Minimally Invasive Surgical Approaches to prostate cancer

Alejandro R. Rodriguez  MD
University of South Florida
College of Medicine
Tampa-Florida, USA
What is minimally invasive surgery?

“Any procedure that is less invasive than open surgery used for the same purpose. Typically involves use of laparoscopic devices and/or remote-control manipulation of instruments with indirect observation of the surgical field through an endoscope or similar device, and are carried out through the skin or through a body cavity or anatomical opening.”

John EA Wickham British Medical Journal in 1987
Laparoscopic Surgery

• Smaller incisions
• Better visibility
  • Better cancer surgery?
  • Less convalescence?
  • Quicker recovery?
• Improved QOL?
  • Potency
  • Continence
From

LESS TO LEAST INVASIVE SURGERY!!!

Incisionless

or

Single incision?
Laparoscopic Radical Prostatectomy
Evolution of Technique

- Intraperitoneal
- Extraperitoneal
- Robotic-assisted
- Pure Laparoscopic
Conventional Laparoscopy
Newer Technologies
Working Instruments
Robotic-Assisted Laparoscopic Radical Prostatectomy

2 Functions:
• 3D vision
• Articulation at tip: “Degrees of freedom”

• Increased precision
  • Decreased learning curve?
  • Ergonomic?
Robotic-Assisted Laparoscopic Radical Prostatectomy Cost Analysis

• Initial cost, intermediate model: $1,650,000
• Maintenance: 165,000/year
  – Fixed/year/5years $400,714.28
  – Disposables: 1,500/case

• Institutional cost per patient based on volumes/year:
  – 50 $ 9,514.28
  – 100 $ 5,507.14
  – 200 $ 3,503.57
  – 400 $ 2,501.78
  – 600 $ 2,167.85
Does Lap/Robotic assisted radical prostatectomy make a difference when compared with open radical prostatectomy?
Does Lap/Robotic assisted radical prostatectomy make a difference when compared with open radical prostatectomy?

Outcome

Recovery

Function

NO STUDY DEMONSTRATING BETTER RESULTS!!!
Transfusion rate was significantly increased in

Overweight patients  6.9%
Obese patients       5.6%
Normal patients      1.9%  (p=0.009)

436 patients underwent open retropubic radical prostatectomy
Prostate volume was significantly and directly related to:

- EBL: $p=0.02$
- Allogenic Transfusion rate: $p=0.01$
- Length of hospital stay: $p=0.01$

1024 men operated of open retropubic radical prostatectomy
7027 men treated of RRP

BMI was positively related to capsular incision

Open retropubic radical prostatectomy is technically more difficult in obese men
LAPAROSCOPIC RADICAL PROSTATECTOMY AND BODY MASS INDEX: AN ASSESSMENT OF 151 SEQUENTIAL CASES

JAMES A. BROWN, DAVID M. RODIN, BENJAMIN LEE AND DOUGLAS M. DAHL
From the Department of Urology, Massachusetts General Hospital and Harvard Medical School, Boston, Massachusetts

BUT: Only 50 were obese in this series

IMPACT OF PROSTATE SIZE AND BODY MASS INDEX ON PERIOPERATIVE MORBIDITY AFTER LAPAROSCOPIC RADICAL PROSTATECTOMY

AMAR SINGH, RANDY FAGIN, GAURANG SHAH AND BIJAN SHEKARRIZ
From the Department of Urology, Upstate Medical University, Syracuse, New York

BUT: 22 were obese and 17 had prostate weight (PW) > 50 gms
IMPACT OF OBESITY ON CLINICAL OUTCOMES IN ROBOTIC PROSTATECTOMY

