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Voiding by increased abdominal pressure in male spinal cord injury patients – long term follow up

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We reviewed the long term follow up of five spinal cord injury patients with detrusor areflexia who emptied their bladder using high abdominal pressure. Ages ranged from 29 to 58 years, and the mean time elapsed from injury was 18.9 years. The bladder pressure during voiding ranged from 95 to 160 cm of water. One patient developed vesicoureteral reflux and hydronephrosis. Long term monitoring is suggested in patients who use high abdominal pressure for bladder emptying.

Key words: spinal cord injuries; neuropathic bladder; micturition; increased abdominal pressure voiding.

Introduction

In spinal cord injury patients with detrusor areflexia, bladder emptying is usually accomplished using intermittent catheterization. Some patients with detrusor areflexia are able to empty their bladder by increased abdominal pressure either by Valsalva or by Crede maneuvers. We report the long term follow up of 5 male patients who required a significant increase of intraabdominal pressure in order to empty their urinary bladder.

Methods

The urodynamic studies of male spinal cord injury patients at the McGuire Veterans Administration Hospital were reviewed. Patients with detrusor areflexia, and closed bladder neck during filling cystography, and who emptied their bladders by increased abdominal pressures to a pressure higher than 50 cm of water were included. No patients had catheter drainage of the urinary bladder in any form.

All the patients underwent a questionnaire regarding stone formation, urinary tract infections and previous urological surgeries. Renal function and anatomy were evaluated by serum creatinine and intravenous urography. A videourodynamic study was performed with a filling rate of 40 cc per minute via a transurethral 10 French double lumen catheter up to a bladder volume of at least 400 cc. Intra-abdominal pressure was measured using a water filled rectal balloon catheter. All pressures were transduced electronically and recorded on a multichannel recorder. Urinary flow rate was recorded with a rotating disk micrometer. The bulbocavernosus reflex and external sphincter striated muscles activity were evaluated electromyographically by inserting a coaxial needle into the periurethral striated musculature. Pressure flow recordings were obtained with the patients duplicating their usual bladder emptying maneuver in both the supine and the sitting positions. The urethral catheter was removed and abdominal pressure was recorded again during emptying attempts. X-ray cystography was obtained during the filling cystometry, and during the bladder emptying maneuvers.

Results

Of the spinal cord injury patients with detrusor areflexia 5 patients had a closed bladder neck during the filling cystometry and emptied their bladders by increasing abdominal pressure to greater than 50 cm of water (Table I). The mean time elapsed

from their injury was 18.9 years. Bladder emptying was accomplished by the Valsalva procedure in 4 patients and by Crede in one patient. One patient had a bladder stone in the immediate post injury period following the use of an indwelling catheter. Table II summarizes the results of the videourodynamic study. In all patients the bladder neck was closed during filling cystography. No funneling of the bladder neck was demonstrated in all patients during voiding attempts on cystography. Vesical pressures at the end of bladder filling ranged from 10 to 30 cm of water. Maximum vesical and abdominal pressures during bladder emptying by Valsalva or Crede ranged from 95 to 160 cm of water. Abdominal pressures were the same with and without the urethral catheter in place. Patient no 1 had impaired renal function and hydronephrosis; grade 1 vesicoureteral right reflux during the filling cystogram; and bilateral grade 3 vesicoureteral reflux during Valsalva to bladder pressure of 110 cm of water. Patient no 3 had grade 2 vesicoureteral reflux during Valsalva maneuver to bladder pressure of 160 cm of water. Quantitative external sphincter striated muscle EMG activity was increased in patients no 1, no 2, and no 3 during voiding attempts, and unchanged in patients no 4 and no 5.

Discussion

Detrusor areflexia following spinal cord injury is most commonly seen in patients with sacral spinal cord or sacral roots injury. But detrusor areflexia can be associated with injury above the sacral root level.[1] We identified a group of continent spinal cord injury patients with detrusor areflexia who emptied their bladder by using Valsalva or Crede. Based on the cystography in which no bladder neck funneling was demonstrated the level of obstruction appears to be at the bladder neck.

Valsalva is defined as increased abdominal pressure using the diaphragm and/or abdominal musculature. The Crede maneuver is suprapubic manual pressure applied over the bladder.

In neurologically normal men, and in most spinal cord injury patients bladder emptying cannot be accomplished by increasing abdominal pressure or Crede because the increase in the abdominal pressure is associated with concomitant increase in intraurethral pressure which prevents urine leak.[2] However some spinal cord injured patients have a neurological deficit of the bladder neck and proximal urethral closure mechanism. In this group of patients the bladder neck is usually open during filling cystography and bladder emptying occurs with low abdominal and vesical pressures. These patients are usually incontinent with routine daily activities. Use of either Valsalva or Crede has been recommended in selected patients[3,4] including patients with detrusor areflexia and lower motor type of dysfunction of the external sphincter,[3] patients with detrusor areflexia following supra

Table 1 Analysis of the patients

Patient	Patient age	Neurological level of injury	Time from onset of injury (years)	Bladder management	Urinary tract infections	Lower extremity muscle tone	Serum creatinine mg/dl
1	51	T4 incomplete	33	Valsalva	Symptomatic	Spastic	2.3
2	58	T3 incomplete	34	Crede	Symptomatic	Spastic	0.9
3	29	L3-4 incomplete	2.5	Valsalva	None	Spastic	1.0
4	40	T12-L1 complete	18	Valsalva	Symptomatic	Flaccid	0.1
5	49	T11 incomplete	7	Valsalva	Asymptomatic	Flaccid	0.6

Table 2 Videourodynamics

Patient	Bladder volume (cc)	Intravesical pressure (cm H_2O) end of filling	Compliance cc/cm H_2O	Maximal intravesical pressure (cm H_2O) during voiding attempt	Bulbocavernosus reflex	Reflux
1	600	30	20	110	Present	Grade II(R) Grade III(L) Filling and emptying
2	550	10	55	95	Present	None
3	400	10	40	160	Present	None filling Grade II(L) emptying
4	400	20	20	100	Absent	None
5	500	20	25	100	Absent	None

sacral spinal injury,[4] and for meningomyelocele children.[5] Our patients had relative competence of the bladder neck and were continent during normal daily activities. Significant complications developed in one patient (no 1) more than 30 years following injury. He began to experience increasing difficulty in emptying his bladder and had several febrile urinary tract infections. The residual urine varied from 400 to 600 ml, renal function was impaired and bilateral hydronephrosis was present on intravenous urography. Videourodynamic study demonstrated reduced bladder compliance, incomplete bladder emptying to bladder pressure of 110 cm water and bilateral vesicoureteral reflux. He was started on intermittent self catheterization. On evaluation 9 months later, the serum creatinine was within normal limits, the bilateral hydronephrosis resolved as did the vesicoureteral reflux during bladder filling cystography. The reflux and the hydronephrosis may have developed secondary to a combination of diminished bladder compliance and high bladder pressure during Valsalva maneuver.[6,7]

We described selected spinal cord injury patients with detrusor areflexia, closed bladder neck during filling cystography, and no funneling of the bladder neck during voiding attempts. These patients are able to empty their bladder using high pressure Valsalva or Crede. Long term monitoring is advisable in patients who prefer Valsalva or Crede for bladder emptying. Intermittent catheterization should replace those maneuvers as soon as urological complications occur.[8]

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