Surgical Performance as a Predictor of Functional and Oncological Outcomes in Robotic Prostatectomy

Mitchell G. Goldenberg, Alaina Garbens, Hossein Sadaat, Antonio Finelli, Rajiv Singal, Jason Lee, Teodor Grantcharov

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Quebec City, Quebec

@mitchgoldenberg
## Potential Conflict of Interest Disclosure

<table>
<thead>
<tr>
<th>Speaker Name</th>
<th>Advisory Boards</th>
<th>Speaker's Bureau</th>
<th>Payment/ Honoraria</th>
<th>Grants/ Research Support</th>
<th>Clinical Trials</th>
<th>Investments</th>
<th>Patents</th>
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</thead>
</table>
| Mitchell Goldenberg| Surgical Safety Technologies     | Surgical Safety Technologies   | 1. Royal College of Physicians and Surgeons of Canada  
2. Canadian Urological Oncology Group |                           |                              |             |         |
Is Technical Performance a Quality Indicator?

Surgeon Performance Predicts Early Continence After Robot-Assisted Radical Prostatectomy

Mitchell G. Goldenberg, MBBS,1,2 Larry Goldenberg, MD3 and Teodor P. Grantcharov, MD2

Retrospective Matched Cohort of 48 Men Undergoing RARP

Video analyzed for GEARS Score and Surgical Errors

GEARS score significantly associated with early continence

Figure 1. Relationship between Summary Peer Rating of Technical Skill and Risk-Adjusted Complication Rates after Laparoscopic Gastric Bypass. Each diamond in the scatter plot represents 1 of 20 practicing bariatric surgeons.
How much of the variability in RARP outcomes can be explained by surgeon technical performance?
Implementing assessments of robot-assisted technical skill in urological education: a systematic review and synthesis of the validity evidence

Mitchell G. Goldenberg*, Jason Y. Lee*, Jethro C.C. Kwong†, Teodor P. Grantcharov‡ and Anthony Costello§

Gold standard = *Global Rating Scales*

Generic = *GEARS*
- Force Sensitivity
- Depth Perception
- Bimanual Dexterity
- Robotic Control
- Efficiency

Procedure-Specific = *PACE*
## GEARs – Global Evaluative Assessment of Robotic Skills

### Depth Perception
- Constantly overshoots or misses the target.
- Accurately directs instruments to the correct plane.

### Bimanual Dexterity
- Uses only one hand.
- Uses both hands.

### Efficiency
- Insufficient efforts; movements are slow, but planned.
- Confident, efficient, and well-organized.

### Force Sensitivity
- Rough movements, tearing tissue, frequent suturing.
- Applies appropriate tension, negligible injury to adjacent structures.

### Robotic Control
- Consistently does not allow adequate view.
- Controls camera and hand position appropriately.

### Procedure
- **Dissection of the Bladder Neck from the Prostate**
  - **Bladder Neck Dissection**
    - **Dissection of the Bladder Neck from the Prostate**
      - Risks tissue coaptation.
    - **Bladder Neck Dissection**
      - Risks tissue coaptation.
- **Preservation of Neurovascular Bundle (NVB)**
  - **NVB Preservation**
    - Risks tissue coaptation.
  - **Preservation of NVB**
    - Risks tissue coaptation.
- **Apical Dissection**
  - **Apical Dissection**
    - Risks tissue coaptation.
  - **Apical Dissection**
    - Risks tissue coaptation.
- **Urinary-Genital Anastomosis**
  - **Urinary-Genital Anastomosis**
    - Risks tissue coaptation.
  - **Urinary-Genital Anastomosis**
    - Risks tissue coaptation.

