

# Use of laryngeal mask airway in anesthesia for treatment of retinopathy of prematurity

Ferim Gunenc, MD, Bahar Kuvaki, MD, Leyla Iyilikci, MD, Necati Gokmen, MD, Aylin Yaman, MD, Erol Gokel, MD.

## ABSTRACT

**الأهداف:** استعراض التجربة السريرية للتخدير باستخدام قناع التنفس الحنجري أثناء عملية التخثير الضوئي لعلاج اعتلال الشبكية عند الأطفال الخدج.

**الطريقة:** بعد الحصول على الموافقة الأخلاقية من لجنة الأخلاقيات، قمنا باستعراض سجلات تخدير خاصة بـ 85 رضيعاً خضعوا لعملية التخثير الضوئي بالليزر لعلاج اعتلال الشبكية عند الأطفال الخدج ما بين فترة يونيو سنة 2004 إلى يونيو من سنة 2010 في قسم التخدير والعناية المركزة في كلية الطب بجامعة دو كيز ايلول بمدينة ازمير، تركيا. وتمت مراجعة سجلات التخدير من أجل النظر إلى كيفية التعامل مع المجرى الهوائي والمضاعفات التنفسية، ومراجعة المعلومات الطبية والتعدادية.

**النتائج:** بلغ متوسط عمر الحمل  $28.61 \pm 2.62$  أسبوعاً، والوزن عند الولادة  $1205.24 \pm 384.51$  غ، فيما بلغ العمر المحسوب على أساس الإخصاب  $38.21 \pm 7.01$  أسبوعاً، وكان الوزن عند إجراء العملية  $2323.9 \pm 588.6$  غ. تم استخدام القناع التنفسي الحنجري عند حدوث مضاعفات قليلة لدى كافة المرضى، حتى المرضى المصابين بأمراض رئوية مُزمنة، بما في ذلك خلل التنسج القصبي الرئوي. بعد الانتهاء من علاج اعتلال الشبكية عند الأطفال الخدج، تمت إزالة القناع التنفسي الحنجري بنجاح عند جميع الرضع تحت تخدير عميق، ولم يحتاج أي من المرضى لإجراء تنبيب رغامى أو وضع جهاز التنفس الصناعي.

**خاتمة:** يُعد القناع التنفسي الحنجري بديلاً آمناً وسهلاً للاستخدام للتحكم بالمجرى الهوائي خلال إجراء عملية التخثير الضوئي باستخدام الليزر للأطفال الرضع المصابين باعتلال الشبكية.

**Objectives:** To review clinical experience of anesthesia management using laryngeal mask airway (LMA) during retinopathy of prematurity (ROP) photocoagulation.

**Methods:** After obtaining the ethical approval from the Ethics Committee, we retrospectively reviewed the anesthesia records of 85 infants who underwent laser photocoagulation for ROP between June 2004 and June

2010 at the Department of Anesthesiology and Intensive Care, School of Medicine, Dokuz Eylül University, Izmir, Turkey. Anesthesia records were reviewed for airway management and respiratory complications in addition to medical and demographic data.

**Results:** The mean gestational age was  $28.61 \pm 2.62$  weeks, birth weight was  $1205.24 \pm 384.51$  g, post-conceptional age was  $38.21 \pm 7.01$  weeks, and weight at the time of operation was  $2323.9 \pm 588.6$  g. Laryngeal mask airway was used with minimal complications in all patients, even in patients with chronic lung disease including bronchopulmonary dysplasia. After the ROP treatment, the LMA was successfully removed in all infants under deep anesthesia and none of the patients needed endotracheal intubation or ventilatory support.

**Conclusions:** Laryngeal mask airway is a safe and easy to use alternative for airway management during laser photocoagulation procedure in infants with ROP.

*Saudi Med J 2011; Vol. 32 (11): 1127-1132*

From the Department of Anesthesiology (Gunenc, Kuvaki, Iyilikci, Gokmen, Gokel) and the Department of Ophthalmology (Yaman), School of Medicine, Dokuz Eylül University, Izmir, Turkey.

