



Robotic Radical Prostatectomy Lessons Learned: 3000 Cases



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Evolution

- Evolution of open radical prostatectomy over 100 years:
 - H H Young 1905
 - P Walsh 1979
- Robotic radical prostatectomy relatively new:
 - First performed in 2000 by J. Binder in Germany
 - approximately 300,000 total
- Where are we today?



What Is The Status Of RALP Today ?

- What is the status of RALP today?
- Have acceptable outcomes been achieved ?
- What are the key principles in achieving the trifecta
- How can we continue to improve our results?



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Goals and Expectations

- Initial goals for robotic prostatectomy (2000)
 - establish a viable minimally invasive option
 - attempt to make laparoscopic prostatectomy a feasible option for a larger number of surgeons and patients
 - Primitive instrumentation and a primitive approach
- What we achieved was beyond our initial expectations:
 - The approach and expectations of robotic prostatectomy have evolved significantly



RALP: Perioperative outcomes

Authors	Year	Patients (N)	Median/ Mean Age	Mean BMI	Pre-op PSA	Clinical Stage		Operative Time. min	Mean EBL	% Transfused	Open Conversion	Hospital Length of Stay (days)	Complication Rate
						T1c	T2						
Hu [14]	2006	322	62.1	27.5	-	74.50%	24.80%	186	250	1.60%	0%	-	14.60%
Joseph [15]	2006	325	60	-	6.6	81.00%	19.00%	130	196	1.30%	0.00%	-	8.60%
Badani [16]	2007	2766	60.2	27.6	6.4	77.30%	22.00%	154	142	1.50%	0.10%	1.14	12.20%
Motttrie [17]	2007	184	62	-	8.7	-	-	171	200	0.5%	0.54%	-	11.9%
Rozet [18]	2007	133	62	24.8	7.6	57.1%	42.8%	166	609	3%	0%	5.4	19.4%
Nelson [19]	2007	629	59.3	-	6.4	-	-	-	-	-	-	1.17	17%
Borin [20]	2007	400	61.2	26.8	6.6	68%	26.5%	-	103.5	-	-	1	-
Zorn [21]	2007	744	59.6	28.1	6.6	74%	26%	234	222	1.20%	1.20%	1.2	-
Wood [22]	2007	117	60.2	-	6.5	-	-	210	151	-	-	1.2	-
Schroeck [23]	2008	362	59.2	27.8	5.4	83.10%	16.90%	-	150	-	1.60%	-	-
Chan [24]	2008	660	60	-	6.8	75.30%	24.70%	207	140	0.80%	0.90%	1.3	-
Patel [25]	2008	1500	61	30.5	6.1	78%	20%	105	111	0.50%	0	1.1	4.30%
Krambeck [26]	2009	294	61	-	4.9	72.8%	26.9%	236	-	5.1%	-	-	4.8%
Murphy [27]	2009	400	60.2	27.2	7	69.70%	30.30%	186	-	2.50%	0.30%	3.1	15.70%
Rocco [28]	2009	120	63	-	6.9	69%	31%	215	200	-	-	3	-
Ham[29]	2009	321	63.5	24.3	29.7	-	-	219	402	-	-	5.3	5.3%
Weighted means			60.5	28	7.32	72.6%	19.2%	166.6	169.1	1.39%	0.34%	1.55	10.5%



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Our Experience With RALP

- First RALP in 2002
- Prostatectomies performed : 3300 +
- Average age 61 yrs (31-80)
- Median Gleasons score 6 (5-10)
- Median PSA 6.9ng/dl (0.5-50)



Peri-Operative Outcomes

- Average OR time 91 minutes (35- 365)
- Average EBL: 100 cc (50-500)
- Average LOS: 1.2 days (1-14)
- Complications: 4.2%
 - Transfusions: 0.3%
 - Conversions: 0.1%



RALP Lessons Learned: The Trifecta:

**Cancer Control
Urinary Continence
Sexual Function**

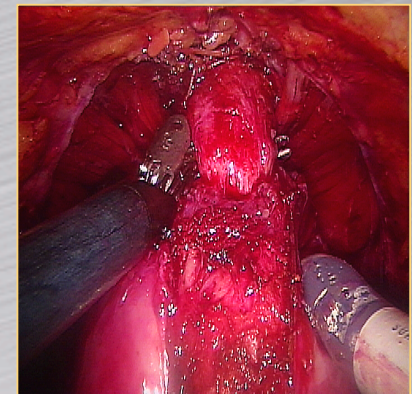


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Factors That May Influence The Trifecta

- Experience of the surgeon
- Tumor status of the patient
- Co-Morbidities
- Complications
- Approach to key portions of the operation:
 - Apical dissection
 - Neurovascular bundle preservation



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The Trifecta:

Cancer Control

Urinary Continence

Sexual Function



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RALP: Oncologic outcomes

Authors	Year	Patients (N)	Pathologic Staging			Positive Surgical Margins		
			pT2	pT3	pT4	pT2	pT3	Overall
Joseph [15]	2006	325	81.00%	19.00%	-	-	-	13.00%
Atug [34]	2006	140	87.9%	9.3%	2.8%	18%	53.8%	18.5%
Badani [16]	2007	2766	77.70%	22.00%	0.30%	13.00%	35.00%	12.30%
Rozet [18]	2007	133	88.5%	11.5%	0	13%	20.9%	19.5%
Mottrie [17]	2007	184	62.5%	37.5%	0	2.5%	37.1%	15.7%
Zorn [21]	2007	744	-	-	-	12.90%	44.80%	18.80%
Borin[20]	2007	400	73.5%	26.5%		6.1%	31.9%	12.5%
Tewari [35]	2008	700	83.5%	13.6%	2.9%	5.4%	-	-
Schroeck [23]	2008	362	79.30%	20.70%	0	-	-	29.30%
Chan [24]	2008	660	80.60%	19.40%	0	11.30%	45.00%	17.90%
Liss [36]	2008	216	68.5%	31.5%	0	5.4%	33%	14.8%
Patel [25]	2008	1500	78.30%	19.50%	1.50%	4.00%	34.00%	9.30%
Murphy [27]	2009	400	70%	29.80%	0.20%	9.60%	42.30%	19.20%
Krambeck[26]	2009	294	90.1%	9.9%		-	-	15.6%
Rocco[28]	2009	120	73%	24%	3%	17%	34%	22%
Ham [29]	2009	321	55.1%	43.7%	1.2%	-	-	33.3%
Weighted Means			77.4%	21.9%	0.7%	9.6%	37.1%	15.2%



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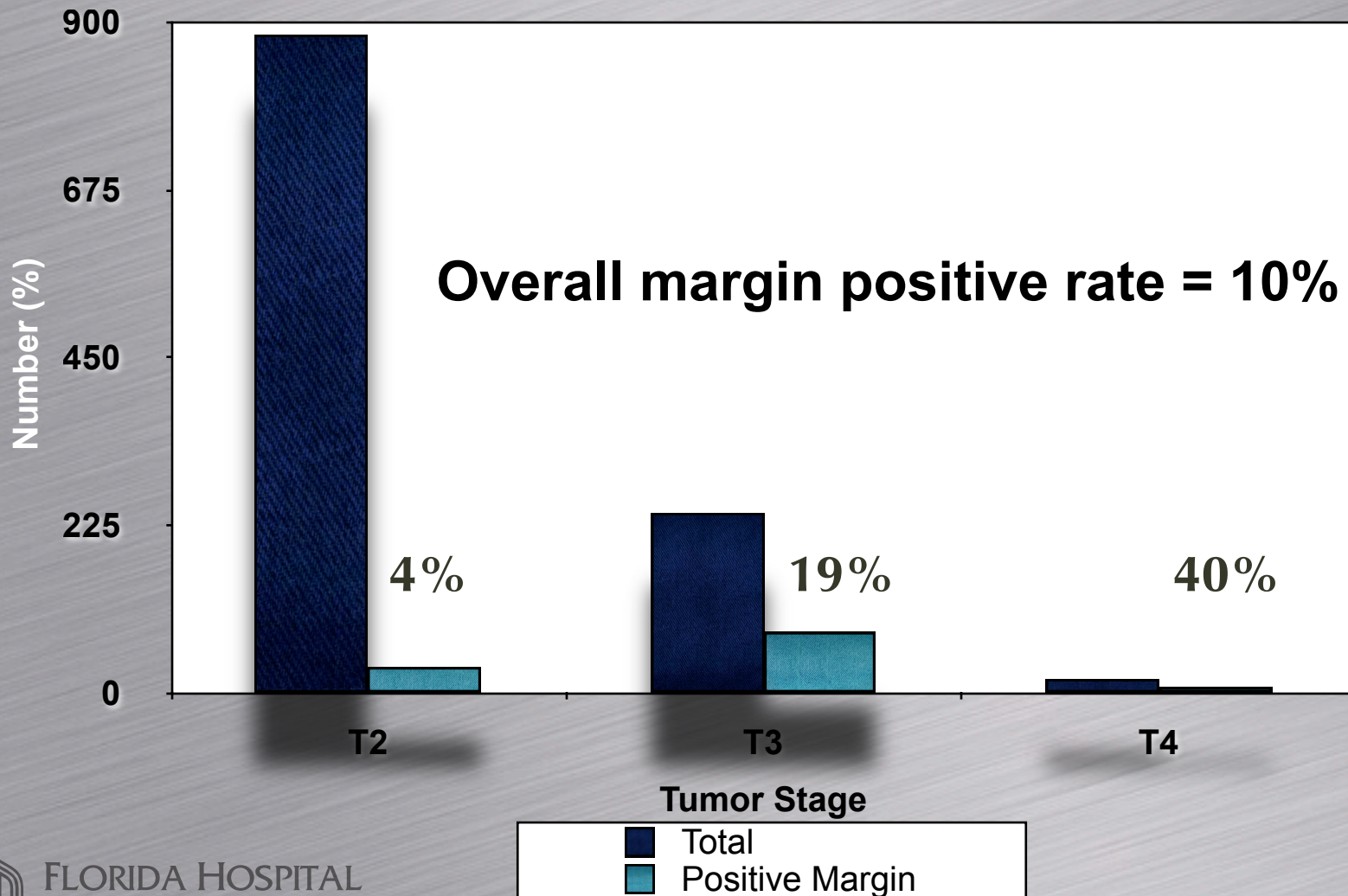
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Histopathology

- 3000 Cases
- Median Gleason's score: 6 (5-10)
- Mean prostate weight = 50 gms (15- 420)
- Pathologic Staging:
 - T2: 78 %
 - T3: 21.9 %
 - T4: 0.1 %



