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ANAESTHESIA
Research Article

Comparison of Ultrasound Guided Radial Artery Cannulation with Conventional Palpation Technique

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Received: September 15, 2015; **Published:** October 5, 2015

Abstract

Objective: To compare ultrasound guided technique with palpation technique for radial artery cannulation to estimate time of procedure and number of cannulas used.

Study Design: Randomized controlled trial.

Sampling Method: Consecutive type of non-probability sampling.

Place Duration of Study: The study was conducted at department of Anaesthesia, CMH Rawalpindi from January 2015 to March 2015.

Patients and Methods: In this study 60 patients were divided in two equal groups. In group A, USG was used to perform radial artery cannulation and in group B conventional palpation technique was used. After aseptic measures and proper positioning, time noted and procedure started. Successful cannulation confirmed by pulsatile blood flow and time noted. SPSS v. 18.0 was used for analysis.

Results: Mean age was 46.06 ± 18.2 years. Mean time for cannulation in group A was 35.6 ± 17.3 seconds and in group B was 34.9 ± 194s econds. Mean number of cannulas used in group a were1.46 ± 1.1 and in group B were1.53 ± 0.93. Radial artery cannulation was unsuccessful in 3 patients in group A and in 1 patient in group B. Statistically there was no difference in both techniques. In comparison P value for time of insertion was 0.882 and for number of cannulas was 0.802.

Conclusion: In our study there was no difference in both techniques of radial artery cannulation in terms of number of cannulas used and time for cannulation.

Keywords: *Ultrasound; Arterial cannulation; Radial artery; Palpation technique*

Introduction

Arterial catheterization is frequently performed for arterial blood sampling and continuous blood pressure monitoring in intensive care, emergency department and operating room [1]. Arterial cannulation in chilen, obese patients and in patients with hypotension becomes often difficult and challenging. It also becomes difficult due to arterial spasm after multiple attempts [2]. Radial artery is used as most common site for arterial line insertion because of its easy accessibility, low risk of complications and dual blood supply of hand [3].

The traditional practice of using landmark technique for arterial cannulation is based on presumed location of vessel, its palpation and insertion of needle until blood is aspirated. Successful cannulation is then confirmed by pulsatile blood flow, pressure measurement with transducer and waveform assessment [4].

Ultrasound guidance is commonly used for central venous access which resulted in increased first attempt success and reduction in number of complications [5,6]. The Agency of Health Care Research and Quality recommends use of ultrasound for central venous catheter placement as one of its 11 practices to improve patient care [7]. Many clinicians are familiar with ultrasound machine and comfortable with ultrasound-guided central venous access, but only few use ultrasound guided technique of arterial catheterization [2].

Ultrasound can facilitate access to artery and is useful in patients with low perfusion, arrhythmias, obesity and previously unsuccessful attempts with palpation technique [8]. Identification of plaque, arterial spasm, hematoma, or decreased luminal diameter with ultrasound avoids futile cannulation attempts and directs the operator to a more desirable location. Real-time ultrasound-guided insertion of an arterial catheter using sterile technique is preferred over a skin marking static imaging technique [9].

Schwemmer studied use of ultrasound for radial artery catheter insertion in small chilen and infants. Ultrasound guided radial artery cannulation by interventional cardiologist have shown improved first attempt success rate and rapid cannulation [10].

In our country ultrasound guided procedures in anaesthesia practice are being introduced. USG guided central venous cannulation and nerve blocks are performed but USG guided arterial cannulation is not practiced. Rationale of our study was to find out whether ultrasound guidance in arterial cannulation decreases time of procedure and number of cannulas used or not.

Materials and Methods

After taking approval from ethical committee Combined Military Hospital Rawalpind, 60 patients were included in study by consecutive type of non-probability sampling. Adult patients of both genders, undergoing major surgeries for which invasive blood pressure monitoring was needed were included in study. Patients with negative allen's test, coagulation disorder, peripheral vascular disease, previous history of arterial spasm and any other contraindication to arterial cannulation were excluded from study.

