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Successful Use of Laryngeal Mask Airway in Low-Weight Expremature Infants with Bronchopulmonary Dysplasia Undergoing Cryotherapy for Retinopathy of the Premature

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AFTER the initial description of the laryngeal mask airway (LMA) by Brain,[1] the use of this technique in airway management has grown considerably, and a number of review articles focusing on this novel method have been published.[2–4] The use of the LMA has been proposed for airway management in resuscitation of newborns performed by personnel inexperienced with neonatal endotracheal intubation,[5] and the LMA technique also has been suggested for use in very small neonates.[6] The aim of the current paper was to review the experience at our hospital with the use of the LMA in low-weight expremature infants, with varying degrees of concomitant bronchopulmonary dysplasia undergoing cryotherapy for retinopathy of the premature.

Case Report

The LMA was used on nine occasions in seven expremature patients undergoing cryotherapy for retinopathy of the premature under general anesthesia (M/F 3/4, postconceptual age range 34–42 weeks, weight range 1.3–2.3 kg). The author was responsible for the anesthetic on all occasions. All patients were diagnosed as having bronchopulmonary dysplasia and were treated with furosemide. Two of the patients also received inhalational steroids (Pulmicort, Draco, Lund, Sweden). Four patients had a history of frequent apnea, necessitating medication with theophylline. Two patients were treated at the time of surgery with continuous positive airway pressure *via* nasal prongs, and four additional patients received supplemental oxygen *via* nasal prongs (table 1).

The patients received no premedication and were fasted for 2–3 h before anesthesia induction. On arrival in the operating room, an intravenous cannula was inserted, if not already in place, and atropine was administered intravenously (10 μg/kg), after which an intravenous glucose-electrolyte infusion (4 $ml \cdot kg^{-1} \cdot h^{-1}$; Rehydrex, Pharmacia, Uppsala, Sweden) was started. Preoxygenation was followed by a gradual increase in inspired isoflurane to 1%. At this time, succinylcholine (2 mg/kg) was given intravenously to facilitate the insertion of the LMA, and manual ventilation was started. As soon as adequate muscle relaxation was achieved, a nasogastric tube was inserted (8 French) and was left open to room air. The nasogastric tube was left in place for the duration of the procedure (except on occasions 1 and 2; see discussion). This was followed immediately by placement of LMA size no. 1. The cuff of the LMA was inflated with 2–3 ml of air to achieve an adequate seal, as judged by an audible air leak at 15–20 cmH_2O, and manual ventilation was continued with isoflurane in a nitrous oxide/oxygen mixture, aiming for a peripheral oxygen saturation within the 88–95% range. Standard monitoring equipment, including pulse oximetry, electrocardiogram, noninvasive blood pressure, and mainstream capnography was used in all patients.

Capnography will not produce accurate measurements of end-tidal carbon dioxide in this setting but was used for early apnea detection and for trend information, indicating developing hypoventilation. After placement of the LMA, the patient was prepared and draped and the cryotherapy started. The isoflurane concentration was adjusted as clinically needed during the procedure. If the patient displayed clinically adequate spontaneous ventilation, only intermittent manually assisted breaths were provided to prevent atelectasis. However, if the patient was apneic or judged to be hypoventilating, ventilation was assisted as needed.

At the end of the procedure the isoflurane concentration was gradually decreased. The LMA was removed when the patient displayed sufficient spontaneous ventilation and opened the eyes in response to cutaneous stimulation. The patients were observed and monitored postoperatively for 24 h in the recovery room.

Results

Successful placement of the LMA, allowing adequate manual ventilation, was achieved on the first attempt on all occasions. Laryngospasm or other signs of airway irritation were not experienced at induction nor at emergence from anesthesia.

Spontaneous respiratory efforts were resumed within 3–5 min after placement of the LMA in all patients. During the cryotherapy, varying periods of apnea occurred in all patients. Intraoperative systolic blood pressures ranged between 60 and 100 mmHg. The LMA was removed successfully on all occasions. On all occasions except one (see be-

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Table 1. Patient Data

Patient No.	Sex	Gestational Age at Birth (wk)	Postconceptual Age at Surgery (wk)	Patient Weight at Surgery (kg)	BPD	Respiratory Support	Medication
1	F	26	42	2.330	Yes	Supplemental oxygen	Furosemide
2	M	24	34	1.290	Yes	CPAP	Furosemide Theophylline
3	M	24	34	1.310	Yes	Supplemental oxygen	Furosemide Theophylline
4	F	26	34	2.080	Yes	Breathing room air	Furosemide
5	F	28	39	2.025	Yes	Supplemental oxygen	Furosemide Inhalational steroids
6	M	25	36	1.605	Yes	Supplemental oxygen	Furosemide Theophylline
7	F	24	37	1.743	Yes	CPAP	Furosemide Theophylline Inhalational steroids

BPD = bronchopulmonary dysplasia; CPAP = continuous positive airway pressure.
Patients 2 and 3 underwent cryotherapy twice.

low), the patient returned to exactly the same level of respiratory support as before the operation. No ventilatory events necessitating consultation of the on-call anesthesiologist were noted during the first 24 h after the cryotherapy.

