Robotic Assisted Radical Prostatectomy CHIAROSCURO

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Potential advantages for the surgeon: 3-D Vision

Twin optical paths, fused to give 3-D image

Potential advantages for the surgeon: laparoscopic instruments with 7 degree of freedom

Traditional laparoscopy

Endowrist® Instrument

Potential advantages for the surgeon and for the patient

- Ergonomy better
- More natural handling
- Classical advantages of laparoscopy
- Ultraprecise dissection possible

eau
European Association of Urology

Review – Prostate Cancer

Retropubic, Laparoscopic, and Robot-Assisted Radical Prostatectomy: A Systematic Review and Cumulative Analysis of Comparative Studies

Vincenzo Ficarra, Giacomo Novara, Walter Artibani, Andrea Cestari, Antonio Galfano, Markus Graefen, Giorgio Guazzoni, Bertrand Guillonneau, Mani Menon, Francesco Montorsi, Vipul Patel, Jens Rassweiler, Hendrik Van Poppel

Outcomes evaluated

- Intraoperative and perioperative
  - tissue damage, operative time, blood loss, transfusion rate, in-hospidal stay, catheter time, overall complication rates
- Oncological
  - positive surgical margins, bDFS, OS and CSS
- Functional
  - urinary continence and potency recovery

Robot-assisted Radical Prostatectomy: Possible outcomes

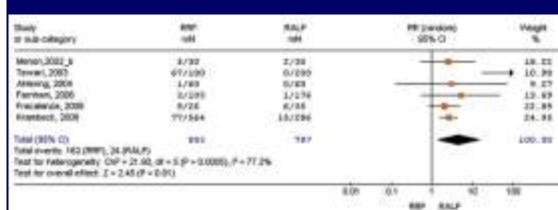
- Perioperative data and learning curve
- Oncological results
- Continence recovery
- Potency recovery

Operative time and blood loss: RALP vs RRP

Cumulative analyses of operative time and blood loss were not possible

Level	Study	No. of cases, type	Median/mean operative time, min	Median/mean blood loss, ml	Transfusion rate, %
2b	Menon et al [illegible]	30 RRP	[illegible]	[illegible]	[illegible]
		30 RALP	[illegible]	[illegible]	[illegible]
	Tewari et al [illegible]	100 RRP	[illegible]	[illegible]	[illegible]
		200 RALP	[illegible]	[illegible]	[illegible]
	Farnham et al [illegible]	[illegible] RRP	–	[illegible]	[illegible]
		176 RALP		[illegible]	[illegible]
	Nelson et al [illegible]	374 RRP	–	–	–
		629 RALP			
	Ficarra et al [illegible]	[illegible] RRP	[illegible]	[illegible]	[illegible]
		[illegible] RALP	[illegible]	[illegible]	[illegible]
	Krambeck et al [illegible]	[illegible] RRP	[illegible]	–	[illegible]
		[illegible] RALP	[illegible]		[illegible]
4	Ahlering et al [illegible]	60 RRP	[illegible]	[illegible]	[illegible]
		60 RALP	[illegible]	[illegible]	[illegible]

Transfusion rate: RALP vs RRP

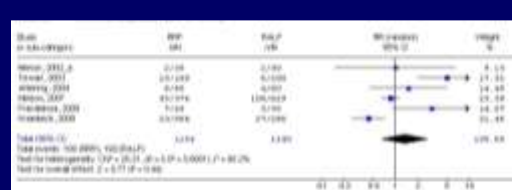


Catheterisation and in-hospital stay : RALP vs RRP

Cumulative analyses of catheterisation time an in-hospital stay were not possible

