PRE-CONGRESS COURSE 9
SIG Reproductive Surgery
"Training and education in endoscopy"

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Speakers’ contributions

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• Is there still a need for a reproductive surgeon? -S. Gordts (BE) p. 78
SIG Reproductive Surgery

Training and education in endoscopy

Course co-ordinator: S. Gordts (B)

Course description: the course intends to offer an overview of the actual different possibilities of training and to evaluate their potential advantage and influence on skills and learning curves. The course will also elucidate on the future guidelines and accreditation of the European commission and their practical application

Target audience: All those involved with endoscopy and education in gynaecology and reproductive medicine

Programme

09.00 - 09.30: Endoscopic surgical skill lab – J. Deprest (B)
09.30 - 09.45: Discussion
09.45 - 10.15: Objective evaluation of endoscopic skills -R. Campo (B)
10.15 - 10.30: Discussion

10.30 - 11.00: Coffee break

11.00 - 11.30: (How) Does preclinical lab training influence the surgical learning curve in residents? -G. Dewin (B)
11.30 - 11.45: Discussion

11.45 - 12.15: What is the place of a specialised center in endoscopic surgical training? -A. Wattiez (F)
12.15 - 12.30: Discussion

12.30 - 13.30: Lunch

Virtual reality training

13.30 - 14.00: Setting up a multicenter clinical anatomy and surgical skills training programme (CASST) -K. Kenton (USA)
14.00 - 14.15: Discussion

14.45 - 15.00: Discussion

15.00 - 15.30: Coffee break

15.30 - 16.00: Accreditation and training programmes in reproductive medicine: European EBCOG-ESHRE guidelines -B. Tarlatzis (GR)
16.00 - 16.15: Discussion

16.15 - 16.30: Validity of computer based methodology to evaluate surgical skill - L. Mettler (DE)

16.30 - 16.45: Is there still a need for a reproductive surgeon? - S. Gordts (BE)

16.45 - 17.00: Round table: “Requirements for endoscopic surgical training” - B. Tarlatzis, A. Wattiez, R. Campo, S. Gordts, D. Wallwiener
Training in Gynaecological Surgery

The paradigm for training in surgery is the *apprentice-tutor model*

- Trainee first observes then assists and finally operates.
- Procedures with increasing complexity are performed
- The presence of the tutor is permanently required
- Reported learning curves are usually very long, i.e. number of procedures needed for reaching proficiency is remarkably high, making this issue critical for gynaecologists.

Critical factors for the current use of this model

1. the necessity of a high volume of surgical procedures,
2. the availability of a sufficient number of skilled mentors
3. the time consuming aspect of this system
4. the difficulties in objective assessment of clinical competence on different surgical levels,
5. the limited methods of credentialing and the lack of correct reimbursement policy towards the mentors.
Laparoscopic surgery

- Laparoscopy requires specific skills, different from those required in open surgery: the Psychomotor Skills
  - Depth appreciation from a 2D screen using subtle visual clues
  - Remote handling of instruments without tactile feedback
  - Hands–eyes coordination
  - Fine motor skills
  - Long instruments
  - Fulcrum effect

- Effective acquisition of Laparoscopic Psychomotor Skills (LPS) is essential for minimal access surgery to become a real minimal invasive & atraumatic surgery.

Training in Gynaecological Surgery

ALARMING REPORT IN THE NETHERLANDS

- Because of an inacceptable amount of serious (lethal) complications in common laparoscopic procedures within general surgery and gynaecology, the ministry of health performed a major inspection regarding patient safety


Training in Gynaecological Surgery

Conclusion of report

- Training in laparoscopic techniques was found to be variable and inadequately structured.

- It is a matter of concern that the standards which a future laparoscopist must meet in order to operate, either independently or under supervision, have not been adequately established.
Standardisation of training programs necessary!

- Using the patient as a model to acquire laparoscopic skills decreases patient safety!
- A standardised and quality-controlled in house training programme to acquire the laparoscopic skills does not exist.
- No test is currently accepted to differentiate laparoscopic surgeons in different levels of expertise.
- No test is available to score the basic skills of an individual and permit in OR laparoscopic surgical activities.

Questions?

- Is the classic apprentice-tutor model sufficient for acquiring the appropriate laparoscopic skills?
- Do in vitro and animal training provide a more objective evaluation of the training process?
- What are the ideal characteristics of a training program?
  - Model? Length?
  - Intensity? Level of supervision?
- How can we measure objectively the typical endoscopic skills?

Training in Gynaecological Surgery

The paradigm for training in surgery is the 

*apprentice-tutor model*

- Trainee first observes then assists and finally operates.
- The presence of the tutor is permanently required
- Insufficient amount of procedures and mentors to train laparoscopic gynaecological surgery.
Training in Laparoscopy

- **In vitro models:**
  - Relatively cheap, relaxed and controlled environment
  - Pelvi-trainers: learning curves for stitching, knot-tying, cutting, dissection
  - Virtual-reality: more objective evaluation of the learning process

- **Animal models:**
  - Usually in large animals, such as pigs
  - Simulation of the clinical scenario, e.g., anaesthesia, pulsating vessels, pneumoperitoneum.
  - Very expensive and therefore not widely and routinely used
  - Short training period, not appropriate for basic skill training

Maximal Learning effect: trainingsession duration

G. Dewin, unpublished data
stitching and knot tying

6 training sessions of 1.5h
160 students
6 groups with different distribution of training sessions

Maximal Learning effect: trainingsession duration

Mean and SEM
G. Dewin, unpublished data
Training session duration of 1.5h daily:
Optimal benefit

[Graph showing training session duration and its impact on learning effect]
Skill Assessment: Possible Goals

- To define someone's **laparoscopic or psychomotor** skill level
- To guide trainees to the right training courses
- To help mentors and training centers to differentiate different skill levels of trainees
- To define the cut off for entering a one to one clinical teaching program.
- To evaluate someone's **surgical** skills
- To establish minimal standard for surgical licence.

Skill assessment: Systems

- Quantitative and Qualitative
- Time
- Observations
  - checklists
  - Global Rating Scale
eg. OSATS, GOALS,.....
- Motion trackers
- Virtual reality

Global Rating OSATS; example
Skill Assessment: Motion Tracking

Time, Path length, Number of movements

Imperial College Surgical Assessment Device: Patriot System + Rovimas Software

Skill Assessment: Virtual Trainers

Assessment Systems: Summary

<table>
<thead>
<tr>
<th>Objective</th>
<th>Accuracy</th>
<th>Easy Available</th>
<th>Endoscope Dimension Only</th>
<th>Price</th>
<th>Easy to detect progression</th>
<th>Evaluation self-diffusion skill</th>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>¥</td>
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<td>¥</td>
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</tr>
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<td>✓</td>
<td>✓</td>
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</tbody>
</table>
Skill assessment: Systems

• Quantitative and Qualitative
• Correct exercise time
• Observations
  - checklists
  - Global Rating Scale
  eg. OSATS, GOALS,
• Motion trackers
• Virtual reality

Skill assessment
Important Considerations

• Reliability
• Validity
  1) Construct Validity
  2) Predictive Validity
  3) Concurrent Validity
  4) Content Validity
  5) Face Validity

Proving construct validity, Remark

Construct Validity
Statistical difference between experts and students in performing test

unpublished data G. Dewin
Proving construct validity, Remark

- Learning curve of assessment-test is essential;

unpublished data G. Dewin

Project From Anatomy to Endoscopic surgery

- Gather scientific evidence to:
  - define the necessary Laparoscopic Psychomotor Skills (LPS) for laparoscopic surgery,
  - provide a scoring system to test the individual student’s ability in this field,
  - provide a training program for in house training that give the students the opportunity to master and acquire the psychomotor skills.

Project From Anatomy to Endoscopic surgery

- Redefine the educational levels of Gynaecological endoscopic training:
  - Within the Standing Committee on Training and Assessment (SCTA) of the European Board and College of Obstetrics and Gynaecology (EBCOG), a project is started with all European parties involved to define 3 educational levels in the training of an endoscopic surgeon.
**Project From Anatomy to Endoscopic surgery**

- First educational platform in gynaecological endoscopic surgery

**Aim**
- Preclinical training to acquire basic theoretical knowledge of surgical principles
- Full endoscopic psychomotor skills (EPS)
- Basic theoretical knowledge of instrumentation and OR functioning

**Target audience**
- Preclinical phase of education for all trainees aiming at an abdominal surgical discipline.

**Content and Teaching strategy: Patient free environment**
- Theoretical lectures
- Practical sessions in pelvic trainer (dry exercises)

**Project From Anatomy to Endoscopic surgery**

- Second educational platform in gynaecological endoscopic surgery
  - Board certified Gynaecologist

- Third educational platform in gynaecological endoscopic surgery
  - Special modules of surgical skills (training centers)
New design of training programs for endoscopic surgery:

- The scientific evidence gathered by the Academy research programs has inspired the experts of the Academy to work on a new design of training programs. It is a global concept with the aim to transfer the knowledge to mentors and provide them the necessary tools to be able to start in house training and evaluation.

