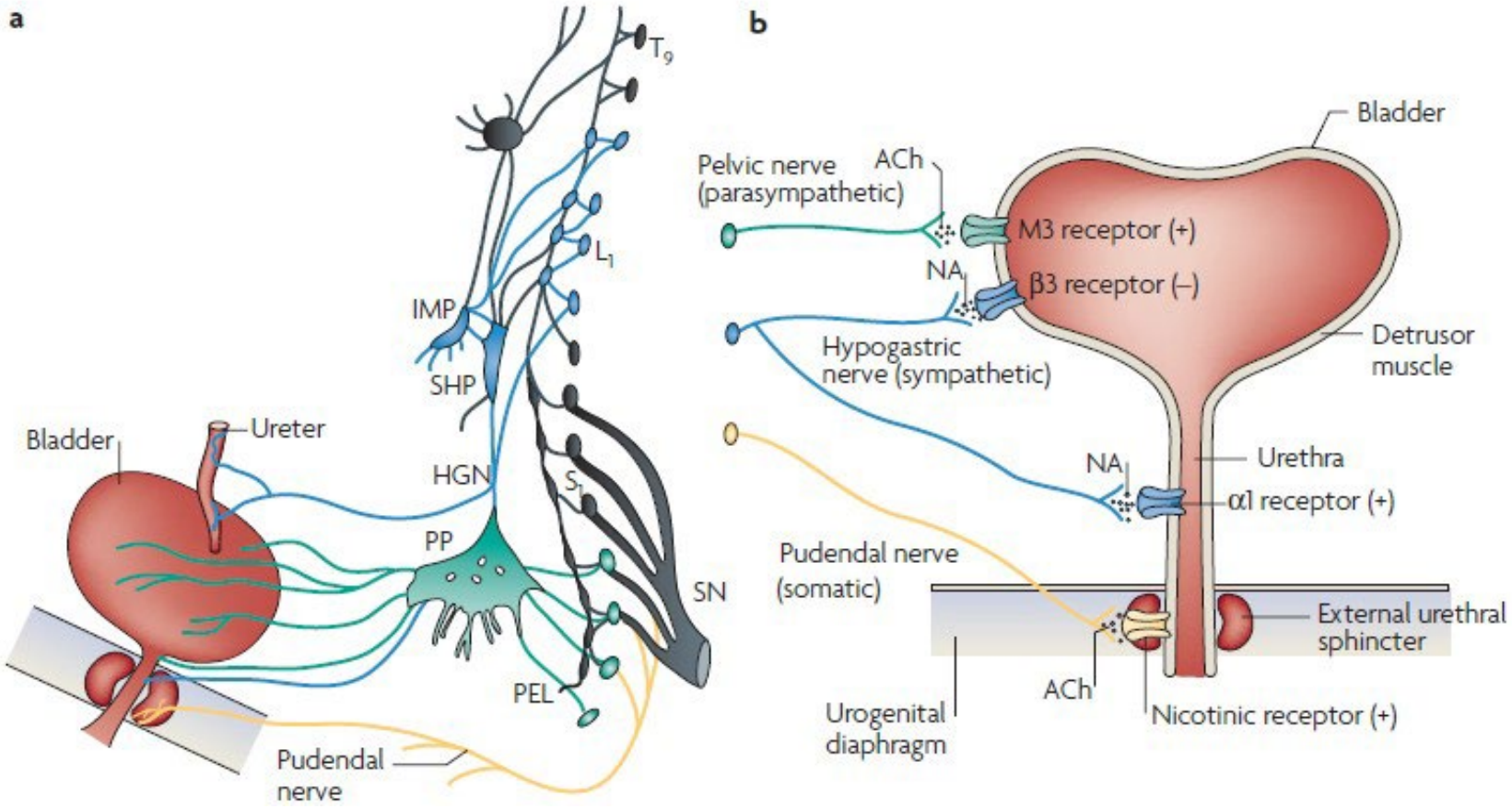
How to assess and manage neurogenic lower urinary tract dysfunction
: after pelvic surgery
(Department of General surgery, Gynecology)

Incidence

- After pelvic surgery
  - Abdominoperineal resection (APR) : 20-68%
  - Low anterior resection (LAR) : 20-25%
  - Radical Hysterectomy : 16-80%

Yalla SV, et al. J Urol 1984;132:199–209.

Efferent pathways of the lower urinary tract



Cause

Main urogenital nerve

- The parasympathetic sacral splanchnic nerves (in the pelvic plexus)
- The sympathetic nerves in the inferior and superior hypogastic plexus
- The somatic pudendal nerve (branches)

