Frozen/Thawed Cadaver Model for Teaching Ultrasound Guided Femoral Vein Cannulation

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INTRODUCTION: Central line ultrasound guidance

- Endorsed by the federal AHRQ as benefiting patient safety
- Ultrasound probe placed contiguous to location of skin and vein puncture
- Real-time visualization of structures in lieu of "educated guesswork"
- A good technique to learn and to be taught

OBJECTIVE

- Can an unembalmed frozen and thawed cadaver approximate the visual and tactile elements encountered with the procedure in the clinical setting?

METHODS

- 89 year old anatomical gift donor died of coronary artery disease
- Remains frozen within 30 hours of death
- Remains thawed 99 days later for use in a resident procedure lab
- Anatomical preparation per Fig. 1 schematic

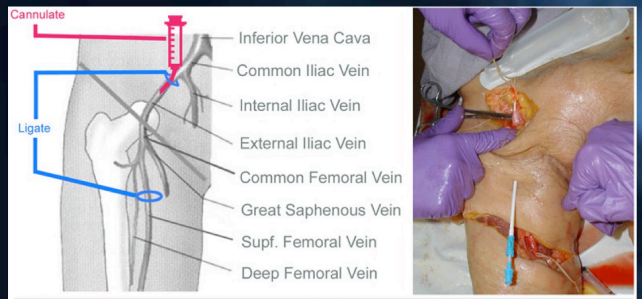

Figure 1: Schematic and photographic depictions of the model's preparation. Photo shown was taken after successful cannulation by Seldinger technique. Note percutaneous entry of large bore trauma line approximately mid-way between the two ligature incisions.

METHODS (cont'd)

- Filling of the vasculature with tap water at the iliacs via syringes
- Ultrasound survey of the planned venipuncture site
- Sonosite-180 portable ultrasound unit, 7.5 - 10 MHz linear transducer
- Venipuncture performed under real-time sonographic guidance
- Standard Seldinger technique at a point inferior to the inguinal groove

RESULTS

- Instillation of 25 - 50 cc was required for venous expansion/visualization
- Observed soft tissues, vessel walls/lumens, and venous valves approximated in-vivo clinical 2-D sonographic appearances (Fig. 2)
- Intraluminal flow observable by doppler could be fabricated by pulsitile iliac instillation of small (< 1cc) fluid aliquots (Fig. 3)

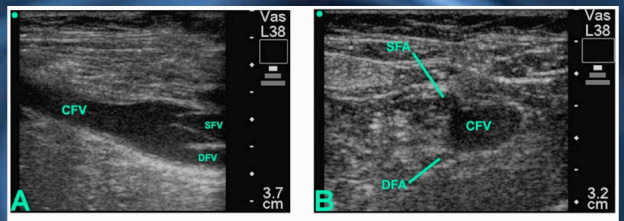

Figure 2: Long- (A) and short- (B) axis ultrasound images of vascular elements at representative portions of the proximal lower extremity. The venous structures were initially collapsed, and not sonographically evident until filled by injection from above. [Key: CFV = common femoral vein, SFV = superficial femoral vein, SFA = superficial femoral artery, DFA = deep femoral artery]

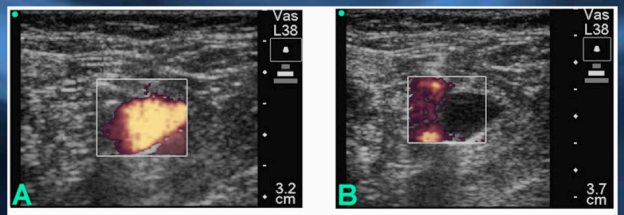

Figure 3: Short axis (transverse) duplex images of femoral vessels at the location clinicians typically choose for venipuncture and cannulation. (A) Flow within superficial femoral vein. (B) Flow within superficial and deep femoral arteries. By injecting the iliacs, the instructor mimics in-vivo blood flow as perceived on color power doppler downstream. Vessel location becomes more conspicuous, enabling easier identification by the student.

RESULTS (cont'd)

- Sonographic appearance of instrumentation during and after cannulation resembled that observed with living patients (Figs. 4,5)

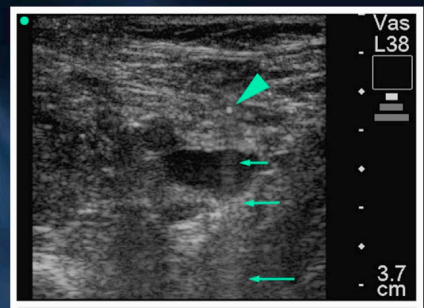

Figure 4: Transverse image during cannulation. Arrowhead = descending venipuncture needle in cross section. Arrows = "comet tail" effect, a phenomenon typically also observed in the live setting, that can aid in needle localization.

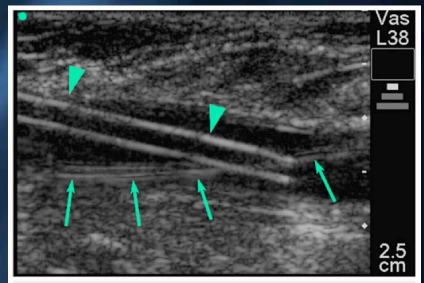

Figure 5: Confirmatory image at the iliac vein. Superior direction is to screen's left. Arrowheads = injection cannula. Arrows = small bore cannula successfully inserted through the femoral vein from below.

CONCLUSION

This model provides a close anatomic approximation to the live patient and avoids the sonographic impediments of the embalmed cadaver. It is a promising tool for the teaching of ultrasound guided vascular cannulation, and could have further potential in the instruction of other ultrasound-assisted invasive procedures.