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Trisomy 18

VACTERL association

orphanaesthesia

a project of the German Society
of Anaesthesiology and Intensive Care Medicine

SUPPLEMENT NR. 4 | 2019

OrphanAnesthesia –
ein krankheitsübergreifendes Projekt des Wissenschaftlichen Arbeitskreises Kinderanästhesie der Deutschen Gesellschaft für Anästhesiologie und Intensivmedizin e.V.

Ziel des Projektes ist die Veröffentlichung von Handlungsempfehlungen zur anästhesiologischen Betreuung von Patienten mit seltenen Erkrankungen. Damit will Orphan Anesthesia einen wichtigen Beitrag zur Erhöhung der Patientensicherheit leisten.

Patienten mit seltenen Erkrankungen benötigen für verschiedene diagnostische oder therapeutische Prozeduren eine anästhesiologische Betreuung, die mit einem erhöhten Risiko für anästhesieassoziierte Komplikationen einhergehen. Weil diese Erkrankungen selten auftreten, können Anästhesisten damit keine Erfahrungen gesammelt haben, so dass für die Planung der Narkose die Einholung weiterer Information unerlässlich ist. Durch vorhandene spezifische Informationen kann die Inzidenz von mit der Narkose assoziierten Komplikationen gesenkt werden. Zur Verfügung stehendes Wissen schafft Sicherheit im Prozess der Patientenversorgung.

Die Handlungsempfehlungen von OrphanAnesthesia sind standardisiert und durchlaufen nach ihrer Erstellung einen Peer-Review-Prozess, an dem ein Anästhesist sowie ein weiterer Krankheitsexperte (z.B. Pädiater oder Neurologe) beteiligt sind. Das Projekt ist international ausgerichtet, so dass die Handlungsempfehlungen grundsätzlich in englischer Sprache veröffentlicht werden.

Ab Heft 5/2014 werden im monatlichen Rhythmus je zwei Handlungsempfehlungen als Supplement der A&I unter www.ai-online.info veröffentlicht. Als Bestandteil der A&I sind die Handlungsempfehlungen damit auch zitierfähig. Sonderdrucke können gegen Entgelt bestellt werden.

Bisher in A&I publizierte Handlungsempfehlungen finden Sie unter:

www.ai-online.info/Orphsuppl
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OrphanAnesthesia –
a common project of the Scientific Working Group of Paediatric Anaesthesia of the German Society of Anaesthesiology and Intensive Care Medicine

The target of OrphanAnesthesia is the publication of anaesthesia recommendations for patients suffering from rare diseases in order to improve patients' safety. When it comes to the management of patients with rare diseases, there are only sparse evidence-based facts and even far less knowledge in the anaesthetic outcome. OrphanAnesthesia would like to merge this knowledge based on scientific publications and proven experience of specialists making it available for physicians worldwide free of charge.

All OrphanAnesthesia recommendations are standardized and need to pass a peer review process. They are being reviewed by at least one anaesthesiologist and another disease expert (e.g. paediatrician or neurologist) involved in the treatment of this group of patients.

The project OrphanAnesthesia is internationally oriented. Thus all recommendations will be published in English.

Starting with issue 5/2014, we'll publish the OrphanAnesthesia recommenations as a monthly supplement of A&I (Anästhesiologie & Intensivmedizin). Thus they can be accessed and downloaded via www.ai-online.info. As being part of the journal, the recommendations will be quotable. Reprints can be ordered for payment.

A survey of until now in A&I published guidelines can be found on:

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orphananesthesia

Anaesthesia recommendations for

Trisomy 18

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 characterised 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 3 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 apnoea, 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 diagnosis is wrong

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

▶ **Citation:** Oguzhan A: Trisomy 18. Anästh Intensivmed 2019;60:S75–S82. DOI: 10.19224/ai2019.S075

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 catheterisations. 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 equalisation 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 a significant developmental disability in the surviving children, there is concern regarding the necessity of surgical intervention. Not only consultants' opinions, but also parents' wishes to support their babies may play an important role in 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 able to 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, haemodynamic assessment is an important component of preoperative evaluation that can affect the decisions regarding operability. Possible pulmonary complications such as pneumonia secondary to pulmonary congestion caused by cardiac dysfunction may require optimisation 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 various 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

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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 in 25–50% of cases, 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, the 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, the participation of the parents in the 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, a 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, also 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 important, acute cyanotic episodes with cerebral hypoxia that may be fatal. In the operating room, similar to 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 a 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. In addition, full blood count and coagulation screening is recommended particularly before major surgeries.

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Particular preparation for anticoagulation

No special considerations.

Particular precautions for positioning, transport or mobilisation

Major complications and documented risk during intrahospital 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 have 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 Edwards syndrome, a wide variety of medications such as anticonvulsive, neuroleptic, digitalis, diuretic, antacid and antibiotic therapy can be used for different indications. Drug interactions with anaesthetics should be assessed individually.

Anaesthetic 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 during the induction of anaesthesia, avoiding arrhythmias, and the maintenance of homoeostasis 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 when applying sedatives to children with either respiratory depression, i.e. hypoventilation, or upper airway obstruction, particularly to 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 inhalation 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.

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In patients with intracardiac 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 paediatric cardiac population. Cisatracurium is associated with a faster spontaneous recovery of neuromuscular function compared with vecuronium, but does not display 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 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 to be the 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 ischaemia. Therefore, these patients should be monitored closely for haemodynamic changes and for ECG changes indicating myocardial ischaemia.

Possible complications

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

Gastroesophageal reflux, gastrointestinal malformations such as oesophageal atresia with tracheoesophageal 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 the patients exhibit a 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 are 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 emphasised that postoperative pain management must be intended for both analgesia and anxiolysis.

Immune suppression in older children with Edwards syndrome can lead to a high prevalence of infection-related deaths. Sepsis is one of the important leading factors for early post-operative mortality of 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-dependent inhibition of respiratory centres. 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.

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