LOWER URINARY TRACT DYSFUNCTIONS IN DIABETES AND CHRONIC KIDNEY DISEASE (CKD) (DEPARTMENT OF INTERNAL MEDICINE)

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Mini review

Medical diseases affecting lower urinary tract function☆

CME Credits

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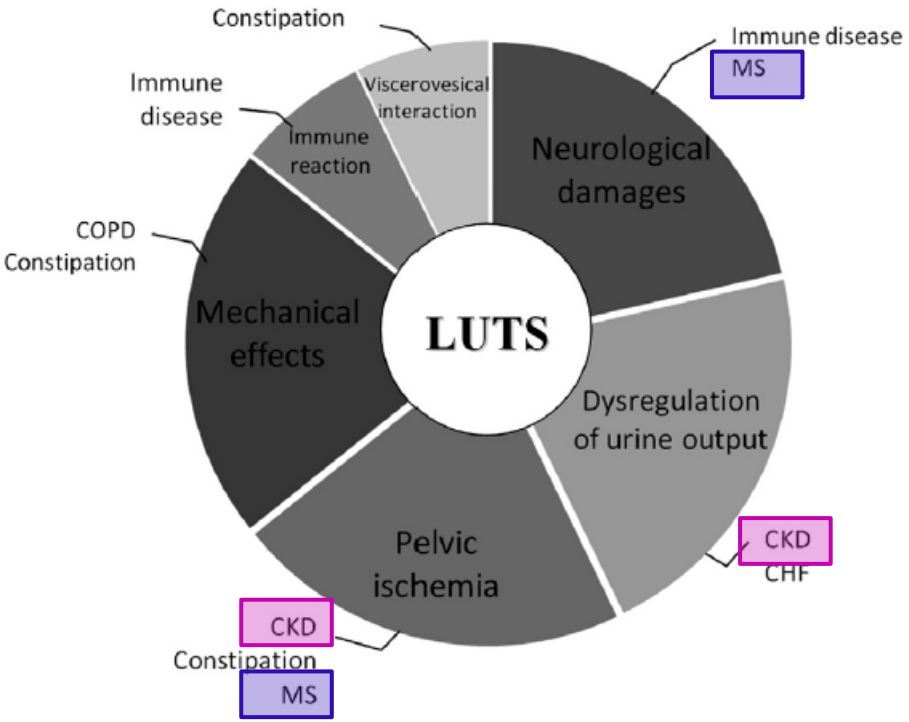
Long-term and systemic effects of disease progression on lower urinary tract function



Diabetes mellitus (DM)

DM and LUTS

- **Over 50% of men and women** with diabetes have bladder dysfunction.
- **Diabetes** has been identified as an **important independent risk factor for incontinence** in several large observational studies.
- LUTS may occur **more frequently among men with diabetes**, nearly twofold **increased risk of LUTS in men with diabetes**.
- **Men with BPH, diabetes is associated with more LUTS symptoms.**

Diabetes Care 2005;28:177-85

DM and LUTS

- Diabetic bladder dysfunction (DBD) is **traditionally described** as a triad of **decreased sensation, increased capacity and poor emptying** but **many inconsistencies** have been found in those classic findings.

- In a recent study, DM was associated with a **40% to 80% increased risk of urge incontinence** and a **30% to 80% increased risk of overflow incontinence** on controlled multivariate analyses.

