CASE REPORT

Anesthetic management of patients with spinocerebellar ataxia type 2. A case report

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ABSTRACT

Introducción: la ataxia espinocerebelosa tipo 2 es una enfermedad hereditaria con carácter autosómico dominante en la que se produce degeneración del cerebelo y sus vías aferentes y eferentes y que se caracteriza por ataxia, disartria, dismetría, adiadococinesia, temblor de acción, contracturas musculares dolorosas, neuropatía precoz, nistagmos, signos piramidales y trastornos cognitivos, del sueño y autonómicos.
Información del paciente: se informa el manejo anestésico en un paciente en el que las principales implicaciones de la anestesia están relacionadas con la degeneración neuromuscular y la posible aparición de complicaciones respiratorias.
Conclusiones: la selección adecuada de los agentes anestésicos, el uso de relajantes musculares no despolarizantes en dosis reducidas, la anestesia epidural combinada con anestesia general, la retirada precoz del tubo endotraqueal o máscara laríngea, la movilización precoz y la monitorización neuromuscular y cardiorespiratoria son los elementos fundamentales en el manejo anestésico de este paciente.
Palabras clave: ataxia espinocerebelosa; manejo anestésico; monitoreo

RESUMEN

Introduction: spinocerebellar ataxia type 2 is an autosomal dominant inherited disease in which degeneration of the cerebellum and its afferent and efferent pathways occurs and is characterized by ataxia, dysarthria, dysmetria, adiadochokinesia, action tremor, painful muscle contractures, early neuropathy, nystagmus, pyramidal signs, and cognitive, sleep and autonomic disorders.
Patient information: anesthetic management is reported in a patient in which the main implications of anesthesia are related to neuromuscular degeneration and the possible occurrence of respiratory complications.
Conclusions: the adequate selection of anesthetic agents, the use of non-depolarizing muscle relaxants in reduced doses, epidural anesthesia combined with general anesthesia, early removal of the endotracheal tube or laryngeal mask, early

mobilization and neuromuscular and cardiorespiratory monitoring are the fundamental elements in the anesthetic management of this patient.
Key words: spinocerebellar ataxia; anesthetic management; monitoring

INTRODUCTION

The autosomal dominant cerebellar ataxias are a group of clinically, pathologically and genetically heterogeneous neurodegenerative disorders that result from degeneration of the cerebellum and its afferent and efferent pathways.[1,2,3]
Spinocerebellar ataxia type 2 (SCA2) is a disease characterized clinically by progressive gait ataxia, dysarthria, dysmetria, adiadokinesia, action tremor, painful muscle contractures, early neuropathy, slowing of horizontal saccadic eye movements, hyperreflexia, clonus, Babinsky's sign, sleep disturbances, cognitive disturbances, and dysautonomic symptoms and signs.[1,2,3,4,5,6]
The most important neurophysiological alterations are the drop in the amplitude of the sensory potentials, which is an expression of an axonal type of sensory neuropathy, and the slowing in the conduction of afferent pathways, mainly of the dorsal lemniscal system, according to somatosensory evoked potentials. The slowing of peak saccadic velocity is the main marker in patients with preclinical disturbances. Changes in REM sleep and in the motor function of the pathways were determined in polysomnographic studies and by transcranial magnetic stimulation appear very early in these patients. Transcranial magnetic resonance imaging is the determining imaging study in SCA2.[1]
The distinctive neuropathological feature is an early olivopontocerebellar atrophy accompanied by degeneration of the somatosensory pathways, the thalamus, the substantia nigra and the anterior horns of the spinal cord.[1]
Researchers have identified chromosomal segment 12q23-24.1 as the site of the disease gene (ataxin 2, ATXN2) and the underlying mutation is an unstable expansion of the polyglutamine domain within the ataxin 2 protein content, which is a cytoplasmic protein found in various body tissues and neuronal populations, with a function not yet completely identified.[1,4]
Current therapeutic alternatives do not have an effective treatment that modifies the progressive course of SCA2. Dopaminergic and anticholinergic treatments have been reported to reduce tremor, dystonia and bradykinesia, while painful muscle contractures can be relieved with magnesium, quinine, mexiletine, muscle relaxants and amitriptyline.[1,2] Rehabilitation as a therapeutic element is one of the main measures in the physical treatment of patients with SCA2.[1,2,7,8]

PATIENT INFORMATION

Male patient, 49 years old, weighing 72 kg, diagnosed with SCA2 for 19 years, who went to the preanesthetic evaluation consultation of the "Arnaldo Milián Castro" University Clinical Surgical Hospital of Santa Clara City, Villa Clara Province, for presenting an adenocarcinoma of the sigmoid rectum. In the preoperative clinical evaluation, ataxia, dysarthria, dysmetria, painful muscular contractures, peripheral neuropathy, osteotendinous hyperreflexia,

Babinsky's sign, tremor in upper limbs and nystagmus, in addition to chronic gastritis, for which he was under occasional treatment with omeprazole or ranitidine. Preoperative medication included the administration of vitamin E, baclofen and amitriptyline plus preoperative chemotherapy-radiotherapy for his oncological disease and dexamethasone as an antiemetic drug during the administration of cytostatics. The hemogram, coagulogram, chemical analysis, chest X-ray, electrocardiogram and echocardiogram were normal.