Project
From Anatomy to Endoscopic surgery

Pilot study LASTT
Laparoscopic Skill Trainer and Tester

- General Objective:
  - To develop a system for training and evaluation of LPS

- Methodology:
  - 12 exercises where tested on novices, gynaecologists and expert surgeons
  - Time of successful performance is used as the objective outcome parameter.

- Result
  - Feasibility and Construct validity was proven for 3 laparoscopic psychomotor exercises.

Exercise 3: Instrument handling and bimanual coordination

Exercise 3: Instrument handling and bimanual coordination
Construct validity testing of E 1-3 on 283 Individuals

- Our data demonstrate that a simple inanimate model is feasible for both testing and training laparoscopic Psychomotor skills.
- The data also indicate that systematic repetitions of simple tasks, even without any tutor’s feedback have a major impact in the learning process.
- The learning curves demonstrate that experts have better skills than novices, proving the construct validity of the model.
- In conclusion, our study demonstrate that a simple, cost friendly and reproducible inanimate model, with proven construct validity, is suitable for both testing and training laparoscopic skills.

Conclusion

Final Study LASTT

• Evaluation of the learning curve of a basic psychomotor skill versus a more complex exercise
Study characteristics

- **Subjects**
  - 60 gynaecologists aged 25-50 years old
  - Gynaecologists with little or no experience in laparoscopy

- **Laparoscopic exercises**
  - E1: basic laparoscopic skill (stereotaxis). Dominant hand (DH) and non-dominant hand (NDH) separately
  - E2: intermediate laparoscopic skill (intracorporeal knot-tying). Dominant and non-dominant hands together

- **Experimental design:**
  - 5 phases
  - 3 groups (n=20)

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**Experimental design**

<table>
<thead>
<tr>
<th>Phase 1 Test</th>
<th>Phase 2 Training E1</th>
<th>Phase 3 Test</th>
<th>Phase 4 Training E2</th>
<th>Phase 5 Test</th>
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**Hypothesis**

- Differences at start
- Curve differences
- Differences at end
Conclusion

• Training of intracorporeal knot-tying only does not provide full skill acquisition.
• Also specific psychomotor skills exercises are necessary.
• Training and Testing can be done in a simple model suitable for in house training.
• Instrumentation setup is cheap and easy movable, multifunctional use is possible
• OR or Animal training should only start when full acquisition of EPS has been achieved.

Conclusion

• Within the Standing Committee on Training and Assessment (SCTA) of the European Board and College of Obstetrics and Gynaecology (EBCOG), a project is started with all European parties involved to define 3 educational levels in the training of an endoscopic surgeon.

• The same scientific evidence has inspired the experts of the Academy to work on a new design of training programs. It is a global concept with the aim to transfer the knowledge to mentors and provide them the necessary tools to be able to start in house training and evaluation.

More info on the special training programs in endoscopic surgery

+theAcademy@ESGE.ORG
(How) Does preclinical lab training influence the surgical learning curve in residents?

Gunter De Win
Dirk De Ridder
Marc Miserez
Centre Surgical Technologies
KU Leuven
Belgium
Barcelona
July 2008

See One, Do One, Teach One?

Training in Endoscopic Surgery

long and steep learning curve
different way of teaching
medicolegal aspects
time constraints
Simulation

Structured training program needed; from simulation in the lab to real operations in theatre room

- Trainee: central
- Repetitivity
- Standardized
- No stress
- Critical situations
- Availability

Different Models

Different Curricula

• Psychomotor skills
• Suturing and Knot Tying
• Tissue Handling, Coagulation, Dissection
Training in laparoscopic surgery

- to develop specific laparoscopic skills pregraduate
- to help clinicians along the learning curve quickly and safely

- reducing complication rates & shortening of operation time
- increased cost-effectiveness

Scientific Evidence? : What Study we need?

- Experimental group: Structured preclinical Training and Standard Residentship
- Control Group: Standard Residentship
- Real Clinical Transfer study on learning curve

No single publication

Scientific Evidence??

- Dozens of validation studies on different models
- Few studies on training transfer to theatre room
- Recent RCT’s on training curricula
Training Transfer?

Training Transfer

• Proficiency?
• Automaticity?
• Proficiency Maintenance …

Stimulating performance during training?
Amount of Training?

20 days 8 hours ↔ Short Term Courses

Randomisation

Test-group

Control-group

Video Trainer pre test

Video Trainer pre test

Pretest Transferprocedure

Pretest Transferprocedure

Training

No Training

Video Trainer post test

Video Trainer post test

Posttest Transferprocedure

Posttest Transferprocedure

Data-analysis

Southwestern centre for minimal invasive surgery

Training To Predetermined level

RCT on the effect of suturing training to a predetermined level

17 surgical residents proficient in basic skills

Simulator training on mannequin suturing task model during 8 weeks (4 hours/week) until proficiency reached mean time 181 minutes

Both groups improved significantly, but improved operative performance of suturing the wrap into a protein liver model in the trained group

(Speed, not in seconds) with short-term written

Randomized trial / No Cursory bias

RCT on the effect of suturing training to a predetermined level

17 hours week during 8 weeks training among basic skills training video test
Structured Training needed

Fidelity

Pre-test laparoscopic knot after short demonstration

Unstructured Rosser MIST VR Self Training No Training

Video 10 x 10 x 30 minutes Nothing

Structured Modelling

10 laparoscopic knots

Pearson; 2002

Grober; 2004
Fidelity

Experts: Concentrated Exercise & Critical steps

Optimal Frequency of Skill Labs?

* Laparoscopic Intracorporal Suturing
  * Difficult Surgical Procedure, Important in the clinic
  * Fine motoric movements and 2D-3D interpretation
  * Not enough time to exercise in real life

Which is the optimal distribution of training sessions to teach laparoscopic skills?
Randomisation

- 145 students (novices, 18-23 years) randomized into 6 comparable groups with respect to:
  - Spatial Ability: Schlaufigurentest
  - Ambidexterity: Oldfield Questionnaire
  - Laparoscopic Skills: Southwestern drills
  - Motivation
  - Age and Sex


Different Groups

9 hours of training in each group

<table>
<thead>
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<th>Group</th>
<th>Day</th>
<th>Time (h)</th>
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<tr>
<td>B</td>
<td></td>
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<td>C</td>
<td></td>
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<td>D</td>
<td></td>
<td></td>
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<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
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</table>

Different Groups

- A: Pre-training
- B: Evaluation 1 month
- C: Evaluation 6 months
- D: Evaluation 1 month
- E: Evaluation 6 months
- F: Deliberate Practice

Evaluation: Basic Skills

Checkerboard drill

- Time (s)
- Group
- Pre-training
- Evaluation
- Evaluation 1 month
- Evaluation 6 months
Chicken Skin
ANOVA; P= 0.003

Evaluation: Advanced
AFTER training

12'42'' 19'44'' 13'52''
16'41'' 19'35'' 13'52''

Evaluation: Advanced
RETENTION

Evaluation post training
Evaluation 1 month
Evaluation 6 months

1 month: p = 0.0036
A vs C, D, F
6 months: p = 0.0385
A vs C

Evaluation moment
p = 0.49
1 month
p = 0.05
6 months
p = 0.05
Short Daily Training

- Promote Local Training Centers
- Selftraining:
  - Webcam

Virtual reality (VR) simulators

Consensus guidelines for validation of virtual reality surgical simulators
Carter et al, Surg Endosc 2005

RCT's

The effect of training basic laparoscopic skills with virtual reality simulator on operating room performance: RCTs

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<td>VR</td>
<td>VR</td>
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<td>Surgical Performance</td>
<td>Pre-surgery</td>
<td>Pre-surgery</td>
<td>Pre-surgery</td>
<td>Pre-surgery</td>
<td>Pre-surgery</td>
<td>Pre-surgery</td>
<td>Pre-surgery</td>
</tr>
<tr>
<td>Effect</td>
<td>&lt;1 week</td>
<td>&lt;1 week</td>
<td>&lt;1 week</td>
<td>&lt;1 week</td>
<td>&lt;1 week</td>
<td>&lt;1 week</td>
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</table>

long-term retention of training? common training frequency?
RCT's

Comment on RCT's

• Only Psychomotor skills Trained
• No comparison virtual dissection and real dissection
• Maybe better because of:
  → cognitive modelling
  → inherent feedback

Link Motor learning

<table>
<thead>
<tr>
<th>Cognitive training: Modelling</th>
<th>Critical steps</th>
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<table>
<thead>
<tr>
<th>Level</th>
<th>Feedback of performance</th>
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</table>

| Retention & transfer of learned skills |
Operative Skills

Knowledge of skill

Knowledge of procedure

Specific procedure

Preclinical Learning

Clinical Learning

Knowledge of Procedure

- Mimics…
Setting Up a Multi-center Clinical Anatomy & Surgical Skills Training Program

Kimberly Kenton, MD, MS
Associate Professor
Fellowship Director, Female Pelvic Medicine & Reconstructive Surgery
Departments of Obstetrics & Gynecology and Urology
Loyola University Stritch School of Medicine
USA

Disclosures
None

Learning Objectives

Participant should be able to:

• Discuss advantages to multi-center, multidisciplinary collaboration.

