Original Research Paper

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A PROSPECTIVE RANDOMIZED COMPARATIVE STUDY OF USG GUIDED RADIAL ARTERY CANNULATION BY IN PLANE AND MODIFIED OUT OF PLANE TECHNIQUE IN PEADIATRIC POPULATION

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ABSTRACT **BACK GROUND** We compared Inplane IP and modified out of plane MOP approach using ultrasound for radial artery cannulation in childrens. **STUDY DESIGN** Prospective randomized study conducted in 120 childrens undergoing open heart procedure as **GROUP IP AND GROUP MOP** Cannulation time , Ultrasonic location line and number of attempts were compared . **RESULTS** Shorter cannulation time and ultrasonic location time and minimal number of attempts in MOP compared to IP approach with no difference in incidence of complication. **CONCLUSION** MOP approach has been found to increase success rate in radial artery cannulation in paediatric population.

KEYWORDS :

INTRODUCTION

Intra-arterial blood pressure (IABP) measurement is often considered to be the gold standard for blood pressure measurement. Percutaneous radial artery cannulation is a procedure done commonly in operating room and in the intensive care units for its ease of access and high success rate. The ultrasound guidance for radial artery cannulation had been shown to increase the rate of cannula insertion success in the first attempt thus reducing complications in childrens .

AIM AND OBJECTIVES

The aim of this study is to compare the traditional In Plane(IP) approach with Modified Out of Plane (MOP) approach for radial artery cannulation in childrens using USG.

PRIMARY OBJECTIVES

1. Success of First insertion attempt
2. Cannulation time

SECONDARY OBJECTIVES

1. Number of attempts
2. Complications- Hematoma, vasospasm and posterior wall puncture

METHODOLOGY

INCLUSION CRITERIA

1. Age 1 to 12 years
2. ASA I – IV PS in all consented patients posted for cardiac thoracic surgical procedures

EXCLUSION CRITERIA

1.Peripheral vascular disease
2.Haemorrhagic shock
3.Coagulation disorders
4. Negative modified Allen's test

GROUPS

GROUP IP

Radial artery cannulation done by In Plane (IP) approach using USG.

GROUP MOP

Radial artery cannulation done by Modified Out of Plane (MOP) approach using USG.

PROPOSED DURATION OF THE STUDY: Six Months

DATA COLLECTION PROCEDURES

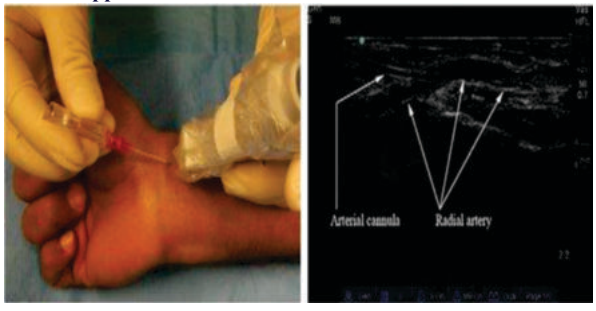
After Ethical Committee approval from Institute of Child Health (ICH) and informed written consent, 120 ASA I-IV patients were selected for the study based on the inclusion and exclusion criteria. Patients were randomized into two Groups i.e. Group IP & Group MOP using computerized random number. On arrival of the patient in the operating room monitors like pulse oximeter, non-invasive BP and ECG were connected and baseline values were recorded. An IV access was obtained in the arm using a 22 G or 24 G cannula.

After induction of general anaesthesia , the left hand of all patients were chosen for the puncture. The hand positioned in dorsiflexion and fixed to the roll. Sterile preparation was performed over the skin insertion site and local anaesthesia given using 1ml of 2%ligncaine. The ultrasonic probe with disposable sterile covers of 18MHZ frequency was used to identify the radial artery.

LONG AXIS IN PLANE APPROACH

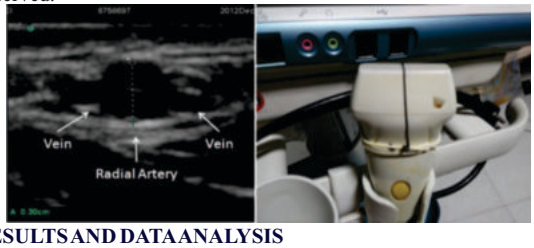
After identifying the artery in the long axis view the arterial cannula needle (20 G or 22 G) was inserted steeply downward at the midpoint of the long axis of the ultrasonic probe. Entry into the artery was confirmed by visualizing the backflow of blood into the needle. Then the angle of needle was lowered to 15 degrees and pushed proximally for 2 to 3mm using modified Seldinger's technique. The arterial cannula was connected to transducer and the waveform was observed.

