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General anesthesia management in 15 preterm infant undergoing diode laser photocoagulation for retinopathy of prematurity: a retrospective study

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Abstract

Anesthesia management of preterm infants is challenging for the anesthesiologist. Because of the rudimentary build of the infants, many medical and physical problems have been observed in the treatment of the disease such as complications, airway problems, temperature disregulation and deficient drug metabolism. This retrospective study evaluates the perioperative management and postoperative course in premature infants undergoing diode laser photocoagulation (DLP) for retinopathy of prematurity (ROP). We analyzed the preoperative data, anesthesia chart, and postoperative course of 15 preterm infants for general anesthesia exposures for ROP surgery. Minimum weight and gestational age at birth were 480 g and 23 weeks, respectively. Mean value of weight at birth was less than 1000 g (886,3g) differently from other studies. The mean anesthesia and surgery duration were 80,9 and 60,4 min, respectively. Paracetamol was implemented for postoperative analgesia through rectal route in 5 infants and intravenous route in 10 infants at the start of surgery. Eleven patients were extubated in the operating room and 4 infants were extubated in the following days. Birth weights of infants were between 480 and 1240 g. Supraglottic airway such as I-gel was applied in 5 infants, laryngeal mask airway (LMA) in 5 infants and endotracheal intubation (ETI) was applied in 4 infants. In the present study, we found that intraoperative complications, duration of anesthesia and surgery were acceptable and similar to those of other studies. However, the value of apnea in current study was less significant when compared to other studies,which can be correlated with intubation without muscle relaxant or post-conceptual age over 35 weeks.

Keywords: General anesthesia, preterm infant, retinopathy of prematurity

Introduction

Retinopathy of prematurity (ROP) is an ordinarily blinding eye disorder that principally affects premature infants weighing less than 1250 g and/or those born before 31 weeks of gestation [1]. ROP was first reported in the 1940s after the implementationof the oxygen therapy to premature infants, but later it was also observed in low birth weight and low gestational age. The frequency of ROP is increasing, while gestational age and birth weight are decreasing [2]. The incidence of ROP in premature infants was reported 19%-65.8% in developing countries. In the treatment of ROP, cryotherapyordiode laser photocoagulation(DLP) is applied [2]. Laser ablation is a painful procedure and should be aplied under general anesthesia. But in recent years, in some institutions, where general anesthesia is not available, laser ablation is routinly done under local anesthesia [3]. Analgesia and immobility are important for the success of general anesthesia.

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Life-threatening complications such as severe bradycardia, oxygen desaturation, apnea and cardiovascular arrest are increasing in the anesthetic management of preterm infants [4]. There is no consensus of the ideal anesthesia method yet. The purpose of present study was to review clinical experience of general anesthesia management of 15 preterm infants undergoing DLP for ROP and determine the complications during and after anesthesia.

Material and Methods

We retropectively investigate clinical data and anesthesia process of 15 preterm infants with ROP, who underwent DLP between 2014 and 2016, from anesthesia charts. This presented retrospective study was confirmed by the Institutional Clinical Research Ethics Board. This study is registereted in ClinicalTrials.gov as NCT03044366 protocol number. Neonates born under 30 weeks gestation and low birth weight under 2000 g were recruited to the study. No infant was excluded from the study. Preterm infants were evaluated before surgery and informed consent was obtained from their parents. We recorded the gestational age, the American Society of Anesthesiologists (ASA) physical status scores, post-conceptual age, the weight at birth and during surgery, the duration of anesthesia and surgery, the blood glucose values at surgery, the

management of airway, total hospitalisation period, analgesia management, the complications and comorbidities. Bradycardia (<90 beats/mean), desaturation (SpO2<90%) and arrhythmia were recorded. Electrocaridography(ECG), pulse oximetric saturation (SpO2), end-tidal carbondioxide pressure, heart rate (HR) and body temparature were monitored in the operating room. Topical 0.5% proparacaine eye drops were administered to all infants routinly. Anesthesia was induced with tiopenthal 6 mg kg-1 and fentanyl 1 µg kg-1 and it was maintained with 50% oxygen +50% air +1%-3% sevoflurane in all cases. Inhaled anesthetic agent was not preferred for induction of anesthesia because of the hypotension it causes. The premature infants were intubated by the same experienced anesthesiologist. All infants were intubated without muscle relaxant under spoantaneous ventilation. Perioperative complications, blood glucose value, devices in airway management and the extubation value were recorded. After surgery, extubation was performed when spontane ventilation was enough, and it was recorded, before all infants were taken to newborn intensive care unit (NICU). Statistical analyses were performed by using SPSS 16.0 (SPSS Inc., Chicago, IL, USA). Data are reported as mean ± SD and percentage (%).

