Laparoscopic Suturing: Intracorporeal, Extracorporeal, Barbed Suture and Suturing Techniques (Simulation Lab)

PROGRAM CHAIR
Joseph L. (Jay) Hudgens, MD

PROGRAM CO-CHAIR
Benoit Rabischong, MD

Deborah Arden, MD  Shan M. Biscette, MD  Aarathi Cholkeri-Singh, MD
Howard L. Curlin, MD  Megan A. Daw, MD  Nita A. Desai, MD
Jessica B. Feranec, MD  Isabel C. Green, MD  Hye-Chun Hur, MD
Eric C. Liberman, MD  Michael L. Lewis, MD  Kimberly A. Kho, MD
Nash S. Moawad, MD  Ja Hyun Shin, MD  Michael L. Sprague, MD

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Professional Education Information

Target Audience
This educational activity is developed to meet the needs of residents, fellows and new minimally invasive specialists in the field of gynecology.

Accreditation
AAGL is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The AAGL designates this live activity for a maximum of 3.75 AMA PRA Category 1 Credit(s)™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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# Table of Contents

Course Description ........................................................................................................................................... 1

Disclosure .......................................................................................................................................................... 3

**Needle Loading and Tissue Approximation**  
J.L. Hudgens .................................................................................................................................................. 5

**Critical Steps for Efficient Intracorporeal Knot Tying**  
J.L. Hudgens ................................................................................................................................................ 14

**Techniques for Extracorporeal Knot Tying**  
B. Rabischong ............................................................................................................................................... 18

**Barbed Suture, Suturing Devices, and Suturing Technologies**  
M.L. Sprague ............................................................................................................................................... 23

**Cultural and Linguistics Competency** ........................................................................................................ 26
Laparoscopic Suturing: Intracorporeal, Extracorporeal, Barbed Suture and Suturing Techniques (Simulation Lab)

Joseph L. (Jay) Hudgens, Chair
Benoit Rabischong, Co-Chair


This hands-on course will provide each participant the opportunity to demonstrate various laparoscopic suturing and knot tying techniques in an interactive dry lab setting. This course is designed to present the fundamentals of needle loading, tissue approximation and knot tying. This course will aim to present the material in a systematic and stepwise fashion that is learner focused and can be applied regardless of port placement or instrumentation. The course will present techniques for loading the needle, tissue approximation, tips for extracorporeal and intracorporeal knot tying, introduce barbed suture, as well as various suturing technologies and suturing devices. There will also be a brief interactive session with the faculty to address clinically relevant scenarios. The goal is to introduce the fundamentals of laparoscopic suturing while also providing exposure to a variety of techniques and solutions relevant to clinical situations.

Learning Objectives: At the conclusion of this activity, the clinician will be able to: 1) Demonstrate techniques for laparoscopic loading of the needle and tissue approximation; 2) apply techniques for extra-corporeal knot tying; 3) recognize and employ the critical steps for efficient intra-corporeal knot tying; 4) identify the mechanism of barbed suture and interpret the current studies that have investigated its use in gynecology; 5) compare suturing technologies and suturing devices and their potential benefits; and 6) discuss clinically relevant applications of laparoscopic suturing.

Course Outline

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
<td>Welcome, Introductions and Course Overview</td>
<td>J.L. Hudgens</td>
</tr>
<tr>
<td>8:05</td>
<td>Lecture: Needle Loading and Tissue Approximation</td>
<td>J.L. Hudgens</td>
</tr>
<tr>
<td>8:20</td>
<td>Hands-on: Needle Loading and Tissue Approximation</td>
<td>All Faculty</td>
</tr>
<tr>
<td>9:00</td>
<td>Lecture: Critical Steps for Efficient Intracorporeal Knot Tying</td>
<td>J.L. Hudgens</td>
</tr>
<tr>
<td>9:15</td>
<td>Hands-on: Intracorporeal Knot Tying</td>
<td>All Faculty</td>
</tr>
<tr>
<td>9:45</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>10:00</td>
<td>Lecture: Techniques for Extracorporeal Knot Tying</td>
<td>B. Rabischong</td>
</tr>
<tr>
<td>10:15</td>
<td>Hands-on Intracorporeal Knot Tying</td>
<td>All Faculty</td>
</tr>
<tr>
<td>11:00</td>
<td>Barbed Suture, Suturing Devices, and Suturing Technologies</td>
<td>M.L. Sprague</td>
</tr>
</tbody>
</table>
11:15  Hands-on Use of Barbed Suture and Suturing Devices  All Faculty
11:45  Interactive Discussion of Clinically Relevant Applications of Laparoscopic Suturing  All Faculty
12:00  Course Evaluation/Adjourn
PLANNER DISCLOSURE
The following members of AAGL have been involved in the educational planning of this workshop and have no conflict of interest to disclose (in alphabetical order by last name).
Art Arellano, Professional Education Manager, AAGL*
Viviane F. Connor
Kimberly A. Kho*
Frank D. Loffer, Executive Vice President/Medical Director, AAGL*
Linda Michels, Executive Director, AAGL*
M. Jonathan Solnik*
Johnny Yi*