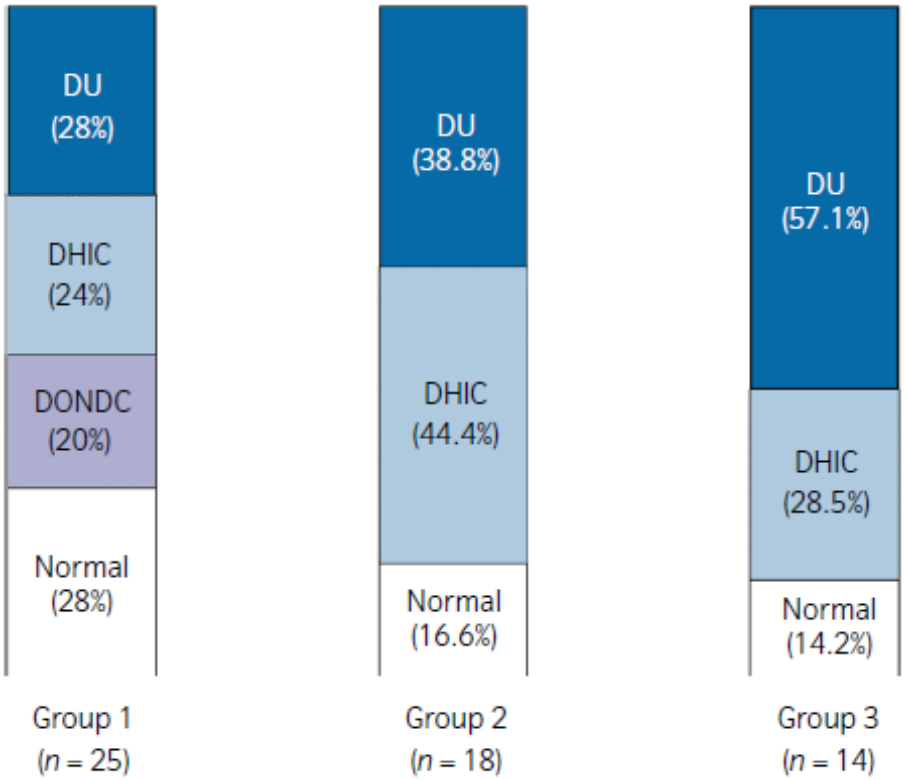
- It is now clear that DBD manifestations are a **combination of storage and voiding bladder problems**

J Urol 2009;182(6 Suppl):S18-26

INTERNATIONAL JOURNAL OF UROLOGY
International Journal of Urology (2019) 26, 618–622 doi: 10.1111/iju.13935

Original Article: Clinical Investigation

Urodynamic analysis of the impact of diabetes mellitus on bladder function



Distribution of urodynamic patterns according to the status of diabetic complications. DONDC pattern was seen only in the patient group with neither DR nor DN (group 1); 20% of the patients in group 1 showed DONDC, while no patient in the other groups showed DONDC. The proportion of DHIC pattern was highest in the patient group with only DR (group 2). In the patient group with both DR and DN (group 3), the proportion of DU pattern was highest among all patient groups (i.e. fewer complications group).
DO = detrusor overactivity, DONDC = detrusor overactivity with normal detrusor contractility
DR = diabetic retinopathy, DU = detrusor underactivity

