Facteurs de risque de complications post-opératoires et de réinterventions dans la réparation du canal atrioventriculaire complet : impact du statut chromosomique

Risk Factors for Postoperative Complications and Reintervention in Complete Atrioventricular Canal Repair: Impact of Chromosomal Status

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Summary

Objective: To identify independent predictors of early mortality in complete atrioventricular canal (CAVC) repair and determine whether Down syndrome (DS) status independently predicts surgical outcomes.

Methods: Retrospective analysis of 56 consecutive patients with isolated, balanced CAVC (1994–2012). Univariate and multivariable logistic regression examined 7 preoperative and anatomic factors.

Results: Early mortality occurred in 11 of 56 patients (19.6%). Univariate analysis identified preoperative weight <5 kg (P=0.04), Down syndrome (P=0.12), and mitral regurgitation ≥grade III (P=0.56) as potential risk factors. In multivariable analysis, weight at surgery <5 kg was the sole independent predictor of early mortality (adjusted odds ratio 28.4; 95% confidence interval, 1.4–563; P=0.02). Down syndrome status was not independently associated with mortality (P=0.24).

Conclusions: In this series of 56 CAVC patients, preoperative weight—not chromosomal status—independently predicted early postoperative mortality. These findings support early identification and surgical timing while providing reassurance that chromosomal status per se does not confer independent surgical risk.

Keywords

atrioventricular canal defect; Down syndrome; surgical outcomes; risk factors; congenital heart disease

Résumé

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Mots-clés

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INTRODUCTION

Complete atrioventricular canal (CAVC) defect, also called endocardial cushion defect or atrioventricular septal defect, represents 1–2% of all congenital heart lesions and is the most common cardiac malformation in Down syndrome (DS), occurring in 30–40% of DS patients compared with <0.1% in euploid populations [23]. The anatomic hallmark is a common atrioventricular valve (regurgitation and stenosis are frequent), ostium primum atrial septal defect, and inlet ventricular septal defect.

Surgical repair—performed in infancy or early childhood—has become standard therapy, with early mortality rates typically 5–25% depending on anatomic complexity and institutional experience [1]. Prior studies have identified age at surgery, weight at surgery, degree of valve dysplasia, and associated cardiac anomalies as potential risk factors; however, the independent effect of Down syndrome status on surgical outcomes remains debated [6,8,10].

This study re-analyzes our 56-patient CAVC cohort with a focused objective: to identify independent predictors of early mortality by comprehensively examining seven preoperative and anatomic factors, with explicit attention to whether Down syndrome status independently predicts surgical outcome.

METHODS

Study Design and Population

This was a retrospective analysis of 56 consecutive patients with isolated, balanced CAVC (n=56; Down syndrome, n=44 [78.6%]; euploid, n=12 [21.4%]) undergoing surgical repair between 1994 and 2012 at CHU La Rabta, Tunis, Tunisia. Patients with other complex cardiac lesions or major extracardiac malformations were excluded. The study was approved by the Institutional Ethics Committee of CHU Sahloul, Sousse.

Data Collection

Preoperative variables included age at diagnosis, age at surgery, weight at surgery, chromosomal status (karyotype or FISH), and hemodynamic parameters derived from echocardiography: left atrioventricular valve regurgitation grade (0–IV), and anatomic features (valve dysplasia, associated cardiac anomalies). Surgical data included technique (single vs two-patch method) and presence of mitral valve cleft repair. Early outcomes (≤30 days postoperatively) included mortality, complications (infection, arrhythmia, low cardiac output, pulmonary hypertensive crisis), and reintervention for residual lesions.

Statistical Analysis

Categorical variables are expressed as number (percentage); continuous variables as mean±SD or median [range]. Group comparisons used Mann-Whitney U test (continuous) or chi-square/Fisher exact test (categorical). Univariate and multivariable logistic regression (backward stepwise selection) identified independent predictors of early mortality, with $P<0.05$ considered significant [31,32]. Variables examined included preoperative weight (<5 kg vs ≥5 kg), age at surgery (continuous, per month), Down syndrome presence, mitral regurgitation ≥grade III, associated cardiac anomalies, surgical era (before vs after 2000), and cleft repair status. Analysis used SPSS version 19.0.

