APDVS Committee of Fundamentals of Vascular & Endovascular Surgery Report 2016-2017

Jean Bismuth, MD FACS
Associate Professor
Houston Methodist Hospital
Houston, Texas
Disclosures

• None
Committee FVEVS

• Members
  • Malachi Sheahan
  • Murray Shames
  • Jason Lee
  • David Rigberg
  • Jean Bismuth

• Contributors
  • John Eidt
  • Cassidy Duran
  • Brian Dunkin
  • Claudie Sheahan
  • Rabih Chaer
  • Erica Mitchell
  • Carlos Bechara
Fundamentals of Endovascular Surgery (FEVS)

• Metrics defined - LSU, Rice University, Houston Methodist Hospital

• 8 scenarios
  • Catheter and wire skills
  • Imaging

• Developers
  • Jean Bismuth
  • Cassidy Duran
  • Malachi Sheahan
  • Murray Shames
  • Jason Lee
  • John Eidt
  • Rabih Chaer
  • David Rigberg
  • Erica Mitchell
  • Claudie Sheahan
FLS News
SAGES-ACS Fundamentals of Laparoscopic Surgery™ (FLS) announces new supplier for the FLS Trainer Box and Accessories
FLS Testing available at the SAGES Annual Meeting 2015 in Nashville, TN!
New Pricing for Residency Programs
New Rates For FLS

FLS Supporting Literature

SAGES – FUNDAMENTALS OF ENDOSCOPIC SURGERY
DEVELOPED BY FES (FES)

The SAGES Fundamentals of Endoscopic Surgery™ (FES) program is a comprehensive educational and assessment tool designed to teach and evaluate the fundamental knowledge, clinical judgment and technical skills required in the performance of basic gastrointestinal (GI) endoscopic surgery (endoscopy). Our goal is to provide participants with an opportunity to learn the fundamentals of endoscopic surgery in a consistent, scientifically accepted format, and to test cognitive and technical skills – all with the goal of improving the quality of patient care.

FES was designed for medical and surgical residents, fellows, practicing general surgeons, gastroenterologists, and other physicians to learn and test basic endoscopic skills required to form a foundation in the practice of flexible endoscopy.

SAGES Fundamentals: Revolutionizing Surgical Training Worldwide
SIGN UP NOW FOR TESTING AT THE SAGES ANNUAL MEETING
Introduction

• Fundamentals Technical Skills assessments
  – mandatory steps to certification for General Surgery

• No vascular or endovascular correlate to an FLS model

Bismuth, et al., October, 2010
<table>
<thead>
<tr>
<th>Section</th>
<th>Comment</th>
<th>Maximum score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
<td>Review a paper from a journal.</td>
<td>32</td>
</tr>
<tr>
<td>Clinical Cases</td>
<td>Vivas on 4 clinical cases: Aortic, Lower Limb, Endovascular and Miscellaneous</td>
<td>64</td>
</tr>
<tr>
<td>Overall Viva</td>
<td>Viva on 8 topics</td>
<td>32</td>
</tr>
<tr>
<td>Open Technical</td>
<td>Practical surgical skills test on three models: aortic anastomosis, femoro-distal anastomosis and SFJ ligation</td>
<td>48</td>
</tr>
<tr>
<td>Endovascular</td>
<td>Practical endovascular skills test on a model</td>
<td>16</td>
</tr>
<tr>
<td>Total score</td>
<td></td>
<td>192</td>
</tr>
</tbody>
</table>
FEBVS
Fellow of the European Board of Vascular Surgery

Muvat Kayabali

has passed the assessment of the European Board of Vascular Surgery in Amsterdam, The Netherlands. Thursday 16 September 2010.