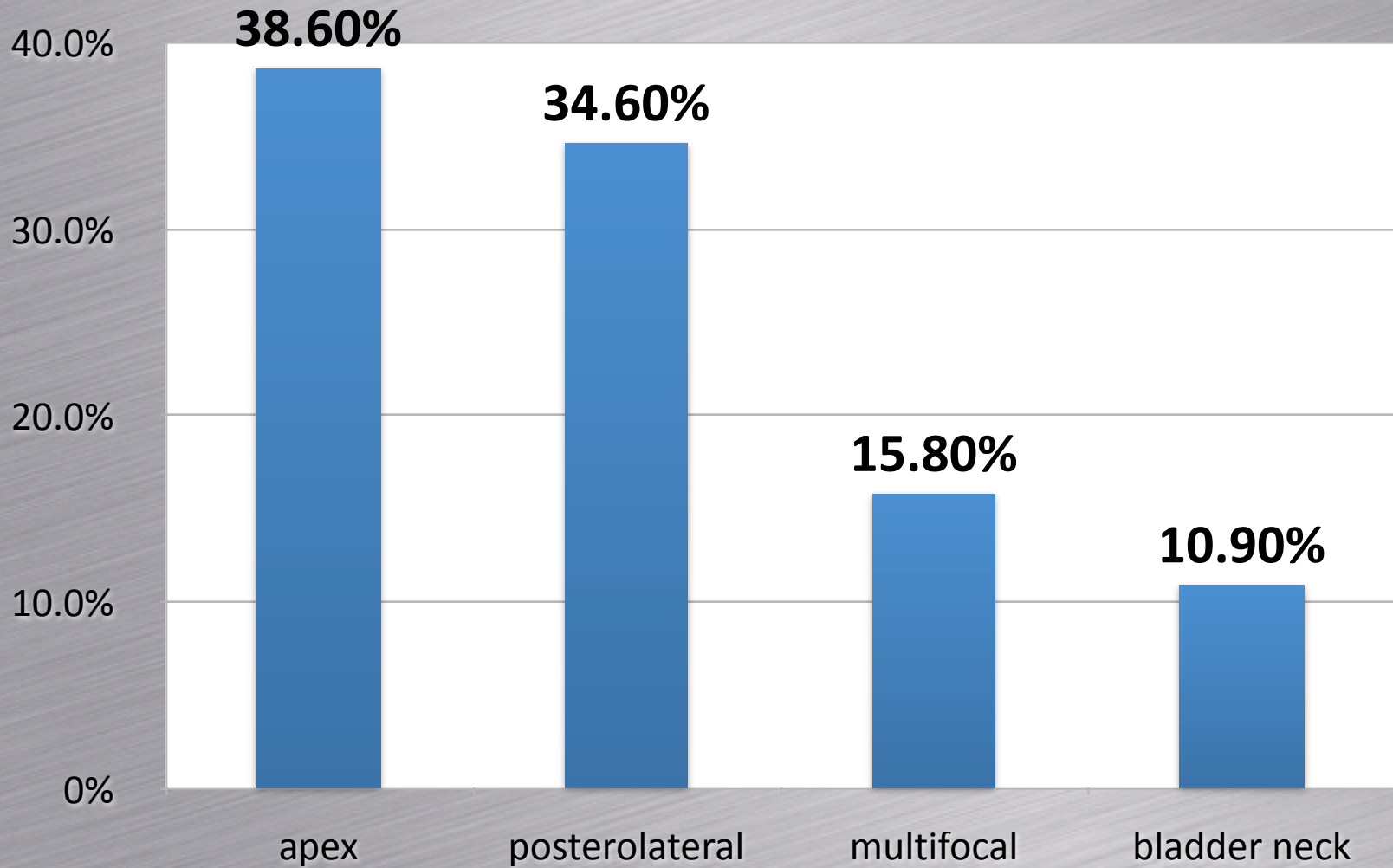
Margin Positive Rate @ 3000 cases



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PSM - Location

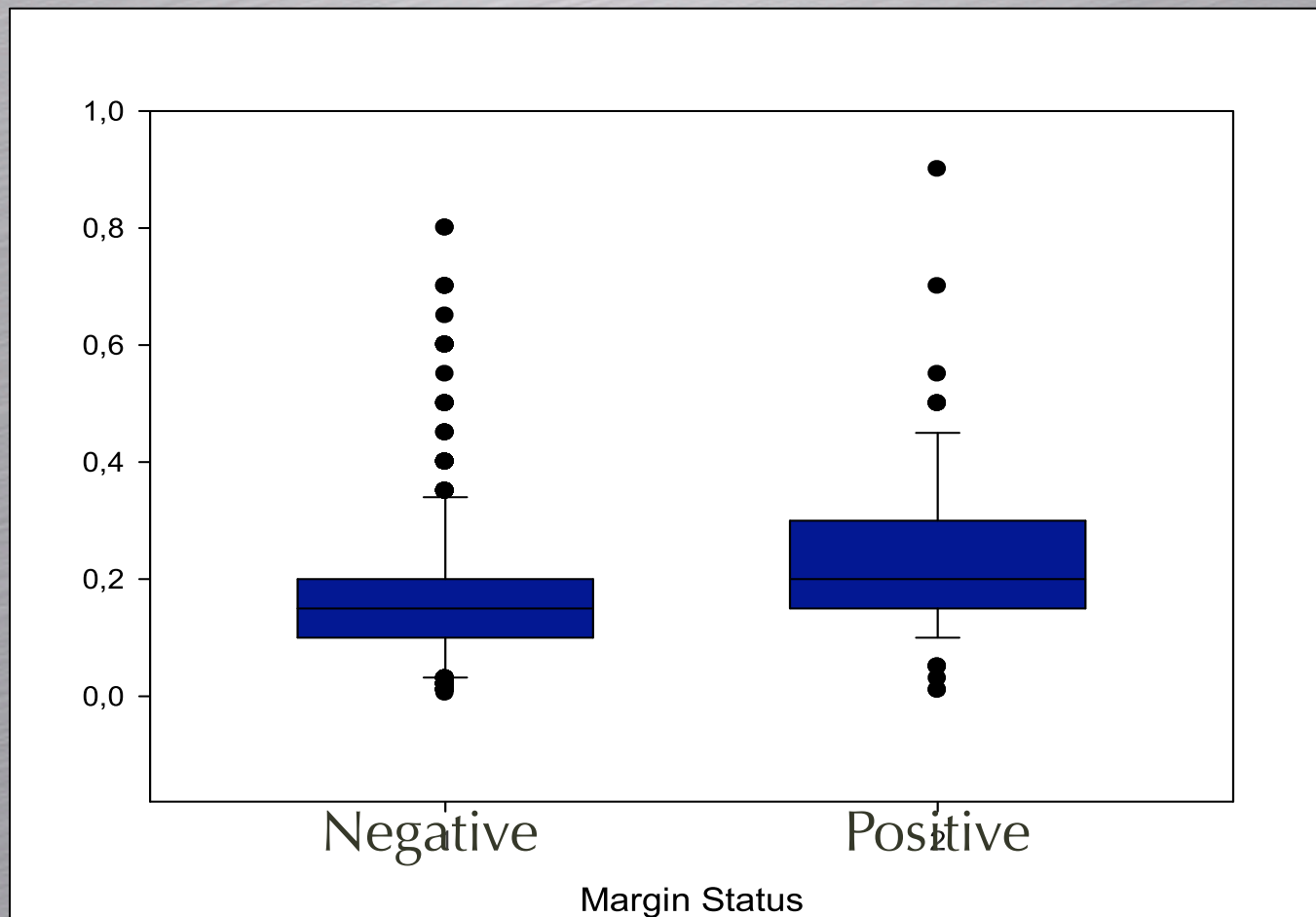


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PSM - % Tumor Surgical Specimen

% Tumor
Surgical
Specimen



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$$p=1.09 \times 10^{-6}$$

Multivariable Analysis

Independent predictive factor for PSM

Predictive Factor	Comparison	Chi-square p-value	Odds Ratio (95% CI)
<i>Pre-operative variables</i>			
Clinical Stage	T2 vs T1	< 0.0001	2.9 (1.9 - 4.6)
	T3 vs T1	< 0.0001	10.7 (2.6 - 43.8)
<i>Pre-op, intra-op and post-operative variables combined</i>			
Percentage of Tumor	continuous	0.0022	8.7 (2.2 - 34.5)
Pathological Stage	PT3 vs PT2	< 0.0001	3.8 (2.4 - 6.1)
	PT4 vs PT2	0.0045	27.9 (2.8 - 277.8)



Independent predictive factors for apex and posterolateral PSM locations

Predictive Factor *	Comparison	Chi-square p-value	Odds Ratio (95% CI)
<i>Apex Location</i>			
BMI	continuous	0.0119	1.1 (1.0 - 1.3)
EPE	0 vs 1	0.0032	5.3 (1.7 - 15.9)
<i>Posterolateral Location</i>			
BMI	continuous	0.0321	0.89 (0.79 – 0.99)



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Multivariate Analysis

- Independent predictive factors
- Clinical stage
- Pathologic stage
- Percentage of tumor burden



Predictive Factors

- What we operate on is the most important factor during our advanced learning curve
- Clinical stage >T1c, High tumor burdens > 25%, pathologic stage >T2
- Non-predictive factors: Gleason's grade, preop PSA, tumor location, BMI, prostate size



The Trifecta:

Cancer Control

Urinary Continence

Sexual Function



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Post Prostatectomy Urinary Incontinence

- **AUA Guidelines:** The reported risk of urinary incontinence following prostate cancer therapies ranged from 3% to 74% for radical prostatectomy.
- **EAU Guidelines:** urinary incontinence persists after 1 year in 7.7%



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RALP: Continence outcomes

Authors	year	Patients (N)	Median/ Mean Age	Follow-up (months)	Immediate	1 month	3 month	6 month	12 month
Joseph [15]	2006	325	60	6	24%	56%	93%	96%	-
Menon [39]	2007	1142	60.2	12	-	-	-	-	92.00%
Mottrie [17]	2007	184	62	6	-	43%	-	95%	-
Borin[20]	2007	400	61.2	6	-	70.5%	89%	97%	-
Zorn [40]	2007	300	59.4	24	-	23.00%	47.00%	68.00%	90.00%
Patel [37]	2007	500	63.2	12	27%	-	89%	95%	97%
Tewari[35]	2008	214 (NR)	64.3	13	13.1%	35.2%	50.2%	61.9%	82.1%
		304 (AR)	62.8	13	27%	59%	76.6%	85.6%	91.2%
		182 (TR)	61.2	6	38.4%	82.5%	91.3%	97.1%	-
Murphy [27]	2009	395	60.2	>18	-	-	-	-	91.40%
Krambeck[26]	2009	294	61	12	-	-	-	-	91.8%
Rocco[28]	2009	120	63	12	-	-	70%	93%	97%
Van der Poel[41]	2009	151	60	12	-	-	-	54% (any loss of urine)	70% (any loss of urine)
Weighted Means			61.15%		25.7%	53.2%	78.6%	86.4%	91%



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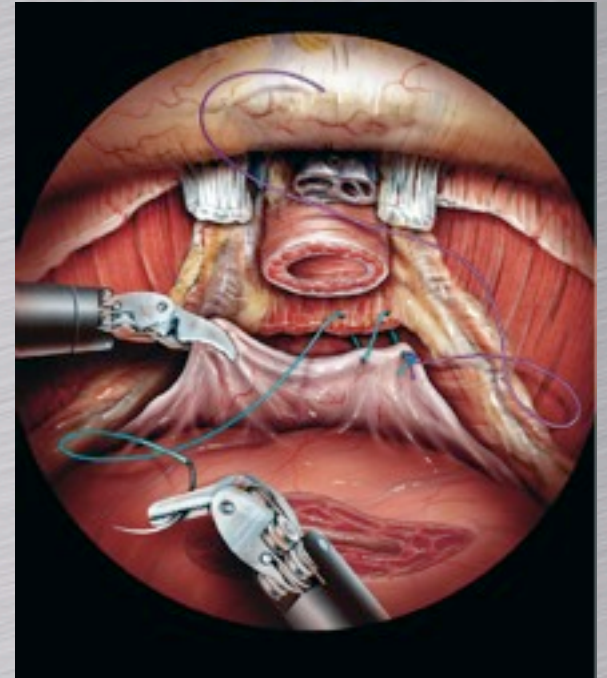
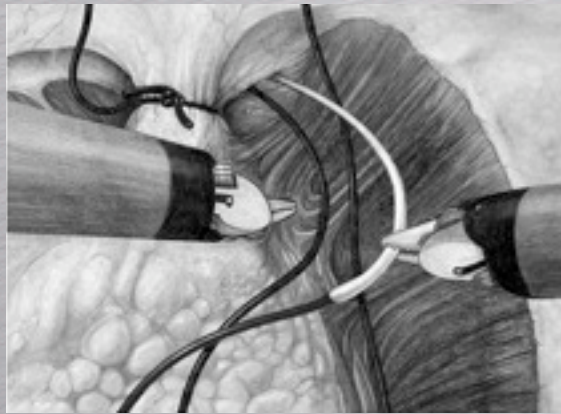
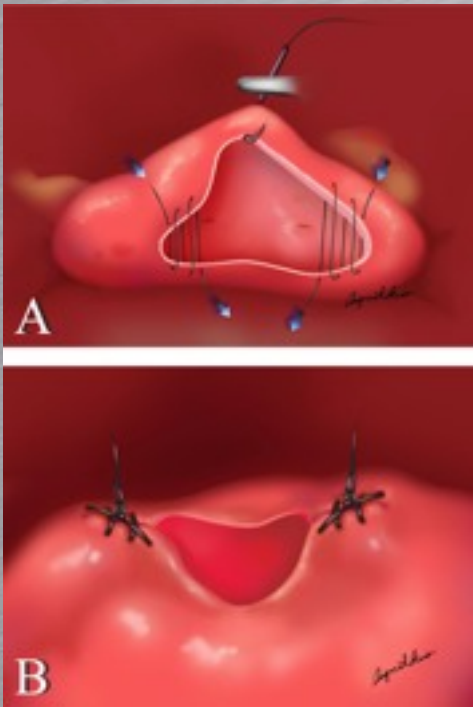
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The Most Important Question Is Which Patients Are At Risk For Long Term Incontinence ?

- Despite all of the technical innovations patients recover continence at variable rates and some not at all
- Who are these outliers?
- Can we predict pre-operatively the characteristics?
- What can we do to improve their chances?