Results

We investigated the anesthetic management of 15 preterm infants. Demographic data of preterm infantsand perinatal history are presented in Table 1. Minimum weight and gestational age at birth were 480 g and 23 weeks, respectively. Mean value of weight at birth was less than 1000 g (886,3g), which significantly differs from other studies regarding the subject.

Data of anesthesia management is given in Table 2. The mean anesthesia and surgery duration were 80,9 and 60,4 min, respectively. Paracetamol was applied for postoperative analgesia through rectal route in 5 infant and intravenous route in 10 infants at the start of the surgery. Eleven patients were extubated in the operating room and 4 infant were extubated in the following days. Six infants (40%) were reported to have undergone DLP previously. The mean blood glucose value was 70,5 at the start of the surgery and 87,8 mg dl-1 at the end of it. None of the infants required glucose supplementation during anesthesia, and the mean time of total hospital stay was 22,1 day.

Comorbidities were shown in Table 3. As is indicated in the table; one infant had atrial septal defect, three infants had patent foramen ovale, one infants had cystic fibrosis, two infants had duedonal atresia and two infants had mitral regurgitation. Detailed data of the characteristic properties is given in Table 4. Birth weights of infants were between 480 and 1240 g. Airway devices which was selected forthe security of airway could be seen at Table 4. Supraglottic airway such as I-gel was applied in 5 infants and laryngeal mask airway (LMA) in another 5 infants. Endotracheal intubation (ETI) was applied in the other 4 infants, including one in whom we could'nt perform LMA. This infant was born at 27 gestational weeks and weighed 900g at birth. On the day of the surgery, his weight was 1900g and was aged 36 weeks postconception. We could extubate this infant without any trouble. None of our patients were intubated preoperatively, but 5 preterm infants were intubated multiple times in previous days. The number of days the infants were intubated were shown in Table 4. After the operation, all patients were transferred to NICU for clinical observation.

The following intraoperative complications were observed; bradycardia (in 2 infants) and arrhythmia (in 2 infants). Surgeries were stopped because of these complications, and in all 4 infants bradycardia and arrhythmia got better without any more medical treatment. Atropin was not administered in these cases, and there was no severe apnea resulting in desaturation and hypoxia.

Table 1. Demographic data (mean±sd)

Gestational age at birth (weeks)	26,8 ± 2,9 (23-28)*
Post-conceptual age at procedure(weeks)	37,2 ± 23,5 (33-46)*
Weight at birth (g)	886,3 ± 611 (480-2700)*
Weight at procedure (g)	1923,3 ± 553 (1300-3100)*
ASA 1/2 (n)	0 / 15
Male / Female (n)	10 / 5

n: number of infants, ASA: AmericanSociety of Anesthesia, *range

Table 2. Characteristics of Anesthesia management (mean±sd)

Extubation at the end of surgery (n)	11 (73,3 %)
Intubation before surgery (n)	6 (40 %)
Total hospital stay (day)	22,1 ± 26 (2-76)*
Duration of anesthesia (min)	80,9 ± 24 (45-120)*
Duration of surgery (min)	60,4 ± 20 (35-90)*
Airway devices (n)	
Endotrachealtube	4
LMA-classic	6
I-gel	5
Peri-operative analgesia (n)	
Paracetamol (rectal/intravenous)	5 / 10
Fentanyl	15
Topical0.5% proparacaine eye drops	15
First application of ROP	9 (60 %)
Blood glucose (mg/dl)	
At the start of surgery	70,5 ± 23
At the end of surgery	87,8 ± 25

n: number of infants, LMA: laryngeal mask airway, ROP: retinopathy of prematurity, *range

Table 3. Comorbidities (n)(%)

Atrial septal defect	1 (6,6 %)
Mitral regurgitation	2 (13,3%)
Duodenal atresia	2 (13,3%)
Cystic fibrosis	1 (6,6 %)
Patent foramen ovale	3 (20,2 %)
None	6 (40%)

n: number of infants

Table 1. Demographic data (mean±sd)

