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Modified Senning procedure for the correction of the transposition of the great arteries: Mid-term results

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ABSTRACT

Background: Many patients with Transposition of the great arteries (TGA) who underwent Senning procedure are in follow-up and approaching adulthood. This study aimed to assess the mid-term outcome after Senning procedure to disclose and manage subsequent complications.

Methods: Twenty five d-TGA patients, who underwent Modified Senning Procedure were enrolled in the study. Investigations done included 12- leads ECG and 24 h Holter monitoring for detection of cardiac arrhythmias. Two dimensional Echocardiography and 2-D Doppler ultrasound were done to evaluate the right ventricular function and detect any postoperative complications.

Results: The median age was 6.3 years (mean: 7.25 ± 3.2, range 4–16 years). The median follow-up duration was 5.5 years (mean: 6.04 ± 3.2, range: 1.5–14.6 years). There were no mortalities and no need for reoperations. All patients had good right ventricular function and baffle leaks were present in 12% of the cases. Significant tricuspid regurgitation was encountered in 36% of the patients. Ninety six percent of the patients maintained sinus rhythm. Tachyarrhythmias were present in 3 patients (12%) and one patient (4%) had complete heart block and required pacemaker insertion. Eighty eight percent of the patients were in NYHA class I-II and the event-free survival rate was 100%, 67.8% and 28.6% at 1, 5, and 10 years respectively.

Conclusions: Despite that data from our study revealed satisfactory outcome as regards mortality and functional status of d-TGA children, further studies are warranted to assess the long term outcome of these patients and for further assessment of their right ventricular function.

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1. Introduction

Transposition of the great arteries (TGA) is a congenital heart disease where the large arteries are not connected to the morphologically appropriate ventricles [1].

In 1958, Atrial switch operation (SO), a radical surgical treatment for TGA, was introduced by Ake Senning [2]. Since then, there was a dramatic change in the prognosis of TGA patients. The Senning procedure implies directing the venous return to the contra-lateral atrioventricular valve and contra-lateral ventricle, using an atrial baffle derived from the septal tissue of the patient. In 1963, Mustard introduced an alternative technique in which atrial septum excision and usage of a synthetic or a pericardial baffle for venous return direction was described [3].

Untreated TGA carries a high mortality risk which may reach 90% within the first year of life [4]. Atrial SO helped a lot of TGA patients reach adulthood. However, since the mid1980s, in fear of its late complications, the atrial SO has been largely replaced by the arterial switch operation (ASO) [5].

Nevertheless, based on the large number of survivors of the Senning procedure that are in follow up and starting adulthood, there is growing interest in their long term outcome [5,6] which can help reveal the results of having the morphological right ventricle play the role of a systemic ventricle [1].

As a result of the delayed presentation and diagnosis of congenital heart diseases that are not infrequent in developing countries, many patients outgrow the age at which full anatomical correction of their heart defects is not associated with high morbidity and mortality. d-TGA patients are a typical example [7]. d-TGA, where the aortic valve lies to the right of the pulmonary valve, is the most common arterial arrangement encountered in the hearts with discordant ventriculoarterial and concordant atrioventricular connections [8].

Despite the fact that some d-TGA patients are able to survive beyond the age of 5 years, their left ventricles are no longer fit for ASO. Their surgical options are limited to an atrial SO, ASO with mechanical left ventricular assist & ASO after retaining the left ventricle [7].

The functional status and quality of life of TGA patients following atrial switch operation (SO) are reported to be satisfactory throughout the childhood period up to the beginning of adulthood [9]. However, the hazards of the right ventricle being the systemic ventricle comprise sudden death, right ventricular dilatation, right ventricular dysfunction, cardiac arrhythmias, sinus node dysfunction, baffle leaks and obstruction to the pulmonary and/or systemic pathways [10].

The current study aimed at assessing the mid-term outcome following Senning procedure performed on d-TGA Egyptian children in a single large referral center. It also aimed at identifying the risk factors for postoperative complications and evaluating the functional status of these d-TGA children postoperatively.

2. Patients and methods

2.1. Study population

Between June, 2011 and December, 2012, 25 patients with simple d-TGA, aged 4–16 years were recruited from the post-cardiac surgery clinic, Pediatric hospital, Faculty of medicine, Cairo University after undergoing modified Senning procedure and enrolled in the study. They were 19 males and 6 females and were all submitted to Rashkind operation prior to surgery.

The current study was approved by the ethical committee at Faculty of Medicine, Cairo University and an informed consent was obtained from the legal guardians of all patients.

Thorough history taking, retrospective analysis of the patients' medical records, review of their follow-up data, and complete clinical examination were conducted for all d-TGA patients understudy. The functional class of the patients was assessed using New York Heart Association (NYHA) classification.

Twelve leads electrocardiogram (ECG) and 24 h holter monitoring were conducted for all patients for the detection of cardiac arrhythmias (Labtec Cardiospy ER-3, PC software v 4, Hungary).

2.2. Echocardiographic examination

Echocardiographic examination was conducted by a single experienced observer using a vivid 5 machine. M - Mode was used to measure the size of the cardiac chambers. When the ejection fraction (EF) was less than 50% in 2 consecutive assessments, the right ventricular function was considered depressed. Parameters were averaged over 3 cardiac cycles and all measurements followed the American Society of Echocardiography guidelines [11]. Two dimensional Doppler and continuous wave Doppler were used to evaluate baffle patency, baffle leak, left ventricular outflow tract to exclude obstruction, degree of tricuspid regurgitation (done by measuring Jet area-central jets (cm^2) and comparing the results to reference values).

2.3. Operative procedure

The surgical technique comprised a modified Senning procedure using widely based pedicled pericardial patch. The pericardium was opened in the midline; the left half was prepared to be used if needed to enlarge the septal flap, while the right half was left to be used as an in-situ patch to complete the outer baffle.

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