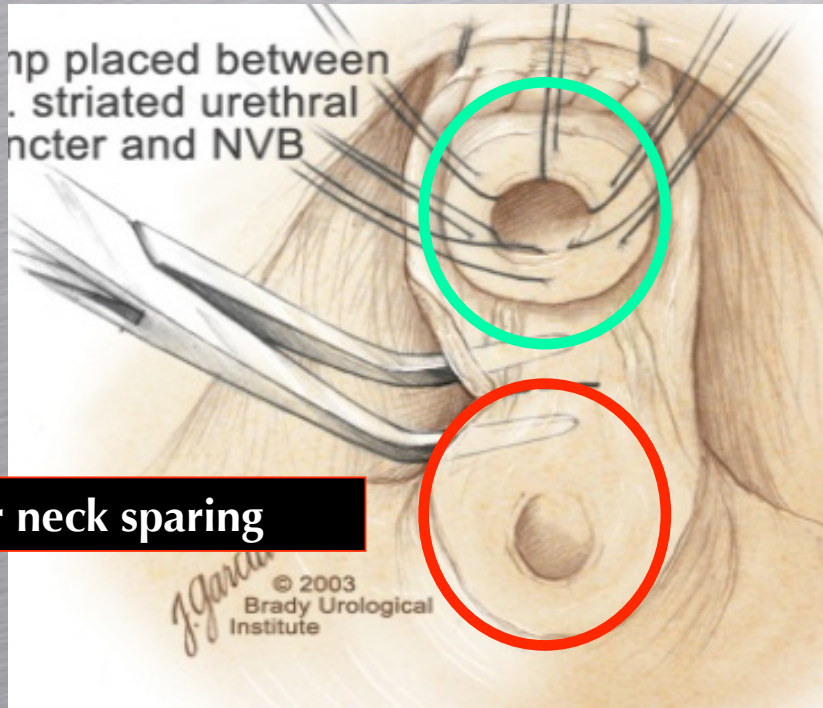
Techniques To Improve Early Recovery Of Urinary Continence



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Key Surgical Principles



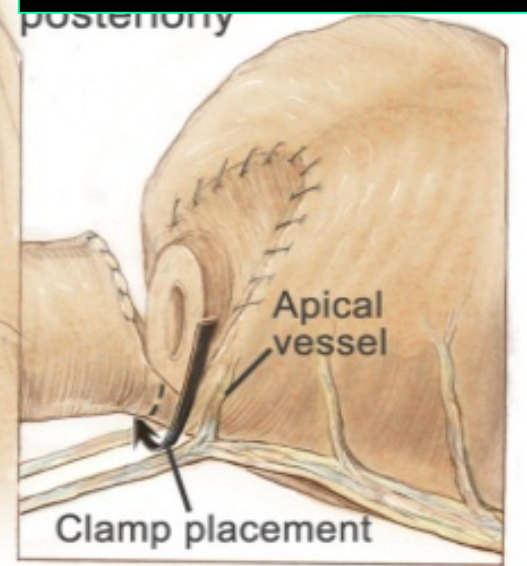
Puboprost. preservation

Anterior suspension

Posterior reconstruction

Bladder neck sparing

Bladder neck intussusception



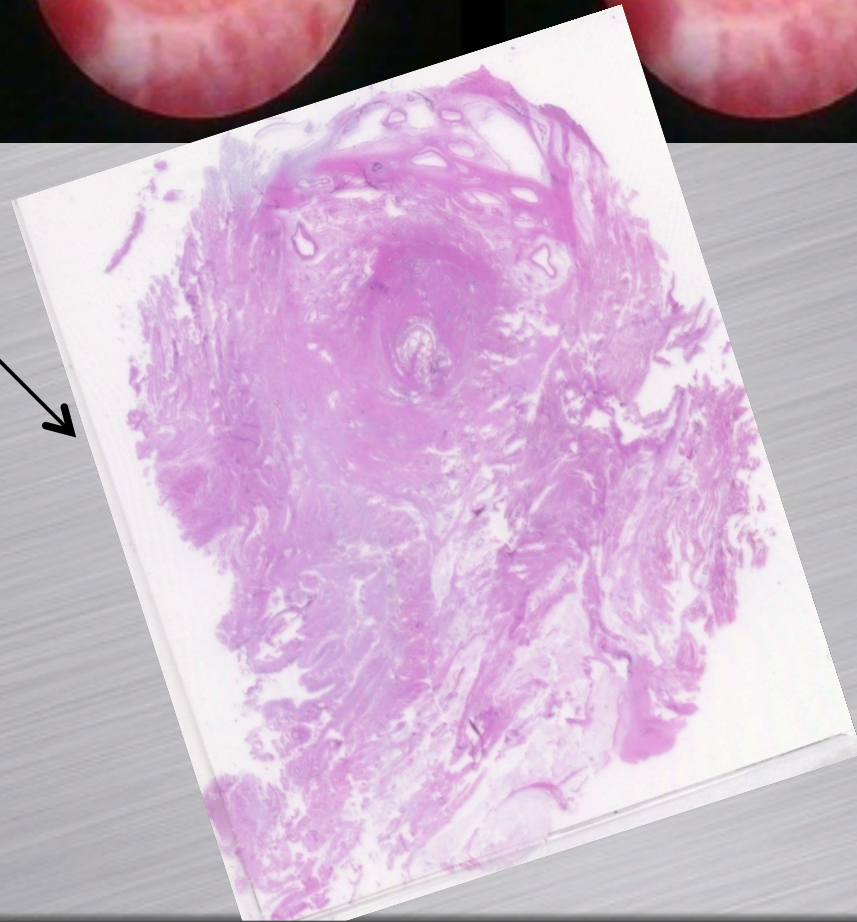
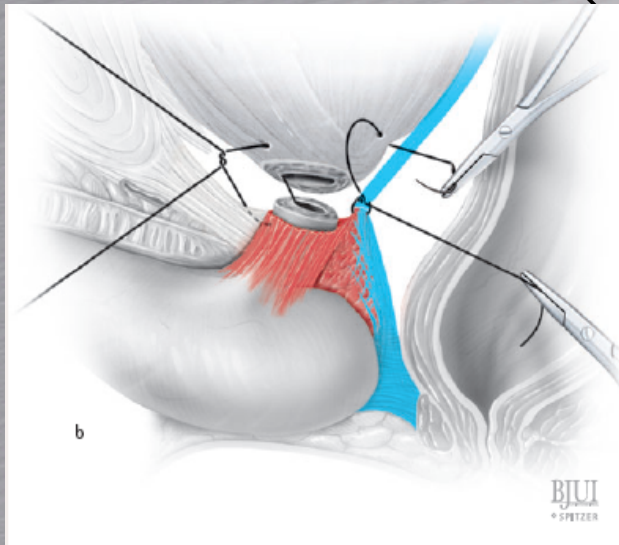
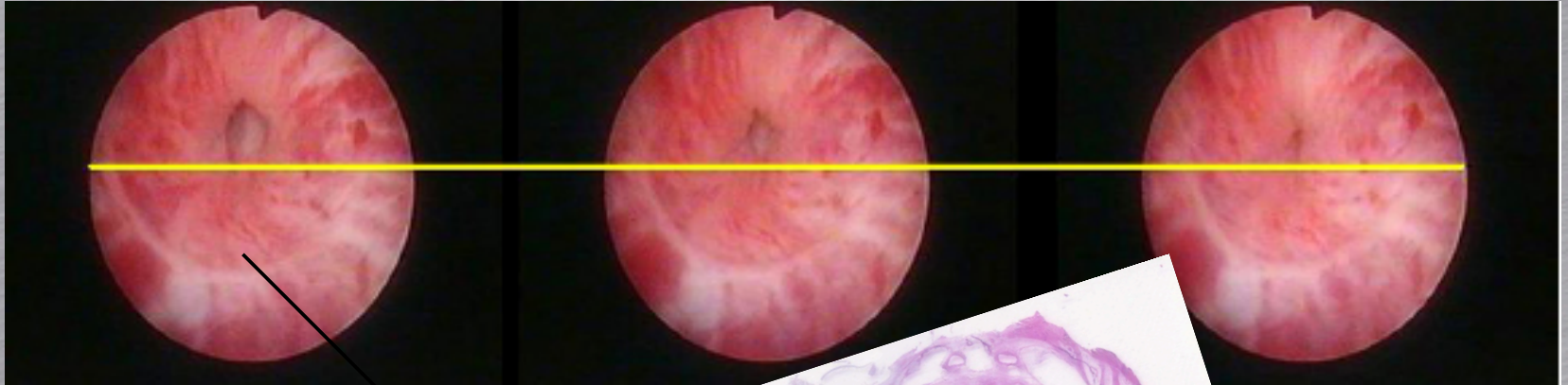
Two functionally independent areas have been



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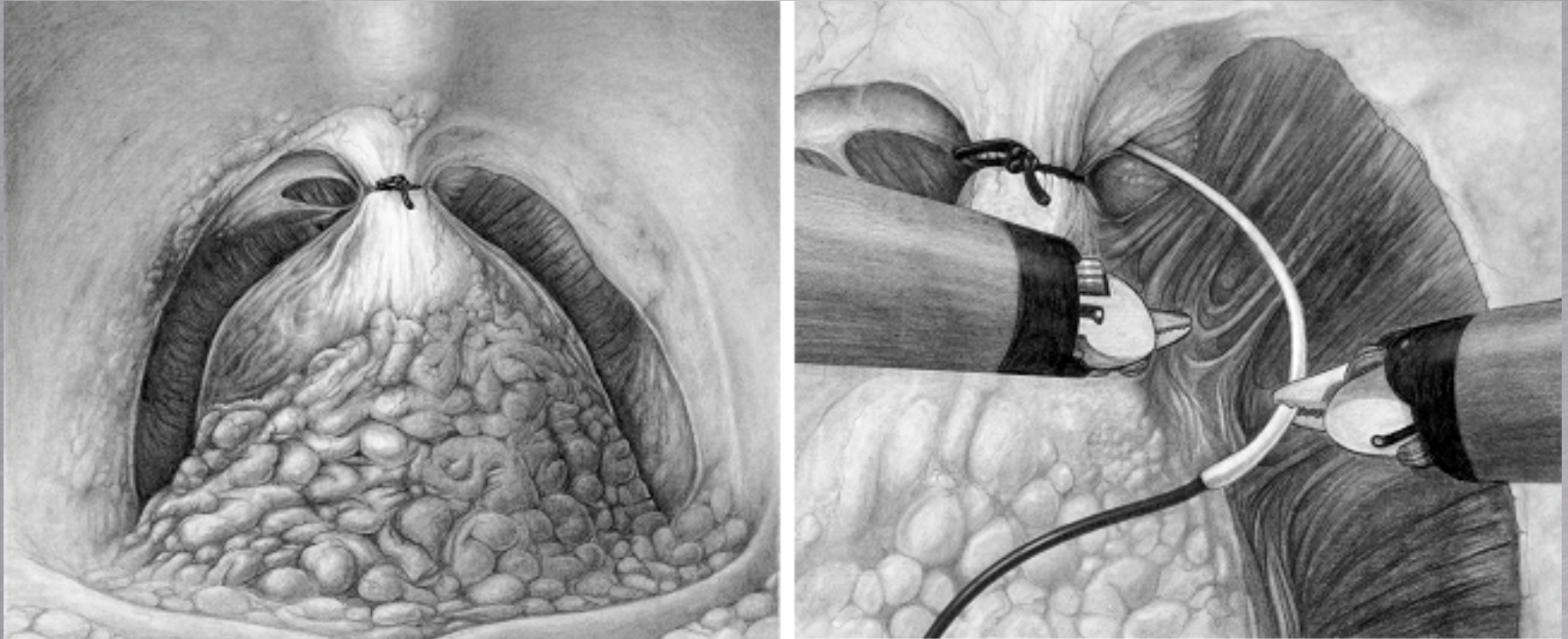
Key Surgical Principles



