CONTROVERSES ET ACTUALITÉS EN CHIRURGIE VASCULAIRE

CONTROVERSIES & UPDATES IN VASCULAR SURGERY

JANUARY 23-25 2014

MARRIOTT RIVE GAUCHE & CONFERENCE CENTER PARIS, FRANCE

Puncture Ultrasound Guidance: Decrease Access Site Complications

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Disclosure

Speaker name: Peter A. Schneider

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- I have the following potential conflicts of interest to report:

  Chief Medical Officer for Intact Vascular

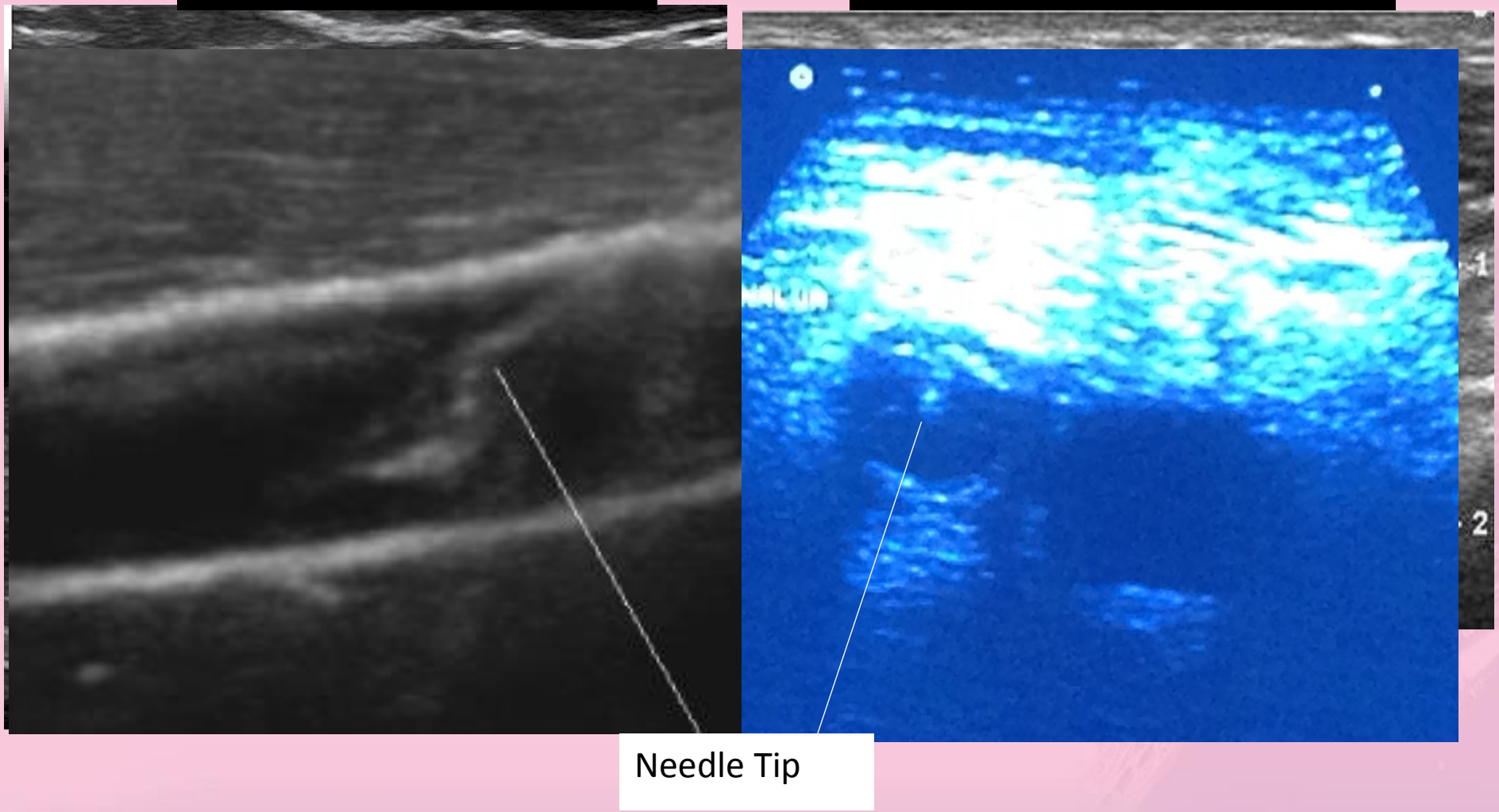
  Modest royalty from Cook

Usage of Ultrasound in Routine Vascular Practice

- All venous cases
- Evaluate for vein as conduit for bypass or dialysis access
- Plan incisions for arterial access; distal bypass, carotid endarterectomy, vein graft revisions
- Endovascular access-both arterial and venous

