Published in final edited form as:

Urology. 2015 September ; 86(3): 506–510. doi:10.1016/j.urology.2015.06.005.

UROLOGICAL SURVEILLANCE AND MEDICAL COMPLICATIONS AFTER SPINAL CORD INJURY IN THE UNITED STATES

Anne P Cameron¹, Julie Lai², Christopher S Saigal³, and J Quentin Clemens¹ the NIDDK Urological Diseases in America Project

¹University of Michigan, Ann Arbor, MI

²RAND Corporation Santa Monica, CA

³University of California in Los Angeles, Los Angeles, CA

Abstract

Objectives—To evaluate national patterns of urologic follow up after SCI and the occurrence and predictors of urological complications.

Methods—This retrospective cohort study utilized a 5% sample of Medicare data 2007–2010. The minimum adequate urologic surveillance was defined as a: urologist visit; serum creatinine; and upper urinary tract imaging study within the two year period. Each patient was classified to their most severe complication in a multivariate linear regression model.

Results—Among the 7162 patients with SCI, the majority were functionally paraplegic (82.4%) and Caucasian (80.9%). 4.9% received no screening studies over the two year period, 70.5% received some, but not all screening and 24.6% received all three screening tests. Patients travelled a mean of 21.3 ± 27.5 miles to receive care. A total of 35.7% of patients saw a urologist during the two year period, 48.6% had some form of upper tract evaluation, with the majority being CT scans and 90.7% had serum creatinine. Fully 35.8% of all patients had a minor complication during their two year follow up. 17.1% had a moderate complication and 8.0% had a severe complication. In our prediction model, patient factors that correlated with increased complications included male gender, African American race, paraplegia and receiving some or all of the NGB recommended screening. Patient distance of travel to their treating physician (urologist or physiatrist) did not affect the rate of complications.

Conclusions—Most patients with SCI are not receiving the recommended screening for urological complications which are common in this population.

Keywords

Spinal Cord injuries; neurogenic bladder; complications; screening

Introduction

After traumatic spinal cord injury (SCI), virtually all patients experience some form of neurogenic bladder (NGB) dysfunction, and even 70% of those who have regained ambulation after SCI have a persistent NGB¹. Well established urological complications from NGB include urinary tract infections, bladder cancer, bladder and renal urolithiasis, hydronephrosis, and renal failure^{2–6}. Pressure ulcers can also be the result of urinary leakage and have been shown to be associated with less ideal bladder management⁷. Many of these common complications could potentially be ameliorated or prevented with adequate surveillance and urologic care.

Surveillance for urological complications in SCI patients is not standardized, and published guidelines have varying recommendations^{8–11}. The simplest recommendations are from the Paralyzed Veterans of America, who suggest that patients should receive an annual urologist visit, serum creatinine measurement and renal ultrasound¹⁰. There is, however, a lack of universal acceptance of screening guidelines for this population and variable adherence to the guidelines that do exist.

Our objectives in this study are to assess the method of urologic follow up after SCI and to determine how many patients are receiving adequate surveillance based on the Paralyzed Veterans of America guideline. We will also evaluate the occurrence and predictors of urological complications, including the impact of adequate urological surveillance. We hypothesize that the majority of patients with NGB do not receive appropriate urologic surveillance, but that the presence of surveillance does not impact the overall prevalence of complications.

Materials and Methods

This retrospective cohort study utilized a 5% sample of Medicare administrative data for the years 2007–2010. Medicare is federal medical insurance available to all individuals over the age of 65 and to some younger people with permanent disabilities such as SCI. Specific diagnostic codes (ICD-9) for spinal cord disorders were used to identify the study population (appendix A) and included only those patients with 24 months of follow up data. NGB-related complications were also collected utilizing ICD-9 codes (appendix A).

