

ORIGINAL ARTICLE

Quality of life and urological morbidity in tetraplegics with artificial ventilation managed with suprapubic or intermittent catheterisation

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Study design: Mono-centric, retrospective study.

Objective: Analysis of correlation between bladder management and age in respirator-dependant high-tetraplegic patients. Additionally suprapubic catheter (SPC) and intermittent catheterisation (IC) were reviewed concerning urological complications and quality of life (QoL).

Setting: Level 1 trauma centre.

Methods: A QoL questionnaire 'International Consultation on Incontinence' (ICIQ-SF) was sent to 56 tetraplegic respirator device-dependant (RDD)-spinal cord injury (SCI) patients. Their scores concerning urological morbidity were reviewed. For analysis reasons they were divided in three groups: SPC, IC and others.

Results: SPC 38, IC 12 and others 6 patients. Significant difference in age (SPC vs IC=49.9 vs 31.8 years) was observed but no disparity in gender. Within a follow-up period 2–26 years (median 8 years) significant urological complications in patients with IC ($P<0.05$) were ascertained. These were in general minor complications. Especially renal deterioration or bladder cancer was not diagnosed in any of the group. The questionnaire return rate was high (83.9%) with complete answers (SPC=32, IC=11). Self assessment of QoL with ICIQ-SF revealed no significant difference for both groups on low level, but SPC patients tend to score better.

Conclusion: In our study, tetraplegic RDD-SCI patients with SPC suffered less urological complications and tend to score a better QoL. Therefore we recommend SPC as a serious alternative for these selected patients and concurrently underline the necessity of close urological surveillance at least annually.

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Keywords: spinal cord injury; high tetraplegia; bladder management; suprapubic or intermittent catheterisation; quality of life; urological complications

INTRODUCTION

Avoiding chronic complications of bladder and upper urinary tract is one important aim of long-term neuro-urological treatment in patients with spinal cord injury (SCI). Additionally quality of life (QoL) should be impaired as less as possible by the way of bladder management. Therefore bladder management is at all times an individual decision.

Intermittent self catheterisation still is the gold standard¹ for SCI patients with adequate hand function. Otherwise, there is the recommendation² that intermittent catheterisation (IC) has to be avoided in patients unable to catheterise themselves. However, despite these conflicting recommendations, comparisons with various types of bladder management have not been made in highly dependant, long-term ventilated tetraplegic patients.

SCI patients worldwide are getting older with serious previous diseases. Additionally there is an increasing incidence of non-traumatic SCI. However, it is not known, how these changes influence the bladder management in SCI patients concerning the alternative of a suprapubic catheter (SPC). More and more patients choose this alternative for comfort reasons.

Nevertheless, only few studies concerning bladder management and QoL in SCI patients exist. Especially the correlation between level of

SCI with regard of hand function and QoL according to bladder management is poorly examined.

From our clinical experience, long-term ventilated, high-tetraplegic SCI patients with SPC suffer less urological complications. To our knowledge, also in this regard there are only little comparisons with various types of bladder-management in this group of patients.³

Therefore this study reviews the correlation between age, bladder management and patient-rated QoL in patients with high, respiratory device-dependant (RDD) tetraplegia.

METHODS

A total of 56 patients with high-level SCI (C0–C4) were polled to estimate their QoL using a standardised questionnaire. The used QoL questionnaire was developed by 'International Consultation on Incontinence' (ICIQ-SF) in 2002 (<http://www.iciq.net>). It is valid and reliable for both sexes. Three questions were scored from 0–16 points (0=best/16=worst). We choose ICIQ-SF because it is easy and free to use. ICIQ-SF mainly reflects the impact of urinary incontinence to QoL, and we know that incontinence is of the utmost significance to QoL in SCI patients.

Medical information concerning urological complications that required readmission was extracted from medical charts in a retrospective chart review. Minor complications, such as urinary tract infection (UTI), were not fully

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documented, because these were mostly medicated by the general practitioner without hospital readmission.