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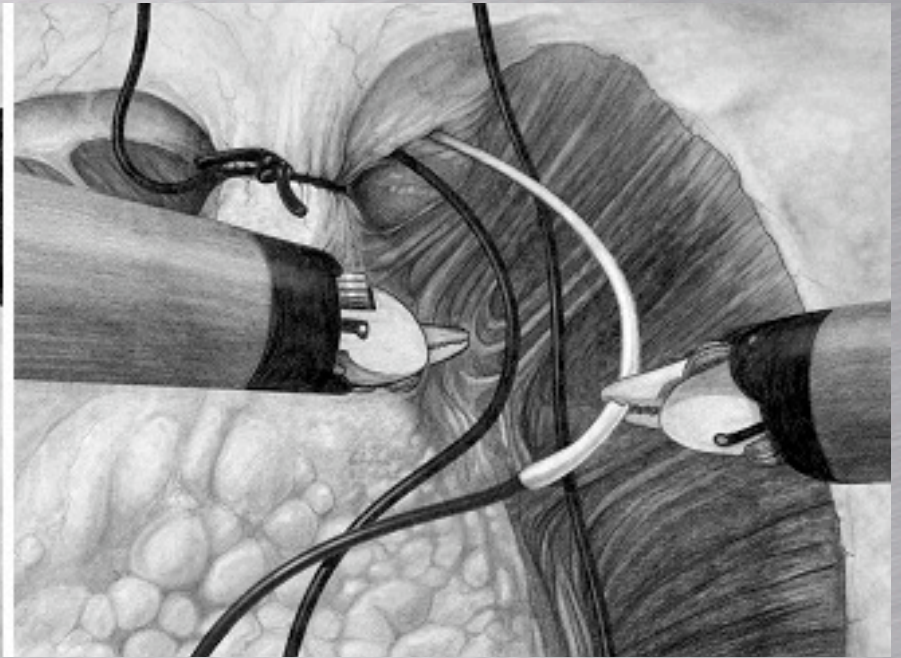
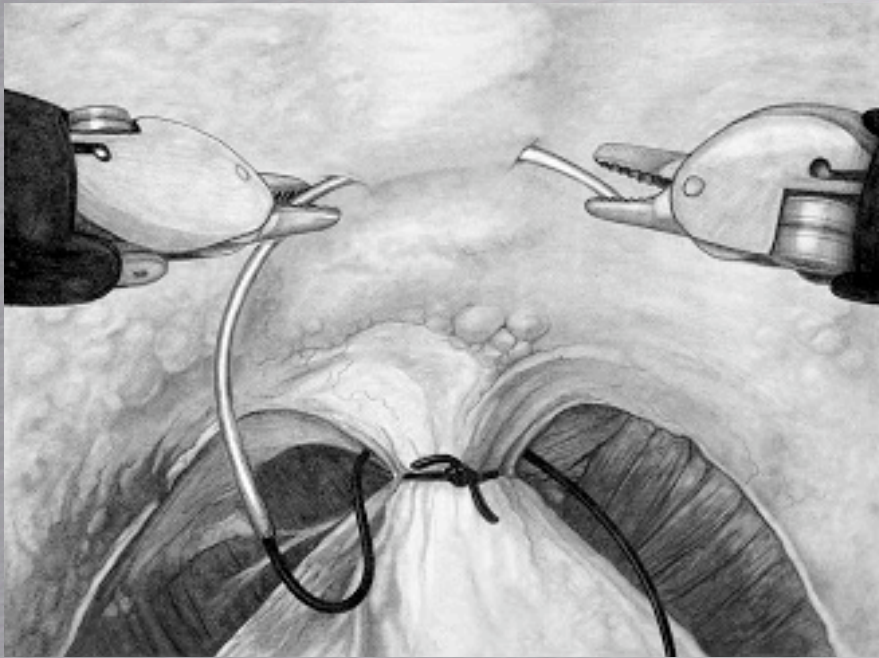
Peri-Urethral Suspension Stitch



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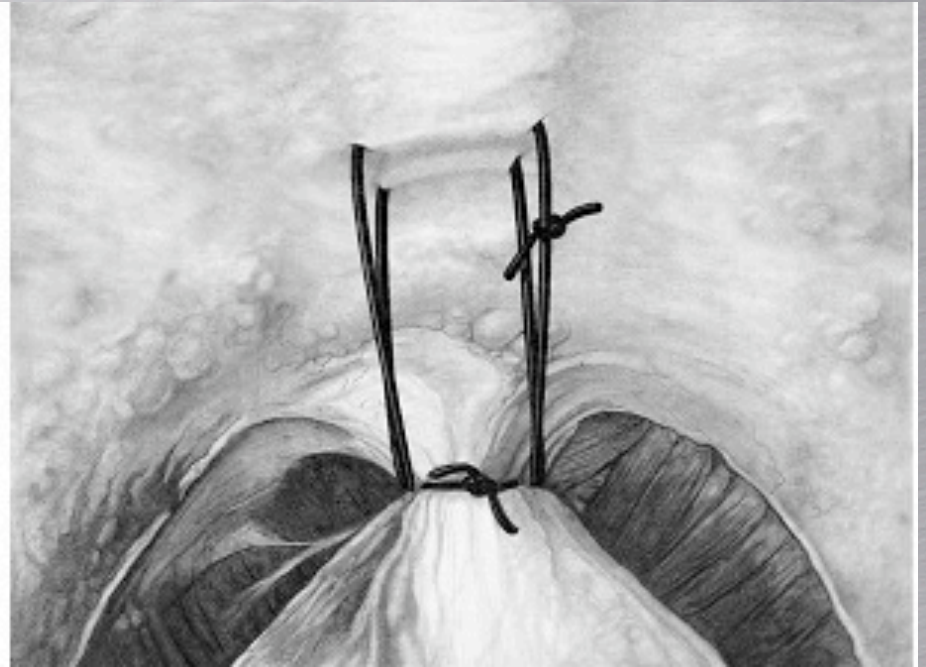
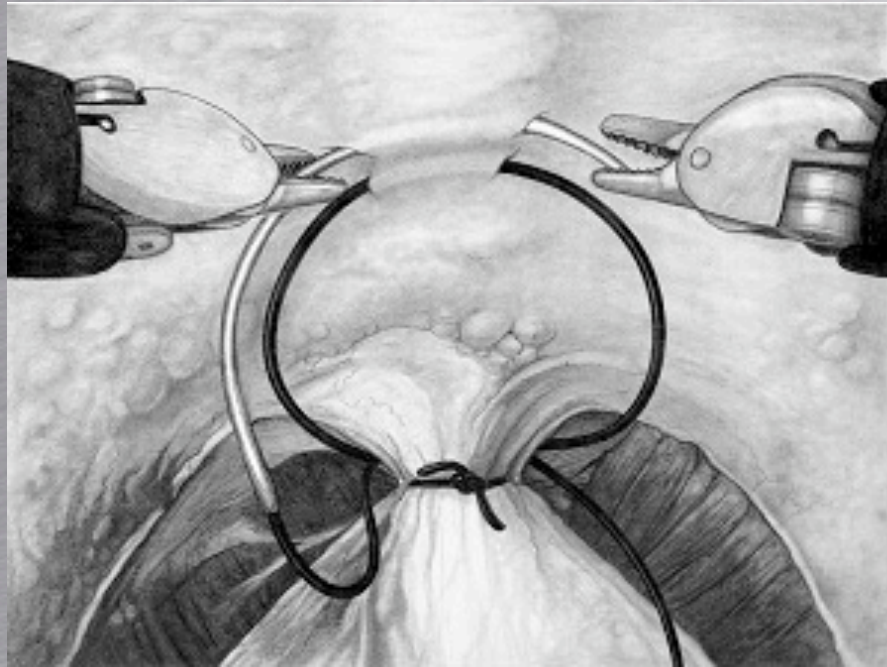
Peri-Urethral Suspension Stitch



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Peri-Urethral Suspension Stitch



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Patients Characteristics

Patients' Characteristics	No-Suspension	Suspension	p-value
Age – years- Median/ mean \pmSD (range)	60/60,1 \pm 6.79 (45-73)	60/59.8 \pm 7.48 (42-79)	0.699
BMI, kg/m2	28.75 \pm 3,59 (20-38)	28.19 \pm 3.61 (20-370)	0.243
PSA level before RALP, ng/mL - mean \pmSD (range)	6.03 \pm 5.03 (0,6-16,3)	5.52 \pm 3.46 (0.5 -13.3)	0.502
Prostate weight (gr) mean \pmSD (range)	51.84 \pm 22.9 (15.3 – 96.6)	52.18 \pm 23.4 (23-155)	0.610
AUA–SS - mean \pmSD (range)	7.61 \pm 7.55 (0-35)	8.21 \pm 7.24 (0-32)	0.410
Biopsy Gleason Score			
≤ 6	48/94(51%)	142/237 (60%)	0.192
7	40/94 (42.6%)	78/237 (33%)	0.127
≥ 8	6/94 (6.4%)	17/237 (7%)	0.988



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Perioperative Parameters

Perioperative parameters	Non-Suspension	Suspension	p-value
Operative time (min)	77,34 ± 11,81 (55-100)	76,28 ± 9,54 (45-100)	0.804
Estimated blood loss (ml)	121,86 ± 54,82 (75-500)	114,02 ± 32,31 (50-400)	0.265
Transfusion rate (%)	0	0	
Catheterization time (days)	5.33 ± 0.72 (4-8)	5.37 ± 1.3 (4-12)	0.110
Nerve-Sparing Procedure			
Bilateral nerve-sparing	58 (61.7%)	150 (63.3%)	0.886
Unilateral nerve-sparing	20 (21.3%)	45 (19%)	0.749
Non nerve-sparing	16 (17%)	42 (17.7%)	0.895



Pathological stage and positive surgical margins

	No-Suspension	Suspension	p-value
Pathologic Stage			
pT2	68/94 (72.3%)	184/237 (77.6%)	0.381
pT3	26/94 (27.6%)	53/237 (22.3%)	0.381
PSM rates	9/94 (9.5%)	29/237 (12.2%)	0.621
pT2	3/68 (5.3%)	12/184 (6.5%)	0.743
pT3	6/26 (23%)	11/53 (20%)	0.989
PSM at the apex	4/94 (4.2%)	15/237(6.3%)	0.639
Gleason Score-Surgical Specimen			
≤6	40/94(42.6%)	105/237 (44.3%)	0.868
7	43/94 (45.7%)	106/237 (44.7%)	0.372
≥ 8	11/94 (11.7%)	26/237 (11%)	0.998



Continence rates

Follow-up time	Without suspension stitch (N=94)	With suspension stitch (N=237)	p-value
1 month	31 (33.0%)	95 (40.0%)	0.282
3 months	78 (83.0%)	220 (92.8%)	0.013
6 months	89 (94.7%)	232 (97.9%)	0.237
12 months	90 (95.7%)	232 (97.9%)	0.479

Accepted for publication in European Urology May 2009



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Periurethral Suspension Stitch During Robot-Assisted Laparoscopic Radical Prostatectomy: Description of the Technique and Continence Outcomes

Vipul R. Patel^{a,b,*}, Rafael F. Coelho^{a,b,c}, Kenneth J. Palmer^{a,b}, Bernardo Rocco^{a,b,d}

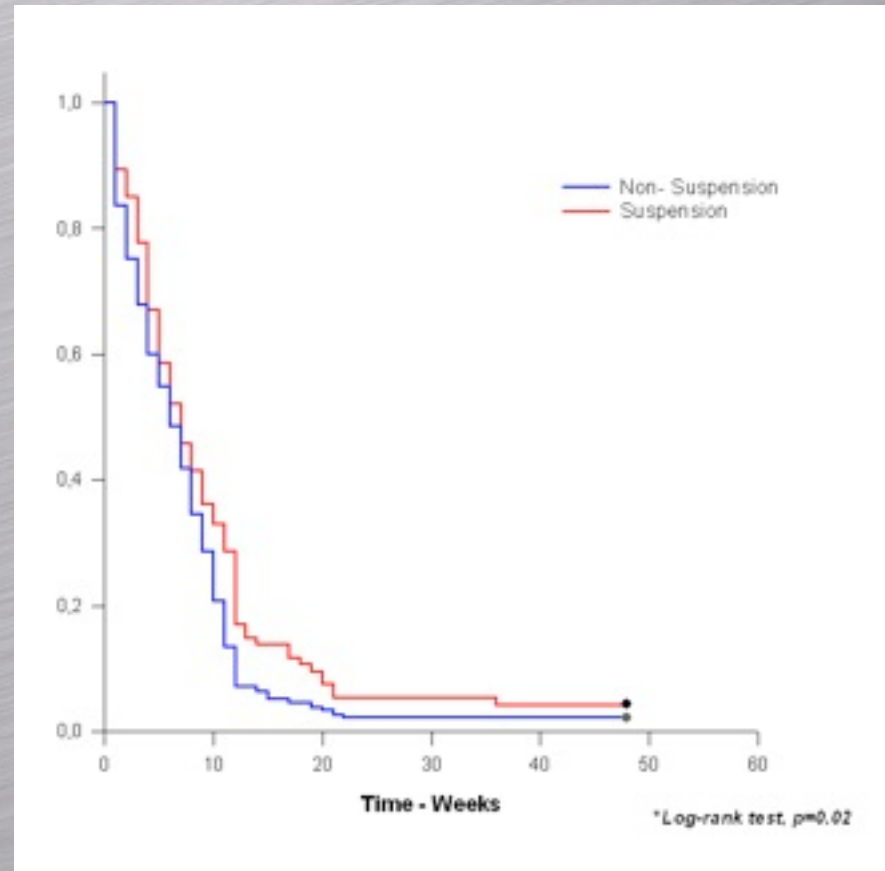
^a Global Robotics Institute, Florida Hospital Celebration Health, Celebration, FL 34747, USA

