Chapter 8
Urinary and Bowel Complications After Stroke

Zehra Mehdi and Mehool Patel

Abstract Urinary and bowel complications are fairly common after stroke. Post-stroke urinary incontinence is a prevalent condition up to 2 years after stroke. Short-term and long-term year stroke survival, disability, handicap, and institutionalisation rates are adversely influenced by post-stroke urinary incontinence. Bowel function is often affected following a stroke, resulting in complications of faecal incontinence and constipation. Communication and mobility difficulties resulting from stroke may further contribute to bladder and bowel problems. A proactive patient-centred approach to assessing and managing these problems is essential to improving stroke outcomes. Healthcare professionals should address these common complications and be aware of strategies to assess and actively manage them, with the aim of regaining continence, which is associated with better stroke outcomes. Good continence care has a multitude of benefits for stroke patients and their carers. Although continence may not always be restored, several interventions can be instituted to improve the patient's quality of life, which in turn may improve their engagement with stroke rehabilitation.

Keywords Urinary • Bowel • Stroke • Post-stroke • Incontinence

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Key Messages

- Bowel and bladder complications are common sequelae of acute stroke.
- Post-stroke urinary incontinence is widely recognised as an important predictor of poor functional outcomes, increased institutionalisation, and mortality rates.
- Bowel function is often affected following a stroke, resulting in complications of faecal incontinence and constipation.
- Communication and mobility difficulties resulting from stroke may further contribute to bladder and bowel problems.
- Healthcare professionals should address these common complications and be aware of strategies to assess and actively manage them, with the aim of regaining continence.

Introduction

Bladder and bowel problems occur frequently following a stroke. Urinary incontinence affects more than a third of stroke patients admitted to hospital, with up to a quarter of them remaining incontinent at 1 year, and up to 10 % at 2 years. Faecal incontinence is also a significant problem affecting 30–40 % of individuals immediately after stroke, and constipation is a common complaint on rehabilitation wards. These complications can have a devastating impact on the patient's physical, psychological, and social well-being, adversely affecting their ability to participate in stroke rehabilitation. A proactive patient-centred approach to assessing and managing these problems is essential to improving stroke outcomes. This chapter discusses the prevalence, natural history, causes, assessment methods, and management strategies of post-stroke bladder and bowel complications.

National Standards for Continence Care

Good continence care has a multitude of benefits for stroke patients and their carers. The UK National Clinical Guidelines for Stroke 2012 [1] present clear recommendations for managing bladder and bowel complications following a stroke during the acute and rehabilitation phases of care (Table 8.1). These guidelines specify "All wards and stroke units should have established assessment and management protocols for both urinary and faecal incontinence, and for constipation in stroke patients". The guidelines emphasise the importance of a documented active management plan for all patients with persistent problems. The implementation of these recommendations has been extremely variable across the UK.

The National Sentinel Stroke Clinical Audit 2010 [2] found that only 63 % of stroke patients with persistent bowel and bladder complaints had a documented plan

Table 8.1 National clinical guidelines for stroke 2012: continence care

	Recommendations
Acute phase	**A**. All wards and stroke units should have established assessment and management protocols for both urinary and faecal incontinence, and for constipation in stroke patients
	B. Patients should not have an indwelling [urethral] catheter inserted unless indicated to relieve urinary retention or where fluid balance is critical
Rehabilitation phase	**A**. All wards and stroke units should have established assessment and management protocols for both urinary and faecal incontinence, and for constipation in stroke patients
	B. Patients with stroke who have continued loss of bladder control 2 weeks after diagnosis should be reassessed to identify the cause of incontinence and have an ongoing treatment plan involving both patients and carers. The patient should:
	Have any identified causes of incontinence treated
	Have an active plan of management documented
	Be offered simple treatments such as bladder retraining, pelvic floor exercises, and external equipment first
	Only be discharged with continuing incontinence after the carer [family member] or patient has been fully trained in its management and adequate arrangements for a continuing supply of continence aids and services are confirmed and in place
	C. All stroke patients with a persistent loss of control over their bowels should:
	Be assessed for other causes of incontinence, which should be treated if identified
	Have a documented, active plan of management
	Be referred for specialist treatments if the patient is able to participate in treatments only be discharged with continuing incontinence after the carer [family member] or patient has been fully trained in its management and adequate arrangements for a continuing supply of continence aids and services are confirmed and in place
	D. Stroke patients with troublesome constipation should:
	Have a prescribed drug review to minimise use of constipating drugs
	Be given advice on diet, fluid intake, and exercise
	Be offered oral laxatives
	Be offered rectal laxatives only if severe problems remain

