



# Case Report

## Preoperative Evaluation of Refugee Children With Heart Disease

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### ABSTRACT

The objective of this report is to identify nutritional deficiencies and health concerns in Canadian paediatric refugee patients with heart disease before cardiac surgery. A retrospective case study was conducted with 4 refugee children, aged 0–18 years, with heart disease referred to Cardiac Surgery. A total of 75% of patients had low vitamin D levels, 50% had selenium deficiency, 50% had iron deficiency anaemia, 75% were below the third percentile for height and weight for age, and 75% had dental caries. Early laboratory, nutritional, and dental screening of paediatric refugee patients at the time of heart disease diagnosis can optimize general and cardiovascular health before surgical intervention.

### RÉSUMÉ

Notre étude visait à dépister des carences nutritionnelles et des problèmes de santé présents chez les enfants réfugiés au Canada atteints de cardiopathie, avant une intervention chirurgicale cardiaque. Une étude de cas rétrospective a été menée auprès de quatre enfants réfugiés, âgés de 0 à 18 ans, souffrant de cardiopathie et orientés vers la chirurgie cardiaque. Au total, 75 % des patients présentaient un faible taux de vitamine D, 50 % avaient une carence en sélénium, 50 % souffraient d'anémie ferriprive, 75 % avaient une taille et un poids inférieurs au troisième percentile pour leur âge et 75 % présentaient des caries dentaires. Un dépistage précoce comprenant des analyses de laboratoire, une évaluation nutritionnelle et un examen dentaire, au moment d'un diagnostic de cardiopathie chez les enfants réfugiés, pourrait permettre d'améliorer leur état de santé général et cardiovasculaire avant une intervention chirurgicale.

### Background

Immigrant and refugee children may present with distinct physical and psychosocial medical problems related to their status.<sup>1</sup> Many of these children have not had an accurate health assessment.<sup>1</sup> At the time of initial contact with the Cardiac Surgery service, we have discovered that refugee children often require targeted medical optimization before they are candidates for surgical intervention. In addition to the standard initial assessment, completing additional early medical screening can identify health disparities preoperatively and allow time for optimization before intervention.

### Methods

A clinical retrospective case study was conducted with 4 refugee children. Participants who met our inclusion criteria were children aged 0–18 years, identified as having refugee status, with

a congenital or acquired cardiac defect referred to the Cardiac Surgery service for an operation at British Columbia Children's Hospital (BCCH) between July 4, 2018, and December 31, 2020. Heart disease encompassed structural congenital heart lesions, rhythm disorders, and cardiomyopathy.

Data collection and extraction began after Research Ethics Board approval, July 14, 2021 (reference number H20-01200). Data analysis began September 1, 2021. Data points of interest included cardiac diagnosis, noncardiac medical conditions, the planned cardiac intervention, age at initial diagnosis, age at presentation to BCCH, country of origin, growth percentile, nutritional status, dental status, and interventions required before the cardiac procedure. Data collection occurred at BCCH via medical records and electronic health records. Permission to access medical records was obtained through the BCCH Program Utilization form, and only the principal investigator and co-investigators had access to the data. This research project qualified in the minimal risk category; therefore, a peer review was not completed, and participant consent was not obtained.

### Results

The demographics of the 4 patients who met the inclusion criteria are listed in [Table 1](#). Routine preoperative evaluations

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**Novel Teaching Points**

- Evaluate vitamin and trace element deficiencies and supplement preoperatively.
- Detailed nutritional status assessment and optimization preoperatively.
- Advanced dental assessment and early referral to dentistry.

were conducted on all 4 patients. In addition to the routine preoperative laboratory studies, 2 of 4 patients received additional laboratory screening based on findings from their health history and physical examination, including poor dietary habits, potential exposure to infectious diseases such as tuberculosis, parental consanguinity, and evidence of extensive dental disease. One patient received additional screening as part of a pre-heart transplant evaluation.

Three of 4 children (75%) had low vitamin D levels and received preoperative supplementation. Two patients (50%) had selenium deficiency and both received preoperative supplementation. Two of 4 patients (50%) had iron deficiency anaemia and received preoperative supplementation. Three of 4 patients (75%) were below the third percentile for both height and weight for age at the time of presentation, and 2 (50%) required hospital admission for nutritional management before surgical intervention with the goal of having the patient in an anabolic state preoperatively. Three of 4 patients (75%) had dental caries requiring a dentistry consult before surgical intervention, 1 of whom underwent multiple dental extractions delaying surgical intervention (Table 2).

No adverse events were reported secondary to the delay in surgical intervention to optimize medical health preoperatively. At the 2-year postoperative follow-up, all 4 patients classify as New York Heart Association Class 1.

**Discussion**

This case study highlights how additional early screening of paediatric refugee patients with heart disease can identify and allow optimization of potential unknown health disparities before cardiac intervention. The most prevalent health disparities

identified in this small sample size of refugee patients included low vitamin D levels, low selenium levels, iron deficiency anaemia, poor nutritional status/growth, and dental disease. The entry to Canada screening protocol for refugee children does not specifically recommend screening for trace element deficiencies.<sup>1</sup> In our study, 3 of 4 patients had additional laboratory screening revealing various trace element deficiencies.

