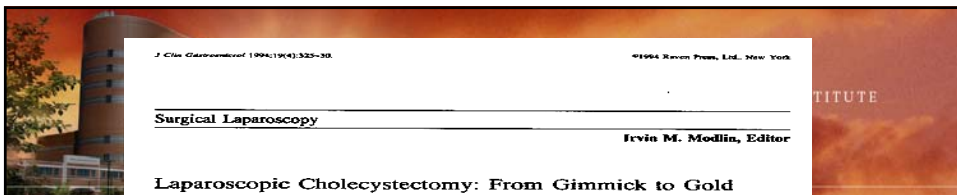




# ROLE OF COMPUTER ASSISTED SURGERY IN THE PRESENT & FUTURE

*Khurshid A Guru*  
*Director, Robotic Surgery*  
*Assistant Professor of Surgical Oncology*  
*University of Buffalo*  
*Roswell Park Cancer Institute, NY*



## **Laparoscopic Cholecystectomy: From Gimmick to Gold Standard**

Dennis G. Begos, M.D., and Irvin M. Modlin, M.D., F.R.C.S., F.A.C.S.

There is no doubt that objective data regarding postoperative length of stay and overall convalescence are valuable. Nevertheless, one has only to clinically compare patients after traditional and laparoscopic cholecystectomy to be convinced that the latter is a quantum leap forward as far as patient recovery and satisfaction are concerned. Indeed, removal of the gallbladder is often little more than

ROSWELL PARK CANCER INSTITUTE  
Living for Life

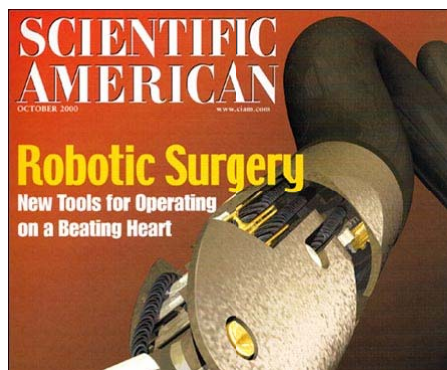
# LIMITATIONS OF CONVENTIONAL LAPAROSCOPY

- Maneuverability  
(Trocar positioning)
- Vision  
(Two dimensional on flat screen)
- Dexterity  
(Long awkward instruments)
- Counter-intuitive Movement





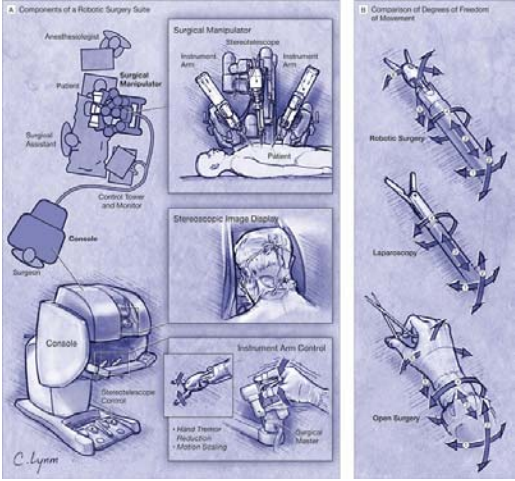
- Industrial Use
- Surgical Sciences
- First Robot : 1960
- 1982: 32,000 in use
- 1994: 20 Million
- 1989
- None
- First FDA Approval (AESOP) - 1993
- Da Vinci System Approval - 2000