• List strategies to build educational programs with other centers or departments.

• Be familiar with one multi-center, multidisciplinary program.
Chicago

- 5 Large Academic Medical Centers
- 6 Medical Schools
- 13 Residency Programs

Optimizing “Limitations”

- Less time spent in the OR
  - Limited work hours
  - Decreased surgical volume
  - Patient safety concerns
- Maximize time & teaching in OR
  - Need to come to OR with more knowledge and skills
- Universal to surgical residents
  - Ob/Gyn, Urology, General Surgery

Resources

- Faculty time
  - Most valuable
- Facilities
- Trainers, instruments
- Cadavers
Principles

• Teamwork & collaboration

• Think of "unique" or "non-traditional" teams
  ➢ Female Pelvic Medicine & Reconstructive Surgery

• “Make sure you get at least 2 uses of each academic effort”
  ➢ Dr Linda Brubaker

How Maximize Time & Resources?

• Multiple Disciplines
  ➢ FPMRS: Gyn & Urology

• Multiple Centers
  ➢ Faculty
  ➢ Facilities
  ➢ Resources

Clinical Anatomy and Surgical Skills Training

• Aim:
  ➢ To develop a multicenter, multidisciplinary anatomy and surgical skills training program

• Methods
  ➢ 4 Residency Programs
    ✴ 3 Ob/Gyn Program
    ✴ 1 Urology Program
Curricular Development

Program Assessment

Needs Assessment

Learner Assessment

Learning Objectives

Educational Strategies

Implementation

Needs Assessment

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Excellent</th>
<th>Adequate</th>
<th>Marginal/Poor</th>
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<tr>
<td>Surgical Knots</td>
<td>7%</td>
<td>68%</td>
<td>25%</td>
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<tr>
<td>Suture Properties</td>
<td>0%</td>
<td>25%</td>
<td>75%</td>
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<tr>
<td>Abdominal Wall Anatomy</td>
<td>0%</td>
<td>46%</td>
<td>54%</td>
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<tr>
<td>Pelvic Anatomy</td>
<td>0%</td>
<td>39%</td>
<td>61%</td>
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<tr>
<td>Hysterectomy</td>
<td>0%</td>
<td>7%</td>
<td>93%</td>
</tr>
<tr>
<td>3rd &amp; 4th Degree Laceration</td>
<td>0%</td>
<td>7%</td>
<td>93%</td>
</tr>
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</table>

- 100% - benefit from more formal basic surgical skills training
- 86% - prosected cadavers increase anatomy knowledge
- PGY2 more likely than PGY1s to
  - Rate knot tying skills as excellent or adequate (p=0.009)
- Urology more likely than Gynecology to
  - Rate knowledge of pelvic anatomy as poor (p=.001)
  - Rate knowledge of hysterectomy as poor (p=.012)
Pretest

- 40% knew difference between 1-4O laceration
- 27% identify 3 branches of pudendal nerve
- 10% knew 3 most common sites of ureteral injury during TAH

Curriculum

- 5, 3 hour sessions
  - Knot tying & instrumentation
  - Abdominal wall anatomy
  - Opening and closing the abdomen
  - Pelvic & neural anatomy and TAH
  - Repairing perineal lacerations
- 1st hour – didactics
  - 13 didactics/10 faculty
- 2nd-3rd hours – gross anatomy or surgical skills labs
- 2-3 learning objectives per session

Learner Assessment

<table>
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<tr>
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<th>Pre-test</th>
<th>Post-test</th>
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<tr>
<td>Anatomy</td>
<td>38</td>
<td>64</td>
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<tr>
<td>Surgical Knowledge</td>
<td>50</td>
<td>80</td>
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Pre & post test data available for 28/32

- P<.001
- P<.0001
Learner Assessment

**Urology vs Gynecology**
- Gyn residents scored higher in anatomy and surgical skills on pre-test
  - P=.03 & P=.002
- No DIF in post-test scores
  - Anatomy, P=.11
  - Surgical skills knowledge, P=.82

Program Assessment

<table>
<thead>
<tr>
<th>Residents</th>
<th>Excellent/ Helpful</th>
<th>Marginal</th>
<th>Waste of Time</th>
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<td>78%</td>
<td>22%</td>
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<td>96%</td>
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<td>97%</td>
<td>19%</td>
<td>3%</td>
</tr>
</tbody>
</table>

- Faculty
  - Multicenter collaboration lessened individual burden
  - Multidisciplinary collaboration heightened educational benefit for residents

Page 36
Program Assessment

<table>
<thead>
<tr>
<th>Residents</th>
<th>Excellent</th>
<th>Helpful</th>
<th>Marginal</th>
<th>Waste of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knot Tying</td>
<td>78%</td>
<td>22%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Abdominal Wall</td>
<td>99%</td>
<td>1%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Opening &amp; Closing</td>
<td>97%</td>
<td>3%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pelvic &amp; Neural Anatomy</td>
<td>99%</td>
<td>1%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Repairing Lacerations</td>
<td>67%</td>
<td>10%</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

- Faculty
  - Multicenter collaboration lessened individual burden
  - Multidisciplinary collaboration heightened educational benefit for residents

Costs

Formal Cost Analysis not done *a priori*
- Faculty time NOT included
  - Biggest cost
- 1 site (6 residents): $1700 per resident
- 4 sites (32 residents): $800 per resident
- 45% start-up costs
  - ~ half next time

CASST Sr

- Similar program for senior residents
- Included 1 additional program (N=5)
- Similar process of curricular development
CASST Sr

• FACULTY
  ➢ General Gynecology (9)
  ➢ Urogynecology (3)
  ➢ Urology (3)
  ➢ Gynecologic Oncology (1)
  ➢ Program Directors (3)
  ➢ Endourology and Uroyn fellows (2)

• RESIDENTS
  ➢ Ob/Gyne (34)
  ➢ Urology (6)

Curriculum

4 sessions (3 hours)

• 1 hour: didactics
• 2 hours: workshops
  ➢ round table discussions
  ➢ prosected cadavers
  ➢ bench models

Curriculum

• Urogyn and Endoscopy
  ➢ Clinically relevant anatomy
  ➢ Advanced surgical skills
• Ethics of Surgical Innovation
• Problem-Solving in the OR
• Surgical Complications: Identification &Treatment
• Enhancing Communication
Conclusions

• Multicenter, multidisciplinary approach to surgical education is
  ➢ Feasible
  ➢ Cost effective
  ➢ Maximizes faculty time & effort
  ➢ Perceived as beneficial by residents

• Expands education for residents & faculty

• Think outside the box for potential collaborators
Clinical anatomy and surgical skills training (CASST): Development of a multicenter, multidisciplinary program

Kimberly Kenton, MD, MS,a,* Elizabeth R. Mueller, MD,a Scott Graziano, MD,b Sondra Summers, MD,b Leslie Rickey, MD,a Lisa Oldham, MD,c Xavier Pombar, DO,c Francesca Turner, DO,d Brenda Darrell, MDd

Division of Female Pelvic Medicine and Reconstructive Surgery, Departments of Obstetrics and Gynecology and Urology,a Department of Obstetrics and Gynecology,b Loyola University Medical Center, Maywood, IL; Department of Obstetrics and Gynecology,c Rush University Medical Center; Department of Obstetrics and Gynecology,d Illinois Masonic Medical Center, Chicago, IL

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Objective: The aim of this program was to develop a multicenter, multidisciplinary anatomy and surgical skills training program for junior residents in obstetrics and gynecology and urology.

Study design: After administering a needs assessment, we developed a collaborative clinical anatomy and surgical skills training program for junior residents in obstetrics and gynecology and urology at 3 academic medical centers in Chicago.

Results: Thirty-two residents participated in the program. Needs assessment results indicated that all residents felt they could benefit by more formal training in basic surgical skills. Learning objectives were developed for each of the 5 3-hour sessions that dealt with basic surgical skills, anterior abdominal wall anatomy, opening and closing the abdomen, female pelvic anatomy, and perineal anatomy and laceration repair. The cost of training each of the residents was approximately $600. Forty-five percent of the costs were one-time “start-up” costs for abdominal trainers and surgical instruments.

Conclusion: By including multiple centers and disciplines, we were able to reduce costs of teaching basic surgical skills and anatomy and maximize faculty teaching time and effort.

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Resident surgical training is increasingly challenging because of limited resident work hours, decreased surgical volume, concerns for patient safety, and increasing clinical demands of academic faculty.1,2 As a result, much basic surgical education has moved outside the operating room and into structured surgical skills laboratories. Multiple authors have demonstrated that structured surgical skills laboratories can be used to reliably...
train and evaluate resident surgical skills. In a survey of 199 obstetric and gynecology residency programs about their surgical education curriculum, only 58 programs (30%) had developed formal curricula. Of the programs without formal curricula, 100% used direct observation in the operating room, while only 61% had bench laboratories. The relatively low rate of technical skills laboratories is likely a result of limited faculty time and limited resources. As a result, new, innovative, cost-effective programs must be developed to teach junior residents anatomy and basic surgical skills. Junior residents from all surgical disciplines need to master the same basic technical skills and clinical anatomy. By collaborating with other departments and institutions teaching similar concepts and skills, we may be able to increase teaching efficacy, decrease faculty burden, and reduce costs.

