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ORIGINAL ARTICLE

To cystoscope or not to cystoscope patients with traumatic spinal cord injuries managed with indwelling urethral or suprapubic catheters? That is the question!

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Study design: Retrospective review of findings during cystourethroscopic surveillance of symptomatic and asymptomatic patients with indwelling urethral catheters (IUC) and suprapubic catheters (SPC) monitored between January 2003 and December 2008.
Objectives: To audit and compare findings between symptomatic and asymptomatic patients and between SPC and IUC population. To systematically review the literature including the recent National Institute for Health and Clinical Excellence guidelines on cystoscopic surveillance.
Methods: Theater management system and the electronic patient records used to retrieve demographics, injury details and operative findings.
Results: Of 925 cystoscopies performed in 507 patients, 449 were performed in 277 patients with IUC/SPC. Only 419 procedures (SPC 264; IUC 155) in 262 patients fit the inclusion criteria. Thirty procedures in fifteen non traumatic patients were excluded. Statistically there was no significant difference in incidence of findings between the symptomatic and asymptomatic group. Recurrent blockage of catheter was predominant in the SPC group and symptomatic urinary tract infections (UTIs) were the most common indications in the IUC group. In the asymptomatic group, there were 44 squamous metaplastic changes in 27 patients. Two of these patients had keratinizing variants. The duration of catheterization ranged from 20 months to 27 years and mean of 13.7 years. The average duration between two cystoscopies in the symptomatic group was 16 months compared with an average 21 months in the asymptomatic group.
Conclusion: Cystourethroscopic surveillance in high-risk patients with IUC/SPC is essential to diagnose and manage at an early-stage complications associated with IUC/SPC, minimize symptomatology, mitigate aggravation of complications, maintain good health and probably good quality of life.
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Keywords: traumatic spinal cord injury; suprapubic catheter; indwelling urethral catheters; cystourethroscopic surveillance

INTRODUCTION

Spinal cord injuries (SCI) cause multisystem physiological impairment, malfunction and disability. The sensory loss can delay presentation and diagnosis of pathology. It also results in absence of classical signs and symptoms of an organ system and can present differently. For example, the intersystem effect of bladder pathology manifesting as acute exacerbation of spasticity/autonomic dysreflexia (AD).

Since the second world war, integration of urological surveillance and timely intervention in the management of patients with SCI has reduced morbidity and mortality prolonging survival.[1]

Clean intermittent catheterization remains the gold standard for bladder drainage, however, it is not always possible. Poor hand function, aversion to being catheterized by others, impaired cognitive function, difficulty and trauma during catheterization and non-compliance are some limiting factors.[1]

Indwelling urethral (IUC) or suprapubic (SPC) catheters are safe alternative methods of drainage provided catheter hygiene and urological surveillance is ensured.[1] Neglected IUC and SPC are associated with a high risk of development of vesical and upper urinary tract calculi, recurrent upper and lower UTIs, catheter blockage causing bypassing of urine and/or AD, urethral or skin erosions, difficulty in reinsertion, septicemia and death. A higher risk of bladder cancer in the SCI population with SPC/IUC compared with the general population is acknowledged.[2,3]

There is consensus that SCI patients benefit from urological surveillance, but no agreement on the cystoscopic surveillance protocol of patients with IUC or SPC.

In order to minimize complications, symptomatology, morbidity, pathology, diagnose and/or treat early, the Midland Centre for Spinal Injuries (MCSI) has found it necessary to offer these patients 12–24 monthly cystourethroscopic surveillance depending on the presence or absence of symptoms.

Aim

The aim of our study was to analyze the positive findings of cystourethroscopic surveillance in our population of SCI patients with SPC or IUC. We performed a systematic literature review to examine the evidence with respect to urological surveillance in neurogenic bladder and screening cystourethroscopy.

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MATERIALS AND METHODS

We carried out a retrospective review of findings during cystourethroscopic surveillance in IUC/SPC group between January 2003 and December 2008. We used the theater management system and the electronic patient records to retrieve patient demographics including injury details and operative findings. We only included traumatic SCI patients. We excluded non traumatic patients. We categorized the patients into symptomatic and asymptomatic group and audited the procedures in these two groups. Microsoft Office Excel was used to collate and analyze the data.