The follow-up time span was defined from 24 month to 26 years (median 8 years). All patients were seen for urological surveillance at least once a year. Standard urological examinations for IC patients were laboratory test (that is, for screening of renal function), kidney and bladder ultrasound, and complete video-urodynamic evaluation with adjustment of the anticholinergic dosage if necessary.

Patients with SPC also had laboratory test, kidney and bladder ultrasound, and urethrocytoscopy or/and cystography. In case of pathological results, further examinations as intravenous urography or renography were performed in both groups.

Statistically all data were included in χ^2 -test with Yates correction, Fisher's exact test and student's *t*-test. Confidence interval was 95% (95% CI).

RESULTS

In all, 56 high-tetraplegic patients (16 female and 40 male) with a mean age of 45 years (range 17–78 years) were included. Figure 1 shows the different life decades.

The patients presented following levels of lesion: C0=11, C1=0, C2=29, C3=14 and C4=2. A total of 46 tetraplegics were complete (ASIA A) and 10 incompletely paralysed (ASIA B=4, ASIA C=6). The mean SCIM-score (Spinal Cord Independence Measure) at the last follow up were assessed to 3.49 (range 0–12).

The study includes 38 SPC patients whose urinary bladder was continuously drained by SPC group (10 female and 28 male). These SPC patients achieved anticholinergic drugs in a low dosage, and the catheter was changed in at least 3-week intervals.

Furthermore there were 12 high tetraplegics whose urinary bladder was voided by IC group performed by home caregivers (nurses or relatives). These received an anticholinergic medication for complete suppression of their hyper-reflexive detrusor.

The other patients used transurethral catheter ($n=2$), reflex voiding by suprapubic tapping ($n=2$) an IC per umbilical stoma ($n=2$).

The following studies only include the 50 patients with typical usage of IC and SPC.

Table 1 illustrates the correlation between age and bladder management: SPC group: 38 patients, mean age 49.9 years (95% CI: 44.06–55.67).

IC group: 12 patients (four female and eight male), mean age 31.8 years (95% CI: 21.42–42.08).

The difference concerning the mean age between the SPC and the IC group (Figure 2) is statistically highly significant (student's *t*-test $P=0.0035$).

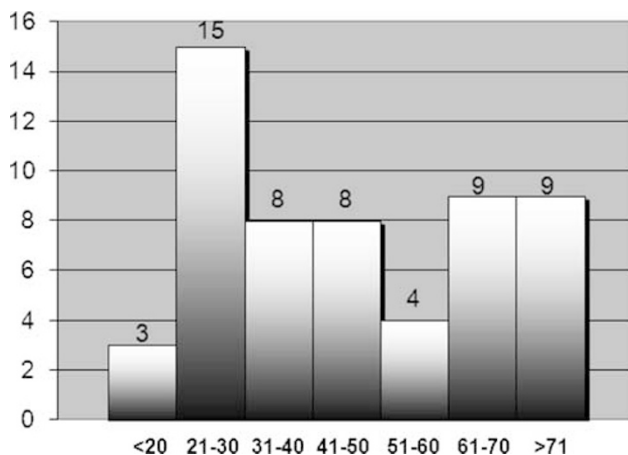


Figure 1 Age of the RDD-SCL patients.

Coherence between gender and bladder management could not be ascertained (Figure 3; 33% of IC and 26.3% of SPC patients were female, $P=0.7177$).

Regarding the follow up from 2 to 26 years, seven patients changed from IC to SPC due to urethral complications. According to the urological complications these patients were reviewed in both the groups. Therefore the IC group increases from 12 to 19. Out of this 11 patients with IC suffer urological complications (Figure 4, Table 2) that caused 19 stationary readmissions, whereas 8 IC-patients were free from complications.

A total of 10 out of 38 SPC patients suffered 15 urological interventions (Figure 4, Table 2); 28 SPC patients remained without any complications and procedures, respectively.