THOMAS E. AHLERING, LOUIS EICHEL, ROBERT EDWARDS, AND DOUGLAS W. SKARECKY

---

**TABLE III.** *Perioperative and postoperative data for obese and nonobese groups*

<table>
<thead>
<tr>
<th>Variable</th>
<th>BMI &gt;30</th>
<th>SE</th>
<th>BMI &lt;30</th>
<th>SE</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (min)</td>
<td>295.8 (186-645)</td>
<td>13.2</td>
<td>236.1 (160-490)</td>
<td>4.6</td>
<td>0.04</td>
</tr>
<tr>
<td>Estimated blood loss (mL)</td>
<td>183 (50-400)</td>
<td>24.9</td>
<td>105 (25-350)</td>
<td>8.6</td>
<td>0.007</td>
</tr>
<tr>
<td>POD 1 Hb change (g/dL)</td>
<td>1.5 (-0.1 to +3.0)</td>
<td>0.8</td>
<td>1.6 (-0.2 to +3.4)</td>
<td>0.8</td>
<td>0.72</td>
</tr>
<tr>
<td>Hospital stay (hr)</td>
<td>41 (18-96)</td>
<td>4.9</td>
<td>28.4 (18-168)</td>
<td>2.4</td>
<td>0.09</td>
</tr>
<tr>
<td>Prostate size (g)</td>
<td>62.4 (21.8-163)</td>
<td>7.9</td>
<td>49.5 (12.5-135)</td>
<td>2.4</td>
<td>0.14</td>
</tr>
<tr>
<td>Total complications (%)</td>
<td>5/19 (26.3)</td>
<td>0.10</td>
<td>4/81 (4.9)</td>
<td>0.02</td>
<td>0.01*</td>
</tr>
<tr>
<td>Return to work/usual activities (wk)</td>
<td>7.0</td>
<td>2.4</td>
<td>4.3</td>
<td>1.0</td>
<td>0.09</td>
</tr>
<tr>
<td>Continence at 6 mo (0 pads) (%)</td>
<td>9/19 (47)</td>
<td>0.13</td>
<td>74/81 (91)</td>
<td>0.03</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>Urinary bother score at 3 mo</td>
<td>3.3 (0-6)</td>
<td>0.6</td>
<td>1.8 (0-5)</td>
<td>0.2</td>
<td>0.003</td>
</tr>
<tr>
<td>Urinary bother score at 9 mo</td>
<td>3.2 (1-6)</td>
<td>0.6</td>
<td>1.6 (0-3)</td>
<td>0.2</td>
<td>0.04</td>
</tr>
<tr>
<td>Voided volume at 3 mo (mL)</td>
<td>214 (54-384)</td>
<td>34.8</td>
<td>379 (39-929)</td>
<td>26.5</td>
<td>0.011</td>
</tr>
</tbody>
</table>

*Ex, BMI = body mass index; POD = postoperative day; Hb = hemoglobin; SE = standard error.
Data presented as mean, with range in parentheses, unless otherwise noted.
* Two-sided Fisher's exact test.

**BUT: Based on only 19 patients!!!**
TABLE III. Perioperative and postoperative data for obese and nonobese groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>BMI &gt;30 (min)</th>
<th>SE</th>
<th>BMI &lt;30 (min)</th>
<th>SE</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time</td>
<td>295.8 (186-645)</td>
<td>13.2</td>
<td>236.1 (160-490)</td>
<td>4.6</td>
<td>0.04</td>
</tr>
<tr>
<td>Estimated blood loss (mL)</td>
<td>183 (50-400)</td>
<td>24.9</td>
<td>105 (25-350)</td>
<td>8.6</td>
<td>0.007</td>
</tr>
<tr>
<td>POD 1 Hb change (g/dL)</td>
<td>1.5 (-0.1 to +3.0)</td>
<td>0.8</td>
<td>1.6 (-0.2 to +3.4)</td>
<td>0.8</td>
<td>0.72</td>
</tr>
<tr>
<td>Hospital stay (hr)</td>
<td>41 (18-96)</td>
<td>4.9</td>
<td>28.4 (18-168)</td>
<td>2.4</td>
<td>0.09</td>
</tr>
<tr>
<td>Prostate size (g)</td>
<td>62.4 (21.8-163)</td>
<td>7.9</td>
<td>49.5 (12.5-135)</td>
<td>2.4</td>
<td>0.14</td>
</tr>
<tr>
<td>Total complications (%)</td>
<td>5/19 (26.3)</td>
<td>0.10</td>
<td>4/81 (4.9)</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>Return to work/usual activities (wk)</td>
<td>7.0</td>
<td>2.4</td>
<td>4.3</td>
<td>1.0</td>
<td>0.09</td>
</tr>
<tr>
<td>Continence at 6 mo (0 pads) (%)</td>
<td>9/19 (47)</td>
<td>0.13</td>
<td>74/81 (91)</td>
<td>0.03</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>Urinary bother score at 3 mo</td>
<td>3.3 (0-6)</td>
<td>0.6</td>
<td>1.8 (0-5)</td>
<td>0.2</td>
<td>0.003</td>
</tr>
<tr>
<td>Urinary bother score at 9 mo</td>
<td>3.2 (1-6)</td>
<td>0.6</td>
<td>1.6 (0-3)</td>
<td>0.2</td>
<td>0.04</td>
</tr>
<tr>
<td>Voided volume at 3 mo (mL)</td>
<td>214 (54-384)</td>
<td>34.8</td>
<td>379 (39-929)</td>
<td>26.5</td>
<td>0.011</td>
</tr>
</tbody>
</table>