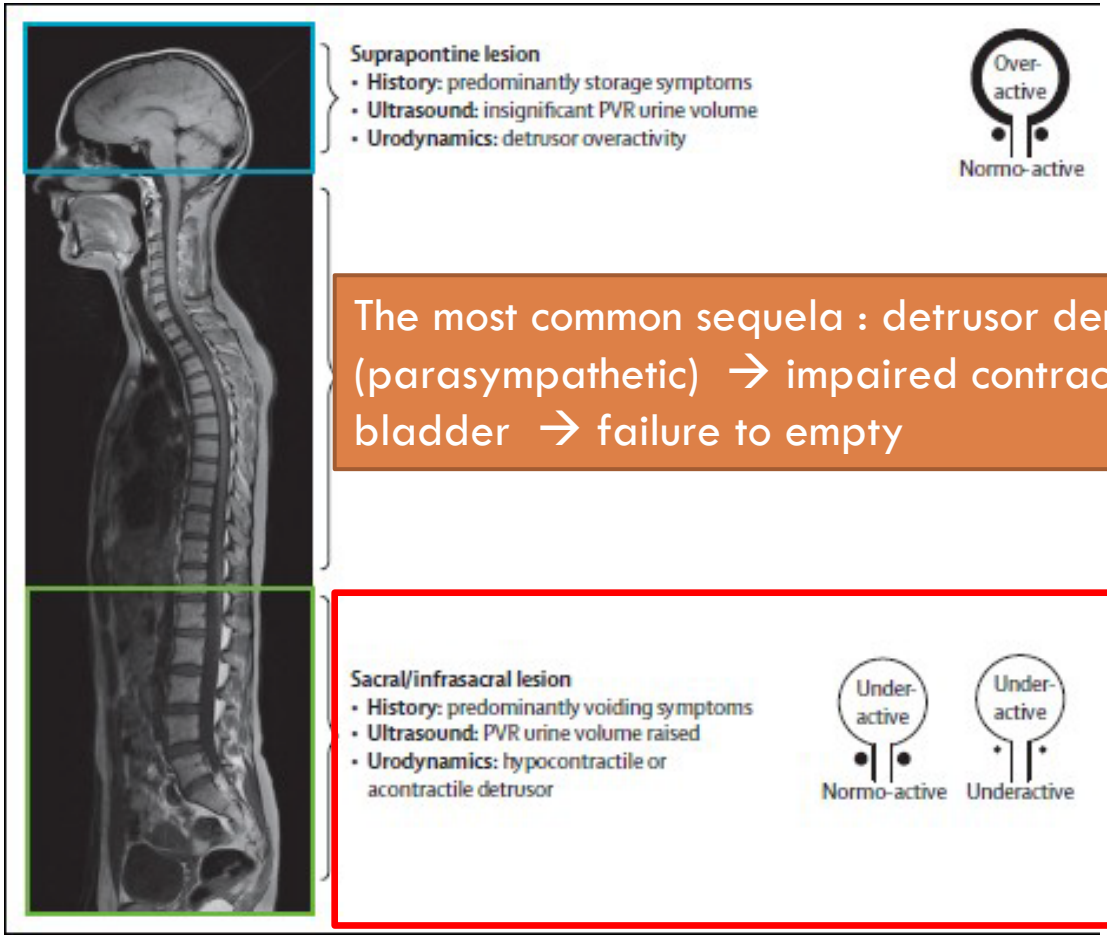
- A complete peripheral denervation (lower motor neuron lesion), which is rare, would result in the full-blown urodynamic condition of an acontractile low compliance bladder with a non-functioning rhabdosphincter. It is clear that denervation often is partial only.

Cause

Additional cause

- In women, postoperative **scarring**, and **partial excision of the vaginal wall** in women, which is sometimes necessary for oncological reasons, may impair the anatomy and function of the urinary sphincter.
- In men, the bladder, prostate, or membranous urethra (with the rhabdosphincter) is sometimes **damaged** during colorectal surgery; in rare cases, a rectourethral or vesicorectal fistula can occur.
- Impaired blood flow to the pelvic organs and the resulting tissue **hypoxia** may also have an effect on the lower urinary tract. **Hypoxia** has been associated with detrusor hypertrophy in (partial) bladder outlet obstruction and related detrusor overactivity. Furthermore, **bladder wall fibrosis** as a result of chronic hypovascularity will ultimately lead to poor compliance.

Patterns of LUTD following neurological disease



The most common sequela : detrusor denervation (parasympathetic) → impaired contractility of the bladder → failure to empty

