

Three Years' Experience of Senning Operation: Short Term Results

Senning
Operation: Short
Term Results

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ABSTRACT

Objective: To discuss three years' experience with Senning operation and its short-term results.

Study Design: retrospective study

Place and Duration of Study: This study was conducted at the Children's Hospital/ university of Child Health Sciences Lahore for a period of 03 years from January, 2019 to November, 2021.

Materials and Methods: Record of all the patients who underwent Senning operation was reviewed. Age, sex, weight, pre-operative diagnosis, concomitant procedures, cross clamp time, bypass time, ICU stay were noted for each patient.

Results: 41 patients had Senning operation for transposition of Great Arteries in last 3 years. 39 (95%) were successfully discharged home. Mean age was 4.2 years and mean weight was 10.5kg. Two patients died of low cardiac output.

Conclusion: In developing countries where diagnosis of TGA is delayed due to multiple reasons, the Senning operation can make significant difference in the life of these patients. In the expert hands, it is safe and reproducible operation with good outcome.

Key Words: Senning Operation, Short Term, Results

Citation of article: Khan MA, Rasool F, Shah SA. Three Years' Experience of Senning Operation: Short Term Results. Med Forum 2022;33(1):115-117.

INTRODUCTION

Dextro-transposition of the great arteries (D-TGA) is the second-most common cyanotic congenital heart defect, accounting for 5% of all congenital heart diseases. D-TGA has a prevalence of 20–30 per 100,000 live births. In D-TGA, the aorta arises from the right ventricle with the pulmonary artery arising from the left ventricle. That results in parallel circulation.¹ Ideal operation for TGA is arterial switch operation which is done at the age of less than 3 weeks.² In developing countries like ours, delayed presentation of TGA patients make arterial switch operation impossible. At delayed age, Senning operation is performed which is physiological repair of TGA.³

In 1958, Atrial switch operation, a radical surgical treatment for TGA, was introduced by Ake Senning. Since the advent of Senning operation, the prognosis of TGA patients improved dramatically.

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Received: December, 2021

Accepted: December, 2021

Printed: January, 2022

The Senning operation diverts deoxygenated blood coming from superior and inferior vena cavae toward mitral valve and into left ventricle. The pulmonary venous blood coming from pulmonary veins is diverted towards right ventricle thus making right ventricle a systemic ventricle.⁴

90 percent of TGA patients die within one year of life if left untreated.⁵ with the help of Senning operation, most of these patients can reach adulthood.⁶

MATERIALS AND METHODS

Study design: It's a retrospective review of the patients who underwent Senning operation from January 2019 to November 2021 at children's hospital / university of child health sciences Lahore. Files of all the patients were reviewed. Age, sex, weight, pre-operative diagnosis, concomitant procedures, cross clamp time, bypass time, ICU stay were noted for each patient.

Operative procedure: After taking written informed consent from the parents, surgery was started with sternotomy. Thymus was removed in every patient. Aortic and bicaval cannulation with metal tipped canulae was made. DelNido cardioplegia was used in each operation. Right and left atria were then opened. After resecting the remanent of inter atrial septum, Coronary sinus was opened. 1st layer to isolate the pulmonary veins from mitral valve was made by inverting the left atrial appendage and sewing it to right margin of atrial septal defect thus making the floor of systemic venous baffle. 2nd layer was created with a autologous pericardial patch to divert superior and inferior vena caval blood towards mitral valve and left

ventricle. This completed systemic venous baffle. 3rd and last layer was completed by using the autologous pericardium to baffle the pulmonary venous blood toward tricuspid valve around the systemic venous baffle, as described by shumaker.⁷

Statistical Analysis: Data were analyzed by the Statistical Package for the Social Sciences. Results were shown in mean with range.

RESULTS

From January 2019 to November 2021, 41 patients underwent Senning operation. There were 31 male and 10 female patients. Mean age was 4.2 years. Mean weight was 10.5kg. 3 patients had concomitant left ventricular outflow tract obstruction, which was dealt with during the operation.