Complications of interest included urinary tract infections, renal failure, upper tract deterioration, pressure ulcers, urethral complications, urolithiasis, and bladder cancer. Complications were categorized as mild, moderate and severe based on their clinical implications. Any disease typically treated as an outpatient was classified as *mild*. Any complication requiring minor surgery or admission for treatment or with the potential to result in upper tract deterioration classified as *moderate* and any life-threatening or condition requiring major surgery classified as *severe*. Complications considered chronic (Appendix A) were excluded if they occurred in the two years prior to the study period. The minimum adequate urologic surveillance was defined as a: urologist visit; serum creatinine; and upper urinary tract imaging study within the two year period of follow up. Patients were considered to have “complete surveillance” if they received all three components in the two year period, “some surveillance” if they received one or two and “none” if they received

none of these. The urologist visit was identified based on provider identification numbers. The serum creatinine and imaging were collected with CPT-4 codes in the same time period. An upper tract evaluation was defined as a renal or abdominal ultrasound (US), intravenous pyelogram, abdominal computed tomography (CT) scan or magnetic resonance imaging, nuclear medicine renal scan or voiding cystourethrogram. Other common urological diagnostic tests such as urinalysis, urine cytology, cystoscopy, urodynamics and urine cultures were reported as well (appendix A).

Patient variables collected included patient age, gender, race/ethnicity, and region of residence based on zip codes. Distance of patient travel to a referral center was based on the patient zip code and hospital location based on information from the American Hospital Association Guide¹². Distance of travel was analyzed since a lengthy distance of travel for specialized care may result in less surveillance. Most patients would have been injured for some time before qualifying for Medicare hence the date of SCI is not available.

We classified each patient to their most severe complication and implemented a multivariate linear regression model predicting level of complication. Covariates in the model included level of injury, gender, age, race/ethnicity, geographic location of residence, distance of travel to a referral center windsorized to 95%.

Charlson comorbidity scores based on the D'Hoore¹³ adaptation utilizing ICD-9 diagnostic codes were only available for 3373 patients and was included in the initial model, but did not assist in predicting complications hence it was removed as a variable from the final model to preserve our sample size.

Results

7162 patients with SCI were included in the analysis. Mean age was 65.8 ± 17.2 years, and 47.2% were male. The majority were functionally paraplegic (82.4%) and Caucasian (80.9%). In the entire cohort 4.9% received no surveillance studies over the two year period, 70.5% received some, but not all surveillance and 24.6% received all three surveillance tests. Patients travelled a mean of 21.3 ± 27.5 miles to receive care from a urologist or a rehab center. Paraplegic patients, males and African American patients received significantly more urological surveillance (table 1).

During the two year period, 35.7% of patients saw a urologist, 90.7% had a serum creatinine and 48.6% had some form of upper tract evaluation, with the majority being CT scans (39.0% of entire cohort) followed by abdominal ultrasound (35.2%). Other urologic investigations that were performed include urinalysis in 78.9%, urine culture in 57.5%, cystoscopy in 11.8%, and urodynamic studies in 6.7% (table 2).

Minor complications occurred in 35.8% of patients during their two year follow up, with the majority of these being acute or recurrent cystitis (21.1% prevalence). Moderate complications were identified in 17.1% with the most common being chronic renal failure at 5.6%. Severe complications occurred in 8.0% (table 3). Prostate specific antigen (PSA) screening occurred in 33.3% of all male patients and prostate cancer was diagnosed in 48 men (1.4%). PSA screening and prostate cancer diagnoses were not included in the

surveillance or complication models. In our prediction model, patient factors that correlated with increased complications include male gender, younger age, African American race, paraplegia and receipt of some or all of the NGB recommended surveillance. Patient distance of travel to their treating physician (urologist or physiatrist) did not affect the rate of complications.

Comment

Even with a very lenient urological surveillance schedule of a single urologist visit, upper tract imaging and serum creatinine once in a two year period, only 24.6% of this SCI population received the minimum urologic surveillance. This was surprising since all of these patients have medical insurance.

