ORIGINAL ARTICLE

A Population Retrospective Study on Pediatric Ambulatory Anesthesia for Ophthalmological Examination

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Abstract: We reviewed the recorded data of the pediatric ophthalmological examination during anesthesia in an ambulatory setting. Sixty-seven children (35 males, 32 females), born from July 1994 to August 2004, were ophthalmologically examined. Since some of them underwent ophthalmological examination many times, the total examinations were 145. The mean gestational age at birth was 32.8 ± 5.4 weeks. The mean birth-weight was 1,921 ± 1,181 grams. Forty-one children (63%) were preterms: gestational age 28.3 ± 2.8 weeks, birth-weight 1,087 ± 425 grams. The mean age of the children at first examination was 1.5 ± 1.5 years. Pediatric anesthetists administered both atropine and fentanyl intravenously, followed by propofol. During the anesthetic procedure, only one case of side effect was recorded. This report shows the effectiveness of both propofol and fentanyl sedation in very young children, performed in ambulatory setting and with good performance.

Key words: ophthalmologic examination, anesthesia, infant, propofol, fentanyl.

Introduction: The number of preterm infants is increasing in time. Their survival rate is ameliorating, since both the knowledge and protocols for neonatal management are better (1). The preterm infants have frequently medical problems that require follow-up for many years. In fact, the retinopathy is frequent in preterm infants (2), as they commonly require airway intubation and oxygen to treat respiratory failure because of pulmonary immaturity. The introduction of the surfactant improved both pulmonary outcome and survival (3). However, oxygen can lead to retinal damage. Since, in ex-preterm children the morbidity associated with ophthalmological disability could lead to severe handicapped children (4), an increasing number of infants affected by the retinopathy of prematurity require specialized pediatric ophthalmological approaches. These subjects, during follow-up, need sedation for the best ophthalmological examination, and an accurate observation during ambulatory anesthesia. In this context, the Pediatric Ophthalmologist can collaborate with the Pediatric Intensivist and an expert in the procedure of sedation. Even other children can need ophthalmological examination in an ambulatory setting with anesthesia.

The aim of the present retrospective study was to review the data concerning 3 years of activity of pediatric ophthalmological examination during anesthesia performed in an ambulatory setting.

Methods: The data of children enrolled for an ophthalmological visit during anesthesia at the Pediatric Ophthalmological Ambulatory Service were revisited. The children who had systemic diseases to demand the hospitalization were excluded. The anesthesiology program did not require the execution of preoperative examinations. The children needed instead a written clinical relation from their pediatricians, and a specialized pediatric visit almost 3 hours before the anesthesia.

Forty minutes after a pre-treatment with a lidocaine-prilocaine plaster (EMLA) anesthetic applied on an arm, a venous access carried out through a needle of 24 Gauge was performed. To induce anesthesia, the pediatric anesthetists administered both atropine (10-15 µg/Kg body weight) and fentanyl (1 -1.5 µg /Kg body weight) intravenously, followed by propofol (1.5-2.5 mg/Kg body weight). Boluses of 0.5 mg/Kg of body weight of propofol were administered for maintaining anesthesia. During the period of the observation the child was assisted by the anesthesiology equipment that monitored the vital signs. No muscle relaxants were used, since none of the children needed intubation. Anesthesia was maintained with assisted ventilation using a mask.

The ophthalmological visit consisted in the front and posterior ocular segments investigation through portable fissure lamp and indirect ophthalmoscope. The clinical documentation with digital images was obtained with RetCam 120 (Massie Research Laboratories, Inc, Pleasanton, CA). The measurement of ophthalmic tone was obtained by portable Perkins tonometer (Medtronic Solan, Jacksonville, FL) that calculated the ocular hypotensive effect of propofol (5). The measurement of the refraction in cycloplegia was performed by means of Retinomax Autorefractor (Right Manufacturing, Virginia Beach, VA).