Adapted from Intercollegiate Stroke Working Party [1]

to promote continence. The audit also revealed the inappropriate use of urinary catheterisation in acute stroke patients: 20 % of patients were catheterised in the first week following stroke, and in 10 % of these cases there was no clear rationale for the insertion. These results demonstrate a failure by healthcare professionals to adequately assess and manage a significant number of stroke patients with continence problems. This may be the consequence of multiple factors such as inadequate education on bowel and bladder management amongst nurses and doctors, nursing staff shortages, time constraints, inadequate toilet facilities, and a lack of

moving and handling aids. It is vital that these factors are acknowledged as barriers to providing good continence care and are adequately addressed to improve the quality of care provided.

Post-stroke Urinary Incontinence

Epidemiology

The International Continence Society has attempted to standardise the terminology of lower urinary tract dysfunction. It has established the definition of urinary incontinence as "the involuntary loss of urine that is a social or hygienic problem", which has been further subdivided according to the patient's symptoms [3]. This terminology has been universally accepted for use in international consultation documents and National Institute for Health and Care Excellence (NICE) guidelines [3, 4].

It is widely recognised that post-stroke urinary incontinence is common, but there is considerable variation in the reported prevalence rates; this is due to several factors:

1. The use of different definitions of urinary incontinence
2. Different population samples (hospital versus community)
3. Measurement of prevalence at varying time intervals following acute stroke (at admission, 1 week, 1 year)
4. Different study designs
5. Failures to account for the presence of premorbid incontinence

In a review of nine hospital-based studies published between 1985 and 1997, Brittain et al. reported rates of post-stroke urinary incontinence at admission between 32 % and 79 % of patients [5]. In a population-based study conducted in 2001, Patel et al. found rates of post-stroke urinary incontinence of 40 % at 7–10 days following admission [6]. Data from the UK collected between 1998 and 2004 have also demonstrated urinary incontinence rates of 39–44 % at 1 week post-admission [7].

Comparatively, epidemiological trials such as the Leicestershire MRC Incontinence Study found that 34.2 % of adults over the age of 40 had urinary incontinence at times, with severity increasing with age [8]. This suggests that many stroke patients may have already experienced bladder problems prior to their stroke.

Natural History of Post-stroke Urinary Incontinence

Post-stroke urinary incontinence is a persistent condition, with significant numbers of patients remaining incontinent at discharge [6, 9]. Patel et al. explored the natural history of post-stroke urinary incontinence in 235 patients over a 2-year period [6].

Data for this study was acquired from the South London Stroke Register, a population-based register covering a population of over 230,000. Follow-up data was obtained using personal interviews with patients and their carers and through postal questionnaires [10]. The study reported urinary incontinence prevalence rates of 19 % at 3 months, 15 % at 1 year, and 10 % at 2 years [6]. Three further studies have demonstrated the persistence of urinary incontinence at 1 year, reporting prevalence rates ranging from 9 to 27 % [11–13]. Although all of these studies excluded patients with premorbid bladder problems, the definitions of urinary incontinence and assessment methods varied, which may account for the variation in prevalence rates reported.