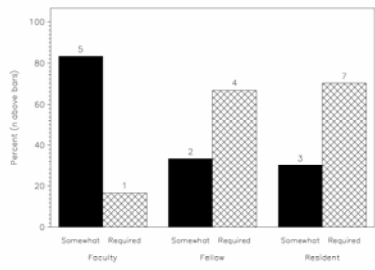
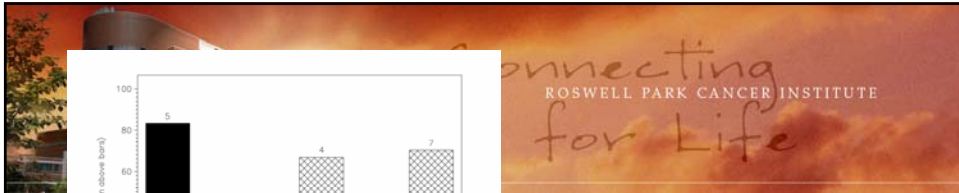


- Tele-operated System
- Stereoscopic visual display
- “Main Console” control handles with direct movement of “in vivo” instruments

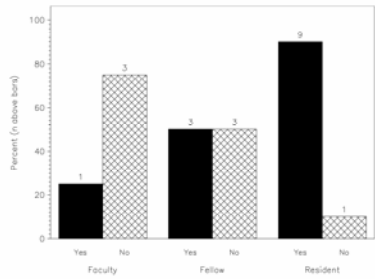




High resolution 3D visualization  
Fully articulating *EndoWrist®* instruments  
Intuitive movement, motion scaling,  
tremor reduction



Importance of robotic training for future career goals



Participants interested in pursuing a robotic fellowship

Figure 1.

Guru KA, Pavlov S, Kuschinoff BW, Bienko M, Aflab N, Brady WE, Mohler JL:  
*Impact of Robotics and Laparoscopy on Surgical Skills: A Comparative Study.*  
*Journal of American College of Surgeons: January, 2007.*

Fig 1. A representation of a robot from Capek's play "Rossum's Universal Robots."

**STAR WARS OR LOST IN SPACE.**  
**CRAIG PETERS**

Connecting  
**PROPOSED USES**  
ROSWELL PARK CANCER INSTITUTE  
for Life

| Medscape®                                        | www.medscape.com                |                      |                        |                       |                       |
|--------------------------------------------------|---------------------------------|----------------------|------------------------|-----------------------|-----------------------|
| Orthopedic surgery                               | Neurosurgery                    | Gynecologic surgery  | Cardiothoracic surgery | Urology               | General surgery       |
| Total hip arthroplasty: femur preparation        | Complement image-guided-surgery | Tubal re-anastomosis | Mammary artery harvest | Radical prostatectomy | Cholecystectomy       |
| Total hip arthroplasty: acetabular cup placement | Radiosurgery                    | Hysterectomies       | CABG                   | Ureter repair         | Nissen fundoplication |
| Knee surgery                                     |                                 | Ovary resection      | Mitral valve repair    | Nephrectomy           | Heller myotomy        |
| Spine surgery                                    |                                 |                      |                        |                       | Gastric bypass        |
|                                                  |                                 |                      |                        |                       | Adrenalectomy         |
|                                                  |                                 |                      |                        |                       | Bowel resection       |
|                                                  |                                 |                      |                        |                       | Esophagectomy         |

Source: Ann Surg © 2004 Lippincott Williams & Wilkins



- Base of tongue tumors (supraglottic carcinoma)
- 3 human patients
- Completed robotically
- Overall Operating Time: 120 minutes
- No intraoperative complications
- Technically feasible and safe

*Transoral robotic surgery: supraglottic partial laryngectomy.  
Ann Otol Rhinol Laryngol. 2007;116 (1) 19-23.*



- University Hospital Innsbruck, Austria
- Initiated program in 2001
- 10 thymectomies, 16 funduplications, 4 Esophag. Dissections, 5 Removal of Mediastinal Masses.
- One Conversion
- Most elegant to perform Thymectomies

*First experience with DaVinci in Thoracic Surgery.  
European J Cardiothoracic Surg 2004, May 25(5).*



- 21 consecutive patients
- 18 were thoracoscopic completion
- Operating time: 180 min (120-240)
- EBL: 400 ml (150-700)
- Median LN : 20
- Hospital Stay: 18 days ( 11-182)
- Pulmonary Complications: 48%, One death