A nasogastric tube was not inserted before placement of the LMA in two cases. In the first patient, no abdominal distention was noted, and the procedure was carried out without problems. In the second patient, abdominal distention, caused by manual ventilation, was noted during the cryotherapy. This was not associated with any intraoperative problems. However, within 1–2 min after successful removal of the LMA, the infant burped, which was followed immediately by the characteristic sound of secretions in the pharynx. Pharyngeal suction revealed possible gastric regurgitations. To verify or rule out aspiration, immediate tracheal intubation combined with bronchial suction and a postoperative chest radiograph were performed. However, no signs of aspiration could be detected. The trachea was successfully extubated later the same day. At a second cryotherapy session, this patient received a nasogastric tube, which was left open to room air during the anesthetic procedure. On this occasion, no abdominal distention was noted, and the procedure was carried out uneventfully.

Discussion

Expremature patients with retinopathy of the premature and concomitant bronchopulmonary dysplasia present the anesthesiologist with a significant challenge regarding airway management. This group of patients will have an increased risk of postoperative respiratory complications.[7–9] General anesthesia with tracheal intubation will guarantee a patent airway, make positive pressure ventilation possible, and allow the anesthesiologist to remove their hand from the surgical field. However, these patients are sensitive to airway infections and often suffer from bronchial hyperreactivity.[10] Thus, inserting a foreign object into the bronchial tree will increase the risk both for respiratory infection and bronchospastic episodes. General anesthesia and tracheal intubation also is not uncommonly associated with a setback regarding the need for respiratory support, and certain patients thus will require postoperative ventilator treatment of varying duration. Another option is to use ketamine in these patients. However, this technique is not entirely satisfactory regarding the patency of the airway, and ketamine will not safeguard against the risk for intra- and postoperative apnea.[11]

The current technique avoids all intravenous sedative or anesthetic agents and exposes the patient only to isoflurane. The use of succinylcholine allowed successful placement of the LMA despite the fact that the LMA size no. 1 is not designed for use in patients within this weight range. Anesthesia was uneventful, and the patients were able to resume spontaneous ventilation at the end of the procedure on all occasions. All patients except one could return to their previous level of respiratory support immediately after the anesthetic. The only problem experienced was one occasion of abdominal distention due to manual ventilation. However, after modifying the technique by inserting a nasogastric tube before placement of the LMA, we observed no further problems with abdominal distention.

In conclusion, the LMA can be successfully used even in low-weight expremature infants with bronchopulmonary dysplasia undergoing cryotherapy for retinopathy of the premature. The above described technique

might be an option for other types of minor surgery within the first months of life in the high-risk population of expremature infants.

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The Stellate Ganglion in Magnetic Resonance Imaging: A Quantification of the Anatomic Variability

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STELLATE ganglion blockade is a well established method for the management of certain pain syndromes (*e.g.,* sympathetic reflex dystrophy, facial pain) in the cervicothoracic region and upper extremity. The stellate ganglion resides between the C7 transverse process and the head of the first rib.[1] Local anesthetics are mostly injected at the anterior tubercle of the transverse process of C6 to avoid the pleura, vessels, and nerve roots. It is necessary to know the exact anatomic position of the stellate ganglion when permanent blockade is required by means of a radiofrequency-induced lesion. Unlike during electrical stimulation of somatic nervous tissue no distinct sensory sensation or motor activation is provoked. Magnetic resonance imaging (MRI) provides excellent soft tissue contrast and direct multiplanar views[2] and was used to identify the anatomic position of the stellate ganglion in 8 patients with reflex sympathetic dystrophy. The known anatomic variability of the stellate ganglion was quantified. We report the therapeutic effects of a radiofrequency-induced lesion of the stellate ganglion after MRI-guided localization.

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Case Reports

Magnetic Resonance Imaging

The patients were scanned with a 1.5 Tesla Siemens (Erlangen, Germany) magnetic resonance system (type SP). The patient was centered in a cervical coil. Transverse and sagittal images were made at 3-mm intervals with spin echo T1-weighted pulse sequences, number of acquisitions 3, matrix 256 x^{256} from C5 to T2 and from the lateral tip of the transverse processes on one side to those on the other side. In the magnetic resonance images, in the transverse plane,