Although in the SPC group the development of bladder stones was common, the leading cause of readmission in the IC group was urethral trauma, respectively.

On the other hand, the only serious complications occur in the SPC group: two patients suffered nephrolithiasis with nephrectomy in one case. Both patients had no ureteric refluxes in their history.

Table 1 Age and bladder-emptying

Age	SPC n=38	IC n=12	Other n=6
≤20	2		1 (IC-stoma)
21–30	8	7	
31–40	3	2	3 (2×tapping, 1×IC-stoma)
41–50	5	3	
51–60	3		1 (indwelling urethr.cath.)
61–70	9		
≥71	8		1 (indwelling urethr.cath.)
Mean	49.9 J.	31.8 J.	
95% CI	44.06–55.67	21.42–42.08	

Abbreviations: CI, confidence interval; IC, intermittent catheterisation; SPC, suprapubic catheter.

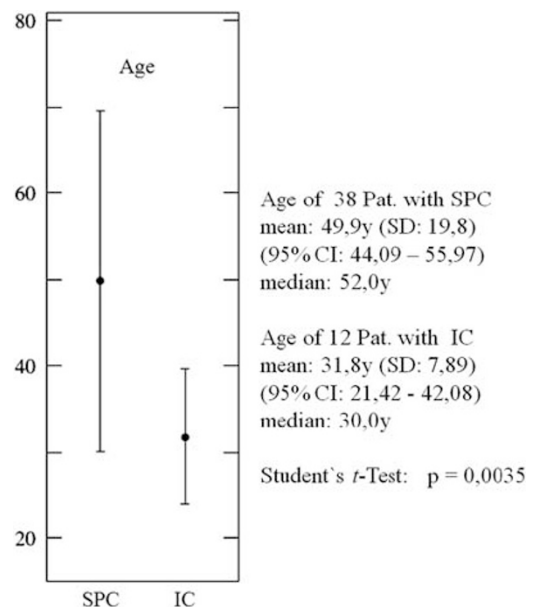


Figure 2 Age of SPC and IC patients.

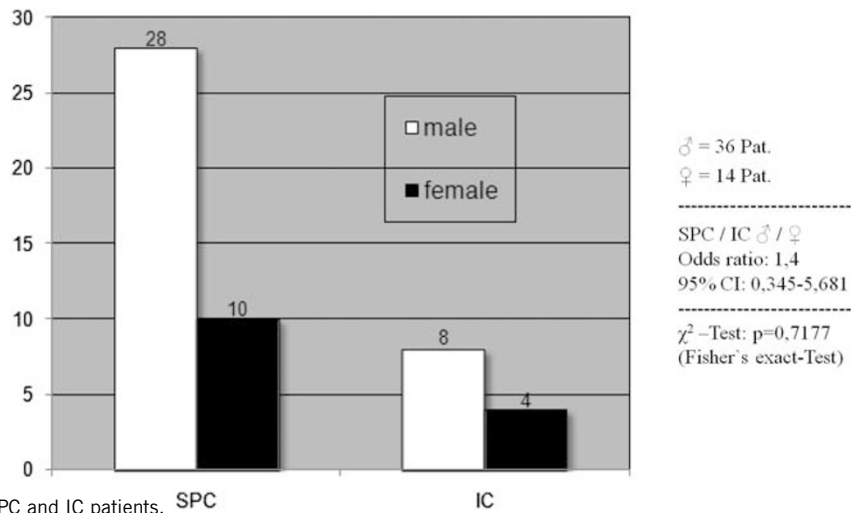


Figure 3 Gender of SPC and IC patients.