Preterminfant	GA (weeks)	PCA (weeks)	Weight at birth (g)	Weight at surgery (g)	Airwaydevice	IBS (day)	Intraoperative Complication
Case 1	28	35	1050	1960	I-gel	0	None
Case 2	23	33	540	1300	ETI	76	None
Case 3	25	35	725	1900	ETI	0	None
Case 4	24	46	670	2200	LMA	0	Bradycardia
Case 5	28	40	1050	2160	I-gel	0	Apnea
Case 6	27	38	480	1500	LMA	60	Bradycardia
Case 7	26	36	1190	3100	I-gel	50	None
Case 8	27	35	760	1600	I-gel	5	None
Case 9	28	38	1240	2500	ETI	0	Arrhythmia
Case 10	25	35	810	1780	ETI	40	None
Case 11	28	38	880	1340	I-gel	0	None
Case 12	29	38	1100	1800	LMA	0	None
Case 13	28	37	1050	2100	LMA	0	None
Case 14	29	39	850	1800	LMA	0	Arrhythmia
Case 15	27	36	900	1900	LMA/ETI	0	None

GA: Gestational age, PCA: Post-conceptual age, IBS: Intubation before surgery, LMA: Laryngeal mask airway, ETI: Endotracheal intubation

Discussion

In the present study, we investigated the anesthesia application for ROP and characteristics of premature infants. The number of premature infants has been increasing over the recent years. Due to the rudimentary build of these infants, a number of medical and physical problems such as complications, airway problems, temperature disregulation and deficient drug metabolism have occured within treatment process of disease. These problems can be rather compulsive for the anesthesiologists. Anesthtetic management of premature infants is often difficult owing to multisystem disease, and the longer duration of anesthesia increases the risks of preterm infant. In the current study, the duration of anesthesia and the duration of surgery were 80,9 and 60,4 min, respectively. The data obtained from this study seems to be compatible with other similar studies in literature [5].

The inspection of ROP and DLP is painful and, contrary to common belief, it causes meaningful pain response in neonates less than 32 weeks gestational age and 1500 g birth weight. DLP causes severe pain in premature infants, and neither proparacaine nor dextrose proves to be an effective analgesic [6]. From the viewpoint of sedation/pain relief, anesthesia with air, oxygen and sevoflurane has been suggested [7]. Therefore, sedation or general anesthesia is necessary for the comfort of surgery. Immobility and analgesia are related with each other with regard to increasing the success of surgery. Ulgey et al [8] reported that ketamine and propofol as a bolus for induction reduced the need for postoperative mechanical ventilation after surgery for ROP. But et al [9] informed that anesthesia with sevoflurane+ O_2+ N_2O and with remifentanyl+midazolamwere established to be safe anesthetic access for preterm infants.

Comorbid diseases of premature infants can make the management of anesthesia rather difficult. Many diseases such as cardiovascular diseases can accompany the medical problems associated with prematurity. In present study, cardiovascular diseases such as atrial septal defect or patent foramen ovale were detected in 6 patients.

Recently, supraglottic airway (SGA) devices have been preferred for the security of airway mostly. We preferred SGA devices such as LMA and I-gel in 11 of 15 patients. We couldn't perform LMA in one infant and after this unsuccessful attemp; we were obliged to perform ETI. This can be related to multiple preoperative intubation practices. Gunenc et al [10] suggested that LMA is a safe and easy to use as an alternative method for airway management during laser photocoagulation procedure in infants with ROP. We performed I-gel in 5 infants and did not meet any difficulty during application. But, ophthalmologist complained from I-gel due to aggravated DLP.

Life-threatening complications can occur during the anesthesia management of premature infants. Some of these can be overcome easily, while others may require a more elaborate medical treatment. Litman et al [11] reported that no correlation was constituted between postoperative complications and gestational age contrary to ASA scores and body weight. The incidence of apnea after general anesthesia in infants with ROP treated with cryotherapy or laser photocoagulation was informed at the rate of 24% and the risk factors of postoperative apnea were post-

conceptual for the ones with the age less than 35 weeks and prior history of apnea [12]. Cote et al [13] reported that risk of apnea is related with gestational and postmenstrual age. There was no severe apnea resulting in desaturation and hypoxia in our study. This can be correlated with intubation performed without muscle relaxant or being over post-conceptual age of 35 weeks. Because of the risk of apnea, all patients were transferred to NICU for clinical observation and closely monitored. The number of complications seen in our patients was within acceptable range. Further studies are needed in order to find out the correlation between muscle relaxant and apnea in anesthesia management of preterm infants.

Conclusion

IIn conclusion, anesthesiologist can play an important role in the anesthetic management of preterm infants. Further studies are needed for the ideal anesthetic protocolin anesthesia management of preterm infants. We found that intraoperative complications, duration of anesthesia and surgery were within acceptable range and similar to other studies. The value of apnea in current study was less significant than that of the other studies, and this may have resulted from the intubation without muscle relaxant or being over post-conceptual age of 35 weeks.

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