Longitudinal/In-plane

Transverse/Out-of-plane



Ultrasound Guidance of Optimal Puncture Site

Thresholds for Access Site Complications

- SIR: MAE threshold
  - hematoma (requiring transfusion, surgery or increased LOS) <0.5%
  - access site occlusion <0.2%
  - pseudoaneurysm or AVF <0.2%
- ACC benchmark
  - After diagnostic <1.0%
  - After intervention <3.0%

Singh et al. J Vasc Interv Radiol 2003;14:S283-288.

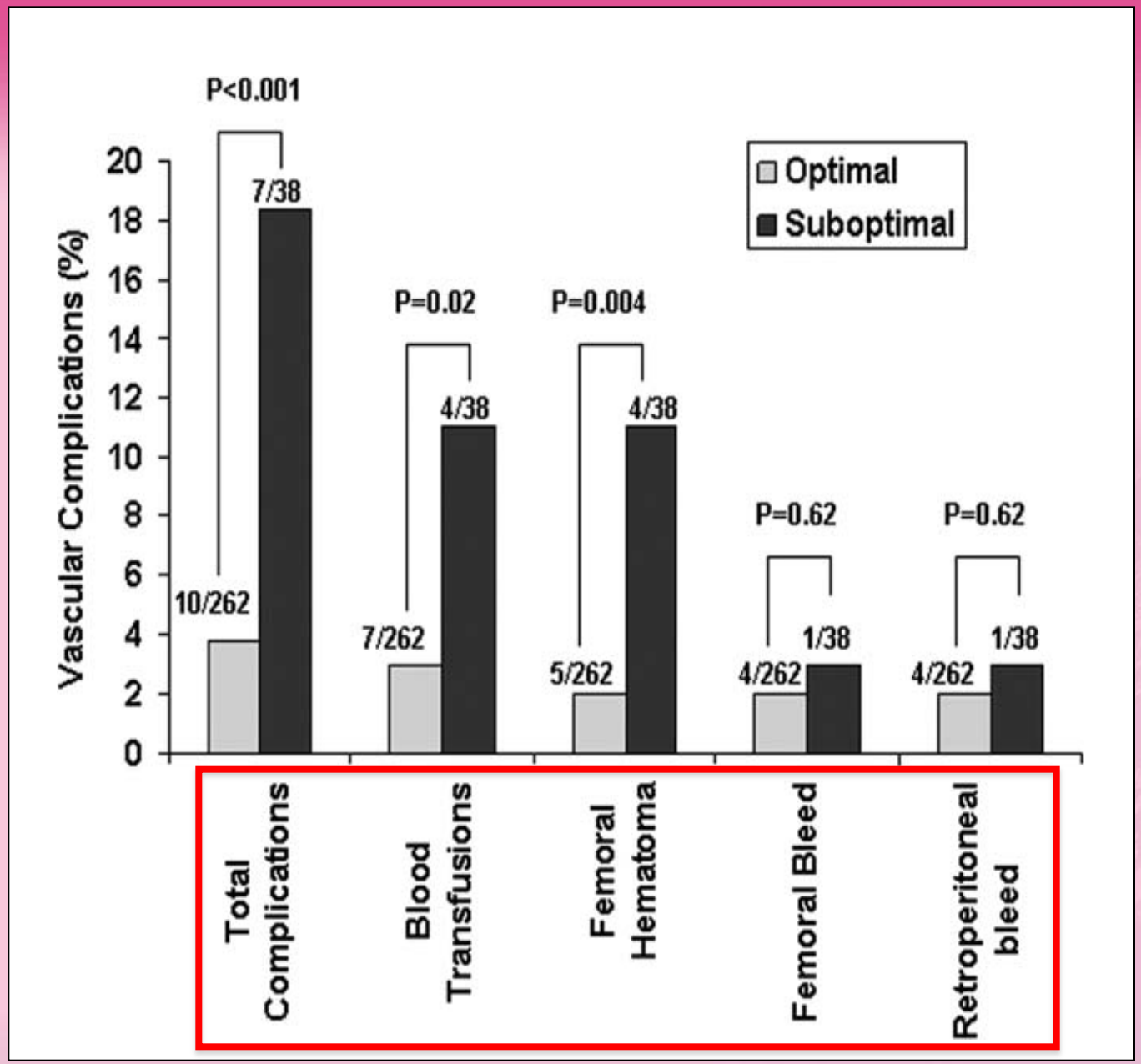
Bashmore et al. J Am Coll Cardiol 2001;15:2170-2214.

