CORRELATION OF FEMORAL ARTERY VS RADIAL ARTERY PRESSURES WITH CENTRAL PRESSURE AFTER CARDIOPULMONARY BYPASS IN CHILDREN

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ABSTRACT
Objective: To assess the effectiveness of femoral and radial arterial lines on the correlation of peripheral and central mean arterial blood pressure in children after discontinuation of cardiopulmonary bypass.
Setting: Department of Anaesthesiology, National Institute of Cardiovascular Diseases, Karachi.
Patients: Fifty children scheduled for cardiac surgery with cardiopulmonary bypass were included in the study.
Methodology: After approval from the hospital ethics committee and informed consent. 50 children undergoing cardiac surgical procedures with cardiopulmonary bypass were randomly assigned to two different groups. In Group-A (RAP, n=2) a radial arterial line and in Group-B (FAP, n=25) a femoral arterial line was used to monitor the blood pressure. Simultaneous mean peripheral arterial pressure and mean central aortic pressure were recorded before cardiopulmonary bypass and 5 mins after separation from the cardiopulmonary bypass. The correlation of mean peripheral arterial pressure (radial and femoral) versus mean aortic pressure were compared. The data was recorded as Mean ± SD and P-value.
Results: The ages of children ranged from 4-12 years and their weight from 14.1-28.5 kg. In all of them following cardiopulmonary bypass, aortic pressure correlates better with femoral arterial pressure (p<0.001). The radial arterial line readings under estimated central aortic pressure when compared to femoral arterial line readings.
Conclusion: Aortic pressure readings correlate better with femoral arterial pressure than radial arterial pressure in children

KEY WORDS: Cardiac Surgery, Cardiopulmonary Bypass, Aortic Pressure, Radial Artery Pressure, Femoral Artery Pressure

INTRODUCTION
The relationship of the radial and femoral arterial pressure to the aortic pressure is examined in several studies in patients during the various stages of cardiopulmonary bypass. Radial artery pressure is known to differ from central arterial pressure in adult patients in early post-cardiopulmonary bypass period.1-3 The adequacy of radial artery as a site for blood pressure measurement in children undergoing cardiopulmonary bypass has not been carefully examined.4-7

This study compares radial and femoral arterial pressure versus aortic pressure before and after cardiopulmonary bypass in children.

PATIENTS & METHODS
This quasi experimental study was conducted by the Department of Anaesthesiology at National Institute of Cardiovascular Diseases, Karachi from May to October 2007. After approval from the hospital ethics committee and informed consent, 50 children undergoing cardiac surgical procedures with cardiopulmonary bypass were randomly assigned to two groups. In Group-A (RAP,
Table I. Demographic Data (n=50)
n-25) a radial arterial line and in Group-B (FAP, n-25) a femoral arterial line was used to monitor the blood pressure. The aortic pressure was measured via aortic cannula. A 22 guage cannula was used for measurement of blood pressure in radial artery and femoral artery after induction of anaesthesia. Children were induced with sevoflurane and maintained with combination of morphine, midazolam, pancuronium and isoflurane.

The peripheral and central aortic catheter were connected by non-compliant pressure tubing to the same pressure transducer through two sets of three way stopcocks. The pressure transducer was leveled at the right atrium and calibrated before each procedure. The natural frequency and dampening co-efficient of the system were determined by the flush method of Gardner at the beginning of each operation to rule out errors resulting from dampening and frequency changes.

The mean peripheral arterial pressure (radial and femoral) and central aortic pressure were recorded consecutively within a few seconds of each other on the same transducer before cardiopulmonary bypass and 5min after discontinuation from cardiopulmonary bypass. Moderate hypothermia (28-30°C) were used in all patients. Patients

Table II. Operative Procedure Performed (n=50)
were separated from cardiopulmonary bypass once they were rewarmed to temperature 37°C. Result are expressed as mean ± standard deviation and analyzed by paired ‘t’ test.

RESULTS

The ages of 50 children included in the study ranged from 4-12 years and their weight from 14.1-28.5 kg. The demographic data of the patients is shown in Table I and the procedures they underwent in Table II. In Group-A (RAP) the mean aortic pressure was not significantly greater than mean radial artery pressure before cardiopulmonary bypass but after discontinuation from cardiopulmonary bypass the mean aortic pressure was significantly greater than the mean radial artery pressure - p<0.001) Table III.

In Group-B (FAP) the mean aortic pressure was not significantly greater than mean femoral artery pressure before cardiopulmonary bypass but after discontinuation of cardiopulmonary bypass the mean aortic pressure was still greater than the mean femoral artery pressure, but not significantly p>0.05 (Table IV). Thus it is evident that in all children following cardiopulmonary bypass,
Correlation of Femoral Vs Radial Artery Pressure with Central Pressure

Rehana Yaseen et al

aortic pressure correlates better with femoral artery pressure. The radial arterial line reading underestimated central aortic pressure when compared to femoral arterial line readings (P<.001).

**DISCUSSION**

In adults, the systolic arterial pressure (SAP) can be 30 to 40 mmHg higher in the radial artery than in the aorta and the radial mean arterial pressure (MAP) is equal to or 2-3 mmHg lower than that in the aorta. At the end of cardiopulmonary bypass, however both the systolic arterial pressure and mean arterial pressure are sometimes much lower in the radial artery than in the aorta or the femoral artery.1-2

Moher et al studying the radial artery to aorta pressure gradient and the radial artery to femoral artery pressure gradient in patients after cardiopulmonary bypass found that the systemic vascular resistance was significantly lower in patients whose radial artery pressure were lower than their aortic or femoral artery pressure.3 These authors concluded that the low radial artery pressures were due to peripheral constriction, volume factors and proximal shunting at the vascular beds of forearm and decreased in vascular resistance in hand.

In children the difference in femoral artery pressures versus radial artery pressures may be much more marked (12-18 mmHg) than in adults (10 mmHg), probably because of the greater vascular reactivity of children as compared with adults undergoing coronary artery bypass grafts surgery who have stiffer arteries.4-5

The femoral artery has a higher rate of ischemic complications and pseudoaneurysm formation after diagnostic angiography and cardiac catheterization procedures6, but the use of smaller size catheter for pressure monitoring would not increase the risk of complications. The benefit of knowing the correct pressure may outweigh the theoretical risks.7-9

Erroneous low radial artery pressure may result in the inappropriate use of vasconstrictors and inotropes to raise the pressures, which could be avoided with femoral artery pressure monitoring.10

**CONCLUSION**

Monitoring of femoral artery pressures is more desirable than radial artery pressure after discontinuation of cardiopulmonary bypass in children, as it correlates better with the central pressure.

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**REFERENCES**


