Risk Factors of Prolonged Postoperative Pleural Effusion After Repair of Tetralogy of Fallot

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Background: Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart disease, and total correction is the definitive treatment. Chest tube drainage of pleural effusion (PE) is essential after surgery. Prolonged PE (> 7 days) is one of the complications; it may increase hospital stay and the risks of morbidity and mortality. The aim of this study was to investigate and analyze the possible risk factors for prolonged PE after total correction of TOF.

Methods: Thirty-seven patients who received total correction of TOF between July 1999 and April 2001 were included in this study. They were divided into 2 groups according to the duration of chest tube drainage for postoperative PE: Group I had postoperative PE ≤ 7 days; Group II had postoperative PE > 7 days. Detailed records were taken on patients' demographic characteristics, blood parameters, surgery, electrocardiographic and radiologic data, and angiographic and echocardiographic findings. The data of the 2 groups were compared using the Wilcoxon rank-sum test and Fisher's exact test. Risk factors were analyzed by logistic regression and model selection.

Results: Of the 37 patients, 16 were male and 21 were female. There were 32 patients (86.5%) in Group I and 5 (13.5%) in Group II. Mean patient age at repair was 1.82 ± 1.29 years (range, 0.53–3.11 years). Significant differences ($p < 0.05$) between the 2 groups were noted for gender, age at repair, body weight, presence of wound infection, duration on heart-lung machine (bypass time), oxygen saturation before surgery, duration of endotracheal intubation, length of hospital stay, and Nakata index. These risk factors were analyzed by logistic regression and model selection. Two models were set up: Model 1 – oxygen saturation before surgery, presence of wound infection, age at repair; Model 2 – oxygen saturation before surgery, presence of wound infection.

Conclusion: Prolonged PE is a significant morbidity after TOF repair. The risk factors for prolonged PE are gender, age at repair, body weight, bypass time, low oxygen saturation before surgery, wound infection after surgery, duration of endotracheal intubation, length of hospital stay, and Nakata index. Oxygen saturation before surgery and wound infection were major risk factors while age at repair was a confounder. [*J Chin Med Assoc* 2005;68(9):406–410]

Key Words: pleural effusion, tetralogy of Fallot

Introduction

Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart disease, accounting for approximately 12% of congenital cardiac lesions. Definitive repair of TOF consists of closure of the ventricular septal defect (VSD) and relief of the right ventricle outflow tract (RVOT) obstruction. The technique to relieve RVOT obstruction is dictated by the type of obstruction that exists. Techniques range from simple pulmonary valvotomy/valvectomy to subpulmonary infundibular resection and patch augmentation of a hypoplastic pulmonary annulus, area of pulmonary artery hypoplasia, stenosis, or atresia (with RVOT reconstruction).[1] The best age to perform definitive repair depends on the individual anatomic features,

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particularly the size and distribution of the pulmonary artery tree (ex. McGoon ratio, Nakata index). Chest tube drainage of pleural effusion (PE) is essential after surgery. Many studies have found risk factors for mortality after total corrective surgery, including tricuspid regurgitation, pulmonary regurgitation, renal dysfunction, late ventricular dysfunction, and other late complications.[2–10] Prolonged PE after surgery for congenital heart disease is also an important morbidity factor, and it may result in extended hospitalization. The purpose of this retrospective study was to investigate and analyze the possible risk factors for prolonged PE after total surgical correction of TOF.

Methods

Thirty-seven patients who received total correction of TOF between July 1999 and April 2001 were included in this study. They were divided into 2 groups according to the duration of chest tube drainage for postoperative PE: Group I had postoperative PE ≤ 7 days; Group II had postoperative PE > 7 days.

Detailed records were taken on patients' demographic characteristics, blood parameters, surgery, electrocardiographic and radiologic data, as well as angiographic and echocardiographic findings. Demographic data included gender, age at repair, body weight and surface area, prior Blalock-Taussig (B-T) shunt, duration of follow-up, associated cardiac lesions, inotropic drugs used, and preoperative oxygen saturation. Blood laboratory parameters included white blood cell counts, hemoglobin, hematocrit, platelets, C-reactive protein, prothrombin time (PT), and activated partial thromboplastin time (APTT). Surgical data included patients' perioperative condition, duration on the heart-lung machine, aortic clamp time, pleural volume on days 1, 7, 14 and long term (> 1 month), length of hospital stay, duration of endotracheal intubation, and any wound infection. Electrocardiographic and radiologic data included mean RR interval, superior QRS axis, QRS duration, low QRS voltage, ventricular premature contractions (Lown grade), and C/T ratio. Angiographic data were the McGoon ratio and Nakata index, while echocardiographic findings included residual VSD, pulmonary stenosis, regurgitation, tricuspid regurgitation, ejection fraction (EF), and fraction of shortening (FS).

Statistical analysis

Descriptions of basic data, such as age and gender, were presented as mean ± standard deviation (SD), range, percentage or median. The data of the 2 groups were compared using the Wilcoxon rank-sum test for continuous data and Fisher's exact test for categorical data. Statistical significance was set at a p value of less than 0.05. Risk factors were analyzed by logistic regression and model selection.

Results

Of the 37 patients, 16 were male and 21 were female. There were 32 patients (86.5%) in Group I (postoperative PE ≤ 7 days) and 5 (13.5%) in Group II (postoperative PE > 7 days). Mean patient age at repair was 1.82 ± 1.29 years (range, 0.53–3.11 years). Five patients (13.5%) had a previous B-T shunt. The mean follow-up period was 1.2 ± 0.89 years (range, 0.08–3.0 years). Body weight at repair was 9.64 ± 2.78 kg (range, 1.75–17.5 kg), and body surface area at repair was 0.45 ± 0.97 kg/m^2 (range, 0.28–0.73 kg/m^2). Mean duration of hospital stay was 19.2 ± 12 days (range, 3–56 days) (Table 1).

Significant differences ($p < 0.05$) between the 2 groups were noted for gender, age at repair, body weight, presence of wound infection, duration on heart-lung machine (bypass time), oxygen saturation before surgery, duration of endotracheal intubation, length of hospital stay, and Nakata index. Tables 2 and 3 show these continuous and categorical data by group. These risk factors were then analyzed by logistic regression and model selection. Two models were

Table 1. Demographic data for Group I (postoperative PE ≤ 7 days) and Group II (postoperative PE > 7 days) patients

Group	*n* (%)	Age at repair (yr)	M/F (*n*)	Body weight (kg)	BSA (kg/m^2)	Previous B-T *n* (%)	Follow-up (yr)	Duration of hospital stay (d)
I	32 (86.5)	3.96 ± 1.06	12/20	9.27 ± 2.42	0.44 ± 0.08	4 (12.5)	1.18 ± 0.94	19.78 ± 12.77
II	5 (13.5)	2.53 ± 2.36	4/1	11.00 ± 4.28	0.49 ± 0.15	1 (20.0)	0.72 ± 0.45	24.60 ± 10.50
Total	37 (100)	1.82 ± 1.29	16/21	9.64 ± 2.78	0.45 ± 0.97	5 (13.5)	1.20 ± 0.89	19.24 ± 12.07

BSA = body surface area; B-T = Blalock-Taussig shunt; F = female; M = male; PE = pleural effusion.