Level	Study	No. of cases, type	Catheterisation duration, d	In-hospital stay, d	Overall complication rate, %
2b	Menon et al [illegible]	30 RRP	[illegible]	[illegible]	[illegible]
		30 RALP	[illegible]	[illegible]	[illegible]
	Tewari et al [illegible]	100 RRP	[illegible]	[illegible]	[illegible]
		200 RALP	[illegible]	[illegible]	[illegible]
	Farnham et al [illegible]	[illegible] RRP	–	–	[illegible]
		176 RALP			
	Nelson et al [illegible]	374 RRP	–	[illegible]	[illegible]
		629 RALP		[illegible]	[illegible]
	Ficarra et al [illegible]	[illegible] RRP	–	[illegible]	[illegible]
		[illegible] RALP		[illegible]	[illegible]
	Krambeck et al [illegible]	[illegible] RRP	–	–	[illegible]
		[illegible] RALP			[illegible]
4	Ahlering et al [illegible]	60 RRP	[illegible]	[illegible]	[illegible]
		60 RALP	[illegible]	[illegible]	[illegible]

Overall complication rate: RALP vs RRP



Perioperative parameters: RALP vs LRP

Level of evidence	Study	No. of cases, type	Median/mean operative time, min	Median/mean blood loss, ml	Transfusion rate, %	Catheterisation duration, d	In-hospital stay, d	Overall complication rate, %
2b	Menon et al [16]	40 LRP	[illegible]	[illegible]	[illegible]	–	[illegible]	–
		40 RALP	[illegible]	[illegible]	[illegible]		[illegible]	
2b	Hu et al [31]	[illegible] LRP	[illegible]	[illegible]	[illegible]	–	–	[illegible]
		[illegible] RALP	[illegible]	[illegible]	[illegible]			[illegible]
	Rozet et al [35]	[illegible] LRP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible] RALP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	Joseph et al [37]	50 LRP	[illegible]	[illegible]	[illegible]	–	–	–
		50 RALP	[illegible]	[illegible]	[illegible]			

- Operative time (p=0.58), blood loss (p=0.96), transfusion rate (p=0.09) and overall complications (p=0.16) were overlapping
- Cumulative analyses of catheterisation time and in-hospital stay were not possible

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EUROPEAN UROLOGY 57 (2010) 363–370

Prospective Evaluation With Standardised Criteria for Postoperative Complications After Robotic-Assisted Laparoscopic Radical Prostatectomy

Giacomo Novara, Vincenzo Ficarra, Carolina D'Elia, Silvia Secco, Stefano Cavalleri, Walter Artibani

EUROPEAN UROLOGY 57 (2010) 371–386

Comprehensive Standardized Report of Complications of Retropubic and Laparoscopic Radical Prostatectomy

Farhang Rabbani, Luis Herran Yunis, Rodrigo Pinochet, Lucas Nogueira, Kinjal C. Vora, James A. Eastham, Bertrand Guillonneau, Vincent Laudone, Peter T. Scardino, Karim Touijer

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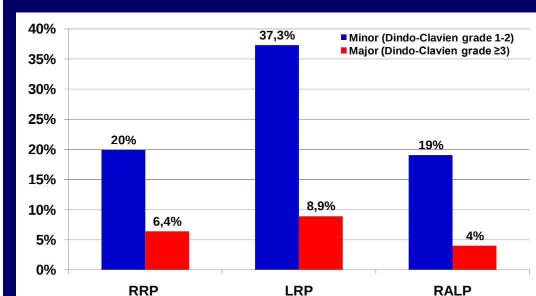
Overall complication rate



Novara G, Artibani W, et al. Eur Urol 2010; 57: 363 – 370
Rabbani F, et al. Eur Urol 2010; 57: 371-386

Perioperative data and postoperative morbidity

- LRP and RALP allowed a significant reduction in blood loss and perioperative transfusion rates compared with RRP
- The main comparative studies showed a significant advantage for laparoscopic approaches both in terms of catheterization and in-hospital stay duration