^b University of Central Florida School of Medicine, Orlando, FL 32826-0116, USA

^c Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo, Divisão de Urologia, São Paulo, Brazil

^d Divisione di Urologia Istituto Europeo di Oncologia, Milano, Italy

European
Urology 2009

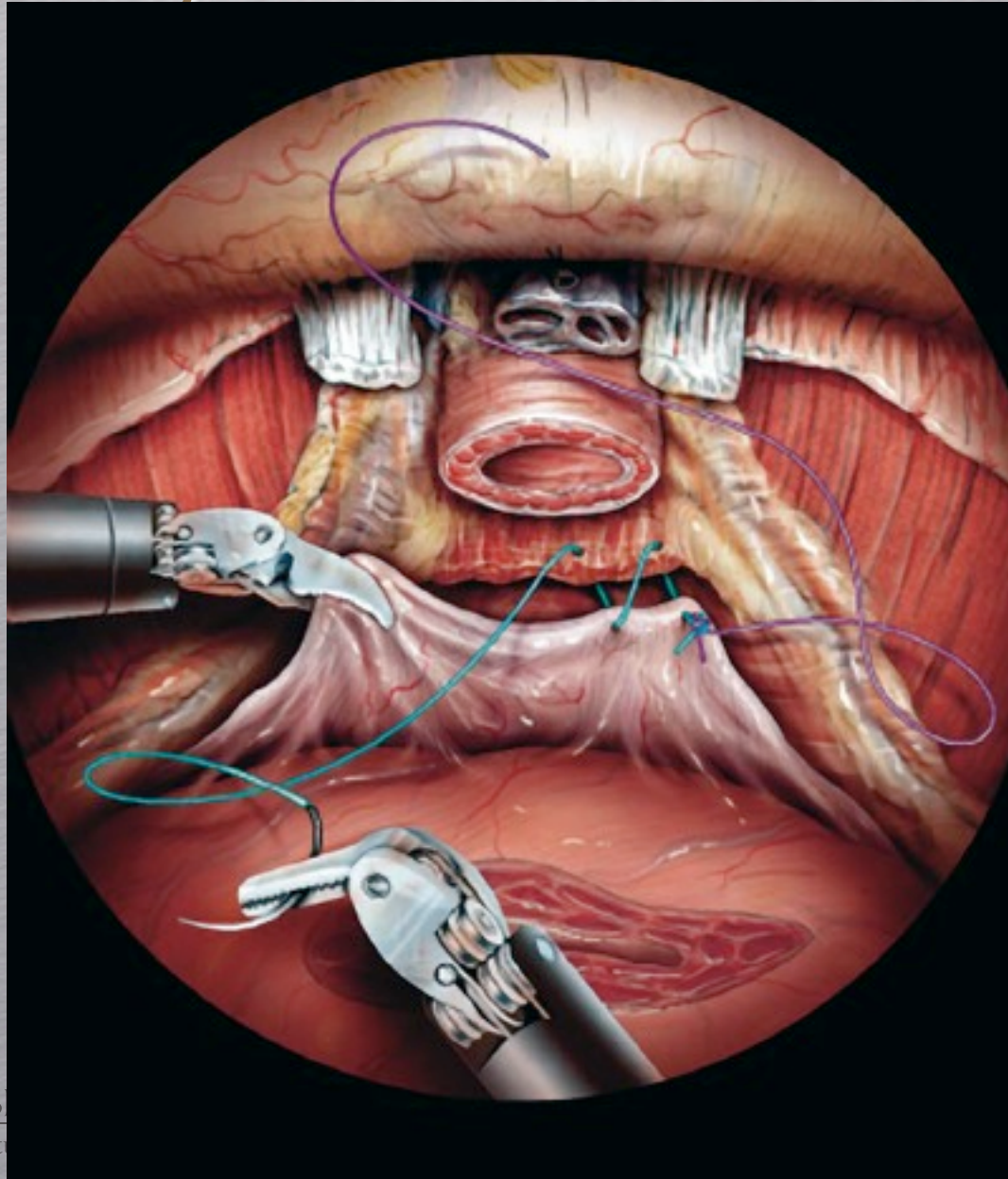


Posterior Reconstruction

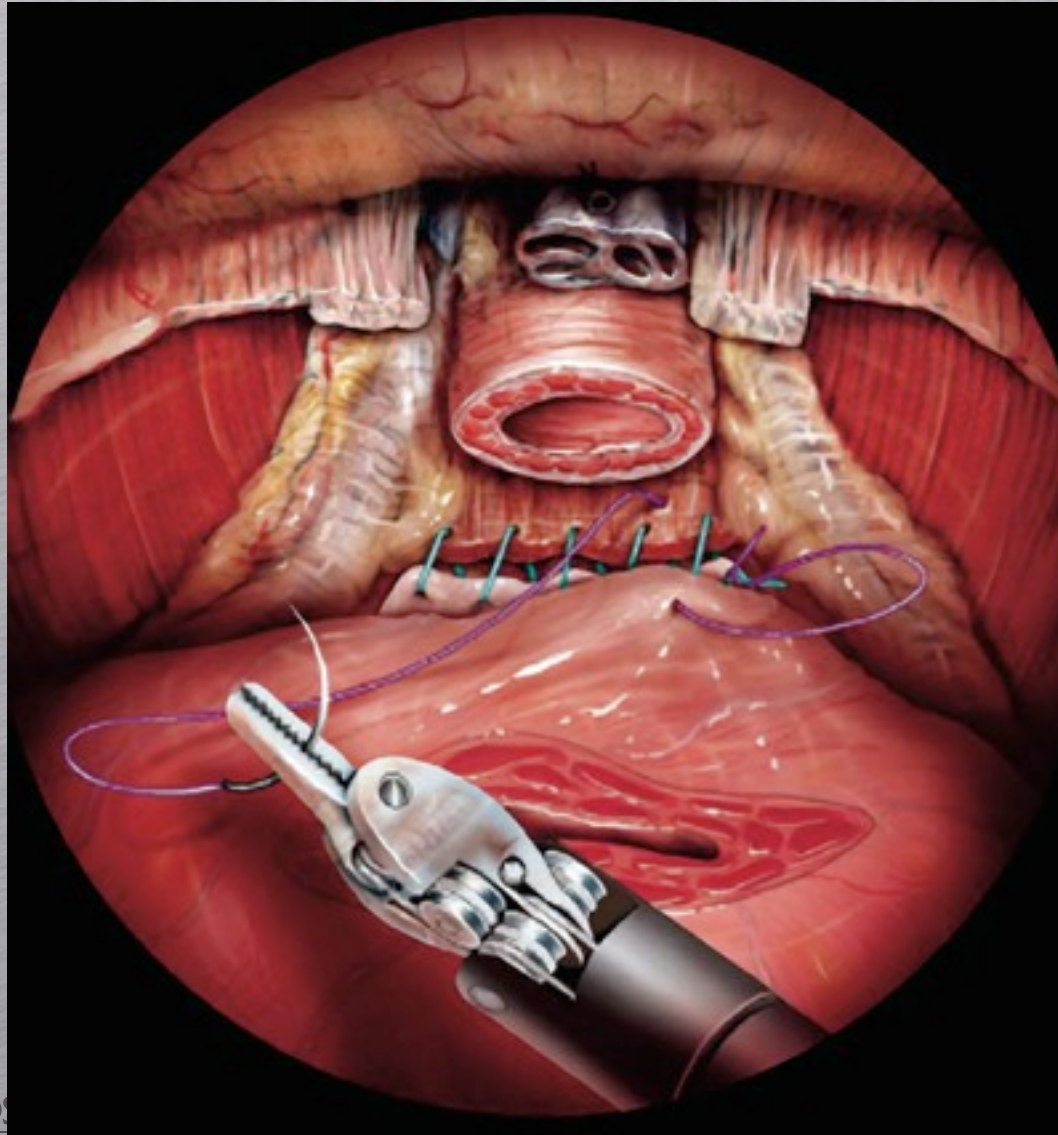
- First introduced by Rocco et al.
 - Open surgical approach
 - Reconnecting Denonvilliers fascia
 - Attaching posterior bladder neck to urethra
- **Technical modifications to robotics:**
 - **Continuous suture**
 - **Second layer through bladder neck**



First Layer of Reconstruction



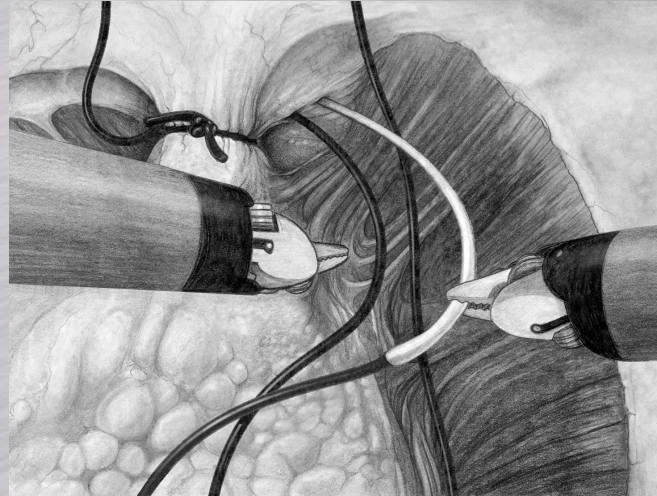
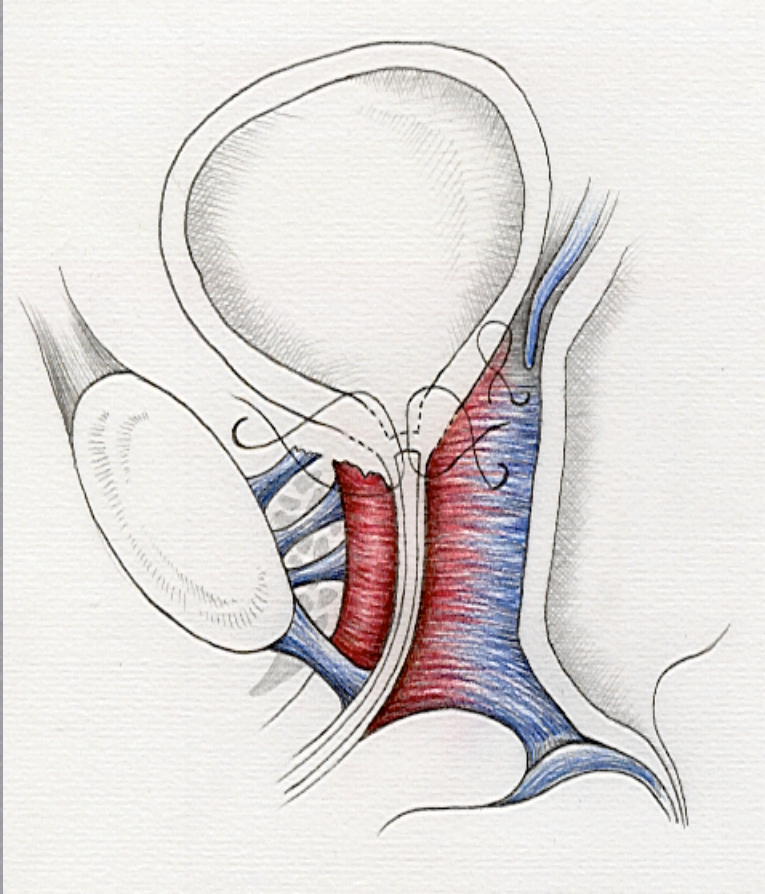
2nd Layer of Reconstruction



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Combined Anterior & Posterior Reconstruction