Vitamin D deficiency has been found to be common in refugee children, with a reported incidence between 40% and 80%.<sup>1</sup> Vitamin D deficiency is not as prevalent in Canadian born children.<sup>2</sup> Vitamin D plays a role in regulation of the renin-angiotensin-aldosterone system; a deficiency can result in uninhibited renin-angiotensin-aldosterone system activation, causing worsening heart failure.<sup>3</sup>

Selenium deficiency is uncommon in Canadian children. Low soil micronutrients in parts of the world can result in selenium deficiency.<sup>4</sup> Selenium has stimulating effects on the immune system; a deficiency may result in defective immune function.<sup>4</sup> Selenium supplementation has been demonstrated to reduce certain types of cardiomyopathy.<sup>4</sup>

The rates of anaemia in North America are approximately 9%, whereas the rates of anaemia in low- and middle-income countries can be as high as 55%-60%.<sup>5</sup> Screening with a complete blood count and ferritin is recommended on the entry to Canada screening protocol for refugee children.

Children with heart disease are at an increased risk of micronutrient deficiencies due to chronic hypoxia, congestive heart failure requiring the use of antifailure medicine that may impair appetite, feeding intolerance, and increased nutrient excretion.<sup>4</sup> Micronutrient replacement within a time-sensitive period has been shown to prevent myocyte death and restore overall heart function.<sup>3</sup>

Refugee children present with failure to thrive and micronutrient deficiencies due to poor nutrition.<sup>6</sup> Infants with heart failure have an increased metabolic demand and have significantly higher caloric intake requirements.<sup>7</sup> Formula fortification and enteral feeding resources may not be available in low-income countries. The entry to Canada screening protocol encourages an assessment of dietary history and nutritional status.<sup>1</sup> Clinicians should attempt to optimize the nutritional needs of children to establish anabolic metabolism before invasive cardiac intervention. The consequences of suboptimal growth in children with heart disease include progressive heart failure symptoms, the potential need for

**Table 1. Patient demographics**

Patient	Cardiac diagnosis	Noncardiac diagnoses	Cardiac intervention	Age at diagnosis (y)	Age at presentation (y)	Country of origin
A	Left ventricular outflow tract obstruction, aortic valve and mitral valve stenoses, and left ventricular hypertrophy	Short stature Dental caries	Aortic root replacement with Konno and mechanical mitral valve replacement	1.5	8	Syria
B	Crisscross heart, hypoplastic right ventricle, double inlet left ventricle, and severe valvar and subvalvar pulmonary stenosis	Fragile X syndrome Dental caries Severe malnutrition Onychomycosis	Glenn operation	Unknown	9	Somalia
C	Ventricular septal defect and subaortic membrane	Cerebral palsy Developmental delay	Ventricular septal defect repair and subaortic membrane resection	14	14	Syria
D	Dilated cardiomyopathy and wide complex tachycardia	Asthma Dental caries Stroke	Orthotopic heart transplant	11	11	Jordan

**Table 2. Results**

Patient	Growth percentile	Vitamin D level	Ferritin level	Selenium level	Dental status	Preoperative intervention
A	Height and weight <3rd %	46	9	1.17	Advanced dental caries	Selenium supplementation Vitamin D supplementation Dental extractions
B	Height and weight <3rd %	27	23	1.00	Dental caries	Iron supplementation Selenium supplementation Vitamin D supplementation Thiamine supplementation Hospital admission for nutritional management
C	Height and weight <3rd %	Not completed	Not completed	Not completed	Satisfactory	None required
D	Height 7th % Weight 31st %	39	21	Not completed	Dental caries	Vitamin D supplementation Multivitamin supplementation Hospital admission for nutritional management

invasive ventilatory support preoperatively, and ongoing high metabolic demand postoperatively, which can impair wound healing and overall recovery.

Poor oral health, including dental caries and periodontal disease, can increase individuals' susceptibility for chronic disease development and further contributes to poor nutritional intake and cardiovascular disease risk.<sup>6</sup> The entry to Canada screening protocol for refugee children encourages the completion of a dental assessment.<sup>1</sup> The presence of an active dental infection increases the risk of systemic infection and endocarditis. By implementing rigorous dental screening at BCCH, we were able to initiate early referral to dentistry and minimize surgical delay due to the need for dental intervention.

The main limitation of this study is the small sample size and ability to generalize these recommendations to the larger paediatric refugee population with heart disease. Unfortunately, all 4 patients included in our study did not receive the same preoperative laboratory studies at the time of initial presentation, limiting our ability to correlate vitamin and trace element deficiencies further. However, after reviewing these initial 4 children and the associated literature, we have developed an extended laboratory screening protocol for refugee children (Supplemental Appendix S1).

### Ethics Statement

Research was conducted in accordance with the principles embodied in the Declaration of Helsinki.

### Funding Sources

No funding was received for this study.

### Disclosures

The authors have no conflicts of interest to disclose.

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### Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Pediatric and Congenital Heart Disease* at <https://www.cjpc.ca/> and at <https://doi.org/10.1016/j.cjpc.2022.05.004>.