In the surgical unit, preoperative medication was administered with midazolam (2 mg), dexamethasone (4 mg), ranitidine (50 mg) and antibiotic prophylaxis with cefazolin (1 g) plus metronidazole (500 mg) intravenously; continuous electrocardiographic monitoring, noninvasive measurement of blood pressure and oxygen saturation (SpO_2) were started. Epidural anesthesia was performed with bupivacaine 0.25% through epidural catheter and combined with general anesthesia with induction based on midazolam (2 mg), propofol (75 mg), fentanyl (150 mcg), lidocaine (75 mg) and vecuronium (4 mg) intravenously. After ventilation with face mask, inspired oxygen fraction (FiO_2) of 1 and cricoid pressure, he was fitted with a ProSeal laryngeal mask and ventilated with Fabius anesthesia machine at a tidal volume of 7 ml/kg and respiratory rate of 12 breaths per minute. Maintenance of anesthesia was performed with continuous epidural perfusion of bupivacaine and vecuronium (1 mg) 35 minutes after its first administration and ventilation with a mixture of oxygen and air at a FiO_2 of 0.4 plus isoflurane 0.5%. Intravenous ondansetron (4 mg) was administered 15 minutes before skin closure and benzodiazepine action was reversed with flumazenil (1 mg) intravenously. Preventive analgesia was started with dipyrone (1.2 g) intramuscularly, no anticholinesterase agents were administered and the supraglottic device was removed in the operating room when the criteria established for its removal were met. The sigmoid rectum was resected and the remaining rectum was left closed with terminal colostomy in the left iliac fossa (Hartmann operation) in a time of 95 minutes. In the recovery room, postoperative surveillance was established with continuous electrocardiographic monitoring and pulse oximetry, and hemoglobin, glycemia, ionogram and blood gas values were determined. The evolution was satisfactory.

DISCUSSION

SCA2 is one of the most common forms of autosomal dominant ataxias in the world. This disease reaches the highest prevalence and incidence rates in Cuba; it has a higher prevalence in the Eastern Region of the country, with predominance in the territory corresponding to Holguín Province.[1,2]

In the anesthetic management of patients with SCA2, general or regional anesthesia can be used interchangeably depending on the requirements of the surgical procedure. Depolarizing neuromuscular blockers such as succinylcholine should not be used because of the risk of producing hyperkalemia in these patients who present neuromuscular degeneration, while non-depolarizing muscle relaxants can be used in restricted doses and with monitoring of neuromuscular function because these patients present increased sensitivity to these drugs.[9,10,11]

General anesthesia using intravenous or volatile inhalation agents can be used, but there are controversies in this regard. Total intravenous anesthesia (TIVA) with propofol can be used at the correct established doses, but prolonged infusion should be avoided because of the possible risk of propofol infusion syndrome in these patients.[11] Polyglutamine diseases, such as SCA2, are characterized by an increasing energy deficit at the neuronal level due to the high adenosine triphosphate (ATP) demand required for degradation of misfolded proteins by polyglutamine expansion[12] and prolonged infusion propofol may interfere with oxidative phosphorylation and uncouple the mitochondrial respiratory chain, which may lead to an imbalance in energy demand.[11] A TIVA with propofol at recommended doses for a surgical time of 95 minutes can be safely performed. The administration of halogenated agents is not contraindicated in this type of patient, but may cause a reversible decrease in (cyclic guanosine monophosphate) cGMP levels in the cerebellum and affect the control mechanisms of motor activity as well as induce calcium release from the sarcoplasmic and endoplasmic reticulum and produce exacerbation of motor symptoms.[13] Calcium leakage caused by volatile anesthetics takes place through IP3R and RyR channels with depletion of intracellular stores from sarcoplasmic and endoplasmic reticulum; the role of calcium channel inhibition in the central nervous system effects of inhalational anesthetics is not entirely clear.[13] To date there is no established official consensus on the anesthetic management of patients with ACS2 and other ataxias and there are various trends, but anesthesia should focus on the selection and correct utilization of anesthetic agents, on selecting non-depolarizing neuromuscular blockers using them in lower doses, and on establishing full monitoring. In the patient reported, continuous epidural anesthesia with bupivacaine combined with endotracheal general anesthesia was chosen, vecuronium was used in reduced doses as a non-depolarizing muscle relaxant and isoflurane was used in very low concentrations without exacerbation of motor symptoms in the postoperative period.