ORIGINAL CONTRIBUTION

Measuring Sexual and Urinary Outcomes in Women after Rectal Cancer Excision

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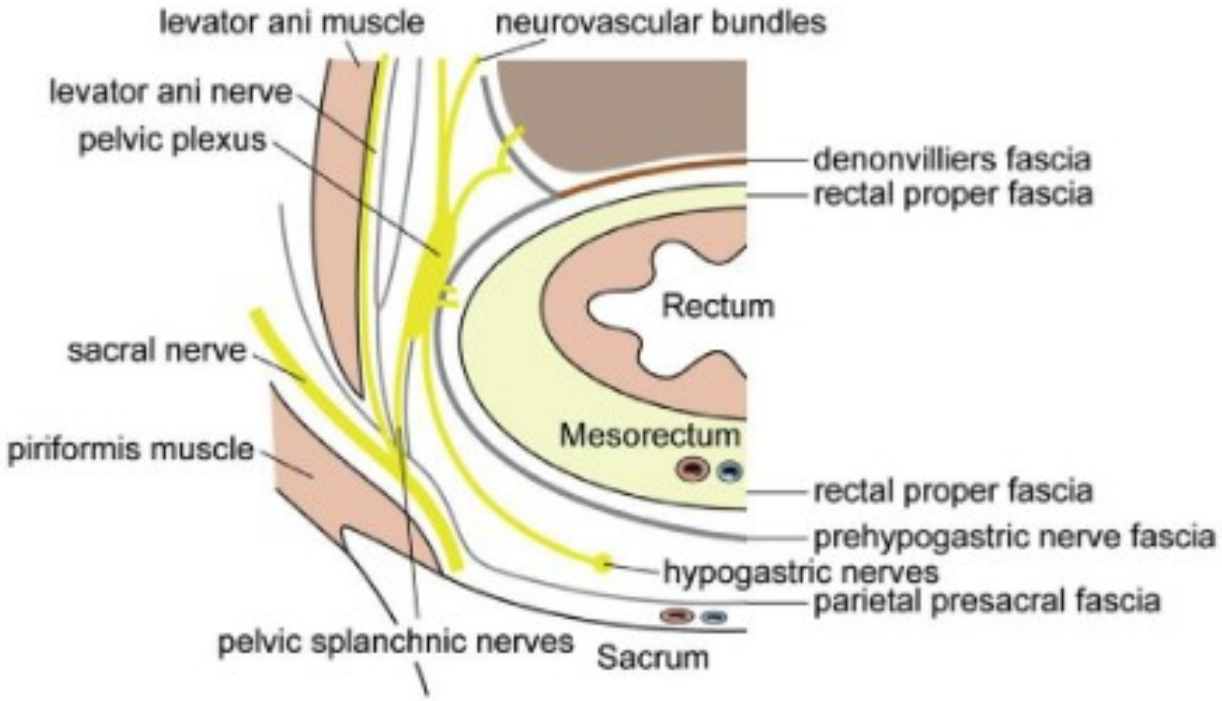
TABLE 4. Seven domains of urinary function in women: AR *vs.* APR

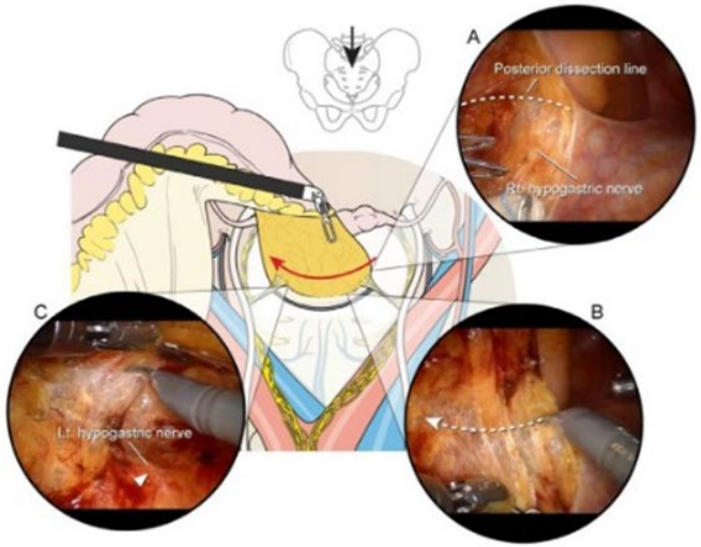
Urinary function	*Preoperative*	*0.4 years*	*0.8 years*	*1 year*	*2 years*	*3 years*	*4 years*	*5 years*	*P value trend (time)*
Poor stream									
AR	7 (10)	14.1 (19)	8.9 (11)	5.6 (6)	11.8(13)	15.1(73)	17.9 (56)	15.6 (32)	0.343*
APR	12.5 (48)	28.6 (42)	28.9 (38)	25.6 (39)	32.3 (31)	30.4 (23)	31.3 (16)	30.8 (13)	0.861*
P value†	0.239	**0.031**	**0.002**	**0.001**	**0.007**	0.1	0.245	0.25	
Nocturia									
AR	33.3 (144)	25.7 (136)	22.2 (126)	21.1 (109)	22.5 (111)	16.4 (73)	23.2 (56)	30.3 (33)	0.597*
APR	27.1 (48)	35.6 (45)	35.9 (39)	28.6 (42)	25 (32)	24 (25)	20 (15)	15.4 (13)	0.053*
P value†	0.421	0.204	0.087	0.33	0.769	0.399	0.791	0.299	
Strain water									
AR	2.8 (144)	8.8 (136)	8.8 (125)	5.5 (109)	6.3 (111)	5.5 (73)	12.7 (55)	9.4 (32)	0.974*
APR	8.3 (48)	24.4 (45)	15.4 (39)	14.3 (42)	9.7 (31)	13 (23)	18.8 (16)	7.7 (13)	0.145*
P value†	0.095	**0.006**	0.239	0.074	0.517	0.224	0.542	0.857	
Urinary retention									
AR	16.3 (141)	22.1 (136)	22.4 (125)	22.2 (108)	17.6 (108)	31.1 (74)	20 (55)	27.3 (33)	0.473*
APR	18.8 (48)	48.9 (45)	51.3 (39)	40.5 (42)	38.7 (31)	44 (25)	43.8 (16)	30.8 (13)	0.225*
P value†	0.697	**0.001**	**0.001**	**0.024**	**0.013**	0.24	0.055	0.813	
Urgency									
AR	35 (143)	32.4 (136)	36 (125)	35.8 (109)	36.4 (110)	47.3 (74)	42.9 (56)	54.5 (33)	**0.008***
APR	47.9 (48)	60 (45)	59 (39)	54.8 (42)	48.4 (31)	45.8 (24)	62.5 (16)	39.5 (13)	0.221*
P value†	0.11	**0.001**	**0.011**	**0.034**	0.225	0.901	0.165	0.326	
Incontinence									
AR	20.7 (140)	16.2 (136)	21.8 (124)	17.8 (107)	28.4 (109)	29.7 (74)	34.5 (55)	33.3 (33)	**<0.001***
APR	25 (48)	42.2 (45)	28.9 (38)	36.6 (41)	29 (31)	29.2 (24)	37.5 (16)	23.1 (13)	0.305*
P value†	0.535	**<0.001**	0.361	**0.015**	0.949	0.958	0.828	0.496	
Catheter									
AR	0.7 (143)	1.5 (136)	0.8 (125)	1.9 (108)	1.8 (109)	0 (73)	0 (55)	0 (33)	0.304*
APR	0 (48)	9.1 (44)	2.6 (39)	4.8 (42)	3.2 (31)	1 (25)	0 (16)	7.7 (13)	0.393*
P value†	0.561	**0.014**	0.381	0.321	0.637	0.086		0.107	