### PACE - Prostatectomy Assessment and Competency Evaluation

<table>
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<tr>
<th>Domain</th>
<th>1</th>
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<th>3</th>
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<td>Preservation of Neurovascular Bundle (NVB)</td>
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</table>
Multicenter Prospective Cohort Study

Surgical Steps Scored using GEARS and PACE

Intracorporeal Video Collected from consecutive RARP Cases

Three Primary Outcomes Selected

3 Content Expert, Trained Analysts

Erections @ 12m

Continence @ 3m

PSM
31 Surgeons Completed ≥1 Step (11 Faculty, 14 Fellows, 6 Residents)

<table>
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<th>Surgeon RARP Experience</th>
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<td>101-250</td>
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<td>&gt;250</td>
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<tr>
<td>10-30 cases</td>
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<tr>
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92 Patients Included in Final Analysis

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92 Patients Included in Final Analysis

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Bivariate Analysis

Overall GEARS and PACE Scores Significantly Higher in Continent Patients (p < 0.01)

Overall PACE Scores Significantly Higher in Patients with Erectile Function at 1 Year (p = 0.03)

Steps Associated
- Overall Only
- Bladder Neck
- NVB
- Apical Dissection
- UVA

Overall PACE Scores Significantly Higher in Patients with Negative Margins (p = 0.02)

Steps Associated
- Bladder Drop
- Seminal Vesicles
- Posterior Dissection
- Apical Dissection
Multivariable Analysis

Overall GEARS
Age
Nerve-Spare
Volume
BMI
Posterior Reconstruction

Continence and Overall GEARS Score

0.1 1 10 100
Multivariable Analysis

Overall PACE
Age
Nerve-Spare
Volume
BMI
Posterior Reconstruction

Continence and Overall PACE Score

0.1 1 10 100
Multivariable Analysis

Erectile Function and Overall PACE Score

- Overall PACE
- Age
- Nerve-Spare
- Volume
- BMI
Multivariable Analysis

Overall PACE
- ≤ pT2b
- pT2c
- ≥ pT3a
- Gleason 6
- Gleason 7
- ≥ Gleason 8
- PSA < 4.5
- PSA 4.5-8.9
- PSA ≥9

Positive Surgical Margin Overall PACE Score
Sensitivity Analysis

Included Surgeon Experience and Hospital Volume as Categorical Variables in the Model

- PACE Remained Independently Predictive of Continence ($p < 0.02$) and PSM ($p = 0.02$)
- PACE No Longer Predictive of Erectile Function ($p = 0.13$) GEARs No Longer Predictive of Continence ($p > 0.05$)

Model Validation

K-Fold Validation done with 10-folds

- AUC of the Continence Model Stable at 0.74
- AUC of Positive Margin Model Fell from 0.73 to 0.52
Key Findings

- Among first studies to show that surgeon technical skill associated with outcomes in RARP

- Technical Skill Can be Incorporated into High Stakes Assessments
  - In-Training/Credentialing

- Provides Key Validity Evidence for the Assessment Tools Used

- Possibility for surgeon skill/performance as a reliable quality indicator
Thanks For Listening!

• Co-Authors
  • Dr. Teodor Grantcharov
  • Dr. Tony Finelli
  • Dr. Jason Lee
  • Dr. Rajiv Singal
  • Dr. Alaina Garbens
  • Dr. Hossein Sadaat

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  • Dr. Ken Pace
  • Dr. Jason Lee
  • Dr. Rajiv Singal
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  • Dr. Raj Satkunasivam

• Analysts at the International Centre For Surgical Safety
Extra Slides
Skill vs. Performance

Number of trials or attempts at learning

- Performance measure
- Slow beginning
- Steep acceleration
- Plateau
Skill vs. Performance

Learning curve for robotic-assisted laparoscopic colorectal surgery

Malak B. Bokhari · Chirag B. Patel · Diego I. Ramos-Valadez · Madhu Ragupathi · Eric M. Haas

DOI 10.1007/s00464-010-1281-x
Statistical Analysis

Primary Outcomes Dicotomized

68 patients subjects needed (90% power, p < 0.05)

Binary Logistic Regression

Sensitivity Analysis (Surgeon, Hospital Effects)

K-Fold Cross-Validation