Received 3rd August 2011. Accepted 19th September 2011.

Address correspondence and reprint request to: Dr. Ferim Gunenc, Department of Anesthesiology and Intensive Care, School of Medicine, Dokuz Eylül University, 35340 Inciralti, Izmir, Turkey. Tel. +90 (232) 4122833. Fax. +90 (232) 4122836. E-mail: ferim.gunenc@deu.edu.tr

**Disclosure.** Authors have no conflict of interests, and the work was not supported or funded by any drug company.

The medical problems of the premature neonate do not end with discharge from the neonatal intensive care unit. A lot of complications of prematurity can appear in the follow-up period some of which require surgical intervention. Retinopathy of prematurity (ROP) is a proliferative disease of the retinal vasculature that may cause severe visual loss, and it is a major cause of blindness in infants. The disease is a frequent complication of prematurity and occurs in over 50% of infants born before 30 weeks gestational age and a birth weight less than 1500 g.<sup>1</sup> It is widely acknowledged that numerous risk factors have been associated with the development of ROP, the most important of which are; low birth weight, early gestational age at delivery, duration of oxygen therapy, neonatal sepsis, and bronchopulmonary dysplasia.<sup>2,3</sup> It is now well recognized that noxious stimulation can evoke specific hemodynamic changes in the cortex of the preterm infants from 25 weeks. It is reasonable to presume that increasing hemodynamic responses correlate with increasing cortical activity.<sup>4</sup> Therefore, during the indirect laser photocoagulation procedure for the treatment of ROP, preterm infants require adequate analgesia and anesthesia. Premature infants are more prone to cardiorespiratory instability than full term infants of the same postnatal age. The reason of this is the immaturity of their respiratory control, which predisposes them to apnea, hemoglobin oxygen desaturation, and bradycardia. Also, there are a variety of challenging conditions in the perioperative period including: central nervous system lesions, infection, sepsis, ambient temperature fluctuations, cardiac abnormalities, metabolic derangements, anemia, upper airway structural abnormalities, necrotizing enterocolitis, drug administration (including opiates and general anesthetics), and possibly gastro-oesophageal reflux.<sup>3,5</sup> Although evidence from the literature is limited, the anesthetic technique could have an impact on the risk of postoperative respiratory depression in preterm infants. It is therefore recommended to use an anesthetic technique based on inhaled anesthetics with avoidance of muscle relaxants and opioids whenever possible.<sup>6</sup> Since the laryngeal mask airway (LMA) does not enter the trachea, it is less irritating to airways; therefore, it may be advantageous in premature infants, even in those with chronic lung disease and hyper reactive airways.<sup>7</sup> The disadvantages of laryngoscopy and tracheal intubation, such as marked increases in intraocular pressure, systemic blood pressure can also be avoided by the utilization of the LMA.<sup>7,8</sup> In addition, avoidance of muscle relaxants and a lower drug dose required to suppress the stress response for LMA insertion alleviates the pharmacological risk in the neonate.<sup>7,9</sup> In our hospital, ROP treatment for laser photocoagulation

has started in 2004. In this article our goal was to review our experiences of anesthesia management with LMA during ROP photocoagulation.

**Methods.** After obtaining the ethical approval from the Ethics Committee, we retrospectively reviewed the anesthesia records of 85 infants who underwent laser photocoagulation for ROP between June 2004 and June 2010 at the Department of Anesthesiology and Intensive Care, School of Medicine, Dokuz Eylül University, Izmir, Turkey. Since June 2010, ROP treatment is discontinued due to technical reasons related with the laser photocoagulation device. As it is the routine for this kind of patients in our clinic, the anesthesia records showed that the patient's electrocardiography (ECG), non-invasive blood pressure, peripheral oxygen saturation (SpO<sub>2</sub>), end-tidal CO<sub>2</sub> concentration, and body temperature were monitored. All patients were monitored to keep the body temperature at approximately 36.5°C. Patients' gestational age and birth weight, postconceptional age and actual body weight were also recorded. Anesthesia agents used for induction and maintenance, duration of surgery, LMA size and number of insertion attempts, duration of general anesthesia and perioperative complications could be obtained from the anesthesia records.

