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Long term urinary prognosis of cervical cord injury patients

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We made a retrospective comparative study of 88 cervical cord injury patients concerning their long term urological prognosis. In all, 129 urinary complications have occurred in 54 cases (61.4%). The incidence of urinary complications was high in those with higher levels of injury (except C ~ 4 lesions), a complete injury, a younger age of onset and a longer period after injury. Patients who had an indwelling catheter and a suprapubic cystostomy showed a higher rate of urinary complications. Urodynamically, there was no significant difference between the presence and absence of detrusor hyperreflexia. Those with detrusor–sphincter dyssynergia (DSD) also showed no difference compared to those without DSD. For the prevention of urinary complications in cervical cord injury patients, proper urinary management with clean intermittent catheterisation (CIC), or low pressure voiding is necessary in the early period after the onset of the injury.

Keywords: cervical spinal injury, urinary complications; urinary prognosis.

Introduction

Although the management of spinal cord injury had been improved, cervical cord injury patients still have more difficulties in many physical activities than do those with injuries of other spinal cord levels. Urologically in these cases, CIC sometimes cannot be indicated because of tetraplegia and poor activities of daily living (ADL). The aim of this study is to determine which factor is risky for long term prognosis of cervical SCI patients concerning their urinary tract and how we should conduct their urinary management.

Table I Clinical features of patients

Levels of injury	Complete	Incomplete
C ~ 4	7	5
C5	23	2
C6	19	9
C7	8	1
Unknown	3	11
Total	60	28

Male:Female = 84:4
Age: 23–80 yrs (mean age 40.2 yrs)
Period after injury: 2–36 yrs (mean period 11.6 yrs)

Patients and methods

There was a total of 88 cervical cord injured patients with a mean age of 40.2 yrs (23–80 yrs). The mean period after injury was 11.6 yrs (2–36 yrs). The distribution of injury levels and degrees of injury can be seen in Table I. Their urinary management and periodical follow ups had been done in at the urology department of Bibai Rousai Hospital. We made a retrospective comparative study of the patients based on the relationships between the urinary complications and some factors including age of onset, duration of illness, injury levels, degrees of injury, urinary management and urodynamic findings. Furthermore, we divided the patients into three groups according to the number of urinary complications. Group I had no urinary complications;

group II had one–two complications; and group III had more than three complications. We also evaluated their differences in background, which might have influenced the urinary complications. A statistical examination was done by Student's *t* test.

Results

There were 129 urinary complications during the clinical study (Table II). Lower urinary stones were the most frequent complication and symptomatic urinary infections followed. Chronic renal failure, upper urinary stones, epididymitis, and hydronephrosis were relatively late urinary complications, whereas vesicoureteral refluxes, urethral diverticula, urethral strictures, urethrocutaneous fistula, and prostatic abscesses occurred in the early period after onset.

The incidences of urinary complications of C ~ 4 and C7 levels were relatively lower than those of C5 and C6 (Fig 1). Also, the incidence of urinary complications in cases with a complete lesion was significantly higher than those with an incomplete lesion ($p < 0.05$). The subjects were divided into five groups according to the age of onset: younger than 29 years; 30–39 years; 40–49 years; 50–59 years; and older than 60 years (Fig 2). The group younger than 29 years showed a significantly high incidence of urinary complications as compared to other groups ($p < 0.05$ or $p < 0.01$).

The rate of occurrence of urinary complications was higher in those with a longer period after injury. There was a significant difference ($p < 0.05$) between the group with a duration shorter than 5 years and the groups with a duration longer than 11 years (Fig 3).

Concerning urinary management, patients using CIC showed the lowest incidence of urinary complications (53.8%), those who were self voiding were second (58.1%), those with a suprapubic cystostomy were third (61.2%), and the group with an indwelling catheter showed the highest rate of urinary complications (75.0%) (Fig 4).

Urodynamically, there were 52 patients with detrusor hyperreflexia and 24 without (cystometry was done for 76 cases). In the cases with detrusor hyperreflexia, 29 (55.8%) had experienced urinary complications, whereas 15 of 24 (62.5%) showed urinary complications in those without detrusor hyperreflexia. There was no significant difference between the two groups. On electromyography of the external urethral sphincter, DSD was shown in 51 of 59 cases examined. The incidence of urinary complications in the patients with DSD was 26.9%, and that in the cases without DSD was 50.0%. There was also no significant difference between these two groups (Fig 5).