There are other guidelines proposing different follow up regimens for patients with neurogenic bladder due to spinal cord injury. Abrams et al⁸ with the “SCI Think Tank” from the United Kingdom proposed a relatively similar follow up schedule for SCI as the one studied here. They recommend surveillance be performed at six months after injury, twelve months and then annually thereafter. This surveillance at each visit consists of imaging with ultrasound, renal function assessment (creatinine clearance at twelve months and serum creatinine thereafter), a frequency volume chart, and a review of bowel/sexual/fertility issues. Repeat urodynamic testing was recommended only for specific indications or previously concerning urodynamic findings. The authors of the guideline determined that the literature contained limited good quality data and that expert opinion was used for much of the guideline creation.

The European Association of Urology (EAU) created a guideline for the follow up of patient with neurogenic bladder that is much more intensive⁹. Their minimum required investigations include urinalysis and ultrasound of bladder and upper tract every six months, and annual urologist visit, blood biochemistry, and urine culture. They recommended videourodynamics every year for patients with detrusor overactivity or poor compliance, and every two years for the remainder.

The adherence to surveillance guidelines is difficult to determine, and the majority of studies thus far have relied on self-reported physician surveys. In the Netherlands, a survey of urologists found that only 18% followed the EAU guideline frequently when treating patients with NGB, 35% occasionally and 47% not at all. Only 12% performed the recommended annual urodynamics¹⁴.

In another survey study from France, urologists preferred follow up every six months, and annual upper tract imaging and urodynamics was recommended by 56%¹⁵. In a survey of twelve SCI treatment centers in the United Kingdom and Ireland, most of the centers saw patients annually and performed annual upper tract imaging, but most did not obtain routine UDS and there was a significant amount of variability from center to center¹⁶. A Canadian survey of urologists reported that 80% favored annual renal US and routinely used UDS to evaluate the bladder¹⁷.

A survey of 160 members of the Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction found that 85% performed annual renal US, 65% performed routine annual or biennial videourodynamics, 25% recommended routine office cystoscopy, and 93% obtained a yearly creatinine¹⁸. This may explain the relatively high rate of cystoscopy performed in this US sample of patients.

There are certain limitations to this study. Billing data has inherent biases since it offers only a limited number of patient variables and possible diagnoses, with no patient reported outcomes. It is also unclear if these urologic surveillance tests were performed as investigations for specific symptoms (for cause) or were part of routine surveillance. We did not feel that this was necessarily a detriment to this study since in clinical practice a patient receiving a particular surveillance test as part of a diagnostic workup would be excused from routine surveillance since it would be redundant. This does, however, imply that the number of patients actually being actively surveyed for complications is lower than our reported 24.6%. Our analysis found that increased urologic testing was associated with a higher risk of complications. This is most likely a result of the model for urologic complications suffering from endogeneity where the same surveillance tests were performed both for screening and symptom diagnosis with no ability to differentiate between the two which is the major limitation of this model.

Our study is also limited since Medicare is an older population typically over 65. Conversely many patients with long term disabilities who are not employed are eligible to receive Medicare hence this dataset was chosen anticipating capturing the most severely affected individuals in need of such surveillance.

It is also possible that not all of these patients with SCI had a neurogenic bladder despite their injury. Another US claims database study evaluated urological complications also measured urologist follow up in a population of patients with neurogenic bladder. The authors utilized Marketscan ® as their data source which is comprised of nearly 28 million covered lives from large employers, managed care organizations, Medicare, and Medicaid programs¹⁹. They identified the presence of neurogenic bladder differently than in this present study using lower urinary tract ICD-9 codes rather than spinal cord injury specific codes. In their study the rate of urologist visit (35.7%) and reported complications in their SCI subset were very similar to our own²⁰

This study highlights a large disparity in care for individuals with SCI. All of these patients had medical insurance yet over 75% did not get the recommended minimal annual surveillance, even in a full two year period. None of these surveillance tests are painful or morbid, hence other factors must be driving this lack of surveillance effort. It may be that it is the patients who fail to return for scheduled follow up. Appointments that are scheduled, but not attended cannot be measured in claims data. There are many unknown factors that may cause a patient to fail to return for care. In this study distance of travel did not impact surveillance frequency, but it is possible that travel of any distance is equally difficult for this group due to their disability and inherent lack of simple transportation solutions. Having more treatment centers therefore would not solve this problem. Patients may also not

recognize the importance of the visit to their health or may not have any symptoms so fail to attend.