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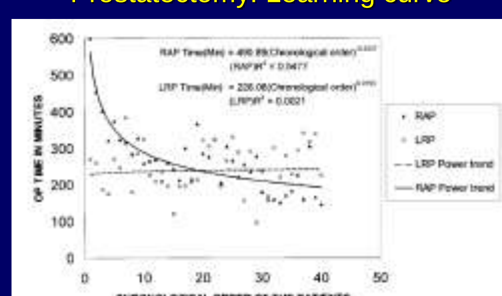
Perioperative data and postoperative morbidity

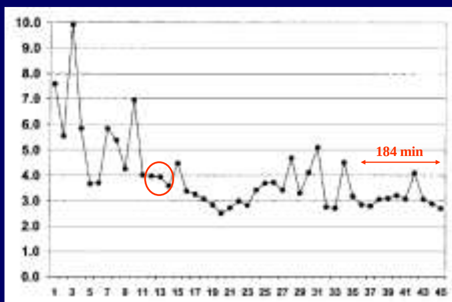
- Operative time is shorter in RRP, while the figures for LRP and RALP were similar
- Differences between LRP/RALP and RRP decrease with improved experience
- RALP can simplify the learning process, allowing quicker reduction in the operative time compared to RP

Robot-assisted Laparoscopic Radical Prostatectomy: Learning curve



Menon et al, J Urol 168: 945-949, 2002

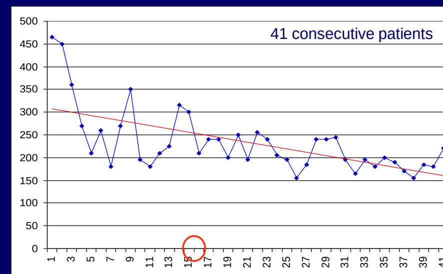
Robot-assisted Laparoscopic Radical Prostatectomy: Learning curve



Ahlering et al, J Urol 170: 1738-1741, 2003

Learning curve: personal experience

Mean operative time: 226.5 ± 68.9 (median 210; i.r. 182-240)



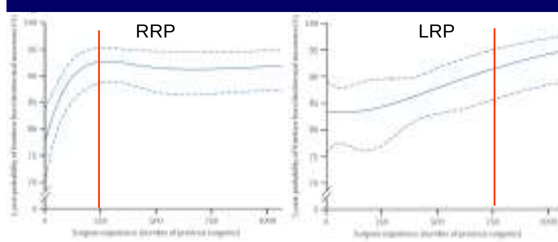
Artibani W. et al Urol Intern 2008;80:237–244

Learning curve: personal experience

	Pts 1-10	Pts 11-20	Pts 21-41	p Value
Anesthesia time	380	320	270	<0.001
Operative time	270	222	195	<0.001
Blood loss	700	400	300	0.02
Transfusion rate	4 (40%)	0	0	0.006
Complication rate	33%	10%	0	0.03
Conversion rate	1 (10%)	1 (10%)	0	0.33
Hospital. Time	7	7.5	7	0.70
Catheter time	7	7	7	0.91

Artibani W. et al Urol Intern 2008;80:237–244

Learning curve



- Similar data based on biochemical recurrence-free survival are still lacking for RALP

Vickers A, et al. J Natl Cancer Inst 2007;99: 1171 – 7
Vickers A, et al. Lancet Oncolo 2009; 10:475-480

Robot-assisted Radical Prostatectomy: Learning curve

- Available studies available did not allow to define the precise number of RALPs to be performed to complete learning curve
- 20 procedures seem a reasonable limit to perform RALP with acceptable operative times and complication rates
- The number of RALPs to be completed before obtaining optimal functional and oncological outcomes is surely larger

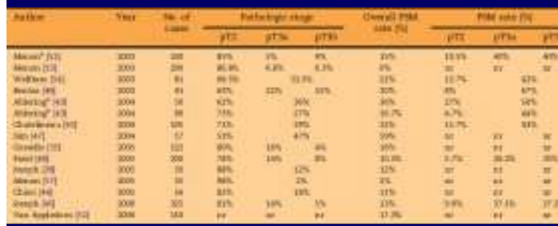
Robot-assisted Radical Prostatectomy: Possible outcomes