An electronic English literature search was conducted using MEDLINE and EMBASE databases. The search terms included spinal cord injury, neurogenic bladder, cystourethroscopy, bladder cancer, uro-lithiasis, UTIs, bladder management, urine cytology and urinary markers.

A total of 79 abstracts were reviewed with six articles meeting the inclusion criteria. Most of the articles were of Level III/Level IV evidence.

The articles were narrowed down to those that assessed the clinical and cost effectiveness of cystourethroscopy in urological surveillance of neurogenic bladder. We also studied the National Institute for Health and Clinical Excellence (NICE) guidelines and recommendations.

Following gentamycin or ceftazidime in renal impairment, sedation by experienced anesthetist, most procedures are carried out with rigid cystoscope. AD is very rare and its effects minimized with antimuscarinics prophylaxis in AD-sensitive patients.

RESULTS

There were a total of 925 cystoscopies performed in 507 patients. (Tables 1–7) We excluded 245 patients (no permanent catheter in 230; non traumatic SCI in 15). We included 262 patients on whom 419 cystoscopies were performed. The duration of indwelling catheter ranged from 20 months to 27 years. The average duration between 2 cystoscopies in the symptomatic group was 16 months.

In the asymptomatic group, histo-pathological findings (Table 6), vesical calculi ($n=44/274$; 16%) and thick proteinaceous debris that would block catheters ($n=74/274$; 27%) were found on cystourethroscopy. We considered minimal to moderate amount of proteinaceous debris and inflamed bladder mucosa to be negative findings in 60/274 procedures (22%).

A Fisher's exact test was not significant in the incidence of findings in symptomatic and asymptomatic group.

Eleven of the 13 patients presenting with AD reported freedom from AD for up to 12 month follow-up (Figure 1). This could be due to pre-cystourethroscopic blockage of catheter with thick proteinaceous debris and/or luminal encrustations, which resolved post cystourethroscopy.

Table 1 Total number of procedures and patients across the groups

Group	*Procedures*	*Patients*
Suprapubic catheter	264	147
Urethral catheter	155	115
Total	419	262

Table 2 Procedures—Symptomatic and asymptomatic across both group

Group	*Symptomatic (%)*	*Asymptomatic (%)*	*Total*
Suprapubic catheter ($n=264$)	78 (30%)	186 (70%)	264
Urethral catheter ($n=155$)	67 (43%)	88 (57%)	155
Total	145 (35%)	274 (65%)	419

Table 3 Indications for cystourethroscopy in symptomatic group

Indication	*SPC (n = 78) (%)*	*Urethral (n = 67) (%)*
UTIs	16 (20%)	23 (35%)
Recurrent blockage	27 (35%)	9 (13%)
Prev H/o metaplasia	15 (19%)	2 (3%)
Radiological finding of calculi	13 (17%)	6 (9%)
Autonomic dysreflexia + UTI	7 (9%)	6 (9%)
Insertion of suprapubic catheter	—	21 (31%)

Abbreviations: SPC, suprapubic catheter; UTI, urinary tract infection.

Table 4 Cystoscopic findings in symptomatic SPC group (78 patients) of whom 15 patients had metaplastic changes (predominant indication only included although most of the patients had more than one indication)

Indications	*Proteinaceous debris*	*Vesical calculi*	*Inflamed bladder*
UTIs ($n=16$)	8 (50%)	6 (37.5%)	2 (12.5%)
Recurrent blockage($n=27$)	13 (48%)	11 (40%)	3 (12%)
Radiological finding of calculi ($n=13$)	3 (23%)	8 (62%)	2 (15%)
Autonomic dysreflexia + UTI ($n=7$)	1 (14%)	4 (57%)	2(29%)

Abbreviations: SPC, suprapubic catheter; UTI, urinary tract infection.

Table 5 Cystoscopic findings in symptomatic urethral catheter group (67 patients) of whom 2 patients had metaplastic changes

Indications	*Proteinaceous debris*	*Vesical calculi*	*Inflamed bladder*
UTIs ($n=23$)	7	2	14
Recurrent blockage($n=9$)	3	2	4
Radiological finding of calculi ($n=6$)	1	5	—
Autonomic dysreflexia + UTI ($n=6$)	3	1	2

Abbreviation: UTI, urinary tract infection.