The aim of our program was to develop a multicenter, multidisciplinary anatomy and surgical skills training program for junior residents in obstetrics and gynecology and urology. We will describe how we developed and assessed our clinical anatomy and surgical skills training (CASST) program.

Material and methods

Program directors from 3 obstetric and gynecology residency programs and 1 urology residency program agreed to develop a joint clinical anatomy and surgical skills training program for junior residents in obstetrics and gynecology and urology. We will describe how we developed and assessed our clinical anatomy and surgical skills training (CASST) program.

Needs assessment

We administered a needs assessment questionnaire on knowledge of basic surgical skills and clinical anatomy to first and second year residents from 4 residency training programs in the Chicago area.

Learning objectives

Clearly defined objectives were developed based on the consensus opinion of the faculty and the results of the needs assessment. Faculty opinions were derived from personal experience and consulting with national experts in surgical education. Specific objectives were written for each session and distributed to the residents at session one.

Educational strategies and implementation

We used results of the needs assessment to develop 5 3-hour workshops, including 13 short didactics, surgical skills laboratories, and prosected cadaver dissections to teach basic surgical skills and anatomy.

Assessment of learners

A short answer, fill-in the blank, pretest was given before the first session to assess baseline knowledge. The same test was administered at the conclusion of the fifth session and will be given again at the end of the academic year to assess the resident’s short- and long-term knowledge retention.

Program evaluation

We used 2 methods to assess the CASST program: all residents completed a course evaluation after the final session and faculty met to formally discuss and evaluate what they thought of the program.

The needs assessment, learning objectives, and program evaluation results are presented here. We also describe the start-up and on-going costs of the program.

SPSS (Version 13, Chicago, Ill) was used for data entry and analysis. Chi-square test of association was used for nominal data. Data were considered significant at the .05 level.

Results

Thirty-two residents participated in the program. Faculty included physicians from gynecology (n = 7) and urology (n = 3) from 3 different academic medical centers.

Educational outcomes

Needs assessment

Ninety-three percent of participants preferred hands-on surgical models or cadavers to didactic lectures. One hundred percent of participants agreed or strongly agreed that they would benefit from more formal training in basic surgical skills before entering the operating room, and 86% thought that prosected cadavers would increase their knowledge of anatomy. Table I demonstrates participants’ assessment of their current knowledge regarding anatomy and surgical skills. Over half...
of residents thought their knowledge and/or skills in all areas surveyed (except knot tying) were marginal or poor. A significantly higher percentage of second year residents felt their knot tying skills were excellent or adequate \( (P = .009) \). Urology residents were significantly more likely to report that their knowledge of pelvic anatomy and hysterectomy was poor compared to gynecology residents \( (P = .001 \text{ and } P = .012, \text{ respectively}) \).

Pretest results further emphasized the need for the CASST program. Twenty-seven percent of residents could correctly identify all 3 branches of the pudendal nerve, and less than half (40%) accurately described differences between first- and fourth-degree perineal lacerations. Only 10% knew the 3 most common sites of ureteral injury during hysterectomy, while another 33% could name 2 sites. Only 50% of residents selected an appropriate suture type to close fascia, subcutaneous tissues, and skin.

Learning objectives
The objectives for each session included cognitive and psychomotor components. Table II contains the objectives for each session.

### Table II  Resident learning objectives

<table>
<thead>
<tr>
<th>Session 1: Basic surgical skills</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Choose appropriate surgical instruments and suture based on biomechanics and tissue, suture, and healing properties.</td>
<td>Demonstrate how to tie surgical knots, including 1-handed, 2-handed, and instrument.</td>
<td>Place a tie using a passer and free hand.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 2: Abdominal wall anatomy</th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Discuss the muscular and fascial layers and vasculature of the abdominal wall.</td>
<td>Compare common surgical incisions used in gynecology and urology and identify specific instances in which each is beneficial.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 3: Opening and closing the abdomen</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Select appropriate instruments (eg, smooth vs toothed pick-ups) and suture for the different layers of an abdominal closure.</td>
<td>Demonstrate how to create and close an abdominal incision.</td>
<td>Demonstrate how to first assist opening and closing an incision.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 4: Pelvic anatomy</th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify clinically important anatomic structures in the pelvis and apply anatomic relationships to clinical scenarios.</td>
<td>Demonstrate how to position a patient in stir-ups and place a self-retaining retractor to prevent pelvic nerve injury.</td>
<td>Discuss steps of abdominal hysterectomy and identify common sites of ureteral injury.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 5: Perineal anatomy and laceration repair</th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Define the anatomic structures involved in the 4 degrees of perineal lacerations.</td>
<td>Demonstrate how to repair a fourth-degree laceration on a beef tongue model, including repairing all layers and choosing appropriate suture types for each layer.</td>
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<td></td>
</tr>
</tbody>
</table>

Table III  Residents’ ratings of 5 CASST sessions \( (n = 32) \)

<table>
<thead>
<tr>
<th>Session</th>
<th>Excellent</th>
<th>Helpful</th>
<th>Marginal</th>
<th>Waste of time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knot tying</td>
<td>26%</td>
<td>52%</td>
<td>22%</td>
<td>0</td>
</tr>
<tr>
<td>Abdominal wall anatomy</td>
<td>36%</td>
<td>60%</td>
<td>4%</td>
<td>0</td>
</tr>
<tr>
<td>Opening and closing</td>
<td>56%</td>
<td>36%</td>
<td>8%</td>
<td>0</td>
</tr>
<tr>
<td>Pelvic and neural anatomy</td>
<td>50%</td>
<td>46%</td>
<td>4%</td>
<td>0</td>
</tr>
<tr>
<td>Repairing perineal lacerations</td>
<td>56%</td>
<td>31%</td>
<td>10%</td>
<td>3%</td>
</tr>
</tbody>
</table>

and suture properties and types; (3) knot tying principals. The laboratory session consisted of 6 stations, where residents practiced knot tying (1-handed, 2-handed, and instrument), passing with a free tie and instrument, and reviewing the names and purpose of various surgical instruments.

### Session 2: Clinical anatomy of the anterior abdominal wall

Didactics were given on the layers and anatomy of the anterior abdominal wall, on common incision types, including midline, paramedian, Pfannenstiel, Maylard, Gibson, and Cherney, and on laparoscopic port placement for various procedures. We spent the remainder of the time in the gross anatomy laboratory. Four prosected cadavers were used to review layers, musculature, vessels, and innervation of the abdominal wall. We demonstrated where different incisions would be placed and important nearby structures by presenting clinical scenarios for the groups to discuss. We also repeated the knot tying and instrument naming stations from the first session.
Session 3: Opening and closing the abdomen
Two didactics were presented on opening and closing the abdomen emphasizing abdominal wall anatomy and basic surgical principles (traction and counter traction, how to hold knife, pick ups, needle driver). The residents spent the remainder of the time in groups of 2 practicing making and closing incisions using abdominal wall trainers and pig’s feet.

Session 4: Pelvic anatomy
The didactic portion of this session was dedicated to a review of basic pelvic and retroperitoneal anatomy—broad and cardinal ligaments, uterus, ovaries, and tubes, vessels, the course of the ureter—steps of abdominal hysterectomy focusing on clinically relevant anatomic relationships, and important neural anatomy and injuries. Laboratory session included reviewing pelvic and retropubic anatomy on prosected cadavers, using clay models to practice the steps of abdominal hysterectomy, and case scenarios of common nerve injuries associated with pelvic surgery.

Session 5: Perineal anatomy and laceration repair
Three short didactics were presented at the beginning of this session: review of perineal anatomy, repairing episiotomies and second-degree lacerations, and repairing third- and fourth-degree lacerations. We used a beef tongue model for repairing third- and fourth-degree lacerations during the laboratory session.

Program evaluation
Upon completion of the program, all (100%) residents strongly agreed or agreed that the CASST program was beneficial. Table III shows residents’ evaluations of the 5 individual sessions. There were few differences in responses between residency year and program. First year residents were more likely to rate the session on opening and closing the abdomen as excellent, while second year residents only found it helpful ($P = .029$). Urology residents were significantly more likely than gynecology residents to rate the session on perineal lacerations as marginal ($P = .005$). Similarly, urology residents were more likely to remain neutral to the statement that the session on perineal lacerations was beneficial ($P < .0005$).

Faculty assessment of the program was positive. Faculty unanimously agreed that collaborating with other centers/programs lessened their individual burden, resulting in an educational benefit for their residents. Faculty also benefited from working with specialists from other institutions and disciplines, frequently stating that they learned from the program. We identified several areas for improvement. More surgical instruments and trainers would improve some sessions. Next time, we will divide residents by specialty for certain breakout sessions. We will incorporate a more formal mechanism to provide formative feedback during individual sessions.