At the end of the observation, the children in state of waking were able to ingest liquids after almost half an hour and to ingest solid after an hour. Therefore they were held in observation at the pediatric day hospital until the resignation carried out approximately 2-3-hours later, after the visit of a pediatrician.

Subjects: Sixty-seven children (35 males, 32 females), born from July 1994 to August 2004, were ophthalmologically examined during anesthesia at the Pediatric Ophthalmological Service of the University of Verona, Italy, from the year 2002 to 2004. Their recorded data were reviewed. The mean gestational age at birth was 32.8 ± 5.4 weeks (range 25 - 45). The mean birth-weight was 1,921 ± 1,181 grams (range 700 – 4,100). Forty-one children (63%) were born preterm: gestational age 28.3 ± 2.8 weeks (range 23 - 33), birth-weight 1,087 ± 425 grams (530 – 2,340).

In particular, 16 children (7 males, 9 females) were examined in the year 2002, 25 children (15 males, 10 females) in the year 2003 and 26 (13 males, 13 females) children in the year 2004. A total of 57 children (85.1 %) were less than 3 year-old, when admitted for the first pediatric ophthalmic visit in anesthesia, 29 of which (43.3 %) were less than 1 year of age. The children studied were anaesthetized in an ambulatory setting to perform a total of 145 ophthalmological observations (mean observations 2/each baby (range 1 –13). In fact, some children underwent ophthalmological observation in anesthesia many times. The mean age of the children, considering only the first ophthalmological visit with ambulatory anesthesia, was 1.5 year (SD ± 1.5; range 0.1-9.5). The mean

age of the children, considering the total ophthalmological visits performed in anesthesia, was 1.9 year (SD ± 1.3).

Table II. Ophthalmic diseases, number of patients examined in anesthesia for each disease, total of visits performed in anesthesia for each disease and sex distribution.

Disease	Patients (n)	Total visits (n)	Sex (M/F)
Right Retinal hamartom	1	1	0/1
Left Atrophy eye spot	1	1	1/0
Congenital bilateral cataract	3	13	0/3
Left Congenital cataract	1	1	1/0
Right Coloboma of optical and retinal nerve	1	1	1/0
Right Coloboma of optical nerve	1	1	1/0
Left Coloboma of iris and retina	1	1	0/1
Tapeto-retinal degeneration	1	1	1/0
Tapeto-retinal degeneration and bilateral cataract	2	2	1/1
Pre-retinic post-partum hemorrhage	1	1	0/1
R.O.P.	36	94	18/18
R.O.P. + Shaken baby syndrome	1	2	1/0
Familial exudative vitreoretinopathy	1	2	0/1
Congenital glaucoma	1	2	1/0
Hypertrophic iris	1	1	0/1
Corneal leucomas	1	1	1/0
Microphthamia, cataract, persistent hyperplastic primary vitreous	1	1	1/0
Neuropsychiatric patient	2	2	1/1
Retinoschisis X linked	3	6	3/0
Retinitis pigmentosa	1	2	0/1
Sclerocornea and microphthalmia	1	4	0/1
Sclerosis tuberosa	1	1	1/0
Cranio-facial syndrome, left atrophia optical nerve	1	1	0/1
Suspect congenital glaucoma	1	1	1/0
Sturge Weber syndrome	1	1	0/1
Persistent hyperplastic primary vitreous	1	1	1/0
Total	67	145	28/27

Note: ROP = Retinopathy of Prematurity

Results: Table I reports the ophthalmic diseases diagnosed and followed-up in our children. Out of 67 observed children, 57 (29 males and 28 females) showed ocular diseases of the posterior segment of the eye [retinopathy of prematurity (ROP), retinitis pigmentosa, retinoschisis X-linked, retinal hamartoma, tapeto-retinal degeneration, atrophy and coloboma of the optical nerve, FEVR (familial exudative vitreoretinopathy), post-partum pre-retinal hemorrhages]. Furthermore, 10 children (6 males and 4 females) showed diseases of anterior ocular segment of the eye (congenital cataract, congenital glaucoma, corneal leucoma, sclerocornea, microphthalmus, and persistent hyperplastic primary vitreous).