SCIENTIFIC PROGRAM COMMITTEE
Ceana H. Nezhat
Consultant: Ethicon Endo-Surgery, Lumenis, Karl Storz
Other: Medical Advisor: Plasma Surgical
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Andrew I. Sokol*

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The following have agreed to provide verbal disclosure of their relationships prior to their presentations. They have also agreed to support their presentations and clinical recommendations with the “best available evidence” from medical literature (in alphabetical order by last name).
Shan M. Biscette*
Aarathi Cholkeri-Singh
Consultant: Ethicon Endo-Surgery, Karl Storz
Howard Curlin*
Megan A. Daw*
Nita A. Desai
Other: Proctor: Intuitive Surgical
Jessica B. Feranec*
Isabel C. Green*
Joseph L. (Jay) Hudgens
Grants/Research: Karl Storz
Consultant: Terumo CVS
Hye-Chun Hur
Other: Author: UpToDate
Other: Travel Expenses: Intuitive Surgical
Kimberly A. Kho*
Michael L. Lewis
Consultant: Plasma Surgical
Eric C. Liberman*
Nash S. Moawad*
Benoit Rabischong*
Ja Hyun Shin*
Michael L. Sprague*

Asterisk (*) denotes no financial relationships to disclose.
Laparoscopic Suturing and Knot Tying

Jay L. Hudgens, M.D., F.A.C.O.G.
Assistant Professor
University of Mississippi Medical Center
Director of Minimally Invasive Gynecology
Wiser Women’s Hospital
Jackson, MS

Disclosure

- Grants/Research Support: Karl Storz
- Consultant: Terumo, CVS

Objectives

1. Present a system for learning laparoscopic suturing & knot tying
2. Review obstacles to reproducible laparoscopic suturing
3. Discuss the potential benefits of laparoscopic suturing technologies

System

1. Set the Needle
2. Reapproximate
3. Knot Tying

Lectures

1. Port placement, needle handling, & tissue re-approximation
2. Intra-corporeal knot tying
3. Extra-corporeal knot tying
4. Barbed suture and suturing technologies

Learning = Experience
Objectives

1. Present the different port placements used in laparoscopic suturing
2. Present a system for setting the needle
3. Discuss strategies for tissue re-approximation

Port Placement Video
Port Placement Video 2

Ipsilateral

- Ergonomics
- Assistant
- One Sided

Contralateral

- Ideal Triangulation
- Poor Ergonomics?
- No Assistant

Suprapubic

- Gravity
- Ergonomics?
- Two Sided

System

1. Set the Needle
2. Re-approximate
3. Knot Tying

System

- Set (perpendicular)
- Parallel (tissue)
- Rotate (key)
- Reset

Tie Knot
Needle Entry

- Direct-trocar
- Backloaded
- Abdominal Wall

- 5mm......Backload
- 8mm......SH-1
- 10mm.....CT-2 & CT-1
- 12mm......CT

Setting the Needle

A-B-C

“A” = 2cm from Swedge

“B” = 1/3 from Point

“C” = 1/3 from Swedge

1.  
2.  
3.  
4.  

4.
Setting Video 3

A-C Method

1

2

C: Confirm

3

4

Setting the Needle

A-B-C

Left Hand

Right Hand

Turn the Key

Turn the Key Video
Right Hand Motion

Novice

Expert

Hiemstra et al. JMIG 2011 vol. 18, pgs 494-499

Ipsilateral Relationship

Contra-lateral Relationship

Contra-lateral Relationship

Contra-lateral Relationship

Supra-pubic Relationship
Clinical video 2

System

- Set (perpendicular)
- Parallel (tissue)
- Rotate (key)
- Reset

Tie Knot

References


Laparoscopic Suturing and Knot Tying

Jay L. Hudgens, M.D., F.A.C.O.G.
Assistant Professor
University of Mississippi Medical Center
Director of Minimally Invasive Gynecology
Wiser Women’s Hospital
Jackson, MS

Disclosure
• Grants/Research Support: Karl Storz
• Consultant: Terumo, CVS

Objectives
Understand Ergonomics, Theory, & Rationale, for Reproducible Laparoscopic Knot Tying.

Review Obstacles to Laparoscopic Knot Tying and How to Overcome Them.