DM and LUTS

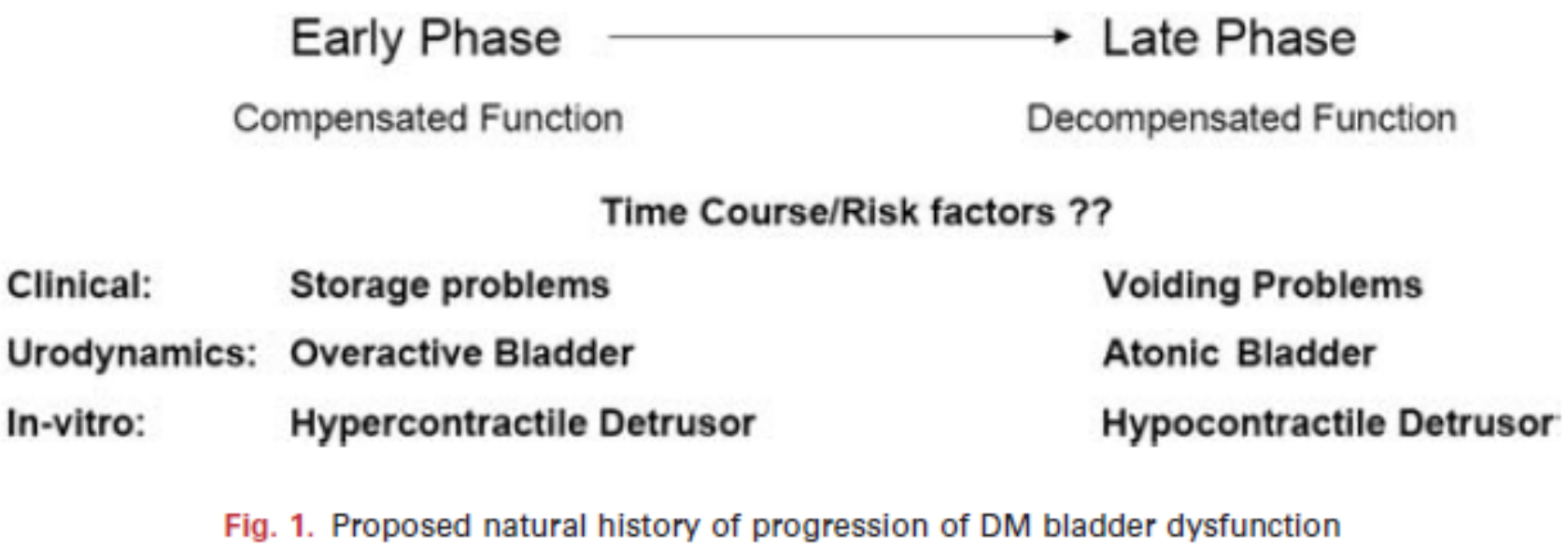


Fig. 1. Proposed natural history of progression of DM bladder dysfunction

- Morphological and functional manifestations of DBD in DM animal studies are time dependent.

J Urol 2009;182(6 Suppl):S18-26

DM and LUTS: Polyuria and Early Phase

- Bladder in DM patient is affected by not only **hyperglycemia** but also an exceptionally **high volume of urine output**.

- **Bladder hypertrophy** in diabetic animals may result from a **physical adaptation to increased urine production (hyperosmolar polyuria**).

- Otherwise, a study reported that **OAB symptoms was not associated with increased urine production** when compared **with bladder diary measurements**

Am J Physiol Regul Integr Comp Physiol2006; 291: R837
Neurourol Urodyn1990; 9: 171
Neurourol Urodyn. 2010;29:354

DM and LUTS: Prolonged Hyperglycemia, Oxidative Stress and Late Phase

- **Oxidative stress** product accumulation in most cell types is a **prominent feature of prolonged hyperglycemia.**

- **Accumulation of oxidative stress** products during prolonged hyperglycemia **causes decompensation of bladder tissue and function.**

