Faculty of medicine

Sternotomy versus Mini-Sternotomy in Pediatric Patients undergoing Modified Blalock-Taussig Shunt

Thesis

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

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Abbreviations

ASD: Atrial septal defect

BT: Blalock Taussig

CHD: Cyanotic Heart Disease

CPB: Cardiopulmonary bypass

DORV: Double outlet right ventricle

ICU: intensive care unit

MAPCAs: Major aorto-pulmonary collaterals

MBT: Modified Blalock Taussig

PA-IVS: Pulmonary atresia with intact interventricular septum

PA-VSD: Pulmonary atresia with ventricular septal defect

PDA: Patent ductus arteriousus

PG E1: prostaglandin E1

PTFE: Polytetrafluoroethylene

RVOT: Right ventricular outflow tract

TA: Tricuspid atresia

TGA: Transposition of Great vessels

TOF: Tetrology of Fallot

VSD: Ventricular septal defect

Abstract

Background: In the present era, primary correction is the preferred approach to the neonate or young infant with a cardiac anomaly who has two ventricles. However, when only one functional ventricle is present or pulmonary blood flow is reduced, an initial palliative systemic-to-pulmonary arterial shunt is mandatory. In this study we compare post-operative short term outcomes of sternotomy versus mini-sternotomy approaches in pediatric patients undergoing Modified Blalock Taussig Shunt. **Patients and Methods:** A prospective randomized study was conducted on 90 pediatric patients who underwent MBT shunt between March 2017 and October 2019. They comprised 2 groups G1: sternotomy group (n=45) and G2: ministernotomy group (n=45). Preoperative characteristics, Intraoperative events, mortality, and morbidity were recorded, inclusion criteria were Cyanotic heart diseased patients undergoing MBTS and of age group between newborn & 4 years old.While exclusion criteria were Refusal of procedure or participation in the study, patients with multiple comorbidities and major organ failure & other types of shunts rather than MBT shunt. **Results:** Mean age was 11± 3.39 months and mean weight was 6.75±1.96 kg in the sternotomy group, while for ministernotomy group the mean age was 10.55± 4.65 and mean weight was 7.00±2.03 kg. The change (%) between preoperative and postoperative oxygen saturation was 35.6% for sternotomy group and 43.8% for ministernotomy group. There were seven cases of mortality (15.6%) in sternotomy grouped compared to three cases of mortality (6.7%) in ministernotomy with P value of 0.314. Superficial wound infection occurred in one case (2.2%) in each group. Mean duration of ventilation was 52.53 ± 15.76 h for sternotomy group and 46.93±19.23 h for ministernotomy group with P value of 0.025, mean ICU stay was 7.42 ± 2.94 days for sternotomy group and 5.13± 2.37 days for ministernotomy with P value of <0.001. **Conclusion:** Upper ministernotomy is a safe alternative approach for MBT shunt in pediatric patients. It provides the advantages of less ventilation time, less post operative bleeding, and ICU stay.

Key words: sternotomy, mini-sternotomy Pediatrics, Modified Blalock-Taussig Shunt.

Introduction

The Blalock-Taussig (BT) shunt is an excellent and widely accepted form of palliation for neonates with congenital cyanotic heart disease and decreased pulmonary blood flow. It was first described by Blalock and Taussig in 1945 and modified by de Leval and colleagues with a polytetrafluoroethylene (PTFE) graft interposed between the subclavian artery and the ipsilateral pulmonary artery (PA). As the subclavian artery orifice of the BT shunt acts as a flow regulator, it provides controlled blood flow to the lungs **(1)**.

The purpose of MBT shunt is to create a reliable path of blood flow to the lungs when the pulmonary blood flow is restricted and the patient is not suitable for total repair. During the last few years, a midline approach is preferred for systemicto-PA shunt. The advantages of sternotomy approach are preservation of subclavian artery, ease of take down and relative ease of construction of the shunt. There are two other advantages with sternotomy approach if the child desaturates alarmingly or becomes hemodynamically unstable, the procedure can be done under CPB support. If the child suffers a cardiac arrest, cardio pulmonary resuscitation is facilitated. Access to patent ductus arteriosus for ligation to remove a source of competitive flow is also possible with sternotomy approach **(2).**

In this study we are going to review another novel technique through a ministernotomy approach, in which skin incisions are shorter, arguably improving cosmetic results. Additionally, it has been argued that despite lengthier operations with a ministernotomy approach, patients have improved outcomes, including less bleeding, reduced ventilation time and reduced intensive care unit (ICU) and hospital stays. This may be due to maintenance of the integrity of the chest wall **(3)**.

Aim of the Study

In this study we are going to compare between sternotomy approach and mini-sternotomy approach in pediatric patients undergoing Modified Blalock Taussig Shunt regarding post-operative short term outcome in both groups.

