Original Article

Anaesthetic management of children with Congenital Rubella syndrome for ophthalmic procedures: our experience and a review of the literature

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ABSTRACT

Background and Aims: Congenital rubella syndrome (CRS) includes hearing impairment, congenital cataract and congenital heart disease (CHD). Children with CRS may need anaesthesia for imaging as well as for ophthalmic, cardiac and cochlear implant surgeries. The anaesthetic management of children with CRS is challenging because of multiple anomalies. Aim of the study was to analyse incidence of CHD, extra cardiac manifestations, symptoms, drug therapy, mental retardation, associated anomalies and to review the anaesthetic management, postoperative course and complications in CRS patients.

Methods: This two year retrospective study was done in an ophthalmic center of a tertiary care hospital. Medical records of children with CRS who underwent ophthalmic procedures were collected, reviewed and analysed and incomplete case records were excluded.

Results: Total 46 children (28 infants, 18 >one year old) were included. Congenital cataract was present in 33 (71.7%) children. CHD was diagnosed in 42 (82.5%) children. Patent Ductus Arteriosus (PDA) was present in 32 (69.6%) children; isolated uncorrected PDA (14), corrected PDA (2), pulmonary stenosis (PS) with PDA (5). Twelve children (26.1%) had preoperative history of one or more cardiac symptoms. All patients were stable intraoperatively. Six children had postoperative complications. Three children were managed in post anaesthesia care unit. The three infants (< 60 days old) with uncorrected CHD were shifted to intensive care unit due to respiratory distress and cardiac failure.

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Conclusion: CRS is a multi-organ dysfunction with CHD; which needs multidisciplinary management for optimization. Symptomatic heart disease is a strong risk factor for postoperative complications.

Key Words: congenital rubella syndrome, cardiac anomaly, perioperative management, supra glottic device, ophthalmic surgery, cardiac failure

Introduction

Congenital rubella syndrome (CRS) is a triad of congenital malformations (Gregg's triad) which includes hearing impairment, congenital cataract and congenital heart disease (CHD).[1] Rubella infection is caused by a Toga virus of the genus Rubi virus and presents with maculopapular rashes.[2] Rubella infection causes multiple congenital malformations known as CRS with an incidence of more than 1,00,000 cases per year.[3] The incidence of congenital cataract with CHD is approximately 95% in CRS patients. CRS may also present with congenital glaucoma, pigmentary retinopathy, purpura, hepatosplenomegaly and jaundice.[4] Infants and children with CRS may need anaesthesia for imaging studies as well as for ophthalmic, cardiac, cochlear implant and cleft palate surgeries. Perioperative management of these children poses a challenge to anaesthesiologist because of presence of multiple anomalies. We reviewed perioperative course of children with CRS, who underwent ophthalmic procedures at our institute retrospectively. We aimed to analyse CHD, extra cardiac manifestations, symptoms, drug therapy, mental retardation, associated anomalies and to review the intraoperative variables i.e. type of anaesthesia, surgery, analgesia, airway, cardio-respiratory events, recovery, anaesthetic complications and postoperative course in CRS patients.

Methods

This two year retrospective study was conducted after approval from Institutional ethics committee and Clinical trial registry. Medical records of children with CRS who underwent ophthalmic procedures and examination under anaesthesia (EUA) at our institute were collected and reviewed. The data of children aged less than 10 years of age with CRS were included for analysis and incomplete case records were excluded.

Preoperative as well intraoperative variables were recorded and presented as numbers and percentage [Table1, Table2]. History of limited activity, cyanosis, cyanotic spell, forehead sweating, suck–rest-suck cycle and failure to thrive were recorded for all children. Postoperative course like cardiac failure, respiratory distress, need for ventilation and paediatric intensive care unit (PICU) care were noted. Analysis of data was done using IBM SPSS version 17 (Chicago, IL) and Microsoft excel 2010. A p value of less than 0.05 was considered to indicate statistical significance.

