Title: TOURNIQUET INDUCED REACTIVE HYPEREMIA MAY IMPROVE THE TECHNIQUE OF ARTERIAL CANNULA INSERTION

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Introduction: Percutaneous direct cannulation of a peripheral artery is often necessary to monitor for hemodynamic and biochemical dysfunction. Difficulty or failure at insertion is common and may be due to technique, low peripheral blood flow states, atherosclerotic narrowing or arterial spasm. Reactive hyperemia refers to the state of increased blood flow in proportion to the cellular metabolic and oxygen debt that occurred during a period of arterial occlusion. The degree and duration of increased blood flow is in direct proportion to the total metabolic debt.[1] The objectives of this pilot study are to document the increase in blood flow and arterial lumen dilation that occurs in the radial artery after a period of vascular occlusion. To our knowledge, this is the first study to document flow rate and vessel size using a real-time imaging technique after tourniquet occlusion. A subsequent study will use reactive hyperemia to aid in the technique of percutaneous arterial catheter insertion.

Methods: Twelve healthy adult volunteers were studied after obtaining informed consent and institutional review board approval. With the person supine and relaxed, baseline blood flow and lumen diameter where measured using real-time color doppler imaging utilizing a 7.5 MHz linear array transducer (Quantum, Isaquha, Washington). The distal radial artery was measured in a standardized fashion with the arm and transducer fixed throughout the study. Next, an upper arm blood pressure cuff was inflated 20 mm of mercury above systolic pressure and left inflated for ten minutes. (Shorter occlusion times produced less vessel dilation and less significant blood flow increases). On deflation, measurements were obtained each minute for a total of five minutes. Results were analyzed utilizing a student paired t-test. A p value $\leq$ 0.05 was considered statistically significant.

Results: Significant reactive hyperemia occurred in all subjects tested. The inner diameter of the radial artery increased in size approximately 28 percent. Maximal dilation occurred one minute after tourniquet release then gradually returned to baseline over three additional minutes. Blood flow significantly increased in all subjects, averaging 86 percent above baseline. Maximum flow occurred immediately upon tourniquet release and gradually returned to baseline over a four minute period.

Table 1. Flow and Size Post Hyperemia

Radial Artery Size		Immediate
Baseline Size	1 Minute Size	Flow Rate
2.23mm ± 0.37	2.77mm ± 0.32	↑ 86% (66-100%)

Discussion: This study demonstrates that radial artery blood flow and arterial lumen diameter increase significantly after tourniquet occlusion for 10 minutes. By increasing the size and flow characteristics of the radial artery, theoretically, a cannula should be technically easier to insert.

References:

1. Lewis T, Grant R: Observations upon reactive hyperemia in man. Heart 12:73, 1925

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