ORIGINAL ARTICLE

# Comparative Analysis of Urethral Catheterization Versus Suprapubic Cystostomy in Management of Neurogenic Bladder in Spinal Injured Patients

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## Abstract

***Background:*** *The objective of this study was to prospectively and retro respectively evaluate urethral catheterization (UC) versus supra-pubic cystostomy (SPC) in prevention of urinary tract infection (UTI) in patients with spinal cord injury lesion.*

***Methods:*** *A total of 125 patients with neurogenic bladder and a mean age of 30 years had UC (n = 80) and SPC (n = 40) at the Jos University Teaching Hospital (JUTH) between January 1984 and June 2005.*

***Results:*** *Episodes of UTI were significantly more; UC 65% versus 14% for SPC (P<0.05). Urinary tract infection occurred relatively late in the course of admission, in patient who had SPC. Patients in SPC group were significantly satisfied with this management option; 57% versus 8% for UC.*

*Similarly, mortality at 1 year post admission was significantly less; 9% versus 36% for UC and death due to UTI related septicaemia was 33% versus 18% respectively.*

***Conclusion:*** *It was concluded that SPC was a better management option since it was associated with a low morbidity, better quality of life and a longer life expectancy than UC.*

***Key words:*** *Spinal cord injury, neurogenic bladder, intra-urethral catheterization, supra pubic cystostomy.*

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## INTRODUCTION

Urinary tract infection (UTI) is responsible for major morbidity and mortality in spinal cord injury (SCI) patients at our institution and worldwide[1,2] Eighty percent of persons with SCI, experience a UTI by their 16th year post injury and diseases of the urinary system are the fifth most common cause of death. Several factors appear to be responsible for an increased risk of infection in the neurogenic bladder. Incomplete voiding, elevated intravesical pressure and catheter use contribute to increased risk of symptomatic UTI. UTIs interfere with rehabilitation and may lead to secondary urologic complications.

Concerning the iatrogenic factors involved in the pathogenesis of UTI, the important consideration in management of neurogenic bladder in SCI patients seems to be the choice between intermittent catheterization and indwelling catheterization. In a predominantly illiterate population were economic prospects are lean, the choice between urethral catheterization (UC) and supra-pubic cystostomy (SPC) seem an attractive and practical option. Current methods of neurogenic bladder management are often based on professional or institutional presuppositions rather than scientific data[3]. This paper comparatively evaluates the place of UC versus SPC in preservation of renal function and prevention of recurrent UTI in SCI patients' management at the Jos University Teaching Hospital.

## PATIENTS AND METHODS

A total of 125 SCI patients with complete spinal cord lesion managed at JUTH between January 1, 1984 and June 30, 2005 were both prospectively and retrospectively studied. Eighty-five patients who underwent UC and 40 who had SPC performed on them were available to study. The two groups were comparable in terms of age, sex, cause and level of SCI (Table 1). The retrospective study spanned the period from January 1, 1984 to December 1989 while the prospective aspect was undertaken from January 1990 to June 2005.

During the first month of admission corresponding to the period of neurogenic shock, all 125 patients were managed by UC. Following which patients were assigned to bladder management by SPC or IUC under aseptic conditions depending on the patient's wishes after explanation. The retrospective group did not have this option. Through out the study period the management of the patients remained the same in the retrospective and prospective groups since all patients were seen by the same units; under the same management protocol.

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In symptomatic patients in whom UTI was suspected, blood cultures were carried out in addition to urine cultures. Weekly catheter changes, urinary microscopy, culture and sensitivity studies were done routinely. Urinary tract infection was defined as significant bacterial or yeast cultures after 24 hours incubation in association with elevated white blood cell (WBC) counts equal or greater than 10 per high power field in centrifuged urine specimens. UTI was treated with bladder irrigation using 400mg of crushed Nitrofurantoin tablets in 500ml of normal saline in combination with appropriate systemic antibiotics for 7 days. Records on the incidence and timing of UTI, urinary bacterial cultures, blood culture, patients' satisfaction with either method of treatment and mortality at 1 year post admission in both groups were compared and statistically analyzed for significance values employing the EpiInfo computer software.

## RESULTS

The clinical, and radiological features of a total of 125 patients with SCI with complete cord lesion managed by UC (n = 85) versus SPC (n = 40) are listed in Table 1. The median age of presentation for UC was 28 years versus 32 for SPC. Male to female ratio compared was 13:1 for UC versus 19:1 for SPC. The three commonest causes of SCI were road traffic accident (RTA) (58%) resulting in 60% of injuries in UC versus 61 % for SPC, falls (36%) 36% versus 35% respectively and cave-in injuries (4%) 3% versus 2% respectively. In UC, 26% were stable injuries versus 25% in SPC. Injury to the cervico-thoracic spine is 41% versus 45% for UC and SPC groups respectively. Injuries involving the thoraco-lumbar spine in UC were 59% versus 55% in SPC group.

