# The Role of Robotics in Urologic Surgery

*~ Paul D. Maroni, MD*

## The Role of Robotics in Urologic Surgery

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## Objectives

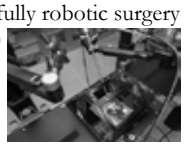
- Review history of robotics in surgery/urology
- Identify areas where robotic surgery can be useful.
- Avoid pitfalls of robotic surgery.
- Learn a responsible way to integrate into your practice.

## Brief history of robotic surgery

- "robot" coined by Karel Capek in 1921 from Czech word robota meaning forced labor
- 1985 – PUMA 560 used for brain biopsy
- 1987 – first robotic gall bladder removal
- 1988 – PROBOT for TURP
- Late 1980s – ROBODOC first FDA approved for hip surgery
- Late 1980s – NASA and US Army developed systems

## Brief history of robotic surgery

- 1993 – AESOP approved for surgery
- 1997 – daVinci begins use
- 1998 – ZEUS first fully robotic surgery (Computer Motion)

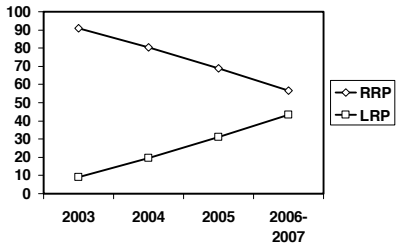


- 2000 – daVinci approved by FDA (Intuitive Surgical, Inc)
- 2003 – Computer Motion merged with Intuitive Surgical, Inc.

JAMA

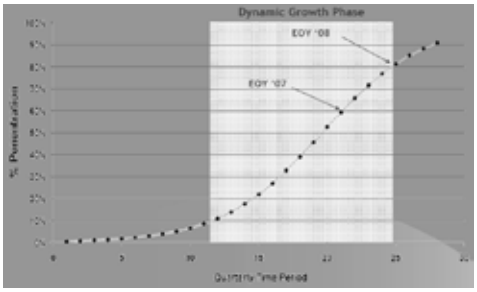
**Comparative Effectiveness of Minimally Invasive vs Open Radical Prostatectomy**

Jim C. Hu, Xiangmei Gu, Stuart R. Lipsitz, et al.

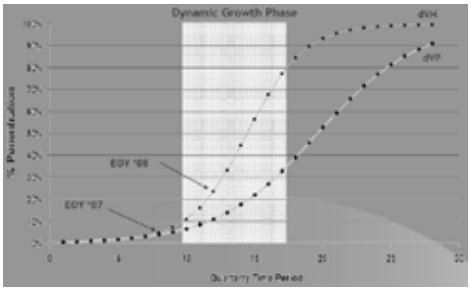



Adapted from Hu et al.

## Adoption of robotic prostatectomy
## Market estimate




Adoption of robotic hysterectomy
Market estimate




## Gold or Bubble Gum

- Winners
  - Early adopters
  - Intuitive Surgical, Inc./ stockholders
  - Late patients (?)
- Losers
  - Late/non adopters
  - Healthcare system
  - Early patients

## How are late patients helped?

- Forced most prostate surgeons to improve results/technique
- Regionalization

or

- Identify processes of care in high volume hospitals and implement at lower volume centers

## Robotic procedures in Urology

- Radical prostatectomy
- Nephrectomy/partial
- Pyeloplasty
- Ureteral reimplant
- Cystectomy
- Adrenalectomy
- Simple prostatectomy
- Bladder diverticulectomy
- Urinary diversion
- Pelvic lymph node dissection
- RPLND
- Inguinal lymph node dissection

## Lap versus robotic

- Would you close one eye while operating? NO
  - 3-dimensional view with robot
- Would you lock your wrists? NO
  - Wristed instrumentation with robot
- Would you prefer to move more precisely? YES
  - Motion scaling and tremor filtering with robot
- Would you rather be comfortable? YES
  - Ergonomic seated position with robot
- Would you prefer to be cost effective? YES
  - Don't use the robot for things safely done laparoscopically

## Robotic assisted partial nephrectomy

- AUA Guidelines

"… only a few small, single-institution reports offer limited information regarding this procedure, including whether robotic-assisted LPN offers any advantages over other forms of nephron-sparing surgery (NSS). At present there are insufficient data to evaluate outcomes."