Table 1: Preoperative Variables of children with CRS for ophthalmic procedures

Preoperative Variables		Number of children n=46 (%)
Age (Months)	0 – 1	4 (8.7)
	>1 – 12	24(52.2)
	>12	18 (39.1)
Gender	Male	26 (56.5)
	Female	20 (43.4)
Procedure done	Cataract	33 (71.7)
	Glaucoma	4 (8.7)
	Pseudophakia	1 (2.1)
	Squint	3 (6.5)
	Ocular examination	2 (4.3)
	Aphakia	3 (6.5)
Congenital heart disease	PDA	14 (30.4)
	Device Closed PDA	1 (2.1)
	Ligated PDA	1 (2.1)
	PDA & PS	5 (10.8)
	PDA, PS & AS	2 (4.3)
	PDA & PAH	3 (6.5)
	PDA & ASD	2 (4.3)
	PDA & PFO	2 (4.3)
	PDA, AS & COA	2 (4.3)
	PS	3 (6.5)
	TOF	3 (6.5)
	ASD	1 (2.1)
	MS	1 (2.1)
	MS & PAH	1 (2.1)
	Operated TGA	1 (2.1)
Presence of Cardiac Symptoms		12 (26.1)
On Cardiac drugs		13 (28.2)
Extra cardiac Manifestations		20 (43.4)
Hearing impairment		8 (17.4)
Mental retardation (Yes/No)		15 (32.6)

PDA: Patent Ductus Arteriosus, PS: Pulmonary Stenosis, AS: Aortic stenosis, PAH: Pulmonary Artery Hypertension, ASD: Atrial Septal Defect, PFO: Patent Foramen Ovale, COA: Coarctation of Aorta, TOF: Tetrology of Fallot, MS: Mitral Stenosis, TGA: Transposition of the Great Arteries,

Table 2: Intraoperative variables of children with CRS for ophthalmic procedures

	Intraoperative Variables			Number of children n (%)
Type of anaesthesia	General	Induction technique	Inhalational	38 (82.6)
			Intravenous	6 (13.0)
	Monitored anaesthesia care (MAC)			2 (4.3)
Airway devices			Supraglottic airway device	27 (58.7)
			Endotracheal tube	15 (32.6)
			Face mask	4 (8.7)
Ventilation			Controlled / Assisted	42 (91.3)
			Spontaneous	4 (8.7)
Analgesia			Fentanyl	22 (47.8)
			Fentanyl, Paracetamol	16 (34.7)
			0.5%Proparacaine, 2% lignocaine gel	4 (8.7)
			Fentanyl, Paracetamol, Topical anaesthesia	4 (8.7)
Complications			Yes	3 (6.5)
			No	43 (93.4)

RESULTS

Total 51 cases of CRS underwent ophthalmic procedure during study period. Total 46 cases were eligible for analysis as records of five cases were incomplete (Table 1). Out of 46 children, 28 were infants and 18 were more than one year old. Congenital cataract was present in 33 (71.7%) children. Congenital cardiac anomaly was diagnosed in 42 (82.5%) children. Patent Ductus Arteriosus (PDA) was the commonest cardiac anomaly (Table 1). Three children had past history of cardiac surgery before ophthalmic procedure.

Twelve children (26.1%) had one or more symptoms of limited activity, cyanosis, cyanotic spells, forehead sweating, suck–rest-suck cycle and failure to thrive. Thirteen children (28.2%) were on cardiac drugs including beta-blockers, diuretics and digoxin. Extra cardiac manifestations like high arched palate, low set ears or delayed milestones were present in 20 (43.4%) children. Brain-stem evoked response audiometry (BERA) diagnosed hearing impairment in eight children. Mental retardation was present in 15 children.

Three children having PDA with pulmonary arterial hypertension (PAH) received oral midazolam for premedication. All intraoperative variables are tabulated in Table 2. Inhalational induction with sevoflurane was the most commonly used technique (82.6%) followed by intravenous induction in 13.6% cases. Ketamine was used as induction agent in three children with tetralogy of fallot (TOF). Thiopentone was used as induction agent in three children.

For maintenance of anaesthesia, sevoflurane in oxygen and air was used. Two ocular examinations were done under monitored anaesthesia care. A supraglottic airway device (SGD) was the most common airway device used followed by an endotracheal tube (ETT) and facemask. Controlled or assisted ventilation was used in 42 patients, while four were managed with spontaneous ventilation. Perioperative analgesia was administered with proparacaine drops, i.v. fentanyl and paracetamol at the discretion of the attending anaesthesiologist. The intraoperative course was uneventful in 43 children. Six children had perioperative complications. Children experiencing breath holding (n=1), laryngospasm (n=1) and delayed awakening (n=1) were managed successfully in the post-anaesthesia care unit. A two-month-old infant with fever had respiratory distress, as well as two neonates with cardiac failure symptoms with respiratory distress were shifted to ICU (Table 3) and managed with respiratory support and decongestive measures. After discharge from ICU, definitive cardiac intervention was advised.