Cost analysis
The budgeted and actual expenses of the program for 32 residents are shown in Table IV. The abdominal trainers and surgical instruments were a one-time purchase and can be reused at further training sessions. Approximately 45% of the costs were associated with start-up. Disposable or on-going costs included pads for the trainers, cadavers, supplies, and administrative support. Faculty salaries and meeting room expenses were not included. Four cadavers were prosected by the faculty to illuminate specific teaching points. The number of cadavers was dependent on the learning objectives and not the number of resident participants. If we consider doing the same program with only 6 residents from a single program, the costs would increase by $800 per resident.

Conclusion
We have developed a unique multicenter, multidisciplinary program to train junior residents in clinical anatomy and surgical skills. By including multiple centers and disciplines, we were able to maximize faculty teaching time and effort, reduce costs to individual programs, and
establish collaborative relationships with specialists outside our departments.

As medical education and training change to meet the Accreditation Council for Graduate Medical Education’s new requirements for resident duty hours, increasing clinical demands are being placed on academic faculty. Experts predict that the clinical activity of academic surgeons will likely increase at the expense of their academic productivity (teaching and research). By collaborating with other surgical residency programs, we decreased each individual faculty member’s preparation, didactic, and teaching time. The CASST program included 13 short didactics, which complemented the ‘hands-on’ portion of each session. Each of the 10 faculty prepared at least 1 didactic session. Likewise, we shared preparation and cadaveric dissections. Most programs have a limited number of teaching faculty to participate in surgical skills programs, forcing a small number of faculty to develop, prepare, teach, evaluate, and assess their program. Our program maximized each program and faculty member’s time.

Additional costs that were not included in the analysis were costs of faculty time, facilities fees, and actual administrative costs of the program. Our multicenter program allowed us to utilize each program’s unique resource. For example, one program had new medical school facilities that could accommodate the didactic sessions and the anatomy breakout sessions. Chicago is unique in having 5 university medical centers in addition to several strong community based medical centers in close geographic proximity, which lends to close working relationships with other centers. This certainly aided our efforts to assemble a team from multiple medical centers. However, we also successfully collaborated with our own urology department, demonstrating the potential for intraintitutional collaboration within more remote medical centers. In fact, we hope to expand the program to include general surgery as well as urology and gynecology from other institutions. Our multidisciplinary collaboration provided several additional educational benefits: (1) the distinctive input and view-point of different specialties exposed residents and faculty to alternative ways of approaching a problem or task; (2) residents initiated professional relationships with future colleagues with whom they will collaborate clinically, and hopefully, academically; (3) residents witnessed professionalism and cooperation among surgical subspecialists.

Additionally, we believe the CASST program accomplished our major educational goals. We determined a need for an anatomy and technical skills program, developed concise, specific learning objectives, and put together a relevant curriculum. Program evaluations by residents and faculty judged the program to be beneficial. Final summative feedback will not be available until July 2006. Until that time we cannot comment on final assessment of resident’s knowledge. However, most programs have subjectively acknowledged improvement in junior resident’s knowledge and skill about objectives covered in CASST.

References
Validity of computer based methodology to evaluate surgical skill

L.METTLER
Dept. of OB/GYN, University Hospitals of Schleswig Holstein, Campus Kiel, Germany
lmettler@email.uni-kiel.de
www.profmettler.de

ESHRE, 2008
Learning objectives

1. Basic endoscopic training models are still essential for laparoscopic and hysteroscopic procedures
2. Computerized trainers offer better teaching possibilities
3. Virtual reality trainers are advantageous
4. Live animal surgery and human cadaver surgery should be performed when possible

Disclosure statement

- We have no commercial or financial relationship with manufacturers of any medical devices shown in this lecture.

Objectives

- 1. The intelligent hospital
- Advances in computer graphics, robotics and virtual reality (VR) technology open up new possibilities in medicine.

Robots fit readily into the infrastructure of today's hospitals.

Users, as the new generation of computer literate physicians and patients recognize these potentials and benefits.
Objectives

2. Demographic change
- In developed countries are more elderly people requiring hospital care and fewer working age people able to provide it. One solution is automation in health care.
- Robotics is one example of modern techn. together with computer based surgical skill training before the actual surgery on the patient that helps to deliver effective surgical care

Objectives

3. Telesurgery
- Advances in telecommunications now routinely allow surgeons to view operations taking place in distant hospitals using video conference techniques. Adding a robot assistant to this set up allows a distant surgeon to participate directly in the operation, controlling the robot in exactly the same way as if they shared the same room.

Enhancing laparoscopic skills with the LTS3e: A computerized hybrid physical reality
- What are our study objectives?
- To determine the value of this interactive simulator in acquiring basic laparoscopic skills among its users and to evaluate the correlation between the frequency of trials/practice and the overall performance
- Accepted for publication in Fertility and Sterility 2008, Soyinka, A., Meinhold, I., Schollmeyer, T. and L. Mettler
Design

- Cross-sectional study with paired analysis.

Setting

- The study was carried out at the Kiel School of Gynaecological Endoscopy and Reproductive Medicine
  Department Obst.Gynec.Christian Albrechts-University - Campus Kiel, Germany

Subjects

- Twenty-five in-training gynaecological endoscopic surgeons from various parts of the world and
  fifteen third-year medical students of the above institution.
Interventions

- Verbal explanation and video demonstration of a set of 10 laparoscopic skill tasks, suitable for application in endoscopic surgery, was presented to participants before administration of a pre-test. Voluntary rounds of further trials were encouraged thereafter, based on self-motivation.

Interventions

- The post-tests were administered five days later once the participant was comfortable performing the tasks. Assessments were conducted by the same independent supervisor and recorded on the LTS3e simulator.

Main outcome measures

- Improvements in overall scores and relative performance mean scores were measured using the independent t-test and comparison of various trial groups was performed by the ANOVA, an analysis of variance.
Results

- Significantly better post-test scores were achieved in all tasks for both groups compared to the pre-test scores $p<0.0001$.

Results

- There was no statistical difference between the overall relative training outcomes of both groups (when the numbers of trial rounds were taken into consideration) $p=0.471$.

Results

- No significant difference in group mean scores between the group of trainees who performed five or more rounds of trials and those with two and three trials ($p<0.012$ and $p<0.018$ respectively) was detected.
Fig. 3: Relative training success of both groups compared for each of the tasks and displayed in figure boxes.
Conclusions

- The LTS3e simulator device substantially contributes to the acquisition of laparoscopic skills in the less experienced or novice trainee surgeon. Performance improves progressively with practice.

Simulators

- Mechanical simulators, also called box trainers or conventional trainers, have long been used to teach laparoscopic skills. Box trainers are a popular alternative to animal and cadaver models, because they are less expensive and more convenient.
- Computer-based virtual reality simulators are relatively new to surgical education but are growing in popularity.
- Virtual reality simulators allow more independent instruction and objective feedback.

Box trainers

- Commonly used for practicing or assessing laparoscopic skills.
- Most box trainer simulators use actual laparoscopic equipment.
- The trainee performs the laparoscopic tasks under direct guidance of an experienced mentor for instruction and feedback.
- Scott et al., 2000 randomized surgical residents to a box trainer group or to a no training group. Using a global assessment tool for laparoscopic cholecystectomy on an actual patient, the investigators found that the training group demonstrated significantly greater improvement.
Virtual reality
- Can virtual reality training improve operating room performance?
  - Randomized, blinded, control trial
  - Assessed surgical residents during a laparoscopic cholecystectomy (on an actual patient) using a global assessment scale
  - Residents were randomly assigned to additional MIST-VR training or no simulator training
  - They found that significantly shorter operating times, fewer errors, and better economy of motion in the group with VR training
  - Schijven M, Surg Endosc 2005
  - Similar results
    - No difference

Virtual reality trainers versus box trainers
  - Randomized 50 surgery residents to box training or virtual reality training
  - After the designated training, participants had their technical skills assessed during an actual laparoscopic cholecystectomy
  - The virtual reality training significantly improved resident performance during operating room case, whereas training with a box trainer did only improve performance slightly
  - The authors concluded that virtual reality training is superior
  - In that study, performance was assessed in an animal model.
  - Again, investigators found that the virtual reality trainer was superior

- Education model project at our 3 months courses
- 1. group conventional training
- 2. group VR training (LapSim, VR1, LAP-Mentor)
  - 2 hours per week VR training
- Both groups receive 10 hours of didactical education
- After 8 week education technical skills are assessed during an actual timed exam and best at home with an easy surgery, like tubal ligation
Virtual Reality Trainers

- One such system, the **VR Pelviscopy Trainer, VSOne**, consists of two main components.
  - The 3-D interaction to guide the surgical instruments and the 2-D user interface for visual feedback and control of training session.
To provide the virtual environment, a realistic 3-D representation of the anatomic situs is derived from 2-D medical image data using imaging algorithms and visualisation techniques.

