Surgical Simulation: A Clinical Perspective

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Typical Surgeon’s Perspective
“We don’t need simulation.”
“We have plenty of clinical material.”
(patients)

Outline
- Surgery yesterday and today
- Surgical simulation yesterday and today
- Surgical education and certification
- Surgical patient care
- Simulation in trauma care
- Surgical simulator development
  - Today’s challenges
  - Ultimate challenges

Surgery: 50 years ago
- No vascular surgery
- No intracardiac surgery or pump
- Open surgery only
- Patients spend weeks in hospital

Surgery: Today
- Vascular surgery, intracardiac surgery
- Minimally invasive surgery
- Expanding knowledge base
- More procedures increasingly technical
- 50% of US surgery is on outpatient basis
**Surgical Simulation: 50 years ago**

- Patients
- Animals
- Cadavers
- Dolls

**Surgical Simulation: Today**

- Patients
- Animals
- Cadavers
- Dolls: Mannequins
- Virtual Reality

**Patients**

**Animals and Cadavers**

**Dolls**

**Mannequins**
Virtual Reality Simulators

Traditional Surgical Education
- Apprenticeship
- See one, do one, teach one
- Learning on patients

Surgical Education Today
- Less physician teaching time
- Less resident time
- Fewer patient hours available for resident and student teaching
- Larger number of procedures to learn
- Procedures more technical and high risk
- Institute of Medicine report

Challenges in Surgical Education
- Need a safe transition from classroom to patient
- Solution: Surgical Simulators

Every great scientific truth goes through three stages. First, people say it conflicts with the Bible. Next they say it had been discovered before. Lastly they say they always believed it.

LOUIS AGASSIZ 1807 – 1873
Definitions

- Virtual Reality (VR)
- Immersive Environment
- Haptics
- VR Simulators

Surgical Selection and Certification

- Selection for training
- Selection for completion of training
- Written and oral examinations
- No technical skills examination
- Interest exists in using simulators to certify surgeons
- (Recertification also)

Surgeon Patient Care Steps: Perceived

- See patient
- Cut patient
Surgeon Patient Care Steps:  
Actual  
(Trauma Patient Care)  

- Triage  
- History and Physical Examination 
- Resuscitation  
- Diagnostic Studies  
- Decision making  
- Operative care  
- Postoperative care

Simulation in Trauma Care:  
Triage

Simulation in Trauma Care:  
History and Physical Examination

Simulation in Trauma Care:  
Resuscitation  
- A, B, C’s of trauma care

Simulation in Trauma Care:  
Decision making
Simulation in Trauma Care:
Diagnostic Studies

Simulation in Trauma Care:
Decision Making

Simulation in Trauma Care:
Operative Care

Patient Counseling

• Technique/skill trainer
• Partial task trainer
• Task trainer
• Validity?
• Transference rate?

Simulation in Trauma Care:
Operative Care

• Educate/consent/prepare patient
• Preoperative planning
• Position, scrub, drape patient
• Skin and subcutaneous incision
• Deep (muscle, fascia) incision
• Tissue dissection
  (sharp, blunt, cautery, hand)
• Suturing
• Knot tying (instrument, hand)
Simulation in Trauma Care: Postoperative Care

Surgical Simulator Development
Today’s Challenges
- Multiple use
- Task training focus (integrated scenarios)
- High volume surgical cases or low volume/high risk
- Fidelity: adequate graphics and haptics
- Inexpensive
- Validated

The Ultimate Challenges
- Open surgery – all procedures
- Instruments and hands
- 2 point tactile discrimination
- Kaufmann test (Can I tell if I’m operating on a real patient or a simulated patient?)