As in our routine anesthesia management in infants <6 months, no premedication was given and oral intake was stopped 2-3 hours before induction of anesthesia. If intravenous access was established on the ward, induction of anesthesia was performed via the intravenous route. If the patient had no intravenous access, induction of anesthesia was started with 60% N<sub>2</sub>O: 40% O<sub>2</sub>, and sevoflurane. After deep anesthesia was achieved, intravenous access was obtained and 10 µg kg<sup>-1</sup> atropine was given. Anesthesia was maintained with 60% N<sub>2</sub>O: 40% O<sub>2</sub>, and sevoflurane or isoflurane in all cases. According to our routine airway management in pediatric ophthalmic anesthesia, LMA was applied in all infants except in those who already been endotracheally intubated, those who received nasal CPAP or another respiratory support and those with a specific contraindication such as severe oropharyngeal deformities or those who have the risk of aspiration such as esophageal atresia for LMA application.<sup>10</sup> In case of gastric dilatation secondary to mask ventilation, a nasogastric catheter was placed prior to placement of LMA and removed immediately after emptying the stomach. The LMA with the semi inflated cuff was inserted with the standard method after loss of spontaneous ventilation and onset of jaw relaxation. All patients were ventilated manually during the whole

surgery. The LMA was removed under deep anesthesia. Contrary to our routine protocol in older pediatric patients, muscle relaxant was avoided in these infants undergoing photocoagulation.<sup>10-13</sup>

All statistical analyses were conducted using SPSS version 15.0. No statistical tests were used, only mean  $\pm$  SD and percentage (%) were calculated.

**Results.** Table 1 shows the demographic characteristics of the patients. Eighty-five infants underwent indirect laser photocoagulation. Forty of them were female and 45 male. Their mean gestational age was  $28.61 \pm 2.62$  weeks, birth weight was  $1205.24 \pm 384.51$  g, post-conceptional age was  $38.21 \pm 7.01$  weeks and their body weight at the time of surgery was  $2323.94 \pm 588.60$  g.

Possible risk factors associated with ROP which collected from the charts are shown in Table 2. Challenging factors for LMA use were history of respiratory distress syndrome (RDS) in 34 (40%)

cases, bronchopulmonary dysplasia (BPD) in 18 (21%) cases. Size one LMA was inserted in all patients and was placed at the first attempt in 80 (94.2%) patients and at the second attempt in 5 (5.8%). It was inserted with semi inflated cuff via the standard method. If this method failed (after one attempt) the rotational technique was tried after additional doses of induction agent.<sup>10</sup> The rotational technique is the first choice technique in our clinic for older infants and pediatric cases. This alternative technique was successful in those patients with failed first insertion attempt. There is no comparative study on LMA insertions techniques in prematures, and further studies on airway management are needed in this population. Duration of anesthesia was  $73.17 \pm 25.25$  minutes and duration of surgery  $55.23 \pm 15$  minutes.

