In vitro study of magnetic resonance imaging artefacts of six supraglottic airway devices

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Summary
We investigated the artefacts created during magnetic resonance imaging by five different laryngeal mask airways: the Classic (cLMA™); the LMA ProSeal™; the LMA Unique™; the Ambu® Disposable Laryngeal Mask; the LMA Supreme™; and one other supraglottic airway device, the i-gel supraglottic airway. The devices were placed on top of and inside a phantom simulator to resemble the position in vivo. The artefacts with the cLMA, Unique and Supreme were similar and related to ferromagnetic material in the pilot balloon valve. Artefacts were more prominent with the ProSeal. There were no artefacts with the Ambu Disposable Laryngeal Mask or the i-gel.

Methods
We evaluated six supraglottic airway devices: Classic LMA (cLMA™), LMA ProSeal™, LMA Unique™, LMA Supreme™ (all obtained from Bioser-MBA, Gijón, Spain), Ambu® Disposable Laryngeal Mask (Ambu S.I., Madrid, Spain), and i-gel supraglottic airway (i-gel; Intersurgical Spain SA, Madrid, Spain) during a magnetic resonance imaging procedure in a 1.5-Tesla MRI scanner (Philips Intera 1.5 T; MRI Medical System, Best, the Netherlands).
e.g. when cerebral haemorrhage must be ruled out. In most of these cases, T2-weighted GE images cannot be replaced by SE sequences. In the clinical setting, the need for T2-weighted GE sequences could be considered as the ‘worse case scenario’.

The artefacts of the MR images were subjectively evaluated by an expert neuroradiologist.

**Results**

The images of the different supraglottic airways with the T2-weighted GE sequences are shown in Figs 2 and 3. We chose the image in which maximal size of the artefact was shown. The artefacts of the cLMA, LMA Unique and LMA Supreme were similar and related to the ferromagnetic material in the pilot balloon valve. The magnetic susceptibility artefact was much more prominent with the LMA ProSeal (Figs 2 and 3). When we repeated the MRI of the cLMA after severing the pilot balloon, the artefacts disappeared (Fig. 4). There were no artefacts with the Ambu Disposable Laryngeal Mask nor with the i-gel (Figs 2 and 3).

**Discussion**

Radiologists are accustomed to artefacts in image interpretation; however the similarity of silicone to human tissue under imaging may make the LMA unsuitable for use with MRI [3–5]. Manufacturers of the LMA-Flexible™, LMA-ProSeal, and LMA-Fastrach™ tracheal tube all highlight the potential of these devices to create image distortion (and they also warn that the device could become warm) [6]. Añez et al. [7] reported that the LMA ProSeal distorted MRI images (1-Tesla scan) but the
cLMA yielded acceptable images in a 4-year-old patient scheduled for a brain MRI. Steven and Burden [8] found that the force exerted by the MRI magnet on an LMA-Flexible device was modest and that the cuff remained in place during the procedure (although the LMA-Flexible caused an artifact by producing a black hole around the tube).

Our data for the two devices that yielded few or no artefacts is consistent with previous reports. The Ambu Disposable Laryngeal Mask appears suitable for use with MRI [9, 10]. There appears to be only one case report on the uneventful use of the LMA Supreme for a cranial MRI exploration in a patient with cranio-cervical dystonia [11]. There are no data available on the use of the i-gel during MRI, so our data are novel in this regard.

We infer that the concentric circles of artefact in the short- and long-axis sections in Figs 2 (a), (c) and (e) and 3 (a), (c) and (e) were caused by the spring contained in the pilot balloon of the cLMA, LMA Unique and LMA Supreme, since this was the only metal part of those devices. This notion is supported by the fact that, when we severed the pilot balloon in a cLMA, the artefacts vanished (Fig. 4). The outsized artefact of the LMA ProSeal was caused by the summation of the metal in the pilot balloon and in the airway tube. The Ambu® Disposable Laryngeal Mask and the i-gel supraglottic airway do not contain any metal parts, and thus did not cause any artefacts, so these may be the most appropriate for use during MRI.

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References