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Patients' Characteristics	No-Suspension	Suspension	p-value (Suspension Vs.No-Susp)	Susp. plus Posterior Reconst.	p-value (Susp. Vs. Susp. + Posterior)
Age – years Median/mean ± SD (range)	60/60,1± 6.79 (45-73)	60/59.8 ± 7.48 (42-79)	0.699	61/60.2 ± 7.4 (41-79)	0.141
BMI, kg/m2	28.75± 3,59 (20-38)	28.19± 3.61 (20-370)	0.243	27.6 ±3.8 (17-50)	0.145
PSA ng/mL mean±SD (range)	6.03 ± 5.03 (0,6-16,3)	5.52 ± 3.46 (0.5 -13.3)	0.502	5.6±4.0 (0.21-46)	0.758
Prostate weight (gr) mean ±SD (range)	51.84 ± 22.9 (15.3 – 96.6)	52.18 ± 23.4 (23-155)	0.610	52.5±25.6 (22-413)	0.319
AUA–SS – mean ±SD (range)	7.61±7.55 (0-35)	8.21 ± 7.24 (0-32)	0.410	8.39±6.5 (0-35)	0.872
Biopsy Gleason Score					
≤6	48/94(51%)	142/237 (60%)	0.192	279 (58.9%)	0.333
7	40/94 (42.6%)	78/237 (33%)	0.127	157 (33.2%)	0.667
≥ 8	6/94 (6.4%)	17/237 (7%)	0.988	37 (7.9%)	0.667



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Perioperative Parameters

Perioperative parameters	Non-Suspension	Suspension	<i>p-value</i> (Suspension Vs.No-Susp)	Suspension plus Posterior Reconst.	<i>p-value</i> (Susp. Vs. Susp. plus Post.)
Operative time (min)	77,34 ± 11,81 (55-100)	76,28 ± 9,54 (45-100)	0.804	75/78.3±11.4 (50-120)	0.053
Estimated blood loss (ml)	121,86 ± 54,82 (75-500)	114,02 ± 32,31 (50-400)	0.265	117 ± 32 (50-300)	0.102
Transfusion rate (%)	0	0		0	
Catheterization time (days)	5.33 ± 0.72 (4-8)	5.37 ± 1.3 (4-12)	0.110	5.53±1.3 (4-10)	0.388
Nerve-Sparing					
Bilateral NS	58 (61.7%)	150 (63.3%)	0.886		
Unilateral NS	20 (21.3%)	45 (19%)	0.749	73 (15.5%)	0.627
Non NS	16 (17%)	42 (17.7%)	0.895	318(67.2%)	0.372
				82 (17.3%)	0.587

Pathological Stage and Positive Surgical Margins

	No - Suspension	Suspension	p-value (Suspension Vs.No-Susp)	Suspension plus Posterior Reconstruction	p-value (Susp. Vs. Susp. plus Posterior)
Pathologic Stage					0.19
pT2					
pT3			0.381	393(83%)	
	68/94 (72.3%)	184/237 (77.6%)	0.381	80 (17%)	
	26/94 (27.6%)	53/237 (22.3%)			
Overall PSM	9/94 (9.5%)	29/237 (12.2%)	0.621	54/473 (11.4%)	0.912
PSM - pT2		12/184 (6.5%)	0.743	28/393 (7.1%)	0.823
PSM - pT3	3/68 (5.3%)		0.989	26/78 (33.3%)	0.672
	6/26 (23%)	11/53 (20%)			



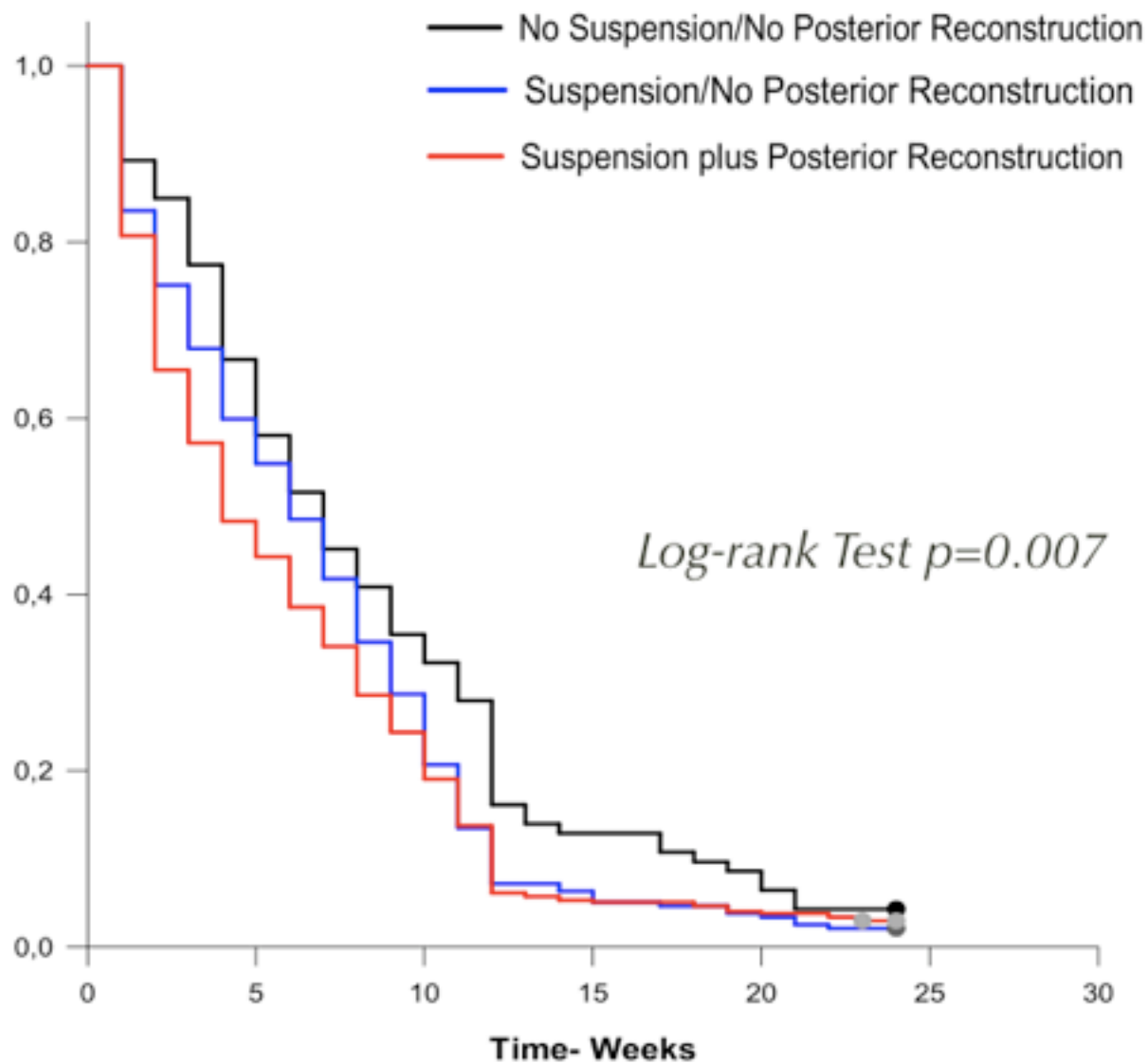
Continence rates

Follow-up time	No-Suspension	Suspension	<i>p-value</i> (Suspension Vs.No-Susp)	Suspension plus Posterior Reconstruction	<i>p-value</i> (Susp. Vs. Susp. plus Posterior)
1 month	31/94 (33.0%)	95/237 (40.0%)	0.282	244/473 (51.6%)	0.005
3 months	78/94 (83.0%)	220/237 (92.8%)	0.013	431/473 (91.1%)	0.527
6 months	89/94 (94.7%)	232/237 (97.9%)	0.237	459/473 (97%)	0.678



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The Trifecta:

Cancer Control

Urinary Continence

Sexual Function

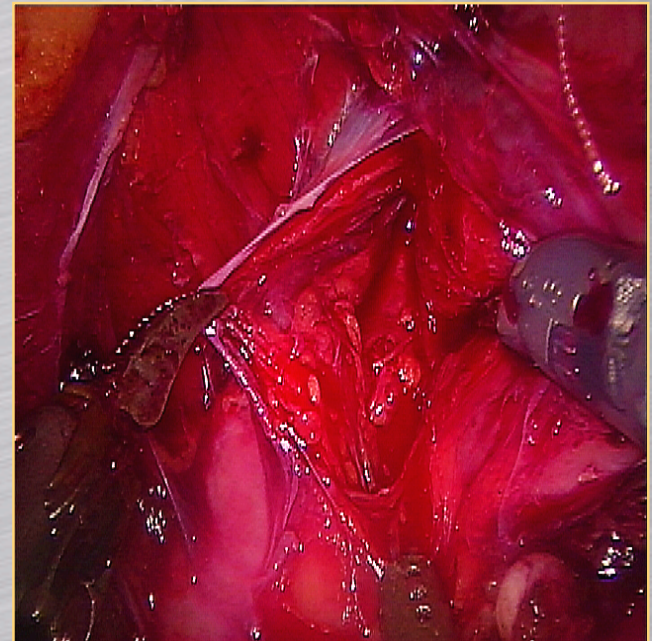


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Nerve Sparing

- Athermal, atraumatic nerve preservation
- Advantages of robotics:
 - Pneumoperitoneum
 - Visualization- 3D, 10x
 - Dexterity of instrumentation- 7 dof



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RALP: Potency Outcomes

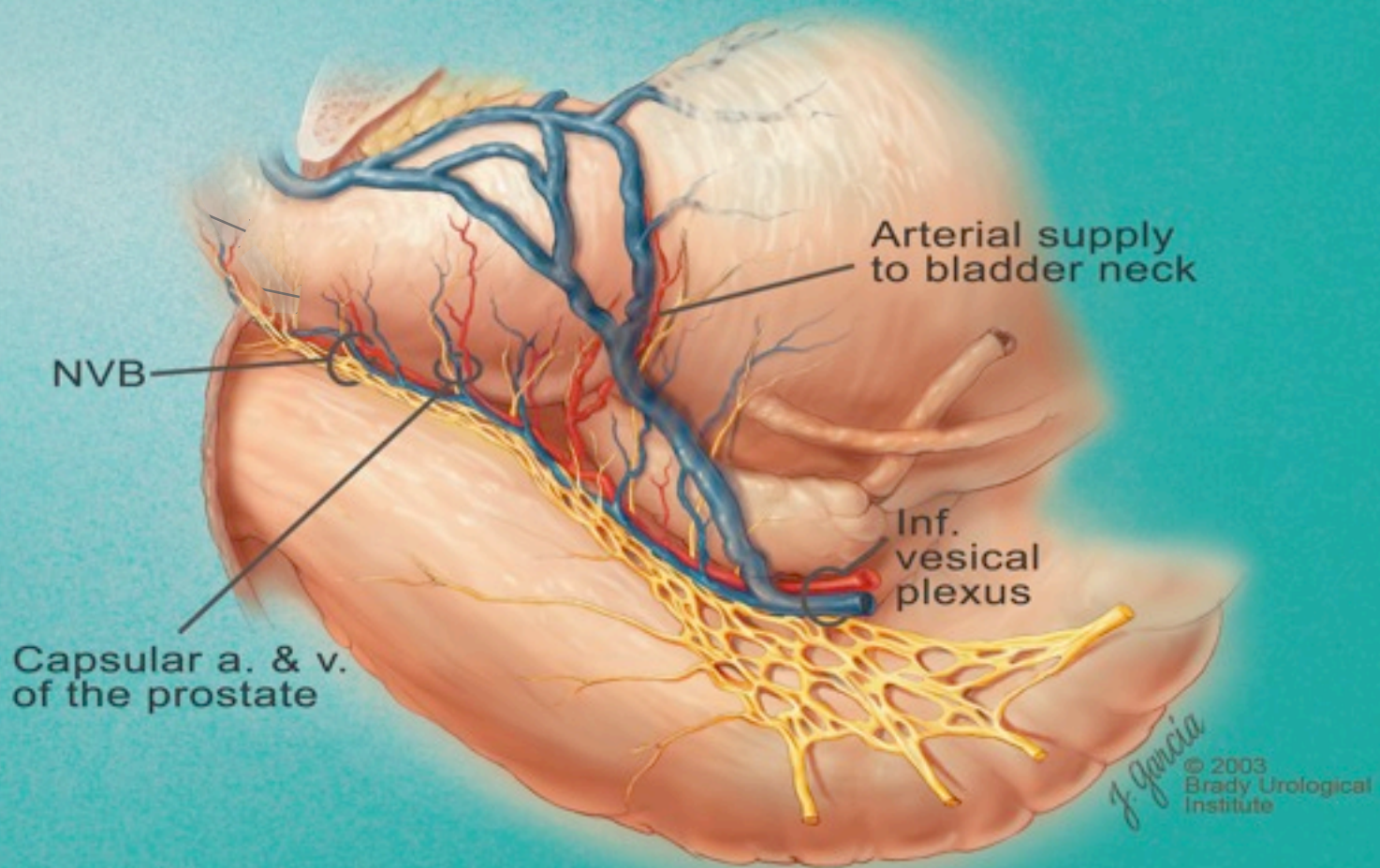
Authors	Year	Patients (N)	Median/Mean Age	Type of Nerve Sparing			Follow-up (months)	Potency		Overall Potency Rates after Nerve-sparing procedure (considering bilateral AND unilateral NS)			
				Unilateral	Bilateral	NNS		Unilateral NS	Bilateral NS	3 month	6 month	12 month	>18 month
Joseph [15]	2006	325	60	23,6%	70%	6,4%	12	58%	80,60%	-	77,1%	-	-
Menon [39]	2007	1142	60,2	25,00% (unilateral veil)	33,00% (bilateral veil)		>18	-	100%	-	-	70% (bilateral veil NS)	100% (bilateral veil NS)
Mottrie [17]	2007	184	62	13%	64,5%	18,1%	6	47%	70%	-	66,6%	-	-
Zorn [40]	2007	300	59,4	26,40%	59,60%	14%	24	62,00%	83,00%	47%	58%	74%	76,5%
Patel [37]	2007	500	63,2	-	-	-	12	-	-	-	-	78%	-
Tewari [49]	2008	215	60	11%	85%	4%	12	-	87%	-	-	-	-
Krambeck[26]	2009	294	61	91%		9%	12	-	-	-	-	70%	-
Rocco[28]	2009	120	63	-	-	-	12	-	-	31%	43%	61%	-
Murphy[27]	2009	395	60,2	28,2% of potent men	65,3% of potent men	-	12	-	-	-	-	62%	-
Finley[50]	2009	42 (using cautery)	56,5	26%	74%	-	>18	50%	67,8%	8,3%	14,7% (9 months)	43,2%	63,1%
		62 (cautery free)	57	26%	74%	-	>18	80%	93%	32,1%	57,1% (9 months)	76,6%	89,6%
Van der Poel [51]	2009	107	59,6	45,8%	54,2%	-	6	40,8%	63,8%	-	53%	-	-
Weighted Means			60.6	23.5%	53.2%			56.4%	89.3%	38.4%	61.1%	71.2%	94%