All cases received  $10 \mu\text{g kg}^{-1}$  atropine at induction. Ten (11.7%) patients were induced with propofol ( $2-3 \text{ mg kg}^{-1}$ ), 42 (49.4%) patients with thiopental ( $5-7 \text{ mg kg}^{-1}$ ) and 33 (38.8%) patients with sevoflurane. Anesthesia was maintained with sevoflurane in 82 (96.5%) patients and with isoflurane in 3 (3.5%) patients. None of the patients received muscle relaxant and 23 (27.5%) cases received fentanyl ( $1-2 \mu\text{g kg}^{-1}$ ). Perioperative adverse events included, bronchospasm in 3 cases (3.5%) desaturation ( $\text{SpO}_2 \leq 88\%$ ) in other 3 cases (3.5%) (just after LMA insertion) and bradycardia (when heart rate is lower than 100 beat/min) in one case (1.1%). Four cases (4.7%) had desaturation and 6 patients (7.0%) developed apnea (in case of pause of respiration longer than 15 seconds or accompanied by bradycardia) postoperatively; immediately after removal of LMA.<sup>6</sup> All adverse respiratory events were managed with assisted mask ventilation immediately and atropine treatment was not required for the patient with bradycardia. Sixty-eight cases (80%) had an uneventful perioperative period. Laryngeal mask airway were removed at the end of the operation under deep anesthesia when cardiorespiratory measurements were stable with a  $\text{SpO}_2 > 90\%$ , heart rate 120-150 beats.min<sup>-1</sup>, systolic blood pressure 60-100 mm Hg, and adequate frequency and depth of spontaneous breathing. In the postoperative period, infants were observed for 30 min in a heated and oxygen supplied incubator. After transporting to the premature intensive care unit, no further adverse events or any other problems were reported.

**Discussion.** The most important risk factor for developing ROP is prematurity and low birth weight.<sup>14</sup> The survival of extremely low birth weight infants has increased in recent years, and so the incidence of patients with ROP. The preferred method to treat advanced

**Table 1** - Demographic data of 85 infants who underwent laser photocoagulation for retinopathy of prematurity.

Demographic data	Mean $\pm$ SD
Gestational age (weeks)	$28.61 \pm 2.62$
Birth weight (gram)	$1205.24 \pm 2.62$
Post-conceptional age (weeks)	$38.21 \pm 4.39$
Weight at treatment (gram)	$2323.94 \pm 588.60$
Duration of anesthesia (minutes)	$73.17 \pm 25.25$

**Table 2** - Risk factors of retinopathy of prematurity photocoagulation among 85 infants who underwent laser photocoagulation.

Risk factors	Numbers of patients (%)
Respiratory distress syndrome	34 (40.0)
Bronchopulmonary dysplasia	18 (21.2)
Intraventricular hemorrhage	13 (15.3)
Neonatal sepsis	12 (14.1)
Treatment with surfactant	8 (9.4)
Apnea	12 (14.1)
Oxygen therapy	56 (65.9)
Convulsion	3 (3.5)
Cardiovascular disease	5 (5.9)
Hyperbilirubinemia	7 (8.2)
Phototherapy	2 (2.3)
Hydrocephalus	1 (1.2)
Electrolyte imbalance	1 (1.2)
Anemia	6 (7.1)
Pneumothorax	3 (3.5)
Necrotizing enterocolitis	3 (3.5)
Pneumonia	3 (3.5)
Mechanical ventilation	9 (10.6)

stages of ROP is photocoagulation, resulting in better visual acuity and fewer complications than other methods.<sup>15</sup> All cases in our study were also treated with the laser photocoagulation method. Treatment of ROP is usually associated with significant systemic stress. Infants undergoing treatment are mostly unwell and suffering from other complications of preterm delivery. Although laser photocoagulation therapy itself may not necessarily be painful, the very strong light stimulus from the indirect ophthalmoscope and manipulation of the globe may be both stressful and painful for the infant, even if a topical anesthesia has been performed. Oxygen saturation significantly decreases, pulse rate significantly increases during physical manipulation of the eye, and variations in these parameters are usually related to significant neonatal distress. Due to the insufficient analgesia, the use of topical anesthesia alone is associated with an increased incidence of potentially life-threatening cardiopulmonary events when compared to the use of general anesthesia.<sup>16</sup> The different methods of anesthesia used during laser treatment of ROP vary widely, but no national consensus on the optimum method of anesthesia for the treatment of ROP currently exists.<sup>16</sup> We always performed general anesthesia to premature infants since the beginning of this procedure. General anesthesia is challenging in these infants due to coexisting multisystem diseases and developmental stage of many organs. It is possible for premature infants to experience cardiopulmonary events during the perioperative period of which apnea, bradycardia, and cyanosis are the most common signs.<sup>17</sup> In a survey of Chen et al,<sup>16</sup> 50% of premature infants had general anesthesia during the laser treatment, 37% patients had topical anesthesia with intravenous sedation and the remaining patients had topical anesthesia with combination of oral sedative premedication, rectal chloral hydrate or intravenous ketamine. None of the patients had topical anesthesia as a sole method. The neuroendocrine and neuroanatomical systems of neonates are sufficiently developed to perceive pain and it is known, that severe pain can increase neonatal morbidity.<sup>16</sup> General anesthesia with tracheal intubation will guarantee a patent airway, making positive pressure ventilation possible and permitting hands free anesthesia and surgical field during the therapy of ROP. However, most premature infants undergoing ROP surgery have been weaned off mechanical ventilation days or weeks before the surgery. When they are re-intubated for ROP surgery, it can be difficult to extubate them postoperatively.<sup>18</sup> Aoyama et al<sup>17</sup> retrospectively analyzed the clinical records of 29 premature infants who underwent vitrectomy for ROP between January

