

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

Hypothesis / aims of study:

After traumatic spinal cord injury (SCI), virtually all patients experience some form of neurogenic bladder (NGB) dysfunction. Well established complications from NGB include urinary tract infections, urethral strictures, bladder cancer, urolithiasis, incontinence and upper tract deterioration (1) and many of these could potentially be preventable with adequate screening and urologic care. Surveillance for urological complications in neurogenic bladder (NGB) patients is not standardized, and published guidelines have varying recommendations (2,3). 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 ultrasound (3).

Our objectives are: to assess the method of urologic follow up after SCI; and to evaluate the occurrence and predictors of urological complications including the impact of adequate bladder surveillance. Our hypotheses are that: The majority of patients with neurogenic bladder (NGB) do not receive appropriate urologic surveillance, but that the presence of surveillance does not impact the overall prevalence of complications.

Study design, materials and methods:

This retrospective cohort study utilized a 5% sample of Medicare administrative data for the years 2007-2010. Specific diagnostic codes (ICD-9) for spinal cord disorders were used to identify the study population and included only those patients with 24 months of follow up data. NGB-related complications were also collected utilizing ICD-9 codes. 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. Complications were categorized as mild, moderate and severe based on their clinical implications. Any disease typically treated as an outpatient is classified as *mild*. Any complication requiring minor surgery or admission for treatment or with the potential to result in upper tract deterioration is classified as *moderate* and any life-threatening or condition requiring major surgery is classified as *severe*. We then 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%.

Results:

7162 patients with SCI were included in the analysis of which 47.2% were male with a mean age of 65.8±17.2 years. The majority were functionally paraplegic (82.4%) and Caucasian (80.9%). In the entire cohort 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 from a urologist or a rehab center. Paraplegic patients, males and African American patients received significantly more screening.

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 (40.0% of entire cohort) followed by abdominal ultrasound (35.2%) and 90.7% had a serum creatinine. Other urologic investigations that were performed in this population that are not considered part of annual screening include urinalysis in 78.9%, urine culture in 57.5% and cystoscopy in 11.8%.

Fully 35.8% of all patients had a minor complication during their two year follow up with the majority of these being acute or recurrent cystitis (21.1% prevalence). 17.1% had a moderate complication and 8.0% had a severe complication (table 2). 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) and age did not affect the rate of complications.

Interpretation of results:

Even with a very lenient screening schedule of a single urologist visit, upper tract imaging and serum creatinine once in a two year period only 24.6% of the SCI population was completely investigated. There is a high utilization of CT scans in this population, typically not the imaging modality of choice for screening, implying that these scans were performed for cause and not screening. The presence of screening tests correlated with a higher risk for complications, suggesting that the symptomatic presentation of these complications likely lead to these investigations. There are several limitations to these analyses. There are no data on the reason for any of these investigations either screening or for-cause. The prediction model likely suffered from endogeneity possibly explaining some of the unexpected results. This dataset is also limited to those patients enrolled in Medicare which is an older population and the use of administrative data has inherent bias.

Concluding message:

Urological complications are common in patients with SCI, but most are not receiving the recommended screening for these complications. More education is needed to provide the best care for this vulnerable population.

Table 1: Adequacy of bladder surveillance

	Spinal Cord Injury			Total (n=7162)	
	None (n=350)	Some surveillance (n=5049)	Complete bladder surveillance (n=1763)		
Tetraplegia	61 (4.8%)	954 (75.6%)	246 (19.5%)	1261 (17.6%)	p<0.0001
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	p<0.0001
Male	199 (5.9%)	2073 (61.4%)	1107 (32.8%)	3379 (47.2%)	p<0.0001
Female	151 (4.0%)	2976 (78.7%)	656 (17.3%)	3783 (52.8%)	
White					p=0.015
Black	268 (4.6%)	4109 (70.9%)	1416 (24.4%)	5793 (80.9%)	
Other	46(5.0%) 36 (8.0%)	630 (68.6%) 310 (68.9%)	243 (26.4%) 104 (23.1%)	919 (12.8%) 450 (6.3%)	
Travel distance	20.1±23.7	21.6±28.1	20.6±26.4	21.3 ±27.5	p=0.5
Midwest	82 (5.2%)	1100 (69.4%)	402 (25.4%)	1584 (22.1%)	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%)	

Table 2: Rate of Complications

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%
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%

References

1. Cameron AP, Rodriguez GM, Schomer KG: Systematic review of urological followup after spinal cord injury. The Journal of urology 187(2): 391-7, 2012.
2. 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: 989-994.
3. Consortium for Spinal Cord Medicine. Bladder management for adults with spinal cord injury: a clinical practice guideline for health-care providers. J Spinal Cord Med 2006;29(5):527-573.

Disclosures

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