Table 3: Postoperative complications in children with CRS after ophthalmic procedures

Complications	Age / Gender	Weight	Diagnosis	Cardiac Lesion	Cardiac symptoms
Fever Respiratory Distress	2 months/ Male	2.5kg	Cataract	PS ASD PDA	Previous hospitalization Forehead sweating
Respiratory distress Cardiac failure symptoms	25 Days/ Female	1.3 kg	Glaucoma	PDA PS	Tachypnea, respiratory distress, grunting and difficulty with feeding
Respiratory distress Cardiac failure symptoms	21 Days/ Female	1.2 kg	Glaucoma	Large PDA	Tachypnea, respiratory distress, grunting, and difficulty with feeding

Among three children who had intraoperative complications, two children had a PDA and one child had pulmonary stenosis (PS) with PDA. Two months old child with PS, ASD and PDA was managed in NICU and transferred to ward on second postoperative day. Child with PDA and PS was treated in NICU for four days and then discharged from the hospital. Infant who had cardiac failure due to a large PDA were managed successfully in the NICU for six days and discharged from the hospital. The type of cardiac anomaly did not correlate with perioperative complications. Extracardiac manifestations and the presence of mental retardation also did not correlate with perioperative complications. Statistically significant association was found between the presence of cardiac symptoms and postoperative ICU stay

(three of 12 children who had symptoms needed ICU care postoperatively, p=0.014).

No association was found between age and incidence of intraoperative events (p = 0.787), postoperative complications (p = 0.222) and postoperative ICU stay (p = 0.222). Sex of the child did not establish significance with intraoperative complications, postoperative complications (p =0.075 and 1.000 respectively) and ICU stay (p = 0.572).

Discussion

Rubella infection is characterized by rash, fever & lymphadenopathy. Pregnant women with Rubella infection in early pregnancy have an increased incidence of miscarriages, still births and severe congenital anomalies in the new born.[5] Gregg's triad of CRS includes hearing impairment, congenital cataract and CHD. Hearing impairment is the commonest single defect in CRS. At our institute, BERA is done in all patients preoperatively to diagnose hearing impairment in CRS patients. PDA and peripheral pulmonary artery stenosis are the most common cardiac manifestations with a 95% incidence of associated cataract.[1] In our study PDA was the most common cardiac anomaly. Other manifestations include glaucoma, mental retardation, microcephaly, developmental delay. Meningoencephalitis, panencephalitis, radiolucent bone disease, thrombocytopenia, hypothyroidism, diabetes, growth hormone deficiency and renal disorders may be associated with CRS.[4,6] WHO working definitions on various presentations of CRS are shown in Table 4.[7]

Table 4: WHO working definition [adapted from WHO guidelines]7

Suspected CRS	Clinically Confirmed CRS	Laboratory Confirmed CRS	Congenital Rubella Infection (CRI)
Infant presenting with 1) Heart disease (±) 2) Suspected deafness (±) 3) ≥ 1 of • Microphthalmos • Nystagmus • Leucocoria • Strabismus • Buphthalmos • Diminution of vision	Infant with ≥2 of following 1) Congenital glaucoma 2) Cataract 3) Pigmentary retinopathy 4) Congenital Heart Disease 5) Hard of hearing Or One finding above & 1 below 1) Purpura 2) Splenomegaly 3) Microcephaly 4) Mental retardation 5) Meningoencephalitis 6) Radiolucent bone disease 7) Neonatal jaundice	Clinically confirmed CRS & rubella-specific IgM antibody in blood (100% positive - 0-5 months & 60% positive - 6-11 months) Rubella virus can be isolated from pharyngeal and urinary samples if facility available. (60% shed rubella virus at age of 1-4 months; 30% at 5-8 months: 10% at 9-11 months)	Infant with no clinical signs of CRS, but who has a positive rubella-specific IgM

Neonates and infants with CRS are infectious as the virus spreads by droplets. Virus can be isolated from the body fluids for a year or more.[8] As cataractous lens is infectious, universal precautions should be followed during surgery.[1]

To date, there are no trials or retrospective reviews to study the anaesthetic management in this special group of population. Few case reports are available emphasizing airway management or maintenance of cardiac grid (preload, systemic vascular resistance, pulmonary vascular resistance, contractility and heart rate) in patients with CHD.[9] Ideally cardiac surgery should be done prior to eye surgery to improve outcomes. Due to various issues like long cardiac surgical waiting lists and financial constraints, we do get children presenting with uncorrected CHD for eye surgery as early cataract and glaucoma surgery is required to prevent amblyopia. In the present study only three children had undergone cardiac surgery.

