Disturbances of Micturition in Patients with a Spinal Arteriovenous Malformation

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Summary

Neuro-urological studies were performed on 9 patients with a spinal arteriovenous malformation (S-AVM). The micturitional history revealed that all 9 patients had voiding symptoms, obstructive in 9 and irritative in 3 patients. All patients still had obstructive symptoms after treatment of S-AVM. Six of the 9 patients had a large volume of residual urine before treatment; 5 showed urinary retention. Four of the 5 patients (80%) for whom urodynamic studies were performed before treatment had micturitional dysfunction; 2 patients had detrusor hyperreflexia, 1 with detrusor external urethral sphincter dyssynergia (DSD) and 1 with a normal sphincter, 1 patient had an autonomous bladder with DSD and 1 patient had an atonic bladder with DSD. Only 1 patient had a normal bladder and sphincter. Findings of the urodynamic studies after treatment in 9 patients showed detrusor hyperreflexia in 3 patients (2 with DSD and 1 with normal sphincter), autonomous bladder in 1 patient with DSD, atonic bladder in 4 patients (2 with DSD, 1 with incompetent sphincter and 1 with normal sphincter) and normal bladder with normal sphincter in 1 patient. Lower urinary function after treatment of S-AVM was improved in 2 patients, unchanged in 4 patients and worsened in 3 patients.

The above results showed 80% of S-AVM had a severe neuropathic bladder manifested mainly by disturbance of micturition. Treatment of S-AVM does not necessarily improve the lower urinary tract function.

Key words: Spinal arteriovenous malformations; Disturbances of micturition; Urodynamic studies.

A spinal arteriovenous malformation (S-AVM) is a rare condition occurring in only 4% of spinal mass lesions (Yasargil, 1971).

Figure Localisation of anomalous vessels.

It has been reported to occur along the spinal cord at all levels, but especially in the region between the lower thoracic and lumbar regions of the spinal cord. Vesicorectal disturbances were recognised in many reports, however, since there have been no reports of urodynamic studies, we performed neuro-urological studies in 9 patients with S-AVM.

Materials and methods

The subjects consisted of 9 patients (8 males, 1 female) with S-AVM without organic bladder outlet obstruction. The patients were selected at random from our hospital. Their mean age was 51.5 years (range, 22–74). Doppman's classification of S-AVM (Doppman *et al.*, 1969), patient's age, the extent of the mass, the levels of the arterial feeders and nidi are shown in the Figure.

Detailed micturitional histories were obtained before and after treatment of S-AVM. General urological as well as neurological examination were performed to exclude other disorders which might cause voiding dysfunction. Urodynamic studies with measurement of residual urine, cystometry and electromyography of the external urethral sphincter were performed as previously reported. We defined DSD when continuous EMG activity was obtained during either detrusor contraction or attempted micturition (Yasuda *et al.*, 1982). The studies were performed before and after treatment on 5 patients, and only after treatment in the remaining 4 patients. Evaluation of lower extremity function was based on the standard of Cooper *et al.* (1985) (Grade 0, intact; Grade 1, walks independent but not normally; Grade 2, walks but needs cane or walker; Grade 3, stands but cannot walk; Grade 4, slight movement but cannot walk or stand; Grade 5, paralysis).

Table I

Urinary symptom	Pre-treatment (case)	Post-treatment
Obstructive	9	9
Dysuria	9	9
Retention	5	3
Irritative	3	4
Frequency	2	4
Nocturia	3	3
Urgency	3	4
Incontinence	3	3

Table II Results of UDS

No.	Treatment	residual Urine (ml)	Sensation FS (ml)	MS (ml)	Cystometrogram	External urethral Sphincter EMG
1	pre	retention	460	> 600	atonic	DSD
	post	retention	> 600		atonic	DSD
2	pre	10	120	120	hyperreflexia	DSD
	post	250	190	450	hyperreflexia	DSD
3	pre	270	350	650	hyperreflexia	normal
	post	460	450	> 600	atonic	DSD
4	pre	retention	260	450	autonomous	DSD
	post	80	100	100	hyperreflexia	DSD
5	pre	10	390	600	normal	normal
	post	25	350	550	normal	normal
6	pre	retention				
	post	retention	30	330	autonomous	DSD
7	pre	retention				
	post	150	520	> 600	atonic	normal
8	pre	10				
	post	80	200	250	hyperreflexia	normal
9	pre	retention				
	post	retention	> 600		atonic	incompetent

pre: UDS findings before treatment for AVM

post: UDS findings after treatment for AVM

FS: first sensation. Ms: maximum sensation

DSD: detrusor-sphincter dyssynergia

Results

Urinary symptom

Before treatment, all 9 patients had obstructive symptoms and 3 also had irritative symptoms. After treatment, all patients still had obstructive symptoms and 4 had irritative symptoms (Table I).