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Open Approach: Retrograde NVB Dissection



Techniques To Improve Early Recovery Of Sexual Function



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My Approach To Nerve Preservation

- Approaches to prostatic pedicle:
 - Antegrade approach with early retrograde release of NVB's
- Approaches to fascia:
 - Interfascial or incremental
- Thermal or athermal:
 - Athermal- clip



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J Robotic Surg (2009) 3:13–17
DOI 10.1007/s11701-009-0127-9

ORIGINAL ARTICLE

Athermal early retrograde release of the neurovascular bundle during nerve-sparing robotic-assisted laparoscopic radical prostatectomy

**Geoffrey Coughlin · Pankaj P. Dangle ·
Kenneth J. Palmer · Srinivas Samevedi · Vipul R. Patel**



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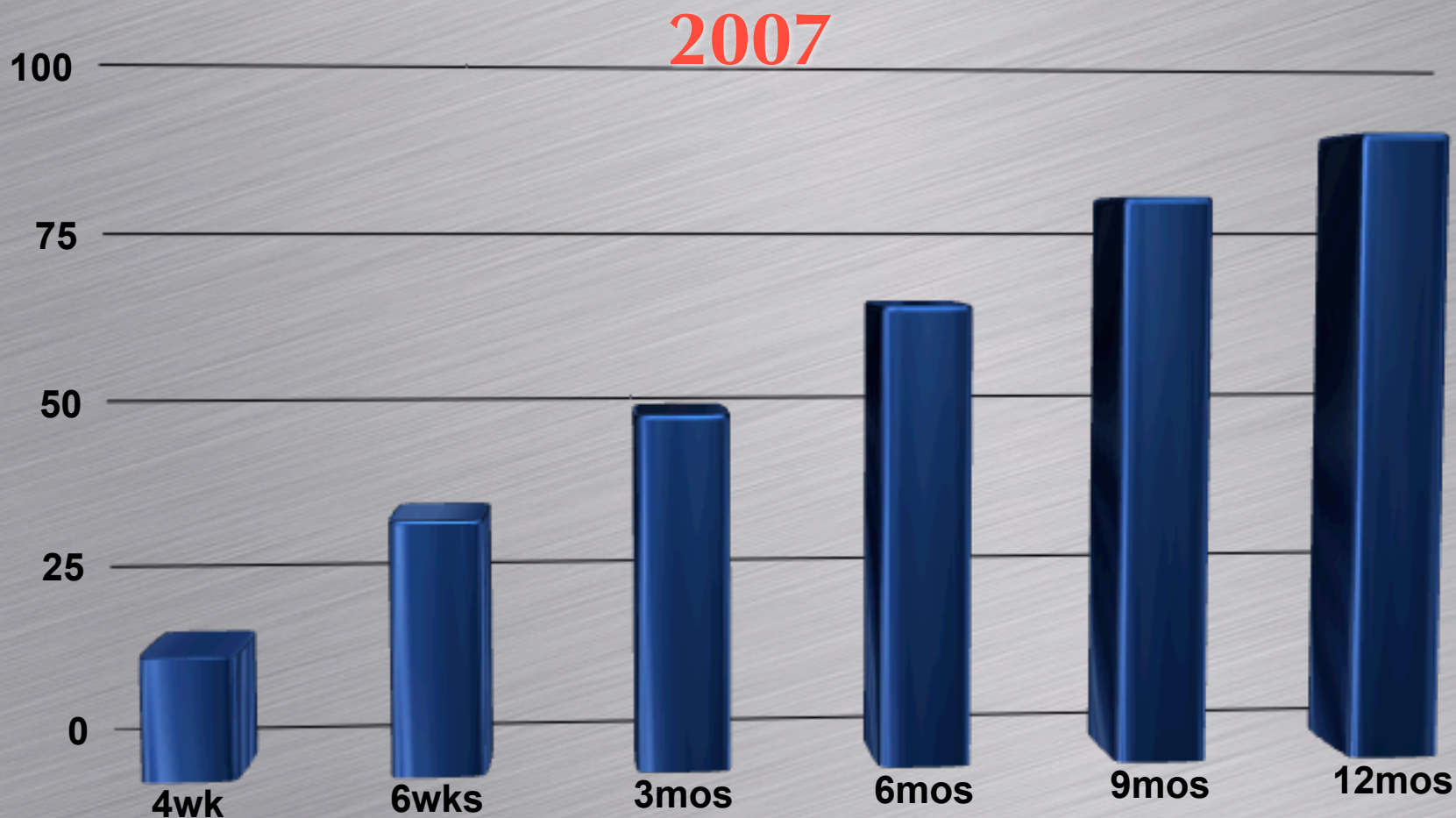
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Return Of Sexual Function

- Use of validated questionnaires:
 - SHIM, EPIC, IIEF
- Definition of potency
 - with or without PDE 5
 - Questions 2 and 5 of SHIM
 - Scale of 1-5, Potent if greater than or equal to 4
 - Ability to achieve an erection and have satisfactory intercourse much more that half of the time



Bilateral Retrograde Nerve Sparing Patient Pre-op SHIM > 21

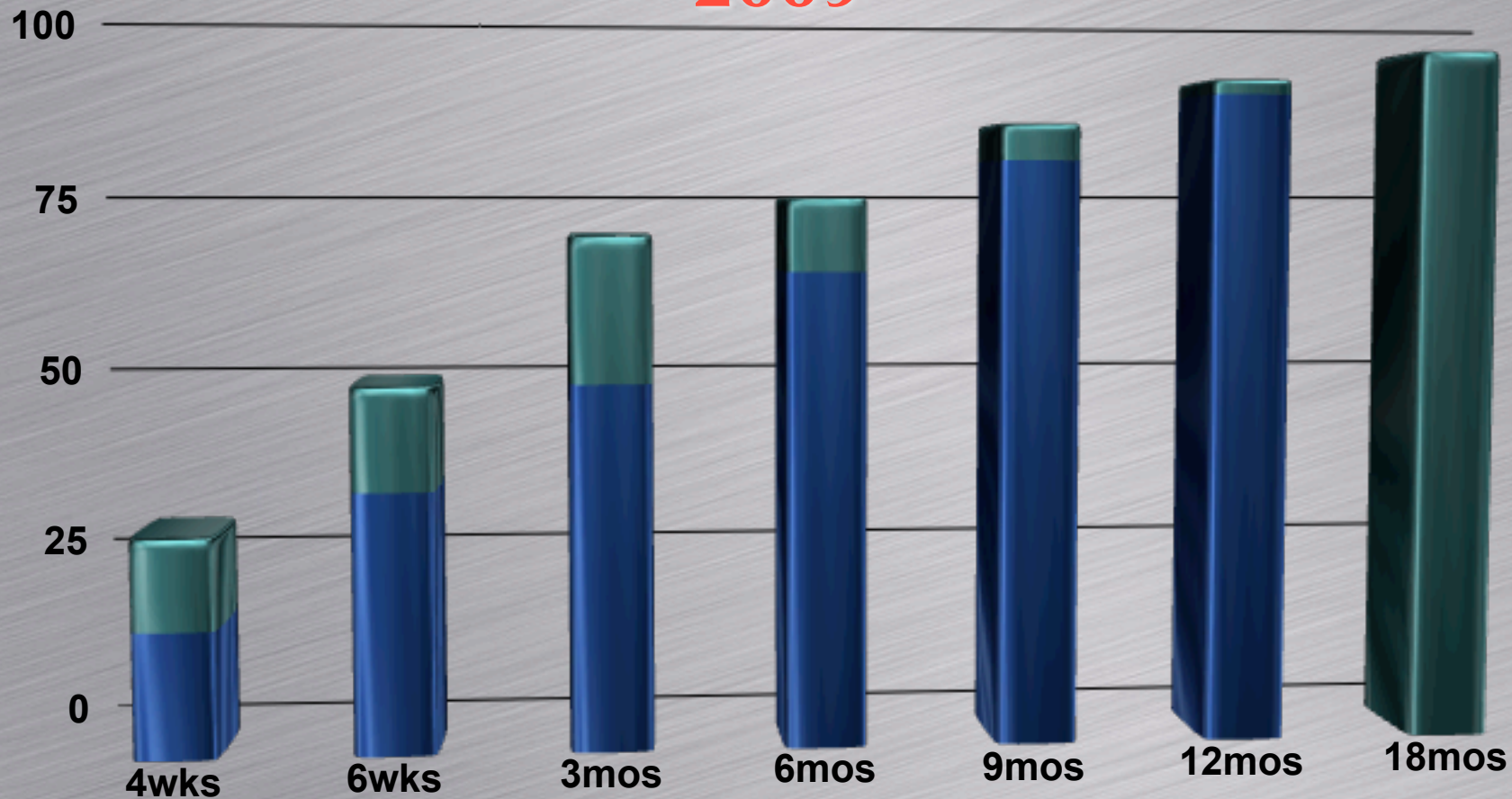


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Bilateral Retrograde Nerve Sparing Patient Pre-op SHIM > 21