A lack of education or guidance may be the culprit. General care physicians may not be aware of the need for urological follow up in this population, but most urologist, at least based on survey studies, recommend some form of basic surveillance. Unfortunately these urologists have little guidance on precisely what is considered surveillance for complications. The available literature on surveillance for complications has relatively low quality data^{8,11}, and no large organizations in the US except for the Paralyzed Veterans of America¹⁰ have given screening recommendations.

If there were an established national guideline that was widely distributed to patients, providers and stakeholders such as those for other urologic conditions, surveillance could potentially be simpler to recommend and follow.

Conclusions

Urological complications are common in patients with SCI, but most patients are not receiving even the minimum recommended surveillance for these complications. More education and robust guidelines are needed to provide the best care for this vulnerable population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding: NIDDK-HHSN276201200016C

Appendix

ICD-9 Codes:

<u>Paraplegia:</u>	
Fracture of vertebral column with SCI T1 and below	806.20–806.9
Spinal cord injury without bony fracture T1 and below	952.10–952.4
Paraplegia	344.1
<u>Tetraplegia:</u>	
Fracture of vertebral column with SCI Cervical (C1-7)	806.00–806.19
Spinal cord injury without bony fracture C1-7	952.00–952.09
Quadriplegia	344.0

CPT-4 codes for diagnostic test:

Serum creatinine	80048, 80050, 80053, 80069
-------------------------	----------------------------

Upper tract imaging:

Intravenous urogram	74400, 74410, 74415
Ultrasound abdomen	76700, 76705, 76770, 76775
ystogram/fluoroscopic UDS	74430, 74450
Voiding cystourethrogram	74455, 78740
CT abdomen	74150, 74160, 74170
MRI abdomen	74181, 74182, 74183, 74185
Nuclear renal scan	78700, 78701, 78704, 78707, 78708, 78709, 78725

Other investigations:

Urinalysis	81000, 81001, 81002, 81003, 81005, 81007, 8101, 81020, 81025, 8105, 81099
Urodynamics	51725, 51726, 51741, 51772, 51784, 51785, 51795, 51797
Urine culture	87086, 87088
Urine cytology	88104, 88106, 88107, 88108, 88112, 88160, 88161, 88162
Cystoscopy	52000, 52204, 52260, 52265, 52285,
Post void residual	51798, 78730
24 hour urine	82570, 84156
Serum PSA	84153

ICD-9 Codes for complications:**Mild:**

Acute cystitis	595.0
Infection and inflammation reaction due to indwelling urinary catheter	996.64
Inflammation of prostate	601
*Pressure ulcers low back, hip, buttock	707.03–05
*Unspecified stage	707.20, 707.25
*Stage 1	707.21
*Stage 2	707.22
Urethral false passage	599.4

Moderate:

Infection of kidney	590
Acute pyelonephritis	590.1×
Renal and perinephric abscess	590.2
Other not specified infection of kidney	590.8×
Unspecified infection of kidney	590.9
Urethral abscess	597.0
Orchitis and epididymitis	604
*Traumatic urethral stricture	598.1
*Post operative urethral stricture	598.2
*Other specified causes of urethral stricture	598.8
*Unspecified cause urethral stricture	598.9
*Urethral fistula	599.1
*Urethral diverticulum	599.2