2005 and February 2007. Twenty-one infants had a diagnosis of chronic lung disease. All infants underwent endotracheal general anesthesia with sevoflurane and fentanyl with a mean dose of  $6.4 \mu\text{g kg}^{-1}$ . There were no intraoperative complications, except in one patient developed pulmonary edema and upper airway obstruction associated with post-extubation laryngeal oedema. Ten patients were extubated the day after the operation. Six patients required postoperative ventilatory support for more than 2 days.

Ferrari et al<sup>7</sup> studied 27 former premature infants and children with a history of bronchopulmonary dysplasia, presenting for vitrectomy. Children in the LMA group opened their eyes and were discharged home earlier than children in the endotracheal intubation tube group. From the intubation group patients, 3 developed transient respiratory complications, and the authors concluded that, unless there is a specific contraindication to the use of the LMA, such as gastroesophageal reflux, the use of the LMA can be recommended for all ophthalmic procedures. Lönnqvist et al<sup>19</sup> evaluated 7 former premature newborns undergoing cryotherapy for ROP under general anesthesia with LMA (post-conceptional age range 34-42 weeks, weight range 1.3-2.3 kg). All patients had BPD, 4 of them had a history of frequent apnea necessitating medication with theophylline and 2 patients were treated at the time of surgery with continuous positive airway pressure via nasal prongs. After atropine premedication ( $10 \mu\text{g kg}^{-1}$ ), patients were induced with gradual increase in inspired isoflurane. For successful placement of the LMA, the authors administered succinylcholine ( $2 \text{ mg kg}^{-1}$ ), and inserted the LMA at first attempt in all patients. The LMA was removed when the infant displayed sufficient spontaneous ventilation and opened the eyes in response to cutaneous stimulation. Laryngospasm or other signs of airway irritation were neither observed at induction nor at emergence from anesthesia. There is no evidence-based anesthesia protocol during the surgical treatment of ROP. Infants with bronchopulmonary dysplasia have hyperactive airways and an increased incidence of bronchospasm, atelectasis or pneumonia. These patients also have reduced alveolar development and show poor lung function lasting up to one year after birth.<sup>3</sup> Airway management is an important part of anesthesia management in premature patients per se, and if they have coexisting respiratory disease, it is more challenging. However, it is surprising, that endotracheal intubation for ophthalmic procedures (even in this high risk group) is still common. Anesthesiologists' reasons for this may be lack of experience with LMA or the need to have a more conservative airway during surgery