Diabetes2005; 54: 1615

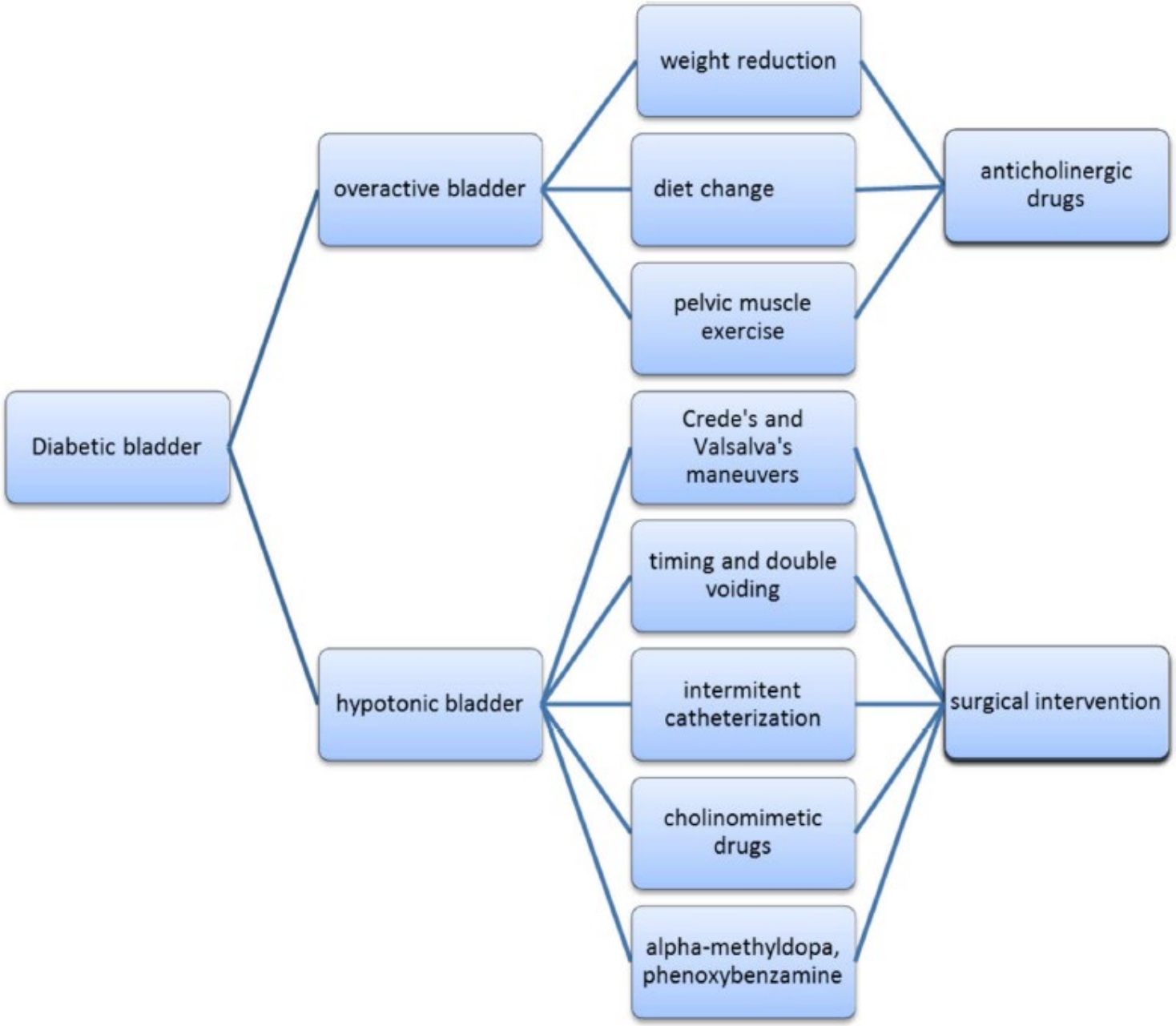
DM and BPH

- Not only do **BPH and DM have significant overlap in voiding dysfunction** symptoms, but evidence also exists that **diabetes promotes the disease process of BPH.**

- **BPH** is believed to cause LUTS through a dynamic component of **increased smooth muscle tone mediated by α1-adrenergic receptors** as well as a **static component of BOO due to the mass of the prostate.**

- Diabetes is thought to **increase the sympathetic tone of the prostate**.

J Mens Health Gend. 2005;2:230
J Urol. 2009;182:S32


Diabetic bladder
overactive bladder
hypotonic bladder
weight reduction
diet change
pelvic muscle exercise
anticholinergic drugs
Crede's and Valsalva's maneuvers
timing and double voiding
intermitent catheterization
cholinomimetic drugs
alpha-methyldopa, phenoxybenzamine
surgical intervention

Chronic kidney disease (CKD)

Lower Urinary Tract Symptoms Are Frequent in Dialysis Patients

Mei-Yi Wu[1], Shang-Jen Chang[2], Szu-Chun Hung[3] and I-Ni Chiang[4,5,*]

This Article
doi: 10.3747/pdi.2010.00054
Perit Dial Int January/February

- Overall, 54.4% of patients undergoing dialysis reported voiding symptoms and 74% reported storage symptoms

- Moderate-to-severe IPSS were 24.0% and 24.7% for patients receiving HD and PD respectively ($p > 0.05$).

- ESRD patients who receive peritoneal dialysis are more likely to present with nocturia and abdominal straining than those treated with hemodialysis.

Perit Dial Int 2011;31:99-102

Nocturia and CKD

- Nocturia associated with polyuria

  - Polyuria: urine output > 40 mL/kg/24hr or > 2.8L/24hr in a 70 kg adult

- Regulation of renal urine output

  - Impairment of renal tubular reabsorption

    ▷ Increased urine output and albuminuria

  - Risk factor: male, family history of renal disease, proteinuria, older age

    DM, HTN, higher BMI, raised Cr

Curr Opin Pulm Med 2008;14:543-50
BJU Int 2002;90 Suppl 3:7-10

ORIGINAL ARTICLE

Are Middle-Aged Men with Chronic Kidney Disease at Higher Risk of Having Nocturia than Age-Matched Controls

Chun-Kai HSU,[1,2] Mei-Yi WU,[3,4] I-Ni CHIANG,[5] Stephen S.-D. YANG,[1,2] and Shang-Jen CHANG[1,2*]