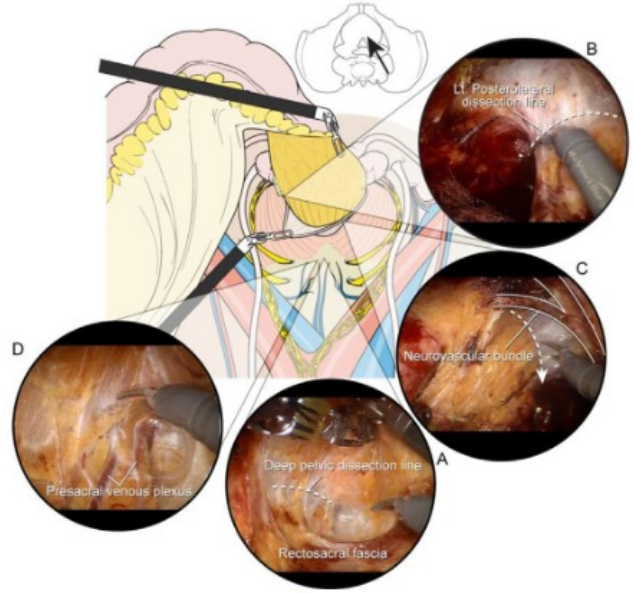
The results of changes in urinary function for anterior resection and APR over time can be seen in Table 4. Poor stream was more common after APR than AR at four months, eight months, one year, and two years (P = 0.007) and became worse over time. Urinary urgency was more frequent in APR patients for up to one year after surgery (APR 54.8 percent vs. AR 35.8 percent; P = 0.034), but symptoms of urgency increased over time for anterior resection patients (32.4 percent at 4 months vs. 54.5 percent at 5 years; P = 0.008). APR patients were significantly more likely to develop urinary retention than anterior resection patients up to two years after operation (APR 38.7 percent vs. 17.6 percent AR; P = 0.013); however, use of a catheter was only significantly higher for APR patients four months postoperatively (APR 9.1 percent vs. AR 1.5 percent; P = 0.014). APR patients had a higher incidence of incontinence than anterior resection patients at four months (APR 42.2 percent vs. AR 16.2 percent; P G 0.001) and at one year (APR 36.6 percent vs. AR 17.8 percent; P = 0.015). Anterior resection patients had an increased risk of

