with resuscitation and, once the patient is stable, proceed with the treatment of the less severe trauma injuries.[2] When the patient is taken to surgery we have the unique opportunity to do comprehensive resuscitation, correct any conditions that may lead to secondary damage and establish invasive monitoring for later ICU management.

A National Survey in Colombia showed that neurosurgery anesthesia is mostly administered by anesthesiologist that are not formally and specifically trained in neuroanesthesia and that the clinical practice often fails to comply with the evidence-based recommendations published in the literature.[3] This article reviews the general concepts necessary for a clear understanding and proper management of the TBI patient and is intended to contribute in improving the quality of care given to the patient.

Pre-anesthesia evaluation

The initial evaluation should focus on estimating the extent and the significance of the injuries, the respiratory and hemodynamic stability of the patient, understanding the mechanics of the trauma and identifying the presence of aggravating conditions such as intoxication, comorbidities and previous treatments.

There is a need to determine how the patient was managed before being transferred to the OR (salvage, transfer, resuscitation in the ER), particularly in terms of airway management, blood pressure maintenance and oxygenation. Inadequate airway management with a poor selection of drugs and maneuvers, or failing to secure the airway, may lead to a more extensive secondary injury.

A secondary evaluation shall be done in the OR, including airway and ventilation assessment, evaluation of the hemodynamic stability and potential neck and chest trauma, in addition to a neurological evaluation including the awareness status (Glasgow Coma Score – GCS), pupillary condition and limbs motor function. The patient's skin must be thoroughly inspected to identify any traces of trauma or comorbidities. The patient's interrogation should focus on determining the mechanics of the trauma, the neurological status when the patient was admitted to the ER, any injuries diagnosed up to that moment, the treatments administered, history of allergies and the presence of comorbidities; potential anemia, coagulopathy, metabolic status: electrolytes, glycemia. The vascular access and the need to proceed to advanced monitoring are evaluated (Table 2).

Management of anesthesia

Several objectives are to be kept in mind: improving the oxygenation and the brain perfusion pressure, avoid secondary injury, timing of the best conditions for the surgical field using strategies to prevent brain herniation.

Induction and intubation

If the patient is in a coma (GCS < 9), presents unstable airway or thorax, or requires aggressive resuscitation or surgery under general anesthesia, the airway must be secured. The device of choice is the endotracheal tube because the supraglottic devices are not amenable to proper ventilation control in every case and fail to protect the patient from bronchoaspiration. The general assumption is that every trauma patient has a potential spinal cord injury and a full stomach and thus should be managed with neck stabilization and precautions for bronchoaspiration. Rendering the patient unconscious is also key to avoid a hypertensive response to laryngoscopy-intubation that tends to raise the ICP and be extremely deleterious. The recommended agents are the fast-acting drugs: Thiopental, Propofol, Midazolam and Ketamine. The first two are fast, their effect is predictable, and have considerable effect on blood pressure, so that these drugs must be titrated until the patient is rendered unconscious. Midazolam is a valuable adjuvant, but it is not enough for induction, although it may be appropriate when the patient is already unconscious. Ketamine has been recently considered safe in this situation, as long as it is administered with a hypnotic agent and at moderate doses (0.6–1 mg/kg, as a slow intravenous bolus).[4] The use of

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