VEST Applications

- Arthroscopy
  - Logan et al. (1996), Univ. of Hull, UK

- Bronchoscopy
  - Bro-Nielsen et al. (1999), HT-Medical, USA

- Cardiac-Surgery / Anastomosis
  - Playter et al. (1997), BDI, USA

- Craniofacial Surgery
  - Keeve (1996), Uni-Erlangen, D

- Eye-Surgery
  - Ziegler, Müller et al. (1995), FhG-IGD, D

- Eye-Surgery
  - Logan et al. (1996), Univ. of Hull, UK

- Gynaecology
  - Sinclaire et al. (1998), Georgia-Tech, USA
  - Szekely et al. (1998), ETH-Zürich, CH
  - Kühnapfel et al. (1998), FZK, D

- Laparoscopy
  - Cover et al. (1993), Georgia-Tech, USA
  - Kühnapfel et al. (1995), FZK, D

- Trauma Surgery (mil.)
  - Basdogan et al. (1997), Musculographics, USA

VEST System Requirements

- Limited surgical Interactions
- Limited anatomical „Realism“
- Limited modelling of „Physiology“

Modelling-Tool KisMo (KISMET-Modeller)

Implementation of the Software-Tool KisMo for elastodynamical Objects
Surgical Simulation Scene

Application 1
Cholecystectomy
Clinical partner
Universitätsklinik Tübingen
Prof. Buess (since 1995)

Technical Details
Objects: 2
Knots: 325
Springs: 1317
Performance: 24 fps (SGI OnyxIR2, 2 CPUs)
17 fps (SGI OnyxIR2, 1 CPU)
15 fps (SGI OctaneMXE, 2 CPUs)
9 fps (Intergraph PC, 2 CPUs)

Surgical Simulation Scene

Application 2
Gynaecology
Clinical partner
Universitäts-Frauenklinik Kiel
Mrs. Prof. L. Mettler (since 1997)

Technical Details
Objects: 21
Knots: 2,847
Springs: 11,326
Performance: 12 fps (SGI Octane, 2 CPUs)
9 fps (SGI VPC-320, 2 CPUs)
6 fps (Intergraph PC, 2 CPUs)

Basic Surgical Interactions

- Grasping
- Application of clips
- Coagulation
- Cutting
Simulation of Suturing

- Suture material modelled as Spring-Mass-System
- Collision management

Sling Mechanism and Interaction

Arterial Bleeding

- Particle System Simulation
- Coupled with Pulse Simulation
- Application of clips to stop bleeding
- Accumulation of blood
- Parameters: Blood loss per vessel
- Rendering settings
Virtual Reality Trainer
VSOne

Model Overview
Camera introduction
Placement of clips
Coagulation
Suction and irrigation
Suture
Old training models meet computerized technology

1. Basic training on the pelvi-trainer, „popp trainer“, LTS-1 with simple exercises on models or organic tissue - specially advisable to practice suturing
2. Computerized trainers
3. Virtual reality trainers
4. Animal organs
5. Animal live situation training
Role and value of laparoscopic training devices in assessing nondominant and two-handed dexterity

Robotics

AESOP™
(automated endoscopic system for optimal positioning)
was the robot of the year 2000 in medical application.
It enables a tremor-free voice-commanded movement of the camera holding arm during laparoscopic surgery.
Methods

- **Zeus** uses 3 robots, one for the camera movement and 2 for robotic instrumentation.

Methods

- **Intelligent operation rooms**
  - 2. The integration and the central steering of different operation room components are realised in the OR1 of Storz.
    This technology allows a completely new operation room management: central control of all room components, processing, capturing and mailing of all patient data for data exchange between clinics, doctors and health care staff; efficiency increase.
Using the da Vinci M Surgical System, it is possible to operate with the look and feel of open surgery, performing complex surgical manoeuvres through 1cm ports in a sitting position with a so-called Surgical Immersion™ Technology.

"da Vinci M Surgical System"

MIS becomes second nature. The eyes and hands of the surgeon are completely immersed in the patient. True-to-life, 3-D vision and instinctive operative control make complex MIS procedures feel like open surgery.
Other robotic tools are:

HUMPHRY
as robotic uterine manipulator for LAVH etc.

Results

- A comprehensive finite element framework to enable simulation of patient specific biomechanics gives new possibilities for diagnosis and surgical planning as well as training before the individual case.

Results

- The VSOne advanced training system was applied by 71 doctors for intensive training prior to surgery on the patient.
- LTS 3e. Our real simulation system can be used as a screening mechanism for advanced laparoscopic surgeons. It also showed its teaching effects evaluation 50 doctors and medical students.
Results

- AESOPTM was used in comparison to assistant-held laparoscopic surgery in a group of 132 patients.
- The length of surgery, the skill of surgery and the outcome proved to be superior in those cases where the camera was held and moved by AESOPTM compared to human assistance.

### Results

<table>
<thead>
<tr>
<th>Surgical procedure</th>
<th>Operation time with assistant camera holder</th>
<th>Operation time with robotic arm (voice control)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>time</td>
</tr>
<tr>
<td>ovarian cysts</td>
<td>55</td>
<td>25</td>
</tr>
<tr>
<td>myomectomies</td>
<td>62</td>
<td>24</td>
</tr>
<tr>
<td>hysterectomies</td>
<td>25</td>
<td>15</td>
</tr>
</tbody>
</table>

* times are rounded up to 5 and 10.

Results

- The surgical revolution initiated by the da VinciTM Surgical System enables surgery to be performed with unprecedented precision and control. The immersion in the patient by looking into the da VinciTM is now practised in many centers around the world. Results on patients are fascinating and comparative studies to laparoscopic conventional surgery are running.
Avantis Third Eye Retroscope™

Provides retrograde view to reveal hidden lesions

The Future of Surgery

- Additional types of instruments
- Reusable instruments
- Use of the CO2 laser
- Robotic Needle holder

Conclusions and future aspects in gynecologic surgery

1. Surgical skills have to be trained computerized today.
2. 90% of all surgical interventions will be performed by laparoscopy or hysteroscopy.
3. Natural orifice surgery
4. Robotics with 3-dimensional surgery, high definition optics
5. A combination of molecular genetic early disease detection and endoscopic, minimal invasive surgery will hopefully induce less trauma to our patients in the future.
Conclusions

- With the da Vinci™ Surgical System the future of surgery is at your fingertips.
- We are able to take surgical precision and technique beyond the limits of the human hand.

Conclusions

- Benefits of the Intelligent Operating Room are at hand: “OR1” - “Hermes”, Alpha Image track, High definition cameras Olympus, Storz
  - improved ergonomics
  - better data management
  - more efficient personal utilisation
  - enabling new procedures and tools: HDTV
  - optimised surgeon control

Conclusions

- Robotic surgical instruments give the surgeon:
  - telesurgery chances
  - image guided positioning
  - image augmented dexterity
  - sensor guided positioning of instruments with multiple degrees of liberty
  - data preservation
  - sensor guided dexterity
  - task specific end-effectors
  - increased manual dexterity
Thank you for your attention
Is there still a need for a reproductive surgeon

Stephan Gordts M.D.
Leuven Institute for Fertility and Embryology

YES!
RESTORATION NORMAL ANATOMY
TREATMENT DISEASE
OFFERING POTENTIAL FOR SPONTANEOUS CONCEPTION
OPTIMALIZATION RESULTS IVF

Investigation
uterine pathology congenital
acquired
tubal pathology
endometriosis
Hysteroscopic Findings in Subfertile Patients

<table>
<thead>
<tr>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>530</td>
</tr>
<tr>
<td>Normal</td>
<td>370</td>
</tr>
<tr>
<td>No diagnosis</td>
<td>9</td>
</tr>
<tr>
<td>Abnormal</td>
<td>151</td>
</tr>
</tbody>
</table>

Oliveira et al. Fertil Steril, 80, 2004

Hysteroscopic findings in patients with repeated IVF failure

Nb patients with 2 IVF failures and nl. HSG n=55

- SUBMUCOUS LEYOMYOMA 2
- POLYPS 10
- ADHESIONS 6
- ENDOMETRITIS 7

45%

Oliveira et al. Fertil Steril, 80, 2004

Hysteroscopy and IVF outcome

Tarek El-Thouki RBM online 2008, 16
**UTERINE SEPTUM**

**Pre- and Post-operative Pregnancy Outcome**

<table>
<thead>
<tr>
<th></th>
<th>Pre-operative</th>
<th>Post-operative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>43</td>
<td>31</td>
</tr>
<tr>
<td>Pregnancies</td>
<td>117</td>
<td>37</td>
</tr>
<tr>
<td>• abortions</td>
<td>*104 (88.9%)</td>
<td>*5 (13.5%)</td>
</tr>
<tr>
<td>• premature</td>
<td>6 (5.1%)</td>
<td>5 (13.5%)</td>
</tr>
<tr>
<td>• at term</td>
<td>7 (6.0%)</td>
<td>27 (73%)</td>
</tr>
<tr>
<td>• children alive</td>
<td>*12 (10.2%)</td>
<td>*32 (86.5%)</td>
</tr>
</tbody>
</table>

---

**Septated Uterus and Implantation after IVF**

<table>
<thead>
<tr>
<th></th>
<th>Uteroplasty</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preg. rate</td>
<td>20%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Impl. Rate</td>
<td>10.5%</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