Table No.1: Demographic Details

N	41	
Gender	Male 31	Female 10
Age	Mean 4.2yaers	Range 1 to 14 years
Weight	Mean 10.5kg	Range 7 to 20kg
Previous Rashkind balloon atrial septostomy	22 pateints	
Mode of admission	Out patient clinic	

Table No.2: Surgical Details

Cross clamp time	71minutes (mean)	Range 35 to 135 minutes
Cardiopulmonary bypass time	93 minutes (mean)	Range 50 to 190 minutes
LVOT resection	3	
Accessory mitral tissue	1	
PDA ligation	2	

Table No.3: Short Term Results

Survival	39 (95%)	
Icu stay	52 hours	24 to 90 hours
Duration of mechanical ventilation	18 hours	4 to 60 hours
Duration of inotropic support	32 hours	24 to 90 hours
Arrhythmia	20%	
RV dysfunction	5%	
Re operation for bleeding	1	

Out of 41, 22 had Rashkind operation (balloon atrial septostomy) in their neonatal age. Rest of them had natural large atrial septal defect. All the patients had diagnosis of d TGA with intact ventricular septum.

Average cross clamp time was 71 minutes and cardiopulmonary bypass time was 93 minutes. All the patients underwent intra operative echocardiogram to rule out baffle obstruction, left ventricular outflow obstruction and other lesions.

Average ICU stay was 52 hours. Average stay on ventilator was 18 hours. Inotropic support was required for the mean of 32 hours. 2 patients died because of low cardiac output. Rest of the patients were discharged home on mean of 5th post-operative day. See table 1, 2 and 3.

DISCUSSION

The modern cardiac surgery centers are now doing arterial switch operation in most of the cases of TGA. Because of antenatal diagnosis, early care of the patients, availability of rashkind atrial septostomy and prostaglandin, arterial switch has now become the standard of care ⁸⁻⁹. In developing countries like Pakistan, the diagnosis of TGA is made late because of limited number of pediatric cardiac centers, birth in remote areas, home deliveries of the babies, reluctance to go to pediatricians and financial constraints. In cases of delayed diagnosis, when arterial switch operation is not possible, atrial switch is one option. Other option is two stage prep switch.

Senning performed the first 'complete' repair for TGA in 1957. In the Senning repair, a baffle is created within the atria that baffles the superior and inferior vena caval blood to the mitral valve and thus left ventricle and into pulmonary circulation for oxygenation and the oxygenated pulmonary venous blood to the tricuspid valve and thus right ventricle and into systemic circulation thus oxygenated blood in systemic circulation. This leads to anatomic left ventricle acting as the pulmonary pump and the anatomic right ventricle acting as the systemic pump.¹⁰

Because of technical difficulties, most of the surgeons at that time were reluctant to adopt this new technique. In 1970s Broom was the one who modified it and made it simpler. Due to surgical modifications, there was more acceptance for Senning operation.¹¹⁻¹²

More and more infants were getting Senning operation in 1980s. Long terms outcomes were available in 1990s. The long terms results were not very encouraging. The problems of baffle obstruction, arrhythmias, and right ventricle failure were apparent. This lead to fall in interest in Senning operation.¹³⁻¹⁴

With technical modifications, using in situ pericardium to make wider pulmonary venous baffle,¹⁵ the problem of pulmonary venous baffle obstruction can be minimized. Results of the recent studies are encouraging. , Talwar et al¹⁶ published there results of Senning operation. In that study there was 100 percent survival and no one had venous baffle obstruction. All the patients were asymptomatic and were enjoying healthy life.

Results of our study are comparable to Helbing et al.¹⁷, Wells and Blackstone¹⁸ and Maluf¹⁹. With only 3 dedicated pediatric cardiac surgery centers in Pakistan and 45000 new congenital heart disease patients every year, Senning will have its important role to play in TGA patients at least for the next 10 years.

CONCLUSION

In developing countries where diagnosis of TGA is delayed due to multiple reasons, the Senning operation can make significant difference in the life of these patients. In the expert hands, it is safe and reproducible operation with good outcome.

Author's Contribution:

Concept & Design of Study: Mohammad Asim Khan
Drafting: Faiz Rasool, Salman Ahmad Shah

Data Analysis: Salman Ahmad Shah.
Faiz Rasool

Revisiting Critically: Mohammad Asim Khan,
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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