

# Anesthesia and Postoperative Pain Management Associated with the Neurophysiological Monitoring Technique in Pediatric Oncology: Case Report

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*Anestesia e Manejo da Dor Pós-Operatória Associada à Técnica de Monitorização Neurofisiológica em Oncopediatria: Relato de Caso*

*Anestesia y Manejo del Dolor Postoperatorio Asociado a la Técnica de Monitoreo Neurofisiológico en Oncología Pediátrica: Informe de Caso*

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## ABSTRACT

**Introduction:** Neuroblastoma is the most common non-central nervous system in childhood. From six to ten million children are identified with this disease annually. Surgical treatment, which involves tumor resectability, is a decisive factor in the therapeutic strategy of these patients, with clear influence on disease's prognosis. **Case report:** Nursling submitted to general anesthesia and peripheral nerve block for neuroblastoma surgical resection with intraoperative neurophysiological monitoring (IONM) and spinal erector plane block (ESP), associated with the multimodal analgesia technique for pain control. The postoperative pain was evaluated using the Children's and Infants' Postoperative Pain Scale (CHIPPS). **Conclusion:** IONM has established itself as an important tool to monitor neurological functions during surgical approaches with involvement of the central nervous system, in order to avoid permanent damage to important structures. The interaction and communication of the entire team are of paramount importance in the postoperative results.

**Key words:** neuroblastoma; pain, postoperative; surgical oncology.

## RESUMO

**Introdução:** O neuroblastoma é o tumor maligno sólido extracraniano mais comum na infância. Entre seis e dez milhões de crianças são identificadas com essa doença por ano. O tratamento cirúrgico, que envolve a ressecabilidade tumoral, é fator decisivo na estratégia terapêutica desses pacientes, com evidente influência no prognóstico da doença. **Relato do caso:** Lactente submetido à anestesia geral e a bloqueio de nervo periférico para ressecção de neuroblastoma com monitorização neurofisiológica intraoperatória (MNIO). Como estratégia anestésica, foi realizado o bloqueio do plano do eretor da espinha (*ESP Block*) associado à técnica de analgesia multimodal visando ao controle da dor. A dor pós-operatória foi avaliada por meio da *Children's and Infants' Postoperative Pain Scale* (CHIPPS). **Conclusão:** A MNIO, apesar de restringir as técnicas anestésicas, tem se firmado como uma importante ferramenta para monitorar as funções neurológicas durante as abordagens cirúrgicas com envolvimento do sistema nervoso central, com a finalidade de evitar danos permanentes de importantes estruturas. A interação e a comunicação de toda a equipe são de suma importância nos resultados pós-operatórios.

**Palavras-chave:** neuroblastoma; dor pós-operatória; oncologia cirúrgica.

## RESUMEN

**Introducción:** Neuroblastoma es el tumor maligno sólido extracraniano más común en la infancia. Entre seis y diez millones de niños son identificados con esta enfermedad por año. El tratamiento quirúrgico, que implica la ressecabilidad tumoral, es un factor decisivo en la estrategia terapéutica de estos pacientes, con una influencia evidente en el pronóstico. **Informe del caso:** Lactante sometido a anestesia general y bloqueo nervioso periférico para resección de neuroblastoma con monitoreo neurofisiológico intraoperatorio (MNIO). Como estrategia anestésica, para resección del neuroblastoma, se realizó bloqueo del plano erector espinal (Bloqueo ESP), asociado a la técnica de analgesia multimodal para controlar el dolor. El dolor postoperatorio se evaluó mediante la *Children's and Infants' Postoperative Pain Scale* (CHIPPS). **Conclusión:** La MNIO, a pesar de restringir las técnicas anestésicas, se ha posicionado como una importante herramienta para monitorear las funciones neurológicas durante los abordajes quirúrgicos que involucran al sistema nervioso central, con el fin de evitar daños permanentes a estructuras importantes. La interacción y la comunicación de todo el equipo son de suma importancia en los resultados posoperatorios.