We evaluated the backgrounds of the three groups and divided the groups according to the number of complications (Table

Table II Urinary complications

Urinary complications	No. of complications (No. of cases)	Mean period from injury (yrs)
Lower urinary stone	40 (24)	4.1
Urinary tract infection	33 (23)	5.6
Upper urinary stone	15 (13)	10.4
Epididymitis	13 (11)	8.7
Vesicoureteral reflux	11 (11)	1.4
Hydronephrosis	6 (6)	7.5
Urethral diverticulum	4 (4)	1.0
Chronic renal failure	3 (3)	26.3
Urethral stricture	1 (1)	1.0
Urethrocutaneous fistula	1 (1)	1.0
Perirenal abscess	1 (1)	7.0
Prostatic abscess	1 (1)	1.0
Total	129 (54/88)	

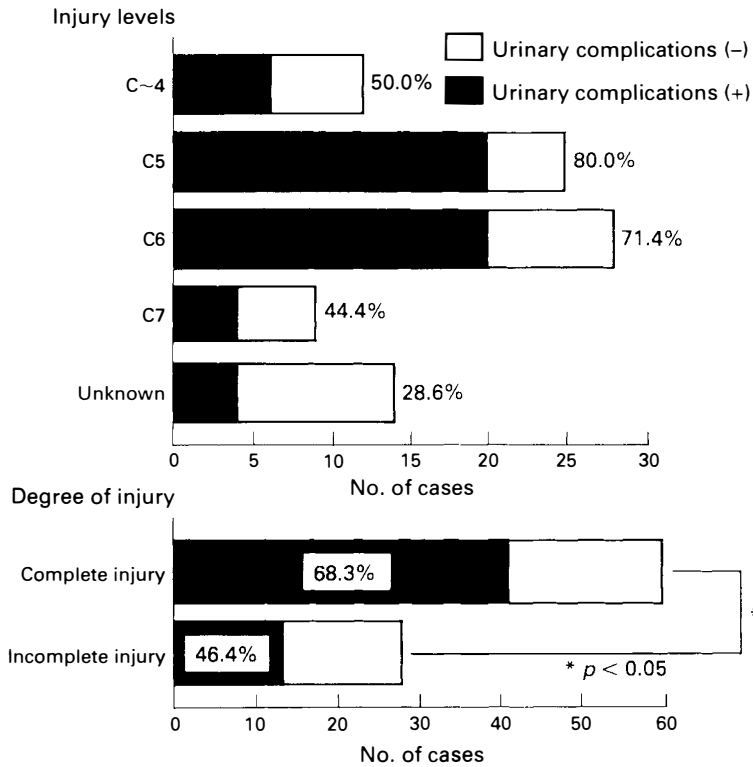

Figure 1 Levels and degrees of injury and incidence of urinary complications.

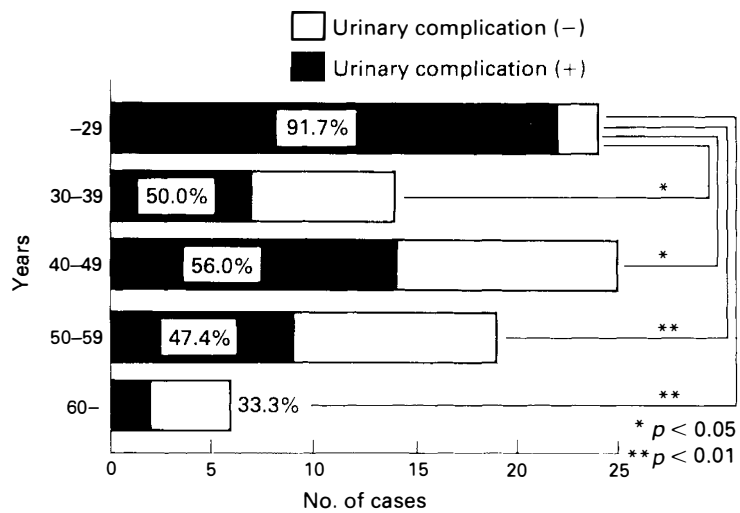

Figure 2 Age of onset of injury and incidence of urinary complications.