in these very small patients. Similar to our practice, Lönnqvist et al<sup>19</sup> and Ferrari et al,<sup>7</sup> also used the LMA, and had no need to prolonged ventilatory support. They did not use any opioids in contrary to Aoyama et al,<sup>17</sup> who used a high dose of fentanyl, which might have been the reason for the need of prolonged ventilatory support in approximately half of their patients. We observed adverse events in our study: bronchospasm in 3 cases and transient desaturation in 3 other cases occurring immediately after the LMA placement. Postoperative problems, such as bradycardia was seen in one case, desaturation in 4 and apnea in 6 cases and these events occurred just after LMA removal. From the 3 cases, in which bronchospasm occurred, one had a history of RDS, and the other 2 had history of BPD and episodes of apnea. Those who developed transient desaturation had a history of RDS (3 patients), BPD (2 patients), and apnea episodes (one patient). All adverse respiratory events were managed successfully with a short period of assisted mask ventilation.

Easy insertion and correct positioning of a LMA requires adequate depth of anesthesia to prevent airway complications. Currently, propofol is recommended as first choice induction agent for LMA insertion.<sup>20</sup> The dose of propofol required to produce adequate depth of anesthesia for LMA insertion as a sole agent in children is  $>5 \text{ mg kg}^{-1}$ , and this may produce significant cardio respiratory depressant effect. It is possible to use a lower dose, when using additional agents such as lidocaine, midazolam, muscle relaxant, and opioids in combination with propofol.<sup>20</sup> However, adjuvant agents should be used cautiously in premature infants, to prevent unwanted effects, like increase of the duration of apnea with opioids. We used fentanyl ( $1\text{--}2 \mu\text{g kg}^{-1}$ ) at induction in 23 cases (27.1%), and 6 patients developed apnea at the immediate postoperative period. Four of them had received fentanyl at induction. These patients recovered rapidly after a short duration of mask ventilation and without an opioid antagonist.

In this study, there are general limitations of retrospective studies, such as no direct comparison with another group, or some non-recorded data. Another limitation of this retrospective analysis is that there are no data according to intraoperative ventilation parameters and adverse events during the postoperative period in the neonatal intensive care unit. However, we are conducting nowadays another study about airway management in premature which is planned prospectively with a lot of data according to ventilation and oxygenation.

In conclusion, anesthesia management is an important part of photocoagulation treatment for

retinopathy of prematurity because patients undergoing such surgery are extremely vulnerable to cardiopulmonary complications. The general advantages of LMA such as its less invasiveness and lower hemodynamic stress response in comparison to the endotracheal tube should be taken into consideration in this population, too. Laryngeal mask airway can be successfully used for these procedures and further comparative studies may focus on which kind of LMA or supraglottic airway device would be the best choice for this patients.