Julian Scott
Chairman

David Bergqvist
President

Armando Mansilha
Secretary General
Fundamentals of Vascular and Endovascular Surgery

- **Endovascular model** (3D Systems Simbionix)
  - Physical model
  - Virtual model

- **Vascular models** (WL Gore & Associates)
  - Clockface
  - Patch
  - End-to-side
BASIC SKILLS

1. ACCESS - 6s guided-donation  
   wire exchange  
   sheath

2. WIRE/CATHETER EXCHANGE VS STABILITY

3. IMAGING - ANGLE/VIEW  
   - VIRTUAL ANATOMY/REFERENCE

4. PUSH/PULL

5. CATHETER FORMATION - E.G. SIMMONS

6. SELECTIVE CATHETERIZATION -
   - ANTERIOR/RETROGRADE

7. CANNULATING SATE

8. ANNULATE - BRANCH ANEURYSM
Objective

Develop and validate a model for “Fundamental EndoVascular Skills (FEVS) assessment.

Fundamental Tasks
1) Navigate up and over bifurcation
2) Cannulate anterior branch
3) Navigate into a 3rd order vessel (posterior branch)
4) Cannulate right angle (renal) branch
5) Cannulate a branch vessel extending from an aneurysm
6) Stable wire/catheter exchange
7) Gate cannulation
8) Cannulate branch off of type 3 arch anatomy
Experimental Methods

• Procedure: Collect catheter-tip data from 20 subjects performing 4 tasks on FEVS model over 3 sessions:
  – Platforms: Silicone physical model, endovascular VR simulator
    • based on FEVS model for fundamental endovascular skills,
  – Tasks: Anterior branch, right angle, 3rd order vessel/posterior, up and over

• Subjects classified based on endo experience:
  – Non-competent: <30 prior endovascular interventions,
  – Competent: >30 endovascular interventions)
## Assessment Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Based</strong></td>
<td>Assessment based on task completion time</td>
</tr>
<tr>
<td><strong>Structured Grading</strong></td>
<td>FEVS Grading tool</td>
</tr>
<tr>
<td><strong>Motion Analysis</strong></td>
<td>Assessment based on metrics derived from motion data</td>
</tr>
</tbody>
</table>

### FEVS Grading Tool

<table>
<thead>
<tr>
<th>Metric</th>
<th>Rating</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter, no wire</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Insufficient wire</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Buckling catheter</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes + wire loss</td>
<td></td>
</tr>
<tr>
<td>Failure to reshape</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Attempts at ostium with wire</td>
<td>&lt; 3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4 - 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 6</td>
<td></td>
</tr>
<tr>
<td>Attempts at ostium with catheter</td>
<td>&lt; 3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4 - 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 6</td>
<td></td>
</tr>
<tr>
<td>Failure to progress</td>
<td>&lt; 20 sec</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>20 - 40 sec</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40 - 60 sec</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 60 sec</td>
<td></td>
</tr>
<tr>
<td>Wire stability</td>
<td>Stable (&lt; 2 cm movement)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ante- or retrograde &gt; 2 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ante- AND retrograde &gt; 2 cm</td>
<td></td>
</tr>
</tbody>
</table>
Quantitative Metrics –
Smoothness

• Smooth, well-coordinated movements are features of well-developed and trained motor behavior¹

• Motion-based metrics can delineate expert versus novice behaviors for basic dynamic tasks²

• Metrics include:
  – Submovement analysis
    • task broken into subsegments of movement
      – quantified by duration and total number of submovements
      – Longer duration and smaller total number correlate with expertise
  • Spectral Arc Length-
    – Describes frequencies of changes in acceleration (jerkiness)

¹Rosenbaum, et al., 2010; ²Huegel, et al., 2009
### Time and Metric Scoring

<table>
<thead>
<tr>
<th></th>
<th>1st left lateral</th>
<th>2nd left lateral</th>
<th>Anterior</th>
<th>Posterior</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competent</td>
<td>4.7</td>
<td>1.63</td>
<td>2.06</td>
<td>1.6</td>
<td>10</td>
</tr>
<tr>
<td>Non-competent</td>
<td>10.1</td>
<td>4.5</td>
<td>6.6</td>
<td>4.3</td>
<td>25.5</td>
</tr>
</tbody>
</table>