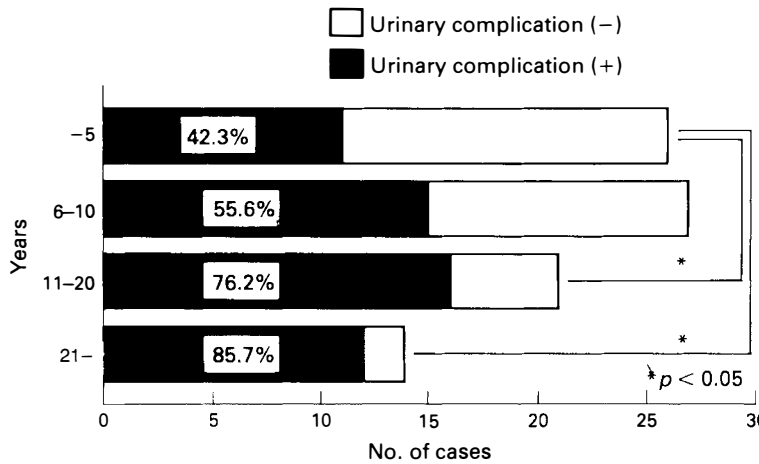

Figure 3 Period after injury and incidence of urinary complications.

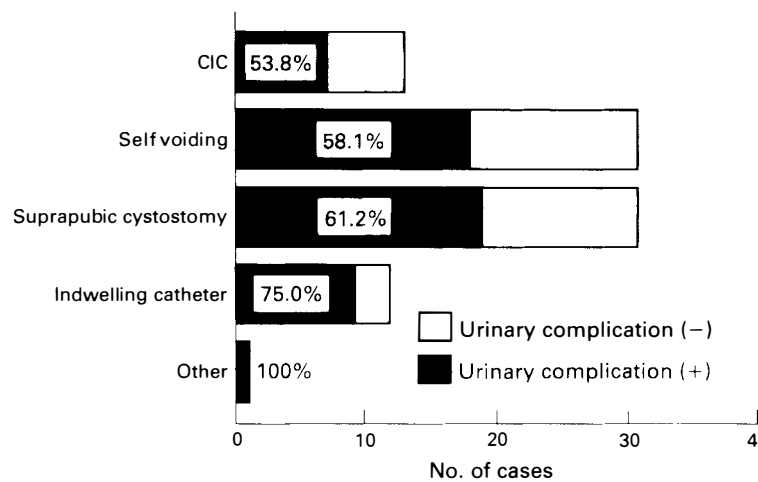

Figure 4 Urinary management and incidence of urinary complications.

III). Although there was no difference in injury levels, the ratio of complete injury patients was higher in the groups with a greater number of complications (group I: 55.9%, group II: 71.9%, group III: 81.8%). Also, the mean age of onset was younger and the mean period after injury was longer in the groups with more complications. Regarding urinary management, it was characteristic that the rate of patients managed by an indwelling catheter was high in group III, whereas in the other groups, the rate of cases with self voiding was high.

Discussion

With the improvement of urinary management, the incidence of death in SCI patients with urinary dysfunction has decreased.[1,2] However, urinary complications such as urinary stones, urinary tract infections, vesicoureteral reflux and hydronephrosis are still some of the most common complications and many authors stress the importance of adequate urinary management from the early stage of injury.[3,4] Among all levels of injury, cervical cord injury patients

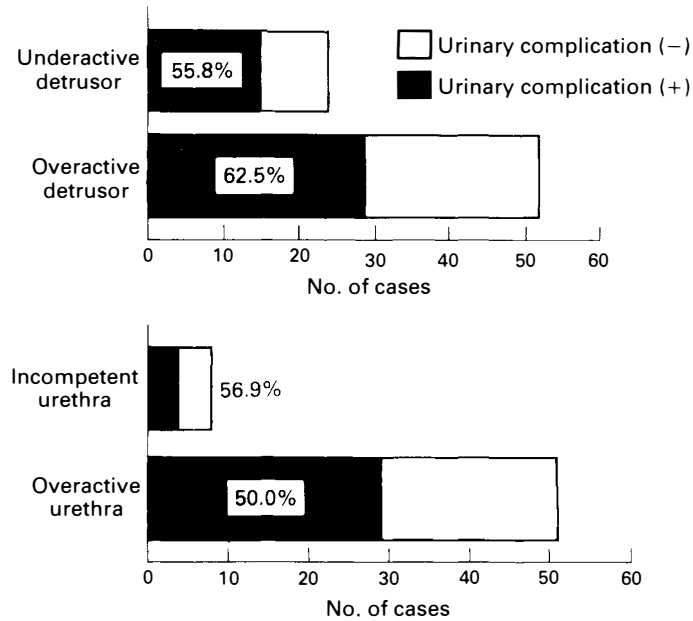

Figure 5 Urodynamic findings and incidence of urinary complications.