Decrease Access Site Complications

Complication	Rate
Femoral hematoma	3.6-5.5%
Pseudoaneurysm	2.0-5.1%
Arteriovenous fistula	0.6-2.2%
Access site occlusion	1.0-1.6%
Retroperitoneal hematoma	0.1-0.7%

Hirano et al. J Cardiol 2004;43:259-265.
Doyle et al. JACC 2008;1:202-209.
Frank et al. J Interv Cardiol 2010;23:569-574.
Farouque et al. JACC 2005;43:363-368.
Stone et al. Vasc Endovasc Surg 2012;46:617-23.

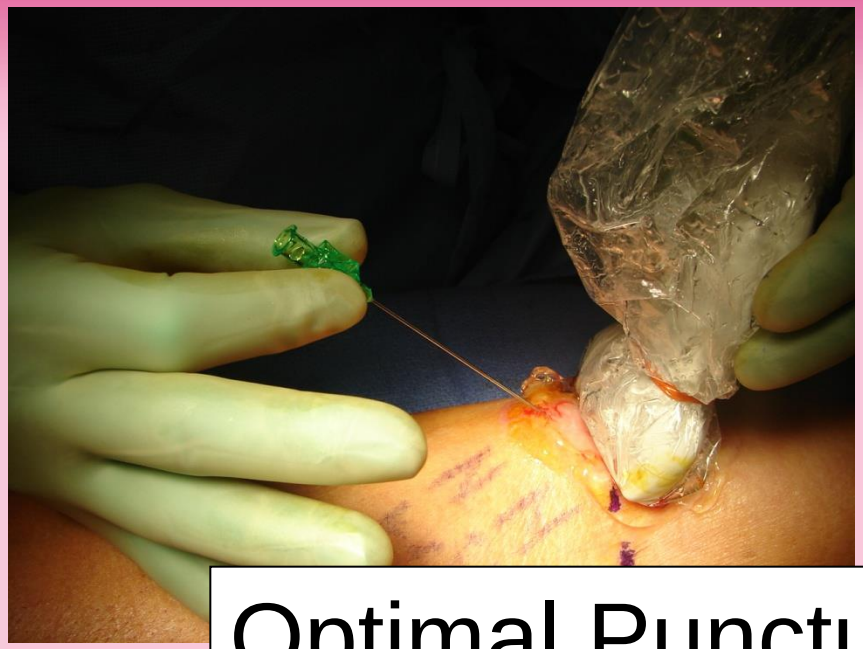
Optimal Puncture Site Placement= Lower Rate of Complication



Pitla et al. CCI. 2011;78:294.

Rationale
Puncture Ultrasound Guidance

- Reduce access site complications
  - Lower risk of hematoma, bleeding, AV fistula
  - Single puncture, first pass, single wall
  - Avoid-branches, calcification, lesions
- Optimal use of closure
  - Avoid arterial access site disease
  - Best choice of closure
  - Safety of percutaneous EVAR-reduce open conversions



Optimal Puncture Site Placement

Puncture Ultrasound Guidance

Endovascular arterial access:

- Brachial artery access
- Antegrade common femoral
- Superficial femoral artery access
- Pedal or distal tibial artery access
- Percutaneous EVAR
- Retrograde common femoral

Where we thought we least needed it!