*First experience with robot assisted thoracoscopic esophagolymphadenectomy.  
Surg.Endoscopy. 2006, Sept 20(9). 1435-9*



- 7 Patients for early distal gastric tumors
- Mean age was 64 yrs
- Median Operating time: 420 min
- Median LN : 24 ( 17-30), Margin Negative
- Hospital Stay: 4 days (3- 9)
- One complication devascularization of Colon
- No death

*Anderson C, Pigazzi A. group COH.  
Surg.Endoscopy. 2007, March 8*



- 7 patients
- Hematologic disorders & Hypersplenism
- OR time: 107 +/- 49 minutes
- No complications
- No conversions
- Median hospital stay: 7 days

*Laparoscopic splenectomy with the DaVinci.  
J Laparoendoscopic Adv Surg Tech.2005, Feb 15(1).*



- 30 Patients
- Mean operating Time: 185 minutes
- Hospital stay 2 day
- No intra-operative complication
- No conversion
- No robot related complication

*Thirty robotic adrenalectomies.  
Surg Endoscopy 2006,20,119-124.*



- 16 Patients
- Mean Operating time: 242 minutes (170-432)
- No conversions
- Mean uterine weight: 131.5 gms
- Average EBL: 96 ml
- 1 delayed thermal injury, 2 infections & 1 vaginal cuff hematomas
- Mean hospital stay 1.5 days

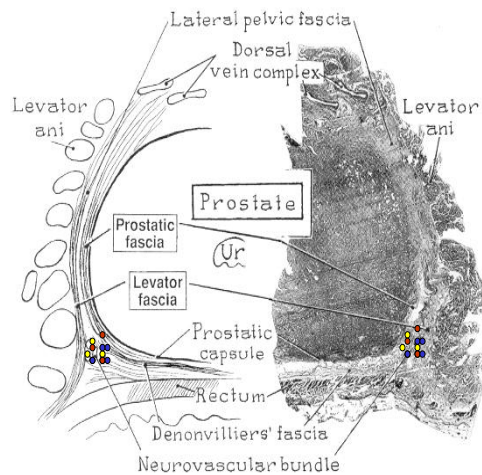
*Robotic assisted lap. Hysterectomy. Technique & initial experience.  
Am J surgery 2006, 191(4) 555-60.*



## PROSTATE SURGERY



- **RPCI completed: 400**
- Cancer Control
- Continence
- Erectile function





|                      | N   | PSM rate (overall) | pT2 (%) | pT3 (%) | Reference                                   |
|----------------------|-----|--------------------|---------|---------|---------------------------------------------|
| Menon (2005)         | 35  | 2%                 | 98      | 2       | (Menon, Kaul et al. 2005)                   |
| Patel (2005)         | 200 | 10.5%              | 78      | 22      | (Patel, Tully et al. 2005)                  |
| Van Appledorn (2006) | 150 | 17.3%              | NR      | NR      | (Van Appledorn, Bouchier-Hayes et al. 2006) |
| Joseph (2006)        | 325 | 13%                | 81      | 16      | (Joseph, Rosenbaum et al. 2006)             |
| Mikhail (2006)       | 100 | 16%                | 79      | 21      | (Mikhail, Stockton et al. 2006)             |



|                | N   | 3   | 6   | 12 mo | Continence definition     | Method of Assessment |
|----------------|-----|-----|-----|-------|---------------------------|----------------------|
| Menon, 2003    | 200 |     | 96% |       | Safety pad                | Interview            |
| Ahlering, 2004 | 90  | 81% |     |       | No pads                   | Questionnaire        |
| Patel, 2005    | 200 | 82% | 89% | 98%   | No pads                   | Questionnaire        |
| Costello, 2005 | 122 | 73% | 82% |       | Safety pad                | Questionnaire        |
| Joseph, 2006   | 325 | 93% | 96% |       | No pads                   | Questionnaire        |
| Mikhail, 2006  | 100 | 70% | 79% | 84%   | Return to 75% of baseline | UCLA-PCI             |



