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ORIGINAL ARTICLE

Morbidity After Cardiac Surgery in Patients With Adult Congenital Heart Disease in Comparison With Acquired Disease

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Q5 **Background** Due to the advancements in congenital cardiac surgery and interventional cardiology in the last five decades, more than 85% of congenital heart patients now survive to adulthood.

Methods This retrospective study included 135 Adult Congenital Heart Disease (ACHD) patients, who had cardiac surgery at Southampton General Hospital over three consecutive years. We also included 42 patients with a structurally normal heart who had cardiac surgery for acquired cardiac conditions as a control group. Preoperative, intraoperative and postoperative data were analysed in both groups to identify risk factors for morbidity and mortality.

Results In the ACHD group, in hospital mortality was 0.7%. In the control group no deaths were observed. Fifty-eight per cent of the ACHD patients had significantly higher perioperative morbidity with arrhythmias (26%), bleeding (3%), prolonged ventilation (11.3%) and renal replacement therapy 1.5%. In the non ACHD Q6 control group 32% ($p = 0.003$) developed perioperative complications with arrhythmias (9.8%), bleeding (2.5%), prolonged ventilation (4.3%) and renal replacement therapy (2.5%). In ACHD patients total in-hospital stay was longer in patients with longer cardiopulmonary bypass (CPB) time ($p = 0.005$), aortic cross clamp time ($p = 0.013$) and higher preoperative alkaline phosphatase level ($p = 0.005$). Early post-operative complications were higher in ACHD patients with longer cardiopulmonary bypass time ($p = 0.04$) and presence of pulmonary artery hypertension ($p = 0.012$).

Conclusions Even though the preoperative and operative characteristics are similar to both groups, the morbidity is more in ACHD group. Longer CBP time, aortic cross clamp time and presence of pulmonary hypertension are risk factors for higher morbidity in this group.

Keywords Morbidity • Adult congenital heart disease • Cardiac surgery • Complications

Introduction

Q7 It is widely accepted that Adult Congenital Heart Disease patients are growing in numbers due to the developments in both medical care and surgical techniques over the last 30 years. Currently, more than 85% of patients with congenital heart disease survive to adulthood [1]. This number will inevitably increase over time until a new equilibrium is

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reached, [2] in which the number of adult patients with congenital heart disease exceeds the number of children with congenital heart disease [3]. These patients are expected to undergo repeat surgical interventions for various reasons. The complexity of the anatomy of their cardiovascular system is challenging for both medical and surgical teams involved in the care of these patients. Currently, little data is available on outcomes and morbidity of cardiac surgery in adult congenital heart disease. The overall surgical mortality in this patient group varies from 1.7% to 6.3% [4–6]. The mortality in patients with moderate to severe complexity according to modified Canadian Consensus Conference criteria is up to 10.6% [7]. The scoring systems designed to predict the overall mortality e.g. EuroScore, [4] Ontario, Parsonnet and STS are well recognised not to predict outcome accurately in this group. These scoring systems tend to overestimate the risk in low complexity patient groups and underestimate the risk in severe complexity patient groups [3,7]. The ARISTOTLE score was weakly associated with postoperative mortality and remains invalidated in this cohort [8].

Patients and Methods

Patients and Operation Details

This was a retrospective, single centre study done at Southampton University Hospitals Foundation Trust, UK. The study included 135 ACHD patients (male 69, female 66), who had cardiac surgery at Southampton University Hospital over three consecutive years. The mean age was 35 (17–77) years. Specialised congenital cardiothoracic surgeons operated on these patients. Also, these ACHD patients were looked after by dedicated adult congenital cardiologists during the perioperative period. In the control group, adult cardiothoracic surgeons performed all the operations (Table 1). In the ACHD group, the patients were above 17 years of age at the time of the surgery. Patients with Fontan surgery, Marfan syndrome and patients with bicuspid aortic valve in the ACHD group were excluded from the study. Diagnosis for each group is summarised in Table 2. Forty-three consecutive age-matched patients (male 28, female 15) with acquired heart disease that underwent cardiac surgery during the same time period were also included in the study as a control group. The mean age for control group was 43 (range 21 to 51).

Table 2 Diagnosis.

Control	ACHD
Bicuspid aortic valve/Marfan	Septal defects
Rheumatic heart disease	AVSD/double outlet RV
Constrictive pericarditis	Aortic coarctation
Aortic rupture/dissection	Congenital AS/sub AS
Ischaemic heart disease	TOF/Pulmonary atresia
Infective endocarditis	Infective endocarditis
Atrial myxoma	Prosthesis failure

Abbreviations: ACHD: Adult congenital heart disease, AVSD: Atrioventricular septal defect, RV: Right ventricle, AS: Aortic stenosis, TOF: Tetralogy of Fallot.

Data and Statistics

Hospital medical and surgical electronic database was used to identify consecutive patients. Demographic and preoperative, intraoperative and postoperative clinical data was collected from hospital records. Preoperative data included demographics, previous cardiac diagnosis and previous cardiac surgeries, left and right ventricular function, ejection fraction from the recent cardiac MRI, preoperative chest X-ray findings, full blood count, renal function, liver function, thyroid function, preoperative co-morbidities (hypertension, diabetes, stroke, ischaemic heart disease, congestive heart failure), preoperative arrhythmias, lung function, history of smoking and presence of pulmonary hypertension. Intraoperative data included cardiopulmonary bypass time, aortic cross clamp time, type of cardioplegia, type of surgery, number of procedures, and basic ARISTOTLE score for each operation and presence of intraoperative complications. Postoperative outcomes included immediate or early postoperative complications (pneumonia, renal failure requiring renal replacement therapy, early reoperation due to bleeding, prolonged ventilation, pneumo/haemothorax, stroke, wound complications, prolonged chest drains, dysrhythmia requiring medical therapy, heart block requiring permanent pacemaker) and total intensive care unit stay and total in-hospital stay. For all patients, preoperative and

Table 1 Procedures performed.

ACHD group	Control group
Septal defect repairs: 52	Coronary artery bypass grafting: 12
Pulmonary valve replacement: 25	Aortic valve replacement: 16
Aortic valve replacement: 19	Mitral valve repair: 8
Aortic coarctation repair: 7	Mitral valve replacement: 3
Other (including mitral and tricuspid valve replacement/repair): 32	Aortic root replacement: 4

Abbreviation: ACHD: Adult Congenital Heart Disease.

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