Table 1
Clinical characteristics of SCI patients managed by UC versus SPC JUTH 1984 -2005

| Patients | U.C (n= 85) | % | SPC (n = 40) | % | TOTAL (n = 125) | % |
|---|---|---|---|---|---|---|
| (SEX) | | | | | | |
| M | 79 | 98 | 38 | 95 | 117 | 94 |
| F | 6 | 2 | 2 | 5 | 8 | 6 |
| (AGE) | | | | | | |
| Range (Yr) | 8 54 | | 12-60 | | 8 60 | |
| Median (Yr) | 28 | | 32 | | 30 | |
| (CAUSE) | | | | | | |
| RTA | 50 | 60 | 24 | 61 | 74 | 58 |
| Fall | 31 | 36 | 14 | 35 | 45 | 36 |
| Cave in | 3 | 3 | 1 | 2 | 4 | 4 |
| Gun shot | 1 | 1 | 1 | 2 | 2 | 2 |
| (MECHANISM) | | | | | | |
| Stable | 22 | 26 | 10 | 25 | 32 | 25 |
| Unstable | 63 | 74 | 30 | 75 | 93 | 75 |
| (Level) | | | | | | |
| Cervico-thoracic | 35 | 41 | 18 | 45 | 53 | 42 |
| Thoraco-lumbar | 50 | 59 | 22 | 55 | 72 | 58 |

RTA = Road Traffic Accidents
UC Urethral catheterization
SPC = Supra pubic cystostomy

The episodes and timing of UTI in SCI patients with complete cord lesion is shown in Table 2. Overall, UTI episodes were significantly more in the UC group versus SPC; 65% versus 14% respectively: P<0.05. Also 4 patients in UC presented with symptomatic bladder stones that were extracted. Urinary tract infection occurred relatively late at 4-6 weeks in UC compared to 2-3 weeks in SPC.

Table 2
Episodes and timing of UTI in SCI patients post admission; JUTH 1984 -2005

| Timing (weeks) | Episodes U.C (n= 85) | % | SPC (n = 40) | % | TOTAL (n = 125) | % |
|---|---|---|---|---|---|---|
| 1 2 | 12 | 20 | 6 | 14 | 16 | 13 |
| 2 4 | 10 | 16 | 3 | 21 | 13 | 10 |
| 4 6 | 33 | 52 | 1 | 07 | 34 | 27 |
| 6 8 | 4 | 06 | 2 | 14 | 6 | 4 |
| 8 10 | 2 | 03 | 1 | 07 | 3 | 2 |
| 10 12 | 2 | 03 | 1 | 07 | 3 | 2 |
| Total | 63 | 100 | 14 | 100 | 75 | 58 |

* Also, 4 patients developed symptomatic bladder stones in UC group.

Table3
Organisms cultured from urine/blood (parenthesis) in SCI patients
JUTH 1984 - 2005

| Bacteria | U.C (n= 85) | % | SPC (n = 40) | % | TOTAL (n = 125) | % |
|---|---|---|---|---|---|---|
| Klebsiella | 22(6) | 26 | 6(2) | 12 | 28(8) | 22 |
| Escherichia coli | 17(3) | 20 | 2(1) | 4 | 19(4) | 15 |
| Proteus | 14(3) | 16 | 1(0) | 2 | 15(3) | 12 |
| Pseudomonas | 4(1) | 5 | 1(0) | 2 | 5(1) | 4 |
| Staph. Aureus | 3(0) | 4 | 4(0) | 8 | 7(0) | 6 |

Blood culture results are in brackets

Table 3 indicates the three commonest bacterial causes of UTI in both groups. In UC, causes included Klebsiella 26%, E. coli 20%, Proteus 16% versus 12%, 4%, 2% respectively in SPC.

Overall, P-values for comparison of patients' satisfaction with management, with either SPC or UC (Table 4) indicated that a significant number of patients were satisfied with SPC 57% versus 8% for UC (P<0.05). Similarly, 10% considered SPC unsatisfactory versus 25% for UC. Table 5 shows that SPC was associated with a significantly lower mortality figure at one year, 9% versus 36% for UC (P<0.05). Causes of death for SPC were decubitus ulcers 45%, UTI related septicaemia 33%, spinal shock/bronchopneumonia 11 % each versus 18%, 11%, 5% respectively for UC group.