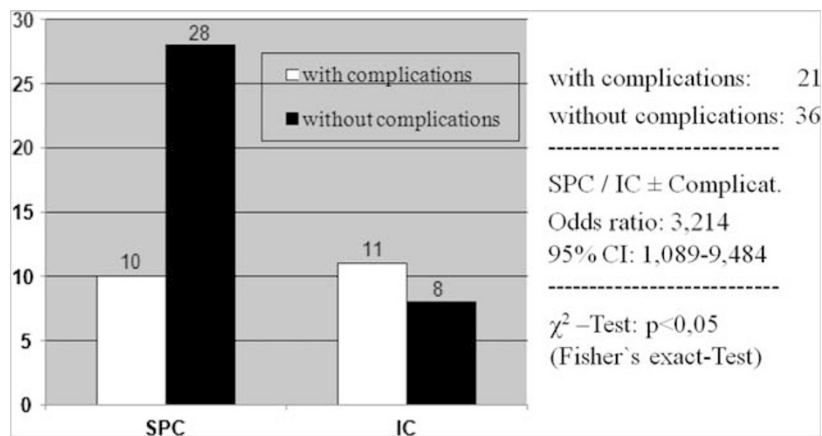


Figure 4 Urological complications of SPC and IC patients.

Table 2 Complications and therapeutical interventions

	SPC (n=38) Procedure	IC (n=19) Procedure
Ureteric reflux	5×ACh↑ ^a	5×ACh↑
Bladder stones	7×transurethral 1×suprapubic	1×transurethral elimination
Bleeding, via falsa, stricture		5×urethrotomy 7×SPC insertion 1×SPC (temporary)
Kidney stones	1×ESWL, double-J, 1×nephrectomy	
<i>n</i>	15	19

Abbreviations: ACh, anticholinergics; ESWL, extracorporeal shock wave lithotripsy; IC, intermittent catheterisation; SPC, suprapubic catheter.
^aHeightening of anticholinergical dosage.

During follow up there were each five patients with ureteric refluxes in both groups, but with moderate increased dosage of anticholinergic drugs all refluxes were unverifiable on next surveillance examination.

Other minor complications, such as UTI, were not completely documented, due to the reasons mentioned above.

The screening tests revealed no indication for renal deterioration; no urogenital tumours were diagnosed in both groups.

In summary, high-tetraplegic patients with long-term-ventilation and IC suffer significantly more urological complications than our patients with SPC ($P < 0.05$, Figure 4).

Finally QoL concerning bladder management was reviewed by using the described ICIQ-SF questionnaire. In all, 47 out of 56 notified patients answered (rate=84%). A total of 11 IC and 32 SPC patients were included. IC group scored 4.27 (95% CI: 2328–6217); SPC group scored 3.06 (95% CI: 1922–4203). The difference was obvious (SPC score higher QoL) but not significant (student's *t*-test $P=0.368$; Figure 5).

To subsume the results:

- (1) The bladder management differed significantly in age (the older the patients the higher the SPC rate) but not in gender.
- (2) IC patients suffered significantly more urological complications.
- (3) In general but not significantly SPC patients scored QoL higher than IC patients.

DISCUSSION

Making the right medical decision concerning bladder management for RDD patients is always a challenge, especially regarding the intermittent catheterisation conducted by caregivers. On the one hand less urological complications and life-long sufficient kidney

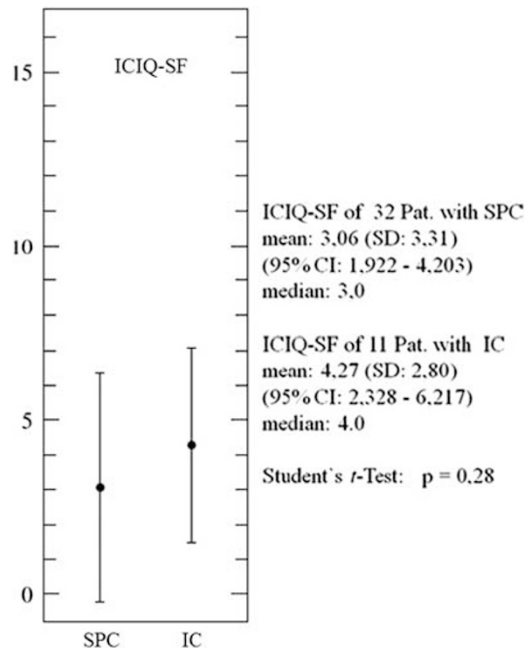


Figure 5 QoL (ICIQ-SF) of SPC and IC patients.