---

**Septated uterus**

<table>
<thead>
<tr>
<th></th>
<th>Small (n=125)</th>
<th>Large (n=54)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before</td>
<td>after</td>
</tr>
<tr>
<td>Time</td>
<td>22.44</td>
<td>6.6</td>
</tr>
<tr>
<td>Preg</td>
<td>109</td>
<td>97</td>
</tr>
<tr>
<td>Deliv</td>
<td>16.5%</td>
<td>90.7%</td>
</tr>
<tr>
<td>Abort.</td>
<td>78%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Ectop.</td>
<td>5.5%</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

---

*Gengolet et al. subm. Fertil Steril*
Laparoscopic findings in 92 oligo-ovulatory infertile patients after 4 failed cycles

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>33</td>
<td>35.9%</td>
</tr>
<tr>
<td>Endometriosis</td>
<td>37</td>
<td>40.2%</td>
</tr>
<tr>
<td>Endometrioma</td>
<td>8</td>
<td>8.7%</td>
</tr>
<tr>
<td>Pelvic adhesions</td>
<td>30</td>
<td>32.6%</td>
</tr>
<tr>
<td>Tubal disease</td>
<td>1</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

Omland et al., Hum Reprod 13, 9, 1998

Unexplained infertility versus minimal endometriosis

<table>
<thead>
<tr>
<th></th>
<th>Unexplained</th>
<th>minimal endometriosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Patients</td>
<td>119</td>
<td>49</td>
</tr>
<tr>
<td>Pregnancy rate</td>
<td>33.6%*</td>
<td>16.3%*</td>
</tr>
<tr>
<td>Implantation rate</td>
<td>43.6%*</td>
<td>18.3%*</td>
</tr>
</tbody>
</table>

* p < 0.005

Based on the concept that fibroids are primarily interstitial and gradually forced outwards or inwards:
- Intramural
- Submucosal
- Subserosal
20-40% of women of reproductive age are affected by leiomyomas

Myomas are associated directly or indirectly with 5-10% of cases of infertility


- Bleeding
- Pain and pressure
- Urinary symptoms
- Pregnancy
  - Infertility
  - Recurrent spontaneous abortion
  - Obstetrical complications

Impact of Intramural Myomas on Fertility

Greater distance for sperm travel
Encroachment on tubal ostium-occlusion
Distortion of uterine cavity
Vascular changes
Interferes with normal rhythmic uterine contractions
Impaired implantation
Abnormal endometrial maturation
Alteration on oxytocinase activity

Vercellini P. 1992 Fertil Steril
Verkauf B. 1992 Fertil Steril
Mechanism of Impaired Fertility in Case of Intramural-submucosal Myoma

Richards et al. (Hum Reprod Upd; 1998, 4)

- The numbers of caveolae in host myometrium and fibromyomata are conceivably decreased compared with normal myometra.
- This specific structural abnormality may affect calcium metabolism by causing a decrease in calcium extrusion and thus raising the intracellular calcium.
- Increased intracellular calcium produces myometrial irritability and hyperactivity.
- Results in disruption of rhythmic contractions of the junctional zone.

Subendometrial tumors:

- Causing endometrial erosion with subsequent inflammation altering the nature of the intrauterine fluid, resulting in a hostile environment.
- Disrupt the endometrial blood supply, affecting nidation and maintenance of early embryo

Fahri et al. 1995

Brosens et al.
**Junctional Zone Myometrium**

Functionally important entity in reproduction

- Ontogenetically related to endometrium
- Cyclic changes in SSH receptors
- Role in gamete transport and implantation

**Myometrial Junctional Zone Important Role in Reproduction**

Functionally important entity in reproduction

- Early changes from time of implantation
- Decidualization and trophoblast invasion
- Defective transformation of JZ spiral arteries in spectrum of pregnancy complications

**THE OUTER MYOMETRIUM**

Less important role in reproduction

Muscle contractions during delivery
Submucosal (JZ) fibroid
- type 0, I, II (European Society for Hysteroscopy criteria, 1994)
- type III: abutting the endometrium

“Outer myometrium” fibroid
- type IV: intramural
- type V, VI: subserosal, pedunculated

Myomectomy efficacy allows pregnancy in 60% of the patients with unexplained infertility in the first year following surgery

Vercellini P. 1998 Hum Reprod.

The decision to proceed with myomectomy in an asymptomatic patient with unexplained infertility remains controversial. Current data suggest surgical treatment for patients who have uterine cavity distortion.

Klatsky P et al 2007
### Submucosal Myoma and Infertility in IVF

*(Pritts EA, 2001)*

<table>
<thead>
<tr>
<th>Study</th>
<th>n Studies</th>
<th>Cycles</th>
<th>RR*</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancy</td>
<td>2</td>
<td>510</td>
<td>0.321</td>
<td>0.130 - 0.697</td>
</tr>
<tr>
<td>Implantation</td>
<td>1</td>
<td>541</td>
<td>0.277</td>
<td>0.096 - 0.720</td>
</tr>
</tbody>
</table>

**AFTER RESECTION**

<table>
<thead>
<tr>
<th>Study</th>
<th>n Studies</th>
<th>Cycles</th>
<th>RR*</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancy</td>
<td>2</td>
<td>157</td>
<td>1.719</td>
<td>1.134 - 2.582</td>
</tr>
<tr>
<td>Implantation</td>
<td>1</td>
<td>55</td>
<td>0.980</td>
<td>0.453 - 2.409</td>
</tr>
</tbody>
</table>

* Referent is infertile control without LM

### Intramuscular Leiomyoma

**Pregnancy Rate after IVF**

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>PR</th>
<th>Controls</th>
<th>PR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hart</td>
<td>106</td>
<td>23%*</td>
<td>322</td>
<td>34%</td>
</tr>
<tr>
<td>Stovall (cycles)</td>
<td>91</td>
<td>37%*</td>
<td>91</td>
<td>53%</td>
</tr>
<tr>
<td>Eldar-Geva</td>
<td>46</td>
<td>16%*</td>
<td>249</td>
<td>30%</td>
</tr>
<tr>
<td>Khalaf Y</td>
<td>122</td>
<td>24%*</td>
<td>322</td>
<td>33%</td>
</tr>
</tbody>
</table>

### Intramuscular Leiomyoma

**Pregnancy Rate after IVF**

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>PR</th>
<th>Controls</th>
<th>PR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surrey</td>
<td>73</td>
<td>51%</td>
<td>316</td>
<td>60%</td>
</tr>
<tr>
<td>Check</td>
<td>61</td>
<td>34%</td>
<td>61</td>
<td>48%</td>
</tr>
<tr>
<td>Ramzy</td>
<td>39</td>
<td>38%</td>
<td>367</td>
<td>34%</td>
</tr>
<tr>
<td>Oliveira</td>
<td>130</td>
<td>48%</td>
<td>245</td>
<td>45%</td>
</tr>
<tr>
<td>Klatsky</td>
<td>94</td>
<td>47%</td>
<td>275</td>
<td>54%</td>
</tr>
</tbody>
</table>
### Intramural Leiomyoma

#### Miscarriage Rate After IVF

<table>
<thead>
<tr>
<th>Subjects</th>
<th>MR</th>
<th>Controls</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eldar-Geva</td>
<td>46</td>
<td>33%</td>
<td>249</td>
</tr>
<tr>
<td>Check</td>
<td>61</td>
<td>34%</td>
<td>61</td>
</tr>
<tr>
<td>Ramzy</td>
<td>39</td>
<td>20%</td>
<td>367</td>
</tr>
<tr>
<td>Oliveira</td>
<td>130</td>
<td>27%</td>
<td>245</td>
</tr>
<tr>
<td>Gianaroli</td>
<td>129</td>
<td>40%*</td>
<td>129</td>
</tr>
</tbody>
</table>

### Intramural Fibroids and Cumulative Outcome Assisted Conception

Khalaf Hum Reprod 2006

### Material and Methods

- Retrospective case-control study

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (N=75 patients with myomas)</th>
<th>Group 2 (N=127 patients without myomas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.of transferred cycles</td>
<td>129</td>
<td>129</td>
</tr>
<tr>
<td>Age (M ± SD)</td>
<td>35.8 ± 4.9</td>
<td>35.7 ± 4.8</td>
</tr>
<tr>
<td>Mean Oestradiol</td>
<td>1205 ± 874</td>
<td>1395 ± 2821</td>
</tr>
<tr>
<td>% fertilized oocytes</td>
<td>67</td>
<td>56</td>
</tr>
<tr>
<td>No of fibroids</td>
<td>2.46 ± 2.8</td>
<td>1</td>
</tr>
</tbody>
</table>
### Results

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (N=75 patients with myomas)</th>
<th>Group 2 (N=127 patients without myomas)</th>
</tr>
</thead>
<tbody>
<tr>
<td># of embryos/ET (M ± SD)</td>
<td>2.02 ± 0.4</td>
<td>2.14 ± 0.6</td>
</tr>
<tr>
<td># of clinical pregnancies (%)</td>
<td>45 (34.9%)</td>
<td>53 (41.1%)</td>
</tr>
<tr>
<td>Implantation rate %</td>
<td>48/267 (18%) *</td>
<td>63/238 (26.5%) *</td>
</tr>
<tr>
<td># of abortions (%)</td>
<td>18 (40%) *</td>
<td>10 (18.9%) *</td>
</tr>
</tbody>
</table>