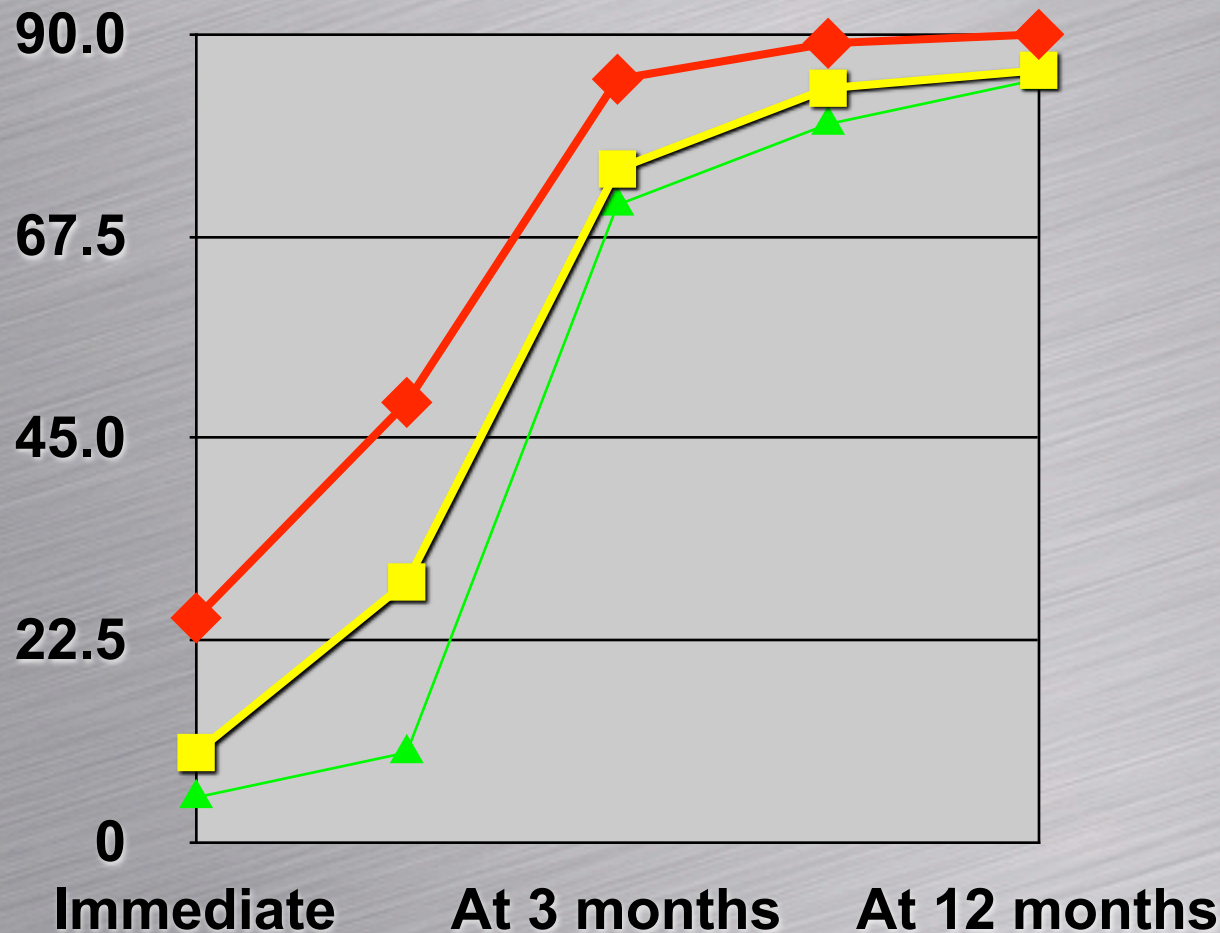
2009



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Potency Outcome Based On Patient's Age



At 12 months:

<55 yrs – 89.7%

56-65 yrs – 86.8%

>66 yrs – 85%

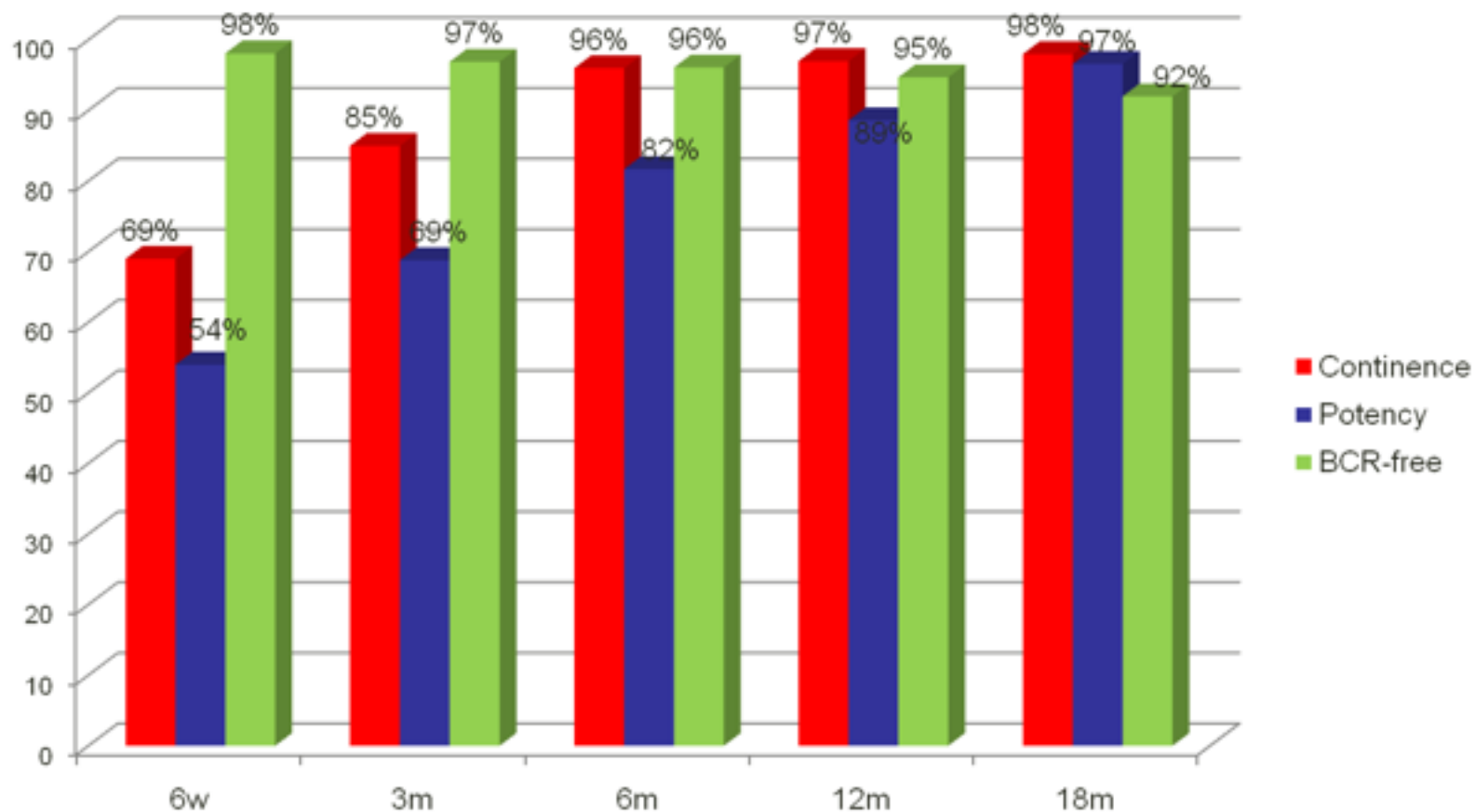
In <55 yrs patients,
potency immediate
and at 1 month was
statistically
significant
(Cochran-Armitage
test)



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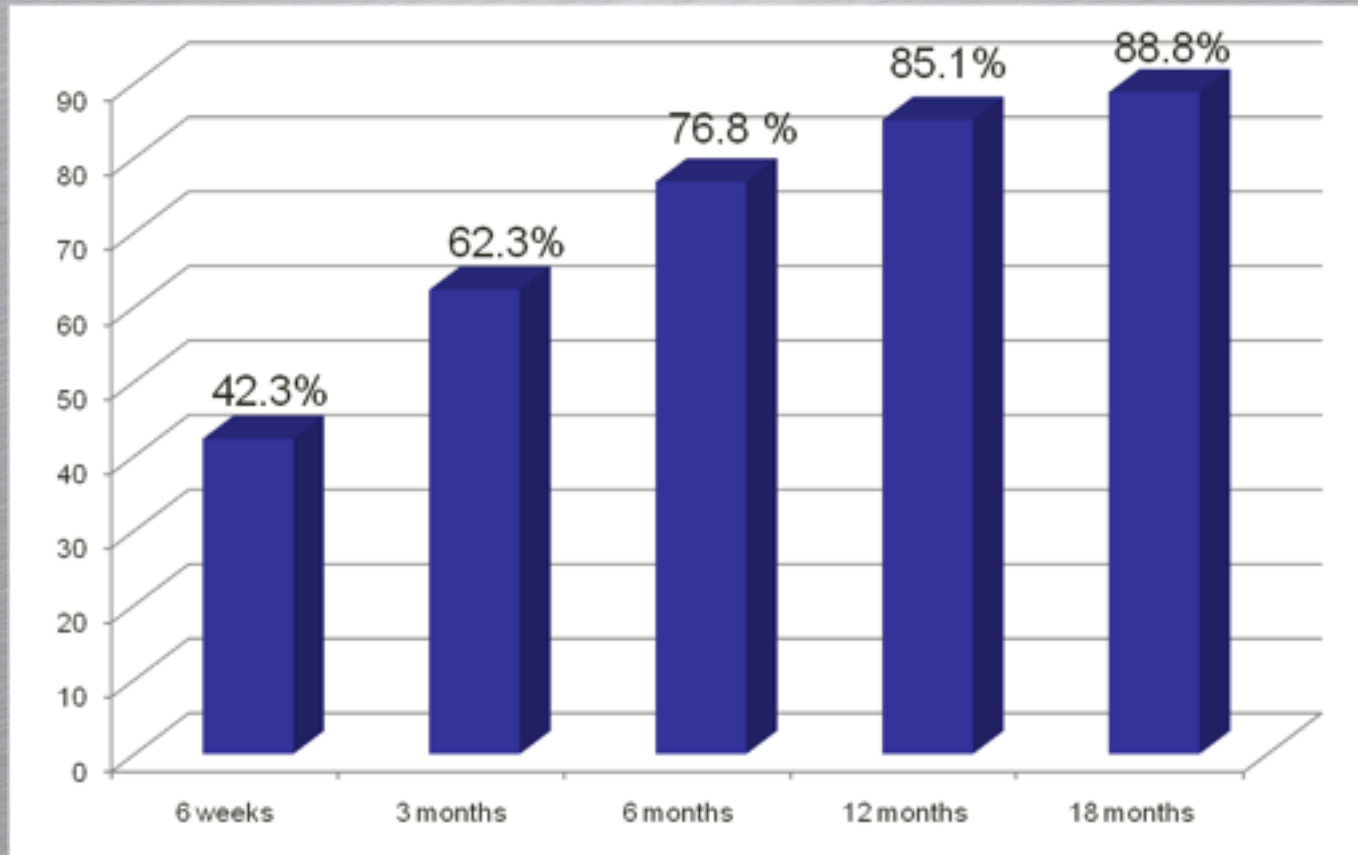
Oncologic and Functional Outcomes



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Trifecta Rates

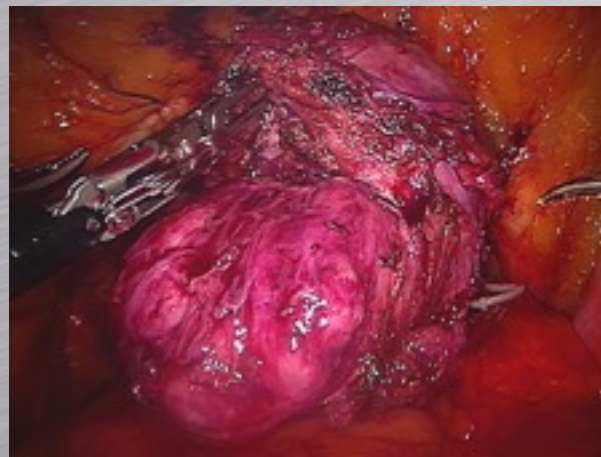


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Challenging Surgical Anatomy

Tips & Tricks



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Conclusions

- Robotic prostatectomy built on the principles of open surgery can be a quality operation
- The procedure is effective in experienced hands
 - The procedure is in evolution
 - Many questions still need to be answered
 - 10 year data is not available yet, but there is a lot of very good data available



Key Principles To Achieving Quality Outcomes

- Follow the principles of open surgery
 - Do not cut corners !
- Minimize trauma to the tissues:
 - no thermal energy use during nerve preserving surgery
 - water tight anastomosis and preservation of the continence mechanisms
- Closely monitoring the outcomes
 - Validated questionnaires
 - self analysis of videos





Robotic Radical Prostatectomy Lessons Learned: 3000 Cases



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Director, Global Robotics Institute

Assoc Professor of Urology @ Univ of Central Florida

Director of Urologic Oncology



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Journal Of Robotic Surgery

- Established in 2006
- Multi-specialty:
 - Urology, Gyn, ENT, Gen Surg, Cardiac
 - Allied health, executives
- Original articles, tips and tricks
- Video online
- Springer publisher



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