- Perioperative data and learning curve
- Oncological results
- Continence recovery
- Potency recovery

Oncological Outcomes

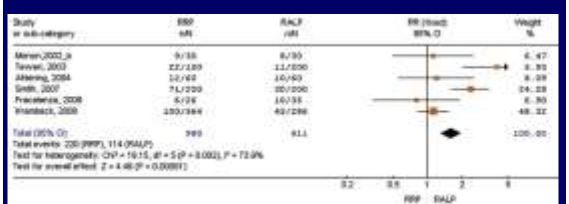
- Preliminary (surgical margins)
- Intermediate (bDFS)
- Final (clinical DFS; CSS)

Oncological results: Positive surgical margins (PSM)

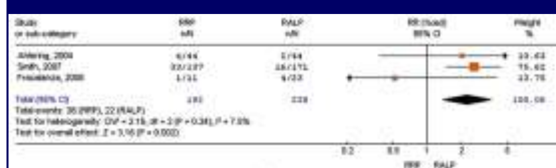


Ficarra V , Artibani W et al Eur Urol 2007; 51: 45-55

Positive surgical margins: RALP Vs RRP



Positive surgical margins (pT2): RALP Vs RRP



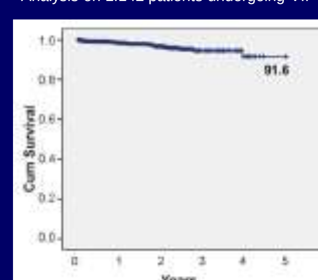
- millimetric surgery ?
- selection bias of patients ?
- few patients analysed ?

Positive surgical margins

- PSM rates observed after RALP were significantly lower in comparison with RRP
- No significant differences were found comparing RALP and LRP
- Many studies did not report the patologic protocol used to process the prostatectomy specimen

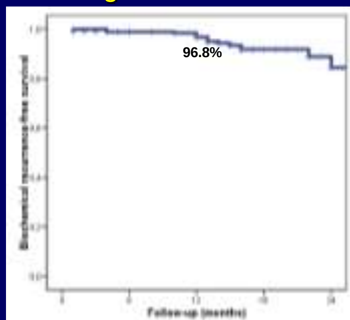
Oncological Results: bDFS

Analysis on 1.142 patients undergoing VIP



Menon M et al Eur Urol 2007; 51: 648-58

Oncological Results: bDFS

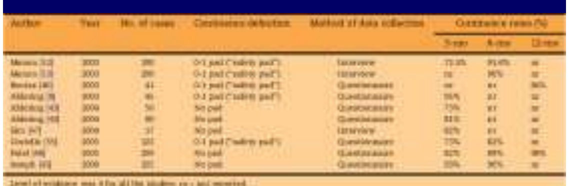


Novara G, Ficarra V, Artibani W, et al. (submitted)

Robot-assisted Radical Prostatectomy: Possible outcomes

- Perioperative data and learning curve
- Oncological results
- Continence recovery
- Potency recovery

Functional Results: Urinary Continence

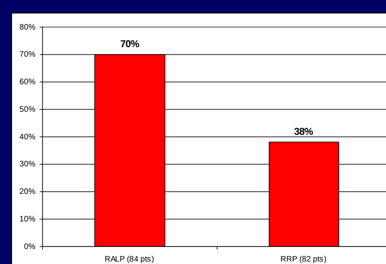


Author	Year	No. of cases	Continence definition	Method of data collection	Continence rates (%)		
					3-mo	6-mo	12-mo
[illegible]	[illegible]	[illegible]	0-1 pad ("safety pad")	Interview	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0-1 pad ("safety pad")	Interview	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	41	0-1 pad ("safety pad")	Questionnaire	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0-1 pad ("safety pad")	Questionnaire	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	No pad	Questionnaire	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	No pad	Questionnaire	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	No pad	Interview	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0-1 pad ("safety pad")	Questionnaire	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	No pad	Questionnaire	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	No pad	Questionnaire	[illegible]	[illegible]	[illegible]