P-value=<.004

### Task Completion Times

<table>
<thead>
<tr>
<th></th>
<th>Right Angle Time (s)</th>
<th>Up and Over Time (s)</th>
<th>Anterior Time (s)</th>
<th>3rd order; posterior Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competent</td>
<td>35.4</td>
<td>41.7</td>
<td>79.6</td>
<td>112.4</td>
</tr>
<tr>
<td>Non-competent</td>
<td>31</td>
<td>44.4</td>
<td>81.4</td>
<td>121.9</td>
</tr>
</tbody>
</table>

p-value

- Right Angle Time: .75
- Up and Over Time: .35
- Anterior Time: .89
- 3rd order; posterior Time: .59
## Results: Motion Analysis

<table>
<thead>
<tr>
<th>Metric</th>
<th>Model (r)</th>
<th>Model (p)</th>
<th>VR Sim (r)</th>
<th>VR Sim (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Submovements</td>
<td>0.80</td>
<td>0.001</td>
<td>0.71</td>
<td>0.003</td>
</tr>
<tr>
<td>Avg Submovement Duration (s)</td>
<td>0.79</td>
<td>0.001</td>
<td>0.85</td>
<td>0.001</td>
</tr>
<tr>
<td>Spectral Arc Length</td>
<td>0.77</td>
<td>0.001</td>
<td>0.84</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Motion scores combining manual/simulator performance metrics for novice and expert users

- Number of Submovements (LGNB)
  - Non-Competent
  - Competent
  - $F(1, 13) = 23.20$, $p < 0.001$

- Average Submovement Duration (Min Jerk) [s]
  - Non-Competent
  - Competent
  - $F(1, 13) = 104.00$, $p < 0.001$

- Spectral Arc Length
  - Non-Competent
  - Competent
  - $F(1, 13) = 17.70$, $p < 0.001$
Conclusions

• Reliable correlations and between-subjects ANOVA results show motion metrics objectively determine skill

• Time alone is a poor measure of expertise

• Error-based metric scoring differentiates competent from non-competent performance
  – Assessment based on evaluation by a trained grader and potentially automated in VR Simulator
MODEL FOR FVS
Model Validation

- Presented at the VAM – June, 2013
Fundamentals of Vascular Surgery
The Patch Model
Fundamentals of Vascular Surgery
The Clock Face Model
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respect for Tissue</td>
<td>Frequent unnecessary tissue force or damage to vessels</td>
<td>Careful tissue handling, occasional inadvertent damage</td>
<td>Consistently handled tissue carefully (appropriately), minimal tissue damage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time and Motion</td>
<td>Many unnecessary moves</td>
<td>Efficient time and motion, some unnecessary moves</td>
<td>Clear economy of motion, and maximum efficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument Handling</td>
<td>Repeated tentative or awkward moves, inappropriate use of instruments</td>
<td>Competent use of instruments, occasionally stiff or awkward</td>
<td>Fluid concise moves with appropriate instruments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knotting and suturing</td>
<td>Defective techniques resulting in poor tissue apposition and unsafe knots</td>
<td>Knotting and suturing usually reliable but sometimes awkward</td>
<td>Sound techniques and smooth action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Assistant</td>
<td>Consistently places assistant poorly or fails to equip them</td>
<td>Appropriate use of assistant</td>
<td>Uses assistant to the best advantage at all times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedural Flow</td>
<td>Frequently stopped and seems unsure of next move</td>
<td>Demonstrates some forward planning, reasonable progression</td>
<td>Effortless, obviously planned course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of Final Product</td>
<td>Final product well below standard and likely to fail</td>
<td>Final product has deficiencies but would probably function adequately</td>
<td>Excellent final product with no flaws and likely to function well</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Global Rating Score**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>
# Global Summary (GS)