They were informed about procedure and its complications and then written consent was taken. They were divided in two groups. In group A, radial artery cannulation was done by ultrasound guidance using out of plane technique and in group B, palpation technique was used for radial artery cannulation. All cannulation attempts were done after patients were anaesthetized. Complete aseptic measures were taken in both groups before cannulation. All cannulations were done by same anaesthetist. When all the equipment was ready, position of wrist for cannulation was made and aseptic measures were taken, time was started on stop watch by assistant and procedure started. When cannula was inserted and confirmed by pulsatile blood flow, time from stop watch noted. Number of cannulas used was also noted. If cannulation was unsuccessful pressure dressing was applied to prevent haematoma and observed. Data was analyzed by SPSS v. 18.0. for description of variables in form of frequencies, numbers and means. Both groups were compared for P value by one way ANOVA test, if P value was below 0.05 it would be considered significant.

Results

In our study total 60 patients were included. Their mean age was 46.06 ± 18.2. 75% were male while 25% were female. Radial artery cannulation was unsuccessful in three patients in group A and in one patient in group B. Total number of cannulas used in study were 90. Mean time of insertion for radial artery cannula and no of cannulas used in both groups are shown in table.1. There is no statistical difference in both groups in terms of time of insertion and number of cannulas used.

Group		Insertion time in Seconds	No of Cannulas used
Group A	Mean	35.6667	1.4667
	Std. Deviation	± 17.36486	± 1.10589
Group B	Mean	34.9310	1.5333
	Std. Deviation	± 19.43842	± .93710
Total	Mean	35.2857	1.5000
	Std. Deviation	± 18.30421	± 1.01681

Table 1: *Time for radial artery cannulation and number of cannulas used.*

When ANOVA test was applied to compare both groups, P value was 0.882 in terms of cannula insertion time and 0.802 in terms of no of cannulas used (Table.2). Both were more than 0.05 and hence these were not significant.

		Sum of Squares	df	Mean Square	F	Sig.
Insertion time in Seconds	Between Groups	7.567	1	7.567	.022	.882
	Within Groups	18419.862	54	341.109		
	Total	18427.429	55			
No of Cannulas used	Between Groups	.067	1	.067	.063	.802
	Within Groups	60.933	58	1.051		
	Total	61.000	59			

Table 2: *One way ANOVA test.*

Maximum cannula insertion time in group A was 80 seconds and minimum time was 17 seceonds while in group B maximum time was 82 seconds and minimum time was 15 seconds. And maximum cannulas used in single patient in group A were 5 and in group B were 4.

Discussion

Continuous arterial pressure monitoring has become important measurement in critical care setting and also in major surgical procedures with hemodynamic instability [11].

The earliest reports on USG-guided arterial cannulation occurred in 1989 and described the application of continuous wave Doppler to aid in cannulation [12]. They successfully placed 11 out of 12 arterial lines using continuous Doppler probe identical to that used for detection of pedal pulses.

Meta-analysis of studies comparing ultrasound and palpation method for radial access showed 71% improvement in first attempt success when ultrasound was used [2]. Even in small chilen and infants first attempt success was improved. Shiver et al compared the complication rate between the ultrasound-guided and palpation groups. They demonstrated a 43% reduction in the development of a hematoma at the puncture site (ultrasound, 7%; palpation, 50%) [13].

A number of randomized controlled trials addressing these topics have reported inconsistent results [14]. Our study also showed similar results. There was not much difference in both techniques in regard to time of procedure and no of cannulas used. Ganesh., et al. also showed that there was no difference in implementing ultrasound guidance and explained that it was likely due to lack of training and experience of the operators [15].

Since ultrasound technique is a relatively new and complex procedure especially in inexperienced operators, the learning curve of ultrasound techniques in radial artery catheterization may affect first attempt success and other clinical end point [16].

In some studies there is strong support for radial artery cannulation by using ultrasound to improve first-pass success [2]. However our study showed insignificant results as we performed procedure in limited number of patients in which radial artery access was not difficult. Studies have to be done in our setup in large number of patients and in cases with difficult arterial access such as obesity, hypotension, arrhythmias and very small chilen where studies have proven significant success with ultrasound guidance [8].

Recommendations

More expertise in this technique may improve results. Further studies should be conducted to find the usefulness of ultrasound guided cannulation in difficult situations. Out of plane technique for radial artery cannulation and colour Doppler flow was not present in our USG machine. We suggest that in plane technique should also be studied and colour Doppler flow should also be used.

Conclusion

Radial artery cannulation was compared using ultrasound guided cannulation vs. conventional palpatory technique for arterial cannulation. In our study there was no difference in both techniques, in terms of number of cannulas used and time for cannulation

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Volume 2 Issue 2 October 2015