Intra-corporeal Knot Tying

To Throw Knot
• Make a Short Tail
• Align Suture Parallel to Right Instrument
• Move Left Hand OVER Knot

There is no place like HOME!
Suture Management

Goal is Control

Expert Knot video 1

Expert Knot video 2

Contralateral Expert Knot

Smiley Knot

Common Mistakes video 1
Common Mistakes video 2

Common Mistakes video 3

Common Mistakes video 4

Keys For Success

- Short Tail
- Parallel
- Length of Loop

Review

Right Hand Motion

Hiemstra et al JMG 2011 vol. 18, pgs 494-499
Let the Left Hand Work
Techniques for Extracorporeal Knot Tying

PG 201, 42nd AAGL, Washington D.C. 2013

B. Rabischong M.D Ph.D.

Disclosure

I have no financial relationships to disclose.

B. Rabischong M.D Ph.D.

Objectives

Extracorporeal knot tying

Knowing:

✓ Indications of extracorporeal knot tying
✓ Advantages
✓ Instrumentation and suturing materials required
✓ Types of knots
✓ Technique and ergonomy of extracorporeal knot tying

Intracorporeal and extracorporeal suturing: indications

| Table 1: Advantages and disadvantages of various methods of tissue approximation |
|---------------------------------|-----------------|-----------------|
| Method                          | Advantage           | Disadvantage     |
| Intracorporeal                  |                  |                  |
| Knots                           |                  |                  |
| Laparoscopic                    |                  |                  |
| Clamps                          |                  |                  |
| Staples                         |                  |                  |
| Advances                        |                  |                  |
| Fiber gut                       |                  |                  |
| Certainly                       |                  |                  |
| Last coil                       |                  |                  |
| Extracorporeal                  |                  |                  |
| Knots                           |                  |                  |
| Laparoscopic                    |                  |                  |
| Clamps                          |                  |                  |
| Staples                         |                  |                  |
| Advances                        |                  |                  |
| Fiber gut                       |                  |                  |
| Certainly                       |                  |                  |
| Last coil                       |                  |                  |

Intracorporeal knots

Extracorporeal knots

Soft tissues reparation (uterus, bowel, bladder...)

Solid tissues reparation (vagina, uterus)

Hemostasis

Suspension/fixation

Deep surgery
Extracorporeal knots

- Nicky’s knot
- Roeder’s knot
- Seoul Medical Centre knot
- Smith & Nephew’s knot
- Simple Sliding knot
- Tennessee’s knot

Roeders’ s Knot

Pushed Half-hitch knots

Set-up of for laparoscopic suturing

Equipment and Instrumentation

- Suturing instruments
- Trocars
- Suturing material
Needle holders

Laparoscopic Needle Holder
“co-axial”
Szabo-Berci

Correct movements - twisting and turning

“displacement” = problems

Knot pusher

Equipment and Instrumentation
Knot Pusher

Clarke HC. A Simple Surgical Ligator. Archives of Surgery 1973

Equipment and Instrumentation
Knot Pusher: Trocars
Equipment and Instrumentation

Knot Pusher: Trocars

Extracorporeal knots
Technique, Myomectomy

Extracorporeal knots
Technique, vaginal closure

Extracorporeal knots
Technique, ovarian vessels hemostasis

Extracorporeal knots
Technique, uterine artery hemostasis
**Conclusions**

- Suturing remains essential to the performance of high-quality surgery
- Intracorporeal and extracorporeal suturing are the preferred methods for laparoscopic tissue approximation
- Learning to suture requires special attention to the set-up, visual perception, hand-eye coordination, and motor skill
- Permanent training on laparoscopic suturing is essential
- Devices available to facilitate tissue approximation are far from ideal
- Advances in robotic surgery, remote surgery, and virtual reality may completely change the way of tissue approximation in laparoscopy

Thank You Very Much For Your Attention!
Objectives

At the conclusion of this activity, participants will be better able to:
- Summarize the applications for barbed suture in minimally invasive gynecologic surgery
- Demonstrate technique for using automated suturing devices

Barbed Suture

- Knot-less
- Maintains tissue apposition during closure
- Distributes tension along incision line

Unidirectional Barbed Suture

Bidirectional Barbed Suture

Disclosures

I have no financial relationships to disclose.
**Einarsson et al. – Barbed Suture for Laparoscopic Cuff Closure**

<table>
<thead>
<tr>
<th></th>
<th>Quill (n=32)</th>
<th>Vicryl (n=31)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to Cuff Closing (min)</td>
<td>10.4 SD (5.2)</td>
<td>11.6 SD (4.8)</td>
<td>0.51</td>
</tr>
<tr>
<td>Dehiscence</td>
<td>1</td>
<td>1</td>
<td>0.99</td>
</tr>
<tr>
<td>Infection</td>
<td>1</td>
<td>3</td>
<td>0.35</td>
</tr>
<tr>
<td>Bleeding</td>
<td>0</td>
<td>4</td>
<td>0.05</td>
</tr>
<tr>
<td>Female Dyspareunia</td>
<td>2</td>
<td>1</td>
<td>0.97</td>
</tr>
<tr>
<td>Male Dyspareunia</td>
<td>1</td>
<td>0</td>
<td>0.45</td>
</tr>
</tbody>
</table>