[illegible]

Ficarra V , Artibani W et al Eur Urol 2007; 51: 45-55

Immediate Urinary Continence: personal experience

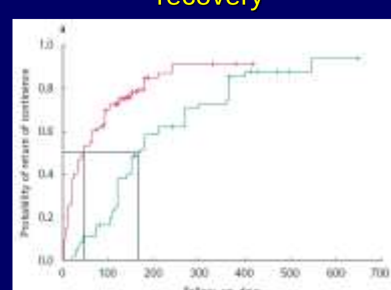


Urinary Continence after 12-month

Definition	RRP	RALP
No pad/ safety pad	84%	96%
> 1 pad	16%	4%
Time to reach continence	68 giorni	28 giorni
Strictures	8%	2%

All $p < 0.01$

RRP Vs RALP: urinary continence recovery



Tewari et al BJU Inter 92: 205-210, 2003

Continence rate

Authors	Origin	Cases	Follow-up	Definition	Continence (%)
Cathelineau	Europe	105	6 months	0 pads	70%
Costello	Australia	122	6 months	0-1 pads	82%
Joseph	USA	325	6 months	0 pads	96%
Menon	USA	2652	12 months	0 pads	84%
Mottrie	Europe	184	6 months	0 pads	85%
Patel	USA	500	12 months	0 pads	97%
Zorn	USA	300	12 months	0 pads	90%
Badani	USA	1110	12 months	0 pads	93%
Krambeck	USA	286	12 months	0 pads	92%
Novara	Europe	208	12 months	No leak (ICIq)	90.4%
Overall					**89% (70-97%)**

Ficarra V, Novara G, Mottrie A, Artibani W. AUA Update series 2010

Continence rate

12-mo continence rate 90%

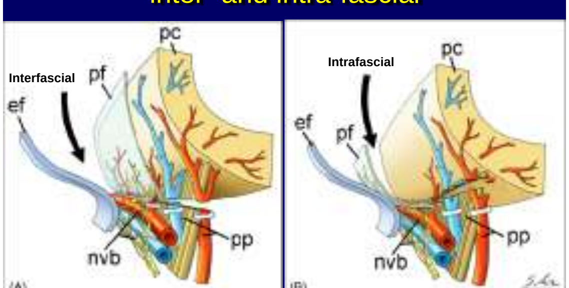
	Univariable analysis			Multivariable analysis		
Parameter	OR	95% CI	P value	OR	95% CI	P value
Age (continuous)	1.075	1.010 – 1.144	0.024	1.076	1.008 – 1.148	0.027
BMI (continuous)	1.097	0.970 – 1.240	0.140		-	
Charlson comorbidity index	1.671	1.150 – 2.429	0.007	1.635	1.132 – 2.362	0.009
Preoperative IIEF-5	0.988	0.927 – 1.052	0.702		-	
PSA (ng/ml) (continuous)	1.017	0.971 – 1.065	0.482		-	
Clinical T stage (cT1 vs cT2)	0.574	0.193 – 1.708	0.318		-	
Biopsy Gleason score (≤6 vs ≥7)	0.909	0.356 – 2.323	0.843		-	

Novara G, Ficarra V, Artibani W et al. J Urol 2010

Robot-assisted Radical Prostatectomy: Possible outcomes

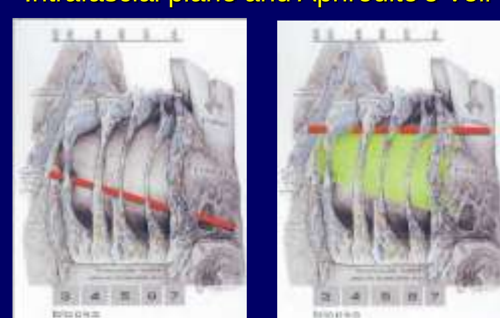
- Perioperative data and learning curve
- Oncological results
- Continence recovery
- Potency recovery

