What is the role of robotics in pelvic floor reconstructive surgery?

Catherine A. Matthews, MD
Associate Professor and Division Chief
Urogynecology and Reconstructive Pelvic Surgery
University of North Carolina
Chapel Hill, NC
DISCLOSURES

Consultant and case observation site: Intuitive Surgical

Fellowship grant funding: Intuitive Surgical

Consultant: American Medical Systems
Case

- 49 yo
- Stage III uterovaginal prolapse
- SUI

- What is the best surgical procedure for this patient?
I'm actually 54, not 49.
Risk factors for prolapse recurrence after vaginal repair

James L. Whiteside, MD, Anne M. Weber, MD, MS, Leslie A. Meyn, MS, Mark D. Walters, MD

Department of Obstetrics and Gynecology, The Cleveland Clinic Foundation, Cleveland, Ohio, and Department of Obstetrics and Gynecology, Magee-Womens Hospital, Pittsburgh, Pa

Received for publication February 11, 2004; revised May 20, 2004; accepted June 29, 2004
Whiteside et. al.

- 1 year post-op, 58% had ≥ Stage II recurrent POP
- Identified risk factors:
  - Age < 60: OR 3.2; 95% CI 1.6-6.4
  - Stage III or IV pre-op POP: OR 2.7; 95% CI 1.3-5.3
Identification of Risk Factors for Genital Prolapse Recurrence

Stefano Salvatore,1* Stavros Athanasiou,2 G. Alessandro Digesu,3 Marco Soligo,4
Myrtia Sotiropoulou,2 Maurizio Serati,3 Aris Antsaklis,2 and Rodolfo Milani5

1Department of Obstetrics & Gynecology, Insubria University, Varese, Italy
2Urogynaecology Unit, 1st Department of Obstetrics and Gynaecology, University of Athens, Alexendra Hospital, Athens, Greece
3Department of Urogynaecology, St. Mary’s Hospital, Imperial College, London, UK
4Department of Obstetrics & Gynecology, San Carlo Hospital, Milan, Italy
5Department of Obstetrics & Gynecology, San Gerardo Hospital, University of Milan, Italy

Aims: To assess the relationship between prolapse recurrence and some risk factors in a group of women submitted to reconstructive pelvic surgery. Methods: Women referred to our Urogynaecological Units complaining of prolapse symptoms were prospectively included. We excluded women who were affected by apical vaginal prolapse ≥ stage I after a previous hysterectomy. All women had pelvic surgery with traditional techniques without using grafts. Each woman was reassessed at 1, 6, and 12 months and then yearly postoperatively. We defined as prolapse recurrence a vaginal descent ≥ II stage involving the operated compartments. Results: A total of 360 consecutive women were recruited and submitted to vaginal reconstructive pelvic surgery. At a mean follow-up of 26 months, 36 women (10%) had a recurrent prolapse. A preoperative vaginal descent ≥ III stage was the only significant risk factor for recurrence (P = 0.02, OR 2.4, 1.1–5.1 95% CI). Conclusions: Women with prolapse ≥ III stage had a significant higher risk of developing prolapse recurrence after surgical repair without grafts. Neurourol. Urodynam. 28:301–304, 2009. © 2009 Wiley-Liss, Inc.

Key words: prolapse; recurrence; risk factors; surgery; women
Salvatore study

- N= 360
- Mean follow up of 26 months
- 10% had ≥ recurrent Stage II POP
- Only identified risk factor: Pre-op ≥ Stage III POP: OR 2.4, 95% CI 1.1-5.1
Main risk factor was advanced prolapse (Grade 3,4)
Fig. 1. Overall surgical outcomes according to the preoperative POP-Q stage.
Incidence and risk factors for reoperation of surgically treated pelvic organ prolapse

Patrick Dällenbach • Carol Jungo Nancoz • Isabelle Eperon • Jean-Bernard Dubuisson • Michel Boulvain

Received: 16 March 2011 / Accepted: 7 June 2011 / Published online: 23 June 2011
© The International Urogynecological Association 2011
Risk factors of reoperation

• Cumulative incidence 5.6%
• Risk factors:
  • POP in > 2 vaginal compartments: OR 5.2, 95% CI 2.8-9.7
  • Sexual activity: OR 2.0; 95% CI 1.5-7.1
Advanced prolapse has higher risks of recurrence
### Abdominal SCP vs. Vaginal SSLF