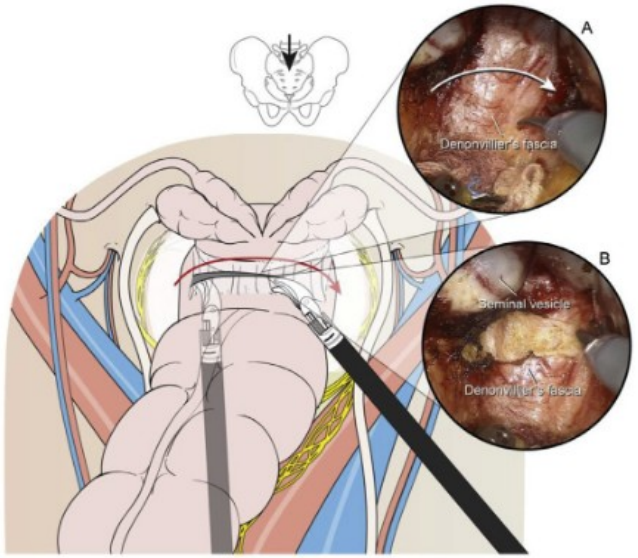
Nerve sparing of colorectal surgery

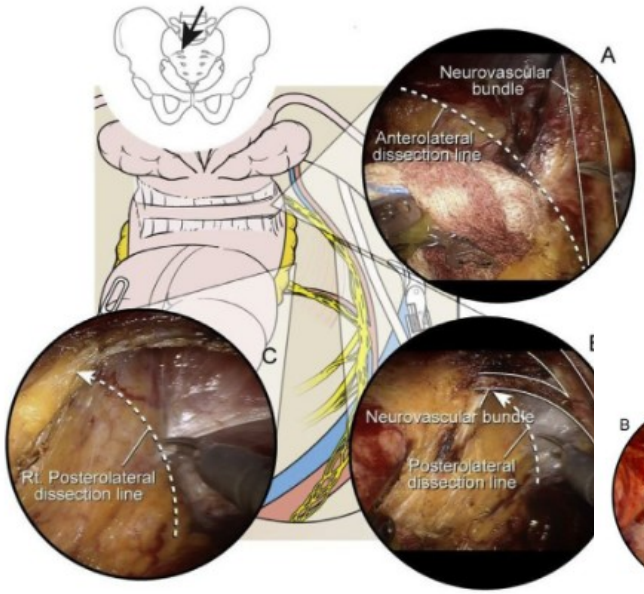
- Pelvic autonomic nerve preservation

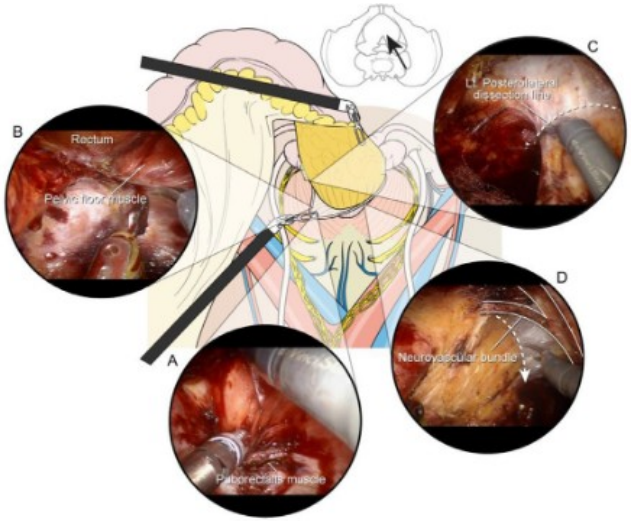



A
Posterior dissection line
Rt. hypogastric nerve
C
Lt. hypogastric nerve
B


B
Lt. Posterolateral dissection line
C
Neurovascular bundle
D
Presacral venous plexus
Deep pelvic dissection line
A
Rectosacral fascia


A
Denonvilliers fascia
B
Seminal vesicle
Denonvilliers fascia


Neurovascular bundle
A
Anterolateral dissection line
C
Rt. Posterolateral dissection line
Neurovascular bundle
Posterolateral dissection line


C
Lt. Posterolateral dissection line
B
Rectum
Pelvic floor muscle
D
Neurovascular bundle
A
Puborectalis muscle

Nerve sparing of colorectal surgery

Urinary and male sexual dysfunction following total mesorectal excision with autonomic nerve preservation.

Authors	Year	N	Urinary dysfunction (%)	Lack/reduction of erection (%)	Lack of ejaculation (%)
Havenga et al. [42]	1996	136	32	17	42
Maas et al. [43]	1998	47	28	11	42
Saito et al. [41]	1998	91	26	24	45
Nagawa et al. [6]	2001	22	27	45	45
Maurer et al. [5]	2001	19	21	55	30
Quah et al. [8]	2002	37	3	24	19
Pocard et al. [7]	2002	9	0	44	11
Kim et al. [4]	2002	68	26	25	38

NK kim, et al. Surgical Oncology, Volume 24,2015

Update on urodynamic bladder dysfunctions after radical hysterectomy for cervical cancer

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Accepted 23 December 2010

Literature review.

Author (yr)	No of pts	Type of RH Piver (Querleu)	Methodology of study		Bladder dysfunctions	Detrusor dysfunctions	Mixed UI	SUI	Urinary findings and comments	Rate
			Type study	F\U time						
Forney (1980)[a] [11]	11	III (C2)	P	6–43 mo	11(100%)	11(100%) (*low compliance*)	–	4(36%)	Decreased MUCP	3
Low (1981) [12]	20	III (C2)	P	12 mo	16(80%)	14(70%) (*low compliance*)	–	2(10%)	Decreased MUCP 5 pts had urinary retention	4
Sasaki (1982) [17]	20	III (C2)	P	12 mo	15(75%)	–	–	–	Decreased MUCP	4
Carenza (1982)[a] [18]	15	III (C2)	P	2 mo	15(100%)	11(73%) (*high compliance*)	–	5(33%)	Decreased MUCP 100% detrusor areflexia	3
Kristensen (1984) [19]	10	III (C2)	P	17–32 mo	–	–	–	3(30%)	–	3
Scotti (1986) [13]	12	II–III (B-C2)	P	12 mo	10(83%)	5(36%) (*low compliance*)	–	6(50%)	25% PVR	4
Fishman (1986) [20]	22	–	P	5–41 mo	15(70%)	–	–	15(70%)	–	2
Bandy (1987) [21]	51	III (C2)	P	7–236 mo	–	2(4%) (*low compliance*) 13(25%) (*high compliance*)	–	–	20(39%) UI 8(16%) PVR	3
Ralph (1988) [22]	40	III (C2)	P	12 mo	–	9(23%) (*low compliance*) 16(40%) (*high compliance*)	–	22(55%)	–	4
Loran (1992) [23]	154	–	P	12 mo	28(18%)	28(18%) (*low compliance*)	–	–	–	5
Sekido (1997) [24]	9	III (C2)	R	14–36 yr	7(77%)	2(22%) (*low compliance*)	1(11%)	4(44%)	–	6
Lin (1998) [25]	42	III (C2)	R	–	–	24(57%) (*low compliance*)	–	34(81%)	Reduced functional urethral length	2
Gulati (2001) [26]	20	III (C2)	R	6 we	3(15%)	3(15%) (low compliance)	–	–	–	1
Chen (2002) [27]	32	–	P	6–12 mo	11(35%)	5(16%) (*low compliance*)	–	6(19%)	Decreased MUCP 56% PVR	3
Chuang (2003) [28]	18	–	P	6 mo	18(100%)	–	–	–	Decreased MUCP Reduced bladder	1