**Palabras clave:** neuroblastoma; dolor postoperatorio; oncología quirúrgica.

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## INTRODUCTION

Neuroblastoma is the extracranial solid malignant tumor most common in childhood with prevalence of 1/100 thousand cases per year. The incidence is nearly 7% of the annual cases of cancer for this population with mean age at diagnosis of 15 months of life<sup>1</sup>. From six to ten million children are diagnosed with the disease annually<sup>2</sup>. Tumor resectability and staging are critical for the initial therapeutic strategy.

Surgical treatment can result in future important complications as urinary, sexual and anorectal dysfunction. Intraoperative neurophysiological monitoring (IONM) has gained popularity as a strategy in preventing surgical complications associated with retroperitoneal resection of these tumors<sup>2</sup>.

The principles of accelerated postoperative recovery consist in reducing the negative physiological impact on the organism and post-surgery response to stress, improving the recovery, minimizing complications and reducing the length of hospital stay. The Enhanced Recovery After Surgery (ERAS)<sup>3</sup> protocol has developed recommendations and guidelines upon review of the available evidences by experts work groups.

In the last years, multimodal analgesia is standing out with the administration of the following medications: non-steroidal anti-inflammatory drugs (NSAIDS), anticonvulsants, common analgesics (acetaminophen and dipyrone), opioids, antagonists of receptors N-Methyl D-aspartate (NMDA), agonists alpha-2 and local anesthetic<sup>4</sup>.

The patients' pain complaint is often poorly treated and can negatively impact not only post-surgery but also in adulthood.

Upon approval by INCA's Institutional Review Board (report number 2464820 (CAAE: 74205517.3.0000.5274) in compliance with Directive 466/2012<sup>5</sup> of the National Health Council, the data were extracted from electronic charts.

The objective of the study is to report a case of pre and immediate postoperative anesthetic management of an infant with neuroblastoma, whose surgical procedure was concomitant with IONM.

## CASE REPORT

Male infant, 11 months of age, 10 kg diagnosed with neuroblastoma and initial clinical condition of paresthesia on the lower limbs, with invasive mass of spinal canal on L1-L3, negative N-myc, in treatment according to the protocol proposed by the Children's Oncology Group (COG) Intermediate Risk (RI)<sup>6</sup> (Figure 1). The

surgical plan was designed and the multi-sequence and multiplanar acquisition was performed before and after the administration of contrast medium corona plane (07/14/22). The green arrow shows the neoplasm.



**Figure 1.** Pre-operative magnetic resonance of the abdomen

**Source:** INCA<sup>7</sup>.

The surgery occurred after eight neoadjuvant chemotherapy cycles and performance of surgical risk according to the American Society of Anesthesiologists (ASA, classification II)<sup>8</sup>. The patient was submitted to exploratory laparotomy with identification of an approximately 4 x 2 cm paravertebral retroperitoneal tumor extending to vertebral foramen with retroperitoneal lymph nodes at the left renal hilum, in addition to nearly 95% resection of the lesion by electrostimulation in July 2022.

Cardioscopy, non-invasive arterial pressure, pulse oximetry, capnography and invasive blood pressure in radial artery were utilized for monitoring. Fentanyl (4 mcg/kg) + lidocaine 1% (3 mg/kg) + propofol (3 mg/kg) were administered for anesthesia induction and orotracheal intubation. Dexamethasone (0.15 mg/kg) + ketamine (0.5 mg/ml) associated with dexmedetomidine (2 mcg/ml) in infusion pump (0.2 mcg/kg/h to 0.5 mcg/kg/h) + dipyrone (40 mg/kg) + ondansetron (0.15 mg/kg) were applied too in peri-operative. Sevoflurane (1 CAM) was utilized for maintenance.

IONM was applied with transcranial electric stimulation motor evoked potential (MEP) (Figure 2), captured at the upper and lower limbs and somatosensory evoked potential (SEP) of the upper and lower limbs. Free and stimulated electroneuromyography captured by the corresponding muscles of levels C8-T1, L1-L2, L2-L3, L4-L5, L5-S1 and left and right anal sphincter and electroencephalogram were performed. During tumor resection, amplitude of MEP in the upper limbs was not reduced. At the end of the surgical procedure, the motor evoked responses were similar to preoperative.