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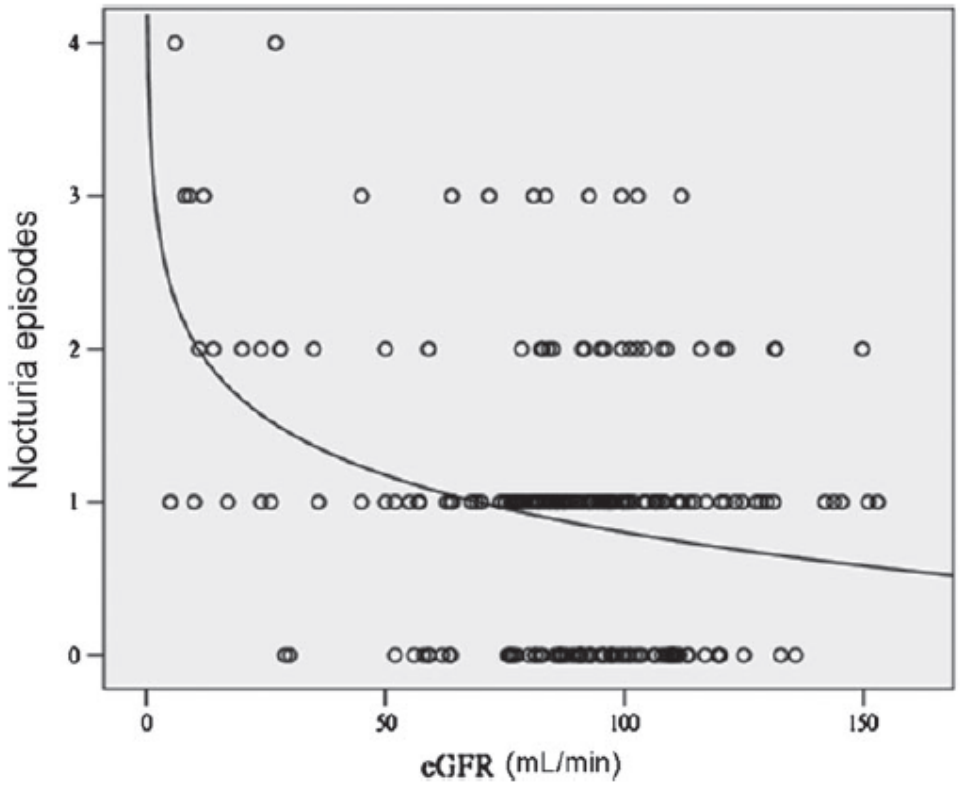
Comparisons of lower urinary tract symptom between patients with and without chronic kidney disease (CKD)

	Without CKD ($n = 187$)	With CKD ($n = 50$)	*P*-value
IPSS	6.1 ± 5.3	4.6 ± 3.8	0.10
Storage symptom score	2.7 ± 2.1	2.5 ± 2.2	0.24
Voiding symptom score	3.4 ± 3.8	2.0 ± 2.2	0.06
1. Incomplete emptying	1.3 ± 1.4	0.5 ± 0.8	<0.01
2. Urinary frequency	1.4 ± 1.3	0.9 ± 1.0	<0.01
3. Intermittency	0.8 ± 1.2	0.6 ± 1.0	0.16
4. Urgency	0.5 ± 0.7	0.4 ± 1.0	0.08
5. Small caliber of urine	0.8 ± 1.3	0.7 ± 1.0	0.59
6. Abdominal straining	0.4 ± 0.8	0.3 ± 0.8	0.47
7. Nocturia	0.8 ± 0.8	1.3 ± 1.1	0.02

IPSS, International Prostate Symptom Score.



Correlations between nocturia and estimated glomerular filtration rate (eGFR).

American Journal of Nephrology

Original Report: Patient-Oriented, Translational Research

Am J Nephrol 2009;29:264–273
DOI: 10.1159/000158526

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Accepted: July 17, 2008
Published online: September 23, 2008

Early Detection of Chronic Kidney Disease: Results of the PolNef Study

- Diagnosis of CKD, estimated glomerular filtration rate (eGFR), albumin concentration in urine, urinalysis and ultrasound examination were used according to the algorithm.

Association between patient characteristics and albuminuria

Covariate in the model for detection of albuminuria	OR (95% CI)	p value
Sex (male to female)	1.41 (1.13–1.77)	<0.005
Diabetes	1.66 (1.14–2.44)	<0.01
Nocturia	1.97 (1.54–2.52)	<0.001
Hypertension	1.81 (1.41–2.31)	<0.001

- For people without DM and HTN, nocturia independently predicted detection of albuminuria.

http://www.kidney-international.org

see commentary on page 602

Home care assistance and the utilization of peritoneal dialysis

Table 1 | Prevalence of conditions in an incident ESRD population that can act as barriers to self-care peritoneal dialysis