Table III Numbers of urinary complications and other factors

	Group I	Group II	Group III
		No. (%)	
Injury levels	34	32	22
C ~ 4	6 (17.6)	4 (12.5)	2 (9.1)
C5	5 (14.7)	10 (31.3)	10 (45.5)
C6	8 (23.5)	13 (40.6)	7 (31.8)
C7	5 (14.7)	3 (9.4)	1 (4.5)
Unknown	10 (29.4)	2 (6.3)	2 (9.1)
Degrees of injury			
Complete/incomplete	19/15	23/9	18/4
Mean age of onset	45.7	38.7	34.1
Mean period after onset	8.0	12.0	16.5
Urinary management			
CIC	3 (8.8)	3 (9.4)	1 (4.5)
Self voiding	16 (47.1)	15 (46.9)	6 (27.3)
Suprapubic cystostomy	12 (35.3)	12 (37.5)	7 (31.8)
Indwelling catheter	3 (8.8)	2 (6.3)	7 (31.8)
Other	0 (0)	0 (0)	1 (4.5)

Group I: no urinary complication; group II: 1–2 urinary complications; group III: more than 3 urinary complications.

especially seem to be at greatest risk for urinary disorders because they have a greater chance of having a higher vesical pressure than those with lower injury levels, as was reported by Herschorn *et al*.[5] The fact that tetraplegics cannot use CIC is also an important factor. In our series, patients with levels higher than C4 showed a lower incidence of urinary complications than did those with C5 and C6 levels. It was probably

because there were more cases with an incomplete lesion in these levels than in others (C ~ 4: 5/12, C5: 2/25, C6: 9/28, C7: 1/9) and as Fam *et al* reported, those with a complete lesion had a higher incidence of urinary tract infection than those with an incomplete lesion.[6] Also, DeVivo[7] reported that spinal cord injury patients in whom renal calculi developed were more likely to be those who had complete lesions. In our cases 68.3% of those with a complete lesion and 46.4% of those with an incomplete lesion had urinary complications.

At the age of onset, there was a significantly higher incidence of urinary complications in those younger than 29 years of age. The reasons for this were considered to be that the ratio of complete injury patients was extremely high in the youngest age group (0–29 yrs: 91.7%, 30–39 yrs: 64.3%, 40–49 yrs: 64.0%, 50–59 yrs: 68.4%, 60 yrs–: 0%). In relatively younger age groups (< 49 years), the mean duration periods after injury were longer than in older age groups (> 50 years), and those with a longer duration had more urinary complications.

As many authors have previously reported,[4,8] CIC is an excellent method of urinary management to prevent urinary complications in spinal cord injury patients. But this cannot be indicated for all cervical injury patients because of the functional disorder of the upper exremities and/or poor ADL. For these cases, self voiding with low vesical pressure should be directed and for those who cannot void under low pressure because of DSD, other urinary management using a catheter (suprapubic cystostomy or indwelling catheter) might be inevitable.

Gerridzen *et al* noted that risk factors for upper tract deterioration were high detrusor pressure during urine storage in those with an areflexic bladder and during voiding in those with hyperreflexic bladder and DSD.[9,10] Although we could not find any urodynamic differences in our cases based on the incidence of urinary complications, it is needless to indicate the importance of low pressure voiding.

From our results, there were some risk factors affecting urinary complications ie complete injury, younger age of onset than 29 years, longer period after injury, and urinary management by catheterisation. In treating these patients we should pay special attention to the prevention of urinary complications. Also we should seek for signs of urinary abnormalities at an early stage by close follow up, using periodical radiographic examinations, urinalysis, blood chemistry etc. If necessary, we should modify urinary management so as to obtain the optimum one as soon as possible.

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