RESULTS

Baseline Characteristics

The cohort consisted of 56 patients: 44 with Down syndrome (78.6%) and 12 euploid (21.4%) (Figure 1). Median age at diagnosis was 4.8 months [interquartile range 1–12]; median age at surgery was 10.2 months [1–30]. As shown in Table 1, the two groups were demographically similar. Mitral regurgitation ≥grade III and valve dysplasia were present in both groups without significant difference.

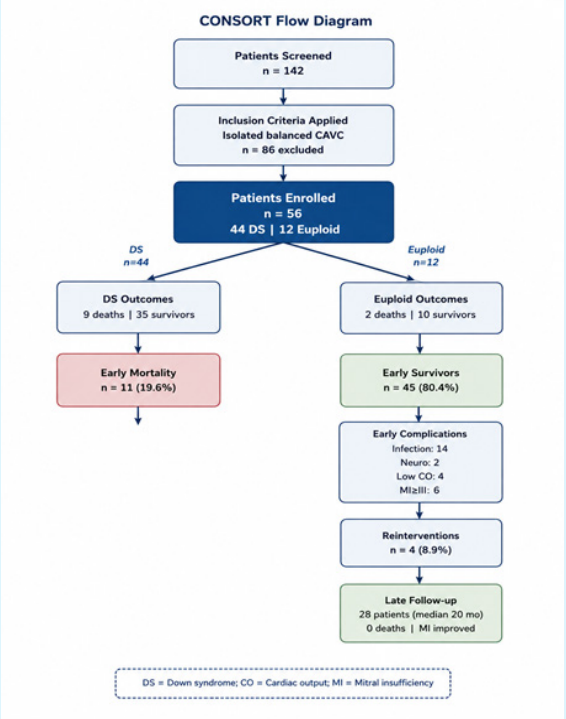

Figure 1. CONSORT flow diagram of patient enrollment

Table 1. Baseline Characteristics of CAVC Patients

Variable	Euploid (n=12)	Down Syndrome (n=44)	P Value
Age at diagnostis, mo	5.2 ± 6.6	5.1 ± 4.7	0.94
Age at surgery, mo	8.8 ± 8.6	12.4 ± 7.4	0.15
Weight at surgery, kg	5.8 ± 1.7	7.0 ± 1.7	0.10
Mitral regurgitation ≥III, no. (%)	2 (16.7)	4 (9.1)	0.43
Valve dysplasia, no. (%)	5 (41.7)	25 (56.8)	0.31

Data are reported as mean ± SD or n (%), Mann-Whitney U test was used for continious variables; χ^2 test was used for categorical variables.

Risk Factors for Early Mortality

Early mortality occurred in 11 of 56 patients (19.6%). Univariate analysis identified preoperative weight <5 kg (P=0.04, OR 6.0), Down syndrome (P=0.12, OR 0.15), and mitral regurgitation ≥grade III (P=0.56, OR 1.9) as factors associated with mortality. In multivariable logistic regression, weight <5 kg remained the sole independent predictor of early mortality (Table 2). Down syndrome status was not independently associated with mortality risk (adjusted P=0.24, OR 0.34). Age at surgery, associated cardiac anomalies, surgical era, and cleft repair status did not retain statistical significance.

