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## Transatrial access for left atrial pressure (LAP) monitoring line placement in Arterial switch operation (ASO) in neonates

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### Abstract

Left Atrial pressure monitoring is a useful and accurate method to guide Left ventricle filling in the patients who undergo Arterial switch operation for transposition of great arteries. We have used a different technique in three TGA patients for LA pressure monitoring line placement. After cleaning and draping, right internal jugular vein (rt IJV) located through 22G venous cannula, guide wire was put in followed by sliding the 22Gx8cm vygon arterial catheter over the guide wire into the right atrium that was directed transatrially into LA by the operating surgeon during atrial septum repair. The catheter was secured by silk on the neck and dressed with transparent dressing and was kept for a period of 48-72hrs. LA pressure monitoring is helpful in anticipating LV dysfunction in ASO.

**Keywords:** Left atrial pressure, Internal jugular vein, Arterial switch operation.

### Introduction

Left Atrial (LA) pressure monitoring is a useful and accurate method to guide LV filling in the patients who undergo Arterial switch operation (ASO) for Transposition of great arteries (TGA) correction. In addition, monitoring of left atrial pressure has an important application after repair procedures on the mitral valve, after surgical correction of complex congenital cardiac malformations, in operations for ischaemic heart disease with left ventricular dysfunction, and during difficulty in weaning from cardiopulmonary bypass. It is more accurate than CVP to guide Left ventricle filling. It is an invaluable aid in the management of critically ill patients in the perioperative period after a cardiac operation until the haemodynamic status of the patient has stabilized.

We are reporting a method of LA pressure monitoring in three Arterial switch operations in TGA neonates in which 22Gx8cm Teflon coated vygon arterial catheter was inserted in the Right Interval Jugular Vein (Rt IJV) that was directed during atrial septum repair by the operating

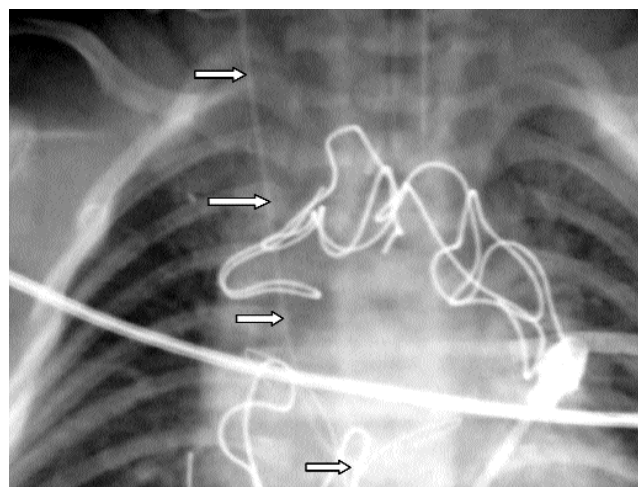
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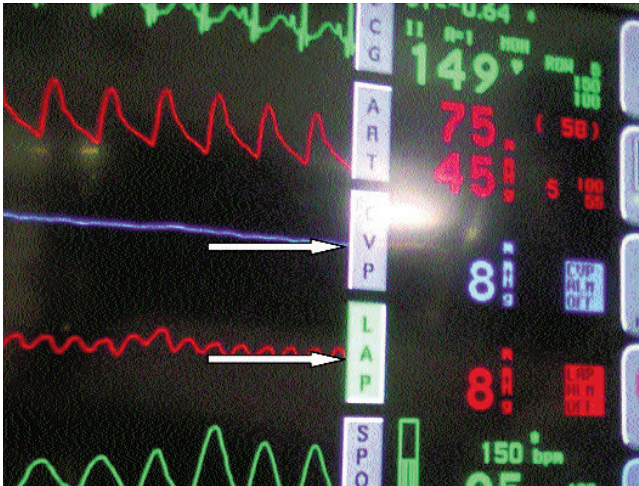
surgeon into LA.

### Case Report

The three neonates (aged 15,17 and 19 days) with average weight and height of 3-3.5 Kg and 55-60cm respectively were operated at Aga Khan University cardiac operating rooms in the last two months of 2012. The neonates had atrial septostomy done in the catheterization lab. at the time of birth to allow mixing of blood thus improving the saturations, were induced with sevoflurane 8% in 100% O<sub>2</sub> and intubated with muscle relaxant to put on mechanical ventilation. Arterial line and central line were put in the groin following antiseptic measures. After cleaning and draping, Rt IJV was located through 22G cannula, guide wire was put in, followed by sliding the 22Gx8cm vygon arterial catheter over the guide wire into the right atrium. Whole length of the catheter was inserted and point of insertion was adjusted to avoid coiling in the right atrium. ECG was continuously monitored and there were no atrial arrhythmias throughout its placement in the intra-operative and post-operative period. The catheter was secured by silk on the neck and dressed with transparent dressing. The vygon catheter was later on directed into the left atrium during septum repair, done by the surgeon (Figure-1). This LA line was used for weaning from the bypass machine and as left ventricle



**Figure-1:** Arrows showing path of LA pressure monitoring line.



**Figure-2:** Monitor showing similar CVP and LA pressure.

function guide in the postoperative period. On an average, LAP monitoring line was kept for 48-72 hours depending on the stability of the left ventricular function confirmed objectively by post operative serial transthoracic cardiac ECHO examination. The size of the communication between the atria was minute after removal of the LA line. In the patients with this method of LA line insertion, no significant intra-cardiac shunt was detected.