**Alessandri et al. – Unidirectional Barbed Suture vs Continuous Suture in Laparoscopic Myomectomy**

<table>
<thead>
<tr>
<th></th>
<th>V-Loc (n=22)</th>
<th>Monofilament (n=22)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Time for Hysterotomy Closure (min)</td>
<td>11.5 SD [4.4]</td>
<td>17.4 SD [5.3]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean Duration of Surgery (min)</td>
<td>81 SD [19]</td>
<td>73 SD [21]</td>
<td>0.177</td>
</tr>
<tr>
<td>Δ Hemoglobin (g / dl)</td>
<td>0.6 SD [0.3]</td>
<td>0.9 SD [0.4]</td>
<td>0.004</td>
</tr>
</tbody>
</table>

**Einarsson et al. – Barbed Suture for Laparoscopic Myomectomy**

<table>
<thead>
<tr>
<th></th>
<th>Quill (n=107)</th>
<th>PDS (n=31)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Duration of Surgery (min)</td>
<td>118 SD [52]</td>
<td>161 SD [69]</td>
<td>0.003</td>
</tr>
<tr>
<td>Mean EBL (ml)</td>
<td>154 SD [244]</td>
<td>140 SD [128]</td>
<td>0.76</td>
</tr>
<tr>
<td>Myomas Removed (#)</td>
<td>3.4 SD [3.7]</td>
<td>4.3 SD [5.5]</td>
<td>0.27</td>
</tr>
</tbody>
</table>
**Barbed Suture**

**Summary**

- Unidirectional barbed suture observed to decrease time required for laparoscopic hysterotomy closure
- Bidirectional barbed suture observed to decrease total time to complete laparoscopic myomectomy
- Vaginal cuff closure times are similar when using barbed versus braided sutures

**Suturing Devices**

- Possible advantages include –
  - One-handed operation
  - Needle protected from neighboring tissues during suturing
  - Simplifying suturing tasks during single-incision laparoscopic procedures

**Barbed Suture, Suturing Devices, and Suturing Technologies**

- Laparoscopic suturing is a attainable, necessary skill for all minimally invasive gynecologic surgeons
- Advances in suture materials and technologies may facilitate development of laparoscopic suturing skillset

**References**

CULTURAL AND LINGUISTIC COMPETENCY

Governor Arnold Schwarzenegger signed into law AB 1195 (eff. 7/1/06) requiring local CME providers, such as the AAGL, to assist in enhancing the cultural and linguistic competency of California's physicians (researchers and doctors without patient contact are exempt). This mandate follows the federal Civil Rights Act of 1964, Executive Order 13166 (2000) and the Dymally-Alatorre Bilingual Services Act (1973), all of which recognize, as confirmed by the US Census Bureau, that substantial numbers of patients possess limited English proficiency (LEP).

California Business & Professions Code §2190.1(c)(3) requires a review and explanation of the laws identified above so as to fulfill AAGL's obligations pursuant to California law. Additional guidance is provided by the Institute for Medical Quality at http://www.imq.org.

Title VI of the Civil Rights Act of 1964 prohibits recipients of federal financial assistance from discriminating against or otherwise excluding individuals on the basis of race, color, or national origin in any of their activities. In 1974, the US Supreme Court recognized LEP individuals as potential victims of national origin discrimination. In all situations, federal agencies are required to assess the number or proportion of LEP individuals in the eligible service population, the frequency with which they come into contact with the program, the importance of the services, and the resources available to the recipient, including the mix of oral and written language services. Additional details may be found in the Department of Justice Policy Guidance Document: Enforcement of Title VI of the Civil Rights Act of 1964 http://www.usdoj.gov/crt/cor/pubs.htm.

Executive Order 13166,"Improving Access to Services for Persons with Limited English Proficiency", signed by the President on August 11, 2000 http://www.usdoj.gov/crt/cor/13166.htm was the genesis of the Guidance Document mentioned above. The Executive Order requires all federal agencies, including those which provide federal financial assistance, to examine the services they provide, identify any need for services to LEP individuals, and develop and implement a system to provide those services so LEP persons can have meaningful access.

Dymally-Alatorre Bilingual Services Act (California Government Code §7290 et seq.) requires every California state agency which either provides information to, or has contact with, the public to provide bilingual interpreters as well as translated materials explaining those services whenever the local agency serves LEP members of a group whose numbers exceed 5% of the general population.

If you add staff to assist with LEP patients, confirm their translation skills, not just their language skills. A 2007 Northern California study from Sutter Health confirmed that being bilingual does not guarantee competence as a medical interpreter.  http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2078538.