During the anesthetic procedure, we observed only one case of severe hypoglycemia in a 1.3 years old ex-preterm female, affected by residua of ROP. The complication was treated with intravenous glucose solution and intra-muscular glucagon. This child did not need further visit with this protocol.

Discussion: In this retrospective study we studied the effectiveness of the propofol in inducing and maintaining anesthesia in young children requiring ambulatory ophthalmological examination. In our survey we found a very low rate of side effects.

Currently, in less than 3 year-old children, the pediatric intensivist can perform with safety and effectiveness the "total intravenous anesthesia" (TIVA). For this purpose, the drug propofol (2, 6-diisopropylphenol) generally allows the pediatric ophthalmologist a complete ophthalmological examination, with minimal traumatism and maximum safeness in children (6-12). However, there are many controversies over the use of propofol in pediatric setting, since respiratory depression, hypotension and other rare potentially life threatening side effects are observed (12,16). On the other hand, propofol sedation has been successfully used in Emergency Department for several procedures (13), and in Pediatric Critical Care Setting (8). However, to our knowledge, no experience has been published on sedation with propofol in an ambulatory setting with the Pediatric Intensivists' assistance.

In the setting of ophthalmologic examination, atropine is used to obtain pupils dilatation. In addition it is frequently administered to all sedated children to reduce oral secretions and bradycardia complication of the anesthesia (12). Fentanyl, an opioid agent, has been widely used in pediatrics along or with propofol for stress control, analgesia and ameliorate the sedation (14, 15).

In general the propofol medication has showed a remarkable safety profile. Generally, in all our children sedated with this drug, the side effects were not so relevant to stop the examination, or to require invasive procedure of assistance. We only recorded a serious episode of hypoglycemia in one small ex-preterm 15 months old baby. The problem was successfully resolved with the hospitalization in Pediatrics Department for one night. It was due to a misunderstanding with the mother, who held the child in too prolonged fasting condition, before sedation.

Besides, no long-term sequels were observed. In our survey, the new rare and frequently fatal propofol infusion syndrome (17) was not observed.

The schemes of sedation, dosage and type of used drug, were in the past different in relation with more or less invasive sedation, necessity of intubation and age of the pediatric patients. The mean dose of propofol generally used to induce anesthesia in pediatric patients (age range: 10 days to 20.8 years) was 1.8 mg/kg, and the total mean dose of propofol used was 8.8 mg/kg, as we did. This dosage was applied also for invasive anesthesiological procedure in Intensive Care Unit setting (18). Similarly, in ambulatory setting, children (mean age: 7.5 ± 4.3 years) in elective oncology procedure were treated only with propofol at the induction doses of 2. 0 ± 0.8 mg/kg and the total propofol dose was 6.6 ± 2.3 mg/kg (19). Furthermore, the dosage applied in a prospective, double blind, randomized study was higher than that in our young children. The optimal dose combination of propofol (3 mg/kg of body weight) and fentanyl (3 mg/kg of body weight) was acceptable for 3-10 years old children requiring intubating conditions (20). Instead, another study showed a different scheme of sedation in children of about 3 years old babies in ambulatory environment. In this setting, ambulatory anesthesia was performed safely using different drugs: oxygen, nitrous oxide, and sevoflurane (21).

To our knowledge, this is the first report showing the effectiveness of both propofol and fentanyl sedation in very young children. The sedation was performed many times for some of them without side effects. It is interesting to note that the anesthesia was applied safely in ambulatory setting and for frequent ophthalmologic follow-up, particularly for ex-preterm babies. In conclusion, our drug scheme to induce and maintain the anesthesia in children less than 3 years of age is a useful and safe tool. In particular we propose therefore this methodology of intravenous anesthesia as effective for the ophthalmologic appraisal in sedation of young babies in outpatient's department.

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