



RANDOMISED COMPARATIVE STUDY OF SUCCESSFUL CANNULATION OF RADIAL ARTERY USING BLIND PALPATION TECHNIQUE AND ULTRASOUND GUIDED TECHNIQUE

Ramya Nagaraju

Assistant professor, Department of Anaesthesiology, Institute of Anaesthesiology & Critical Care, Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai.

Bhavani.M*

Professor, Department of Anaesthesiology, Institute of Anaesthesiology & Critical Care, Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai.
*Corresponding Author

ABSTRACT BACKGROUND

The insertion of radial artery cannula for continuous blood pressure measurement and blood sampling is very much necessary in cardiothoracic surgeries. The radial artery cannula is usually inserted by using blind palpation technique. However, the insertion of the radial artery cannula can sometimes be difficult, requiring multiple attempts which can cause patient discomfort and suffering. The technique of performing radial artery cannulation using ultrasound guidance is increasing in popularity. We compared the successful cannulation of radial artery by blind palpation technique and ultrasound guided technique.

MATERIALS AND METHODS

This study was done as a randomized controlled trial among 80 subjects posted for elective cardiothoracic surgeries of which 40 subjects were put in group P (blind palpation technique) and 40 subjects in group U (ultrasound guided technique).

After ethical committee approval, patients satisfying inclusion criteria and Allen's test, patients randomized by computer generated table. Radial artery cannulation done under complete aseptic precautions with wrist immobilized in dorsiflexed supine position supported by bundle of gauze using blind palpation or ultrasound guided technique. First pass success rate, time taken to cannulate, total number of attempts and complications were noted till the time of decannulation.

RESULTS

The first pass success rate was found to be statistically significant in between both the groups. Time taken to cannulate was significantly shorter in Group U when compared to Group P. The number of attempts were found lesser in Group U when compared to Group P. There was no significant difference in complications in between both the groups.

CONCLUSION

Ultrasound guided technique for radial artery cannulation is associated with higher rate of successful cannulation and lesser time required for arterial line insertion as compared to blind palpation method.

KEYWORDS : Elective cardiothoracic surgeries, blind palpation technique, ultrasound guided technique, first pass success rate, time taken to cannulate, total number of attempts and complications.

BACKGROUND

The insertion of radial artery cannula for continuous blood pressure measurement and blood sampling is very much necessary in cardiothoracic surgeries. The radial artery cannula is usually inserted by using blind palpation technique. However, the insertion of the radial artery cannula can sometimes be difficult, requiring multiple attempts which can cause patient discomfort and suffering. Although the radial artery is usually much smaller than the Central veins, it is easily identified by 2D ultrasound scanning- there it is seen as a pulsating black circle on a background which is otherwise static and mainly white. Recent studies have shown that ultrasound guided techniques are associated with reduction of complications and improved first-pass success rate.

This study aims at comparing the rate of successful cannulation of radial artery using blind palpation and ultrasound guided technique. Study of Levin et al¹ showed the first attempt success rate with ultrasound guidance to be 62% compared to 34% using palpation alone in 69 adult patients undergoing elective surgery. In the emergency setting, Shiver et al² studied 60 patients requiring arterial catheterization randomized to ultrasound guided or palpation technique. They demonstrated a first pass success rate of 87% in ultrasound guided group compared to only 50% in palpation group.

AIMS AND OBJECTIVES:

Aim: To compare the rate of successful cannulation of radial artery using palpation and ultrasound guided technique.

OBJECTIVES:

- First pass success rate (rate of successfully cannulating the artery in the first attempt)
- Time taken to cannulate.
- Total number of attempts (skin pricks).
- Any complications related to the procedure till the time of decannulation (24-48hrs).

MATERIALS AND METHODS:

Study Design

This study was carried out as a randomized, comparative, controlled trial.

Study Area

This study was carried out in the Institute of Anaesthesiology of Madras Medical College Hospital, Chennai.

Study Population

Patients undergoing elective cardiothoracic surgeries were assessed for inclusion and exclusion criteria and were included in the study after obtaining written informed consent.

Total number of patients: 80

Group P: Radial artery cannulation by blind palpation technique.

Group U: Radial artery cannulation by ultrasound guided technique.

Study Duration:

3 months after obtaining ethical committee clearance.

INCLUSION CRITERIA:

Elective surgeries (cardiothoracic)

Adult patients undergoing cardiothoracic surgeries like CABG, Valvular replacements (mitral or aortic valves), septal defect correction, lobectomies, Thoracotomies, Pneumonectomies requiring continuous arterial pressure monitoring.