Erector spinae plane block (ESP) was performed with ropivacaine 0.3% for postoperative analgesia. Dipyrone



**Figure 2.** Patient with IONM electrodes

**Source:** INCA<sup>7</sup>.

(50 mg/kg) and morphine (0.1 mg/kg) were prescribed as intravenous regular postoperative analgesia.

Children's and Infants' Postoperative Pain Scale<sup>9</sup> (CHIPPS) validated and translated to Brazilian Portuguese was applied 48 hours post operation to evaluate pain at the end of the morning and late afternoon at the first and second day.

In four months' time, the patient returned as an outpatient at the pediatric oncology, his physiological functions were regular, without complaints of pain (CHIPPS = 0) with no disability.

## DISCUSSION

IONM is increasingly used as an important tool to monitor neurological functions during surgical approach with involvement of the nervous system. This activity can help the surgeon to detect and prevent neurological damages that can be irreparable as fecal and urinary incontinence, locomotion changes. There is poor data considering IONM in pelvic/abdominal tumors resections in pediatric patients<sup>10</sup>.

The anesthesiologist arsenal should be restricted to the administration of medications and anesthetics during IONM because many of them can impact the results. Aiming to achieve the best results, the anesthesiologist should interact with the neurophysiologist for good pain control and satisfactory postoperative outcome. This scenario is a great challenge for anesthetic drugs

management. Neurophysiologic recordings should not be more important than the anesthetic technique or the latter hinder impede the recordings, except in urgent conditions or due to potential complications.

It is well known the importance of epidural anesthesia in major abdominal surgeries<sup>11</sup>, however, this technique should not be applied during neurophysiologic evaluation because the results may be compromised. In a study published in 1993 about anesthetic management in children with neuroblastoma, Kain et al.<sup>12</sup> showed that only 20 patients had less than one year of age. So far, anesthetic techniques for this population under one year of age have changed substantially with peripheral nerve block as postoperative pain control strategy, currently listed in the last update of ASA<sup>13</sup> guidelines.

The correct postoperative pain management should be prioritized in surgical planning for these patients. The inaccurate pain management can unchain complications as pneumonia, deep venous thrombosis, infections, hospital discharge delay and beginning of a chronic pain process<sup>14</sup>.

The ESP block associated with multimodal analgesic appears to be a good postsurgical alternative when analgesic drugs restriction<sup>15</sup> is imposed. Prospective, randomized, double-blind studies should be encouraged to improve and consolidate a robust multimodal anesthetic technique among the array of existing options.

A literature investigation suggests that surgical treatment of neuroblastoma can be performed safely if associated with IONM, crucial to minimize and/or avoid neurological sequelae in postoperative outcome as motor, urinary, sexual and anorectal dysfunctions which can be permanent.

Despite the continuous progress and technological advances to treat neuroblastoma as Tognonet al.<sup>16</sup> have shown, the anesthetic and surgical events continue being critical for therapeutic success in this challenging pathology. Knowing the critical and complex structural topics of anesthetic procedures are an important tool for the oncology team to reduce the morbimortality of these patients. The quality-of-life of these patients relies on good communication among the medical team.

## CONCLUSION

The case described shows that analgesic management and pain control associated with the surgical technique of choice are of the utmost importance for a successful postoperative result. An appropriate evaluation and treatment of the pain – tough task in children – are paramount if favorable outcomes of oncologic treatment are pursued. IONM is an important tool to monitor

neurologic functions during surgical procedures and the anesthesiologist should be restricted to anesthetic techniques, a great challenge for pain control closely related to good postoperative outcome.

In addition, due to scarce literature, multicenter studies should be encouraged to optimize pre, peri and postoperative management.

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### CONTRIBUTIONS

All the authors contributed substantially to the study design, analysis and/or interpretation of the data, wording and/or critical review. They approved the final version to be published.

### DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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