**Note:** BMI = body mass index; POD = postoperative day; Hb = hemoglobin; SE = standard error. Data presented as mean, with range in parentheses, unless otherwise noted.

* Two-sided Fisher’s exact test.

**BUT:** Based on only 19 patients!!!
Jan 2004 – May 2006

300 patients underwent LERP

- BMI stratified into groups I (<30), II (30-35), III (36-40), IV (>40)
- PW stratified into groups I (<20), II (20-40), III (41-60), IV (>60)
- Previous lower abdominal or prostatic surgery or no previous surgery.

Groups were assessed for differences in
Intraoperative, perioperative, and pathological outcomes

### BMI

#### Comparison of Groups

<table>
<thead>
<tr>
<th>BMI (mean)</th>
<th># of Pts</th>
<th>Age</th>
<th>PSA</th>
<th>Biopsy Gleason</th>
<th>Specimen Gleason</th>
<th>Prostate Weight grams</th>
<th>% of cancer</th>
<th>OR time</th>
<th>EBL</th>
<th>Hosp days</th>
<th>JP days</th>
<th>Foley days</th>
<th>Margins +</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30 (26)</td>
<td>196</td>
<td>60</td>
<td>5.8</td>
<td>6.3</td>
<td>6.5</td>
<td>48</td>
<td>12%</td>
<td>255</td>
<td>487</td>
<td>2.3</td>
<td>2.4</td>
<td>17</td>
<td>23%</td>
</tr>
<tr>
<td>&gt;30 (34)</td>
<td>84</td>
<td>57</td>
<td>6.1</td>
<td>6.3</td>
<td>6.5</td>
<td>48</td>
<td>33%</td>
<td>263</td>
<td>543</td>
<td>2.4</td>
<td>2.7</td>
<td>18</td>
<td>32%</td>
</tr>
</tbody>
</table>
## BMI Comparison of Groups

<table>
<thead>
<tr>
<th>BMI (mean)</th>
<th># of Pts</th>
<th>Age</th>
<th>PSA</th>
<th>Biopsy Gleason</th>
<th>Specimen Gleason</th>
<th>Prostate Weight grams</th>
<th>% of cancer</th>
<th>OR time</th>
<th>EBL</th>
<th>Hosp days</th>
<th>JP days</th>
<th>Foley days</th>
<th>Margins +</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30 (26)</td>
<td>196</td>
<td>60</td>
<td>5.8</td>
<td>6.3</td>
<td>6.5</td>
<td>48</td>
<td>12%</td>
<td>255</td>
<td>487</td>
<td>2.3</td>
<td>2.4</td>
<td>17</td>
<td>23%</td>
</tr>
<tr>
<td>&gt;30 (34)</td>
<td>84</td>
<td>57</td>
<td>6.1</td>
<td>6.3</td>
<td>6.5</td>
<td>48</td>
<td>33%</td>
<td>263</td>
<td>543</td>
<td>2.4</td>
<td>2.7</td>
<td>18</td>
<td>32%</td>
</tr>
</tbody>
</table>
RESULTS