Urodynamic studies

Residual urine. Six of 9 patients had a large volume of residual urine before treatment; 5 showed urinary retention. Two of 5 patients recovered from urinary retention after treatment. In 3 patients the residual urine increased (Table II).

Cystometry and external urethral sphincter electromyography. Urodynamic studies were performed in 5 patients before treatment and all 9

patients after treatment. Before treatment 2 patients had detrusor hyperreflexia (1 with DSD and 1 with normal sphincter). One patient had an autonomous bladder (with DSD). One patient had an atonic bladder (with DSD). One patient had a normal bladder (normal sphincter). After treatment 3 patients had detrusor hyperreflexia (2 with DSD and 1 with normal sphincter), autonomous bladder in 1 patient (with DSD), atonic bladder in 4 patients (2 with DSD, 1 with incompetent and 1 with normal sphincter) and normal bladder in 1 patient (with normal sphincter) (Table II).

Comparison of the lower urinary function before and after treatment of S-AVM. Case 1 unchanged in lower urinary function and continued to have an atonic bladder with urinary retention and DSD after treatment. Case 2 worsened in lower urinary function because of increased residual urine after treatment. Case 3 worsened in lower urinary function due to increased residual urine and change from detrusor hyperreflexia to atonic bladder with DSD after treatment. Case 4 improved because of reduced residual urine. Case 5 showed no change and findings were normal before and after treatment. In 4 patients (cases 6, 7, 8 and 9), lower urinary function after treatment was evaluated only from urinary symptoms and residual urine. Two patients (cases 6 and 9) showed no change and still had urinary retention. Case 7 recovered from retention. Case 8 deteriorated because of increased residual urine (Table II).

Comparison of functional grade of lower extremity with lower urinary function

In 3 patients (cases 2, 4 and 7), lower extremity functions improved after treatment; 2 patients had improved lower urinary functions and 1 patient deteriorated. In 5 patients (cases 1, 3, 5, 6 and 9), whose lower extremity functions were unchanged after treatment the lower urinary functions remained unchanged in 4 patients and deteriorated in 1 patient. In 1 patient (case 8), lower extremity and lower urinary functions deteriorated following treatment (Table III).

Discussion

In the present study, all 9 patients before treatment had urinary symptoms. The details of urinary symptom revealed that all had obstructive symptoms and 5 of them had urinary retention. Irritative symptoms including urinary incontinence were also noted in 3 patients. Therefore the obstructive symptoms predominated in our patients. This is in agreement with the report of Aminoff and Valentine (1974) who noted hesitancy in 34, retention in 17 and urgency in 19 among 56 patients.

Urodynamic studies before treatment in 5 patients revealed that 2 had detrusor hyperreflexia, one had an autonomous curve, 1 had an atonic curve and 1 had a normal cystometrogram. Detrusor hyperreflexia strongly suggests the presence of suprasacral lesions and autonomous curve suggests the presence of sacral cord lesions, but the atonic curve might be secondary due to bladder overdistention. DSD was also seen in 3 out of 5 patients studied before treatment. One out of 3 patients with DSD had detrusor hyperreflexia, 1 had an atonic curve and one had an autonomous curve. The DSD was usually attributed to a suprasacral lesion, therefore the patient who had DSD and auto-

Table III Results of treatment for S-AVM

No.	Functional grade of lower extremity		Lower urinary function	Methods of treatment
	pre-treatment	post-treatment		
1	4	4	Unchanged	Embolisation
2	3	2	Worsened	Embolisation and operation
3	4	4	Worsened	Embolisation
4	4	1	Improved	Embolisation
5	1	1	Unchanged	Embolisation
6	5	5	Unchanged	Embolisation
7	5	1	Improved	Operation
8	2	3	Worsened	Operation
9	5	5	Unchanged	Operation

mous cystometrogram could have a suprasacral as well as a sacral cord lesion. Thus, patients with S-AVM had a severe neuropathic bladder and showed mainly disturbance of micturition. Such severity and variety of neuropathic bladder dysfunction might be caused by wide extended lesion, as is usual with S-AVM.

When lower urinary function was compared before and after treatment of S-AVM, 6 of 8 patients who had micturition dysfunction in urodynamic studies before treatment showed no improvement. Only 2 patients (case 4 and 7) recovered, but still showed distinct disturbed bladder function after treatment. Generally, to evaluate the effects of treatment, Cooper's criteria of lower extremity function is used. So we compared the lower urinary function with the lower extremity function. In 7 of 9 patients, changes of functional grade of lower extremity matched to changes of lower urinary function after treatment. Therefore, the recovery of lower extremity function might suggest the recovery of lower urinary function. However, 2 patients (case 4 and 7) whose lower extremity function almost cured did not show significant improvement in lower urinary function. Therefore, the functional grade of lower extremity will not always be parallel with lower urinary function.

The above results showed that the treatment of S-AVM does not necessarily produce good effects on lower urinary functions and indicate that the lower urinary functions of S-AVM patients should be evaluated carefully and independently.

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