Puncture Ultrasound Guidance Results for Retrograde Femoral Approach

TABLE II. Differences of Variables with Palpation or US Guidance

Variable	Palpation-guided (n =100)	US-guided (n =108)	P value
Technical success rate	96 (96%)	108 (100%)	0.052
Median number of attempts	1 (1–5)	1 (1–3)	**0.001**
The first pass success rate	78 (78%)	101 (93.5%)	**0.001**
Mean time to access (sec)	94.3 ± 66.4	68.6 ± 45.1	**0.001**
Additional sedoanalgesia	18 (18%)	16 (15%)	0.182
Complication rate (local hematoma)	4 (4%)	0 (0%)	0.052

TABLE III. Distribution of the Number of Attempts

Number of attempts	1	2	3	4	5
Palpation guided (n = 100)	78 (78%)	10 (10%)	8 (8%)	2 (2%)	2 (2%)
US guided (n = 108)	101 (93.5%)	4 (3.7%)	3 (2.8%)	0 (0%)	0 (0%)

Gedikoglu, et al. Catheter Cardiovasc Intervent 2013 Jan, epub.

Real-Time Ultrasound Guidance Facilitates Femoral Arterial Access and Reduces Vascular Complications

FAUST (Femoral Arterial Access With Ultrasound Trial)

Characteristic	Fluoroscopy (n = 500)	Ultrasound (n = 502)	p Value
Number of attempts	3.0 ± 3.2	1.3 ± 0.9	<0.000001
First pass success	232 (46.4%)	415 (82.7%)	<0.000001
Venipuncture	79 (15.8%)	12 (2.4%)	<0.000001
Number of arterial punctures	1.14 ± 0.43	1.09 ± 0.36	0.076
Mean time to insertion, s	213 ± 194	185 ± 175	0.016
Median time to insertion, s	148 (102–242)	136 (90–212)	0.003

Complication	Fluoroscopy (n = 501)	Ultrasound (n = 503)	p Value
Hematoma ≥5 cm	11 (2.2%)	3 (0.6%)	0.034
Pseudoaneurysm	0	1	NS
Dissection	3	2	NS
Access bleeding, transfusion	2	1	NS
Hematoma with DVT	1	0	NS
Any complication	17 (3.4%)	7 (1.4%)	0.041

Seto, et al. JACC Intv. 2010;3:751.

Puncture Ultrasound Guidance Quality Improvement Project

Retrograde Femoral Approach

Protocol	Time Period	Complication Rate	Closure Device Usage	Notes
Standard Seldinger technique	2007: 206 consecutive cases	All: 6.0% Serious: 1.0%	55%	Retroperitoneal hematoma (1), surgical repair of hematoma (1)
Ultrasound and micropuncture	2011: 382 cases	All: 1.8% Serious: 0.3%	86%	Operation to evacuate hematoma (1)

Schneider et al. Kaiser Hawaii Experience.

International evidence-based recommendations on ultrasound-guided vascular access

Table 4 Recommendations on ultrasound vascular access in adults and cost-effectiveness

Ultrasound vascular access in adults				
Domain code	Suggested definition	Level of evidence	Degree of consensus	Strength of recommendation
D4.SD2.S1	Ultrasound guidance should be routinely used for short-term central venous access in adults	A	Very good	Strong
D4.SD2.S2	Ultrasound guidance should be routinely used for long-term central venous access in adults	A	Very good	Strong
D4.SD2.S3	PICCs should be routinely inserted at mid arm level by ultrasound guidance using micro introducer technique	A	Very good	Strong
D4.SD2.S4	Use of ultrasound guidance should be taken into consideration for any kind of peripheral intravenous line when difficult access is anticipated	B	Very good	Strong
D4.SD2.S5	Ultrasound-guided arterial catheterization improves first-pass success and should be used routinely in adults	A	Very good	Strong
D4.SD2.S6	Ultrasound can accurately detect pneumothorax and should be routinely performed after central venous catheter cannulation when the pleura could have been damaged	B	Very good	Strong
D4.SD2.S7	CEUS (contrast-enhanced ultrasound) is a valid method for detecting a central venous catheter tip in the right atrium	B	Very good	Strong
Cost-effectiveness of the use of ultrasound for vascular cannulation				
D5.S1–3	Ultrasound-guided vascular access has to be used because it results in clinical benefits and reduced overall costs of care makes it cost-effective	A	Very good	Strong