|               | N   | 3 mos | 6 mos | 12 mos | Data source | Definition                | Ref                             |
|---------------|-----|-------|-------|--------|-------------|---------------------------|---------------------------------|
| Menon (2005)† | 35  |       |       | 97%    | IIEF-5      | Intercourse               | (Menon, Kaul et al. 2005)       |
| Menon (2005)§ | 23  |       |       | 74%    |             | Intercourse               | (Menon, Kaul et al. 2005)       |
| Joseph (2006) | 325 | 46%   |       |        | IIEF-5      | IIEF > 21                 | (Joseph, Rosenbaum et al. 2006) |
| Ahlering*     | 23  | 47%   |       |        | IIEF-5      | Intercourse               | (Ahlering, Eichel et al. 2005)  |
| Mikhail       | 100 | 58%   | 66%   | 80%    | UCLA-PCI    | Return to 75% of baseline | (Mikhail, Stockton et al. 2006) |

† "VEIL OF APHRODITE" TECHNIQUE, § VIP TECHNIQUE, \* CAUTERY FREE TECHNIQUE



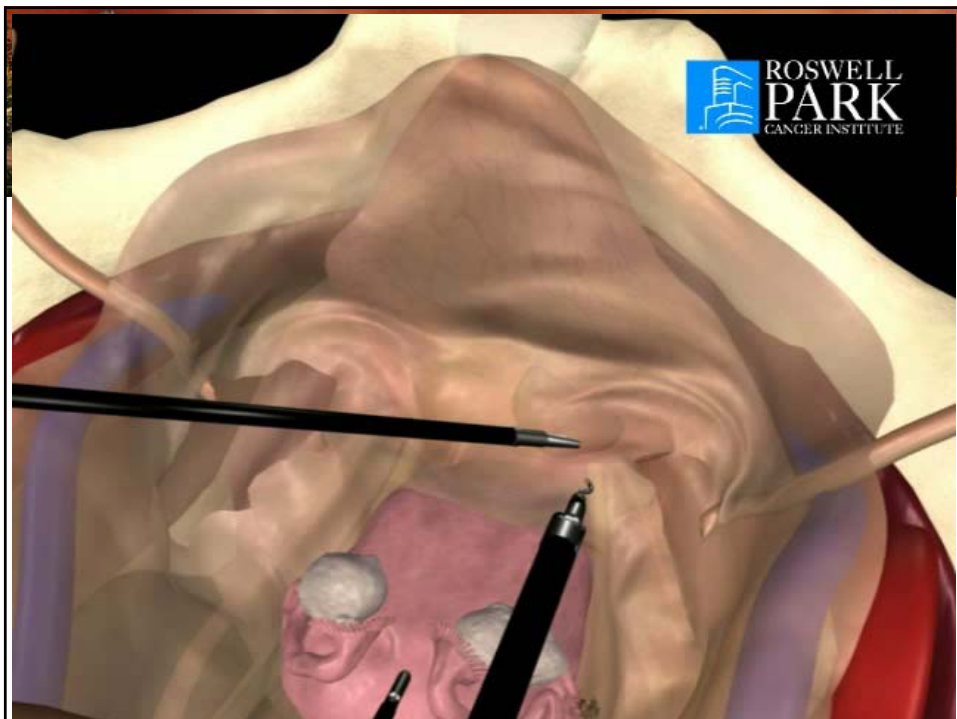
## ROBOT ASSISTED RADICAL CYSTECTOMY & PELVIC LYMPH NODE DISSECTION: INITIAL EXPERIENCE AT ROSWELL PARK CANCER INSTITUTE

*Guru KA, Kim HL, Piacente PM, Mohler JL:  
Robot-Assisted Radical Cystectomy and Pelvic Lymph Node Dissection:  
Initial Experience at Roswell Park Cancer Institute.  
Urology: March, 2007*



- Decreased blood loss
- Decreased operative pain
- Early return of normal activities
- Decreased insensible fluid loss  
*(closed abdominal cavity)*
- Often Elderly with co-morbid condition

*Savage SJ. Radical Cystectomy: the minimal invasive approach. Urologic Oncology. 2004, 22;262-263*





From November 2005 to April 2007,

**50 consecutive** patients

RARC, RAAE and Robot assisted PLND for bladder cancer.

