orphanaesthesia

Anaesthesia recommendations for patients suffering from

Trisomy 18 syndrome

Disease name: Trisomy 18

ICD 10: Q91.1

Synonyms: Edwards syndrome; Trisomy E syndrome; Chromosome 18, Trisomy 18 Complete; Complete trisomy 18 syndrome.

Disease summary: Trisomy 18, the second most common autosomal chromosomal disorder after trisomy 21, is characteristic with the presence of an extra chromosome 18; either full, mosaic trisomy, or partial trisomy 18q. The clinical pattern is characterized by growth deficiency that starts in the prenatal period; specific craniofacial features and marked psychomotor and cognitive developmental delay. Typical craniofacial features include dolichocephaly, short palpebral fissures, micrognathia, external anomalies of the ears, and redundant skin at the back of the neck. The presence of major systemic malformations is common, and any organ and system can be affected. Cardiovascular, respiratory, ophthalmologic, musculoskeletal, genitourinary, neoplastic, neurologic, and developmental problems can occur. Prenatal and early postnatal infant mortality rates are high. The postnatal median survival of children is three to 4.5 days; approximately 50% of babies with trisomy 18 live longer than one week and only five to 10% of children survive beyond the first year. Central apnea, cardiac failure due to cardiac malformations, respiratory insufficiency due to hypoventilation, aspiration, and/or upper airway obstruction are major causes of death. Due to the short life expectancy there are ethical concerns regarding offering interventional surgical operation to the children with Edwards Syndrome.

Medicine in progress

Perhaps new knowledge

Every patient is unique

Perhaps the diagnostic is wrong

Find more information on the disease, its centres of reference and patient organisations on Orphanet: www.orpha.net

Typical surgery

The majority of the surgeries include congenital cardiac surgeries such as atrial septal defect (ASD), and ventricular septal defect (VSD) repairs, patent ductus arteriosus (PDA) ligations, pulmonary artery banding and/or cardiac catheterizations. Palliative surgeries can be preferable to corrective surgery due to ethical concerns. Also, corrective surgeries have a longer duration of surgery and anaesthesia, require more blood transfusion and carry a high risk of perioperative infection.

Other possible surgeries are interventions due to gastrointestinal anomalies such as omphalocele, malrotation, Meckel's diverticulum and gastrostomy, fundoplication, spinal fusion, polydactyly and cleft lip/palate repair, tracheostomy, placement of pressure equalization tubes, oesophageal atresia/fistula (EA/TEF) repair, repair of strabismus, and inguinal hernia repair.

Because of the elevated risk of mortality in the first month of life and the presence of significant developmental disability in the surviving children, there is a concern regarding the necessity of surgical intervention. Not only consultants' opinions but also parents' wishes to support babies may play an important role in the making the decision to proceed with the surgical operation.

Type of anaesthesia

When the surgical operation and patient profile are considered, general anaesthesia might be the best (or the only) option.

There is no data regarding the successful use of neuraxial, regional and/or local anaesthesia techniques in children with Edwards Syndrome in the literature. These techniques can be performed in older children but they might be difficult or unfeasible to perform due to spinal malformations such as scoliosis and developmental disabilities, mental retardation, and anxiety.

Necessary additional diagnostic procedures (preoperative)

Structural heart defects occur in over 90% of infants with the syndrome, and the most common cardiac lesions are atrial septal defect (ASD), ventricular septal defect (VSD), patent ductus arteriosus (PDA) and polyvalvular disease. Heart failure and early development of pulmonary hypertension induced by heart defects that can increase the perioperative mortality rates can be found. All of the patients with Edwards Syndrome should be subjected to a careful cardiovascular evaluation in the preoperative period. In addition to basic preoperative tests, hemodynamic assessment is an important component of preoperative evaluation that can effect the decisions regarding operability. Possible pulmonary complications such as pneumonia secondary to pulmonary congestion caused by cardiac dysfunction may require optimization before elective surgical repair.