Preoperative medication with sedatives can be used and to prevent pulmonary aspiration of gastric contents omeprazole or ranitidine can be used to elevate gastric pH or metoclopramide as a prokinetic agent. Nitrous oxide is not recommended because of its neurotoxic effects.[9,10,11] Induction of general anesthesia can be performed in rapid sequence and modified with cricoid pressure, preoxygenation and very gentle positive pressure mask ventilation to prevent the risk of aspiration. Monitoring of anesthetic depth with the bispectral index (BIS) is useful to achieve rapid recovery times after general anesthesia.[11] Airway management and the use of blood and its derivatives are not subject to special recommendations.[11]

Patients with ACS2 may have alterations in respiratory function and the most affected patterns are alterations in vital capacity and an increase in the FEV1/PEF index (FEV1 is the forced expiratory volume in 1 second and PEF is the peak expiratory flow rate, which is the highest flow rate reached during a forced expiratory maneuver). The increase in this index is due to the reduction in PEF, which denotes a functional alteration of large caliber airways. Other alterations found in these patients have been a decrease in maximal inspiratory pressure, maximal expiratory pressure and maximal voluntary pulmonary ventilation, which together with the decrease in vital

capacity suggests an impairment of inspiratory and expiratory muscle coordination.[12]

Cerebellar and brainstem degeneration and autonomic dysfunction may influence the respiratory alterations found in these patients. The cerebellum plays a role in the voluntary control of respiration and the internal cerebellar nuclei amplify respiratory responses to chemoreceptors and mechanoreceptors, mainly in the presence of large respiratory effort. The degeneration of the brain stem, in which the respiratory center is located, offers an additional role for spirometry as a functional biomarker of the degenerative process of these structures. Another explanation that may contribute to the respiratory alterations in patients with ACS2 is the autonomic degeneration of sympathetic and parasympathetic fibers that control respiration. Sympathetic fibers come from the paravertebral ganglia T3 to T6, while parasympathetic fibers are part of the vagus and glossopharyngeal nerves, which conduct sensory information to the respiratory center.[12] An increased incidence of sleep apnea syndrome has also been reported in these patients.[12]

Abdominal and cardiothoracic surgeries generally carry the highest risk of respiratory complications due to the postoperative diaphragmatic dysfunction that accompanies them. In patients with ACS2, regional anesthetic techniques alone or combined with endotracheal general anesthesia are considered, as do other authors,[14] and laryngeal mask with gastric drainage may be used if possible. The use of the laryngeal mask is controversial in this type of surgery because the maximum duration of its use has not been established and, taking into account the possibility of not being able to perform a definitive surgical intervention, it is decided to use a laryngeal mask with gastric drainage with the possibility of establishing a change of transoperative conduct if the conditions so require. Abdomino-perineal resection was not possible, Hartmann's resection was performed and the surgical intervention could be successfully completed using the laryngeal mask, which was removed at the end of the intervention. After surgery, early removal of the endotracheal tube or supraglottic device should be encouraged and noninvasive mechanical ventilation can be used, together with physiotherapy and preventive multimodal analgesia, with the aim of improving tidal volume and encouraging coughing and early ambulation.[14]

Regional anesthesia (spinal, epidural, nerve blocks) can be used when possible (high sensory levels should be avoided in order not to potentiate autonomic changes) and will always be a weapon in favor due to the possible respiratory alterations that these patients may present and their decreased muscle strength, which is a functional biomarker of disease progression.[11,12,15]

Postoperative care should be aimed at monitoring neuromuscular and cardiorespiratory function with continuous electrocardiography, blood gas, capnometry and pulse oximetry.

Preoperative physiotherapy, preoperative incentive spirometry, early postoperative mobilization, preventive analgesia and the rapid establishment of an intensive regimen of postoperative physical rehabilitation (respiratory gymnastics, postoperative incentive spirometry, physical rehabilitation, yoga

exercises) avoid postoperative complications, promote recovery and prevent secondary muscle atrophy.[11,12]

These patients should be monitored postoperatively in intermediate or intensive care units.

The appropriate selection of anesthetic agents, the use of non-depolarizing muscle relaxants in reduced doses, epidural anesthesia combined with general anesthesia, early removal of the endotracheal tube or laryngeal mask, early mobilization and neuromuscular and cardiorespiratory monitoring are the fundamental elements in the anesthetic management of patients with ACS2.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.