y	Bladder dysfunctions	Detrusor dysfunctions	Mixed UI	SUI	Urinary findings and comments	Rate
time						
o	58(76%)	16(21%) (*low compliance*) 2(2%) (*high compliance*)	18(24%)	22(29%)	Reduced MUCP	7
›	20(100%)	0(0%)	10(50%)	10(50%)	Decreased MUCP 50% low compliance	5
›	41(82%) 21(67%)	32(65%) 1(3%)	– 4(13%)	8(17%) 12(40%)	– –	4 4

Yr: year; no: number; RH: radical hysterectomy; P: prospective; R: retrospective; mo: month; we: week; UI: urinary incontinence; SUI: stress urinary incontinence; MUCP: maximal urethral closure pressure; PVR: post void residual at follow up; F\U: follow up.

[a] CO_2 gas-perfused system. All other studies use water-perfused system.

Nerve sparing of radical hysterectomy

2017 Update on the Querleu–Morrow Classification of Radical Hysterectomy

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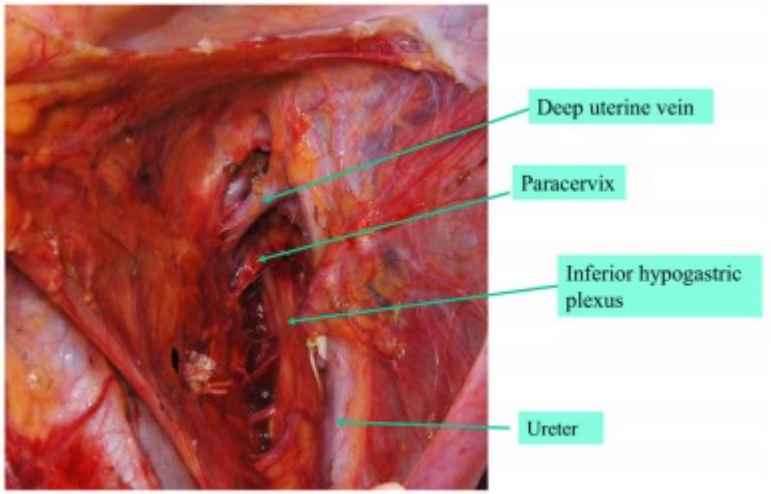

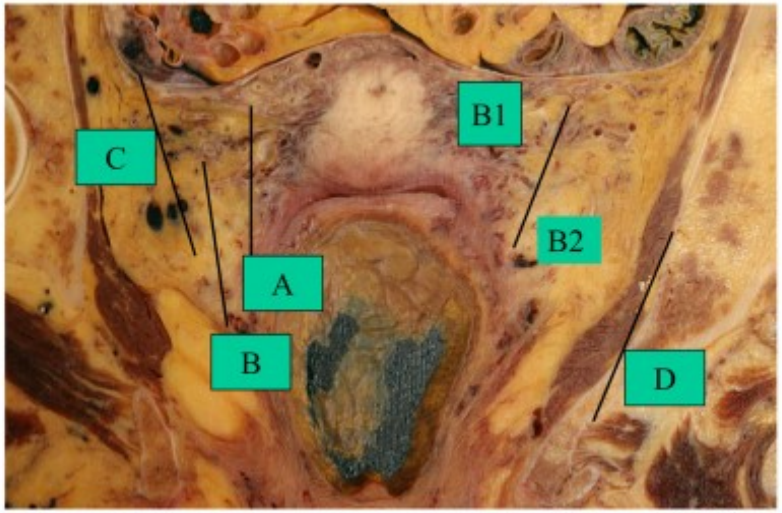

Full resection of paracervical tissues to the pelvic bone with hypogastic vessels)

Factors Affecting Spontaneous Voiding Recovery After Radical Hysterectomy

David Cibula, MD, PhD*, Jiri Sláma, MD, PhD*, Petra Velechovská, MD*, Daniela Fischerova, MD, PhD*, Michal Zikán, MD, PhD*, Iva Pinkavová, MD* and Martin Hill, DSc†

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Abstract

Background: The impairment of spontaneous voiding is the most prominent type of morbidity in the early postoperative period after radical hysterectomy. The aim of our work was to evaluate the parameters affecting the recovery of spontaneous voiding.