Review of Literature

Anatomical Correlations

Subclavian Artery

Introduction

The subclavian arteries lie just below the clavicles, providing blood supply to the bilateral upper extremities with contributions to the head and neck. The right subclavian artery derives from the brachiocephalic trunk, while the left subclavian artery originates directly from the aortic arch. The subclavian arteries course laterally between the anterior and middle scalene muscles. The distal limit of the subclavian artery is the lateral border of the first rib, where it becomes the axillary artery. Additional branches of the subclavian arteries include the internal thoracic artery, vertebral artery, costocervical trunk, thyrocervical trunk, and the dorsal scapular artery. During development, the left subclavian arises from the seventh intersegmental artery and the right subclavian develops in segments; proximally from the fourth aortic arch, medially from the dorsal aorta and distally from the seventh intersegmental artery.**(4)**

Multiple aspects of the nervous system travel alongside or near the subclavian arteries. They include the sympathetic trunk, the vagus nerve, parts of the brachial plexus, the phrenic nerve and the right recurrent laryngeal nerve. Alongside these neuronal pathways, the arteries are also linked closely to venous pathways such as the internal jugular veins and vertebral veins. These vessels make an interconnected highway that helps fuel the cellular processes used by the neck and upper extremity muscle groups, the brain and thyroid gland. As shown in **Figure 1**. **(5)**

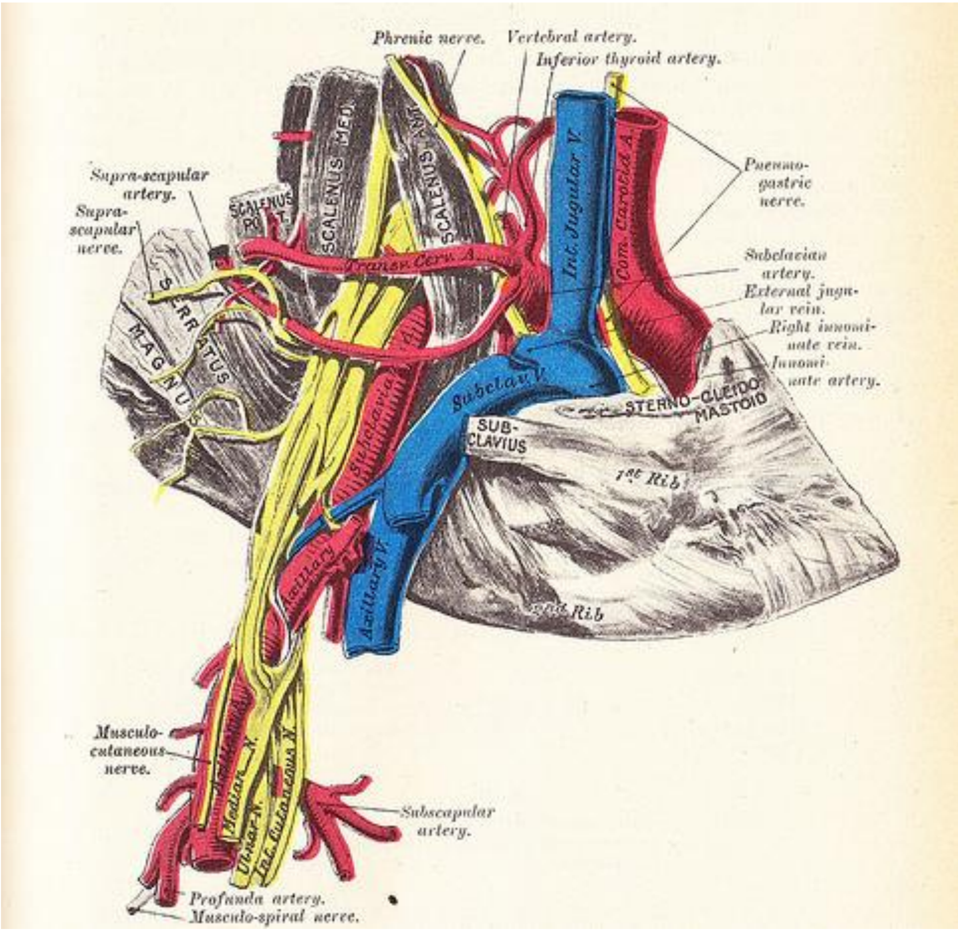

Fig. (1): The subclavian artery, showing its relations **(5)**

Structure and Function

As major branches within the aortic arterial supply line, the subclavian arteries provide vital flow for much of the head, neck, and upper extremities. The left subclavian artery arises directly from the aortic arch, but the right subclavian artery comes off the short brachiocephalic artery which gives off the right subclavian and right common carotid vessels. As the subclavian arteries extend laterally, they pass through the anterior and middle scalene muscles and convert into the axillary artery once they pass the tip of the first rib. Given the long path of the artery, it subdivides into three different parts labeled first, second, and third. The first part initiates as the root of the subclavian artery and ends at the medial edge of the scalene muscles, and this area can feed the circle of Willis, thyroid tissue and breast tissue. The second part starts at the medial edge of the scalenes and extends to the lateral edge of the scalenes; this area feeds the costocervical trunk. The third part initiates at the lateral scalene muscle running to the lateral tip of the first rib at which point the artery becomes the axillary artery and feeds the upper extremity. **(6)**