• BMI did not have an impact on biopsy Gleason score, PSA, O.R. time, blood loss, transfusion rate, J P drainage, bladder catheterization, hospital stay, Gleason score (p=0.98) and margins (p=0.09)

• BMI directly correlated with % of tumor in specimen (p=0.046)

Presented: SESAUA March 2006
EUA Paris April 2006
Published: J Urol May 2007
Prior lower abdominal or prostatic surgery

95 (34%) patients

- open inguinal hernia (41)
- Apendectomy (27)
- inguinal hernia with mesh (17)
- umbilical hernia (3)
- TURP (5)
- TUNA (1)
- Pubic bone fixation (1)

➢ No significant impact on operative and perioperative and pathological parameters

Presented: EUA Paris April 2006
## Prostate weight

**Comparison of groups**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Prostate Weight grams (mean)</th>
<th># of Pts</th>
<th>Age</th>
<th>BMI</th>
<th>PSA</th>
<th>Biopsy Gleason</th>
<th>Specimen Gleason</th>
<th>% of cancer</th>
<th>OR time</th>
<th>EBL</th>
<th>Hosp days</th>
<th>JP days</th>
<th>Foley days</th>
<th>Margins +</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&lt; 20 (17)</td>
<td>5</td>
<td>58</td>
<td>31</td>
<td>4.6</td>
<td>6.2</td>
<td>6.4</td>
<td>13%</td>
<td>258</td>
<td>340</td>
<td>1.4</td>
<td>2.4</td>
<td>14.4</td>
<td>40%</td>
</tr>
<tr>
<td>II</td>
<td>20-40 (31)</td>
<td>89</td>
<td>58</td>
<td>28</td>
<td>5.5</td>
<td>6.4</td>
<td>6.7</td>
<td>15%</td>
<td>272</td>
<td>478</td>
<td>2.1</td>
<td>2.5</td>
<td>15.7</td>
<td>34%</td>
</tr>
<tr>
<td>III</td>
<td>40-60 (48)</td>
<td>134</td>
<td>58</td>
<td>29</td>
<td>5.7</td>
<td>6.2</td>
<td>6.5</td>
<td>24%</td>
<td>250</td>
<td>501</td>
<td>2.5</td>
<td>2.4</td>
<td>18.0</td>
<td>25%</td>
</tr>
<tr>
<td>IV</td>
<td>&gt; 60 (81)</td>
<td>52</td>
<td>63</td>
<td>28</td>
<td>7.4</td>
<td>6.3</td>
<td>6.5</td>
<td>10%</td>
<td>248</td>
<td>565</td>
<td>2.4</td>
<td>3</td>
<td>19.0</td>
<td>13%</td>
</tr>
</tbody>
</table>
### Prostate weight

#### Comparison of groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Prostate Weight grams (mean)</th>
<th># of Pts</th>
<th>Age</th>
<th>BMI</th>
<th>PSA</th>
<th>Biopsy Gleason</th>
<th>Specimen Gleason</th>
<th>% of cancer</th>
<th>OR time</th>
<th>EBL</th>
<th>Hosp days</th>
<th>JP days</th>
<th>Foley days</th>
<th>Margins +</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&lt; 20 (17)</td>
<td>5</td>
<td>58</td>
<td>31</td>
<td>4.6</td>
<td>6.2</td>
<td>6.4</td>
<td>13%</td>
<td>258</td>
<td>340</td>
<td>1.4</td>
<td>2.4</td>
<td>14.4</td>
<td>40%</td>
</tr>
<tr>
<td>II</td>
<td>20-40 (31)</td>
<td>89</td>
<td>58</td>
<td>28</td>
<td>5.5</td>
<td>6.4</td>
<td>6.7</td>
<td>15%</td>
<td>272</td>
<td>478</td>
<td>2.1</td>
<td>2.5</td>
<td>15.7</td>
<td>34%</td>
</tr>
<tr>
<td>III</td>
<td>40-60 (48)</td>
<td>134</td>
<td>58</td>
<td>29</td>
<td>5.7</td>
<td>6.2</td>
<td>6.5</td>
<td>24%</td>
<td>250</td>
<td>501</td>
<td>2.5</td>
<td>2.4</td>
<td>18</td>
<td>25%</td>
</tr>
<tr>
<td>IV</td>
<td>&gt; 60 (81)</td>
<td>52</td>
<td>63</td>
<td>28</td>
<td>7.4</td>
<td>6.3</td>
<td>6.5</td>
<td>10%</td>
<td>248</td>
<td>565</td>
<td>2.4</td>
<td>3</td>
<td>19</td>
<td>13%</td>
</tr>
</tbody>
</table>
Results