Respiratory problems such as upper airway obstruction, hypoventilation and central apnoea are the most common causes of mortality. These problems can occur with both structural defects such as laryngomalacia or tracheobronchomalacia and other problems of different origin like early–onset pulmonary hypertension, feeding difficulties, recurrent aspirations and gastroesophageal reflux that can lead to severe respiratory symptoms. Obstructive sleep apnoea is reported to be more common than expected in older infants. In the presence of

one or more of these factors, perioperative airway management planning should be done carefully and cautiously.

The presence of major systemic malformations is common, and any organ or system can be affected. Although structural genitourinary defects, such as horseshoe kidney that can lead to urinary tract infections, can be seen with 25-50%, renal failure is not common. Hypotonia (in infancy), hypertonia (in older children), central apnoea and seizures are common functional neurologic problems. Functional status of cardiovascular, respiratory, musculoskeletal, genitourinary, and neurologic systems should be assessed with paediatricians.

After multidisciplinary evaluations surgical operation decision and the risks and possible complications of the operation should be discussed with the parents and their wishes should be considered. Because of ethical concerns, parents' participation in decision mechanism is particularly important.

Particular preparation for airway management

Although specific airway management difficulties such as 'cannot intubate, cannot ventilate' situations were not reported, craniofacial conditions that can affect intubation and airway management include cleft lip and palate, and micrognathia. These conditions may exist either isolated or associated with other craniofacial syndromes. Patients with isolated cleft lip usually do not have airway problems. However, cleft palate can cause difficulties during airway management. The tongue can fall into the cleft and obstruct the nasal airway. With the use of neuromuscular blockers the relaxation of the oropharyngeal musculature may allow the tongue to obstruct the oropharynx completely. Properly sized oropharyngeal airway should be ready to use with other adjuncts that can help manage the airway such as supraglottic airway devices.

Micrognathia, a hypoplastic mandible with consequent small retromandibular space, may lead to upper airway obstruction with pushing backward of the tongue onto the soft palate and posterior wall of the oropharynx. Various degrees of upper airway obstruction could result in chronic hypoxia and CO_2 retention, increased pulmonary vascular resistance, cor pulmonale and heart failure and more importantly, acute cyanotic episodes with cerebral hypoxia that may be fatal. In the operating room similar with a cleft palate situation, preparation for difficult airway management is crucial. In the postoperative period, side or prone positioning of the baby and/or use of nasopharyngeal airway may relieve the acute airway obstruction. If these methods are not sufficient, nasal continuous positive airways pressure (nCPAP) treatment may be required.

Particular preparation for transfusion or administration of blood products

There is no specific bleeding disorder/ diathesis associated with Edwards Syndrome. Due to the requirement of surgical procedures that are associated with significant blood loss such as cardiovascular procedures, it would be advisable to keep full cross-matched blood products available in the perioperative period. Also full blood count and coagulation screening is recommended particularly before major surgeries.

Particular preparation for anticoagulation

No special considerations.

Particular precautions for positioning, transport or mobilisation

Major complications and documented risk during intra-hospital transfer of critically ill children are higher than adults. After complex surgical procedures that may require intensive care follow-up postoperatively, transport of the patient to the intensive care unit should be done with great care by experienced medical staff in order to avoid adverse events such as hypotension, oxygen desaturation, arrhythmia, hypercapnia, and/or acidosis. It is reported that mechanically ventilated patients had a higher incidence of adverse events, probably related to their severity of illness.

The developmental and musculoskeletal disabilities preclude most of these children from walking independently. Thus, postoperative mobilisation is not expected for these children.

Probable interaction between anaesthetic agents and patient's long term medication

In children with Edward's Syndrome, a wide variety of medications such as anticonvulsive, neuroleptic, digitalis, diuretics, antacids and antibiotic therapy can be used for different indications. Assessment of drug interaction of anaesthetics should be done in an individual fashion.

Anaesthesiologic procedure

Due to the limited data regarding anaesthesia techniques in patients with trisomy 18, it is impossible to suggest a definite anaesthesia protocol. Anaesthetic goals in these patients with congenital heart disease and major systemic malformations include proper airway management in the perioperative period, preservation of haemodynamic stability with minimal depression of cardiac contractility particularly in the induction of anaesthesia, avoiding arrhythmias, and the maintenance of homeostasis between systemic and pulmonary circulations.

