Testing For Venous Reflux MUST Be Done in The Standing Position

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DISCLOSURE

Mark Meissner, MD

No Relevant Financial Relationship Reported
DEBATE

“Testing for Venous Reflux Should Be Done in the Standing Position”
Consequences of Inaccurate Diagnosis

Inappropriate Interventions
14 yr old with calf cramps and reflux referred for intervention

We MUST Do Better Than This!!!

FraThan Waste, & Abuse
4,529% Increase in Vein Procedures (U.S.)
Valvular Reflux

- Retrograde flow in response to provocative maneuver
- Pathologic reflux > 0.5 sec
- Provocative maneuvers
  - Valsalva’s maneuver
  - Distal compression
  - Distal cuff deflation
  - Parana maneuver
- Position – Supine versus upright
Why John Is Wrong!!!

- Venous disease is a disease of the upright position
  - Venous symptoms characteristically improve with leg elevation
  - Bedridden patients don’t get venous ulcers
  - Varicose veins don’t occur in the arms

- Valves are specifically designed to be open when not upright

The evidence suggest that non-upright testing produces **BOTH** false negatives and false positives (perhaps a bigger problem)

- Virtually ALL major venous societies (e.g. clinicians) support upright testing
I. The Upright Position & Valve Closure

van Bemmelen et al, Arch Surg 1990

[Diagram showing blood flow through a tube with arrows indicating flow direction. The text indicates a blood flow rate of 30 cm/sec, and a duration of 0.5 sec.]
Standing Cuff Deflation
van Bemmelen et al; J Vasc Surg

- 30 nl limbs examined with standing cuff method
- 95% of normal valves close within < 0.5 sec
The **INVEST Study**

*Lurie F, J Vasc Surg 2012*

- Duplex U/S in 17 volunteers and 57 CVD patients
  - **Repeatability & reproducibility**
  - **Limits of agreement**
    - Time of day (morning vs afternoon)
    - Position (standing vs supine)
    - Reflux initiation (manual vs cuff compression)
- Mean reflux times shorter (0.23 sec) in standing position
  - Supine 0.82 ± 0.81 sec
  - Standing 0.59 ± 0.65 sec
- Lower precision = higher reproducibility

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Morning</th>
<th>Afternoon</th>
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<tbody>
<tr>
<td>Patient Position</td>
<td>Supine</td>
<td>Standing</td>
</tr>
<tr>
<td>Precision (sec)</td>
<td>0.71</td>
<td>0.43*</td>
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* * p < .05

**Best Reproducibility Standing in the Morning**
II. False Positives & Negatives

Markel et al; Arch Surg 1994

- Supine maneuvers vs Standing cuff deflation (N = 167)
- False negatives – Absence of dependent venous dilation
- False positives – Failure to generate adequate reverse velocity
Standing vs Supine Reflux
Labropoulous N, J Vasc Surg 2003

- Reflux times measured in 10 patients
  - Standing with cuff compression
  - Supine with cuff compression

<table>
<thead>
<tr>
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<th>Reflux +</th>
<th>Reflux -</th>
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</thead>
<tbody>
<tr>
<td>Standing</td>
<td>51 (88%)</td>
<td>8 (12%)</td>
</tr>
<tr>
<td>Supine</td>
<td>5 (7%)</td>
<td>72</td>
</tr>
</tbody>
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False Negative

False Positive
The Literature Supporting Supine Testing

Carty GA, JVU 2013

- 72 consecutive patients with C2 – C6 disease (no normals)
  - 30º Reverse Trendelenberg
  - Standing

- No data presented for meaningful interpretation

Conclusions

- No normal patients (potentially increased false positives)
  - Supine reflux > 1.13 s always correlates with standing reflux > 0.5 sec
- No data to calculate false positives or negatives
  - Values between 0 – 1.13 supine not predictive of reflux presence/absence
What Expert Clinicians Think
American Venous Forum Appropriate Use Project

- AUC’s bridge gaps between evidence-based medicine & expert opinion
- Structured, quantitative RAND / UCLA methodology
- 9 Point rating scale

**Positioning For Reflux Testing**

- Supine
- Steep Reverse Trendelenburg
- Standing

Masuda E, AVF 2019
Better... But Is Even This Good Enough

- Is an inaccurate test better than no test?
- Reflux is usually NOT the 1º cause of venous dz in patients who can’t stand
  - Calf muscle pump dysfunction (paralysis, arthritis, etc)
  - Obesity (central venous hypertension)

Imprecise “Standards” Are Hardly Standards At All
Theoretical support for standing reflux assessment

- Valves are designed to remain open at rest while supine
- Normal valve closure requires
  - Generation of adequate transvalvular gradient
  - Adequate venodilation for coaptation of valve cusps
- Pathologic reflux is *purely* an upright phenomenon

The data

- Supine position produces both false + and –
- Less reproducibility in supine positions
- IAC standards mandating upright testing are in progress