InPlane Approach :



MODIFIED SHORT AXIS OUT OF PLANE APPROACH

A silk suture of size 1-0 was tied on the midpoint of the ultrasound probe and perpendicular to its long axis as a guide. This created a visible mark on the USG screen which was directed at the beating radial artery on the ultrasound view. The arterial cannula needle(20 G or 22 G) was placed on the contact point of the suture line and skin and inserted steeply downward at an angle of 30 to 45 degree. Entry into the artery was confirmed by visualizing the backflow of blood into the needle. Then the angle of needle was lowered to 15 degrees and pushed proximally for 2 to 3mm using modified Seldinger's technique. The arterial cannula was connected to transducer and the waveform was observed.

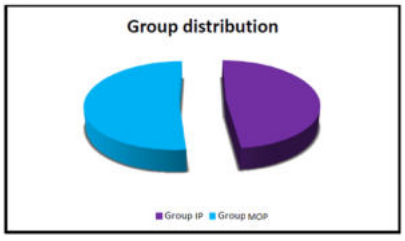


RESULTS AND DATA ANALYSIS

The collected data were analysed with IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics frequency analysis, percentage analysis was used for categorical

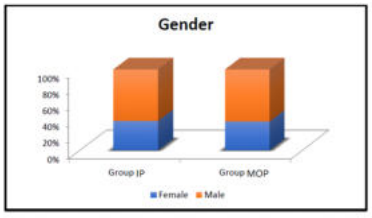
variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in the Independent groups the Unpaired sample t-test was used. To find the significance in categorical data Chi-Square test was used. In all the above statistical tools the probability value .05 is considered as significant level.

THE GROUP DISTRIBUTION:



Gender Distribution

P VALUE IS 0.934(NOT SIGNIFICANT)



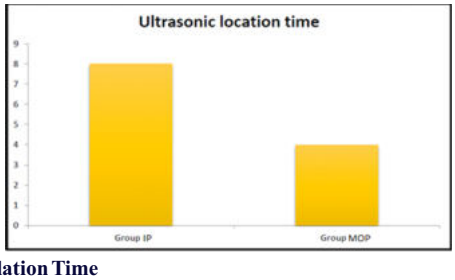
COMPARISON OF ULTRASONIC LOCATION TIME AND CANNULATION TIME BETWEEN THE TWO TREATMENT GROUPS:

Contact of the USG probe with the skin to the start of skin puncture was measured in seconds

Parameter	IP group mean ± SD	MOP group ± SD	P Value
Ultrasonic Loacation Time (Seconds)	8.41 ± 1.109	4.34 ± 0.809	0.000
Cannultaion Time (Seconds)	14,59 ± 2.649	10.06 ± 1.266	0.000

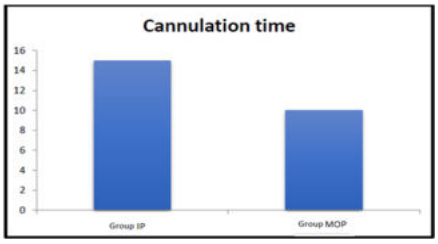
Ultrasonic Location Time

The mean values of ultrasonic location time in the modified OOP approach and IP approach were 4.34s and 8.41s respectively. Thus there is a mean decrease of 4.075s. P value for ultrasonic location time is 0.000. Hence it is statistically significant.



Cannulation Time

The mean values of cannulation time in the MOP approach and IP approach is 10.06s and 14.59s respectively there is a mean difference of 4.522s. the P value for annulation time is 0.000 which is statistically significant.

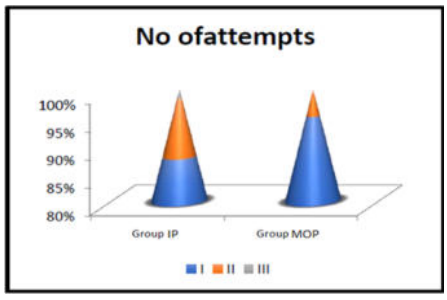


COMPARISON OF NUMBER OF ATTEMPTS BETWEEN THE TWO GROUPS:

The start of skin puncture to the display of arterial waveform on the monitor was measured in seconds

No.Of Attempts	IP group n(%)	MOP group n(%)	P Value
1	87.9	95.2	0.294
2	10.3	4.2	
3	1.7	0.0	

Compared to LA-IP approach the SA-OOP approach tends to have higher rate of attempt one and lower rate of attempt two. The P value is 0.294 which is >0.05 and hence it is statistically not significant.