Methods: Enrolled were women in whom radical procedure for early-stage cervical cancer was performed in the period from 2006 to 2008. Satisfactory spontaneous voiding was characterized by the reduction of postvoiding urine residuum to 50 mL or less in the course of a whole day.

Results: Data from 85 patients were evaluated retrospectively (radical hysterectomy 67, radical parametrectomy 6, and radical trachelectomy 12), of which 35 underwent nerve-sparing modification, 19 underwent type C radicality of procedure, and 31 underwent type D radicality of procedure. Radicality of parametrectomy was the most significant parameter influencing the interval to spontaneous voiding recovery ($P < 0.05$); significant differences were observed between nerve-sparing and type D procedures. Multivariate analysis revealed 3 significant parameters: procedure radicality ($P < 0.001$), type of procedure (radical hysterectomy vs radical trachelectomy; $P < 0.05$), and a negative correlation with body mass index ($P < 0.05$). Long-term spontaneous voiding impairment lasting more than 6 weeks was observed in 7 patients, of whom 5 had undergone type D procedure.

Conclusions: The radicality of parametrial resection is the most prominent factor determining the interval to spontaneous voiding, with significantly poorer outcomes after type D procedure. Interestingly, another significant parameter in our study was the type of parametrectomy, with better outcomes achieved after radical trachelectomy. Delayed voiding recovery was observed in patients with lower body mass index.

Surgical Point

- Nerve sparing vs Radicality

  - nerve sparing : decrease of voiding dysfunction

    but, cancer control ?

  - Radicality : increase life expectancy

    but, voiding dysfunction ?

" Early detection for cancer will decrease the voiding complications. "

Assessment

- **History-taking**

• should assess both the storage and voiding phases of micturition

• Medication history should be reviewed – opiates, anticholinergic properties (eg, antipsychotic drugs, antidepressant) and α-adrenoceptor agonists

- **Bladder diary**
- **Physical examination**
- **Urodynamic Studies**

Assessment (non-urologic)

- Pelvic floor Electromyography

• first introduced for assessing the extent of relaxation of the urethral sphincter during voiding, with the aim of recognizing detrusor–sphincter dyssynergia

• now rarely recorded

• technically difficult to obtain a good quality EMG signal from urethral sphincter

- Pudendal Somatosensory Evoked Potentials

• recorded from the scalp following electrical stimulation of the dorsal nerve of penis or clitoral nerve

- Pudendal Nerve Terminal Motor Latency (PNTML)

• only test of motor conduction for the pelvic floor

• stimulated either per rectally or vaginally using the St. Mark electrode, records from the external anal sphincter

• Prolongation was initially considered evidence for pudendal nerve damage

• This test has not proved contributory in the investigation of patients with suspected pudendal neuralgia.

Management

- Medical Tx
  - anti-muscarinic / a-blocker / cholinergics

	Theoretical ability to cross blood–brain barrier	Active extrusion across blood–brain barrier	Selective receptor binding (M3:M1 affinity ratio)	Dose (mg)	Frequency	Level of evidence for use in neurogenic LUT dysfunction
Darifenacin						
Controlled release	High	Yes	Mainly M3 (9:3:1)	7·5–15	Once daily	NA
Fesoterodine						
Controlled release	Very low	Yes	Not subtype selective	4–8	Once daily	NA
Oxybutynin						
Immediate release	Moderate/high	No	Not subtype selective	2·5–5	Two or three times a day	Level 1: Gajewski et al[50]
Controlled release	Moderate/high	No	Not subtype selective	5–20	Once daily	Level 1: Gajewski et al[50]
Transdermal patch	Moderate/high	No	Not subtype selective	36 (releasing ~3·9 mg oxybutynin per 24 h)	Replace once every 3–4 days	Level 1: Gajewski et al[50]
Propiverine						
Immediate release	NA	NA	Not subtype selective	15	1–3 times daily	Level 1: Stohrer et al[51]
Controlled release	NA	NA	Not subtype selective	30	Once daily	Level 1: Stohrer et al[51]
Solifenacin						
Controlled release	Moderate	No	Mainly M3 (2·5:1)	5–10	Once daily	Level 2: van Rey and Heesakkers[52]
Tolterodine						
Immediate release	Low	No	Not subtype selective	2–4	Once or twice daily	Level 3: Ethans et al[53]
Controlled release	Low	No	Not subtype selective	4	Once daily	Level 3: Ethans et al[53]
Trospium chloride						
Immediate release	Almost none	Yes	Not subtype selective	20	Twice daily (before food)	Level 1: Mazo and Babanina[54]
Controlled release	Almost none	Yes	Not subtype selective	60	Once daily	Level 1: Mazo and Babanina[54]

TABLE 1 An overview of RCTs of parasympathomimetic agents in the treatment of UUB