EXCLUSION CRITERIA:

- Absent pulse
- Thromboangiitis obliterans (Buerger disease)
- Full-thickness burns over the cannulation site
- Inadequate circulation to the extremity
- Raynaud syndrome
- Signs of skin infection.

- Abnormal circulation of the hand.
- Recent arterial puncture <1 month earlier.
- Emergency surgeries.
- Previous surgery in the area.
- Synthetic vascular graft.

Randomization:

Patients were randomly allocated to the computer generated sequence into two equal groups. The sequence was generated as codes to which the study participants were allotted to.

Ethical Approval And Informed consent:

Approval was obtained from the Institutional Ethical Committee prior to the commencement of data collection. Informed consent was obtained from the study subjects prior to the data collection.

Anaesthetic technique:

Patients were checked for Allen's test and wheeled into the operation theatre table. Monitors ECG, Pulseoximeter, NIBP attached and baseline values noted.

Premedicated with I.V Inj Fentanyl 1mic g/kg and Inj Midazolam 0.02mg/kg³.

Palpation technique – Group P

The patient in supine posture with the wrist immobilized in supine dorsiflexed position kept on an arm board and supported by a pack of gauze. Venflon catheter of 20 gauge used for the puncture. Under strict aseptic precautions the forearm was painted and draped. The radial pulse palpated and skin infiltrated with 1 cc of 2% lignocaine.

With 45° angle skin was punctured with 20 gauge venflon, once the artery was punctured, the angle between the skin and needle was reduced, and the needle was advanced 1-2 mm more to ensure that the catheter was also within the lumen of artery. Then the outer catheter was threaded off the needle, maintaining the flow of blood out of the needle hub and the catheter secured⁴.

Ultrasound guided technique – Group U

The patient in supine posture with the wrist immobilised in supine dorsiflexed position kept on an arm board and supported by a pack of gauze. A linear array US transducer with high frequency (8-12 MHz) was used. Under strict aseptic precautions the forearm was painted and draped and skin infiltrated with 1cc of 2% lignocaine. US transducer was covered with sterile glove with adequate US gel and placed over the wrist without palpating the artery in short axis out of plane method^{5,6}. Artery was identified by its anechoic or as dark spot and pulsatile nature. Transducer centered on the radial artery, skin punctured 2-3mm below with 20 gauge venflon. The needle was seen indenting and entering the vessel when it reached the correct depth the needle tip vanishes (vanishing target sign)⁷. The catheter was advanced with confirmation of intraluminal placement.

Data Collection:

Vitals were recorded pre procedure, during and post procedure period. First pass success rate (rate of successfully cannulating the artery in the first attempt), time taken to cannulate, total number of attempts (skin pricks) and any complications related to the procedure like hematoma, infection (local swelling and tenderness), ischemia distal to the insertion site/distal discoloration, thrombosis and embolization were noted till the time of decannulation (24-48 hrs).

Statistical analysis:

Data was analyzed by using SPSS V21; Chi-square test was used to compare the categorical variables. Independent t-test was used for continual variables.

RESULTS:

This study was carried out as a comparative study between radial artery cannulation by blind palpation technique and ultrasound guided technique among 80 patients (40 patients in each group). The mean age of patients in Group P was 40.575 + 14.11 years while that of Group U was 44.9+13.12 years. The mean height of patients in Group P was 160.05+10.39 cm while that of Group U was 156.375+9.13cm. The mean weight, gender, diseases and vital parameters were found insignificant in between two groups.

Table 1

Parameter	GROUP	N	Mean	Std. Deviation	P value
AGE	USG	40	44.9	13.12	0.160
	PALPATION	40	40.575	14.11	
HEIGHT	USG	40	156.375	9.13	0.097
	PALPATION	40	160.05	10.39	
WEIGHT	USG	40	54.625	11.22	0.407
	PALPATION	40	56.9	13.13	

GENDER	USG	PALPATION	P value
Male	26	24	0.642
Female	14	16	

Parameter	GROUP	N	Mean	Std.	P value
HR(B)	USG	40	78.925	20.20	0.411
	PALPATION	40	82.4	17.21	
NIBP SYS (B)	USG	40	148.75	24.09	0.125
	PALPATION	40	139.025	27.95	
NIBP DIAS (B)	USG	40	80.75	8.59	0.064
	PALPATION	40	76.4	11.87	
SpO2 (B)	USG	40	99	0.00	n/a
	PALPATION	40	99	0.00	
HR (A)	USG	40	82.5	19.11	0.244
	PALPATION	40	87.325	17.62	
NIBP SYS (A)	USG	40	136.75	19.66	0.092
	PALPATION	40	128.975	21.03	
NIBP DIAS (A)	USG	40	76.5	10.75	0.733
	PALPATION	40	75.65	11.41	
SpO2 (A)	USG	40	99	0.00	n/a
	PALPATION	40	99	0.00	

Mean time to cannulate in Group P was significantly higher when compared to Group U. The difference was statistically significant (p<0.05).