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0</td>
<td>Insufficient evidence observed to support a summary judgment</td>
</tr>
<tr>
<td>Level 1</td>
<td>Unable to perform the procedure, or part observed, under supervision</td>
</tr>
<tr>
<td>Level 2</td>
<td>Able to perform the procedure, or part observed, under supervision</td>
</tr>
<tr>
<td>Level 3</td>
<td>Able to perform the procedure with minimum supervision (needed occasional help)</td>
</tr>
<tr>
<td>Level 4</td>
<td>Competent to perform the procedure unsupervised (could deal with complications that arose)</td>
</tr>
</tbody>
</table>
Results

- 283 Trainees
- 85 female (30%)
Inter-rater Reliability

- Eleven assessors, all with previous experience
- Cronbach’s $\alpha=0.84$
Internal Consistency

- Spearman’s Rank Order Correlation (rho) = 0.81
- All participants, all three models
Construct Validity

- Discern Junior (PGY 0-2) from Senior (PGY 3-5)
  - End to Side (18.5 vs 29.8, p<.001)
  - Patch (22.1 vs 28.6, p<.05)
  - Clock Face (21.6 vs. 32.4, p<.001)

*Mann-Whitney U test*
• An experienced assessor using the Fundamentals of Vascular Surgery exam can effectively evaluate the technical skills of a vascular trainee.
Core Concepts for FVEVS

• All models are patented
• None of the core developers of the models stand to personally gain from the models financially. Although the developers will retain the IP, the models will otherwise be owned by the APDVS.
• We have designated one major vendor (Simbionix/3D Systems) to cover all endovascular models and a second vendor (WL Gore & Associates) to provide materials for the surgical models. This setup very much mirrors what SAGES uses for the FLS trainers.
• All purchases of the models will happen via a link off of the APDVS website to the aforementioned vendors, again mirroring what SAGES uses for the FLS trainer.
• In order to support educational endeavors vendors will discount their products so that we could secure 5-10% of overall cost to provide grants in the name of our vendors, to be presented to grant applicants with the most deserving proposals. This will be a peer-reviewed process executed by the Education Committee.
• Data will be collected from those ten centers in a prospective fashion; these data will serve to further refine the models and the overall implementation.
• We would eventually expect that trainees cannot sit for boards without having passed the minimum requirements for the Fundamentals of Vascular and Endovascular Surgery.
Timeline

- FVS kits will include graft material, suture boards, tube, videos, and evals.
- FEVS options are virtual package or physical model. Price under negotiation
- Metrics defined - Refinement by collaboration between LSU, Rice University, Houston Methodist Hospital with advisors including David Rigberg, Jason Lee, Murray Shames
Goals for 2016-2017

• Goals

- Identify 10 programs nationally for the limited roll-out
- Complete committee Bylaws
- Complete contracts with vendors:
  - Simbionix
  - WL Gore
- Contracts to be reviewed by APDVS/SVS legal
- Identify process for involving junior faculty

• Fundamentals platform presented to vascular board in June 2016 and under consideration
11 Programs

1. Weill Cornell
2. Michigan State
3. Beth Israel Deaconess Medical Center
4. Maine Medical Center
5. University of Wisconsin
6. University of Washington
7. Cleveland Clinic
8. Mayo Clinic
9. Oregon Health Science University
10. University of Alabama Birmingham
11. Massachusetts General Hospital
Thank you

Assessors
Robert Batson
Carlos Bechara
Rabih Chaer
Audra Duncan
Jodi Gerdes
Jeff Indes
Ash Mansour
Mark Mattos
Erica Mitchell
Peter Nelson
Tapash Palit
John Rectenwald
Will Robinson
Bruce Torrance

Support
Cassidy Duran
Emily Kalata
Julia Wilkinson

APDVS PRESIDENTS
Joe Mills
Michel Makaroun
Michael Dalsing
Linda Harris
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