



ORIGINAL ARTICLE

Ventilation with facial mask in the prone position for radiotherapy procedures in children[☆]



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Airway management;
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Abstract

Objectives: Ventilation of patients undergoing procedures in the prone position represents a challenge for the anesthesiologist, especially when trying to avoid tracheal intubation. This study aimed to test the effectiveness and safety of a prototype designed for pediatric facial mask ventilation in the prone position.

Materials and methods: A prospective descriptive study was conducted on 105 sedations performed in 3 children scheduled for radiotherapy treatment of posterior fossa desmoplastic medulloblastoma (6 and 4 y.o. males), and neuroblastoma in temporal area (4 y.o. male). Induction and maintenance of sedation were conducted with sevoflurane in oxygen, maintaining spontaneous ventilation. After achieving loss of consciousness and immobility, the patients were placed in the prone position. Their heads were fixed with the forehead and face supported by a prototype made with a cast of expanded polystyrene (EPS), which held the facial mask (connected to a Mapleson D circuit), and the back of the head immobilized with a layer of thermoplastic material. Time variables and complications were recorded.

Results: All sedations were performed according to the planned protocol. All patients maintained oxygen saturation levels above 95%, and no complications were reported. Daily hospital length of stay including the procedure and post anesthetic recovery was 54.4 ± 7.9 min (mean \pm SD).

Conclusions: The prototype and the sedation technique with face mask in the prone position employed were effective and safe, allowing the completion of the radiotherapy sessions and securing the airway in a minimally invasive way, maintaining adequate ventilation, light sedation and enabling early hospital discharge.

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PALABRAS CLAVE

Manejo de la vía aérea;
Ventilación no invasiva;
Ventilación CPAP;
Decúbito prono;
Radioterapia

Ventilación con mascarilla facial en decúbito prono para tratamiento radioterápico en niños**Resumen**

Objetivos: La ventilación de los pacientes para procedimientos en decúbito prono representa un reto para el anestesiólogo, especialmente cuando se intenta evitar la intubación endotraqueal. Presentamos un estudio concebido para comprobar la efectividad y la seguridad de un prototipo diseñado para ventilación con mascarilla facial en decúbito prono en niños.

Material y métodos: Estudio descriptivo prospectivo de 105 sedaciones realizadas en 3 niños programados para tratamiento radioterápico en decúbito prono por meduloblastoma desmoplásico de fosa posterior (2 pacientes de 4 y 6 años de edad) y neuroblastoma en área temporal (un paciente de 4 años). La inducción y el mantenimiento de la sedación se realizaron con sevoflurano en oxígeno, manteniendo ventilación espontánea. Tras la pérdida de consciencia e inmovilidad del paciente se procedía a colocarlo en decúbito prono y a fijar su cabeza con frente y cara apoyadas en un prototipo creado con un molde de poliexpan que contenía la mascarilla facial (conectada a un circuito Mapleson D,) y la parte posterior de la cabeza inmovilizada con una capa de material termoplástico. Se recogieron variables de tiempo y posibles complicaciones.

Resultados: Las 105 sedaciones se realizaron según el protocolo previsto. No se produjeron desaturaciones por debajo del 95%, movimientos durante el procedimiento ni otras complicaciones. El tiempo de estancia en el hospital incluyendo procedimiento y recuperación postanestésica fue de $54,4 \pm 7,9$ min (media \pm DE).

Conclusiones: El prototipo y técnica de sedación con mascarilla facial en decúbito prono empleados fueron efectivos y seguros permitiendo la realización del tratamiento radioterápico, asegurando la vía aérea de forma mínimamente invasiva, manteniendo la ventilación adecuada, una sedación superficial y posibilitando un alta a domicilio precoz.

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Introduction

Airway management in children undergoing surgical or diagnostic procedures in the prone position is a challenge for anesthesiologists. In these cases, the airway is usually established by means of an endotracheal tube (ET) or other supraglottic device^{1,2} that must be used under deep general anesthesia. We present the design of a prototype face mask for ventilating pediatric patients in the prone position, and report our experience using this device in 105 sedations for radiotherapy treatment.

Materials and methods

This descriptive study was approved by our hospital's independent ethics committee and signed parental consent was obtained in all cases. The study describes our experience in 3 pediatric patients undergoing craniospinal irradiation in the prone position, who were sedated on a total of 105 occasions using this device. The procedure was carried out in accordance with protocols published by the International Society of Pediatric Oncology. Two of the patients, aged 4 and 6 years, had been diagnosed with desmoplastic nodular medulloblastoma in the posterior fossa, and the third child, aged 4 years, with temporal lobe neuroblastoma. None of the patients had predictive factors for

difficult airway management, and all 3 had a Port-a-Cath® central venous line giving rapid emergency venous access. The first sedation in each patient was carried out for computed tomography (CT) virtual simulation and to create the thermoplastic mask that would immobilize the patient in the prone position. In the remaining sessions, radiotherapy was administered in the same position. All patients were given a daily dose of anti-emetics with ondansetron. Following standard monitoring techniques, and with the child's parents standing by, inhalation induction was started with the patient either sitting or supine. Anesthesia was induced with increasing concentrations of 1–8% sevoflurane until the patient lost consciousness and mobility, but continued to breathe spontaneously. Following this, the patient was turned over into the final prone position, with the forehead and face resting on a prototype created by us from a cast of expanded polystyrene that contained the face mask connected to a Mapleson D circuit (Intersurgical Ltd. Wokingham, UK), as shown in Fig. 1A and B. There was no need for venous access. Anesthesia was maintained with 2% sevoflurane in 100% oxygen, and kept above the 1.3 MAC-awake level, with spontaneous breathing and slight continuous positive airway pressure (CPAP).

After ensuring an adequate level of protection and ventilation, no undue pressure on the eyes, no leaks, and that the reservoir bag connected to the breathing circuit inflated correctly, we fitted the thermoplastic cast on the back of the

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