Table 6 Biopsies and findings

Biopsy findings	*Symptomatic (n = 145)*	*Asymptomatic (n = 274)*	*Total (n = 419)*
Metaplastic changes	17	44 (2*)	61
Inflammatory	50	52	102
Total biopsies	67	96	163

*There were 2 keratinizing variants of squamous metaplasia in asymptomatic group.

Table 7 Patient distribution by level and completeness of injury

Level and completeness	SPC	*IUC*
Cervical complete	60	25
Cervical incomplete	47	36
Thoracic-lumbar complete	34	34
Thoracic-lumbar incomplete	6	20
Total	147	115

Abbreviations: IUC, indwelling urethral catheter; SPC, suprapubic catheter.

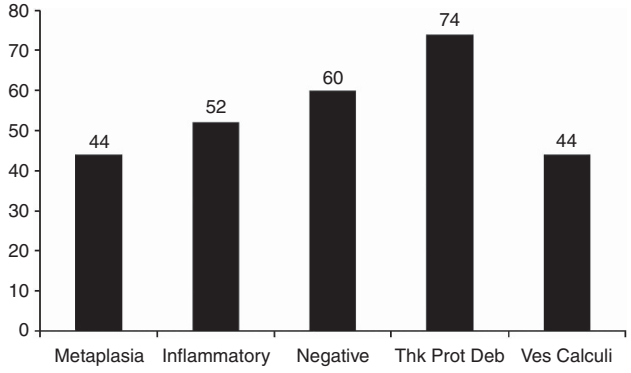

Figure 1 Chart representing findings in the asymptomatic group.

Hematuria is extremely rare except when biopsy or litholapaxy is required. In this series only one patient following litholapaxy required evacuation of blood clot and no patients required transfusion.

DISCUSSION

Our findings confirm some of the published complications associated with neurogenic bladders with SPC/IUC.[1]

Interestingly, almost all patients with AD reported improved symptomatology following cystourethroscopy. It also was interesting to note that the high number of positive biopsies for metaplastic changes were in the asymptomatic group and two of these with keratinizing variants. As we could find no other recent study, which specifically looked into the positive cystoscopic findings during cystoscopic surveillance of a similar group of patients, we proceeded to carry out a literature review to assess the clinical and cost effectiveness of cystourethroscopy.

A study from University of Tennessee[4] evaluated the risk factors for development of bladder tumors in SCI patients in a retrospective study. They reviewed all bladder tumors at 1 institution with matched controls for 7 years. There were 17 malignant and 2 benign tumors identified. 'There was statistically significant evidence for bladder stones and indwelling catheters as risk factors'. Interestingly four patients with initially negative biopsies underwent repeat biopsies due to suspicious cytology and cancer was found. They concluded that a high index of suspicion and thorough evaluation are needed in SCI patients. They also suggested that biopsy and cytology are complementary to cystourethroscopy in diagnosis of urothelial malignancy.

El Masri and Fellows[3] in 1981 studied a series of 6744 consecutive patients with SCI and found 25 patients with diagnosed cancer bladder. Their objective was to record incidence, presentation, histology and prognosis compared with bladder cancer in non-paralysed population. Their findings confirmed that the majority ($n=23$) were managed with IUC or SPC presented at younger age and there was a significantly higher incidence of squamous cell carcinoma (SCC). None of these patients had undergone cystoscopic surveillance. Generally these are fatal tumors whichever way they are treated and 20 out of the 25 patients were dead within 2 years of diagnosis. They concluded that urine cytology is unreliable in presence of infection.