function is an important aim; on the other hand QoL is at least equivalent in estimation. The current 'Guidelines on Neurogenic Lower Urinary Tract Dysfunction' of the 'European Association of Urology'¹ recommend IC as the standard procedure with high grade of evidence for patients with neurogenic lower urinary tract dysfunction. SPC or indwelling urethral catheter is recommended only exceptionally and under strict medical attendance. But the guidelines offer no differentiations between SCI level, hand function and the type of IC (self or by attendant).

On the other hand the Consortium for Spinal Cord Medicine, supported by the Paralyzed Veterans of America, pointed out in their Clinical Practice Guideline for Health-Care Providers,² that bladder emptying by IC should be avoided by those unable to catheterise themselves.

Our received data concerning RDD tetraplegic patients differ explicitly from the mentioned European guidelines and should be discussed, especially concerning age, QoL and the rate of urological complications.

The change in demographic ageing and the increase of non-traumatic lesions⁴ are responsible for a higher rate of co-morbidities. Therefore minor rehabilitation potential in many SCI patients is increasingly determined. This is one explanation for the major SPC group.

We know that bladder management and continence are major factors for scoring QoL positively. A comparable SCI study⁵ of 142 patients with different levels of lesions offered a low-rated QoL when patients were provided with IC by attendant, SPC or indwelling urethral catheter (Short-Form 36-Item Health Survey/SF 36 and King's Health Questionnaire/KHQ). However, the IC group scored even worse in 6 out of 10 Items (SF-36) and 6 out of 9 Items ((KHQ) compared with the SPC group.

Several other studies showed high contentment of SPC patients. Telephone interviews³ with 19 SPC (100% tetraplegic) and 19 intermittent self catheterisation (only four tetraplegic) patients presented a 52% rate of the SPC group 'fully or almost satisfied with their urinary

management' in contrast to only 37% within the intermittent self catheterisation group. Another comparable study⁶ showed similar indication of satisfaction in SPC patient groups in 70%. Our ICIQ-SF results verify the higher contentment of SPC patients (although not significantly).

The rate of long-term complications in SPC patients is not reviewed by randomised, controlled studies. Existing data are inconsistent, older trials reported high rates, whereas newer retrospective studies allocate constant kidney function even after decades of SPC usage.^{3,6,7}

A retrospective study concerning symptomatic UTI³ compared 34 tetraplegic SPC patients (follow-up 8.6 years) with 27 SCI-IC patients (mainly paraplegics, follow-up 9.9 years). The incidence of symptomatic UTI was lower in the SPC group (12 vs 26%), but not significantly.

In a different study,⁸ 149 SCI patients with SPC and different levels of lesion were examined. In all, 27% suffered symptomatic UTIs during a mean follow up of 68 months, few patients with more than one episode.

A newer study⁷ reported that almost every of the examined 45 SCI patients with SPC (mean SPC period 14.3 years) suffered at least one symptomatic UTI, but only 30% had more than one UTI per year, 15% had UTI accompanied by fever, 11% suffered catheter-associated septicaemia and 4% incurred pyelonephritis.

Another study³ with 219 SPC participants with neurogenic lower urinary tract dysfunction or bladder outlet obstruction (mean follow-up 50 months) showed a UTI rate of 21%.

In summary, recent studies represent an acceptable rate of UTIs in SCI patients with SPC.

Unfortunately we couldn't determine the incidence of UTIs in our patients, because these were normally medicated by their general practitioner and not admitted to our hospital. So these events were not fully reported.