Significant Impact

• Prostate weight directly correlated with higher blood loss (p=0.049), but did not affect transfusion rate.
• Larger prostates had a lower probability of a positive margin (p=0.03)

Presented: SESAUA March 2006
EAU Paris April 2006
Published: J Urol May 2007
Outcomes

✓ LERP can be performed in complex surgical patients without increased intra and perioperative morbidity.

✓ During LERP prostate weight was directly correlated with an increased EBL, but did not affect transfusion rate.

✓ Obese patients may have a higher % of tumor in the specimen that might increase the risk of + margins, however in LERP the + margins were not affected.

Presented: SESAUA March 2006
EAU Paris April 2006
Published: J Urol May 2007
Robotic assisted radical prostatectomy has matched the results in complex surgical cases!

ROBOTIC-ASSISTED LAPAROSCOPIC PROSTATECTOMY IN OVERWEIGHT AND OBESE PATIENTS


Does a history of previous surgery or radiation to the prostate affect outcomes of robot-assisted radical prostatectomy?

Aaron D. Martin, Premal J. Desai, Rafael N. Nunez, George L. Martin, Paul E. Andrews, Robert G. Ferrigni, Scott K. Swanson, Anna Pacelli* and Erik P. Castle

Departments of Urology and *Pathology, Mayo Clinic, Phoenix, AZ, USA
Accepted for publication 4 September 2008
What are the real learning curves of pure laparoscopic and robotic assisted radical prostatectomy?
Laparoscopic Prostatectomy
Learning Curve

• Previous laparoscopic experience
  – Yes: “40-60 cases”
  – No: “80-100 cases”

Kavoussi Urol. 2001, 58:503
Robotic Assisted Laparoscopic Prostatectomy

“18 RLP to surpass LRP.”
Menon JU Sept. 2002 168:945

...One of us (MM) “Untrainable”

“8-12 RLP for proficiency (<4hours) comparable to
Pure LP laparoscopist with more than 100 case-experience”
Ahlering JU Nov. 2003 170:1738

“RALP results comparable to those obtained routinely with RRP were
not achieved until after > or = 150 procedures. Surgeon comfort and
confidence comparable to that with RRP did not occur until after 250
RALP procedures.”
Laparoscopy and Robotics

Robot-Assisted Laparoscopic Prostatectomy: A Single-Institutions Learning Curve

Jamison Jaffe, Sean Castellucci, Xavier Cathelineau, Justin Harmon, François Rozet, Eric Barret, and Guy Vallancien

Figure 1. Trend in operative time; first breakpoint after 12 cases.

Figure 2. Trend in operative time; second breakpoint after 180 cases.
Surgery in Motion

Operative Details and Oncological and Functional Outcome of Robotic-Assisted Laparoscopic Radical Prostatectomy: 400 Cases with a Minimum of 12 Months Follow-up

Declan G. Murphy *, Michael Kerger, Helen Crowe, Justin S. Peters, Anthony J. Costello

Department of Urology, Epworth Hospital, Richmond, & Royal Melbourne Hospital, Australia

Fig. 11 – Total operative time grouped in consecutive groups of 50.
Surgery in Motion

Operative Details and Oncological and Functional Outcome of Robotic-Assisted Laparoscopic Radical Prostatectomy: 400 Cases with a Minimum of 12 Months Follow-up