Guideline for Management of the Clinical Stage 1 Renal Mass. AUA 2009

## Healthy, clinical T1a enhancing renal mass

- **Standard: Complete surgical excision by partial nephrectomy is a standard of care and should be strongly considered.**

Both open and laparoscopic approaches to PN can be considered…. LPN can provide more rapid recovery, although **this approach has been associated with increased warm ischemic times and an increased risk of urological complications including postoperative hemorrhage and urinary fistula**. … a solitary kidney, preexisting renal dysfunction, hilar tumor, multiple tumors or predominantly cystic tumor are best managed with an open surgical technique. **With improved laparoscopic instrumentation and greater dissemination of expertise, improved outcomes and more widespread application of LPN is anticipated in the future.**

Guideline for Management of the Clinical Stage 1 Renal Mass. AUA 2009

**Robot Assisted Partial Nephrectomy Versus Laparoscopic Partial Nephrectomy for Renal Tumors: A Multi-Institutional Analysis of Perioperative Outcomes**

Brian M. Benway,* Sam S. Bhayani,† Craig G. Rogers,† Lori M. Dulabon, Manish N. Patel, Michael Lipkin, Agnes J. Wang and Michael D. Stifelman†

**J Urol September 2009**

- 118 LPN, 129 RAPN – 3 surgeons
- No difference in OR time or positive margin rate (3.9% v. 1%)
- Less blood loss and warm ischemia time for RAPN (19.7 min v. 28.4 min)
- Similar post-op complications (10.2% v. 8.6%)
- Long-term oncologic outcomes unknown

## My opinion RAPN

- Still a difficult operation for the novice roboticist

ated with a learning curve. Unlike robotic pyeloplasty and prostatectomy, robotic partial nephrectomy places a time constraint upon the surgeon because of the need to minimize warm ischemia time [17•].

- Little information on learning curve, but probably not as shallow as LPN

Shapiro et al Curr Opin Urol 2009

## Robotic assisted radical nephrectomy/nephroureterectomy

- No literature on RARN
- Probably no different than LRN

## Robotic assisted Ureteral Surgery: Pyeloplasty

| | Patients | ORtime (min) | Comps. (%) | Success (%) | F/U (mo) |
|---|---|---|---|---|---|
| Palese | 35 | 216 | 11 | 94 | 7.9 |
| Gettman | 9 | 138 | 11 | 100 | 4.1 |
| Siddiq | 26 | 245 | 12 | 95 | 6 |
| Schwentner | 92 | 108 | 4 | 97 | 39.1 |
| Patel | 50 | 122 | nil | 96 | 11.7 |

Adapted Leveilee and Williams Curr Opin Urol 2009

## Robotic assisted Ureteral Surgery: Ureteral reimplant

- Limited publications on this subject
- Leveillee and Williams Curr Opin Urol 2009
  - 8 patients with benign diseases
  - Mean follow-up 18 months
  - 1 recurrence treated sucessfully with balloon dilation
  - Psoas hitch and Boari flap still available

Opinion:

Will probably become widely accepted for benign and malignant disease (oncologic results unknown – Glinianski et al J Endourol 2009)

## Robotic assisted Cystectomy

- Around 300 cases published (size 1 to 67 patients)
- Complications (10-30%
  - data largely incomplete
- Avg blood loss <300 ml
- Avg OR time ~ 7 hours
- Oncologic data remains to be seen

Hemal Curr Opin Urol 2009

## Robotic assisted cystectomy Questions

- Will it decrease hospital stay? Complications?
- Can the OR times be shortened?
- Can an equivalent LND be done?
- How to handle the urinary diversion?
- Oncologic outcomes?

Opinion:

Long way to go. Probably good for benign disease.

## Robotic assisted urinary diversion

- Intracorporeal ileal conduit and orthotopic bladder substitution have been done
  - OR time >10 hours
- Most make 8 cm incision to remove specimen and create urinary diversion.

