Best Practices: Success with Surgical Skills Training
Cost Effective Surgical Training Simulators

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No financial conflicts to disclose
Outline

- Why Simulation and what is it?
- What can learn from our General Surgery and Urology Colleagues?
- What are we doing in Orthopaedic Surgery?
- What is FLS and how does it help us in Orthopaedic Surgery?
- Fundamentals of Orthopaedic/Arthroscopic Surgery

The Old Teaching Paradigm

"See one, do one, teach one"

William Halsted
The Need for a Change

- Financial concerns
- Restricted work hours
- Expanded skill requirements
  - Increased public scrutiny
  - Practice outside of the OR
    - Low risk/pressure setting
    - Increase efficiency
    - Basic skills learned

Simulation in Aviation

- Require ≥ 200 hours of flight simulation before flying F18.
- Average 6 – 8 hours simulation before each flight.
- If away ≥ 15 days must complete full curriculum with simulated flying to proficiency requirements.

If it is required for pilots – why not surgeons??

Atul Gawande

"You want to ensure people can do it right 99 percent of time. When we have to fire one of our surgical trainees, it is never because they don’t have the physical skills but because they don’t have the moral skills - to practise and admit failure."
What is Surgical Simulation?

It is the imitation of some real thing, state of affairs, or process for the purpose of learning or practice.

Key Elements of Simulation in Surgery:
- Repetitive practice of skills to prescribed proficiency, away from the patient.
- Immediate feedback and re-practice with learned information from errors or complications experienced during training.
- Learner, rather than patient, centered learning.
- Objective, measurable proficiency.

There is ample evidence to support surgical simulation for learning new skills.

Fortunately...

We can learn a lot from our colleagues…
AUA Validation Study of Basic Laparoscopic Urologic Surgery Skill Tasks

- Transfer model – based on FLS model
- Cutting model – based on FLS model
- Suturing/knot tying model – based on FLS model
- Clip Applying model – developed by Bob Sweet lab with AUA LINST Committee & BLUS Project group

Central Venous Catheter Insertion (CVCI) Training

- Traditional = 4 hrs didactic
- Simulated Training = 1 hr didactic + 3 hrs U/S CVC insertion practice to proficiency

Proof of Improved Outcomes as a Result of Procedural Simulated Training

- CRBI per 1000 catheter days

CRBI = catheter related blood stream infection

Pre-operative Warm-up Exercise Regimen (POWER) Improves Surgeon Performance

Prospective randomized trials show that POWER can give:

- Better attention and focus
- Smoother hand and instrument motion
- Less distraction & better mental effort
- Improved technical performance

POWER = improved operative efficiency & outcomes
What have we been doing in Orthopaedic Surgery?

- Surgical Simulation Summit
  - Friday, November 4, 2011
- Summit Co-Chairs
  - Robert Pedowitz, MD, PhD – AAOS
  - J. Lawrence Marsh, MD – ARDS/RRC

Organizational Representatives
- Richard Angelo, MD – AANA
- Donald Bae, MD – POSNA
- Dale Blasier, MD – Orthopaedic RRC
- Shepard Hurwitz, MD – ABOS
- Jason Koh, MD – ASSG
- Guido Mena, MD – ACOSS
- Jason Otsuka, MD – AOA
- Lisa Toft, MD – Orthopaedic RRC

ArthroSim – Knee Arthroscopy Simulator

- ArthroSim™ is the result of collaboration between the American Academy of Orthopaedic Surgeons (AAOS), the Arthroscopy Association of North America (AANA), the American Board of Orthopaedic Surgeons (ABOS) and Touch of Life Technologies (ToLTech).
  - Championed by Drs. Dilworth Cannon & Robert Pedowitz
  - Purchased at 14 residency Programs
  - Virtual reality shoulder simulator is in development

AAOS, ToLTech develop virtual reality shoulder simulator for arthroscopy training

March 27, 2013

The American Academy of Orthopaedic Surgeons, in partnership with Touch of Life Technologies, has developed a virtual reality-based shoulder simulator to train and evaluate orthopedic residents in surgical proficiency in shoulder arthroscopy.
AAOS-OTA Hip Fracture Simulation Team

- Chairman: Robert A. Probe, M.D.
- Members:
  - Matt Camuso, M.D.
  - Brett D. Crist, M.D.
  - Brett Levine, M.D.
  - Marcus F. Sciadini, M.D.
  - Howard Mevis, Director, Electronic Media, Evaluation, and Course Operations, AAOS

TraumaVision®

What are we doing TODAY in Orthopaedic Surgery?

The American Board of Orthopaedic Surgery
Establishing Education & Performance Standards for Orthopaedic Surgeons

ABOS Surgical Skills Modules for PGY-1 Residents
What is FLS

- Comprehensive Web-based modules
- Hands-on skills training Component
- Assessment Tool that teaches
  - Physiology
  - Fundamental knowledge
  - TECHNICAL SKILLS REQUIRED FOR BASIC LAPAROSCOPY
- Designed to measure
  - cognitive knowledge
  - case/problem management skills
  - MANUAL DEXTERITY

Fundamentals of Laparoscopic Surgery

- Joint program of SAGES and American College of Surgeons
- Used for high-stakes examination
- Required by ABS to take qualifying exam

Joint Statement by the ACS and SAGES on FLS Completion for General Surgeons Who Perform Laparoscopy

FLS is the only validated, objective measure of a surgeon’s fundamental knowledge and skills related to laparoscopic surgery.