<table>
<thead>
<tr>
<th>Study</th>
<th>Method A</th>
<th>Method B</th>
<th>Relative Risk (Fixed)</th>
<th>Weight</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>95% CI</td>
<td>(%)</td>
<td>95% CI</td>
</tr>
<tr>
<td>01 abdominal sacrocolpopexy vs vaginal sacrospinous colpopexy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benson 1996</td>
<td>1/38</td>
<td>5/42</td>
<td></td>
<td>36.5</td>
<td>0.22 [ 0.03, 1.81 ]</td>
</tr>
<tr>
<td>Maher 2004</td>
<td>2/46</td>
<td>8/43</td>
<td></td>
<td>63.5</td>
<td>0.23 [ 0.05, 1.04 ]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>84</td>
<td>85</td>
<td></td>
<td>100.0</td>
<td>0.23 [ 0.07, 0.77 ]</td>
</tr>
<tr>
<td>Total events: 3 (Method A), 13 (Method B)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for heterogeneity chi-square=0.00 df=1</td>
<td>p=0.97</td>
<td>P =0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect z=2.37            p=0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2012 Cochrane review: Surgical management of Pelvic Organ Prolapse

Schmid C, Feiner, B, Baessler K, Glazener C, Maher C
IUGA 2012
Results of 2012 Review

• 54 RCTs totaling 5775 women

• 15 new trials 165 women (Altman 2011, Farid 2010; Feldner 2010; Hiviid 2010; Maher 2011; Iglesia 2010; Withagen 2011; Menefee 2011; Minassian 2010 abstract; Paraiso 2011; Rondini 2011 abstract; Sung 2012; Thijs 2010 abstract; Vijaya 2011 abstract; Vollebregt 2010 abstract)

• 10 major updates of prior work (Borstad 2010; Carey 2009; Costantini 2008; Culligan 2005; Dietz 2010; Guerette 2009; Natale 2010; Nieminen 2008; Pantazis 2011 abstract; Sokol2011)
Apical (upper) Compartment
3 RCT: Benson 1996; Lo 1998, Maher 2004

Vaginal Approach

Abdominal Approach

ASC ↑success rate, ↓dyspareunia
↑operating & recovery time & cost
ASC (54) vs HUSL (56)

Percent of occurrence

Objective Success
Recurrence ant or post
Reoperation
Intraop Complication
Postop Complication

Rondini 2011, Abstract
RCT: TVM vs LSCP

• Prospectively compare Total vaginal mesh (Prolift) and Lap sacral colpopexy for vaginal vault prolapse
• Short & Long-term symptomatic & Objective Follow-up
• All pelvic floor symptoms
• Validated condition specific & QoL question
• Cost Analysis

Maher et al. AJOG 2010
LSC

↑ operating time
↓ blood loss, admission days,
quicker RADL
improved findings at all POPq sites
> TVL
> patient satisfaction
↓ reoperation rate

As compared to total prolift

Maher 2010 AJOG
## Complication and reoperation rates after apical POP repair

Diwadkar et al. Obstet Gynecol, 2009

<table>
<thead>
<tr>
<th></th>
<th>Vaginal</th>
<th>SCP</th>
<th>Mesh kit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dindo IIIa</strong></td>
<td>0.2</td>
<td>1.0</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Dindo IIIb</strong></td>
<td>1.9</td>
<td>4.8</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Reoperation for POP</strong></td>
<td>3.9</td>
<td>2.3</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Total Reoperation</strong></td>
<td>5.8</td>
<td>7.1</td>
<td>8.5</td>
</tr>
</tbody>
</table>
Summary: The data tells us that

- SCP is superior to a native tissue and a vaginal mesh repair for vault prolapse: Unless significant intraperitoneal risk factors exist, use SCP for all VVP.

- IDENTIFY THOSE WOMEN AT RISK FOR AN INTRAPERITONEAL OPERATION AND DO A VAGINAL REPAIR. Weigh risks of recurrence with risks of mesh in individual cases.
Summary: The data tells us that

- The greatest risk factors of recurrent prolapse with native tissue repair are YOUNG AGE and > Stage II prolapse
- Therefore, consider SCP as primary approach in these patients
What to do for uterovaginal prolapse?

• Can we extrapolate data from VVP?
My Current Approach to Prolapse Surgery

What is the age and activity level of the patient?

- "Younger" "Very Active"
  - Laparoscopic Sacral Colpopexy (+/- supracervical hyst)

- "Older" "Less Active"
  - Vaginal surgery
    - Mesh for anterior compartment only
Against SCP
Longer OR time
More expensive

FOR SCP
Lower rate of reoperation
Preserved vaginal length
Can you perform a SCP without laparotomy?
DEBATE: ROBOTIC VERSUS STRAIGHT-STICK LAPAROSCOPY

The promise of robotics in urogynecology

Catherine A. Matthews
What you need to accomplish

• 1. Getting the patient back, positioned, and prepped. SET A TIME GOAL OF < 20 minutes. Promote parallel processing (robot draping during induction) and eradicate duplicated movements (position once).

• 2. Be present during positioning: Avoid nerve injury with correct padding.