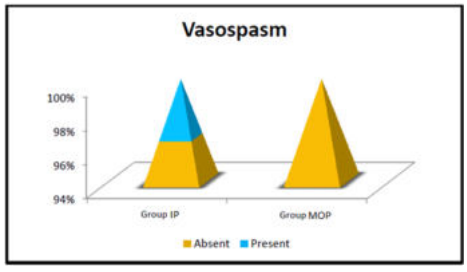


COMPARISON OF COMPLICATIONS BETWEEN THE TWO GROUPS VASOSPASM:

When there was > 30% reduction in the inner diameter of the radial artery

VASOSPASM	IP group n(%)	MOP group n(%)	P Value
PRESENT	3.4	0	0.232
ABSENT	96.6	100	

There is no statistically significant difference in the formation of vasospasm between the two groups. P value is 0.0232.

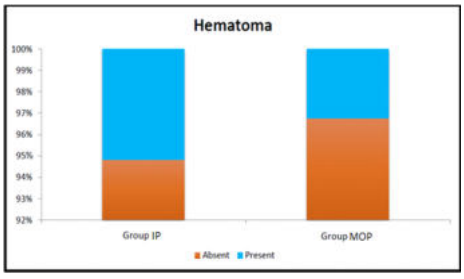


HAEMATOMA FORMATION:

When a visible swelling appears over the puncture site

HAEMATONA	IP n (%)	MOP n(%)	P Value
PRESENT	5.2	3.2	0.672
ABSENT	94.8	96.8	

There is no statistically significant difference between the two groups with respect to hematoma formation. P value is 0.672.

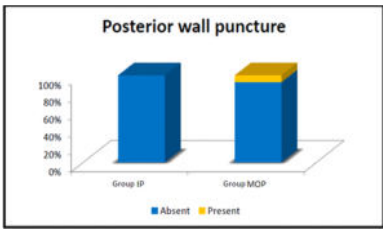


POSTERIOR WALL PUNCTURE:

After the appearance of flash of blood in the chamber when continuous backflow was not present.

POSTERIR WALL PUNCTURE	IP n (%)	MOP n(%)	P Value
PRESENT	0	8.1	0.058
ABSENT	100	91.9	

There is no statistically significant difference between the two groups with respect to posterior wall puncture. P value is 0.058.



DISCUSSION:

Arterial cannulation is the gold standard for continuous invasive blood pressure monitoring. Radial artery is the most commonly chosen site for this purpose. Ultrasound in this setting is commonly used to increase the success rate of needle placement and to reduce the complications. Ultrasound has become the 'third eye' of the clinicians.As discussed earlier there are two basic needling approaches using ultrasound- the short axis out of plane approach and the long axis in plane approach both of which have their own merits and demerits.

Berk et all compared the LA IP and SA-OOP approach. They reported that the LA-IP approach resulted in increased first attempt success (76%) compared to SA-OOP approach (51%). In our study, the modified SA-OOP approach was compared with the LA-IP approach. the first attempt success was 95.2% for modified SA-OOP approach compared to 87.9% for the LA-IP approach. Thus, the modified SA-OOP approach reduces the number of subjects requiring two or more attempts.

Kyung song et ell conducted a study that compared short axis and long axis approach in children. The imaging time in long axis group was significantly longer because the transducer was rotated, from the short axis to the long axis view to capture the whole artery. Zhe feng quan et all concluded that the short axis OOP approach significantly decreases the mean ultrasonic location time. In our study, Ultrasonic location time was lesser with the SA-OOP group when compared with the LA-IP group. The results were statistically significant. When performing an ultrasound guided radial artery cannulation, the artery is placed in the center of the screen. Technically, the modified SA-OOP approach has an advantage over the LA-IP approach in finding the artery more easily. This is by ascertaining the location of the artery using the developing line on the screen by silk suture.

Studies by moon et all showed a 34% incidence of posterior wall puncture in both LA-IP and SA-OOP groups. In our study though there was no statistically significant difference between the two groups, the incidence of posterior wall puncture is slightly higher in the modified S-OOP group. In the LA-IP approach the overall path of the needle and its tip is clearly seen and hence penetration of the posterior wall is prevented.

Zhen feng et all concluded that the presence common complications like hematoma, vasospasm and thrombosis were not statistically significant between the short axis and the long axis group. But there was a slightly lower incidence of hematoma in the modified short axis approach. In our study complications like hematoma formation and vasospasm were not statistically significant between the two groups.

CONCLUSION

In our prospective randomized comparative study of USG guided radial artery cannulation by long axis and modified short axis technique, we conclude that the decrease in ultrasonic location time and cannulation time for the modified OP technique are the direct results of the modifications. The incidence of success in the first attempt was higher in the modified OP approach with no difference in incidence of complications compared to the LA-IP approach.

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