Certain factors have been identified as independent predictors of persistent post-stroke urinary incontinence [13–17]:

1. Increasing age
2. Female sex
3. Stroke severity and size

Patients suffering from total anterior circulation infarcts were found to be less likely to regain continence at 3 months. Comparatively, patients who suffered a lacunar infarct had an odds ratio of 3.65 [95 %, CI: 1.1–12.2] for regaining continence [14]. These finding were supported by a prospective study investigating the association of bladder function with unilateral hemispheric stroke [15], which identified a significant positive correlation between large infarct size and the development of post-stroke urinary incontinence. The authors of this study concluded that such infarcts involving both cortical and subcortical regions of the brain were more likely to result in damage to neuro-micturition pathways (spinothalamic) and result in communication difficulties, both directly and indirectly contributing to incontinence.

Currently, there is no data to support a correlation between either the location of the stroke lesion or the aetiology of the stroke (haemorrhagic versus ischaemic) and the development of urinary incontinence, and further research is required in this area.

Effects of Urinary Incontinence on Stroke Outcomes

It is widely recognised that urinary incontinence following stroke is a strong and independent predictor of poor outcome [6, 11, 12, 14, 18, 19]. Persistent urinary incontinence at 3 months following stroke has been reported to be the single best predictor of moderate to severe disability in patients under the age of 75 [20]. A prospective observational study of 324 patients was conducted in 2001 investigating the impact of persistent urinary incontinence at 3 months on stroke outcome [14]. On multiple logistic regression analysis, persistent post-stroke urinary incontinence was independently associated with a greater rate of institutionalisation of 27 %

compared to 9 % in the group who regained continence. They also investigated the impact on post-stroke disability using the Barthel Index and the Frenchay Activities Index [FAI] and found disability to be significantly worse in those patients who remained incontinent at 3 months. Another population-based study reported even higher rates of institutionalisation—45 % at 1 year, which was four times greater than in those who regained continence [11].

Post-stroke urinary incontinence is also independently associated with higher mortality rates [12, 21]. A study in 2011 reported significantly higher mortality rates in the incontinent group at time intervals of 1 week, 6 months, and 1 year [12]. The authors highlighted that regaining continence within the first week following stroke was associated with a better prognosis, which was similar to those with normal bladder control.

There are many reasons why persistent urinary incontinence is associated with worse outcomes:

1. *Interference with the ability to participate in stroke rehabilitation*. Physical and psychological factors may impact on the patient's ability to participate in rehabilitation [22]. Urinary incontinence may lead to low morale and poor self-esteem, resulting in apathy and a reduced desire to participate in rehab. Stroke patients who have a poor response to rehabilitation are more likely to have a poor functional outcome, increased length of hospitalisation, and a greater mortality rate [22, 23].
2. *Psychological impact*. Urinary incontinence may be extremely distressing for both the patient and their carer. This condition may result in a significant impact on the patient's quality of life, interfering with social activities, sleep patterns, and personal relationships, resulting in feelings of embarrassment and guilt. On multivariate analysis, Brittain et al. demonstrated that depression after stroke was more than twice as likely in patients suffering from incontinence compared to those without bladder problems [24].
3. *Marker of stroke severity*. Persistent urinary incontinence is associated with larger strokes and has been related to coma states [14, 25]. Extensive brain damage may impair toileting skills due to altered sensorium.
4. *Increased risk of falls*. Patients suffering from urge incontinence may attempt to ambulate to the bathroom in a rush, and this has been associated with an increased risk of falls, which may lead to fractures and subsequent increased hospitalisation [26].

Pre-existing urinary incontinence has also been associated with poor outcomes following stroke. Studies analysing this relationship have found higher mortality rates amongst this group. Jawad et al. reported that 79 % of patients who died prior to their 6-month functional review suffered from premorbid urinary incontinence [27]. Similar findings were demonstrated in another study, which reported that of the 16 patients with pre-existing incontinence, 19 % died within the first week, 44 % died within 3 months, and 25 % died within 2 years [7].