Medical conditions	Number (% of population)
Decreased strength (to lift PD bags)	57 (43)
Decreased manual dexterity	49 (37)
Decreased vision/blindness	33 (25)
Psychiatric condition	9 (7)
History of non-compliance	7 (5)
Social conditions	
Lives alone and requires assistance with PD	26 (19)
Residence does not permit PD[c]	12 (9)
Nursing home does not support PD	9 (7)
Rehabilitation facility does not support PD	6 (4)
Moving out of region	5 (4)
Retirement home does not support PD	4 (3)
Other[d]	4 (3)

ESRD, end-stage renal disease; PD, peritoneal dialysis.
Conditions were identified by multidisciplinary assessment.
[a]Patient expressed anxiety, feeling overwhelmed, fear of isolation, or fear of lack of supervision.
[b]Includes dementia, learning disability, or other neurologic condition affecting cognition.
[c]Includes small living space, no storage space, or no permanent residence.
[d]Includes poor hygiene, insomnia, nocturia, and imminent transplant.

International Urology and Nephrology **35:** 93–97, 2003.

Bladder dysfunction and end stage renal disease

Dirk-Henrik Zermann, Uwe Löffler, Olaf Reichelt, Heiko Wunderlich, Steffen Wilhelm & Jörg Schubert
Department of Urology, University Hospital, Friedrich-Schiller-University Jena, Germany

▶ 52 patients (14 women, 38 men, mean age 41.8 (range 14–68) years) were prospectively evaluated for lower urinary tract dysfunction before entering a renal transplantation waiting list

▶ Sonography
: Residual urine after micturition in 14 patients (27%).
: 8 patients (15%), increased bladder wall thickness

▶ Cystoscopic examination
: Mild to marked bladder trabeculation in 16 patients (31%)
: Minor bladder diverticula were found in two patients (4%)

Table 1. Urodynamic parameters in patients suffering from end stage renal disease, considered for renal transplantation

	Glomerulonephritis	Diabetic nephropathy	Chronic pyelonephritis	Polycystic kideny disease	All
Patients (*N*)	25	15	9	3	52
Bladder capacity (range) [ml]	240 (75–400)	420 (200–592)	295 (90–384)	343 (240–380)	305 (90–592)
Bladder sensitivity					
Hypersensitivity	9	3	3	1	16
Normal	14	6	5	2	27
Hyposensitivity	2	6	1	–	9
Bladder compliance					
Normal	11	14	5	2	32
Pathological	14	1	4	1	20
Detrusor instability					
Yes	7	2	4	–	13
No	18				9
Detrusor-sphincter-dyssynergia					
Yes	8	4	3	2	17
No	17	11	6	1	35
Patients *without* any functional abnormality n (% *N*)	4 (16)	5(33)	2 (22)	1 (33)	12 (23)

Abnormal bladder sensitivity (48%) and compliance (38%)

Detrusor instability (25%) during bladder filling

INTERNATIONAL JOURNAL OF UROLOGY

The Japanese Urological Association affiliated with Urological Association of Asia

International Journal of Urology (2010) 17, 791–795 doi: 10.1111/j.1442-2042.2010.02579.x

Original Article: Clinical Investigation

Bladder function of end-stage renal disease patients

- 92 patients (57 men and 35 women; mean age 45.4 years; mean period of renal replacement therapy (RRT) 60.2 months) were divided in two groups based on the presence of detrusor overactivity (DO).

Table 2 Result of pre-renal transplantation video H_2O cystometry

	Total	DO		
		+	–	*P*-value
n	92	25	67	–
Age (years)	45.4	49.8	43.8	0.048
Sex (male/female)	57/35	19/6	38/29	–
Duration of RRT (months)	60.2	64.7	58.5	NS
FS (mL)	77.7	65.3	82.3	NS
MC (mL)	187.0	163.2	195.9	NS
Compliance (mL/cm H_2O)	39.5	33.5	40.8	NS

DO, detrusor overactivity; FS, first sensation; MC, maximum cystometric capacity; NS, not significant; RRT, renal replacement therapy.