*X²=4.34 p<0.05

---

### Retrospective population-based study 1987-1983

- 2,065 singletons
- Comparison group selected randomly; matched by birth year
- No match by age, parity, or race/ethnicity

Coronado et al. 2000

### Uterine Myoma and Pregnancy

- Abruptio placentae OR: 3.87  95% CI: 1.63, 9.17
- 1st Trimester bleeding OR: 1.82  95% CI: 1.05, 3.20
- Dysfunctional labor OR: 1.85  95% CI: 1.26, 2.27
- Breech presentation OR: 3.98  95% CI: 3.07, 5.16
- Caesarean delivery OR: 6.39  95% CI: 5.46, 7.50

Coronado et al. 2000
- Virtually all singleton deliveries of southern Israel occur at Soroka University Medical Center
  - Period 1988-1999 (n=105909) (0.65% myomas, n= 690)

UM independently associated with:
- Caesarean delivery OR: 6.7 95% CI: 5.5, 8.1
- Placental abruptio OR: 2.6 95% CI: 1.6, 4.2
- <36 weeks gestation OR: 1.34 95% CI: 0.7, 2.8

Myomectomy Surgical Technique

Submucous myoma: hysteroscopic myomectomy
- diameter ≤ 5 cm
- partially protruding in cavity
- 2-step procedure can be necessary
- in case of larger myomas a pre-treatment with GnRHa can reduce the diameter

Intramural myoma: laparoscopic myomectomy
- diameter 6-7 cm
- number max. 4
- no pre-treatment with GnRHa

Mini laparotomy with exteriorization of uterus
Myoma and Reproduction

Conclusions I

Infertility: retrospective IVF cohorts with controls
- impaired fertility submucosal myoma
- possible negative impact of intramural myoma
- negative effect seems to be correlated with size and numbers

Conclusions II

Recurrent miscarriage:
- not clearly established link
- prospective studies needed
- increased risk of abortion in presence of several myoma
- increased risk with involvement of JZ

Conclusions III

Obstetric outcome: retrospective population based cohorts
- increased risk of
  - abruptio placentae
  - Caesarean section
  - pre-term delivery
  - breech presentation
Leiomyomas and Infertility

- It is rarely probable that they cause infertility but it has been described:
  - Longer time to conception (Hasan et al. 1990)
  - Reduction of the success of ART (Stovall et al. 1998; Khalaf et al. 2006)
  - Relation to spontaneous abortion (Muhieddine et al. 1992) (Matsunaga et al. 1980)
  - A similar probability of pregnancy after myomectomy compared with patients with no uterine pathology (Buttram & Reiter 1981)

---

Leiomyomas and Infertility

- Consensus on the benefits of treating submucous leiomyomas
- No consensus on the treatment of smaller intramural leiomyomas

---

Junctional Zone Myometrium

Functional important entity in reproduction

- Ontogenetically related to endometrium
- Cyclic changes in SSH receptors
- Role in gamete transport and implantation
T2-weighed NMR imaging in adenomyosis

NMR visualises the distortion of the myometrial architecture

- Accurate soft tissue contrast
- Non invasive
- Differentiates focal and diffuse adenomyosis

NMR is an accurate technique to detect uterine adenomyosis

Focal lesion

Diffuse lesion

Implantation disorder?
277 infertile patients, 160 with endometriosis

In absence of pain

Because no obvious impairment of implantation

Should we treat???

How???

No RCT
No EBM
No large series

ADENOMYOSIS AND TREATMENT

Surgery
Best treatment option?
Exact localization?
Laparoscopy/laparotomy?
Pre-treatment GnRha?
ADENOMYOSIS AND TREATMENT

**Surgery clinical aspects**: darker color, less firm consistency no well defined cleavage plane dichotomous disease -disruption JZ -secund.infiltr. myometrium more difficult wound apposition

---

ADENOMYOSIS AND TREATMENT

Reductive surgery: difference with myomectomy no obvious plane of cleavage

adenomyosis infiltrates normal myometrium ↓ excision of diseased area substracts myometrial mass from the total uterine volume

---

ADENOMYOSIS AND TREATMENT

Reduction in myometrial capacity:

↑ abortion premature labour uterine rupture incidence C-section

---

Page 94
Endometriosis as a
Pleiotropic Reproductive
Disorder

- Endometriotic lesions
- Peritoneal inflammatory microenvironment
- Subtle ovarian dysfunctions
- Aberrant endometrial SSH response
- Myometrial JZ hyperplasia and dysfunction
ENDOMETRIOSIS-Associated INFERTILITY

Randomized, controlled multicenter trial of laparoscopic surgery in minimal/mild disease  
(Marcoux et al, NEJM 1997)

<table>
<thead>
<tr>
<th>No</th>
<th>MF</th>
<th>CPP (36w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>169</td>
<td>2.4% 18</td>
</tr>
<tr>
<td>Treated</td>
<td>172</td>
<td>4.6% 31</td>
</tr>
</tbody>
</table>

Conclusion: “...factors other than the endometriosis interfere with infertility.”

ENDOMETRIOSIS-Associated INFERTILITY

Comparison of Pregnancy Rates  
(Adamson, Sem Reprod Endocrin 1997)

<table>
<thead>
<tr>
<th>Stage of disease</th>
<th>Mini/Mild</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectant</td>
<td>37.4%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Surgical</td>
<td>51.7%</td>
<td>41.3%</td>
</tr>
</tbody>
</table>

ENDOMETRIOSIS-Associated CPP

Prospective, randomized, double-blind trial of laser laparoscopy (Sutton, Fertil Steril 1994)

<table>
<thead>
<tr>
<th>Relief</th>
<th>rAFS 1</th>
<th>rAFS 2-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>25%</td>
<td>20%</td>
</tr>
<tr>
<td>Laser</td>
<td>46%</td>
<td>74%</td>
</tr>
</tbody>
</table>
Endometriosis
Conservative surgery

- Elimination of implants and adhesions
- Effective in infertility and CPP, but more in severe than mild disease

Tubal surgery

- Distal occlusion
- Proximal occlusion
  - Infectious / mechanical
- Ectopic

HYDROSALPINX AND IVF OUTCOME

<table>
<thead>
<tr>
<th>Prospective studies</th>
<th>Hydros. Pos.</th>
<th>Hydros. Neg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strandell et al. 1999</td>
<td>23.9%</td>
<td>36.6%</td>
</tr>
<tr>
<td>Dechaud et al. 1998</td>
<td>18.7%</td>
<td>34.2%</td>
</tr>
</tbody>
</table>
HYDROSALPINX AND IVF OUTCOME

<table>
<thead>
<tr>
<th>Hydrosalpinx</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancy rate</td>
<td>19.57%</td>
<td>31.2%</td>
</tr>
<tr>
<td>Implantation rate</td>
<td>8.53%</td>
<td>13.58%</td>
</tr>
<tr>
<td>Delivery rate</td>
<td>13.40%</td>
<td>23.44%</td>
</tr>
<tr>
<td>Early preg. loss</td>
<td>43.85%</td>
<td>31.11%</td>
</tr>
</tbody>
</table>

Receptivity: lower concentration integrin αvβ3
- out of phase histological maturation
  Meyer et al. 1997

Mechanical:
- fluid interface
- washing out
  Sharara et al. 1999

Mechanism of impairment

Treatment options:
- Correction of endometrial αvβ3
  - Salpingectomy 92.3% (n=13)
  - Neosalpingostomy 33.3% (n=3)
  - Proximal occlusion 66.7% (n=3)
  - Transvaginal aspiration 0% (n=1)

  Pr/ET (%) IR (%)
  - 39 18.8
  - 36.2 16.7
  - 60 27.3

HYDROSALPINX AND IVF OUTCOME

Treatment options

Should a hydrosalpinx been removed before IVF??

Which surgical correction should be performed before IVF??
Salpingostomy
Laparoscopy <= microsurgery

Pregnancy rates

<table>
<thead>
<tr>
<th>grade</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>laparoscopy</td>
<td>50</td>
<td>32.4</td>
<td>8.3</td>
<td>0</td>
</tr>
<tr>
<td>microsurgery</td>
<td>66.6</td>
<td>36.6</td>
<td>14.3</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Canis et al. 1991

Tubal surgery

- Distal occlusion
- Proximal occlusion
  - Infectious / mechanical
- Ectopic

Year Nb IUP % E.P %

Winston 1980 126 60.4 2.4
Gomel 1980 118 82.5 1.7
Rock 1982 125 65.0 4.0
Schlösser 1983 119 60.5 2.5
Dubuisson 1995 206 69.9 -
Boeckx 1986 63 69.8 5
Gordts 2008 261 72.5 -
CONCLUSION

YES WE NEED REPRODUCTIVE SURGEONS

integrated in each unit of reproductive medicine

urgent need specific training