Neural Control of Micturition

In order to determine the cause of urinary incontinence following a stroke, it is important to consider the factors controlling normal micturition. Complex neural mechanisms located in the brain, spinal cord, and peripheral ganglia are responsible for ensuring bladder filling and voiding occurs in a coordinated manner [28]. These mechanisms control smooth and striated muscle activity of the following anatomical structures:

- Urinary bladder and bladder neck
- Urethra
- Urethral sphincter
- Pelvic floor muscles

Figure 8.1 illustrates the different structures and neural mechanisms involved. The spinobulbospinal pathway mediates the voiding reflex and it is believed that this reflex operates as a switch, being either completely "off" during bladder filling or "on" during voiding [28, 29].

Bladder-Filling Cycle

During the filling cycle, stretch receptors within the bladder detrusor muscle signal low intensity afferent impulses to the spinal cord via the pelvic nerves (S2–S4) and then via the spinal cord (lateral spinothalamic tracts) to the pontine micturition centre and the frontal cortex. This results in three processes:

1. Inhibition of the parasympathetic innervation of the detrusor muscle of the bladder via the *pelvic nerves*, resulting in bladder relaxation.
2. Stimulation of the sympathetic outflow in the *hypogastric nerve*, resulting in contraction of the bladder outlet (bladder neck and urethra).
3. Stimulation of the sympathetic outflow in the *pudendal nerve* via neurons in the Onuf's nucleus, resulting in contraction of the external urethral sphincter.

These spinal reflexes are collectively known as the "guarding reflex" allowing one to remain continent. Furthermore, several studies have suggested that a region within the lateral pons of the brain known as the "pontine storage area" may contribute to this process by stimulating striated urethral sphincter activity [28–30].

Bladder-Voiding Cycle

The bladder is usually able to hold approximately 500 ml of urine before needing to empty. At a critical level of bladder distention, the afferent impulses in the pelvic nerves intensify to the spinal cord, switching the spinobulbospinal pathway to