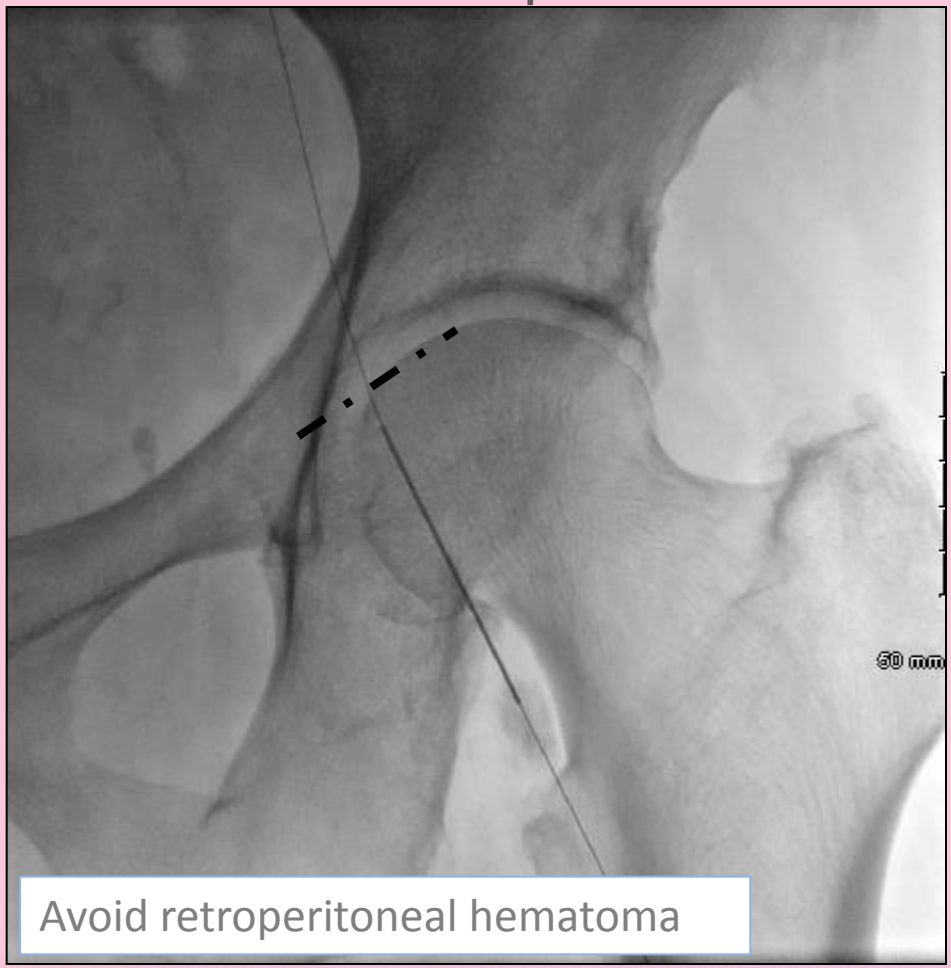
Lamperti et al. Intensive Care Med 2012;38:1105

Puncture Ultrasound Guidance

Tips and Pitfalls

- Find profunda and place needle 1-2cm superior to the bifurcation.
- Inguinal ligament variable
  - Not always clearly visible
  - If too close, can interfere with closure
- Use image to avoid small common femoral artery branches and calcific patches
- More calcified or scarred artery, place needle at steeper angle

Ultrasound and Micropuncture for Endovascular Access
Obtain a Spot Film with the Needle in Place



Avoid retroperitoneal hematoma

Puncture site:
must be inferior to
the top of the femoral head

Comparison of a novel real-time SonixGPS needle-tracking ultrasound technique with traditional ultrasound for vascular access in a phantom gel model