Bladder stones are unquestionably more frequent in SPC patients. The incidence varies from 65³ over 41%⁷ and down to 22%.⁸ SCI patients with SPC carry a 4% annual risk of developing a bladder calculus, which increases up to 16% with calculus anamnesis.⁹ Lower urine pH status (<7.24) reduced the risk of calculus development in 118 SPC patients.¹⁰ Our data agree with these findings.

Additionally, SCI patients have with 6% a higher risk of developing kidney calculus compared with a 2% risk in normal population. The question of correlation between the development of kidney calculus and bladder management nevertheless is still under discussion. Whereas the classical study of Weld and Dmochowski¹¹ states that there is an (non-significant) increase of kidney calculus in SPC patients compared with IC participants, a large American longitudinal cohort study with 8314 patients (SCI Database USA¹²) revealed no correlation.

The frequency of kidney calculus reported by SPC patients varies from 9³ to 26%.⁷

Unfortunately there is a lack of recent studies concerning the correlation between SCI level of lesion and development of kidney calculus, but there is some evidence that such correlation is at least supposable.

The result of a study with 149 SCI patients with different level of lesion⁸ was that without exception only tetraplegic patients suffered kidney calculus ($n=12$). The risk of developing a recurrent kidney calculus seems to be twice as high compared with the risk of paraplegic patients.¹³ The authors supposed that this may be due to immobilisation and consequential disturbed bone metabolism.

In our study both patients with kidney calculi were tetraplegics using SPC. That could be a hint.

There are few data concerning the incidence of urethral trauma in patients with IC by attendant compared with self-catheterisation. But there is some evidence, that the risk of urethral lesion is higher the more of care-givers are involved in IC. In our analysis seven IC patients switched to the SPC group due to urethral trauma.

In general urethral trauma is more frequent in those with IC while bladder stones are more common in those with SPC.

Regrettably, we have no exact information about the incidence of autonomic dysreflexia, but we argue that it is much higher in IC patients because they are more likely to get a bladder overdistension or while passing the catheter up through the sphincter.

Concerning the incidence of bladder tumours in SCI patients different studies exist. Although older studies describe the risk of developing a malignant bladder tumour 16–28 times higher than normal, newer studies report an incidence of the normal population.^{14,15}

Also discussed is the correlation between malignant bladder tumours in SCI patients and SPC or indwelling urethral catheter in long-term studies. Several studies reported a higher incidence of tumours after long-term SPC, chronic bladder infections and bladder calculus. In contrast, a current study¹⁶ with 32 bladder carcinoma patients out of 1319 SCI participants reviewed that more than 50% of these tumour patients never had a SPC or indwelling urethral catheter for a longer period. Under Discussion is the explanation, that the bladder paralysis itself is the risk factor for developing a malignant bladder tumour.

The mentioned studies and our clinical trial underline the necessity of an intensive medically supported long-term surveillance of SCI patients with SPC. Annual re-evaluation with cystography and bladder ultrasonic and, where appropriate, cystoscopy should be performed to minimise the risk of stones and tumours.¹⁷ In addition, examinations of the upper urinary tract should be performed to scan for possible kidney calculi.

Finally prospective studies were desirable to determine the optimal catheter change interval, the need and dose of anticholinergic drugs, the relevance of lowering the urine pH and the significance of clamping the SPC periodically.¹⁸

CONCLUSIONS

Regarding current studies under condition of intensive medical support, SPC has a similar morbidity rate to IC.¹⁹ This is consistent with the results of our study concerning RDD tetraplegic SCI patients. In long-term follow up, we reviewed significantly less (but serious—two patients with nephrolithiasis) urological complications in SPC patients. Therefore the higher scoring of SPC patients concerning QoL attains an increased significance. Thus for RDD tetraplegic

SCI patients SPC associated with sufficient follow up should be taken into account as a serious alternative in bladder management: ‘Suprapubic catheter: with good follow up, can be a good option for selected patients’.²⁰

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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