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Predictors of Death Less Than versus More Than 90 days after Receiving a Modified Blalock-Taussig Shunt in Cyanotic Heart Children

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oomaliwa [1]

[1]Faculty of Medicine, Prince of Songkla University

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oomaliwa

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Objective

1 To determine risk factors affecting time-to-death ≤90 and >90 days in children who underwent a modified Blalock-Taussig shunt (MBTS).

Method

2 After the study was approved,all electronic records of consecutive patients aged 0-3 years admitted for MBTS between January 2005 and December 2016 were reviewed. The source of medical records and anesthetic records were from the hospital information system of Songklanagarind Hospital. All data were fully anonymized before

accessed by the investigators. Children lost to follow up were excluded.

Standard operating procedures

In the intraoperative period the anesthetic technique was designed by the anesthesiologist in charge andwas similar for all children. Anesthesia was induced with fentanyl, ketamine and/or propofol for blunt airway reflex. Cisatracurium was used for the intubation and maintenance periods. Fraction of inspired oxygen between 0.6-1 was used to restore oxygen saturation (SpO_2)greater than baseline SpO_2. Heparin was administered in a dose of 100 units per kilogram in all children before shunt placement. Shunt size selection was based on the basis of body weight, size of pulmonary artery to be shunted and surgeon preference. After the operation, inotropic support (norepinephrine or epinephrine0.05-0.1 mcg/kg/min)was commenced intraoperatively and continued through the postoperative period to maintain adequate blood pressure to promote shunt flow. All patients wereventilated postoperatively and transferred to the pediatric intensive care unit (PICU). If there was no evidence of bleeding, heparin was continuously infused for 48 h, followed by a daily oral dose of aspirin.

Predictors and potential confounding variables

The variables collected were categorized into preoperative(patient and anesthesia-related factors), intraoperative (surgery and anesthesia-related factors) and postoperative factors. Patient-related factors included age, weight at surgery, premature birth(gestational age <37 weeks), cardiac diagnosis(categorized as single ventricle, pulmonary atresia with ventricular septal defect (PA-VSD), tetralogy of fallot (TOF) and others), presentation of noncardiac abnormality(categorized as a syndrome such as heterotaxy, dextrocardia, or chronic lung disease),history of receiving a previous MBTSand preoperative inotropic drug use and ventilator support. The cardiac diagnoses of a single ventricle were pulmonary atresia, pulmonary atresia with intact ventricular septum (PAIVS), tricuspid atresia, double inlet left ventricle, double outlet right ventricle,and complete atrioventricular canal defect with pulmonary atresia. Other complex cardiac diseases includedtransposition of great arteries (TGA), total anomalous pulmonary venous return (TAPVR) and hypoplastic left heart syndrome. Anesthesia-related factors included American Society of Anesthesiologists (ASA) classification(2-4), intraoperative inotropic drug use, intraoperative cardiac failure (requiring at least 2 inotropic drugs), intraoperative hemodilution (requiring phlebotomy to keep hematocrit <60% before surgery), intraoperative hypoxemia (SpO_2<75%), intraoperative hypoxic spell (acute hypoxemia with response to fluid and sodium bicarbonate administration) and bradycardia (heart rate below baseline by child's age with required atropine). Surgery-related factorsincluded shunt size, duration,postoperative SpO_2, duration of postoperative mechanical ventilator use, length of intensive care unit (ICU) stay, length of hospital stay, postoperative complications(shunt thrombosis, bleeding, pneumothorax, perigraft seroma, chylothorax, sepsis, renal failure), required shunt revision and reoperative thoracotomy during admission and readmission within 30 days. Shunt thrombosis was defined as loss of shunt murmur combined with no shunt flow diagnosed by echocardiography. Pneumothorax was defined as abnormal collection of air into the pleural space diagnosed by chest X-ray or computed tomography (CT) scan. Perigraft seroma was defined as collection around prosthesis diagnosed by a pediatric cardiologist.Chylothorax was defined as the presence of chylein the pleural spaces.Sepsis was diagnosed as presumed or proven infection with systemic inflammation. Renal failure was diagnosed as a doubling of baseline serum creatinine level as recorded on admission to PICU.Total number of MBTS operations and other surgeries related to MBTS was defined as the total number of MBTS operations that the patient received previously and currently including shunt revision and reoperative thoracotomy related to complications (hemothorax, chylothorax, diaphragmatic plication) after MBTS in all admissions.

Outcomes of interest

Outcomes of interest weretime-to-deathdefined as the time from postoperative MBTS to death ≤90 days and >90 days. Censored was defined as the time of postoperative MBTS to time of progression to the next stage or when data collection ended (December 31, 2017) if the child was still alive without progression to the next stage of repair. The next stages of repair were biventricular repair or Glenn's operation for univentricular

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