**No open** Radical Cystectomy has been performed

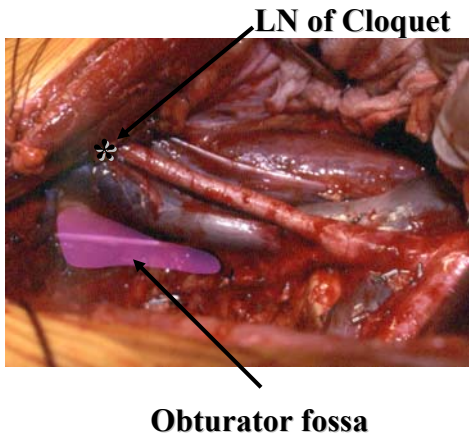
Data was collected prospectively for an quality assurance program



- 50 Patients for invasive bladder tumor
- Mean age was 68 yrs
- Median Operating time: 360 min
- Margin Positive 3/50 all greater than T3
- Hospital Stay: 9 days (5- 54)
- Complication Rate 35%
- One death



# ANATOMIC BOUNDARIES: STANDARD LND



Nodal tissue up to and including common iliac bifurcation

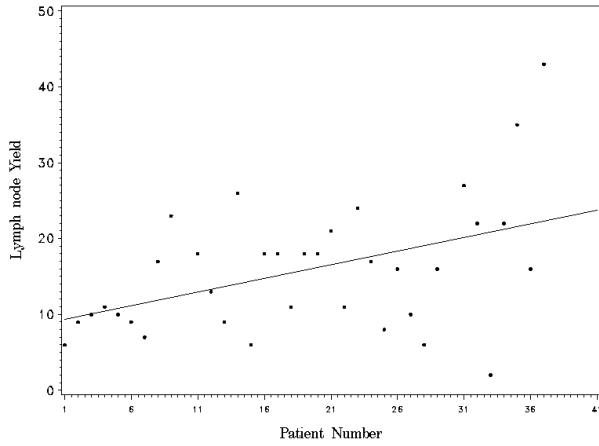
1. Internal Iliac LN
2. Presacral Tissue
3. Obturator Fossa
4. External Iliac LN
5. Distal Common Iliac LN  
( up to where the ureters crosses iliac vessels)



# LYMPH NODES

|                                         | Herr (2002) | Stein (2003) | SWOG Herr (2004) | Honma (2006) | RPCI (Open) (n=8/20) | RPCI (Robotic) (n=43) |
|-----------------------------------------|-------------|--------------|------------------|--------------|----------------------|-----------------------|
| Recommended average nodes to be removed | 11          | 15           | 10               | 13           | -                    |                       |
| Average nodes removed                   | -           | -            | -                | -            | 8 (2-25)             | 18 (6-43)             |

*Herr H et al. J Urol. 2002 167.  
Stein JP et al. J Urol. 2003 170  
Herr H et al. J Clin Oncol. 2004, 22.  
Honma et al, Urology, 2006,68*



RPCI  
(Robotic)  
(n=50)