• 3. Look for the following on your EUA: How long/ redundant is the vagina? Exactly how big is the uterus? Cervical elongation? Relative needs for anterior and posterior dissection?

• 4. Make your first incision within 25 minutes of room entry.
Stepwise approach to RSCP

• Port placement
• Get exposure of promontory and right paracolic gutter: Consider use of fan retractor
• Start at the promontory: Development of avascular spaces: Retrorectal, vesicovaginal, and rectovaginal compartments
• Retroperitoneal tunnel
• Completion of hysterectomy (supracervical if no cervical elongation or abnormal cytology/pathology)
• Efficient suturing of y-graft
When to avoid SCH + SCP

• Cervical elongation
• Any PMP VB
• Large anterior wall prolapse
Relationship Between Race and Abdominal Anatomy: Effect on Robotic Port Placement

Brent A. Parnell, MD,* Esin C. Midia, MD,† Julia R. Fielding, MD,† Barbara L. Robinson, MD,* and Catherine A. Matthews, MD*

Objectives: We sought to characterize differences between African American women and white women in abdominal wall dimensions that could affect robotic port placement. By better understanding these differences, surgeons could assess and adjust port placement to accommodate varying abdominal wall anatomy.

Methods: A radiologist blinded to race-reviewed abdominal/pelvic computed tomographic scans of women aged 30 to 70 prescreened for demographic inclusion criteria. These consecutive scans were screened for radiologic exclusion criteria until 40 consecutive scans from each racial group were identified.

More African American women undergo cesarean section compared with white women,4–6 whereas white women have higher rates of pelvic organ prolapse.7,8 Anatomical differences may carry over to other measurable soft tissue dimensions that could affect clinical care, particularly port placement during robotic-assisted laparoscopic surgery.

Standard placement of laparoscopic ports for gynecologic surgery begins with placement of an umbilical port to house the camera. The umbilicus serves as a natural entry point to the abdominal cavity with minimal iatrogenic trauma.
Suture selection

- Sutures for fixing graft to vagina
  - GoreTex CV-4 on a TH-26 needle (cut to 8” each)

- Sutures for fixing graft to sacrum:
  - GoreTex (Cut to 6”)
  - Avoid braided permanent suture

- Suture for re-peritonealizing:
  - 2-0 Monocryl on CT-1 (cut to 10”
A stepwise approach to efficient robotic sacropexy: Tips and tricks for success

Catherine Matthews, Erinn Myers, Elizabeth Geller, and Barbara Robinson

University of North Carolina at Chapel Hill
Division of Female Pelvic Medicine and Reconstructive Surgery
# Surgical outcomes of LSCP

<table>
<thead>
<tr>
<th>Author</th>
<th>Journal</th>
<th>Year</th>
<th>Design</th>
<th>N</th>
<th>Length F/U</th>
<th>Apical Recur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cosson</td>
<td>J Gynecol Obstet Biol Reprod</td>
<td>2000</td>
<td>Retrospective case series</td>
<td>77</td>
<td>11.5 mo</td>
<td>1.3%*</td>
</tr>
<tr>
<td>Agarwala</td>
<td>JMIG</td>
<td>2007</td>
<td>Retrospective case series</td>
<td>74</td>
<td>24 mos</td>
<td>0%</td>
</tr>
<tr>
<td>Granese</td>
<td>Eur J Obstet Gynecol Reprod Biol.</td>
<td>2009</td>
<td>Retrospective case series</td>
<td>138</td>
<td>43 mos</td>
<td>5.1%</td>
</tr>
<tr>
<td>Maher</td>
<td>AJOG</td>
<td>2011</td>
<td>RCT</td>
<td>53 Lsc 55 Vag</td>
<td>24 mo</td>
<td>23% Lsc† 57% Vag</td>
</tr>
</tbody>
</table>

* Reoperation rate
† Any vaginal prolapse
## Surgical outcomes of RSCP

<table>
<thead>
<tr>
<th>Author</th>
<th>Journal</th>
<th>Year</th>
<th>Design</th>
<th>N</th>
<th>Length F/U</th>
<th>Apical Recur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geller</td>
<td>Obstet Gynecol</td>
<td>2008</td>
<td>Retrospective cohort</td>
<td>73 Rob 105 Abd</td>
<td>6 wks</td>
<td>0%</td>
</tr>
<tr>
<td>Elliot</td>
<td>J Urol</td>
<td>2006</td>
<td>Retrospective case series</td>
<td>30</td>
<td>24 mos</td>
<td>6%</td>
</tr>
<tr>
<td>Moreno Sierra</td>
<td>Urol Int</td>
<td>2011</td>
<td>Prospective case series</td>
<td>31</td>
<td>24 mos</td>
<td>0%</td>
</tr>
<tr>
<td>Akl</td>
<td>Surg Endosc</td>
<td>2009</td>
<td>Retrospective case series</td>
<td>80</td>
<td>4.8 mos</td>
<td>3.7%</td>
</tr>
<tr>
<td>Geller</td>
<td>JMIG</td>
<td>2011</td>
<td>Prospective case series</td>
<td>25</td>
<td>15 mos</td>
<td>0%</td>
</tr>
</tbody>
</table>
Effect of volume on OR efficiency

