

These are often very distressing to patients. 68% of survey respondents experienced this type of problem.

The bladder has somatic, parasympathetic, and sympathetic innervation. In other words, it has input from higher centres (brain) provided that the pathways via the spinal cord are undamaged and also autonomic control

The **pudendal nerve** is the somatic component of bladder innervation and innervates the external sphincter. When stimulated, it produces contraction of the external urethral sphincter, which is only able to remain tightly contracted for a short period of time. This sphincter normally contracts with transient increases in abdominal pressure such as when there is coughing, sneezing, and laughing.

The parasympathetic nerve fibres arise from sacral segments S2-4, innervating the detrusor muscle. When the individual desires micturition. When stimulated by a need to empty the bladder (voluntary control), the detrusor contracts resulting in raised pressure within the bladder.

The internal urinary sphincter is innervated by the sympathetic nervous system, nerves originating from the thoracolumbar region. When stimulated, the internal sphincter relaxes.

As urine fills the bladder via the ureters (tubes which come down from the kidneys), the bladder wall muscle (detrusor) stretches allowing the bladder to expand; as the bladder fills, stretch receptors within the bladder wall are stimulated, sending the brain information as to the amount of urine in the bladder.

Approximately 300 cc of urine within the bladder is necessary before the pressure within the bladder rises enough for the brain to recognize a sense of bladder fullness.

With low bladder volumes, the sympathetic nervous system is stimulated and parasympathetic system is inhibited resulting in internal sphincter contraction and detrusor relaxation.

When the bladder is full and micturition is desired, the inhibitory signals from the brain are replaced by impulses which stimulate the parasympathetic system resulting in detrusor contraction, and inhibit the sympathetic system resulting in internal sphincter relaxation.

The bladder pressure then rises to a point at which it exceeds the resistance within the urethra (the tube through which the urine leaves the bladder), and urine flows out.

Once the bladder has emptied, the brain again sends impulses restoring parasympathetic inhibition and sympathetic stimulation resulting in detrusor relaxation and internal sphincter contraction.

A severe lesion in the **cauda equina** (at the lower end of the spinal cord) affects bladder and bowel function as a result of damage to the **sacral parasympathetic outflow**.

The detrusor muscle of the bladder is affected and reflex connection no longer occurs in response to distension. The bladder wall itself has a certain amount of elasticity, and with rising bladder pressure this forces some urine into the urethra.

However, the unopposed sympathetic supply to the sphincter muscle keeps it contracted and closed, and dribbling incontinence occurs. A similar situation arises with regard to the bowel and anal sphincter.

Damage further up the spinal cord, in which voluntary control of the bowel and bladder is affected, but which does not affect the parasympathetic outflow leads to an automatic bladder. Any voluntary aspect to the control of the bladder is lost, leading to "accidents".

Note that certain medications used in arachnoiditis patients may affect bladder function. For instance, antidepressants such as amitriptyline have anticholinergic effects, inhibiting detrusor muscle function. This may lead to some difficulty in initiating urination and possibly in emptying the bladder fully.

Aldrete looked at bladder dysfunction in arachnoiditis in detail:

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Females %
Males %

Dysuria
62
45

Hesitation
35
42

Incomplete bladder emptying
70
64

Frequency
78
46

Urgency
86
48

Incontinence

65
19

Self-catheterising
4.8%
0

Rectal incontinence
20
6

Types of bladder dysfunction:

1. Urgency: a sudden urge to empty the bladder; confusingly, this may arise when there is partially reduced sensation of bladder fullness, which is quite a common problem in arachnoiditis. This is because there is a delay in perception and an overblown response which can make the urge quite painful.
2. Frequency: the need to pass water more often than usual (up to 8 times in 24 hours is about normal), often passing small volumes. This may be associated with an infection, especially if passing water is painful.
3. Hesitancy: inability to initiate a stream of urine; more usually in men, can be a sign of prostate enlargement. It can also be associated with spinal problems or a side effect of medication such as antidepressants. (especially tricyclics like amitriptyline).
4. Retention: inability to empty the bladder; acute retention is obvious and very painful if untreated; chronically it may arise unnoticed (especially if there is loss of sensation), with a gradual build-up of retained urine. There is increased susceptibility to infection.

5. Dribbling: when the stream of urine does not cut off normally but continues to drip or dribble. There may also be constant incontinence if the bladder sphincter is damaged and unable to hold the urine in the bladder

6. Incontinence: (a) irritable/unstable bladder (detrusor instability): a feeling of urgency may be accompanied by wetting; this can also happen if the bowel is overfull;

(b) reflex incontinence: loss of sensation of bladder fullness and interruption of the messages to the brain may cause it to empty by reflex activity (initiated at a spinal level) which is usually over-ruled by messages from the brain.

(c) overflow: weak muscles due to disrupted nerve impulses fail to empty the bladder properly and it becomes large and floppy, able to hold large amounts of urine but leaking slightly (dribbling)

(d) stress incontinence: weakened pelvic floor muscles mean that the sling which holds the bladder position is ineffective and when the bladder is full, a cough or a sneeze may allow urine to pass out.

7. Neurogenic bladder: (a) spastic: unstable bladder;

(b) flaccid 'lazy' bladder fails to empty (c) dyssynergic: 'conflicting' bladder: muscles of the bladder wall and sphincter no longer co-ordinate; symptoms include urgency followed by hesitancy, dribbling or incontinence. If the bladder muscle contracts but the sphincter fails to open, there is a risk of urine reflux back up to the kidneys which can eventually cause damage.

Urinary tract infection:

Loss of bladder function renders the individual more prone to urinary infection. This occurs particularly in those who have residual urine in the bladder after voiding.

Careful attention to hygiene, especially if catheter use is necessary, is an essential preventive measure.