The Fundamentals of Laparoscopic Surgeon has operations, FLS was used as a strong foundation for postgraduate general surgery residents.

The FLS program was required to evaluate knowledge and skills in laparoscopic surgery.

The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) has recommended that all surgeons practicing laparoscopic surgery be certified through the FLS program. FLS is the only validated objective measure of a surgeon’s fundamental knowledge and skills related to laparoscopic surgery. As such, SAGES and the ACS also recommend that institutions credentialing surgeons to perform laparoscopic surgery consider FLS certification a requirement of their credentialing process.

This joint statement was approved by the ACS Board of Regents Executive Committee in February 2012.

3 Criteria That the Simulator Must Meet

1. The simulator reproduces real world skills
2. Assessment of skills on simulator means something
3. Skills learned transfers to the operating room

First Requirement

Does the simulator reproduce real world skills?

How well does simulation reproduce real world situation? (face validity)

How much of the real world situation is reproduced in simulator model? (content validity)
**FLS Simulator Skills**

**FLS Predictive Validity**

In this study, 19 subjects were assessed in the operating room within 2 weeks of being tested on the FLS tasks.

- The intraoperative evaluators were unaware of the subjects’ simulator scores.
- ***Total FLS score correlated highly with intraoperative measurements of technical skill***

**FLS Predictive Validity**

**Third Requirement**

Transfer of Skills?

Acquisition of technical skills through simulated practice

Transfer of skills acquired to O.R.
FLSTM is a Paradigm for Simulation Based Education in Fundamental Surgical Skills

- FLS reproduces real world skills
- FLS skills assessment is valid and reliable
- FLS skills learned transfer to the operating room
- (FLS is appropriate for use internationally)

Where are we with Orthopaedic Surgery Simulation Training?

- Simulation is currently being used with:
  - cadaveric labs
  - synthetic bone exercises
  - high priced virtual reality simulators

- There is a need to supplement this training with cost effective simulation that teaches basic psychomotor skills that translate across a wide range of operations.
Educational Goals

• The purpose of this study was to develop and validate a cost-effective psychomotor training and assessment tool—The Fundamentals of Orthopaedic Surgery (FORS) for Orthopaedic surgery resident education.

• This simulator allows the learner to practice motor skills intrinsic to Orthopaedic Surgery with high repetitions in a short period of time.

Key elements to simulation in Surgery:
1. Repetitive practice of skills to a prescribed proficiency
2. Immediate feedback and re-practice with learned information from errors
3. Learner centered
4. Objective, measurable proficiency

Educational Goals

A questionnaire was distributed to twelve ABOS certified Orthopaedic surgery attending physicians asking them to rate basic skills necessary to become a competent Orthopaedic surgeon.

Highest Rated Skills
• Fracture reduction
• Correct lag screw placement/Directional control of the drill
• Fluoroscopic drilling
• Drilling with Tactile Feedback
• Drill plunge minimization
• Soft Tissue Closure

Methods- FORS

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Highest Rated Skills
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Simulator Development

• Less than $400 total
• Materials are available at hardware stores
• No cadaver bone, synthetic bones, medical equipment
• Quick setup, reusable parts, easily assembled
• No Expensive camera equipment
## Simulator Development

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**Principles of Development**

1. Low cost  
2. All parts available at national hardware stores  
3. Multiple stations  
4. Quick set up  
5. Reusable parts  
6. Easily assembled  
7. Home use?

## FORS

**Fracture Reduction**
Drill by Feel

Soft Tissue Closure

Do These Tasks Have Construct Validity?
Testing- FORS

- 3 ACGME-accredited Orthopaedic Surgery Residency Programs
- An identical simulation board was created at each institution
- Different observers/core keepers were used at each site
- 26 medical students were retained for longitudinal tracking.

Biweekly training labs were held with initial testing then 15 minutes of training. This occurred over a 4 week period.

Results: FORS

- 46 Medical students, 25 Attending physicians, and 58 Orthopaedic surgery residents participated in the study.
- Comparisons between medical students initial vs. trained scores, junior vs. senior level resident scores, and students trained vs. junior level resident scores were evaluated.
- A one-way ANOVA test was performed to determine statistical significance (p value < 0.05).
- Statistical significance was found in the majority of the exercises between groups.
- The twenty six medical students who were retained for longitudinal training and teaching improved above junior resident level in four of the six tasks.

Discussion

Fundamentals of Orthopaedic Surgery Simulator

- Tasks that clearly are trainable with this Simulator
  - Fracture reduction
  - Fluoroscopic Drilling
  - Depth of plunge minimization
  - Drill by Feel
- Greater numbers being collected for Significance
  - Suturing
  - 3-D drilling
- The Fundamentals of Orthopaedic Surgery Simulator
  - Cost effective
  - Able to differentiate between training levels
  - Has demonstrated the ability to improve the performance of novice trainees with training.
Discussion
Cost Effective Arthroscopy Simulator

Initial Construct
Validity Established
• Able to differentiate between training levels

Further Investigation Needed
• Can the simulator help improve the performance of novice trainees?

http://www.orthopaedicsurgery.uci.edu/fors

Future Goals

• Predictive validity
• If repeated do participants improve?
• Improve OR performance?
• Curriculum to coincide the drills

• Potential for board Certification requirements

Thank you for your attention…. 