Original Article

Analysis of Robotic Performance Times to Improve Operative Efficiency

Elizabeth J. Geller, MD*, Feng-Chang Lin, PhD, and Catherine A. Matthews, MD

From the Division of Female Pelvic Medicine and Reconstructive Pelvic Surgery (Drs. Geller and Matthews), and Department of Biostatistics, Gillings School of Global Public Health (Dr. Lin), University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.
Results
Geller and Matthews, JMIG 2012

Trends in Performance Times

- 1st 10 Cases
- 1st 20 Cases
- Later Cases

Total Room, Total Incision, Total Docked, Total RSCP
Performance Times

First 10 Cases vs Later Cases

- **Peritoneal Closure**
  - 1st 10 Cases: 11
  - Later Cases: 23

- **Sacral Mesh Attachment**
  - 1st 10 Cases: 12
  - Later Cases: 17

- **Ant Mesh Attachment**
  - 1st 10 Cases: 15
  - Later Cases: 21

- **Sacral Dissection**
  - 1st 10 Cases: 13
  - Later Cases: 24
Performance Times

First 10 Cases vs Later Cases

- Total in Room:
  - 1st 10 Cases: 341
  - Later Cases: 255

- Total Incision:
  - 1st 10 Cases: 257
  - Later Cases: 193

- Total Docked:
  - 1st 10 Cases: 197
  - Later Cases: 151

- Total SCP:
  - 1st 10 Cases: 77
  - Later Cases: 121
The longest portions of the procedure

• Were all associated with knot-tying

• Knot-tying is very easy to practice on simulator

• Use published surgical times for each step as your benchmark for performance
Trainee performance at robotic console and benchmark operative times

Andrea K. Crane • Elizabeth J. Geller • Catherine A. Matthews

Received: 8 January 2013 / Accepted: 23 March 2013
© The International Urogynecological Association 2013
Impact of robotic operative efficiency on profitability

Elizabeth J. Geller, MD; Catherine A. Matthews, MD

**OBJECTIVE:** We sought to determine the impact of robotic operative efficiency on profitability and assess the impact of secondary variables.

**STUDY DESIGN:** Financial data were collected for all robotic cases performed for fiscal years 2010 (FY10) and 2011 (FY11) at University of North Carolina at Chapel Hill, and included 9 surgical subspecialties. Profitability was defined as a positive operating income.

**RESULTS:** From July 2009 through June 2011, 1295 robotic cases were performed. Robotic surgery was profitable in both years, with an operating income of $386,735 in FY10 and $822,996 in FY11. In FY10, urogynecology and pediatric surgery were the only non-profitable subspecialties. In FY11 all subspecialties were profitable. Profitability was associated with case time, payor mix, and procedure type (all \( P < .05 \)). Urogynecology case time decreased from 220-179 minutes (\( P = .012 \)) and pediatric surgery from 418-258 minutes (\( P = .019 \)).

**CONCLUSION:** Robotic operative efficiency has a large impact on overall profitability regardless of surgical specialty.

**Key words:** cost, efficiency, robotic surgery

Cite this article as: Geller EJ, Matthews CA. Impact of robotic operative efficiency on profitability. Am J Obstet Gynecol 2013;208:x.ex-x.ex.
Surgical management of apical pelvic support defects: the impact of robotic technology

Ashley W. Carroll · Elizabeth Lamb · Audra Jo Hill · Edward J. Gill · Catherine A. Matthews

Received: 21 December 2011 / Accepted: 4 March 2012 / Published online: 12 April 2012
© The International Urogynecological Association 2012
Surgical Management of apical pelvic support defects: Evaluation of the introduction of robotic technology.
Ashley W. Carroll MD, Elizabeth Lamb NP, Audra Jo Hill, Edward J Gill MD, and Catherine A. Matthews MD. IUJ, 2012

45% increase in procedures

- Uterosacral
- SCP

Pre-Robot
Post-Robot
Conclusions

• Robotic-assistance may help novice laparoscopists bypass the learning curve associated with laparoscopic suturing

• Procedure is cost-efficient if you are surgically efficient

• The robot is more expensive if you cannot contain surgical time: Use benchmarks and simulation for cost containment

• Don’t embark on RSCP just because you can do RTLH
RSCP + robotic rectopexy
References