Premedication with sedatives is feasible particularly in older mentally retarded children to prevent/reduce fear and anxiety derived from separation from parents. But there is an additional risk with sedatives for children with either respiratory depression, ie, hypoventilation, or upper airway obstruction particularly for infants.

Gaining venous access may be problematic. Although most of the patients may have an intravenous (iv) line when they are brought to the operating room, anaesthesia can be induced with inhalational anaesthetics in the absence of a secured iv line. Although induction with volatile anaesthetics in congenital cardiac surgeries can have potentially deleterious effects due to compromised haemodynamic stability caused by these agents, sevoflurane appears to have less cardiac depressant effects than other halogenated agents.

Placement of central venous catheterisation may be necessary due to the procedural requirement and/or poor state of peripheral venous access. In these situations, Courreges et

al pointed out that attempting to place a subclavian catheter is an error as aberrant subclavian artery is common in Edwards syndrome.

In patients with intra-cardiac shunting, a decrease in systemic vascular resistance (SVR) due to the anaesthetic agents may result in an increase in right-to-left shunting and a decrease in the ratio of pulmonary to systemic blood flow that may lead to arterial desaturation.

The clearance of etomidate is lower in neonates and infants with congenital heart disease compared with published values for older children without congenital heart disease. In addition, etomidate pharmacokinetics are highly variable in this pediatric cardiac population. Cisatracurium is associated with faster spontaneous recovery of neuromuscular function compared with vecuronium but not with any differences in intermediate outcome measures in neonates and infants. Short acting opioids might be more beneficial in the management of haemodynamic parameters and respiration.

Particular or additional monitoring

The type of the surgery is the leading deciding factor with regards to additional monitoring requirements. Because most of the children with Edwards Syndrome have congenital cardiac defects, central venous pressure and invasive blood pressure monitoring is considered standard, particularly in cardiac and major invasive surgeries. For minor interventions and low risk surgeries invasive monitoring is optional.

Patients with PDA are more vulnerable to coronary ischemia. Therefore, these patients should be monitored closely for hemodynamic changes and for EKG changes indicating myocardial ischemia.

Possible complications

Airway obstruction, hypoventilation and hypoxemia are well-known pathologic factors that may result in increased pulmonary arterial pressure.

Gastroesophageal reflux, gastrointestinal malformations such as oesophageal atresia with tracheo-oesophageal fistula and pyloric stenosis has been reported and should be considered in the older infants as the possible cause of vomiting in the perioperative period.

Postoperative care

Respiratory problems such as upper airway obstruction, hypoventilation and central apnoea are the most common causes of mortality. Postoperative respiratory care is particularly important for these children. Some of the children may require postoperative mechanical ventilator support.

In the early postoperative course of congenital cardiac surgery, more than 20% of patients exhibit low cardiac output syndrome (LCOS), characterised by poor systemic perfusion and high vasoactive drug requirements.

Postoperative pain assessment might be problematic in patients with developmental disability because they may express pain in different ways due to the specific neurologic

disabilities. It was pointed out that there is still no standard pain measurement scales or systems for children with cognitive impairment. In these patients, observing physiological and behavioural changes is important in the assessment of pain. Facial expressions and aggressive behaviour are common indicators of pain. It is emphasized that postoperative pain management must be intended for both analgesia and anxiolysis.

Immune suppression in older children with Edwards syndrome can lead to high prevalence of infection-related deaths. Sepsis is one of the important leading factors for early postoperative mortality for these children. Prevention of life-threatening infections in the perioperative period is important.

Information about emergency-like situations / Differential diagnostics

Obstructive sleep apnoea and central apnoea are common potential problems with these patients. Opioids can cause dose-dependant inhibition of respiratory centers. The anaesthetic agents, aminoglycoside antibiotics and lithium can prolong neuromuscular blockade and potentiate the risk of postoperative apnoea.

Ambulatory anaesthesia

Not reported.

Obstetrical anaesthesia

Not reported.

Literature and internet links

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