Table 3 The relationship between hemodialysis duration and pre-renal transplantation video H_2O cystometry findings

HD duration (months) ↑	*n* (%)	FS (mL) ↓	MC (mL) ↓	Compliance (mL/cm H_2O) (range) ↓	LC+ *n* (%) ↑	DO+ *n* (%)
<12	13 (14.1)	113.1	316.1	69.6 (12.9–165.5)	4 (30.8)	4 (30.8)
12–16	51 (55.4)	86.6	208.2	48.3 (2.2–289)	19 (37.3)	11 (21.6)
61–120	15 (16.3)	51.1	101	10.4 (0.8–46)	10 (66.7)	6 (40)
120<	13 (14.1)	38	74	6.2 (0.9–22.3)	10 (76.9)	4 (30.8)

Table 5 The relationship between preoperative urine volume and pre-renal transplantation video H_2O cystometry findings

Preoperative urine volume (mL/day) ↑	*n* (%)	HD duration (months) ↓	FS (mL) ↑	MC (mL) ↑	Compliance (mL/cm H_2O) ↑	LC+ *n* (%) ↓	DO+ *n* (%) ↓
<100	41 (44.6)	91.9	42.8	92.9	8.7	32 (78.0)	13 (31.7)
100–400	22 (23.9)	43.9	91.6	225.5	39.8	6 (27.3)	9 (40.9)
401–1000	16 (17.4)	21.3	103.5	248.4	65.9	3 (18.6)	2 (12.5)
1000<	13 (14.1)	35.4	132.4	342.8	98.4	2 (15.4)	1 (7.7)

DO, detrusor overactivity; FS, first sensation; HD, hemodialysis; LC, low compliance (<20 mL/cm H_2O); MC, maximum cystometric capacity.

Sex (male/female)	23/19	34/16	–
Duration of RRT (months)	85.9	38.5	<0.001
FS (mL)	53.6	97.9	<0.001
MC (mL)	117.7	245.2	<0.001

FS, first sensation; LC, low compliance (<20 mL/cm H_2O); MC, maximum cystometric capacity; NS, not significant; RRT, renal replacement therapy.

BJUI
BJU INTERNATIONAL

Chronic kidney disease among men with lower urinary tract symptoms due to benign prostatic hyperplasia

Sung Kyu Hong, Seung Tae Lee, Sung Jin Jeong, Seok-Soo Byun, Young Kwon Hong*, Dong Soo Park*, Jae Yup Hong*, Jeong Hwan Son†, Cheil Kim†, Seok Heun Jang† and Sang Eun Lee

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Accepted for publication 14 July 2009

- Both BPH and CKD are common disease entities among ageing men and that can also adversely affect their quality of life
- In reality, there is currently little information on CKD in patients with BPH of a wide spectrum of severity.
- Review of the data of 2741 consecutive patients who presented with LUTS secondary to BPH
- CKD was primarily defined as having a serum creatinine level of ≥ 133 μmol/L In a secondary set of analysis CKD was defined as having an estimated GFR of < 60 mL/min/1.73 m^2

TABLE 1 Characteristics of the patients according to CKD status

Mean or *n* (%) variable	No CKD	CKD	*P*
No. of patients	2580	161	
Serum creatinine, μmol/L	99.0	169.7	
Age, years	64.31	64.14	0.786
BMI, kg/m^2	24.54	24.44	0.627
Serum PSA level >1.4 ng/mL	1361 (52.8)	86 (53.4)	0.351
IPSS >7	2326 (90.4)	147 (93.0)	0.266
Quality-of-life score >3	1812 (70.2)	112 (69.6)	0.857
Prostate volume >30 mL	1618 (62.7)	101 (64.0)	0.287
Q_{max} <15 mL/s	1547 (60.0)	117 (72.7)	0.001
PVR >100 mL	97 (3.8)	3 (1.9)	0.213
DM	181 (7.0)	28 (17.4)	<0.001
Hypertension	304 (11.8)	44 (27.3)	<0.001

TABLE 2 The association of various clinical characteristics in patients with CKD (serum creatinine level ≥ 133 μmol/L) assessed by multivariate analysis

Variables	Odds ratio	*P*
Age	0.987	0.270
BMI	0.978	0.495
Serum PSA level	1.336	0.192
IPSS	1.332	0.225
Quality-of-life score	1.290	0.462
Prostate volume	1.521	0.212
Q_{max}	0.529	0.001
PVR	1.422	0.154
DM	2.731	<0.001
Hypertension	2.692	<0.001

Summary

- DM and CKD have a influence on the presentation of LUTS
- Although many patients will present with the classic symptoms of diabetic cystopathy, it is now clear that a significant number will have OAB and possible urinary incontinence.
- Therefore, special concern is necessary for these patients to improve their symptoms and QoL.