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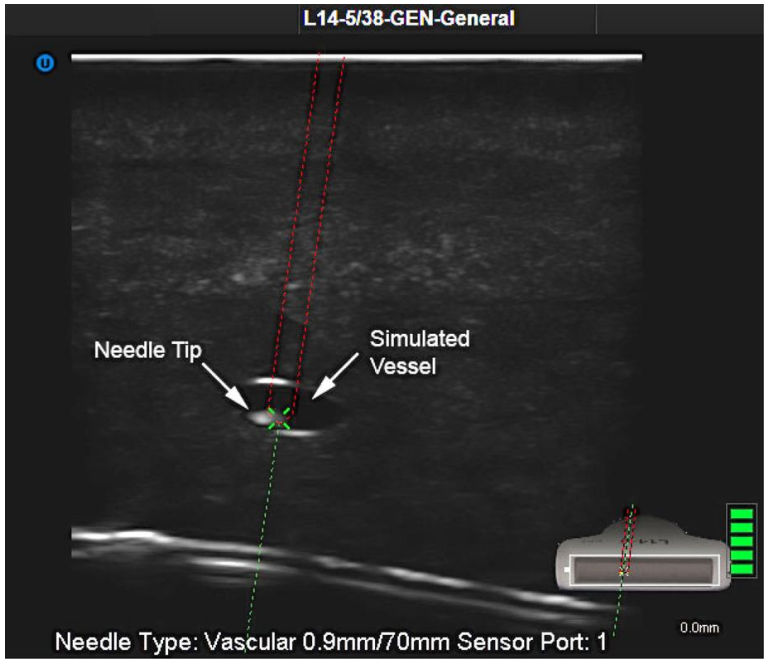

Fig 1. Out-of-plane with guidance positioning system (GPS): The simulated vessel is seen in the short axis and the needle tip is seen within the target. Based on the needle trajectory, an "X" is displayed onscreen where the needle will intersect the ultrasound plane. The "X" changes from white to green when the needle tip intersects the ultrasound plane. The needle position is indicated by the *red silhouette* and the projected path in *green*. On the bottom right, the footprint of the transducer is displayed with the relative needle position.

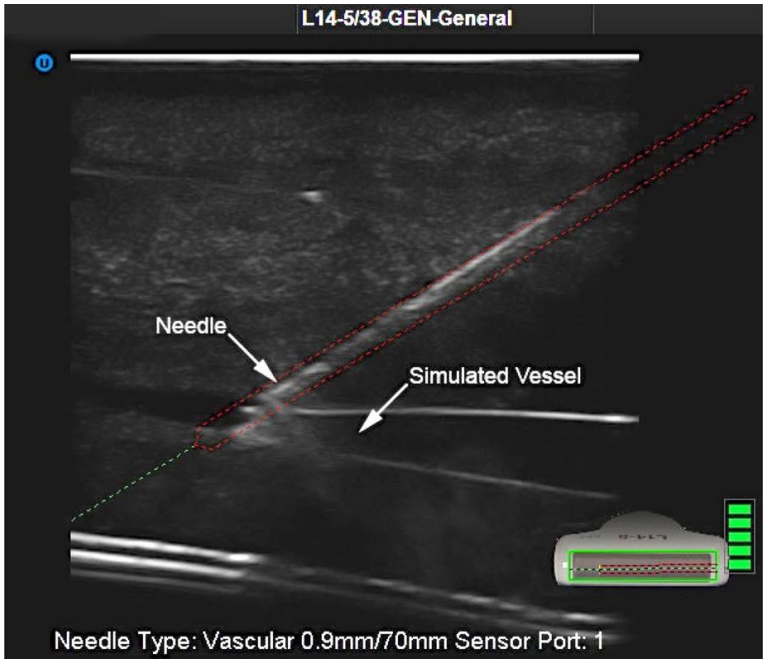

Fig 2. In-plane ultrasound view with guidance positioning system (GPS): The simulated vessel is seen in the long axis and the needle is seen entering the target with the needle tip just beyond the posterior wall. The SonixGPS provides information on needle position indicated by the *red silhouette* and the projected path in *green*. On the bottom right, the footprint of the transducer is displayed onscreen with the relative needle position.

Ultrasound Guidance and Micropuncture

Conclusion

- Ultrasound guided access provides added safety and reduces our most common complications
- Readily available
- More more ideal needle puncture placement
- Enhances use of closure devices
- Opportunity for quality improvement