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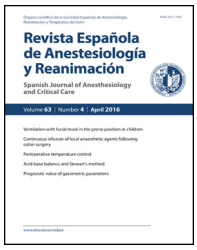

ORIGINAL ARTICLE

Descriptive study of ultrasound images of the upper airway obtained after insertion of laryngeal mask☆

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KEYWORDS
Extraglottic devices;
Ultrasound;
Upper-airway management

Abstract
Objective: To evaluate clinical usefulness of ultrasound images of the upper airway in order to check correct laryngeal mask placement.
Material and methods: A prospective observational study was conducted on patients scheduled for abdominal surgery under general anaesthesia, in whom the patency of the upper airway was ensured using an Ambu® AuraGain™ laryngeal mask. An ultrasound scan was performed of the upper-airway in the cranio-caudal direction and with longitudinal scans in the anterior midline and parasagittal axis, in three moments: before, after inserting and after removing the mask. All recorded images were evaluated for a second time by an expert radiologist in upper-airway ultrasound. Subsequently, the ultrasound data were related to the clinical difficulty of the insertion and presence of air leaks.
Results: Data were collected from 30 patients (20 females and 10 males) being operated on for abdominal hysterectomy (15), eventroplasty (6), uterine myomectomy (3), and umbilical (4) and inguinal herniorrhaphy (2). The blind insertion of the masks did not present difficulties in 24 (80%) patients. Air leakage was detected in eight (26.7%) patients, which was moderate in seven cases and severe in one. The ultrasound findings confirmed good mask placement in 22 (73.3%) patients. Anatomical airway changes after laryngeal mask extraction were only observed in three (12%) patients, all of them minor. There was a statistically significant association ($p < 0.05$) between difficulty in inserting the device and the level of air leakage.
Conclusions: Upper-airway ultrasound is a useful diagnostic method to evaluate laryngeal mask placement. Laryngeal oedema was not observed after removal of the device.

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PALABRAS CLAVE
Dispositivos supraglóticos;
Ecografía;
Manejo de vía aérea superior

Imágenes ultrasonográficas de vía aérea superior tras la inserción de mascarilla laríngea: estudio descriptivo y utilidad clínica

Resumen
Objetivo: Evaluar la utilidad clínica de la ecografía de vía aérea superior en la visualización de la mascarilla laríngea correctamente insertada.
Material y métodos: Estudio observacional prospectivo en pacientes programados para cirugía abdominal bajo anestesia general, a quienes se aseguraba la permeabilidad de la vía aérea mediante mascarilla Ambu® AuraGain™. Se llevó a cabo un escaneo ecográfico de la vía aérea superior, mediante cortes trasversales en sentido cráneo-caudal y cortes longitudinales en línea media cervical anterior y parasagital, en tres momentos: antes, tras insertar y tras retirar la mascarilla. Las imágenes registradas eran evaluadas en un segundo tiempo por un radiólogo experto en ecografía de la vía aérea. Posteriormente, se relacionaban los datos ecográficos con los clínicos de dificultad de inserción y presencia de fuga aérea.
Resultados: Recogimos datos de 30 pacientes (20 mujeres y 10 varones) intervenidos de histerectomía abdominal (15), eventroplastia (6), miomectomía uterina (3) y hernioplastia umbilical (4) e inguinal (2). La inserción a ciegas del dispositivo no presentó dificultades en 24 pacientes (80%). Detectamos fuga aérea en 8 pacientes (26.7%): moderada en 7 casos y grave en uno. Los hallazgos ecográficos confirmaban buena colocación de la mascarilla en 22 pacientes (73,3%). Se objetivaron cambios anatómicos en la vía aérea tras extraer la mascarilla laríngea en 3 pacientes (12%), todos leves. Hubo asociación estadísticamente significativa ($p < 0,05$) entre el grado de dificultad de inserción del dispositivo y el grado de fuga aérea detectado.
Conclusiones: La ultrasonografía de la vía aérea superior podría confirmar la colocación correcta de la mascarilla laríngea. No se objetivó oedema laríngeo tras la extracción del dispositivo.

Introduction

Airway management is one of the most important skills that an anaesthesiologist must master, since close to 64% of anaesthesia-related deaths are due to difficulties in securing an airway.[1,2] Supraglottic airway devices (SADs) or laryngeal mask airways (LMAs) can effectively maintain oxygenation and have several advantages over tracheal intubation (cost-effective, no need for muscle relaxation, and no laryngoscopy-related complications). This is why they are becoming increasingly popular, to the point that they are now considered the technique of choice in most interventions performed under general anaesthesia.[3]

The type and size of the SAD should be chosen on the basis of several factors, such as weight, sex, ease of insertion, seal, whether it impinges on the operating field, and airway morbidity.[4] In routine clinical practice, correct positioning of the SAD is usually confirmed by clinical signs[5,6]; in recent years, it has been done using fibrobronchoscopy[7,8] and upper-airway ultrasound.[9,10]

Ultrasound is a portable, non-invasive, easy to use, highly sensitive, and dynamic instrument that can be used when ionising radiation is contraindicated. Airway management guidelines recommend using ultrasound to confirm the correct position of the tracheal tube whenever capnography is unavailable.[11,12] It has also been used to predict difficult intubation, to guide the choice of the orotracheal tube size on the basis of objective measurements, to locate the cricothyroid membrane, to select the optimal moment for extubation, etc.[13,14] Visualisation of the SAD was hitherto thought to be impossible, unless the cuff was filled with liquid.[9] However, recent studies have shown the feasibility of ultrasound visualisation, and this could be of great help in objectively verifying the correct placement of the SAD[10,15] without the need to mobilise it, thus avoiding complications secondary to this ''blind'' manoeuvre.

The aim of this study was to evaluate the clinical utility of upper-airway ultrasound in evaluating correct placement of the Ambu® AuraGain™ LMA. Specifically, we describe the ultrasound images obtained after insertion of the LMA (comparing them with images obtained in the same ultrasound window before placement and after removal), checking for cuff-leaks, correct LMA placement, and the presence of anatomical changes or oedema after use of the LMA. Finally, we also determined the correlations between the different parameters used in the study.

Material and methods

This is a prospective observational study approved by the Hospital Ethics Committee, document number PI 17-634. We analysed data from patients scheduled for open abdominal surgery under general anaesthesia between 27 February and 31 March 2017. Only patients who had previously accepted and signed the specific informed consent form for