Time to Rethink How We Place Small Intravenous Catheters?

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Introduction

- The majority of hospitalized patients undergo intravenous catheterization, yet the first attempt success rate is quite low.
- The young are most at risk for difficult intravenous access, as they may require smaller-gauge intravenous (IV) catheters.
- Priming the angiocatheter needle with saline subjectively speeds the flow of blood from the vein to the angiocatheter flash chamber.
- One approach to aid intravascular placement of the angiocatheter needle is to "prime" the angiocatheter needle with saline.
- We hypothesized that priming the angiocatheter needle with saline enables faster visual detection of blood in the angiocatheter flash chamber.

Methods

- In this ex-vivo experiment, we compared the time for heparinized human blood to travel the length of
  - Saline-primed and unprimed 24-gauge angiocatheters
  - Saline-primed and unprimed 22 gauge angiocatheters
- We assembled a system where a syringe pump advanced the angiocatheter needle until the needle pierced the silicone membrane of a T-piece (Figure 1).
- When the angiocatheter needle punctured the T-piece membrane and contacted the blood, an electrical circuit was completed, illuminating a light-emitting diode.
- Time from LED illumination (venous cannulation) to visual detection of flash chamber blood was determined by video review.
- Saline-primed angiocatheter needles and unprimed angiocatheter needles were alternated.
- We suspended the blood to simulate 50 mmHg venous pressure.
- Wilcoxon Rank Sum test was used for non-normally distributed data.

Setup

Figure 1: The setup for the needle insertion into the T-piece

Results

- In the 24g catheter group, the median time for blood to travel the length of the unprimed angiocatheter needle was 1.14 (0.61-1.47) seconds, compared with 0.76 (0.41-1.20) seconds in the saline-primed group)
- 3 were excluded from the primed group and 2 from the unprimed group because the LED was no visible in the video or did not illuminate.
- In the 22g catheter group, the median(IQR) time for blood to travel the length of the unprimed angiocatheter needle was 1.80 (1.23-2.95) seconds; compared with 1.46 (1.03-2.54) seconds in the saline-primed group (p-value = 0.046, Wilcox on Rank Sum; Table 1).
- One catheter was excluded from the unprimed group because the LED was not visible in the video or did not illuminate.

Table 1	Seconds to flash Median (IQR)	P-value (Rank Sum)
24g Unprimed (n=103)	1.1.4 (0.61-1.47)	0.006
24g Saline-Primed (n=102)	0.76 (0.46-1.20)	
22g Unprimed (n=104)	1.80 (1.23-2.95)	0.046
22g Saline-Primed (n=105)	1.46 (1.03-2.54)	

Setup/Comparison

Figure 2: The needles used, primed and unprimed

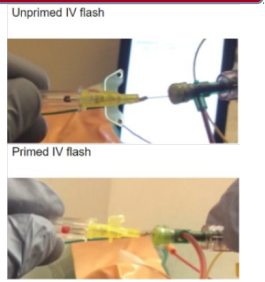

Figure 3: Comparison of unprimed and primed flash

Discussion

- The first attempt success rate for intravenous catheter placement is lower in infants, toddlers, and children <12 years.[2]
- These age groups would benefit from quicker flash detection.
- The visible detection of blood in the flash chamber of saline-primed 24-gauge and 22-gauge intravenous catheters was significantly faster than their unprimed counterparts.
- The reduction in time may be clinically significant, particularly in patients with small veins.
- This technique modification should be considered when placing 24-gauge and 22-gauge intravenous catheters.

Citations

1. R Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.
2. Predictive factors for difficult intravenous cannulation in pediatric patients at a tertiary pediatric hospital Natascha J. Cuper1, Jurgen C. de Graaff2, Atty T. H. van Dijk3, Rudolf M. Verdaasdonk4, Desire´e B. M. van der Werff2 & Cor J. Kalkman2