*Mechanical complication of GU device- due to urethral catheter	996.31
*Mechanical complication of GU device- unspecified device	996.30
*Other complications of device - due to GU implant	996.76
*Chronic kidney disease	585
Calculus of kidney and ureter	592
Bladder stone	594
*Vesicoureteral reflux (VUR)	593.7
*VUR unspecified or no nephropathy	593.70
*VUR with reflux nephropathy, unilateral	593.71
*VUR with reflux nephropathy bilateral	593.72
*VUR with reflux nephropathy, NOS	593.73
*Other: including adhesion of ureter, ureterocele	593.89
*Hydronephrosis	591
*Hydroureter	593.5
*Pressure ulcers low back, hip, buttock Stage 3	707.23
Severe:	
Infection due to other internal GU device, implant	996.65
Septicemia	038
Rupture of bladder, non traumatic	596.6
*Vesical fistula (urethrovesical, vesicocutaneous, vesicoperineal)	596.2
*Bladder cancer	188.x, 233.7
Other diagnoses not include in model:	
*Prostate cancer	185
*Chronic conditions excluded if they occurred in prior two year period	

References

1. Patki P, Woodhouse J, Hamid R, Shah J, Craggs M. Lower urinary tract dysfunction in ambulatory patients with incomplete spinal cord injury. *J Urol.* 2006; 175(5):1784–1787. discussion 1787. DOI: 10.1016/S0022-5347(05)00979-1 [PubMed: 16600760]
2. Weld KJ, Dmochowski RR. Effect of bladder management on urological complications in spinal cord injured patients. *J Urol.* 2000; 163(3):768–772. [PubMed: 10687973]
3. Groah SL, Weitzenkamp Da, Lammertse DP, Whiteneck GG, Lezotte DC, Hamman RF. Excess risk of bladder cancer in spinal cord injury: Evidence for an association between indwelling catheter use and bladder cancer. *Arch Phys Med Rehabil.* 2002; 83(3):346–351. DOI: 10.1053/apmr.2002.29653 [PubMed: 11887115]
4. Pettersson-Hammerstad K, Jonsson O, Svennung IB, Karlsson A-K. Impaired renal function in newly spinal cord injured patients improves in the chronic state—effect of clean intermittent catheterization? *J Urol.* 2008; 180(1):187–191. discussion 191. DOI: 10.1016/j.juro.2008.03.051 [PubMed: 18499190]
5. Ost MC, Lee BR. Urolithiasis in patients with spinal cord injuries: risk factors, management, and outcomes. *Curr Opin Urol.* 2006; 16(2):93–99. DOI: 10.1097/01.mou.0000193376.07071.ac [PubMed: 16479211]
6. Esclarín De Ruz A, García Leoni E, Herruzo Cabrera R. Epidemiology and risk factors for urinary tract infection in patients with spinal cord injury. *J Urol.* 2000; 164(4):1285–1289. <http://www.ncbi.nlm.nih.gov/pubmed/10992382>. Accessed July 2, 2014. [PubMed: 10992382]