Similarly, Kalisvaart[5] examined the characteristics of bladder cancers in SCI population. They included all SCI patients seen and diagnosed with bladder tumors between January 1983 and January 2007. There were 32 patients with bladder cancer identified out of 1319 seen. There were 46.9% SCC, 31.3% transitional cell carcinoma (TCC), 9.4% adenocarcinoma, and 12.5% mixed TCC and SCC. Forty-two percentage of them were found on screening cystourethroscopy. They concluded that pathological makeup of the tumors is similar to that reported earlier. Interestingly over 50% of the patients did not have an indwelling catheter. They concluded that neurogenic bladder, and not the indwelling catheter, may be the risk factor for bladder cancer. They recommended that Urologists should consider diligent, long-term screening of all patients with SCI for bladder cancer and not just those with indwelling catheters.

The diagnosis of bladder cancer ultimately depends on cystoscopic examination of the bladder and histological evaluation of the resected tissue.[6] The diagnostic cystoscopy can be omitted if tumor has been visualized on earlier imaging and proceed to trans-urethral resection.

The rate of incidence in the United Kingdom for bladder cancer as reported by the Office for national statistics is 18.8 and 5.6 per 100 000 males and females, respectively.[2] Bladder tumors in the spinal cord injury (SCI) patient are a well-recognized phenomenon. Although controlled prospective studies are lacking, retrospective studies have suggested that the relative risk/incidence of a bladder neoplasm is twenty times in the SCI population than that in the spinal cord intact population.[3]

Chao *et al*.[7] retrospectively reviewed traumatic SCI patients injured over 20 years or more to compare urinary tract preservation and incidence of urological complications in patients with spontaneous voiding and indwelling catheters. There were 81 patients with long-term injury but only 73 were regularly followed-up. They included patients on intermittent catheters and reflex voiding (spontaneous voider group $n=41$) and patients in indwelling catheter group (IUC/SPC $n=32$). They analyzed renal function, renal tract imaging and incidence of complications in both these groups. The renal function measured by creatinine clearance was similar in both groups. The catheterized group had higher prevalence of scarring and calicectasis, which was statistically significant. There were six patients diagnosed with carcinoma bladder who underwent radical cystectomy and diversion. Two of these were spontaneous voiders with TCC and three were with indwelling catheters (1 TCC, 1 SCC and 1 adenocarcinoma). They concluded that for select groups of SCI patients, the choice of an indwelling catheter may be made if other methods fail, provided patients undergo regular upper urinary tract imaging and cystourethroscopy.

Kamat *et al*,[8] in their study to assess reliability of urine cytology in addition to cystourethroscopy in general population with a history of bladder cancer undergoing surveillance for recurrence, concluded that cystourethroscopy alone remains the most cost-effective strategy to detect recurrence of bladder cancer not invading the muscle. The addition of urinary markers adds to cost, without improved detection of invasive disease.

They identified and included 200 consecutive patients with history of bladder cancer not invading the muscle and were prospectively enrolled. They compared five surveillance strategies, that is, (i) cystourethroscopy alone; (ii) cystourethroscopy and NMP22 (nuclear matrix protein 22); (iii) cystourethroscopy and fluorescence *in-situ* hybridization; (iv) cystourethroscopy and cytology; and (v) cystourethroscopy and positive NMP22 confirmed by positive fluorescence *in-situ* hybridization. They then calculated the cost per tumor detected. Cancer was detected in 13 patients at study entry and detection rate for the five surveillance strategies were: (i) 52%, (ii) 56%, (iii) 72%, (iv) 60% and (v) 56%, respectively.

After they factored in early detection of biomarkers, the cost per tumor detected became (i) $7692; (ii) $11 143; (iii) $19 111; (iv) $10

267; and (v) $9557. None of the tumors detected by biomarkers, but not by cystourethroscopy, were invasive.

Navon *et al.*[9] in California evaluated the effectiveness of annual cystoscopy in chronic SCI patients. They reviewed medical records of all SCI patients with squamous cell cancer of the bladder between 1980 and 1996. They categorized into asymptomatic (screened—chronic/recurrent UTIs) and symptomatic patients (overt signs or symptoms of the bladder lesion) with respect to age, latency since SCI, treatment of neurogenic bladder, therapy, pathological stage and survival. There were 14 patients ($n=9$ symptomatic) and 13 patients underwent cysto-prostatectomy, while 1 presented with metastatic disease and was treated with supportive care only. The pathological stage was more advanced in the symptomatic group.