There are reviews and case reports highlighting anaesthesia management of children with CHD for non-cardiac surgery. Children with uncorrected CHD have a higher incidence of perioperative complications. There is no evidence for the superiority of one anaesthesia technique over other technique.[10] Each case should be evaluated on its individual risk factors. Hariharan U et al reported a successful anaesthesia management of combined surgery for PDA closure with bilateral cataract surgery in a three months old infant with CRS.[11] Ophthalmic surgeries are of short duration with minimal hemodynamic disturbances and minimal blood loss. In CRS, the airway may also be difficult so the difficult airway cart should be available. The need for invasive monitoring should be weighed against complications and reliability of the value in CHD for the short duration ophthalmic surgery. Whilst echocardiography is valuable for assessing cardiac status perioperatively, its intraoperative use during ophthalmological surgery is not practical. Emergency cardiac drugs should be readily available and an ICU bed should be arranged in case of complicated or symptomatic CHD. Children can be monitored in PACU for 2-3 hours and then a decision can be made for shifting to the ward. In the present study, high arched palate; microcephaly and micrognathia were present in children resulting in difficult mask ventilation necessitating two hand techniques. We were able to manage the airway without complications. This may be attributed to the presence of experienced paediatric anaesthesiologists managing the airway. We preferred inhalation induction with sevoflurane for gradual depression of respiration to evaluate assisted ventilation. In the present study, fentanyl was preferred for analgesia as ophthalmic surgery is a short surgery with less painful stimuli as well as being amenable to topical anaesthesia. Controlled ventilation was achieved with atracurium in view of short duration surgery. SGD was preferred in most of the cases as the intubation and extubation responses could be avoided and IOP does not increase during its insertion and removal. Endotracheal tubes were used in neonates and in older children in case of failed SGA or inadequate ventilation with SGD. Our center is a high-volume center for paediatric ophthalmic surgeries; hence our

observations can't be generalized to other low volume centers. The intraoperative period was uneventful in all the cases.

Two infants (20 days and 24 days old), weighing less than 1.5 kg with large PDA and PHT needed urgent IOP measurement for congenital glaucoma and were not fit for general anaesthesia because of cardiac failure. In these two cases, children were wrapped in cotton towel and a pacifier was used. IOP measurement was done under topical anaesthesia with 0.5% proparacaine and oxygen supplementation.

Recovery was delayed in one child for 45minutes after the completion of surgery, without any obvious cause such as opioid overdose, incomplete muscle relaxant or hypothermia. We were unable to rule out hypothyroidism as thyroid functions were not done preoperatively. Two case reports of CRS also had delayed recovery and no definitive diagnosis was made in either cases.[12,13] In children with delayed recovery, we did not measure the temperature during perioperative anaesthetic management but we ensured to keep the child warm using blanket, top-head warming device and warm intravenous fluid. This observation needs further study. Laryngospasm after extubation was present in one case which was managed with CPAP and propofol with lowest SpO_2 of 92%. A breath holding spell occurred for 7-10 minutes in one neonate which gradually subsided and extubation was done without complication and further observation was done in PACU.

None of the children required ICU admission after transfer to PACU or the ward.

Three infants required ICU transfer due to respiratory distress and cardiac failure which was evident in the operating room. These infants were less than 60 days old and had uncorrected CHD that was being managed with diuretics. Infants were managed successfully in the NICU and discharged from the hospital.

In this present study we could not establish any association between age, gender, extra cardiac manifestations with the incidence of intraoperative events, postoperative complications and postoperative ICU stay.

The presence of cardiac symptoms in the preoperative period was found to be a strong predictor for perioperative complications. Out of twelve children who had preoperative cardiac symptoms; three (25%) with PDA (2) and PS with PDA (1) had intraoperative complications.

Conclusion

CRS is a multi-organ dysfunction with ophthalmic involvement and CHD. Anesthesiologists should be aware of other clinical manifestations and multidisciplinary management should be undertaken to optimize the clinical conditions before surgery. Children with CRS and symptomatic heart disease are a strong risk factor for perioperative complications.

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Conflicts of interest

There are no conflicts of interest.

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