7. Cameron AP, Wallner LP, Forchheimer MB, et al. Medical and psychosocial complications associated with method of bladder management after traumatic spinal cord injury. *Arch Phys Med Rehabil.* 2011; 92(3):449–456. [PubMed: 21276958]
8. Abrams P, Agarwal M, Drake M, et al. A proposed guideline for the urological management of patients with spinal cord injury. *BJU Int.* 2008; 101(8):989–994. DOI: 10.1111/j.1464-410X.2008.07457.x [PubMed: 18279449]
9. Stöhrer M, Blok B, Castro-Diaz D, et al. EAU guidelines on neurogenic lower urinary tract dysfunction. *Eur Urol.* 2009; 56(1):81–88. DOI: 10.1016/j.eururo.2009.04.028 [PubMed: 19403235]
10. Guideline CP, Providers H. MANAGEMENT CLINICAL PRACTICE GUIDELINE: Bladder Management for Adults with Spinal Cord Injury.
11. Cameron AP, Schomer K, Rodriguez G. 13 SYSTEMATIC REVIEW OF UROLOGICAL FOLLOW UP AFTER SPINAL CORD INJURY. *J Urol.* 2011; 185(4):e5.doi: 10.1016/j.juro.2011.02.074
12. AHA Data Directories. website. 2014. <http://www.aha.org/research/rc/stat-studies/data-and-directories.shtml>. Accessed December 22, 2014
13. D'Hoore W, Bouckaert A, Tilquin C. Practical considerations on the use of the Charlson comorbidity index with administrative data bases. *J Clin Epidemiol.* 1996; 49(12):1429–1433. <http://www.sciencedirect.com/science/article/pii/S0895435696002715>. Accessed December 22, 2014. [PubMed: 8991959]
14. Rikken B, Blok BFM. Management of neurogenic bladder patients in The Netherlands: do urologists follow guidelines? *Neurourol Urodyn.* 2008; 27(8):758–762. DOI: 10.1002/nau.20582 [PubMed: 18508332]
15. Denys P, Soler J-M, Fattou B, et al. Highlighting differences in the management of neurogenic bladder existing between urologists and physiatrists: A survey conducted among 383 specialists. *Presse Med.* 2012; 41(12 Pt 1):e599–e608. DOI: 10.1016/j.lpm.2011.09.035 [PubMed: 22633051]
16. Bycroft J, Hamid R, Bywater H, Patki P, Craggs M, Shah J. Variation in urological practice amongst spinal injuries units in the UK and Eire. *Neurourol Urodyn.* 2004; 23(3):252–256. discussion 257. DOI: 10.1002/nau.20005 [PubMed: 15098222]
17. Blok BFM, Karsenty G, Corcos J. Urological surveillance and management of patients with neurogenic bladder: Results of a survey among practicing urologists in Canada. *Can J Urol.* 2006; 13(5):3239–3243. <http://www.ncbi.nlm.nih.gov/pubmed/17076944>. Accessed December 22, 2014. [PubMed: 17076944]
18. Razdan S, Leboeuf L, Meinbach DS, Weinstein D, Gousse AE. Current practice patterns in the urologic surveillance and management of patients with spinal cord injury. *Urology.* 2003; 61(5): 893–896. DOI: 10.1016/S0090-4295(02)02518-9 [PubMed: 12735998]
19. Adamson, D. Health research data for the real world: The MarketScan databases. New York Thompson. 2008 Jan. <http://patientprivacyrights.org/wp-content/uploads/2011/06/Thomson-Medstat-white-paper.pdf>. Accessed December 22, 2014
20. Manack A, Motsko SP, Haag-Molkenteller C, et al. Epidemiology and healthcare utilization of neurogenic bladder patients in a US claims database. *Neurourol Urodyn.* 2011; 30(3):395–401. DOI: 10.1002/nau.21003 [PubMed: 20882676]

Table 1

Adequacy of bladder surveillance

	Surveillance Completeness				
	None (n=350)	Some surveillance (n=5049)	Complete bladder surveillance (n=1763)	Total (n=7162)	
Level Injury:					
Tetraplegia	61 (4.8%)	954 (75.6%)	246 (19.5%)	1261 (17.6%)	Chi-square<0.000
Paraplegia	289 (4.9%)	4095 (69.4%)	1517 (25.7%)	5901 (82.4%)	
Age (mean)	59.6±18.4	67.6±17.0	61.9±17.4	65.8±17.2	ANOVA p<0.0001
Sex:					
Male	199 (5.9%)	2073 (61.4%)	1107 (32.8%)	3379 (47.2%)	Chi-square <0.0001
Female	151 (4.0%)	2976 (78.7%)	656 (17.3%)	3783 (52.8%)	
Race/ethnicity					
White	268 (4.6%)	4109 (70.9%)	1416 (24.4%)	5793 (80.9%)	Chi-square p=0.015
Black	46(5.0%)	630 (68.6%)	243 (26.4%)	919 (12.8%)	
Other	36 (8.0%)	310 (68.9%)	104 (23.1%)	450 (6.3%)	
Average distance of travel to referral center	20.1±23.7	21.6±28.1	20.6±26.4	21.3 ±27.5	ANOVA p=0.5
Region:					
Midwest	82 (5.2%)	1100 (69.4%)	402 (25.4%)	1584 (22.1%)	Chi-square p=0.027
Northeast	55 (4.2%)	892 (68.4%)	358 (27.4%)	1305 (18.2%)	
South	137 (4.6%)	2162 (71.9%)	708 (23.6%)	3307 (42.0%)	
West	76 (6.0%)	895 (70.8%)	294 (23.2%)	1265 (17.7%)	
Year of diagnosis:					
2007	163 (3.9%)	2830 (67.1%)	1227 (29.1%)	4220 (58.9%)	Chi-square p<0.001
2008	187 (6.4%)	2219 (75.4%)	536 (18.2%)	2942 (41.1%)	