Hemal Curr Opin Urol 2009

## Robotic assisted adrenalectomy

- Case series and a few comparison studies (1 RT)
- About 150 patients published
- Complications inconsistently published
- Most metrics similar to lap adrenalectomy
- Longer OR time and more expensive for robot
- "subjective improvement" with robot
- Use in malignant disease TBD

Hyams and Stifelman Curr Opin Urol 2009

## Robotic assisted simple prostatectomy

- Technically feasible
- Case series x 2, 3 and 7 patients
- Millin's technique
- Modest EBL <600, 300 respectively
- 3-4 hours!!!

Opinion

Learn HoLEP. Probably not for robot.

Sotelo et al J Urol 2008, Yuh et al Can J Urol 2008

## Robotic assisted bladder diverticulectomy

- Little in literature
- Easy to do robotically
- Curl guidewire in diverticulum
- Unproven for cancer
- Can do PVP simultaneously

Opinion

Excellent training case. Quick and handles all comers. Not for malignancy yet.

## Robotic assisted lymph node dissections

- Pelvic
  - Well described and can do extended lymph node dissections, but tedious
- RPLND
  - Only 2 patients in PubMed
  - Expect more will come
- Inguinal LND
  - Believe it or not (Josephson et al Urology 2009)
  - Leave this to the few

## Medical Ethics

- Commercial
  - Caveat emptor
  - Equal relationship
  - Self-interest
- Professional
  - Primum non nocere
  - Fiduciary relationship
  - Self-sacrifice

## Medical reality

- Practical constraints to practicing physician taking significant amount of time to learn new procedures.

## Old credentialing process

- "Hey, do you want to use the robot?"
- Off-site training certificate and proctoring paid for by industry.

Or

- Letter from program director.

## Gold Rush
## aka - The learning curve

- 2 of first 10 patients at place I did fellowship had rectourethral fistula after prostatectomy
- Bad complications common
  - Urinary leaks
  - Incomplete prostate removal
- Promises not delivered
  - More incontinence and impotence

## University of Colorado Hospital Robotic Credentialing

- Ongoing QI processes and M and M

1. Training pathway
   - Significant residency or fellowship experience
   - 3 proctored cases
   - Period of observation (10 cases)
2. Practice pathway
   - Device training – online, off-site certificate
   - 3 proctored cases
   - Period of observation (17 cases)
   - CME or advanced course

## University of Colorado Hospital Robotic Credentialing

3. Experience pathway
   - 20 cases as surgeon and 10 within last year.
   - List of complications
   - Verification of robotic privileges at other medical center
   - Supportive letter of recommendation from Chair of Surgery/Department.

## Ways for practicing physician to train

- Fellowship
  - 6 months to 3 years
  - Hands-on required
- Mini-fellowships
- Self-directed
  - Dry-lab
  - Courses – hand-on and video observation

## Prerequisites

- Experience with laparoscopy
- Understand an investment is necessary
- Discuss with partners (if any)
- Willingness to start slowly

## How to incorporate

- Case observation
- Video observation
- Basic training
  - Online module
  - Hands-on off-site certification
- Dry-lab time (very helpful!)
- Honesty is the best policy/dispel myths/expectations
- Start with simpler procedures soon after training
  - Nephrectomy
  - Bladder diverticulectomy

## How to incorporate

- Find reputable and experienced proctor for 3-5 cases
  - Case is a failure if the proctor needs to do significant/important portions
- More dry lab
- Get help for first few cases on your own
- Advanced course after 10-15 cases
- Work into more complicated procedures slowly
- Continue to participate in courses

## Tips to minimize complications/facilitate procedure

- Well-prepared team (good assistant important)
- Always keep hands in view
- Center hands every few minutes (minimizes need to clutch)
- Foot positioned by camera pedal
- Let hands lead the way
- Constant back and forth when suturing
- Blink

## Technical improvement

- Record results
  - Use easy questionnaire
- Record procedures
  - Investigate causes of positive margin
- Ongoing review of literature, techniques, courses