Intervention	Indication and endpoint	n	Outcome	Evidence level	Ref
Bethanechol 50 mg × 3 oral from 3 days after surgery, vs no treatment	I: prophylaxis of detrusor hypotonia after W-G op. E: hospital stay, catheter treatment, rate of cystitis and residual urine	40	Hospital stay 18.6 vs 15.5 days, catheter treatment 13.3 vs 9.6 days; rate of cystitis 25.0 vs 18.8%; residual urine <50 mL after 13 vs 8 days for no treatment vs bethanechol; all differences $P < 0.01$	2b	[8]
Bethanechol 10 mg × 1 s.c. vs midazolam vs combination vs placebo	I: treatment of AUR after anorectal surgery; E: incidence of catheterization	132	0 vs 69% responders for placebo and bethanechol ($P = 0.05$) irrespective of other treatment	2b	[11]
Carbachol/diazepam 2 mg each vs alfuzosin 2.5 mg vs placebo, all ×1 oral	I: treatment of AUR after general surgery E: voiding within 2 h after medication	249	No significant difference between groups	2b	[12]
Distigmine 0.5 mg i.m. × 1 for 4 days vs placebo	I: treatment of AUR after prostatectomy; E: flow rates and re-catheterization rate	93	No significant difference between groups	2b	[13]
Bethanechol 25, 50 or 100 mg × 1 oral vs placebo 60 min before urodynamic investigation	I: women with persistent high residual urine but no sign of neurological disease or BOO E: urodynamic changes	48	No significant difference between groups for voided volume, residual volume, % residual volume, mean flow rate and intravesical pressure	2b	[14]
Bethanechol 4 × 50 mg daily oral + intravesical PGE_2 ×1/week vs placebo for 6 weeks	I: Treatment of UUB; E: residual urine	19	Relative to baseline statistically significant reduction with active treatment but not with placebo, but effect size judged as 'limited therapeutic effect' by investigator	1b	[15]
Distigmine 5 mg × 1 oral vs phenoxybenzamine 10 mg × 2 oral vs intravesical $PGF_{2\alpha}$ 7.5 mg vs placebo from 1 day after surgery	I: prevention of AUR after vaginal surgery for genital prolapse. E: residual volume after surgery	100	Statistically significant increase of residual urine for distigmine vs placebo	2b	[9]
Bethanechol 15 mg every 4 h (6 doses) vs no treatment	I: prevention of AUR postpartum; E: catheterization and residual volume	1796	No significant difference between both groups	2b	[10]
Bethanechol 20 mg × 3 or distigmine 5 mg × 3 oral vs urapidil 30 mg × 2 vs combined for 4 weeks	I: treatment of UUB E: mean and max flow rate, postvoid residual volume IPSS	119	No significant effect of cholinergic agonists vs baseline	2b	[16]
Bethanechol 25 mg × 1 oral vs placebo for 2 weeks in cross-over design	I: treatment of UUB E: residual urine, max detrusor pressure and urinary flow	16	Significant reduction of residual urine and increase in max urinary flow vs placebo ($P < 0.02$ and <0.03), detrusor pressure tended to increase	1b	[17]

I, indication; E, endpoint; W-G, Wertheim-Meigs. Patient number refers to all patients in study. Evidence levels were graded according to [7].

Management

	Storage dysfunction		Voiding dysfunction
	Urgency, frequency, with or without incontinence	Stress incontinence	
Conservative	Behavioural therapy; antimuscarinic agents; desmopressin; onabotulinumtoxinA into the detrusor; β_3-adrenoceptor agonists*; tibial neuromodulation*	Pelvic floor muscle exercises	Intermittent catheterisation; indwelling catheterisation; triggered voiding; α-adrenoceptor blockers*; onabotulinumtoxinA into the external sphincter*
Surgical	Sacral neuromodulation*; bladder augmentation; sacral deafferentation/anterior root stimulation; continent/ incontinent urinary diversion	Bulking agents*; autologous/synthetic slings; balloons*; artificial sphincter; continent/incontinent urinary diversion	Sacral neuromodulation*; intraurethral stents*; external sphincter/bladder neck incision; transurethral resection of prostate; continent/incontinent urinary diversion

In the case of combined storage and voiding dysfunction, treat the more dominant component first. *Treatments for which there is only limited evidence.

Neurourology and Urodynamics 31:327–329 (2012)

Should We Screen for and Treat Lower Urinary Tract Dysfunction After Major Pelvic Surgery?: ICI-RS 2011

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DISCUSSION

Irreversible treatment should be delayed in case of LUTD after major pelvic surgery. In fact, most symptoms spontaneously subside within 6 months after the surgery. However, urodynamic screening for the cause of the LUTD is warranted before conservative management is initiated. Anticholinergic medication is initiated in case of detrusor overactivity or poor compliance. Clean intermittent catheterization treats incomplete bladder emptying and in case of urinary incontinence, pads are effective while pelvic floor muscle excercises with or without biofeedback are initiated.

Although there is limited evidence for this, preoperative urodynamic screening before major pelvic surgery may be a wise strategy in those who already have significant lower urinary tract symptoms. However, many of these patients will not have come to the attention of the urologist and therefore these advices have to be communicated to the colorectal surgeon or gynecologist. Furthermore, efforts to predict leakage (due to SUI) with reduction of the prolapse prior to prolapse surgery, have been unsuccessful. Rather than screening for SUI following prolapse repair, women can be given information that can help in decision making prior to surgery for pelvic organ prolapse.