Table 2

Frequency distribution of annual urologic investigations

	Years		
	2007 (n=4240)	2008 (n=2970)	total (n=7210)
Screening			
Urologist visit	1717 (40.5%)	855 (28.8%)	2572 (35.7%)
Cr	3883 (91.6%)	2653 (89.3%)	6536 (90.7%)
upper tract:			
US abdomen	1658 (39.1%)	881 (29.7%)	2539 (35.2%)
IVP	37 (0.87%)	12 (0.40%)	49 (0.68%)
Nuclear renal scan	79 (1.86%)	23 (0.77%)	102 (1.4%)
CT abdomen	1805 (42.6%)	1007 (33.9%)	2812(39.0%)
MRI abdomen	104 (2.45%)	79 (2.66%)	183 (2.5%)
Cystogram	80 (1.89%)	28 (0.94%)	108 (1.5%)
VCUG	53 (1.25%)	17 (0.57%)	70 (1.0%)
Any upper tract evaluation			3505 (48.3%)
Patients who received “minimum surveillance”	1227 (29.1%)	536 (18.2%)	1763 (24.6%)
Other Investigations:			
Urodynamics	333 (7.85%)	153 (5.15%)	486 (6.7%)
Urinalysis	3464 (81.7%)	2224 (74.9%)	5688 (78.9%)
Urine culture	2646 (62.4%)	1498 (50.4%)	4144 (57.5%)
Urine cytology	412 (9.7%)	229 (7.7%)	641 (8.9%)
Cystoscopy	593 (14.0%)	260 (8.8%)	853 (11.8%)
PVR	368 (8.7%)	254 (8.6%)	622 (8.6%)
24 hour urine	743 (17.5%)	510 (17.1%)	1253 (17.4%)
PSA (only male patients)	702 (33.1%)	435 (33.8%)	1137 (33.3%)

Table 3

Complications by Severity

Complications	2007	2008	Total
Mild:			
Acute or recurrent cystitis	22.2%	19.0%	21.1%
Inflammation due to catheter	3.8%	1.7%	3.0%
Prostatitis	0.22%	0.18%	0.21%
Pressure ulcers stage I or II	10.6%	6.0%	9.0%
Urethral false passage	0.07%	0.05%	0.06%
Total Mild	1748 (24.4%)	815 (11.4%)	2563 (35.8%)
Moderate:			
Infection of kidney	2.2%	1.4%	1.9%
Orchitis	0.35%	0.10%	0.26%
Urethral complication	0.76%	0.21%	1.1%
Complication due to device	0.62%	0.52%	0.15%
Chronic kidney disease	5.6%	6.1%	5.8%
Acute renal failure	0.42%	0.18%	0.34%
Kidney stone	1.3%	1.2%	1.5%
Vesicoureteric reflux	0.04%	0.05%	0.05%
Hydronephrosis	1.9%	1.31%	1.6%
Stage III pressure ulcer	4.0%	2.2%	3.2%
Total moderate	840 (11.7%)	381 (5.3%)	1221 (17.1%)
Severe:			
Infection due to internal GU device, implant, graft	0.63%	0.21%	0.48%
Vesical fistula	0.07%	0.08%	0.07%
Bladder cancer	0.14%	0.36%	0.21%
Pressure ulcers stage IV	4.4%	1.9%	3.55%
Total Severe	462 (6.5%)	113 (1.6%)	575 (8.0%)