## Discussion

There are no reported cases of LA pressure monitoring through the catheter inserted into the rt IJV and then directed transatrially into the left atrium in Arterial switch operation in neonates. However one published case report described this simple method of left atrial pressure monitoring by means of a single lumen long length central venous catheter being placed into the left atrium during transatrial surgical procedures.<sup>1</sup> This method was recommended to be safe in the studied patients.<sup>1</sup> There had been no bleeding complication and no air embolism in 36 successive patients. They used this technique in patients undergoing mitral or double aortic and mitral valve replacement, with poor left ventricle function and/or mild and moderate pulmonary hypertension.

There are other methods for putting LA pressure monitoring line. Usually LA line is inserted percutaneously through the right pulmonary vein into LA or directly into LA. The direct access of the LA catheter into the left atrium during open heart surgery can cause some complications (e.g. postoperative bleeding). Even the cannulation of the pulmonary vein can cause some problems like air embolism.<sup>2</sup> Another technique for placement of a LA pressure monitoring line is described in which, following

repair of a complex congenital heart defect, a long catheter previously advanced from the femoral vein into the right atrium is inserted across the interatrial septum through the patent foramen ovale or through a small incision in the atrial septum at the level of the fossa ovalis. A suture is placed to close the interatrial septum around the catheter. This technique of left atrial line placement has been used successfully for four years and has not resulted in any serious morbidity.<sup>3</sup>

There is indirect method of monitoring LA pressure through the Pulmonary artery catheter in adults in which Pulmonary capillary wedge pressure (PCWP) reflects LA pressure. PCWP will reflect LA pressure and Left ventricular end diastolic pressure provided LV function is normal and mitral valve is competent.

Measurement of left atrial pressure proves useful in the assessment of cardiac function and of response to therapeutic intervention.<sup>4-6</sup> It is very helpful in anticipating LV dysfunction in arterial switch operations. Preoperatively LV is used to pump against a low pressure pulmonary system, but post Arterial switch it will pump against a high pressure systemic circulation. LV dysfunction can occur in ASO due to two reasons firstly because of overfilling or increase in after-load and secondly due to myocardial ischaemia secondary to reduced or obstructed flow through re-implanted coronaries.

In our observation, there was no significant difference between Central venous pressure and LA pressure as shown on the monitor in Figure-2 as biventricular function was normal preoperatively. The Central venous pressure lines in our reported cases were put through the femoral vein. In all the three cases, we did not encounter any complication during LA pressure line insertion, its intraoperative monitoring and in intensive care unit even after its removal including coiling, arrhythmias, significant residual perforation and bleeding.

The injection port of LA pressure monitoring line must be closed in order to prevent air embolism into the coronaries or cerebral circulation. Continuous flushing at 2mls/hr should be made sure.

LA pressure catheter can be withdrawn to the superior vena cava position by pulling the catheter 3-5cm. The right position is controlled by the aspiration of venous blood and the catheter can work again as a central venous line. We did not encounter any complication regarding bleeding. There are several advantages to this method. First, there is no possibility of external bleeding in the postoperative period after removal of the left atrial line.

Second, the left atrial line will be coming out through the neck or arm as any other central line depending on the initial site of insertion. Consequently, the inconvenience in the management of a central line coming straight out of the chest wall can be avoided.<sup>7</sup> The only limitation of this technique is the propensity of withdrawal into the right atrium especially when heart gets overfilled. We have got the availability of 8cm catheter which is a little shorter. It will be more appropriate to put in 10cm vygon. Of course, direct LAP catheter inserted directly into the left atrium is ideal and more precise than other methods but at the expense of a serious complication of bleeding on removal.

### Conclusion

This new access has both medical and economic advantages. We are suggesting this new technique of LA pressure monitoring as it has proved to be a simple, easy and safe technique for wide use in paediatric cardiac surgery patients like those scheduled for Arterial switch operations in which LA pressure monitoring is required.

We did not encounter complication like bleeding. This is the advantage in comparison with the transcutaneous insertion of LA pressure monitoring line through the pulmonary vein or directly into left atrium that is associated with bleeding during withdrawal.

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