Endopelvic fascia and dissection planes inter- and intra-fascial



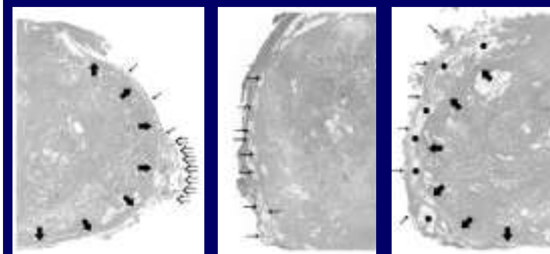
Stolzenburg JU et al, Eur Urol 2007;51(3):629-39

Intrafascial plane and Aphrodite's Veil



Menon M et al Urology 66: 1261-1265, 2005

Course of cavernouse nerves



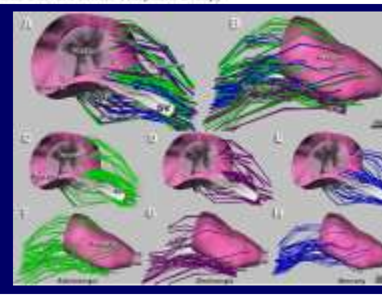
NVB is situated at a localized region as a true bundle

Nerve trunks spread to the Entire lateral aspect without definite bundle

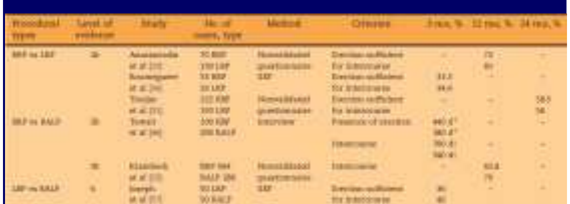
Kiyoshima K et al Jpn J Clin Oncol 2004; 34: 463-468

Tridimensional Computer-Assisted Anatomic Dissection of Posterolateral Prostatic Neurovascular Bundles

Bayan Alsaid, Ibrahim Karam, Thomas Bessede, Issam Abdlsamad, Jean-François Uhl, Vincent Delmas, Gérard Benoit, Stéphane Droupy

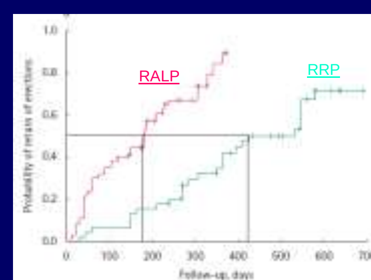


Potency recovery



Cumulative analyses were not possible because the studies reported the results in different formats.

Potency recovery: RALP Vs RRP



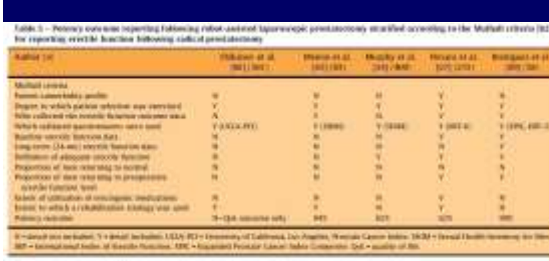
Tewari et al BJU Inter 2003; 92: 205-210.

Potency rate

Authors	Origin	Cases	Follow-up	Definition	Potency (%)
Cathelineau	Europe	105	12 months	Intercourse	79%
Joseph	USA	325	12 months	Intercourse	80.6%
Menon	USA	2652	12 months	Intercourse	70%
			24 months	Intercourse	86%
			48 months	Intercourse	100%
Mottrie	Europe	184	6 months	Intercourse	70%
Patel	USA	500	12 months	Intercourse	78%
Zorn	USA	300	12 months	Intercourse	80%
Badani	USA	1110	12 months	Intercourse	79%
Krambeck	USA	286	12 months	Intercourse	70%
Novara	Europe	216	12 months	IIEF-5 >18	62%
Overall					**76% (60-80%)**

