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Anesthetic Management in an Emergency Surgical Intervention for Supracondylar Fracture in a Pediatric Patient with Malignant Hyperthermia Susceptibility: A Case Report

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Abstract

Malignant hyperthermia is a condition that can be triggered by anesthetic agents in genetically susceptible individuals and may lead to fatal outcomes. This case report discusses the emergency surgical procedure of a 9-year-old child, weighing 40 kg, with no comorbidities and no previous surgical history, due to a left supracondylar fracture. During the preoperative evaluation, it was discovered that the patient's family had a history of malignant hyperthermia and previous genetic screening had revealed a mutation in the ryanodine receptor (RYR1) gene. The anesthetic management was carefully planned to minimize the risk of MH, with strict avoidance of triggering agents and the use of regional anesthesia supported by non-triggering sedative medications. The anesthesia machine was prepared according to MH safety protocols. No complications were observed throughout the perioperative period.

Keywords: Malignant hyperthermia, anesthesia, pediatric surgery, regional anesthesia, ryanodine receptor mutation.

Introduction

Malignant hyperthermia (MH) is a rare yet potentially fatal pharmacogenetic disorder that occurs in genetically susceptible individuals following exposure to certain anesthetic agents [1,2]. MH episodes are most commonly triggered by volatile inhalational anesthetics and depolarizing neuromuscular blocking agents, particularly succinylcholine. Advances in diagnostic capabilities, increased awareness among anesthesia providers, and the widespread availability of the specific antidote dantrolene have significantly reduced mortality [1,3]. Nevertheless, careful preoperative identification of at-risk patients and strict avoidance of triggering agents remain the cornerstone of management.

Clinically, MH is characterized by hypercapnia, muscle rigidity, rapidly increasing body temperature, metabolic acidosis, and rhabdomyolysis, and it may be fatal without prompt recognition and treatment. Therefore, especially in pediatric surgery, preventive strategies and meticulous anesthetic planning are of critical importance [4,5].

Case Presentation

A 9-year-old, 40-kg child was admitted for emergency surgery due to a left supracondylar humerus fracture. The patient had no known comorbidities and no previous history of surgery. During the preoperative evaluation, it was learned that the patient's uncle had died due to malignant hyperthermia (MH) during a surgical procedure. Following this event, family members underwent genetic screening, and the presence of a mutation in the RYR1 gene had been previously identified in the patient. Based on this history, the patient was considered MH-susceptible.

An anesthetic plan avoiding all triggering agents was established, and regional anesthesia was selected as the primary technique. To minimize residual volatile anesthetic contamination, a dedicated anesthesia machine was flushed with high fresh gas flow for one hour and vaporizers were removed.

Sedation was achieved with intravenous ketamine (20 mg) and midazolam (1 mg). Oxygen was administered via a face mask. An ultrasound-guided infraclavicular block was performed using 20 mL of 0.25% bupivacaine, providing adequate surgical anesthesia. Intraoperative hemodynamic and respiratory parameters remained stable. The surgical procedure was completed without complications. Postoperative analgesia was provided with intravenous paracetamol. No signs or symptoms suggestive of malignant hyperthermia were observed during the perioperative or early postoperative period.

Discussion

This case highlights the importance of identifying malignant hyperthermia (MH) susceptibility during preoperative evaluation and individualizing the anesthetic plan accordingly. In patients susceptible to MH, strict avoidance of volatile anesthetics and preference for regional anesthesia techniques, when feasible, are strongly recommended. In this context, sedation achieved with ketamine and midazolam-agents known not to trigger MH-proved to be a safe and effective option [6,7]. Furthermore, preparation of the anesthesia workstation by removing vaporizers and flushing the system with high fresh gas flows was consistent with international safety recommendations [4,7].

Preoperative genetic testing allows early recognition of MH risk and facilitates the implementation of preventive strategies. This case demonstrates that a safe perioperative approach can be achieved through the combined use of regional anesthesia, non-triggering sedative agents, and meticulous equipment preparation [3,8].

Conclusion

This case reinforces the importance of early recognition of MH susceptibility and demonstrates that regional anesthesia can be safely and effectively used in emergency pediatric surgery when appropriate precautions are taken.

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