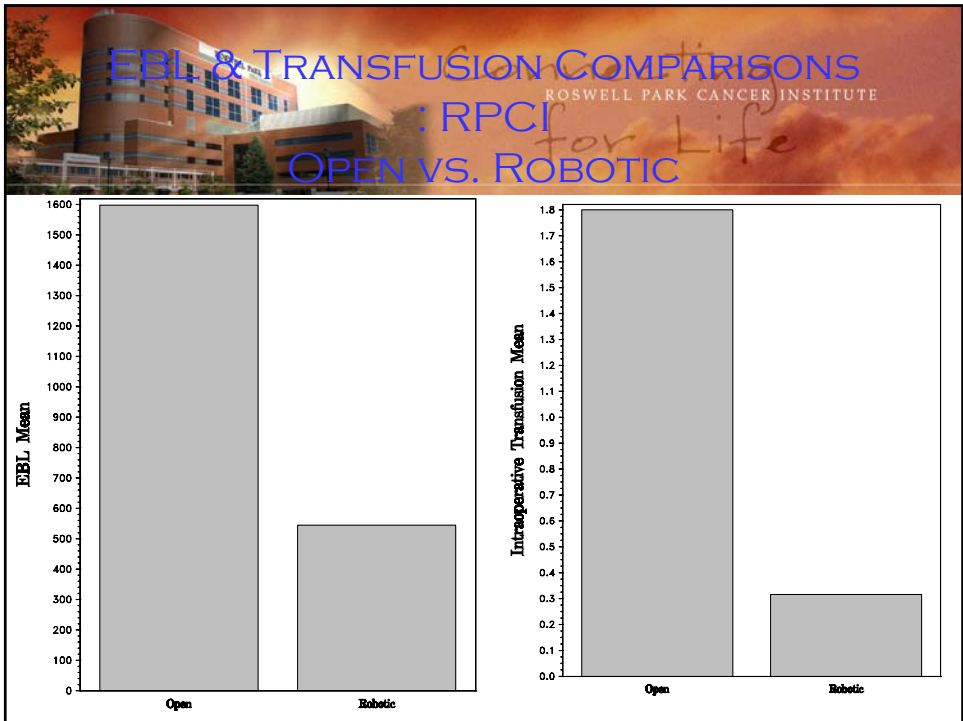
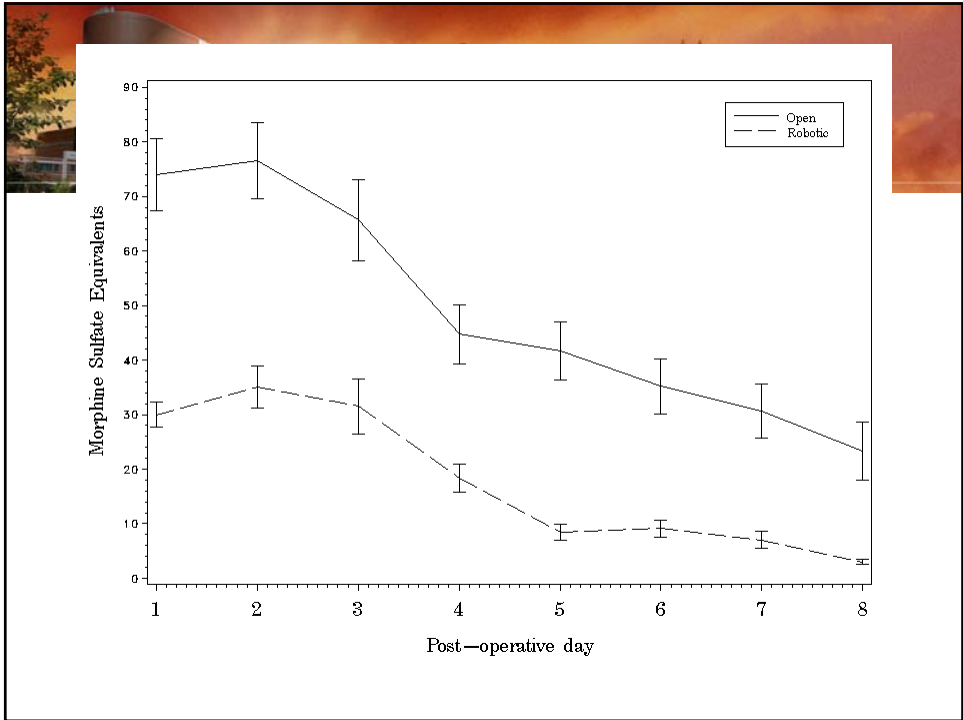
---