Ficarra V, Novara G, Mottrie A, Artibani W. AUA Update series 2010 (in press)

Potency rate



Murphy DG, Ficarra V, Novara G, et al. Eur Urol 2010; 57: 735 – 746

J Sex Med 2010;7:839–845

Preoperative Criteria to Select Patients for Bilateral Nerve-sparing Robotic-assisted Radical Prostatectomy

Giacomo Novara, MD, FEBU, Vincenzo Ficarra, MD, Carolina D'Elia, MD, Silvia Secco, MD, Alberto De Gobbi, MD, Stefano Cavalleri, MD, and Walter Artibani, MD

Department of Oncologic and Surgical Sciences, Urologic Clinic, University of Padua, Italy

DOI: [illegible]

12-mo potency rate after bilateral nerve-sparing RALP 62%

Table 3 Logistic regression analysis for 12-month potency recovery rate in 208 consecutive patients who underwent bilateral nerve-sparing RALP

Variables	Categories	HR	95% CI	P value
Age (years)	[illegible]	[illegible]	[illegible]	[illegible]
Charlson score	[illegible]	[illegible]	[illegible]	[illegible]
Baseline IIEF-6 score	continuous	[illegible]	[illegible]	[illegible]

Potency recovery

- Few of the available comparative studies used validated questionnaires
- No comparative studies showed a significant advantage for LRP in terms of erectile function.
- Advantage in terms of erectile function recovery might be present in those patients having RALP compared with those having RRP

Laparoscopy and Robotics

Trifecta Outcomes After Robotic-assisted Laparoscopic Prostatectomy

Sergey A. Shikanov, Kevin C. Zorn, Gregory P. Zagaja, and Arieh L. Shalhav

	Subjective	Objective
RED % n/total		
3 mon	—	[illegible]
6 mon	—	[illegible]
12 mon	—	[illegible]
24 mon	—	[illegible]
Continence % n/total		
3 mon	[illegible]	[illegible]
6 mon	[illegible]	[illegible]
12 mon	[illegible]	[illegible]
24 mon	[illegible]	[illegible]
Potency % n/total		
3 mon	[illegible]	[illegible]
6 mon	[illegible]	[illegible]
12 mon	[illegible]	[illegible]
24 mon	[illegible]	[illegible]
Trifecta % n/total		
3 mon	[illegible]	[illegible]
6 mon	[illegible]	[illegible]
12 mon	[illegible]	[illegible]
24 mon	[illegible]	[illegible]

Shikanov SA, et al. Urology 2009; 74: 619–625

Trifecta outcome

12-mo Trifecta outcome 57%

	Univariable analysis		Multivariable analysis	
Parameter	**OR**	**P value**	**OR**	**P value**
Age	1.099	<0.001	1.095	0.005
BMI	1.111	0.028	1.031	0.672
Charlson comorbidity index	1.204	0.281	1.054	0.855
Baseline IIEF-6	0.807	<0.001	0.803	<0.001
PSA (ng/ml)	1.009	0.650	0.983	0.712
Prostate volume	1.018	0.036	1.010	0.409
Clinical T stage (cT1 vs cT2)	0.712	0.336	1.405	0.554
Biopsy Gleason score (6 vs 7)	1.019	0.955	0.715	0.508

Novara G, Ficarra V, Artibani W, et al. BJU 2010

EUROPEAN UROLOGY [illegible]

Downsides of Robot-assisted Laparoscopic Radical Prostatectomy: Limitations and Complications

[illegible]

Table 1 – Device failure and adverse events related to the da Vinci surgical system

Author	Study design	System failure rate	Adverse events	Comment
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ORIGINAL CONTRIBUTION

Comparative Effectiveness of Minimally Invasive vs Open Radical Prostatectomy

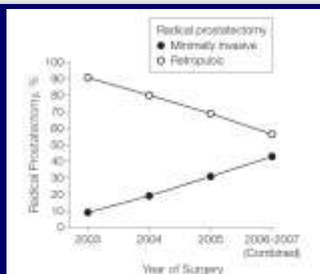


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Table 4. Propensity Model–Adjusted Outcomes by Surgical Approach

Outcomes	MIRP	RRP	MIRP vs RRP, Ratio (95% Confidence Interval)	P Value
Length of stay, median (IQR)	2 (1-2)	3 (2-4)	0.67 (0.66-0.73)	<.001
Heterologous blood transfusion, %	2.7	20.8	0.11 (0.06-0.17)	<.001
30-Day complications, %				
Overall	22.2	23.2	0.95 (0.77-1.16)	.56
Cardiac	2.4	2.9	0.81 (0.49-1.33)	.37
Respiratory	4.3	6.6	0.63 (0.46-0.87)	.004
Genitourinary	4.7	2.1	2.26 (1.61-3.22)	.001
Wound	2	1.9	1.05 (0.61-1.80)	.86
Vascular	3.4	3.9	0.86 (0.55-1.33)	.50
Miscellaneous medical	10	8.5	1.19 (0.88-1.60)	.26
Miscellaneous surgical	4.3	5.6	0.75 (0.58-0.98)	.03
Death	0.1	0.2	0.31 (0.07-1.26)	.10
Anastomotic stricture, %	5.8	14.0	0.38 (0.29-0.52)	<.001
Incontinence per 100 person-years				
Diagnosis	15.9	12.2	1.3 (1.05-1.61)	.02
Procedure	7.8	9.9	0.87 (0.68-1.11)	.24
Erectile dysfunction per 100 person-years				
Diagnosis	26.8	19.2	1.40 (1.14-1.72)	.009
Procedure	2.3	2.2	1.05 (0.74-1.51)	.78
Additional cancer therapy per 100 person-years				
Overall	8.2	6.8	1.19 (0.94-1.08)	.15
Radiation	5.1	4.9	1.08 (0.84-1.38)	.67
Hormone	5.3	3.7	1.42 (0.88-2.30)	.21
Death during the study period per 100 person-years	0.8	0.9	0.91 (0.53-1.57)	.72

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Prostate Cancer

Cost Comparison of Robotic, Laparoscopic, and Open Radical Prostatectomy for Prostate Cancer

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Table 2 – Comparison of the overall direct cost (in US dollars) and the individual cost domains for the three types of radical prostatectomy

Variables	RALP	LRP	RRP	p
Direct cost, median (IQR)	[illegible]	[illegible]	[illegible]	<0.0001
Surgical supply cost (fixed)	[illegible]	[illegible]	[illegible]	–
Operating room cost, median (IQR)	[illegible]	[illegible]	[illegible]	<0.0001
Anesthesia cost, median (IQR)	[illegible]	[illegible]	[illegible]	<0.0001
Medication cost, median (IQR)	[illegible]	[illegible]	[illegible]	[illegible]
Lab cost, median (IQR)	[illegible]	[illegible]	[illegible]	<0.0001
Room and board cost				<0.0001
Median (IQR)	[illegible]	[illegible]	[illegible]	
Mean (SD)	[illegible]	[illegible]	[illegible]	

RALP is associated with higher cost, predominantly due to increased surgical supply and OR costs

Conclusions

- The urologic community missed the windows of opportunity to test novel approaches within an evidence-based frame
- LRP and RALP are followed by significantly lower blood loss and transfusion rates and have all traditional advantages of a minimally invasive procedure
- At present systematic review does not allow to prove the superiority of any surgical approach in terms of functional and oncological outcomes

Conclusions

- It is likely that the most critical issue is the selection of the best surgeon, rather than the surgical approach
- Clearly, the competition that followed the diffusion of laparoscopic surgery had the great merit of pushing open surgeons to improve their surgical technique and perioperative care
- Despite the lack of high quality evidence, it is sure that the place of robotic surgery will increase in the near future