## References

1. Weaver RG, Tobin JR. Ophthalmology. In: Cote CJ, Lerman J, Todres ID, editors. A practice of anaesthesia for infants and children. Philadelphia (PA): Saunders, Elsevier, 2009, pp. 84-699.
2. Chen M, Citil A, McCabe F. Infection, oxygen and immaturity: Interacting risk factors for retinopathy of prematurity. *Neonatology* 2011; 99: 125-132.
3. Shih TH, Chau SW, Liu CC, Chen HS, Kuo HK, Yang SC, et al. Evaluation of risk factors for post operative prolonged intubation in premature infants after cryotherapy for retinopathy of prematurity. *Acta Anaesthesiol Taiwan* 2010; 48: 62-67.
4. Slater R, Cantarella A, Gallella S, Worley A, Boyd S, Meek J. Et al. Cortical pain responses in human infants. *The Journal of Neuroscience* 2006; 26: 3662-3666.
5. Sale SM. Neonatal Apnea. *Best Pract Res Clin Anaesthesiol* 2010; 24: 323-336.
6. Larsen SW, Rasmussen LS. The former preterm infant and risk of post-operative apnea: recommendations for management. *Acta Anaesthesiol Scand* 2006; 50: 888-893.
7. Ferrari LR, Goudsouzian NG. The use of the laryngeal mask airway in children with bronchopulmonary dysplasia. *Anesth Analg* 1995; 81: 310-313.
8. Duman A, Oğün CO, Okesli S. The effect on intraocular pressure of tracheal intubation or laryngeal mask insertion during sevoflurane anaesthesia in children without the use of muscle relaxants. *Paediatr Anaesth* 2001; 11: 421-424.
9. Trevisanuto D, Micaglio M, Ferrarese P, Zanardo V. The laryngeal mask airway: potential applications in neonates. *Arch Dis Child Fetal Neonatal Ed* 2004; 89: F485-F489.
10. Balkan BK, Günenç F, Iyilikçi L, Gökel E, Yaman A, Berk AT. The laryngeal mask airway (LMA) in paediatric ophthalmic anaesthesia practice. *Eur J Anaesthesiol* 2005; 22: 77-79.
11. Lopez-Gil M, Brimacombe J, Garcia G. A randomized non-crossover study comparing the ProSeal and Classic laryngeal mask airway in anaesthetized children. *Br J Anaesth* 2005; 95: 827-830.
12. Nakayama S, Osaka Y, Yamashita M. The rotational technique with a partially inflated laryngeal mask airway improves the ease of insertion in children. *Paediatr Anaesth* 2002; 12: 416-419.
13. Kitching AJ, Walpole AR, Blogg CE. Removal of the laryngeal mask airway in children: anaesthetized compared with awake. *Br J Anaesth* 1996; 76: 874-876.
14. Wikstrand MH, Hård AL, Niklasson A, Smith L, Löfqvist C, Hellström A. Maternal and neonatal factors associated with poor early weight gain and later retinopathy of prematurity. *Acta Paediatr* 2011; 4. doi: 10.1111/j.1651-2227.2011.02394.x. [Epub ahead of print]

15. Connolly BP, Ng EY, Menamara JA, Regillo CD, Vander JF, Tasman W. A comparison of laser photocoagulation with cryotherapy for threshold retinopathy of prematurity at 10 years: part 2. Refractive outcome. *Ophthalmology* 2002; 109: 936-941.
16. Chen SDM, Sundaram V, Wilkinson A, Patel CK. Variation in anaesthesia for the laser treatment of retinopathy of prematurity-a survey of ophthalmologists in the UK. *Eye* 2007; 21: 1033-1036.
17. Aoyama K, Kondou Y, Suzuki Y, Sakai H, Oshima M, Inada E. Anesthesia protocols for early vitrectomy in former preterm infants diagnosed with aggressive posterior retinopathy of prematurity. *J Anesth* 2010; 24: 633-638.
18. Wood DD, Lambert DK, Molloy DA, Schmutz N, Righter E, Baer VL et al. Avoiding endotracheal intubation of neonates undergoing laser surgery for retinopathy of prematurity. *J Perinatol* 2007; 27: 209-213.
19. Lönnqvist PA. Successful use of laryngeal mask airway in low-weight expremature infants with bronchopulmonary dysplasia undergoing cryotherapy for retinopathy of the premature. *Anesthesiology* 1995; 83: 422-424.
20. Begec Z, Demirbilek S. Ketamine or alfentanil administration prior to propofol anaesthesia: the effect on ProSeal™ laryngeal mask airway insertion conditions and haemodynamic changes in children. *Anaesthesia* 2009; 64: 282-286.

#### Related topics

Topuz D, Postaci A, Sacan O, Yildiz N, Dikmen B. A comparison of sevoflurane induction versus propofol induction for laryngeal mask airway insertion in elderly patients. *Saudi Med J* 2010; 31: 1124-1129.

Girgin NK, Kahveci SF, Yavascaoglu B, Kutlay O. A comparison of the laryngeal mask airway and cuffed oropharyngeal airway during percutaneous dilatational tracheostomy. *Saudi Med J* 2007; 28: 1139-1141.

Izdes S, Erkilic E, Simsek M, Gumus T, Gumus T, Kanbak O. Effects of different bolus doses of remifentanyl on laryngeal mask airway insertion during day-case surgery. *Saudi Med J* 2006; 27: 1257-1259.