The overall and cancer-specific survival rates for symptomatic patients were 44% and 50% respectively, with a median of 40 months to death. In the asymptomatic group, there was one non-cancer related death, while the remaining patients were alive at a mean follow-up of 8.2 years. They concluded that screening cystoscopy in SCI patients with chronic or recurrent UTI results in an earlier stage at diagnosis and appear to have longer survival. Interestingly, they did not find any difference between the catheter and non-catheter group.

In-fact they went on to suggest that such a protocol should be strictly followed and careful prospective studies must be performed to ascertain if this will become significant.

The Guidance issued by the National Clinical Guideline Centre for National Institute for Health and Care Excellence (NICE) analyzed cost effectiveness of three monitoring strategies namely regular eGFR measurements, ultrasound and cystourethroscopy in the management of lower urinary tract dysfunction in neurological disease. It concluded that the three monitoring strategies are likely to be cost effective.[10]

Despite acknowledging cost effectiveness, NICE does not recommend cystourethroscopic surveillance in individuals with neurogenic lower urinary tract dysfunction in general[11] with no specific recommendation for the high-risk group managed with IUC/SPC. Although we subscribe to the NICE Guidelines for the great majority of SCI patients, we carry out regular ultrasonography and radiography, which in this group of patients can have limitations.[12]; our findings demonstrate that patients with SPC/IUC are a high-risk group and should undergo cystourethroscopic surveillance. The combination of loss of bladder compliance, relatively small vesical capacity in patients with long-term IUC/SPC and the risk of precipitating AD during clamping in order to obtain optimal bladder volume for adequate ultrasound interpretation reduces reliability of the investigation.

Furthermore, because of the sensory impairment/loss, the usual presentation of bladder pathology is absent. Our data suggest that if these patients' sensory system was not damaged increasing their vulnerability to morbidity, were they able to feel normally, the majority would have presented with symptomatology requiring cystourethroscopy.

Although we believe that cystourethroscopy should be carried out every 12–24 months depending on presence or absence of pathology and/or overt symptomatology, there is a scope for more study to demonstrate the ideal interval between Cystourethroscopic examinations. Because of the various findings presented in our study and associated presenting symptoms it is our practice to commence the cystoscopic surveillance within 2 years of insertion of indwelling catheter (SPC/IUC); repeat every 1–2 years depending on current and previous findings on cystourethroscopic, and/or presence or absence of symptoms such as recurrent catheter blockage, autonomic hyperactivity, hematuria, urethral leakage before the date of the scheduled surveillance.

Our study is limited by inability to stratify risk due to the retrospective nature of the study.

CONCLUSION

We assert from our data that there is a high risk of recurrent catheter blockage, vesical calculi, UTIs, AD and increased spasticity are common complications associated with SPC/IUC in the SCI population. The commonest cystoscopic findings are vesical calculi, thick proteinaceous debris and metaplastic changes in both the symptomatic and the asymptomatic groups of patients. Furthermore, there is acknowledged high risk of bladder cancer associated with permanent catheters.[3] Not all these findings can always be diagnosed by radiology alone in all patients with sensory loss/impairment.

Endoscopic surveillance therefore is strongly recommended only for this group of patients, which is not addressed by the NICE guidelines.

The fact that in our study there was no statistical significance in the incidence of findings between the symptomatic and asymptomatic group reinforces our hypothesis that patients with IUC/SPC require regular cystourethroscopic surveillance. This is to diagnose and manage at an early-stage complications caused by or associated with SPC/IUC in order to minimize symptomatology, mitigate aggravation of complications, maintain good health and also probably maintain a reasonably good quality of life. Unfortunately, we were unable to find published incidence of complications and/or symptomatology associated with SPC and IUC.

Further prospective studies in patients with SPC/IUC to compare outcome between those who undergo cystourethroscopic surveillance and those who do not are required. There is a need to qualify and quantify symptomatology, pathology, morbidity, frequency of clinic attendance, frequency and periods of hospitalization of patients with SPC/IUC between both the groups.

In the meanwhile, we strongly recommend endoscopic surveillance for SCI patients with SPC and IUC.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Author contribution: We applied the Sequence Determines Credit (SDC) approach for the sequence of authors.

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