18  
(6-43)



## POST-OPERATIVE PAIN CONTROL

*Open versus Robotic*





- Robot Assistance provides significant decrease in EBL and need for intra-operative transfusion
- Postoperative Pain is markedly reduced in robotic patients
- Immediate oncological results are comparable.
- Long term oncological results and QOL outcomes will define its permanent position in minimally invasive urologic oncology



- Total reported 110 cases from 2003-2006
- Intuitive reports approximately 400 cases
- Total OR Time: 248 – 697 minutes
- EBL: 150-1400 ml
- Margins: only two series positive out of 12 reports
- Only One of 12 reports performed open LN dissection
- Nodes reported by only 6 of 12 reports
- Number of nodes 3-47
- No conversions reported



# Cost of Capital



NEVER TRUE

# We're Cutting Costs



without Cutting Care

**The New England Journal of Medicine**  
 Established in 1812 as THE NEW ENGLAND JOURNAL OF MEDICINE AND SURGERY  
 VOLUME 348 JUNE 4, 2003 NUMBER 23

**THIS WEEK IN THE JOURNAL**

|                                                                                                           |      |                                                            |      |
|-----------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------|------|
| Article Summaries                                                                                         | 1769 | <b>CLINICAL PRACTICE</b>                                   |      |
| Perspective: Sirolimus-Eluting Coronary Stents                                                            | 1770 | Carpal Tunnel Syndrome                                     | 1807 |
|                                                                                                           |      | J.N. KATZ AND R.P. SIMMONS                                 |      |
|                                                                                                           |      | <b>CLINICAL PROBLEM-SOLVING</b>                            |      |
|                                                                                                           |      | Diagnosis Still in Question                                | 1813 |
|                                                                                                           |      | A.K. IHA, H.R. COLLARD, AND L.M. TENNEY                    |      |
| <b>ORIGINAL ARTICLES</b>                                                                                  |      | <b>EDITORIALS</b>                                          |      |
| A Randomized Comparison of a Sirolimus-Eluting Stent with a Standard Stent for Coronary Revascularization | 1773 | Sporadic Cases of Hereditary Spherocytosis                 | 1818 |
|                                                                                                           |      | M.J.M. SERRANO                                             |      |
| Results of Screening Colonoscopy among Persons 40 to 49 Years of Age                                      | 1781 | When Increased Therapeutic Benefit Comes at Increased Cost | 1819 |
|                                                                                                           |      | A.J.J. WOOD                                                |      |
| T.J. INFERRILE AND OTHERS                                                                                 |      | <b>FOUNDING BOARD</b>                                      |      |
| Mid-diagnosis of Hereditary Amyloidosis as AL (Primary) Amyloidosis                                       | 1786 | What's Ahead for Health Insurance                          |      |

**CONTENTS FROM EARLIER IN THE JOURNAL**

|                                                                              |    |                                                    |      |
|------------------------------------------------------------------------------|----|----------------------------------------------------|------|
| Retinal Hemorrhages in Acute Leukemia                                        | 66 | Large B-Cell Lymphoma                              | 1830 |
| M.J. LEACH                                                                   |    | The Interval between Pregnancies and Pre-eclampsia | 1831 |
|                                                                              |    | Uterine Sarcoma Associated with Tamoxifen Use      | 1832 |
| <b>SPECIAL ARTICLE</b>                                                       |    | Food Allergies and Risking                         | 1833 |
| Cost Effectiveness of Aspirin, Clopidogrel, or Both for Secondary Prevention |    | BOOK REVIEWS                                       | 1835 |
|                                                                              |    | NOTICES                                            | 1837 |

To abandon the search for improved therapies ... on the basis of cost would represent enormous disservice to our patients and would distinguish attempts to improve patient care from the quest for better automobiles, audio systems, or computers, or from any area of human endeavor.

