Radial Artery Cannulation: Recommendations for Improved First Pass Success; Brief Report

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Abstract

Radial artery cannulation is an important procedure in critical care medicine and cardiology. The risk of complications associated with arterial cannulation increases with the number of attempts. A review of the current literature was performed to identify recommendations to increase first pass success in radial artery cannulation. Recommendations include positioning the wrist at 45 degrees and the use of ultrasound. In ultrasound guided arterial cannulation, the choice of long axis versus short axis views should be based on proceduralist preference.

Key words: Arterial cannulation, Art line, Radial Artery


Brief Report

Arterial cannulation is an important procedure in the area of critical care medicine and cardiology [1-5]. The radial artery is seen as an ideal site due to it being part of a dual blood supply to the hand [3]. While arterial cannulation is seen to be a low risk procedure, it is not without complications [3]. The incidence of complications increases with each attempt [2]. For this reason, there is a growing body of evidence evaluating the various aspects of the radial artery cannulation procedure.

One reason for using the radial artery for arterial cannulation is its predictable anatomical location. The position and size of the radial artery may be altered by the position of the wrist during the procedure [2]. A study by Melhuish and White (2016) performed a meta-analysis of level one randomised controlled trials (RCTs) [2]. This study found moderate evidence supporting a wrist position of 45 degrees to improve radial artery size, cannulation time and success rate [2]. A key limitation of the RCTs included in this studies was that the majority of patients were young healthy volunteers [2]. Therefore, the applicability of these results to inpatients predisposed to difficult cannulation (obese, hypotensive, peripheral arterial disease) is unknown.

The use of ultrasound guided radial artery cannulation was evaluated in a recent meta-analysis by White and colleagues (2016) [3]. This was an analysis of level one RCTs in both adult and paediatric patients [3]. The study provided the evidence to make a level one recommendation in support of the use of ultrasound as an adjunct to radial artery cannulation [3]. In the adult population there was level one evidence showing improved first attempt success rate (RR= 1.4; 95%CI= 1.28-1.64; I²=0%; p<0.00001) and number of attempts to success (WMD= -1.17; 95%CI= -2.21

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to -0.13; $I^2=99\%$; $p=0.03$) [3]. These benefits were also demonstrated in paediatric patients with a significantly improved first attempt success rate (RR= 1.96; 95%CI= 1.34-2.85; $I^2=23\%$; $p=0.0005$) and number of attempts (WMD= -1.66; 95%CI= -2.95 to -0.38; $I^2= 98\%$; $p=0.01$) [3].

The position of the ultrasound probe was studied in a meta-analysis by Gao and colleagues (2016) [4]. This was a meta-analysis of five RCTs, which compared long axis in plane with short axis out of plane positioning of the ultrasound probe [4]. This study showed no difference in first attempt success rate and number of attempts [4]. The authors of this paper suggest that the proceduralist use the technique which they are most familiar with.

Once the proceduralist has the ultrasound probe in a familiar position, the final aspect to consider is the way in which the needle pierces the skin and artery [5]. There is one level one RCT by Min and colleagues (2016) investigating bevel up versus bevel down. This was a moderate size study of 205 patients performed in patients with their wrists bent at 45 degrees, using ultrasound guidance. This study showed a significant improvement in first attempt success rate with the bevel down technique (OR: 2.14; bevel up 95%CI= 0.62-0.76; bevel down 95%= 0.76-0.90; $p=0.028$).

In conclusion, current evidence for optimal radial artery cannulation supports positioning the patients’ wrist at 45 degrees, using ultrasound guidance and inserting the cannula in the bevel down position. There is no evidence is support of the in-plane or out-of-plane ultrasound position. More studies are required to further determine the impact of wrist position on cannulation success in patients at risk of difficult cannulation.

References:


