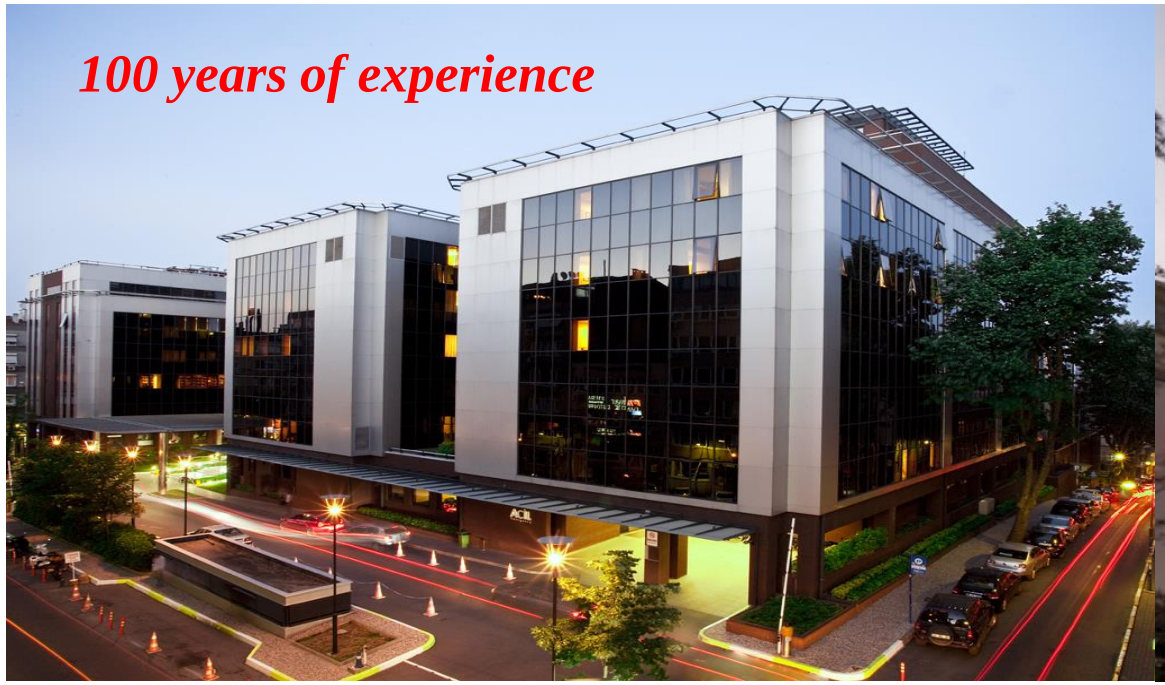
Nerve Sparing Radical Hysterectomy & Technique and Critical Review of the Literature



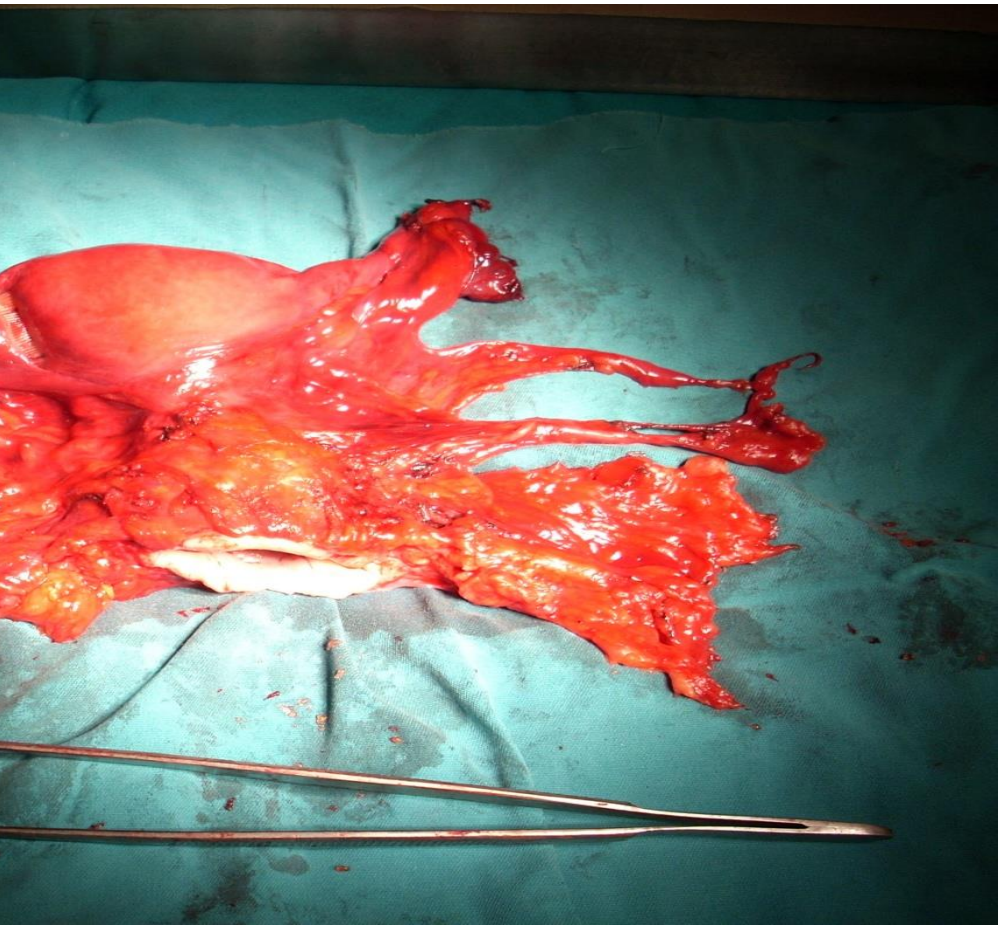
Cagatay Taskiran, MD. ***Professor***

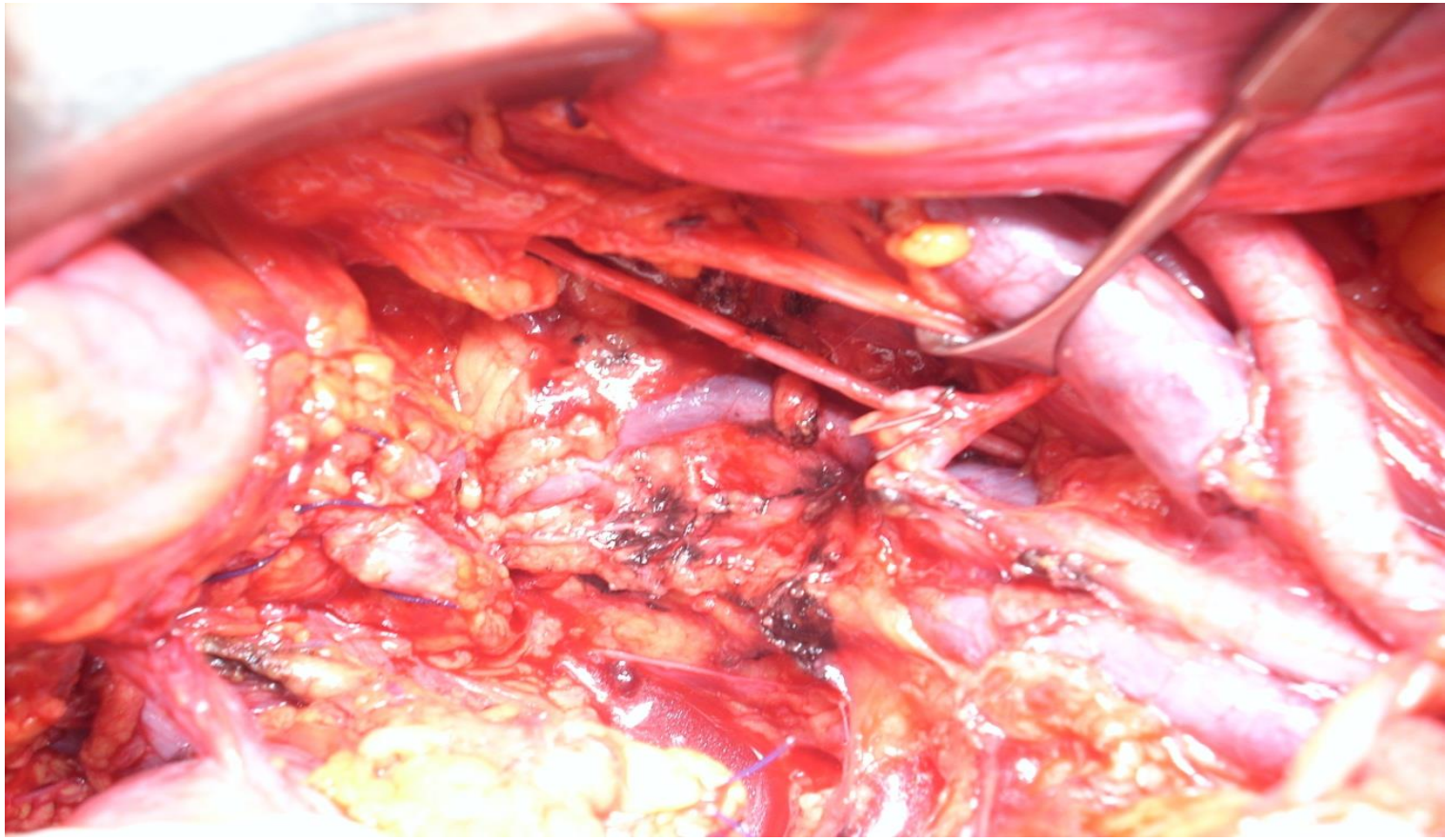
Koc University School of Medicine, and VKF American Hospital

Department of Obstetrics and Gynecology

Division of Gynecologic Oncology

Type 3 or C2 Radical Hysterectomy





Why Nerve Sparing Surgery

- Bladder dysfunction
- Anorectal dysfunction
- Sexual dysfunction

Functional disorders of lower urinary tract

- **Sensory loss**
- **Storage dysfunctions**
- **Voiding dysfunctions**
- **Detrusor instability**
- **Urinary incontinence**

Anorectal Dysfunction

- **Constipation**
- **Feelings of incomplete evacuation**
- **Tenesmus**
- **Diarrhoea**
- **Higher volumes of rectal distension to elicit the anorectal inhibitory reflex**
- **Slow transit constipation**
- **Faecal leakage**
- **Flatus incontinence**

Sexual Dysfunction

- **Neurogenic control of blood vessels of vaginal wall**
- **Neural control of vasocongestion and lubrication response**

2017 update of Querleu-Morrow Classification

QUERLEU - MORROW CLASSIFICATION			
Type of Radical Hysterectomy	*Lateral parametrium*	*Ventral parametrium*	*Dorsal parametrium*
C1	At the iliac vessels transversally, caudal part is preserved	Excision of the vesicouterine ligament at the bladder. Proximal part of the vesicovaginal ligament (bladder nerves are dissected and spared)	At the rectum (hypogastric nerve is dissected and spared)
C2	At the level of the medial aspect of iliac vessels completely (including the caudal part)	At the bladder (bladder nerves are sacrificed)	At the sacrum (hypogastric nerve is sacrificed)

Pelvic Nerves

1. Autonomic nerves

A.sympathetetic n.

celiac ganglia, superior ve inferior mesenteric , hypogastric

B.parasympathetetic n.

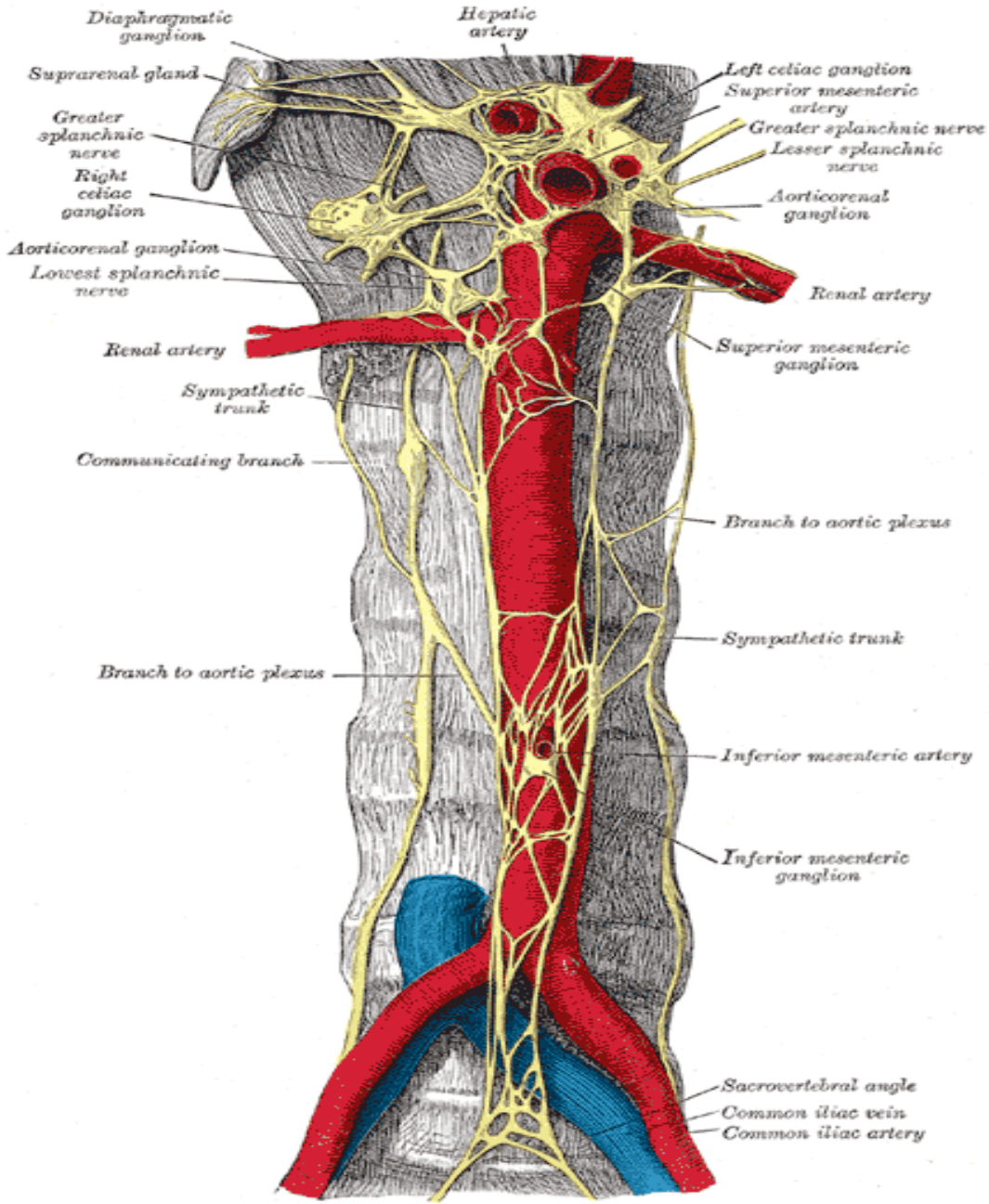
L5-S1, S2-S3-S4

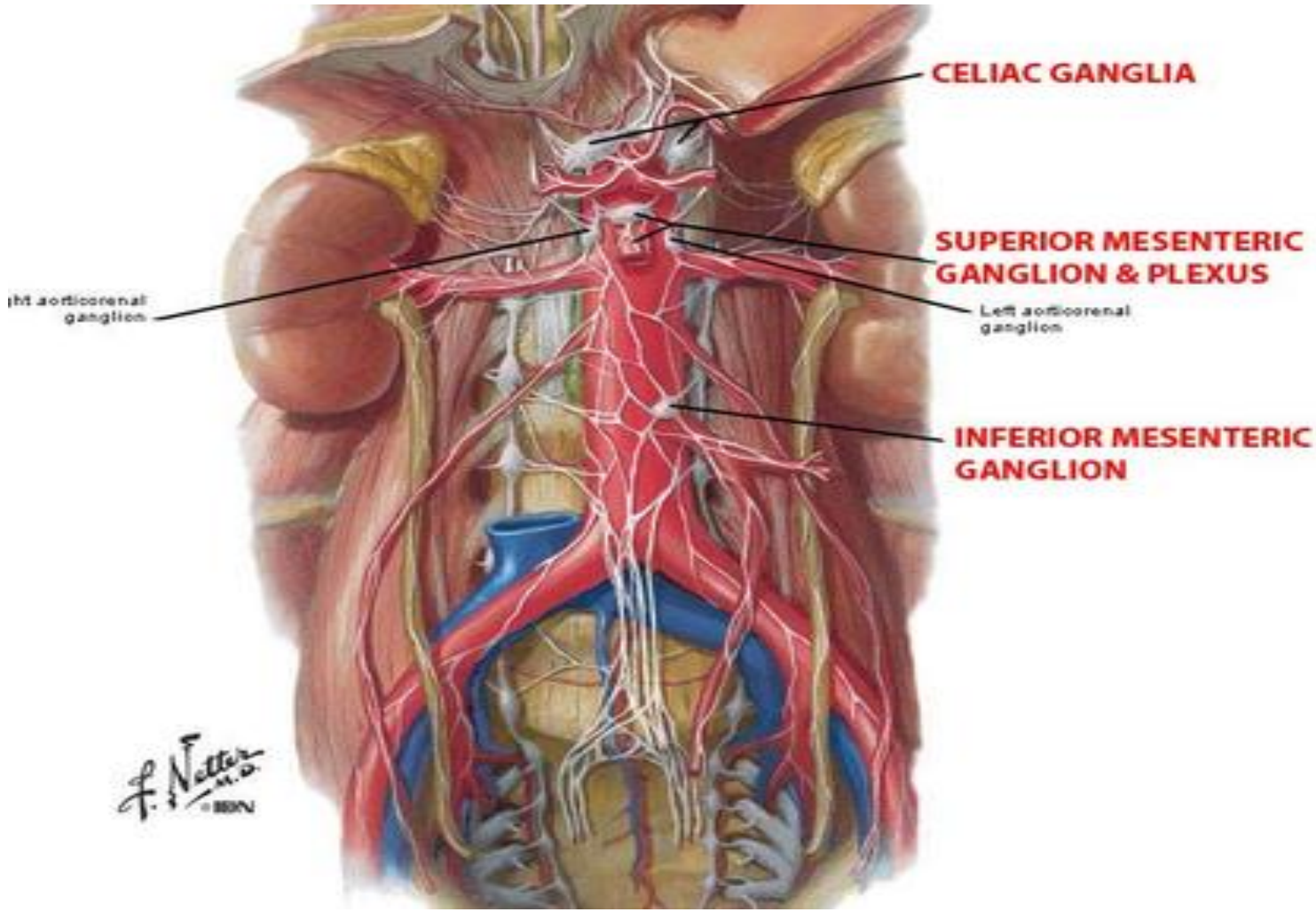
Pelvic Splanchnic Nerves

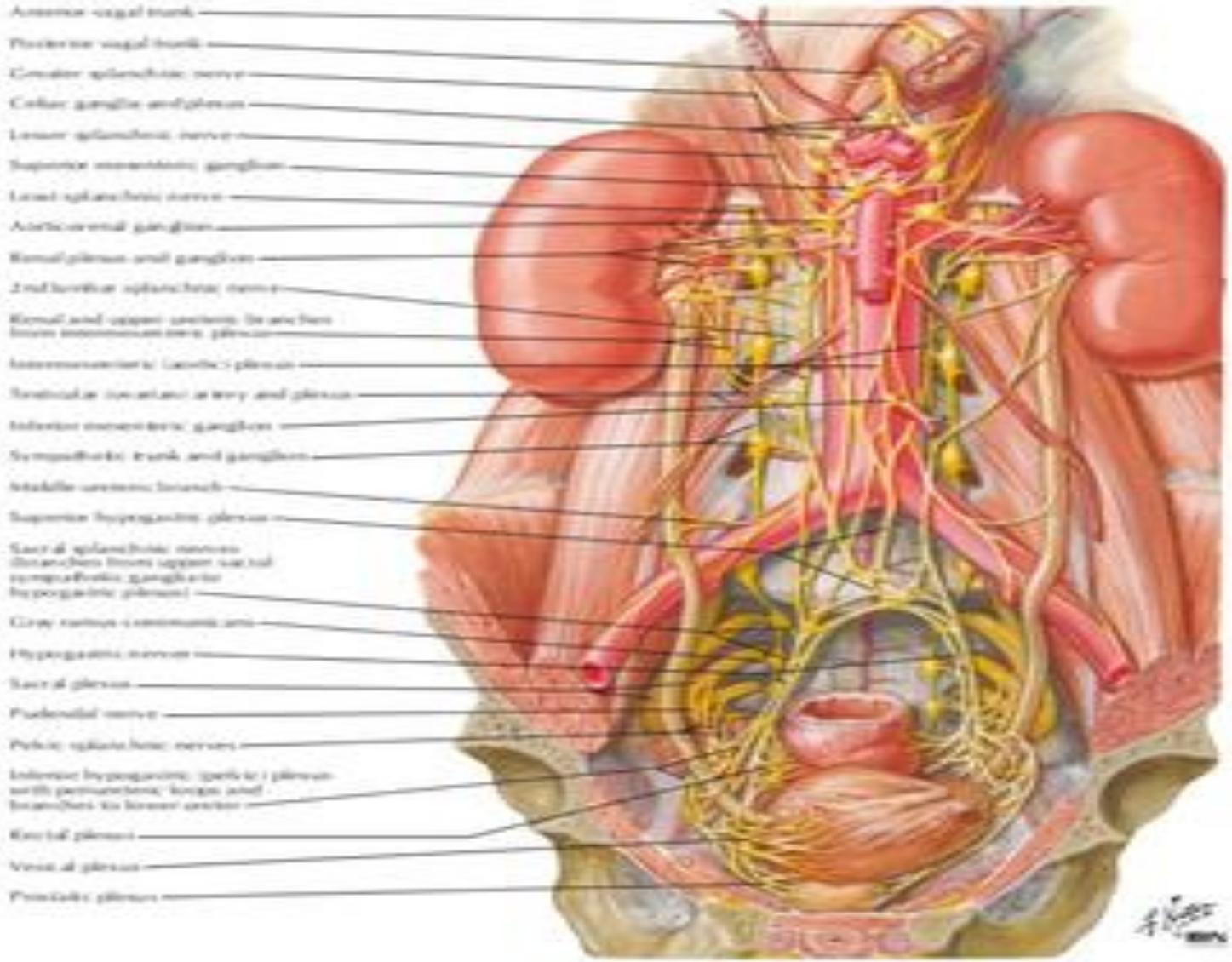
2. Motor nerves

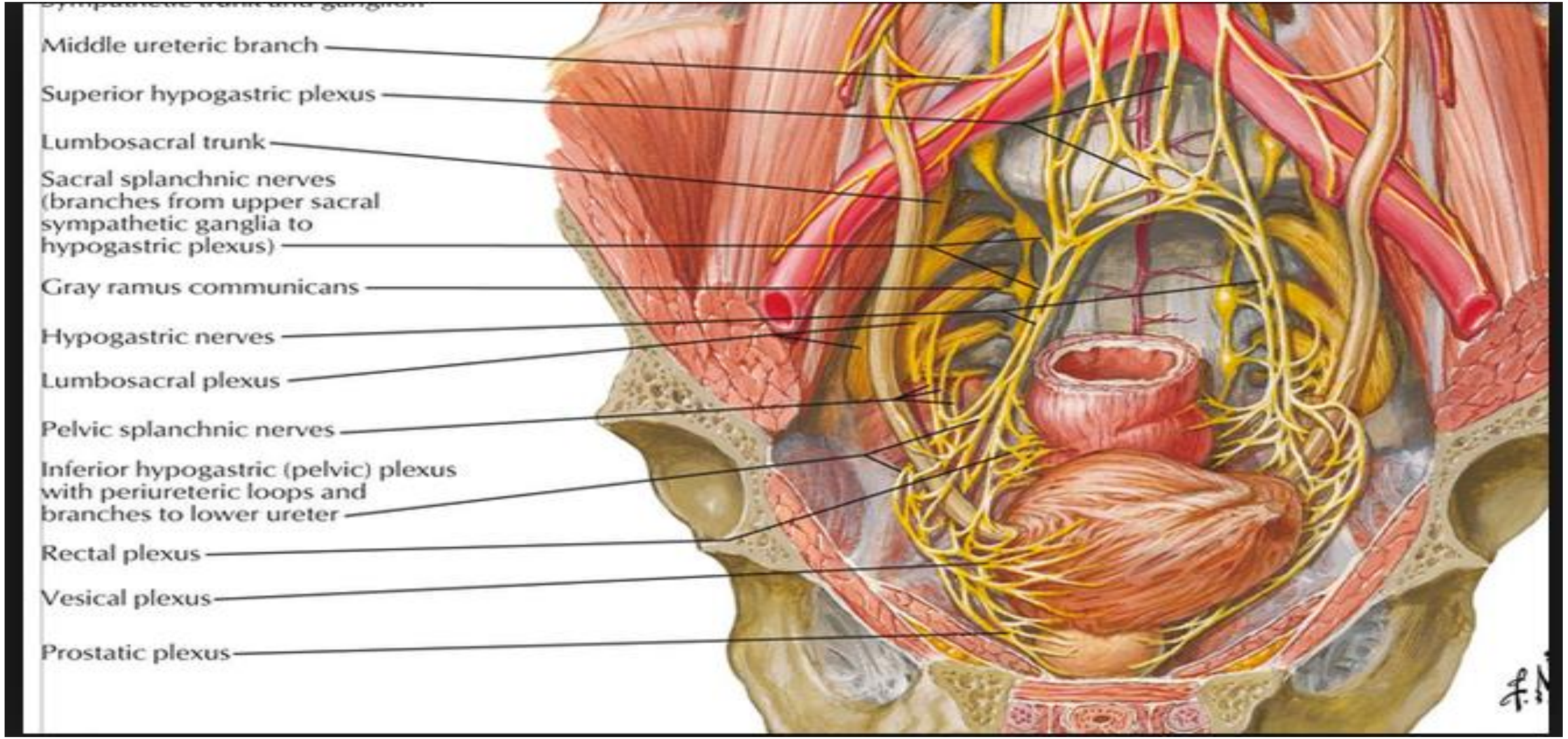
TL trunk; iliohypogastric, ilioinguinal, lateral femoral cutaneous genitofemoralis

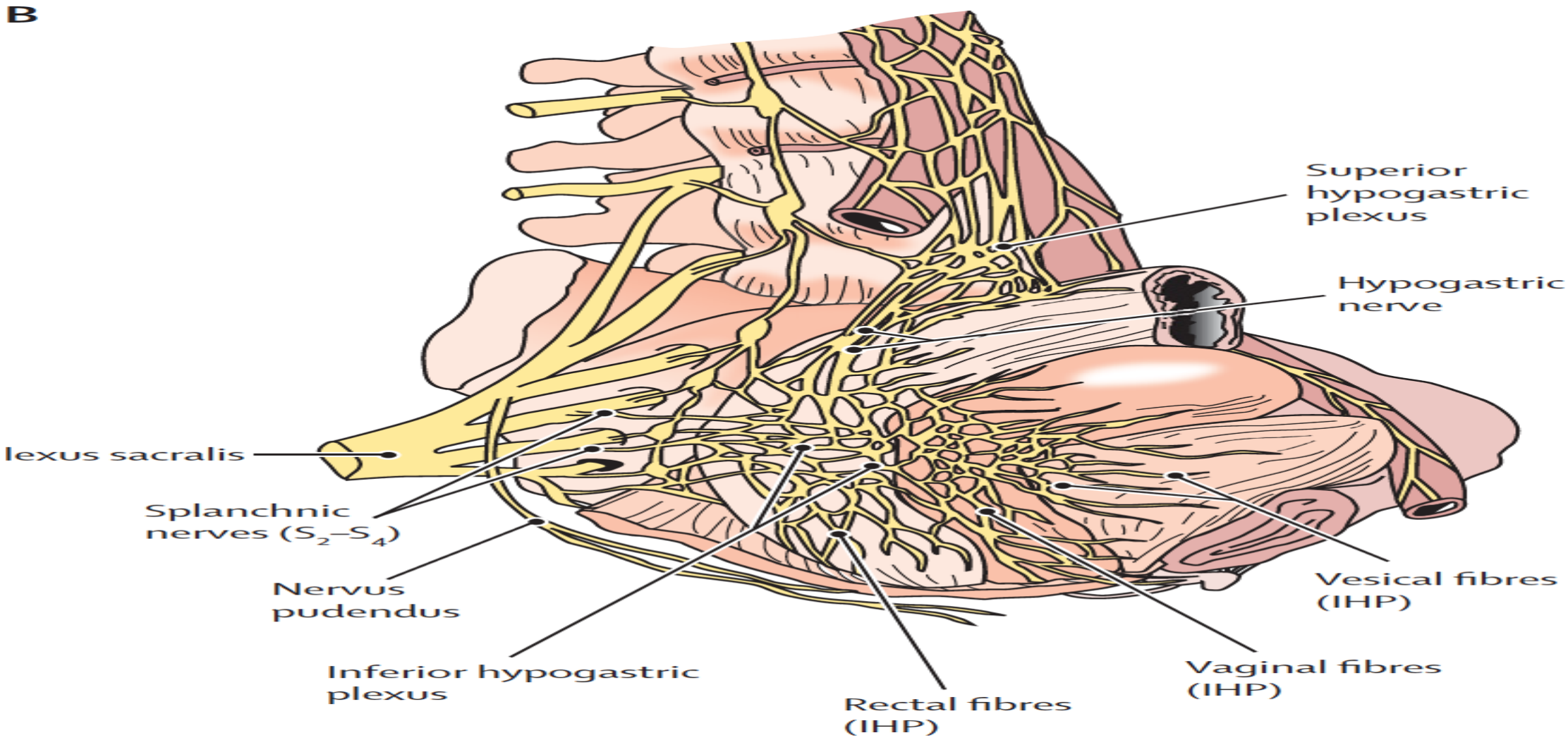
LS trunk; obturator,pudendal, superior & inferior gluteal, sciatic posterior femoral cutaneus


Diaphragmatic ganglion
Hepatic artery
Suprarenal gland
Left celiac ganglion
Superior mesenteric artery
Greater splanchnic nerve
Greater splanchnic nerve
Lesser splanchnic nerve
Right celiac ganglion
Aorticorenal ganglion
Aorticorenal ganglion
Lowest splanchnic nerve
Renal artery
Renal artery
Superior mesenteric ganglion
Sympathetic trunk
Communicating branch
Branch to aortic plexus
Sympathetic trunk
Branch to aortic plexus
Inferior mesenteric artery
Inferior mesenteric ganglion
Sacrovertebral angle
Common iliac vein
Common iliac artery

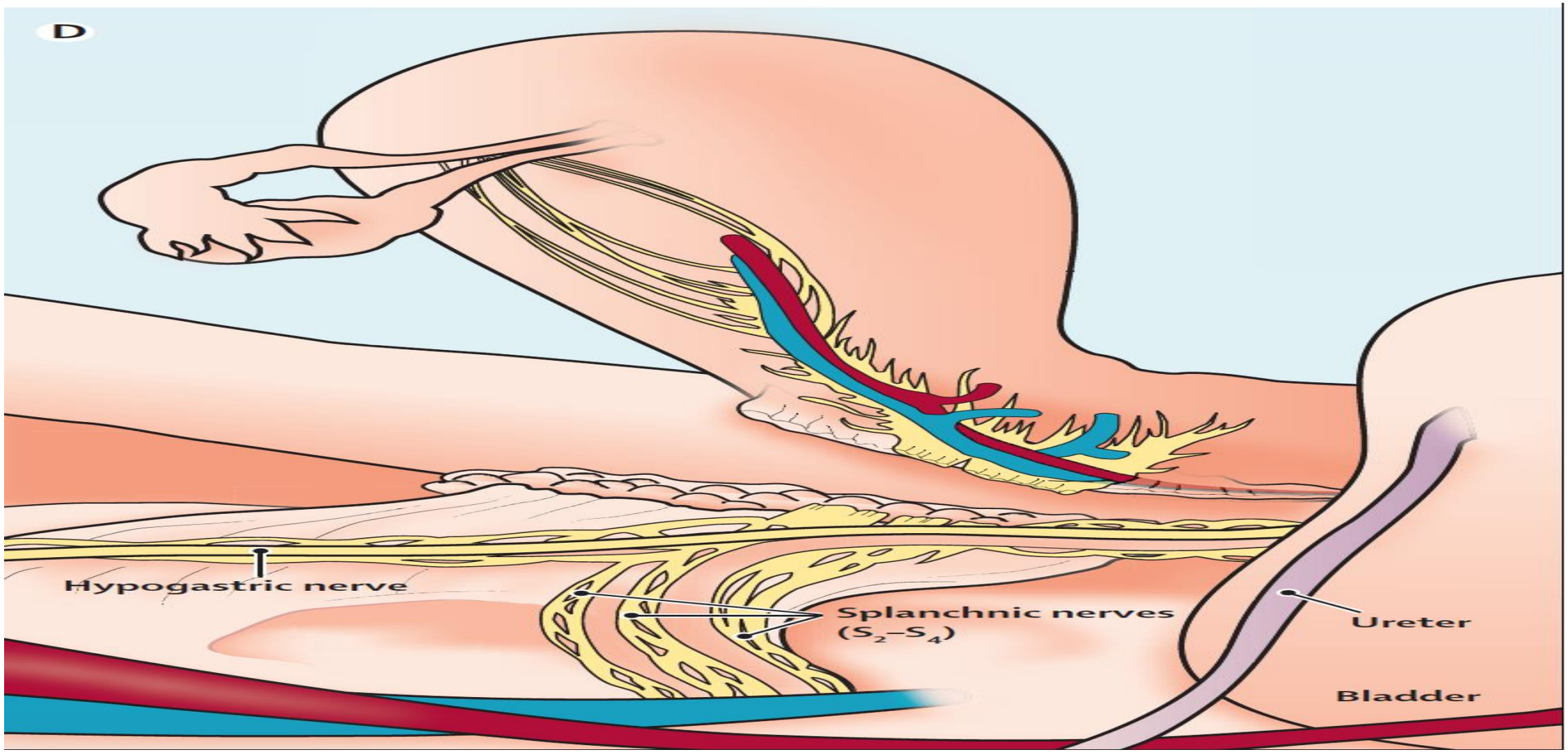

CELIAC GANGLIA
SUPERIOR MESENTERIC GANGLION & PLEXUS
ght aorticorenal ganglion
Left aorticorenal ganglion
INFERIOR MESENTERIC GANGLION



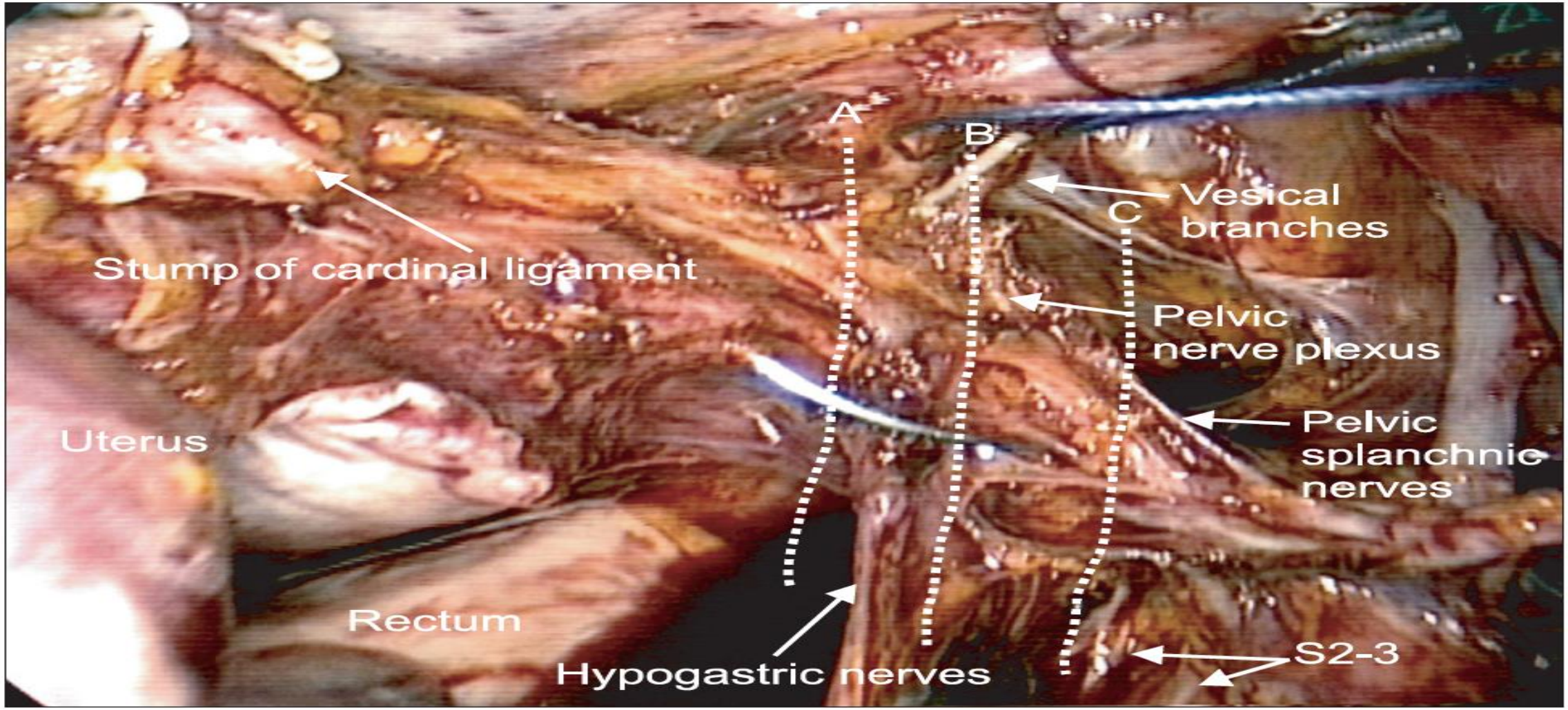

Middle ureteric branch
Superior hypogastric plexus
Lumbosacral trunk
Sacral splanchnic nerves (branches from upper sacral sympathetic ganglia to hypogastric plexus)
Gray ramus communicans
Hypogastric nerves
Lumbosacral plexus
Pelvic splanchnic nerves
Inferior hypogastric (pelvic) plexus with periureteric loops and branches to lower ureter
Rectal plexus
Vesical plexus
Prostatic plexus



LUKAS ROB,2010,LANCET


D
Hypogastric nerve
Splanchnic nerves
(S_2–S_4)
Ureter
Bladder

Cadaveric Dissection



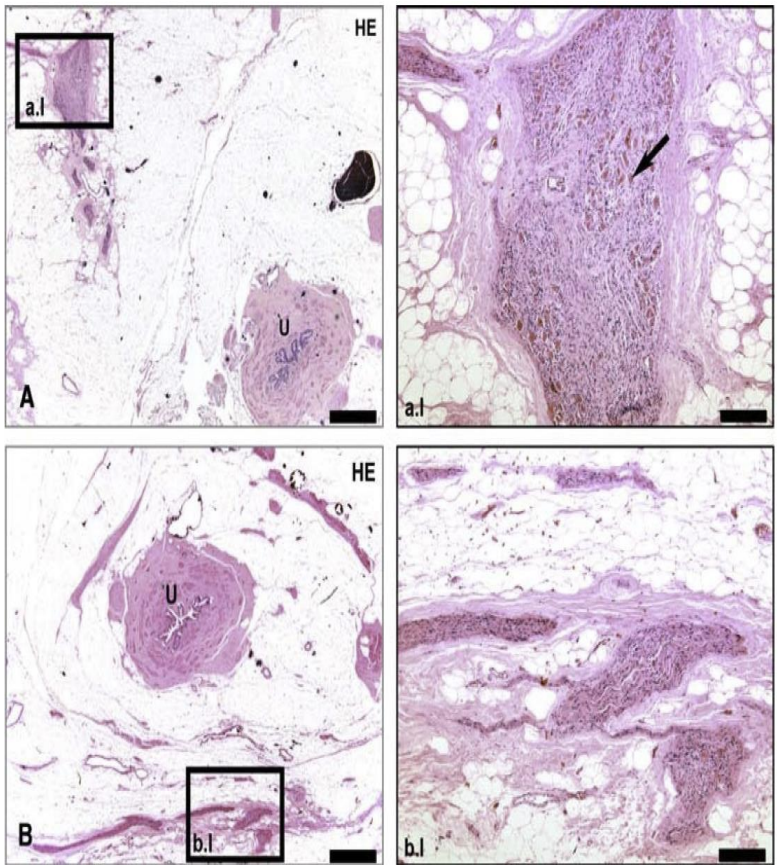
Andou M.,2014,JGO

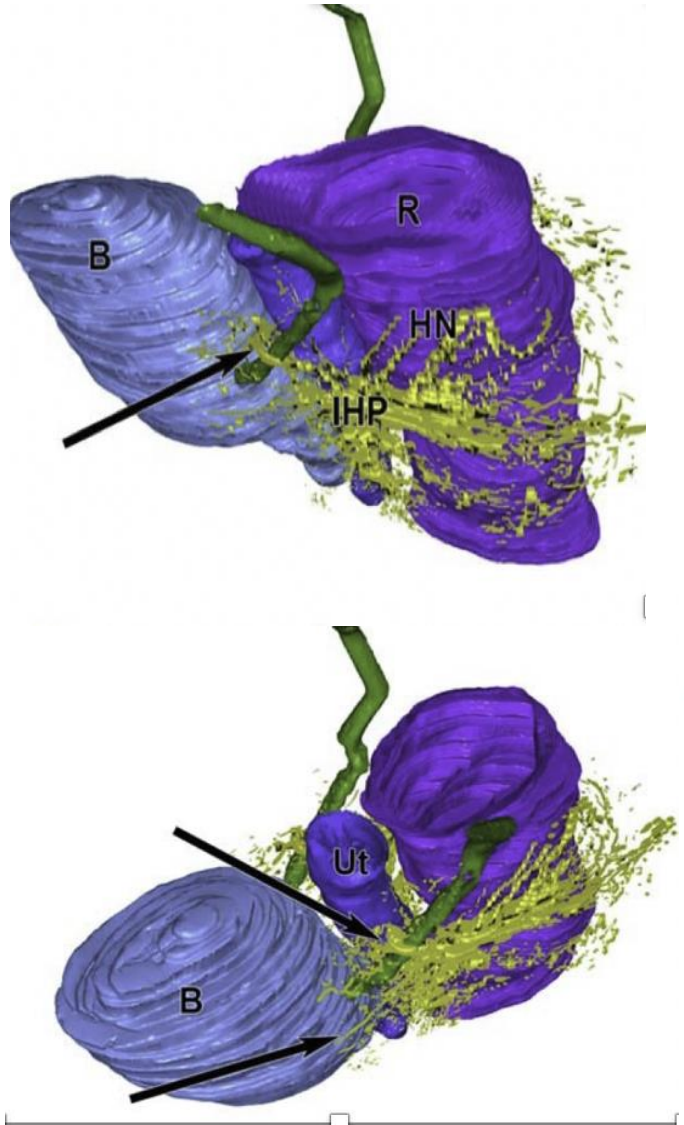
Cadaveric + Fetal Dissections and 3D Reconstruction

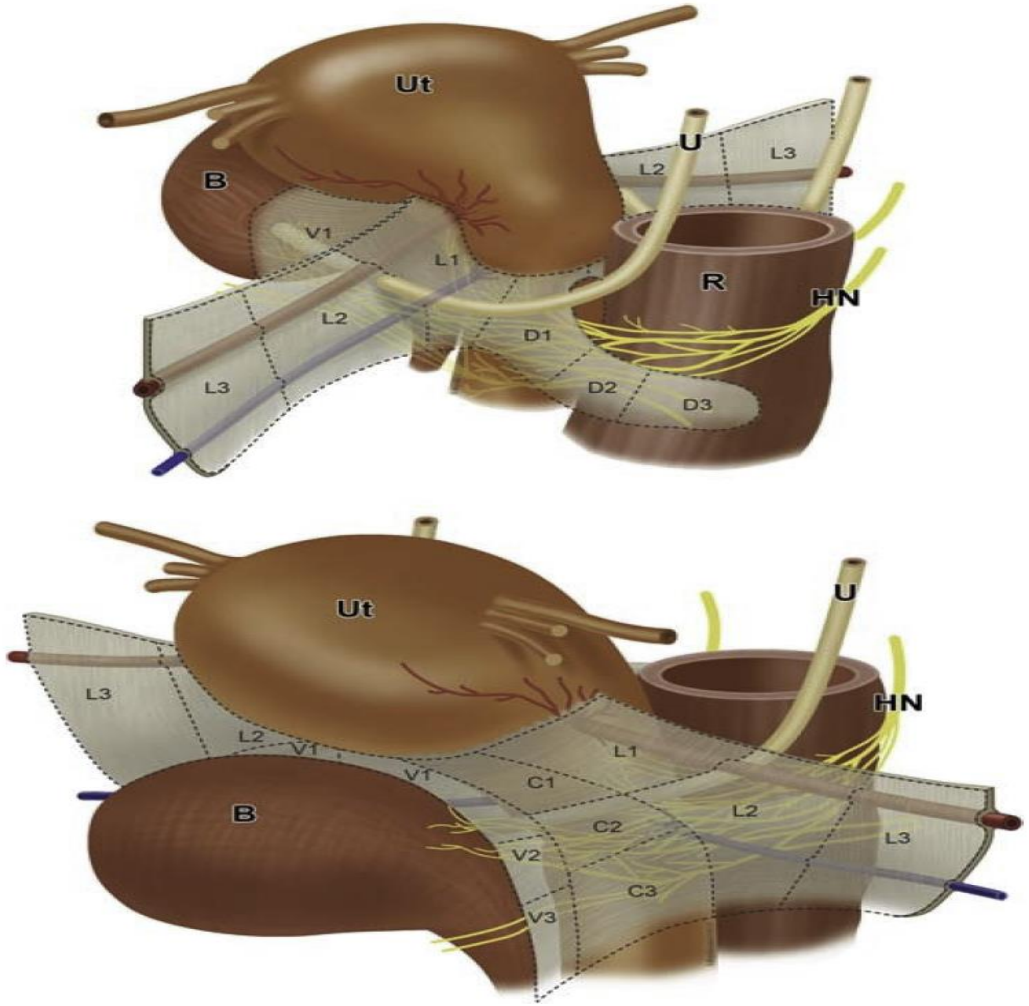
Careful Dissection of the Distal Ureter Is Highly Important in Nerve-sparing Radical Pelvic Surgery

A 3D Reconstruction and Immunohistochemical Characterization of the Vesical Plexus

Anne C. Kraima, PhD,* Marloes Derks, MD,fi Noeska N. Smit, MSc,fl Cornelis J.H. van de Velde, PhD,§ Gemma G. Kenter, PhD,fi and Marco C. DeRuiter, PhD*







Kraima , Int J Gynecol Cancer , 2016

Cadaveric + Fetal Dissections and 3D Reconstruction

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Results:

- The vesical plexus formed a group of nerve fibers branching off the ventral part of the inferior hypogastric plexus to innervate the bladder.
- In all adult and fetal specimens, the vesical plexus was closely related to the distal ureter and located in both the superficialand deep layers of the vesicouterine ligament.
- Efferent nerve fibers belonging to the vesical plexus predominantly expressed tyrosine hydroxylase and little vasoactive intestinal peptide.

Conclusions:

- The vesical plexus is located in both layers of the vesicouterine ligament and has a very close relationship with the distal ureter.
- Complete mobilization of the ureter in RHL might cause bladder dysfunction due to sympathetic and parasympathetic denervation.
- Hence, the distal ureter should be regarded as a risk zone in which the vesical plexus can be damaged.

Kraima , Int J Gynecol Cancer , 2016

...literature.....

Cochrane & 2019

Cochrane Library

Cochrane Database of Systematic Reviews

Nerve-sparing radical hysterectomy compared to standard radical hysterectomy for women with early stage cervical cancer (stage Ia2 to IIa) (Review)

Kietpeerakool C, Aue-aungkul A, Galaal K, Ngamjarus C, Lumbiganon P

Main results

- We identified 1332 records as a result of the search (excluding duplicates).
- Of the 26 studies that potentially met the review criteria, we included four studies involving 205 women; most of the trials had unclear risks of bias.
- We identified one ongoing trial.
- The analysis of overall survival was not feasible, as there were no deaths reported among women allocated to standard radical hysterectomy.
- However, there were two deaths in among women allocated to the nerve-sparing technique.
- None of the included studies reported rates of intermittent self-catheterisation over one month following surgery. We could not analyse the relative effect of the two surgical techniques on quality of life due to inconsistent data reported.

Kietpeerakool , Cochrane Database of Systematic Reviews , 2019

Cochrane & 2019

Cochrane Library

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Authors' conclusions

- Nerve-sparing radical hysterectomy may lessen the risk of postoperative bladder dysfunction compared to the standard technique, but the certainty of this evidence is low.
- The very low-certainty evidence for disease-free survival and lack of information for overall survival
- indicate that the oncological safety of nerve-sparing radical hysterectomy for women with early stage cervical cancer remains unclear.
- Further large, high-quality RCTs are required to determine, if clinically meaningful differences of survival exist between these two surgical treatments.

Kietpeerakool , Cochrane Database of Systematic Reviews , 2019

Review & 2019 – JMIG

ELSEVIER

JMIG The Journal of Minimally Invasive Gynecology

Review Article

Laparoscopic Nerve-Sparing Radical Hysterectomy vs Laparoscopic Radical Hysterectomy in Cervical Cancer: A Systematic Review and Meta-Analysis of Clinical Efficacy and Bladder Dysfunction

Jiayue Wu, MD, Taiyang Ye, PhD, Jianwei Lv, PhD, Zhihong He, BM, and Jie Zhu, BM

From the Departments of Obstetrics and Gynecology (Drs. Wu, Ye, He, and Zhu) and Urology (Dr. Lv), Ren Ji Hospital, School of Medicine, Shanghai Jiao Tong University and Shanghai Key Laboratory of Gynecologic Oncology (Drs. Wu, Ye, He, and Zhu), Shanghai, China.

Table 2

Results of the meta-analysis

Outcome analyzed	Studies, n	MD/OR (95% CI)	I^2, %
Blood loss, mL	29	MD, 0.79 (-7.44 to 9.03)	69
Operating time, min	29	MD, 29.88 (11.92–47.83)*	98
Hospital stay length, d	15	MD, -1.56 (-2.27 to -0.84)*	86
Resectable lymph nodes, n	20	MD, 0.51 (-0.12 to 1.15)	61
Resectable parametrium width, cm	20	MD, -0.02 (-0.05 to -0.00)*	34
Vaginal cuff length, cm	18	MD, -0.06 (-0.09 to -0.04)*	39
Duration of catheterization, d	21	MD, -7.20 (-8.10 to -6.29)*	85
Time to normal PVR, d	17	MD, -7.71 (-8.92 to -6.50)*	88
Satisfaction with micturition	5	OR, 2.90 (2.01–4.19)*	0
Urinary retention	15	OR, 0.20 (0.14–0.31)*	0
Nocturia	3	OR, 0.09 (0.04–0.22)*	0
Dysuria	8	OR, 0.16 (0.10–0.25)*	27
Urinary incontinence	8	OR, 0.13 (0.08–0.22)*	0
Frequency/urgency symptoms	5	OR, 0.24 (0.13–0.42)*	0

* $p < .05$.

MD = mean difference; OR = odds ratio; CI = confidence interval. PVR = postvoid residual urine volume.

Wu, JMIG, 2019

Review & 2016 – Maturitas – van Genta

Review article

Nerve-sparing radical hysterectomy versus conventional radical hysterectomy in early-stage cervical cancer. A systematic review and meta-analysis of survival and quality of life

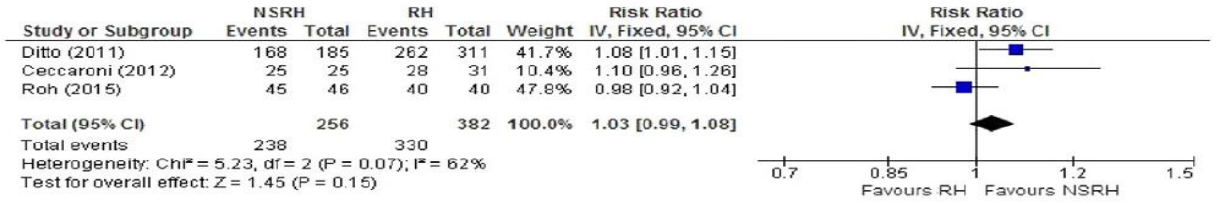
M.D.J.M. van Genta,∗, L.M. Romijnb, K.E. van Santenb, J.B.M.Z. Trimbosa, C.D. de Kroona

Overall Survival

2 year

3 year

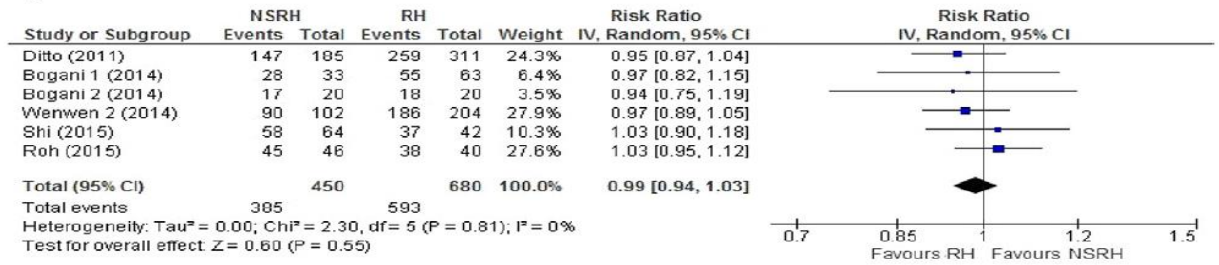
5 year



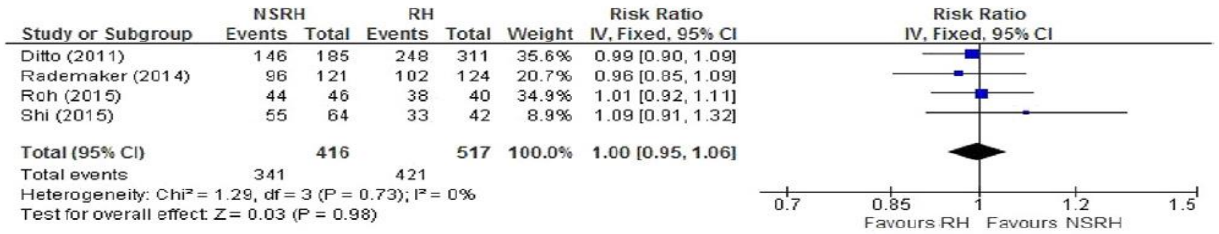
Disease-free Survival

2 year

3 year



5 year



van Genta , Maturitas 94 (2016)

Review & 2016 – Maturitas – van Genta

Review article

Nerve-sparing radical hysterectomy versus conventional radical hysterectomy in early-stage cervical cancer. A systematic review and meta-analysis of survival and quality of life

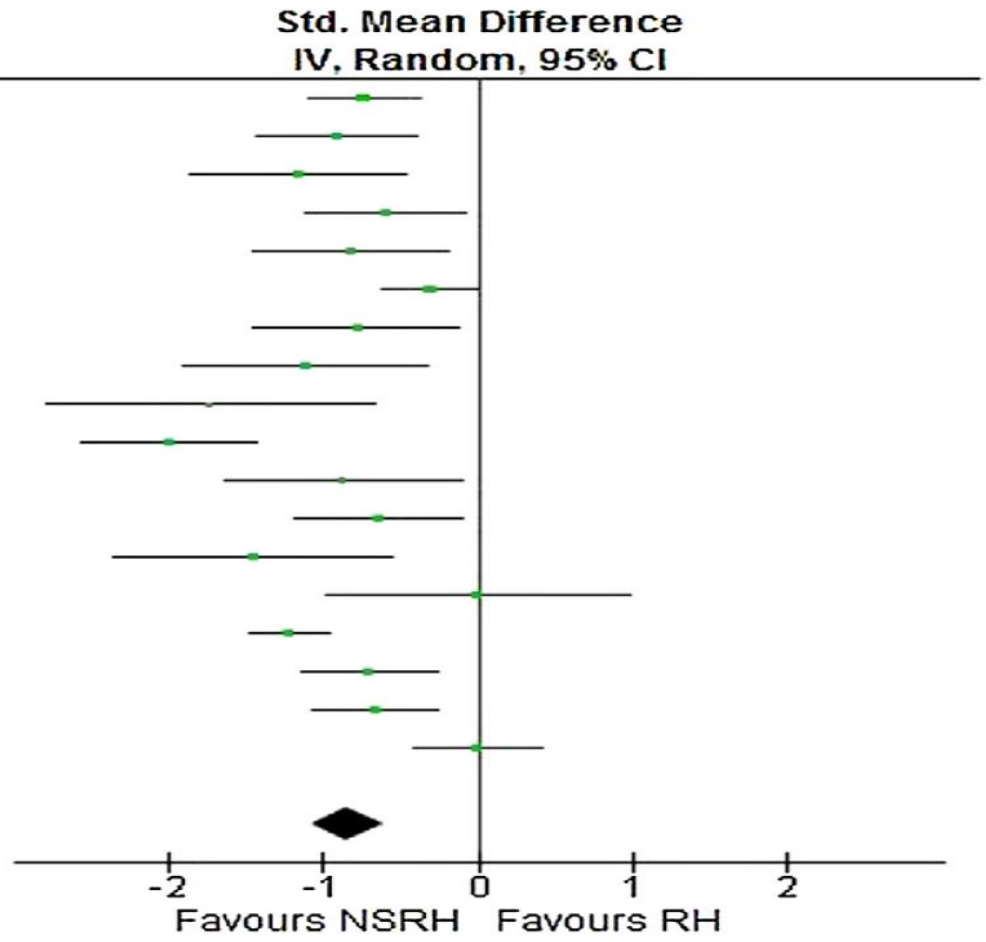
M.D.J.M. van Genta,∗, L.M. Romijnb, K.E. van Santenb, J.B.M.Z. Trimbosa, C.D. de Kroona

Time to Micturition

Study or Subgroup	NSRH Total	RH Total	Weight	Std. Mean Difference IV, Random, 95% CI
Höckel (2000)	41	139	7.1%	-0.74 [-1.10, -0.38]
Possover (2000)	38	28	6.0%	-0.91 [-1.43, -0.40]
Kuwabara (2000)	19	18	4.8%	-1.16 [-1.87, -0.46]
Chen (2009)	37	25	6.0%	-0.59 [-1.11, -0.07]
Sun (2009)	21	21	5.2%	-0.82 [-1.46, -0.19]
Liang (2010)	82	81	7.4%	-0.31 [-0.62, -0.00]
Runnebaum (2010)	53	11	5.0%	-0.78 [-1.45, -0.12]
Wu (2010)	14	15	4.3%	-1.12 [-1.91, -0.33]
Skret-Magierlo (2010)	10	10	3.1%	-1.73 [-2.80, -0.67]
Espino-Strebel (2010)	27	52	5.7%	-1.99 [-2.55, -1.42]
Tseng (2012)	18	12	4.4%	-0.88 [-1.65, -0.11]
Ceccaroni (2012)	25	31	5.9%	-0.64 [-1.18, -0.10]
Chen (2012)	12	13	3.8%	-1.45 [-2.35, -0.56]
Prajwala (2013)	5	18	3.4%	0.00 [-0.99, 0.99]
Wenwen 2 (2014)	102	204	7.7%	-1.22 [-1.48, -0.96]
Bogani 1 (2014)	33	63	6.6%	-0.70 [-1.13, -0.27]
Shi (2015)	64	42	6.8%	-0.67 [-1.07, -0.27]
Roh (2015)	46	40	6.7%	-0.00 [-0.42, 0.42]
Total (95% CI)	**647**	**823**	**100.0%**	**-0.84 [-1.07, -0.60]**

Heterogeneity: $Tau^2 = 0.17$; $Chi^2 = 61.80$, $df = 17$ ($P < 0.00001$); $I^2 = 72\%$

Test for overall effect: $Z = 7.04$ ($P < 0.00001$)



van Genta , Maturitas 94 (2016)

NSRH & Oncologic Safety

Ann Surg Oncol
DOI 10.1245/s10434-015-4377-7

Annals of
SURGICAL ONCOLOGY
OFFICIAL JOURNAL OF THE SOCIETY OF SURGICAL ONCOLOGY

REVIEW ARTICLE – GYNECOLOGIC ONCOLOGY

Oncological Outcomes of Nerve-Sparing Radical Hysterectomy for Cervical Cancer: A Systematic Review

Derman Basaran, MD[1], Ladislav Dusek, PhD[2], Ondrej Majek, PhD[2], and David Cibula, MD, PhD[3]

TABLE 3 Sample size estimates for a noninferiority trial (HR < 1.4), assuming an equal proportion of recurrences in both study arms (CRH and NSRH)

Proportion of recurrence in CRH arm (%)	Proportion of recurrence in NSRH arm (%)	Total sample size estimate	CRH arm sample size estimate	NSRH arm sample size estimate
5	5	4,369	2,184	2,185
10	10	2,185	1,092	1,093
15	15	1,457	728	729
20	20	1,093	546	547

CRH conventional radical hysterectomy, *NSRH* nerve-sparing radical hysterectomy

Zelal – Fujii & Review of Techniques

Nerve-sparing radical hysterectomy: steps to standardize surgical technique

Mustafa Zelal Muallem,1 Yasser Diab,2 Jalid Sehouli,3 Shingo Fujii4

Table 1 The most important points regarding the radicality and the clarity of nerve-sparing surgical steps for each technique

	Radicality				Nerve-sparing surgical steps			
Article	Ventral parametrium	Lateral parametrium	Dorsal parametrium	Vaginal vault/paracolpium	Bladder branches	Pelvic splanchnic nerve	Hypogastric nerve	Inferior hypogastric plexus
Raspagliesi et al	+	+	+	Restricted to only 2 cm because of omitting the maneuver to isolate the inferior hypogastric plexus and lateralize it before resection of the vaginal vault	+	– (The description and the figures do not match our current knowledge about the exact course of the pelvic splanchnic nerves)	+	+/- By misunderstanding the course of the pelvic splanchnic nerve, the preparation of the inferior hypogastric plexus is missed
Charoenkwan et al	+	+	+	Not described	–	–	+	–
Hoeckel et al	–	+	+	Restricted at the anterior vaginal wall	–	–	+	–
Possover et al/ Koehler et al	-/+	+	+	+Vaginal cuff (only one third) but without any paracolpium	–	+ (Middle rectal artery is the landmark)	+	–
Yabuki et al	+	+	+	+	+/-	+	+	–
					Uses the Yabuki space as a landmark, which is difficult to be developed as we do not have reliable anatomical landmarks to define it. Yabuki space itself will highlight only the deep layer of vesico-uterine ligament. The bladder branches reside in the lateral side of the vaginal wall and not in the vesico-uterine ligament			
Sakuragi et al	+	+	+	+	+	+	+	+
					No precise steps to prepare the ventral parametrium isolating the bladder branches of the inferior hypogastric plexus			
Fujii et al	+	+	+	+	+	+	+	+

Zelal , Int J Gynecol Cancer , 2019

Recent Large Series of Experienced Groups

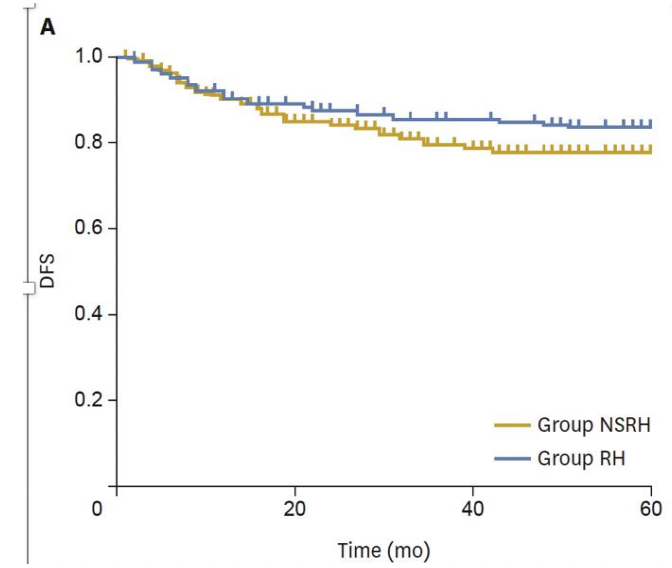
Raspagliesi 2018 & Survival & 650 Patients

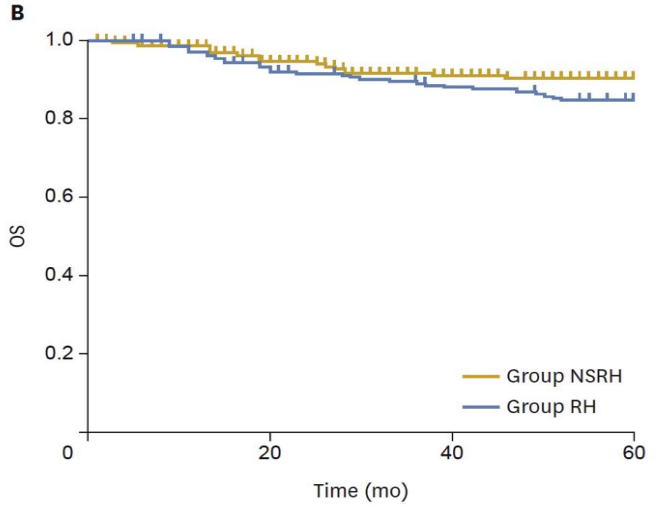
Oncologic effectiveness of nerve-sparing radical hysterectomy in cervical cancer

Antonino Ditto, Giorgio Bogani , Umberto Leone Roberti Maggiore , Fabio Martinelli , Valentina Chiappa, Carlos Lopez, Stefania Perotto , Domenica Lorusso, Francesco Raspagliesi

Table 4. Intraoperative and postoperative characteristics

Characteristics	Group NSRH (n=325)	Group RH (n=327)	p
Operative time (min)	240 (138–370)	240 (120–365)	0.42
Blood loss (mL)	300 (50–2,500)	600 (100–3,000)	<0.01
Number of blood units transfused	1 (0–5)	2 (0–10)	<0.01
Hospital stay (day)	7 (3–16)	18 (7–131)	<0.01
Number of intraoperative complications*	5 (1.5)	11 (3.4)	0.13
Bladder function			<0.01
No recovery	16 (4.9)	43 (13.1)	
Recovery	309 (95.1)	275 (84.1)	
Missing data	0 (0)	9 (2.8)	
Presence of postoperative complications (grade ≥3)†	41 (12.6)	65 (19.8)	0.01
Total early postoperative complications (grade ≥3)	21 (6.5)	28 (8.6)	0.40
Early postoperative complications (grade ≥3)			0.04
Lymphatic (lymphocyst-lymphorrhea)	3 (0.9)	13 (4.0)	
Hemorrhage/bleeding	9 (2.8)	2 (0.6)	
Intestinal ileus	1 (0.3)	3 (0.9)	
Urological	2 (0.6)	3 (0.9)	
Thromboembolism	0 (0)	2 (0.6)	
Need for another surgery	1 (0.3)	2 (0.6)	
Infection	1 (0.3)	2 (0.6)	
Neurologic	3 (0.9)	1 (0.3)	
Voiding	1 (0.3)	0 (0)	
More than one complication	0 (0)	0 (0)	
Total late postoperative complications (grade ≥3)	20 (6.2)	37 (11.3)	0.02
Late postoperative complications (grade ≥3)			0.05
Lymphatic (lymphocyst-lymphorrhea)	6 (1.8)	12 (3.7)	
Impaired bowel function	0 (0)	9 (2.8)	
Urological	7 (2.2)	6 (1.8)	
Need for another surgery	4 (1.2)	4 (1.2)	
Infection	1 (0.3)	4 (1.2)	
Voiding	1 (0.3)	2 (0.6)	
More than one complication	1 (0.3)	0 (0)	





Ditto , J Gynecol Oncol. , 2018

NSRH & Open vs L/S & Raspagliesi et al 2019

Minimally invasive surgery improves short-term outcomes of nerve-sparing radical hysterectomy in patients with cervical cancer: a propensity-matched analysis with open abdominal surgery

Giorgio Bogani , Diego Rossetti , Antonino Ditto , Fabio Martinelli Valentina Chiappa , Chiara Leone , Umberto Leone Roberti Maggiore Domenica Lorusso , Francesco Raspagliesi

Table 2. Operative results of patients undergoing nerve-sparing radical hysterectomy via laparoscopic and open abdominal surgery

Characteristics	Laparoscopy (n=35)	Open surgery (n=35)	p-value
Operative time (min)	249.4 (± 91.5)	223.0 (± 65.0)	0.066
Estimated blood loss (mL)	30.5 (± 11.0)	190.0 (± 90.4)	<0.001
Blood transfusions	0	5 (14.2)	0.053
Hospital stay (days)	3.2 (± 1.2)	5.4 (± 2.0)	0.023
Intraoperative complications	0	1 (3.3)	1.000
30-day severe postoperative complications, grade 3 or worse	0	2 (5.7)	0.492

Table 3. Pelvic dysfunctions rate for patients undergoing nerve-sparing radical hysterectomy via laparoscopic and open abdominal surgery

Characteristics	Laparoscopy (n=35)	Open surgery (n=35)	p-value
Pelvic dysfunctions (not yet recovered at 30-day)	0	6 (17.1)	0.024
Bladder dysfunctions at 30 days	0	5 (14.2)	0.053
Anorectal dysfunctions at 30 days	0	1 (3.3)	1.000

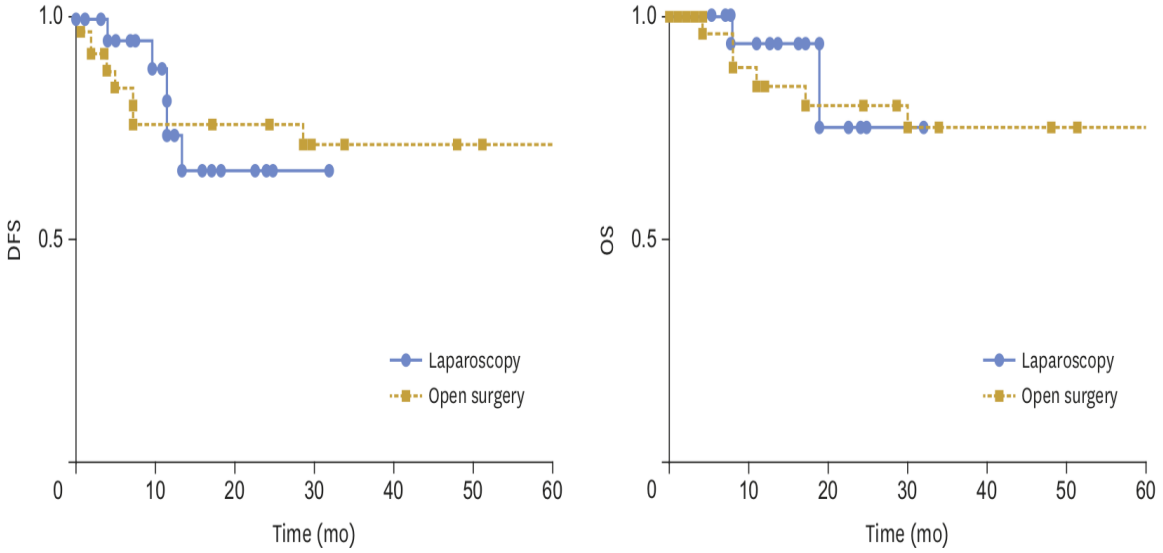


Fig. 3. Survival outcomes.

Bogani , JGO, 2019

LS-NSRH & Safety and Autonomic Function & Zhao, 2019, 530 pts

Clinical Outcomes in Early Cervical Cancer Patients Treated with Nerve Plane–sparing Laparoscopic Radical Hysterectomy

Dan Zhao, MD, Bin Li, MD, Yating Wang, MD, Shuanghuan Liu, MD, Yanan Zhang, MD, and Guangwen Yuan, MD

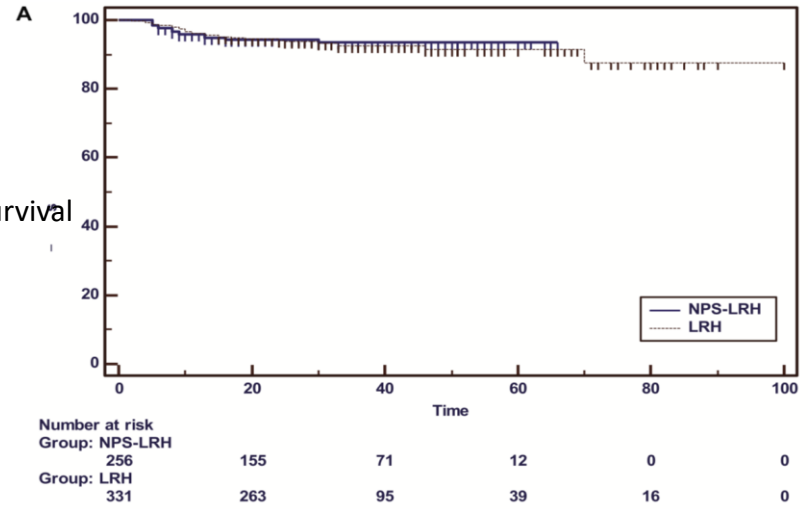
Conclusion: NPS-LRH is a simplified, safe, and feasible type C1 operation that had a shorter length of operation, less intraoperative bleeding, more resected lymph nodes, and better postoperative bladder function compared with the LRH group.

Table 3

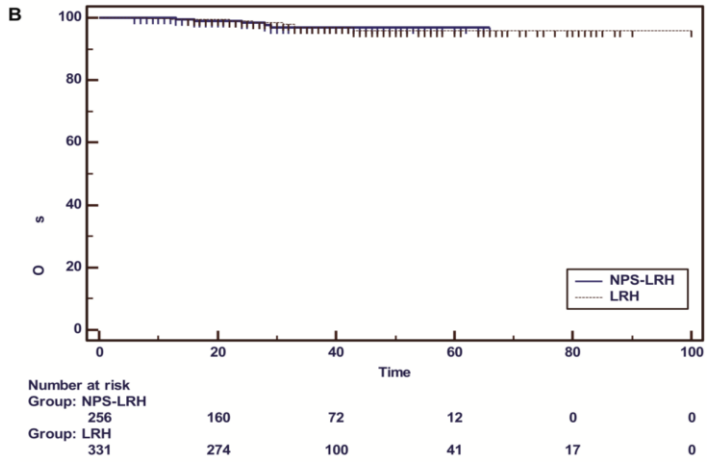
Bladder and Rectal Function 1 Year after Surgery

	NPS-LRH (n = 206), n (%)	LRH (n = 327), n (%)	p Value
Frequent urination	19 (9.2)	57 (17.4)	<.01
Urge incontinence	3 (1.5)	22 (6.7)	<.01
Stress incontinence	17 (8.2)	30 (9.2)	.692
Loss of bladder sensation	2 (0.8)	15 (4.6)	.028
Straining to urinate	23 (11.2)	56 (17.1)	.062
Diarrhea	5 (2.4)	20 (6.1)	.078
Constipation	10 (4.9)	35 (10.7)	0.029

LRH = laparoscopic radical hysterectomy; NPS-LRH = nerve plane–sparing laparoscopic radical hysterectomy.



(A) Progression-free survival (percent).



(B) Overall survival (percent).

Zhao , JMIG , 2019

Voiding Dysfunction after NSRH & Analysis of 755 Patients 2006-2016

Predicting factors for resumption of spontaneous voiding following nerve-sparing radical hysterectomy

Chalaithorn Nantasupha , Kittipat Charoenkwan

Table 3. Characteristics associated with inability to attain adequate voiding function in multivariate analysis

Characteristics	OR	95% CI for OR
Tumor size >4 cm	1.7	1.1–2.7
Postoperative urinary tract infection	1.7	1.1–2.5
Surgeon	1.2	1.2–1.3

Table 1. Comparison of operative data between patients with and those without adequate voiding function on POD7

Operative parameters	Adequate voiding function	Inadequate voiding function	p-value
Tumor size (cm)	2.0 (1.7)	2.5 (1.9)	0.001*
Length of resected Rt. parametrium (cm)	2.7 (0.8)	2.9 (0.8)	<0.001*
Length of resected Lt. parametrium (cm)	2.6 (0.7)	2.8 (0.8)	0.003*
Length of resected anterior vaginal wall (cm)	1.8 (0.8)	2.1 (0.8)	<0.001*
Length of resected posterior vaginal wall (cm)	2.2 (0.8)	2.5 (0.9)	<0.001*
Length of resected Rt. lateral vaginal wall (cm)	1.7 (0.8)	2.1 (0.8)	<0.001*
Length of resected Lt. lateral vaginal wall (cm)	1.7 (0.8)	2.1 (0.8)	<0.001*
No. of pelvic lymph nodes resected	26.5 (10.2)	27.7 (9.7)	0.120
Operative time (min)	221.5 (62.4)	214.7 (42.8)	0.080
Operative blood loss (mL)	454.5 (356.0)	496.9 (420.2)	0.140

Nantasupha , JGO , 2018

L/S NSRH & Locally Advanced Cervical Cancer & Raspagliesi 2017

Introducing nerve-sparing approach during minimally invasive radical hysterectomy for locally-advanced cervical cancer: A multi-institutional experience

Francesco Raspagliesi a, Giorgio Bogani a,*, Arsenio Spinillo b, Antonino Ditto a, Stefano Bogliolo b, Jvan Casarin c, Umberto Leone Roberti Maggiore a,d, Fabio Martinelli a, Mauro Signorelli a, Barbara Gardella b, Valentina Chiappa a, Cono Scaffa a, Simone Ferrero d, Antonella Cromi c, Domenica Lorusso a, Fabio Ghezzi c

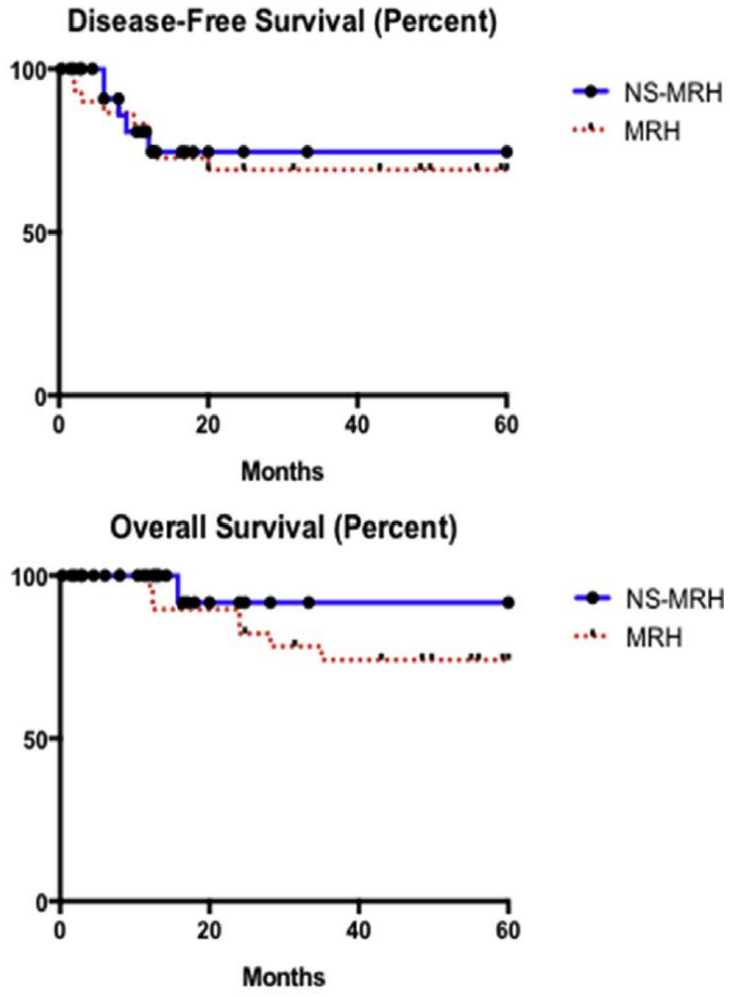


Fig. 2. Survival outcomes.

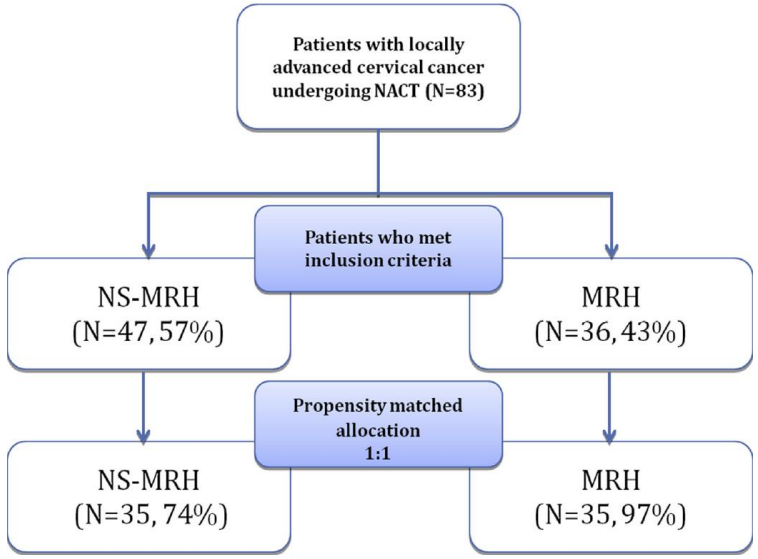


Table 3
Pelvic dysfunction following NSLRH and LRH.

	NS-LRH (n = 35)	LRH (n = 35)	p-value
Pelvic dysfunction (including urinary, rectal and sexual issues), n (%)	**3 (9%)**	**10 (29%)**	**0.03**
Pelvic dysfunction (including urinary and rectal issues), n (%)	**1 (3%)**	**7 (%)**	**0.02**
Urinary dysfunction, n (%)	**1 (3%)**	**6 (17%)**	**0.04**
De novo urinary incontinence, n (%)	0 (0%)	1 (3%)	0.31
Urinary retention, n (%)	1 (3%)	5 (14%)	0.08
Rectal dysfunction, n (%)	0 (0%)	2 (6%)	0.15
Outlet constipation, n (%)	0 (0%)	1 (3%)	0.15
Dyschezia, n (%)	0 (0%)	1 (3%)	0.31
Sexual dysfunction, n (%)	2 (6%)	5 (14%)	0.23

Raspagliesi , EJSO , 2017

IB2 –IIA & NACT & L/S -NSRH

Clinical efficacy and safety of laparoscopic nerve-sparing radical hysterectomy for locally advanced cervical cancer

Zhongyu Liu a, b, 1, Xiuli Li a, 1, Ye Tao c, 1, Weiping Li a, Yizhuo Yang a, Yuanqing Yao a, *, Tongyu Zhu b, **

Table 2
The clinical outcome of operative and follow-up of women underwent surgical treatment.

	LNRH	LRH	*P* Value
	N = 60	N = 60	
Operative time (min)	230.2(180–400)	215.5(130–450)	0.72[a]
Estimated blood loss (mL)	100(30–350)	95.2(35–400)	0.35[a]
Indwelling bladder catheter (days)	10.2(9–20)	15.5(9–35)	0.001[a]
Postoperative hospital stay (days)	11.2 (9–20)	11(9–28)	0.06[a]
Follow-up (months)	31.3 (26–38)	31.5 (26–38)	0.65[a]
Recurrence (N)	0	0	>0.99[c]
Dead of disease (N)	0	0	>0.99[c]

Table 3
The intestinal function and bladder function assessment.

	LNRH	LRH	*P* Value
	N = 60	*N = 60*	
Urinary Symptoms			
Frequency/urgency symptoms	6	20	0.004[b]
Nocturia	4	26	<0.001[b]
Dysuria	2	15	0.001[b]
Urinary retention	1	10	0.01[b]
Intestinal Symptoms			
Passage of gas by anus (hours after surgery)	39.67(33.9–44.6)	56.50(52.7–62.4)	<0.001[a]
Bowel rectal function			0.36[b]
Norma	56	52	
Constipation	4	8	
Fecal incontinence			NA
Never	0	0	
Seldom	0	6	

Liu , International Journal of Surgery , 2016

Bulky Lesion ≥ 6 cm & NACT and L/S - NSRH

Laparoscopic nerve-sparing radical hysterectomy for bulky cervical cancer (lesion ≥ 6 cm) after neoadjuvant chemotherapy:a multicentre prospective study

Yongxiu Yang, Prof Tiansheng Qin, Wei Zhang, Qiyan Wu, Aihong Yang, Feixue Xu

Table 2. The Clinical Outcomes of Surgical , Pathologic and Follow-up.

	LNRH group (n=38)	LRH group (n=38)	*P* value
Follow~up [a] (months)	20.1(12~39)	21.4(13~38)	0.78 ✱
Recurrence	1(2.6%)	1(2.6%)	>0.99 §
Dead of disease	0(0.0%)	0(0.0%)	NA

Table 3. The Assessment of Intestinal and Bladder Function

	LNRH group (n=38)	LRH group (n=38)	*P* value
Bladder Function			
Days for residual urine < 50 mL	11 (7~24)	18 (11~55)	<0.001✱
Frequency symptoms	2(5.2%)	8(21.1%)	0.04 §
urgency symptoms	1(2.6%)	7(18.4%)	0.02 §
Nocturia	1(2.6%)	11(28.9%)	0.002 §
Dysuria	1(2.6%)	9(23.7%)	0.007 §
Urinary retention	2(5.2%)	8(21.1%)	0.04 §
Incontinence	0(0.0%)	18(47.3%)	<0.001 §
Intestinal Function			
Passage of gas by anus (hour)	38.9±4.1	56.5±4.0	<0.001✱
Constipation	2(5.2%)	3(7.9%)	0.64 §
Fecal incontinence	0(0.0%)	4(10.5%)	0.04 §
Air incontinence	0(0.0%)	3(7.9%)	0.08 §

Yang , International Journal of Surgery ,2016

Sexual Dysfunction & NS - LRH

ORIGINAL RESEARCH—WOMEN'S SEXUAL HEALTH

Nerve-Sparing Approach Reduces Sexual Dysfunction in Patients Undergoing Laparoscopic Radical Hysterectomy

Table 2 Preoperative and postoperative FSFI scores in patients undergoing conventional LRH and NS-LRH

	Type C2, conventional LRH (n = 20)			Type C1, NS-LRH (n = 20)		
	Pre-LRH	Post-LRH	*P*-value	Pre NS-LRH	Post NS-LRH	*P*-value
Desire	3.9 (0.8)	2.4 (1.1)	<0.001	4.2 (1.1)	2.9 (1.6)	0.005
Arousal	4.9 (0.5)	2.0 (2.1)	<0.001	5.0 (0.9)	3.1 (2.3)	0.002
Lubrication	5.5 (0.6)	1.7 (2.2)	<0.001	5.5 (0.6)	3.4 (2.3)	<0.001
Orgasm	5.2 (0.8)	2.6 (2.6)	<0.001	5.2 (0.6)	4.1 (2.5)	0.07
Satisfaction	5.4 (0.8)	2.8 (2.2)	<0.001	5.4 (0.8)	4.6 (3.9)	0.05
Pain	5.5 (0.7)	2.4 (2.5)	<0.001	5.3 (1.1)	3.0 (2.0)	<0.001
Overall score	30.7 (2.6)	14.2 (12.5)	<0.001	30.8 (2.7)	21.3 (9.4)	<0.001

Bogani , J Sex Med 2014

Vaginal Blood Flow & Sexual Arousal

A Controlled Study on Vaginal Blood Flow During Sexual Arousal Among Early-Stage Cervical Cancer Survivors Treated With Conventional Radical or Nerve-Sparing Surgery With or Without Radiotherapy

Rinske Maria Bakker, MSc,* Quirine D. Pieterse, MD, PhD,* Luc R.C.W. van Lonkhuijzen, MD, PhD,fi Baptist J.B.M.Z. Trimbos, MD, PhD,* Carien L. Creutzberg, MD, PhD,fl Gemma G. Kenter, MD, PhD,fi Cor D. de Kroon, MD, PhD,* and Moniek M. ter Kuile, PhD*

- **Premenopausal women**
- **Vaginal photoplethysmography**

TABLE 2. The untransformed vaginal pulse amplitude mean scores and subjective arousal scores during the 4 stimuli for the 4 groups

	Control Subjects	Conventional RHL	Nerve-Sparing RHL	Nerve-Sparing RHL With RT
	n = 31	n = 29	n = 28	n = 14
Objective report: VPA, mV				
Neutral stimulus 1	1.96 ± 1.34	1.00 ± 0.76	1.70 ± 1.37	2.07 ± 1.95
Erotic stimulus 1	4.13 ± 2.37	1.69 ± 1.56	3.53 ± 2.33	3.22 ± 3.03
Neutral stimulus 2	3.35 ± 1.98	1.24 ± 0.87	2.99 ± 2.14	2.61 ± 2.19
Erotic stimulus 2	4.73 ± 2.62	1.84 ± 1.64	4.07 ± 2.81	3.87 ± 3.67
Subjective report: sexual arousal (Likert scale)				
Neutral stimulus 1	1.19 ± 0.40	1.34 ± 0.72	1.50 ± 1.00	1.14 ± 0.36
Erotic stimulus 1	3.77 ± 1.43	3.66 ± 1.37	3.61 ± 1.17	3.57 ± 0.85
Neutral stimulus 2	1.26 ± 0.63	1.34 ± 0.61	1.14 ± 0.36	1.07 ± 0.27
Erotic stimulus 2	4.74 ± 1.46	4.41 ± 1.27	3.82 ± 1.31	4.00 ± 0.68

Bakker , Int J Gynecol Cancer ,2017

Anorectal Function by Manometry & Prospective Study

Bowel Dysfunction following Nerve-Sparing Radical Hysterectomy for Cervical Cancer: A Prospective Study

V. Loizzi a, b G. Cormio a, b P.L. Lobascio c F. Marino c M. De Fazio c M. Falagario a L. Leone a G. Difiore a D. Scardigno a L. Selvaggi a D.F. Altomare c

Conclusions: Our findings suggest that nerve-sparing radical hysterectomy for cervical cancer does not seem to be associated with long-term anorectal dysfunction.

Table 1. Anorectal manometry findings at time 0 (before surgery) and time 1 (6 months after surgery)

Finding	Time 0	Time 1	p value
Maximal anal resting and squeezing pressure, mm Hg	67 (19–118)	62 (24–114)	0.24
Mean anal resting and squeezing pressure, mm Hg	42 (19–73)	39 (18–73)	0.34
Maximal squeeze pressure, mm Hg	126 (29–282)	128 (34–268)	0.86
Mean squeeze pressure, mm Hg	70 (17–158)	67 (8–125)	0.58
Length of high-pressure zone, cm	2.5 (2–4)	2.67 (1.05–4)	0.21
Threshold perception of distension, ml	69 (15–160)	64 (15–160)	0.63
Threshold perception of evacuative stimulus, ml	139 (5–255)	144 (40–245)	0.85
Maximum tolerated volume, ml	203 (84–415)	194 (70–400)	0.89
Rectal compliance	14 (2–51)	10 (1.08–25)	0.36

Loizzi , Oncology 2014

...surgical technique.....

Innovative Techniques for Dissection of Nerves

- CUSA
- Waterjet
- Sono Surg
- Intraop Electrical Stimulation
- Electromyography
- Intraoperative nerve staining

Li , Ann Surg Oncol , 2019

NSRH by using CUSA

Cavitron Ultrasonic Surgical Aspirator in Laparoscopic Nerve-Sparing Radical Hysterectomy A Pilot Study

Min Hao, MD, Zhilian Wang, MS, Fang Wei, MS, Jingfang Wang, MS, Wei Wang, MS, and Yi Ping, MS

TABLE 2. Outcomes between 2 groups

	CUSA (n = 24)	Non-CUSA (n = 21)	*P*
Postsurgical outcomes			
Postoperative indwelling catheter time, mean (SD), d	7.13 (0.61)	9.00 (3.24)	0.008*
Postoperative evacuation time, mean (SD), d	2.44 (0.51)	2.47 (0.52)	0.871
Adjuvant radiotherapy (with or without chemotherapy), n (%)	5 (20.83)	4 (19.05)	0.590
Postoperative complications, n (%)	2 (8.30)	3 (14.28)	0.435
Surgery-related outcomes			
Operative time, mean (SD), min	148.04 (18.26)	158.1 (22.24)	0.103
Estimated blood loss, mean (SD), mL	114.17 (35.25)	151.43 (49.63)	0.005*
Hospital stay after surgery, mean (SD), d	6.92 (1.56)	8.67 (2.46)	0.006*

Hao , Int J Gynecol Cancer , 2016

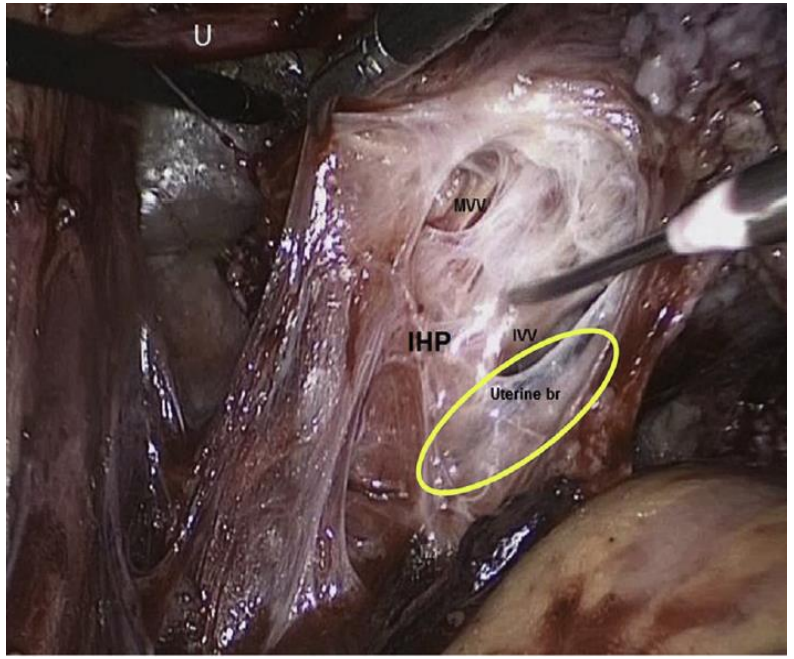
Waterjet Dissection of IHP & RCT of 160 patients

The Urodynamics and Survival Outcomes of Different Methods of Dissecting the Inferior Hypogastric Plexus in Laparoscopic Nerve-Sparing Radical Hysterectomy of Type C: A Randomized Controlled Study

Lei Li, MD, Shuiqing Ma, MD, Xianjie Tan, MD, Sen Zhong, MD, and Ming Wu, MD

TABLE 3 Comparison of urodynamic parameters between the control and waterjet groups

Parameters	Control group [N = 80]	Waterjet group [N = 80]	p value
First removal of catheter at 14 days after RH			
Residual urine volume, ml	50 (0–500)	50 (0–400)	0.065
Residual urine volume < 100 ml [n (%)]	50 (62.5%)	66 (82.5%)	0.005
Residual urine volume ≤ 50 ml [n (%)]	34 (42.5%)	49 (61.3%)	0.018
Voiding volume, ml	200 (30–400)	200 (10–350)	0.331
Voiding time, s	57 (10–300)	50 (3–300)	0.567
Average urinary flow rates, ml/s	2.9 (0.5–18.0)	3.0 (1.0–10.0)	0.889
Second removal of catheter after RH, days	21 (13–42) [n = 32]	21 (13–28) [n = 14]	0.971
Preoperative urodynamic parameters			
Bladder capacity at the first void sense, ml	169 (82–263)	181 (90–346)	0.293
Bladder capacity at normal desire to void, ml	275 (190–445)	313 (157–464)	0.068
Bladder capacity at SDV, ml	441 (302–755)	434.5 (296–571)	0.118
Q_{max}, ml/s	27 (11–79)	29 (11–60)	0.536
Q_{ave}, ml/s	14 (6–29)	13 (4–27)	0.730
P_{ves} at Q_{max}, cmH_2O	42 (22–101)	41 (21–81)	0.551
P_{det} at Q_{max}, cmH_2O	34 (16–52)	30 (14–64)	0.053
C_{ves} at SDV, ml/cmH_2O	50 (24–90)	54 (23–96)	0.125
C_{det} at SDV, ml/cmH_2O	27.5 (20–74)	32.5 (21–72)	0.056
Residual urine volume, ml	0 (0–20)	0 (0–30)	0.785
Postoperative urodynamic parameters			
Bladder capacity at the first void sense, ml	150.5 (74–274)	180 (81–349)	0.008
Bladder capacity at normal desire to void, ml	264.5 (122–454)	300.5 (171–445)	0.016
Bladder capacity at SDV, ml	440 (191–647)	411 (300–580)	0.228
Q_{max}, ml/s	24 (9–60)	26 (10–50)	0.045
Q_{ave}, ml/s	12 (5–28)	12 (3–27)	0.463
P_{ves} at Q_{max}, cmH_2O	43 (19–106)	41 (23–80)	0.836
P_{det} at Q_{max}, cmH_2O	30 (13–54)	29 (14–67)	0.666
C_{ves} at SDV, ml/cmH_2O	45 (20–92)	53.5 (24–96)	0.067
C_{det} at SDV, ml/cmH_2O	29 (12–70)	35.5 (18–69)	0.021
Residual urine volume, ml	0 (0–50)	0 (0–50)	0.305

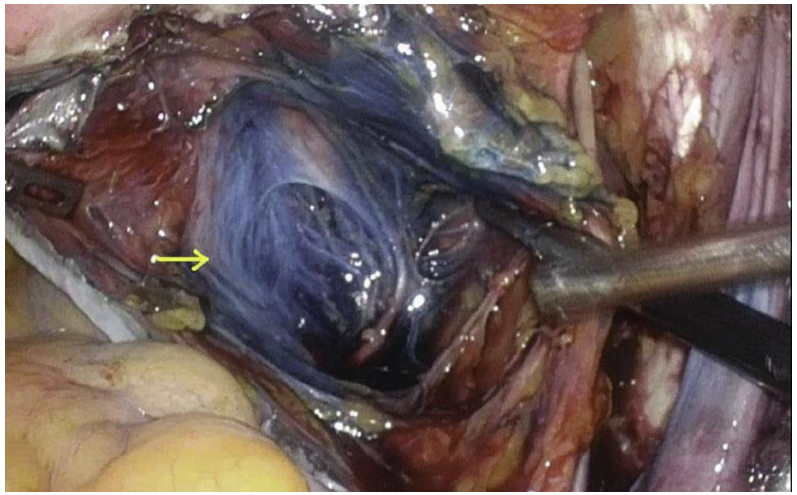


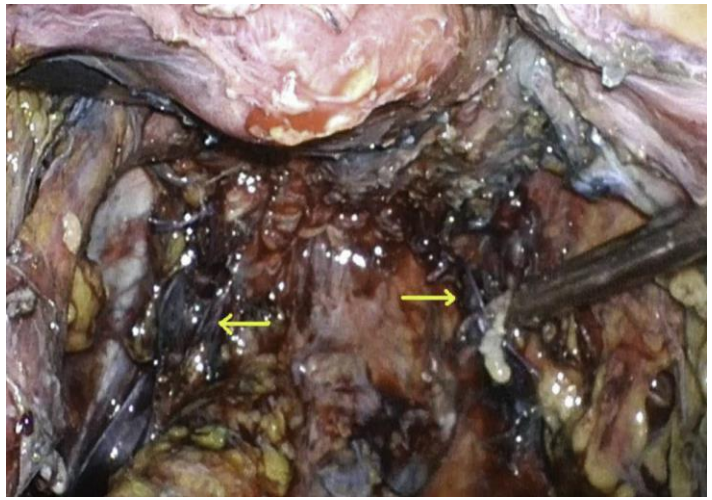
Li , Ann Surg Oncol , 2019

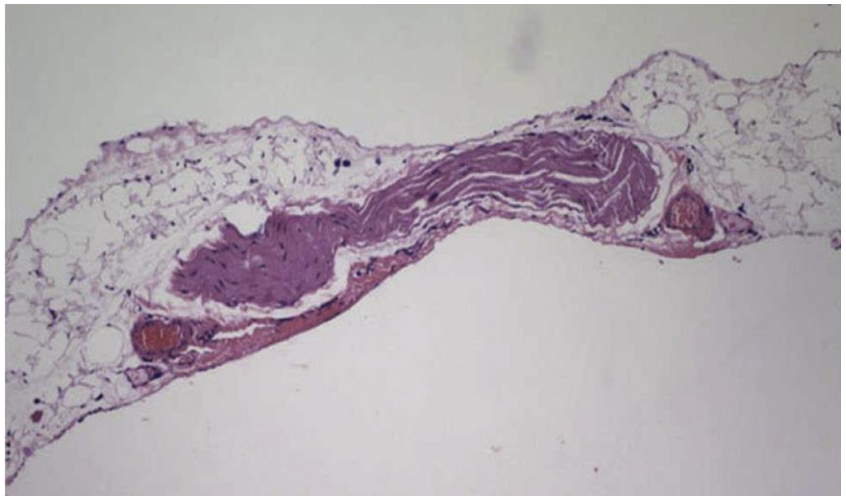
Nerve Staining with Leucomethylene Blue

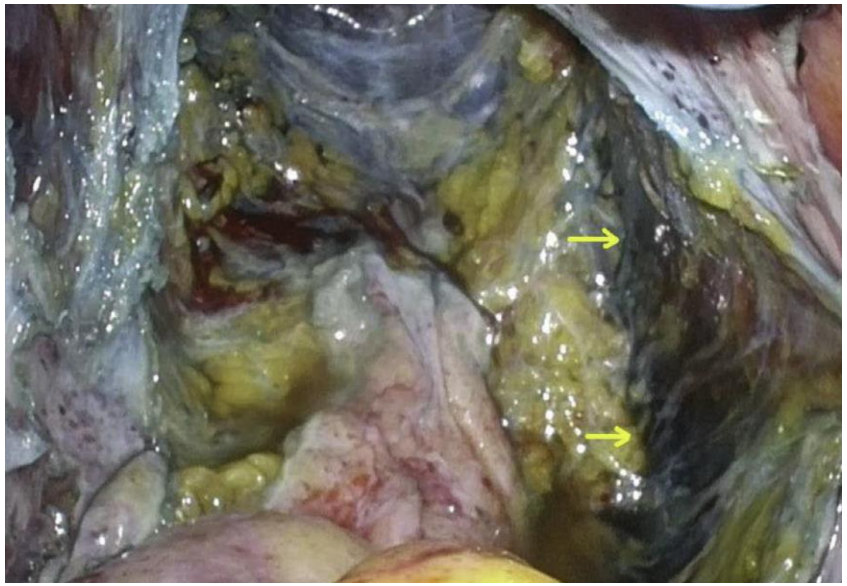
Intraoperative nerve staining in nerve-sparing radical hysterectomy: a pilot study

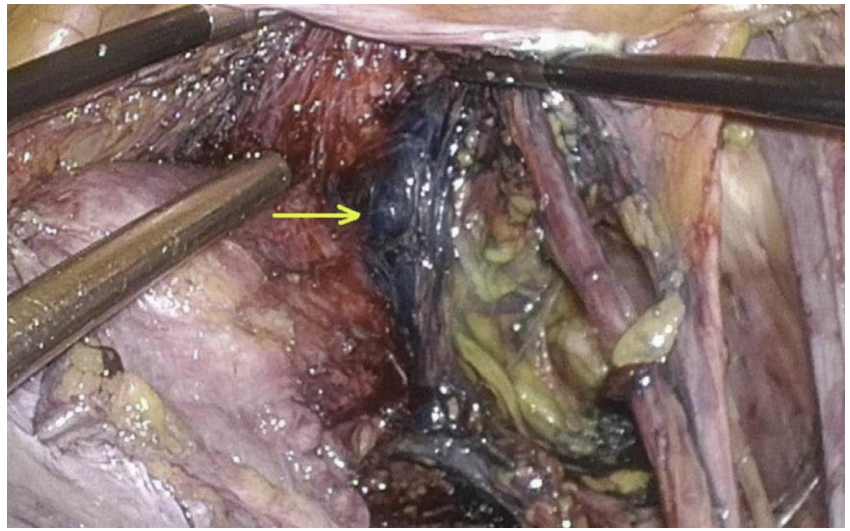
Xuyin Zhang1 · Luoqi Jia1 · Xiang Tao2 · Jingxin Ding1 · Keqin Hua1





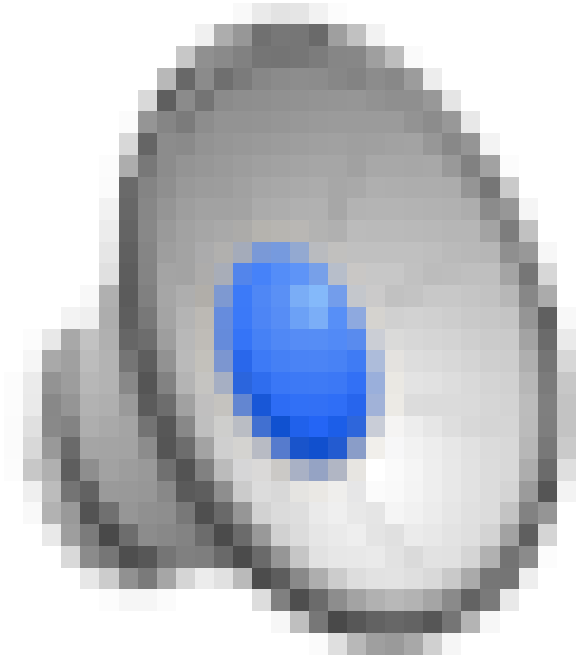




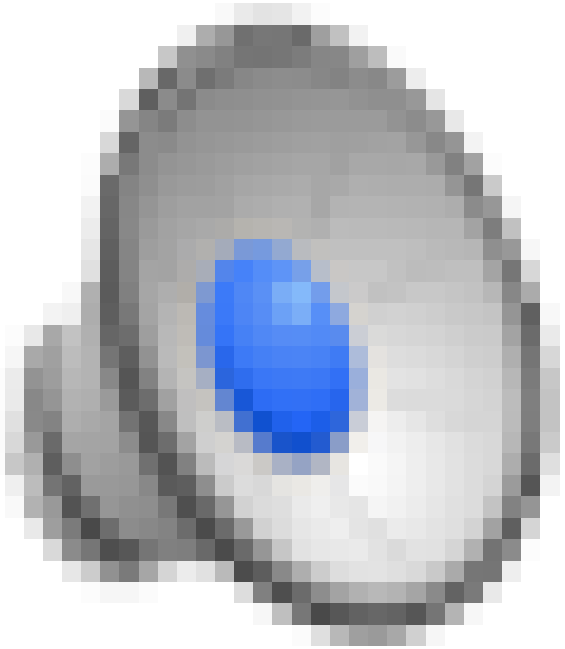


Zhang , Arch Gynecol Obstet .2017

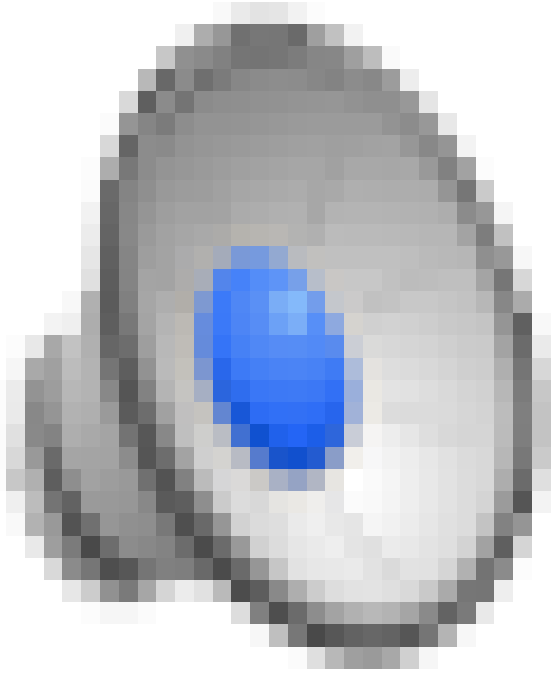
...the final aim ...



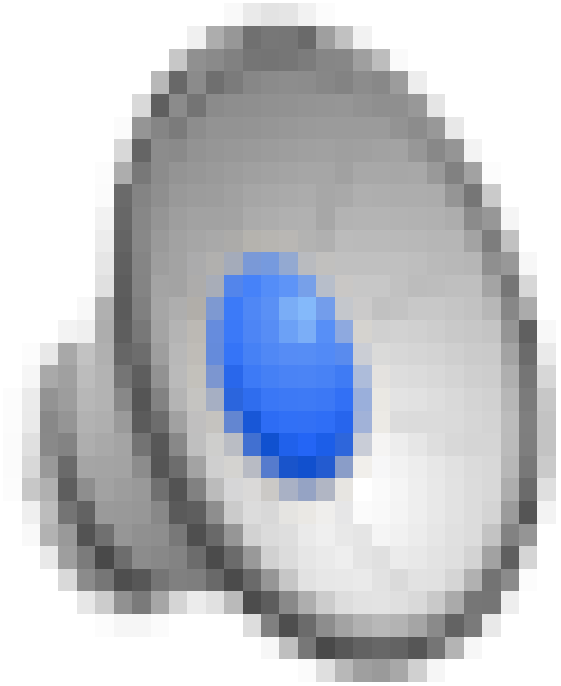
Identification of SHP and R-L Hypogastric Nerves in front of Promontorium



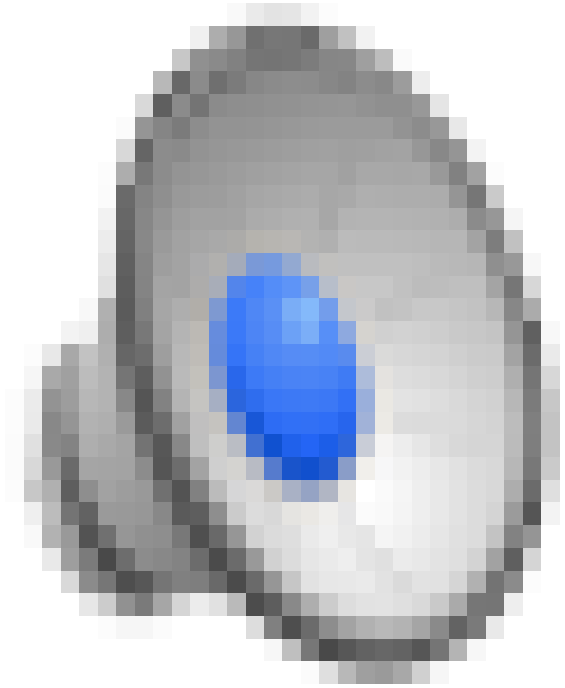
Preparation of Left Pelvic Sidewall



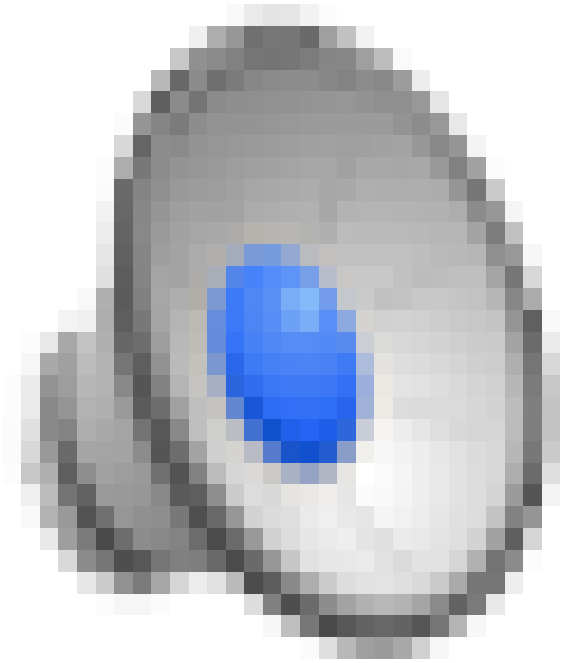
Hypogastric Nerve & PSN & Inferior Hypogastric Plexus



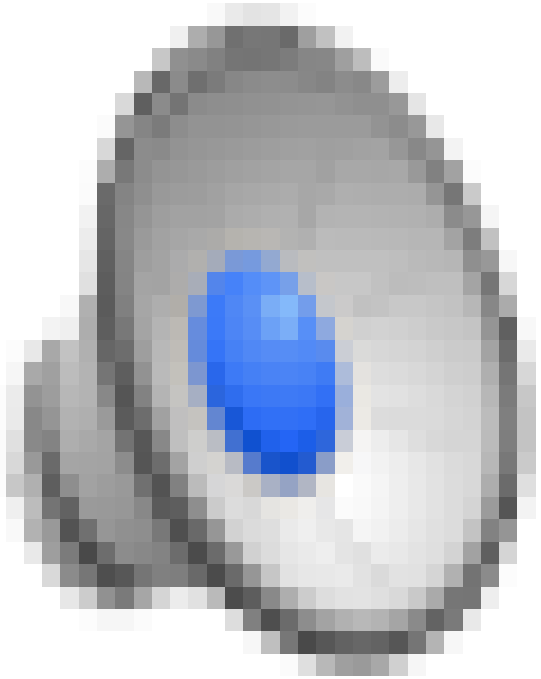
Clearance of Fatty Tissue around the Nerves by SonoSurg



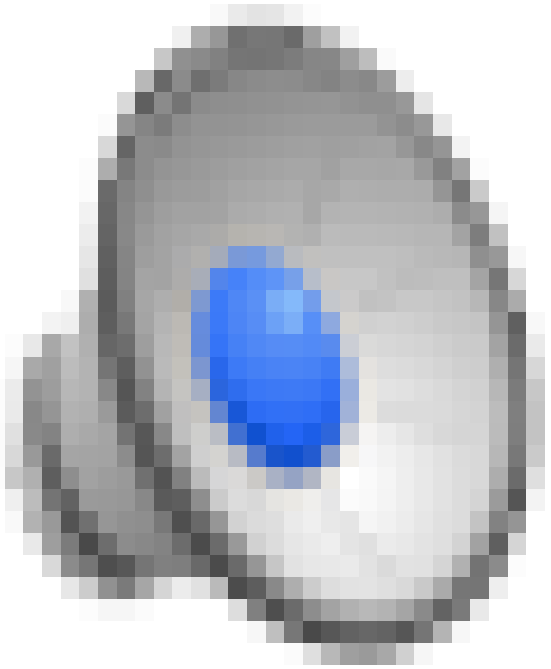
Rectovaginal Space



Anterior Parametrium



Colpotomy



Conclusion

- **Minimally invasive: LACC study…..**
- **Open surgery: no survival difference, and reported as treatment of choice at 2017 update of class'n**
- **Voiding dysfunctions: protective**
- **Bowel and sexual dysfunction: seems protective**
- **Need for further well-designed RCT for safety**

Thanks for your attention…….

NSRH & Survival and Voiding Function Open surgry & IB1-IIA1, 177 pts

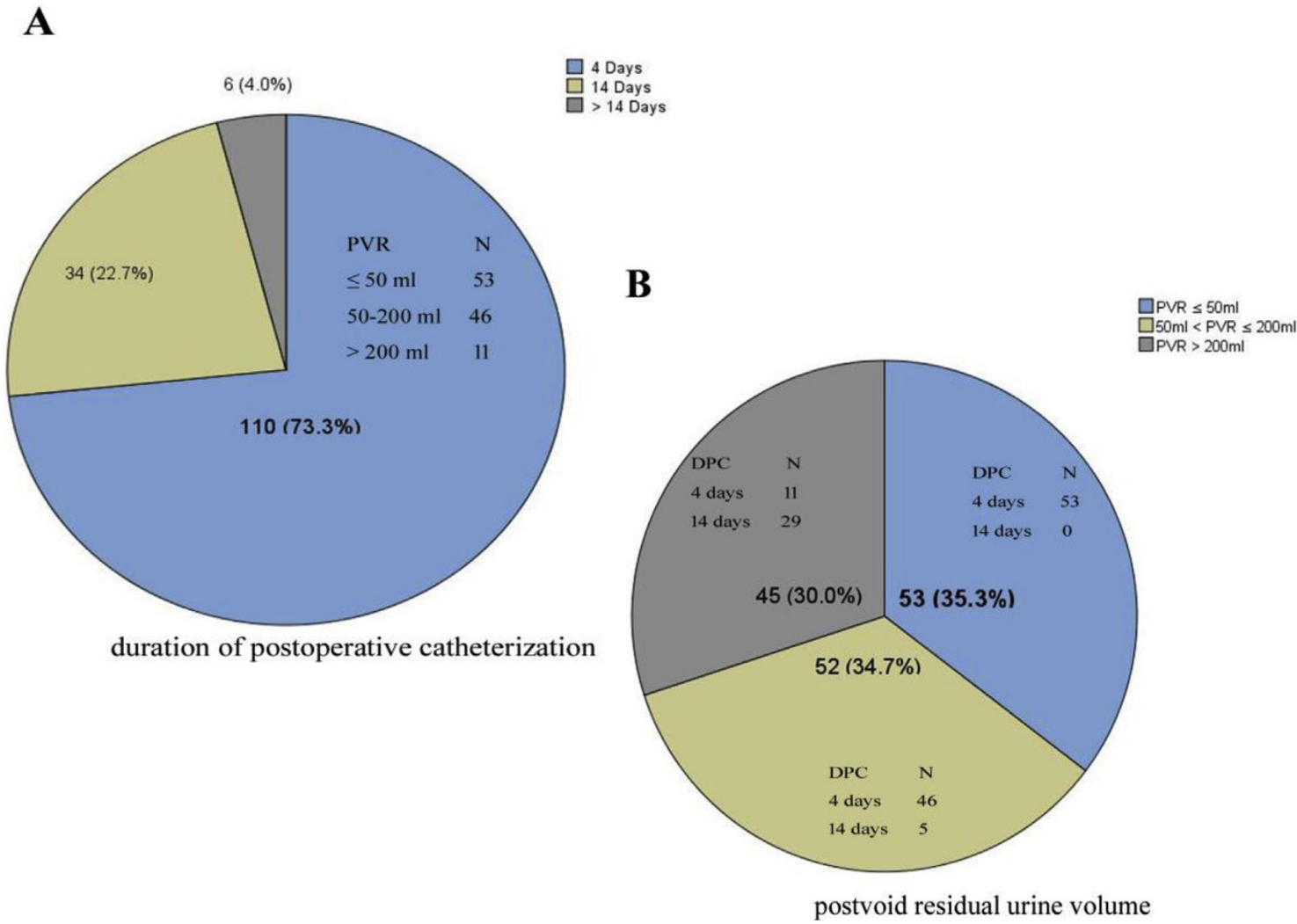
Surgical and oncological outcomes of an improved nerve-sparing radical hysterectomy technique: 6 years of experience at two centres*

Sheng Yin a, 1, Si-Ning Ma a, 1, Yu-Qin Zhang a, Ting-Yan Shi a, Li-Bing Xiang b, Yu-Lan Ren b, Rong-Yu Zang a, *

- 177 patients
- Median f-up 39 months
- 5 yr OS: 96 %
- 7 th day catheter removal : 85 %
- 7 th day PVR < 50 ml : 66 %

Table 2
Recurrence and survival data.

Event	N = 165[a]
Local recurrence	
Pelvic	5(3.0%)[b]
Vaginal	2(1.2%)
Distant recurrence	
Pulmonary	2 (1.2%)[c]
Supra-clavicular	2 (1.2%)[d]
Bone	1 (0.6%)[e]
Para-aortic lymph node	1 (0.6%)
Death for cause	
Died of distant metastasis	3 (1.8%)
Died of other cause	1 (0.6%)[f]
Died of local recurrence	1 (0.6%)



Yin, Surgical Oncology , 2018

Prospective Urodynamic and QOL Study

Short and long-term urodynamic and quality of life assessment after nerve sparing radical hysterectomy: a prospective pilot study

Juliane Kruppa *, Tilemachos Kavvadias, Stefanie Amann, Kaven Baessler, Bernhard Schuessler

NSRH preserves voiding function and bladder sensation.

However, short and long-term urodynamic detrusor overactivity and urge incontinence was observed in a significant number of women although symptoms improved over time.

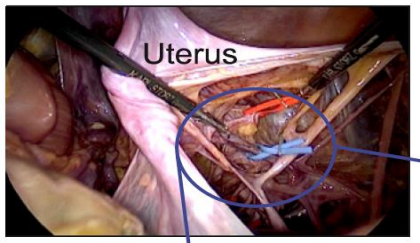
Table 2
Urodynamic findings before (U0) nerve sparing radical hysterectomy, at short-term (U1) and long-term (U2) follow-up, quality of life score (bladder section) at U0 and U2.

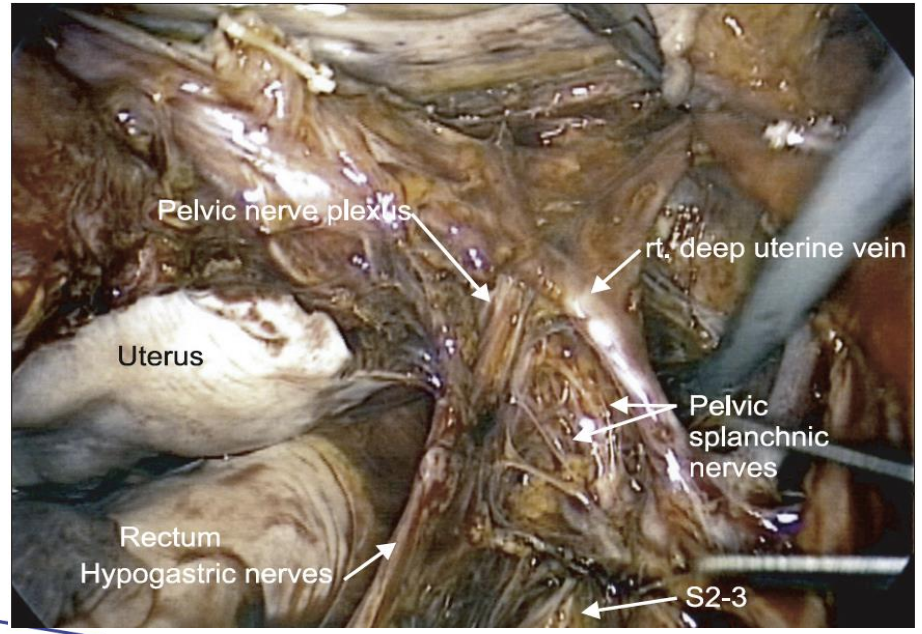
	U0	U1	U2	*p* (V1/V0)	*p* (V2/V0)
Residual volume (ml)	11 ± 12.7	77 ± 87.8	10 ± 9.9	.018	.622
max cystometric capacity (ml)	372 ± 105	279 ± 71	433 ± 111	.50	0.74
Bladder volume at strong desire to void (ml)	292.0 ± 120.3	200.5 ± 74.1	242.8 ± 63.5	.026	.69
Qave (ml/s)	13.7 ± 5.6	6.4 ± 2.7	11.3 ± 8.1	.006	.284
Qmax (ml/s)	24.6 ± 7.9	14.8 ± 6.8	24.7 ± 14.5	.003	.72
Pdetmax (cmH_2O)	37.7 ± 15.5	36.4 ± 21.9	37.2 ± 8.3	.82	.55
PdetQmax (cmH_2O)	30.2 ± 12.4	19.8 ± 9.5	24.0 ± 15.0	.16	.22
Bladder score (whole group)	1.01 ± 1.71		2.47 ± 2.35		.15
Bladder score (urge incontinence)	0.07 ± 0.13		4.81 ± 2.38		.02

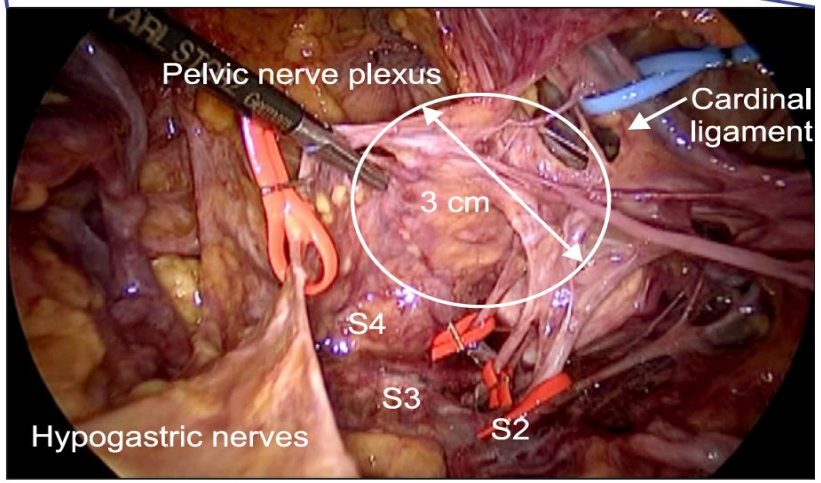
Kruppa , European Journal of Obstetrics & Gynecology and Reproductive Biology , 2016

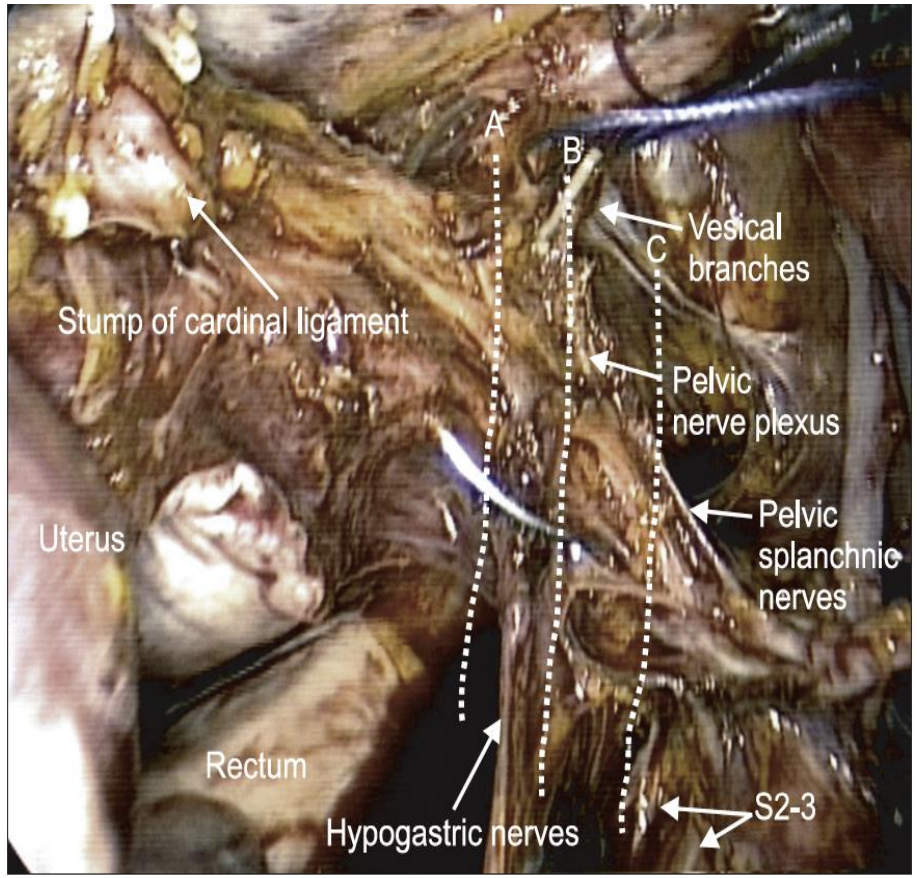
Various types of total laparoscopic nerve-sparing radical hysterectomies and their effects on bladder function

Hiroyuki Kanao, Kazuko Fujiwara, Keiko Ebisawa, Tomonori Hada, Yoshiaki Ota, Masaaki Andou









Kanao , JGO , 2014

Nerve Staining with Leucomethylene Blue

Intraoperative nerve staining in nerve-sparing radical hysterectomy: a pilot study

Xuyin Zhang1 · Luoqi Jia1 · Xiang Tao2 · Jingxin Ding1 · Keqin Hua1

Table 1 Clinical datas of the patients

Case	Stage	Histology	Age	Operating time (min)	Blood loss	Length of hospitalization	Time to recovery of bladder function (day)	Time to recovery of rectal function (day)
1	I B1	SCC	56	190	250	13	10	82
2	I B1	SCC	62	200	250	12	10	65
3	I B1	SCC	48	180	200	15	13	74
4	I B1	SCC	53	200	220	12	10	70
5	I B1	Ad	46	190	310	15	13	68
6	I B1	SCC	55	180	280	13	10	62
7	I B1	SCC	60	170	350	12	10	60
8	I B1	SCC	47	180	210	10	7	63
9	I B1	SCC	43	210	380	13	10	65
10	I B1	SCC	50	170	210	14	10	68

Zhang , Arch Gynecol Obstet .2017