Table 2. Risks Factors for Early Mortality in CAVC Repair (Multivariable Analysis)

Risk Factor	Univariate P	Univariate OR (95% CI)	Multivariate P	Adjusted OR (95% CI)
Weight at surgery, <5kg †	0.04	6.0 (1.1 - 33)	0.2	28.4 (1.4-563)*
Age at surgery, per mo	0.67	1.02 (0.93-1.12)	0.10	1.16 (0.97-1.38)
Down syndrome	0.12	0.15 (0.02-1.7)	0.24	0.34 (0.009-37)
Mitral regurgitation ≥grade III	0.56	1.9 (0.23-16)	0.10	6.7 (0.27-168)
Associated cardiac anomalies	0.42	1.93 (0.39-10)	0.66	NI
Surgical era before 2000	0.08	4.45 (0.8-25)	0.60	NI
Mitral valve cleft repair absent	0.28	0.28 (0.03-2.8)	0.77	NI

* Independent predictor (P<0.05 in multivariable analysis).
† Backward stepwise binary logistic regression. NI indicates not included in the final multivariable model.
OR indicates odds ratio; confidence interval.

Early Postoperative Outcomes

Among 45 survivors, complications included infection (n=14, 31.1%), neurologic events (n=2), low cardiac output (n=4), and residual mitral insufficiency ≥grade III (n=6). Four patients required early reintervention (days 3–13 post-op) for severe residual lesions.

At 28-day follow-up post-discharge, late follow-up data were available on 28 surviving patients (median 20 months; range 3 months to 21 years): no late deaths occurred, and residual mitral insufficiency improved in all patients.

DISCUSSION

This retrospective study of 56 patients with isolated, balanced complete atrioventricular canal (CAVC) defect identifies preoperative weight <5 kg as the sole independent predictor of early postoperative mortality. Importantly, Down syndrome (DS) status did not independently predict surgical outcome when examined in multivariable logistic regression analysis. These findings have important implications for risk stratification in CAVC repair and challenge traditional assumptions about the impact of chromosomal status on congenital heart surgery outcomes.

Weight as an Independent Risk Factor

The observation that preoperative weight <5 kg was independently associated with early mortality (adjusted OR 28.4, P=0.02) aligns with historical literature on CAVC surgical outcomes. Okada et al. [5], in a series of 42 Japanese patients, reported 50% mortality in infants weighing <5 kg compared with 8% in those ≥5 kg, a five-fold difference consistent with our adjusted odds ratio. Weight at surgery is not merely a marker of body size but rather a proxy for disease severity, timing of presentation, and physiologic maturity.

Down Syndrome Status Does NOT Independently Predict Outcome

A central finding of this study is that Down syndrome status was NOT independently associated with early mortality risk (adjusted OR 0.34, P=0.24). This result challenges a longstanding assumption in pediatric cardiology that DS patients carry an inherently higher surgical risk. The comprehensive Society of Thoracic Surgeons (STS) database analysis by Jacobs et al. [14], encompassing 1,476 CAVC patients from 71 North American institutions, found that DS status was not retained in the final risk model. Similarly, Baillie et al.

[10] in a prospective Edinburgh series of 67 CAVC patients reported early mortality of 15% in DS versus 18% in euploid patients (P not significant).

Clinical Implications

Our cohort's early mortality rate of 19.6% (11/56 patients) reflects institutional volume and surgical era differences (1994-2012). Nevertheless, the identification of weight <5 kg as an independent risk factor supports early referral and surgery for CAVC patients. The lack of independent effect of DS status should reassure families that chromosomal status per se does not doom the child to higher surgical risk. Rather, timing of diagnosis, nutritional status, anatomic severity, and surgical expertise determine outcome [17,18].

CONCLUSION

This study of 56 CAVC patients identifies preoperative weight <5 kg as the sole independent predictor of early mortality [1,5], while Down syndrome status does not independently predict outcome [14]. These findings support the contemporary approach of early identification and surgical timing in CAVC patients while providing reassurance that chromosomal status per se does not confer independent surgical risk. Multi-institutional prospective studies are warranted to confirm these findings and refine risk stratification tools for CAVC surgery.In our prospective bicentric cohort, PTFV1 ≥3100 ms·µV and P-wave dispersion ≥55 ms emerged as independent predictors of cardioembolic stroke and occult AF and were incorporated into the ES^{2}CRYP score

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