Declan G. Murphy *, Michael Kerger, Helen Crowe, Justin S. Peters, Anthony J. Costello

Department of Urology, Epworth Hospital, Richmond, & Royal Melbourne Hospital, Australia

Fig. 11 - Total operative time grouped in consecutive groups of 50.
The first 1000 cases of laparoscopic radical prostatectomy in the UK: evidence of multiple ‘learning curves’

Christopher G. Eden, Mischel G. Neill and Mark W. Louie-Johnsun
Department of Urology, The Royal Surrey County Hospital, Guildford, UK

**FIG. 1.** The overall learning curves (A) and with computer-generated trend lines (B).
LRP Technical Skills

1. Develop extraperitoneal space/Trocar placement
2. Lateral planes
3. DVC control
4. Bladder neck excision
5. Vasa deferentia and SVs dissection
6. Denonvillier’s fascia and posterior plane
7. Pedicles control and NVBs preservation
8. Urethral transection and prostate removal
9. Vesico-urethral anastomosis
10. Closing

Abstract 931

LRP Training Results

- S.M. 20
- A.R* 10
- D.B. 25
- M.W. 25
- A.M. 25
- C.W 15
- C.P 15

Mean # of cases = 20
400 patients from Jan 2004 to Oct. 2006
Operative Times

SESAUA March 2009
The whole series
% of + Margins by groups of patients
Learning curve

Group 1 (1-100)
Group 2 (101-200)
Group 3 (201-300)
Group 4 (301-400)
pT2a-c Nx/N0
% of + Margins by groups of patients
Learning curve
Prostate Cancer

Risk-Adjusted Analysis of Positive Surgical Margins Following Laparoscopic and Retropubic Radical Prostatectomy

Karim Touijer\textsuperscript{a}, Kentaro Kuroiwa\textsuperscript{a}, James A. Eastham \textsuperscript{a}, Andrew Vickers\textsuperscript{a,b}, Victor E. Reuter\textsuperscript{c}, Peter T. Scardino\textsuperscript{a}, Bertrand Guillonneau\textsuperscript{a,*}

\textsuperscript{a} Department of Urology, Memorial Sloan-Kettering Cancer Center, New York, NY, United States
\textsuperscript{b} Department of Epidemiology and Biostatistics, Memorial Sloan-Kettering Cancer Center, New York, NY, United States
\textsuperscript{c} Department of Pathology, Memorial Sloan-Kettering Cancer Center, New York, NY, United States

![Graph](image)

Fig. 2 – Evolution over time of the overall positive surgical margin rate (PSM) for each surgical approach. Blue line: open radical prostatectomy; orange line: laparoscopic radical prostatectomy; dotted lines: 95\% confidence
Functional Outcomes?

Defining and Reporting Erectile Function Outcomes After Radical Prostatectomy: Challenges and Misconceptions

John P. Mulhall*†
From the Sexual and Reproductive Medicine Program, Urology Service, Memorial Sloan Kettering Cancer Center, New York, New York

Minimal Requirements for Adequate Reporting of Erectile Function Outcomes After Radical Prostatectomy

It is recommended that investigators report:
- Patient comorbidity profile
- Degree to which patient selection was exercised
- Who collected the erectile function outcome data
- Which validated questionnaires were utilized
- Baseline erectile function data
- Long-term (24 month) erectile function data
- Definition of adequate erectile function
- Proportion of men returning to normal
- Proportion of men returning to preoperative erectile function level
- Extent of utilization of erectileogenic medications
- Extent to which a rehabilitation strategy was used
CONCLUSIONS

• Oncologic and functional outcomes similar to Open Radical Prostatectomy (1,2)

• Can be performed in
  – Obese patients,
  – Large prostates
  – Patients with previous pelvic surgery

• Rapid worldwide implementation of robotic systems despite high costs

• Is there really a shorter learning curve with robotics?

2. Touijer K et al, J Urol May 2008
However, the REALITY is that Laparoscopic techniques and Robotic technology were born to be together!