Table 2

Parameter	GROUP	N	Mean (Min)	Std. Deviation	P value*
TIME TO CANNULATE	USG	40	2.20575	2.63	0.012
	PALPATION	40	4.11	3.88	

*Indicates statistical significance

Mean First pass success rate was found significantly higher in Group U when compared to Group P. The difference was statistically significant (p<0.05).

Table 3

	ATTEMPTS		p Value*
	1	>1	
USG	28	12	0.024
PALPATION	18	22	

Mean success rate for cannulation was 38 out of 40 (95%) in Group U and 32 out of 40 (80%) in Group P. The difference was statistically significant (p<0.05).

Table 4

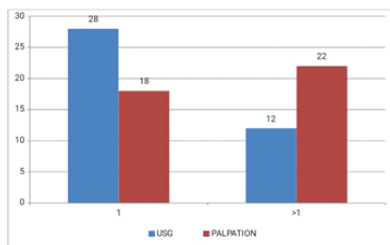
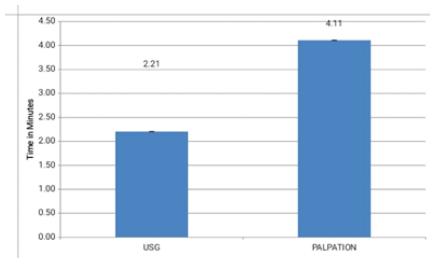
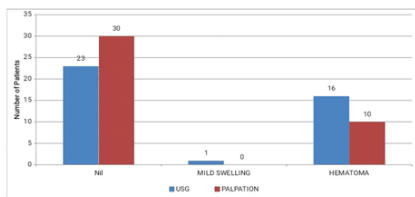
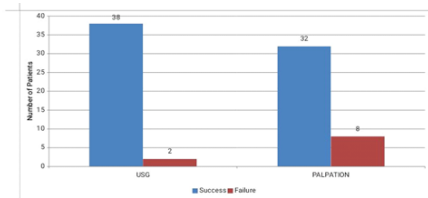
Cannulation Success rate	USG	PALPATION	P value*
Success	38	32	0.043
Failure	2	8	

Mean complication rates were found statistically insignificant in both the groups (p>0.05)

Table 5

Complication	USG	PALPATION	P value
Nil	23	30	0.191
MILD SWELLING	1	0	
HEMATOMA	16	10	
THROMBOSIS AND EMBOLISATION	NIL		

Graphs showing success rate of cannulation, complications, mean time to cannulate and first pass success rate.



DISCUSSION :

Arterial cannulation and the continuous transduction of arterial pressure still remains the accepted reference for monitoring of arterial blood pressure. This idea was proposed long time back by Eather et al⁸, who advocated the monitoring of arterial pressure and pulse contours in patients under anaesthesia. This prospective, randomized study demonstrated the superiority of Ultrasound guided method over blind palpation method. The results obtained in this study are similar to the study done by Levin et al¹ showed the first attempt success rate with ultrasound guidance radial artery cannulation was higher compared to palpation alone in 69 adult patients undergoing elective cardiac surgeries. In the emergency setting, Shiver et al⁷ studied 60 patients requiring arterial catheterization randomized to ultrasound guided or palpation technique. They demonstrated a first pass success rate of 87% in ultrasound guided group compared to only 50% in palpation group. In a study conducted by Ali Ammar et al⁹ showed less number of attempts in ultrasound guided group 1.16±0.37 when compared to blind palpation group 1.44±0.67 (p=0.025) in 100 patients requiring radial artery cannulation. Which is similar to the results obtained in

this study. Meta analysis of seven randomized controlled trials done by Wan-Jie Gu et al¹⁰ compared traditional palpation or Doppler assisted techniques and ultrasound guided radial artery cannulation found that ultra sound guided technique significantly reduces mean attempts to arterial cannulation and mean time to cannulate which coincides with the results obtained in this study. In this study the complications were statistically insignificant between both the groups.

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