Table 4
Patients' satisfaction with treatment options at two months post admission JUTH 1984 - 2005

| Patients comments | U.C (n= 85) | % | SPC (n = 40) | % | TOTAL (n = 125) | % |
|---|---|---|---|---|---|---|
| Satisfactory | 7 | 8 | 23 | 57 | 30 | 24 |
| Manageable | 40 | 48 | 9 | 23 | 49 | 39 |
| Unsatisfactory | 22 | 25 | 4 | 10 | 26 | 21 |
| No comments | 16 | 19 | 4 | 10 | 20 | 16 |
| TOTAL | 85 | 100 | 40 | 100 | 125 | 100 |

Analysis of single table:
Chi-square = 54.96
3 degrees of freedom
P value = 0.0000

Table 5: Causes of mortality at one year post admission in SCI patients JUTH 1984 - 2005

| Mortality (n- 45) | U.C (n= 85) | % | SPC (n = 40) | % | TOTAL (n = 125) | % |
|---|---|---|---|---|---|---|
| Spinal shock | 2 | 6 | 1 | 11 | 3 | 2 |
| Bronchopneumonia | 5 | 14 | 1 | 11 | 6 | 4 |
| UTI | 18 | 50 | 3 | 33 | 21 | 14 |
| Decubitus ulcers | 11 | 30 | 4 | 45 | 15 | 10 |
| Total | 36 | 100 | 9 | 100 | 45 | 30 |

Analysis of single table:
Chi-square = 8.31
3 degrees of freedom
P value = 0.04

## DISCUSSION

Spinal cord injury produces profound alterations in lower urinary tract function. Incontinence, elevated intravesical pressure, reflux, stones and neurological obstruction, commonly found in the spinal cord injured population, increase the risk of urinary infection. The overall rate of UTI in SCI is about 2.5 episodes per patient per year[5]. We have compared the management of neurogenic bladder in a total of 125 spine injured patients, by UC (n = 85) and SPC (n = 40). Patients in UC were relatively more in number, had a female preponderance and were younger in age. The majority of injuries in both groups were due to road traffic accidents which resulted in unstable injuries in the thoraco-lumbar spine.

Urinary tract infection was significantly commoner in UC and occurred mainly at 4-6 weeks post admission versus 2-4 weeks for SPC. Indwelling catheters are a common tool for bladder management in persons with high level spinal cord injury frequently resulting in UTI. Weekly catheter changes is said to dramatically reduce catheter encrustations, stones and UTI in these patients[4] but we believe that SPC can obviate this need in patients with spinal cord injury especially if performed early post-admission. Common bacterial causes of UTI in both groups included, in descending order of frequency, Klebsiella, E. coli and Proteus. It has been conclusively demonstrated that complicated UTI are caused by a much wider variety of organisms in individuals with SCI than in the general population and are often poly-microbial. Also implicated in the causation of UTI in these patients are Serratia spp, Providencia spp, Enterococci and Staphylococci.[5]

A significant number of patients with SCI in the SPC group, 57% were satisfied with the results of this management option when compared to those of UC, 8%. The reasons for this are not far-fetched since SPC was effective in reducing episodes of UTI and was a more comfortable method of urinary diversion obviating the need for more frequent catheter change by medical staff. Patients with thoraco-lumbar lesions were especially gratified since they were able to carry out catheter changes by themselves thus improving their quality of life and functional independence measure. Risk factors associated with repeat infection have been found to be tied up with a functional independence measure of less than 74 and vesico-urethral reflux (odds 10 and 23 respectively).[6] Moreover, mortality figures at one year post admission indicated that SPC significantly carried carried a greater life expectancy than UC; 9% versus 36% respectively. Most of the patients with UC died from UTI related septicaemia, decubitus ulcers and bronchopneumonia in decreasing order of frequency.

In considering the merits and demerits of either treatment option, SPC has been found to be associated with significantly less frequency of UTI, better patient satisfaction and improved survival figures than UC. Similar findings have been reported from Denmark, were it was concluded that supra-pubic cystostomy drainage in patients with neurogenic bladder is preferred to an indwelling urethral catheter.[7] In addition, management cannot be optimal without identification and correction of structural risk factors, aiming for sufficient outlet from the bladder with minimal residual urine and low pressure voiding.

### References

1. Igun G.O., Obekpa P.O., Ugwu B.T., Nwadiaro H.C. Spinal Injuries in Plateau State, Nigeria. East African Medical Journal, 1999; 76: 75-79.

2. Prevention and Management of Urinary Tract Infections in Paralyzed persons. Evidence Report/Technology'Assessment, 1999; 6: 87-102.
3. Andrews N.B. Spinal Cord Injuries in West Africa-Treatment Rationale and Outcome. Afri J. of Trauma, 2003; 1 :14-23.
4. Park Y.I., Linsenmeyer T.A. A Method of Minimizing Indwelling Catheter Calcification and bladder stones in individuals with spinal cord injury. J. Spinal Cord Med. 2001 Summer; 24(2): 105-8.
5. Biering-Sorensen F., Bagi P., Hoiby N. Urinary Tract Infection in Patients with Spinal Cord Lesions: Treatment and Prevention. Pub Med-indexed for MEDLINE 2001; 61 (9): 1275-87.
6. Esclarin De Ruz A., Garcia Leoni E., Herruzo Cabrera R. Epidemiology and Risk Factors for Urinary Tract Infection in patients with Spinal Cord Injury. J. Urol 2000 Oct., 164(4): 1285-9.
7. Biering-Sorensen F. Urinary Tract Infection in Individuals with Spinal Cord Lesion. Curr Opin Urol. 2002 Jan., 12(1): 45-9.