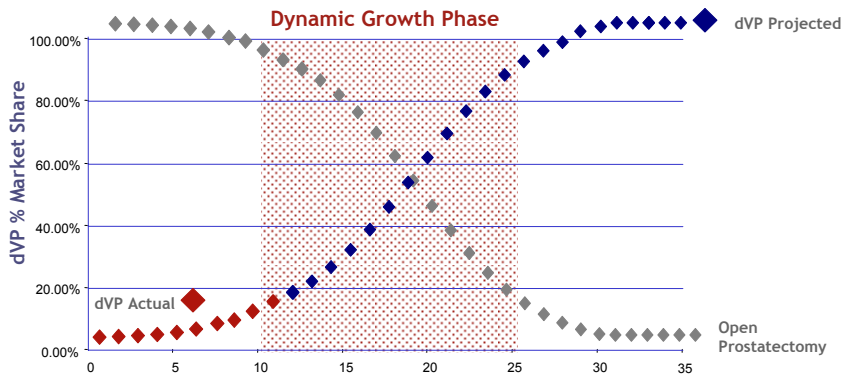
Surely the search for better therapy is at least as important as the search for improved audio performance?

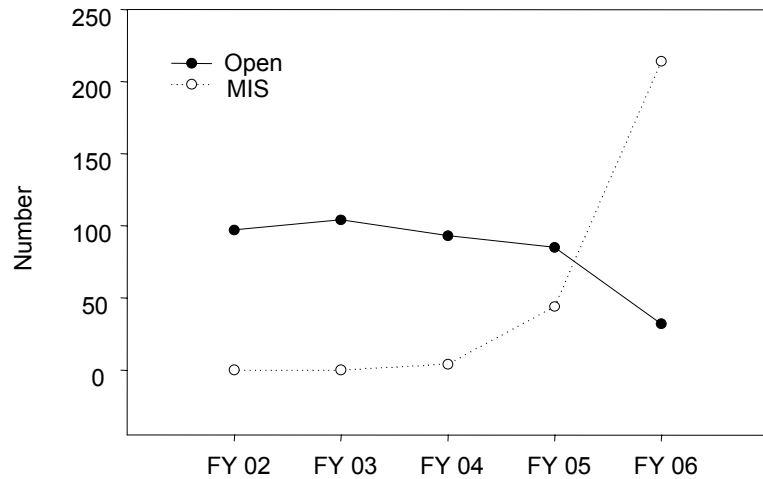
If organized medicine ... takes the position that the increments in therapeutic benefit must be achieved at costs similar to those of current therapy, however cheap that therapy, then we are destined to be trapped at our current level of therapeutic efficacy forever--





## HOW DOES ONE MEASURE THE MERIT OF AN ENDEAVOR?





- FDA needs interventional vascular device only allow physicians who have shown competency
- Anesthesia Simulator
- Reduction of simulator recorded operative errors with improvement of 500%
- Quantifiable technical & cognitive competence will be tested

*Clayman RV. A tipping point in surgical education: Simulation at the gates. J Urol 2006 February,*



- Critical evaluation of outcomes (patient database)
- Practical Surgical Training
- Continue research & development of surgical techniques, instrumentation, engineering collaboration
- Extension of robotics to other disease states (oncology & non oncology)



- Machine always wins!
- This is true whether it be John Henry vs. a steam engine or Mile a Minute Murphy raising a train.
- To be sure, there will always be an individual who can beat the machine, but for rest of us mere mortals, the machine du jour, a reasonable quitting time and a warm dinner will do just fine please.

*Clayman RV. Man versus Machine. J Urol 2004 December,*