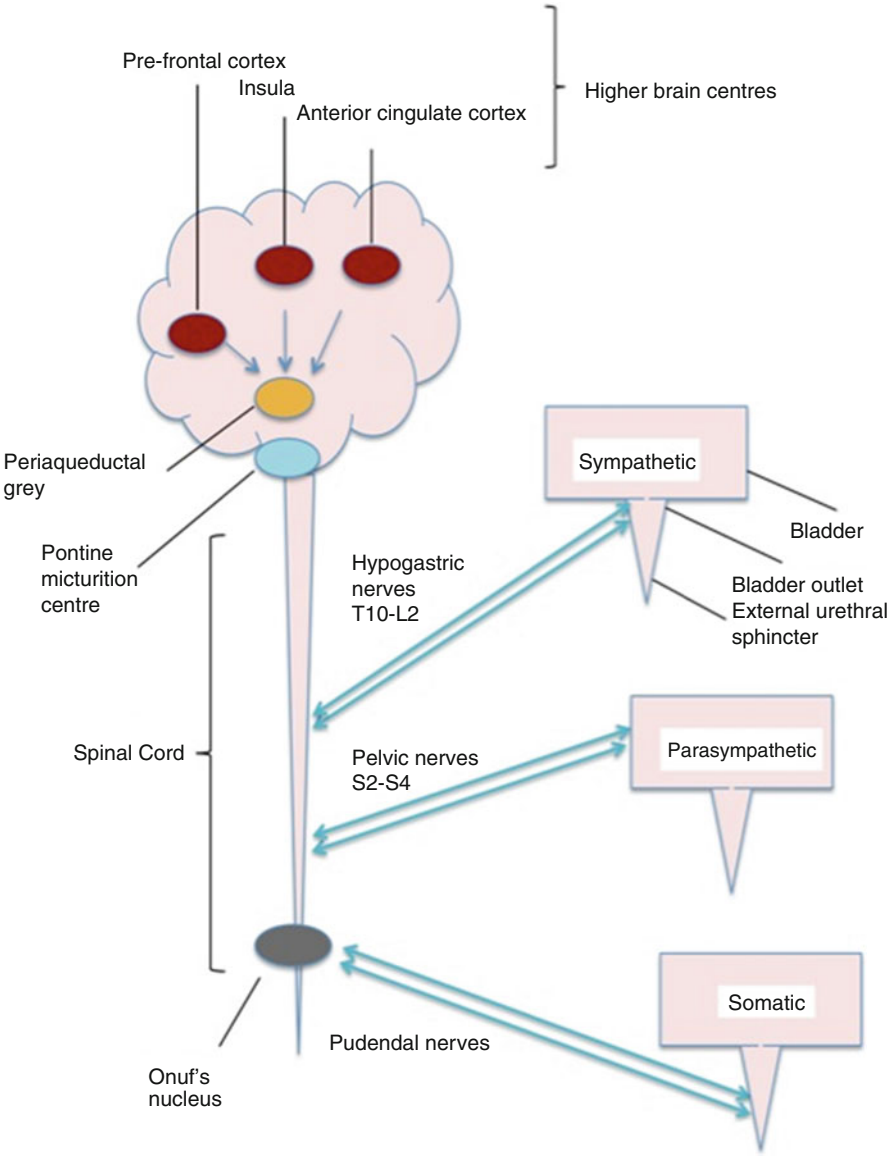

Fig. 8.1 The neural control of micturition (From Mehdi et al. [80]. © 2013 John Wiley & Sons Ltd. With permission from John Wiley and Sons)

maximal activity [28]. These signals are relayed from the spinal cord to the pontine micturition centre of the brain via the periaqueductal grey. Activation of the pontine micturition centre results in the following:

1. Inhibition of sympathetic outflow in the hypogastric and pudendal nerves, resulting in bladder outlet and urethral sphincter relaxation.
2. Stimulation of parasympathetic outflow to the bladder, resulting in detrusor muscle contraction.

Voluntary Control

Voluntary voiding is under strict control from higher brain centres, which have been identified using functional magnetic resonance imaging. These include the prefrontal cortex—in particular the right inferior prefrontal gyrus—the anterior cingulate cortex, the thalamus, the caudal hypothalamus, and the insula [28, 30]. The periaqueductal grey plays a pivotal role in relaying signals to and from these higher brain centres to control primary input into the pontine micturition centre. This process ensures that voiding only takes place when it is considered to be socially desirable to do so and effectively suppressed at all other times [28–31].

Types of Post-stroke Urinary Incontinence

Several different processes may account for the development of post-stroke urinary incontinence. Figure 8.2 illustrates the various types of urinary incontinence that may occur following a stroke.

Direct Damage to the Neuromicturition Pathways: Urge Incontinence

This is the most frequently reported cause of post-stroke urinary incontinence [15, 32, 33]. The stroke lesion itself may directly disrupt the neuromicturition pathways within the brain, resulting in uninhibited detrusor contractions. The consequence of detrusor overactivity is often a sudden urge to void that is difficult to postpone, and subsequently may result in the involuntary leakage of urine. The strength of the contractions will determine the degree of urinary leakage, with stronger ones resulting in complete bladder emptying. Conversely, weaker contractions lead to frequent small-volume leakages and ineffective bladder emptying, which results in large residual volumes of urine [>100 ml]. Thus, patients with urge incontinence also complain of symptoms of urinary frequency and nocturia [33]. Detrusor overactivity is also referred to as detrusor hyper-reflexia and can be demonstrated using urodynamic studies; however, this investigation is not routinely required. Studies using urodynamic evaluation of stroke patients have reported a wide variation in

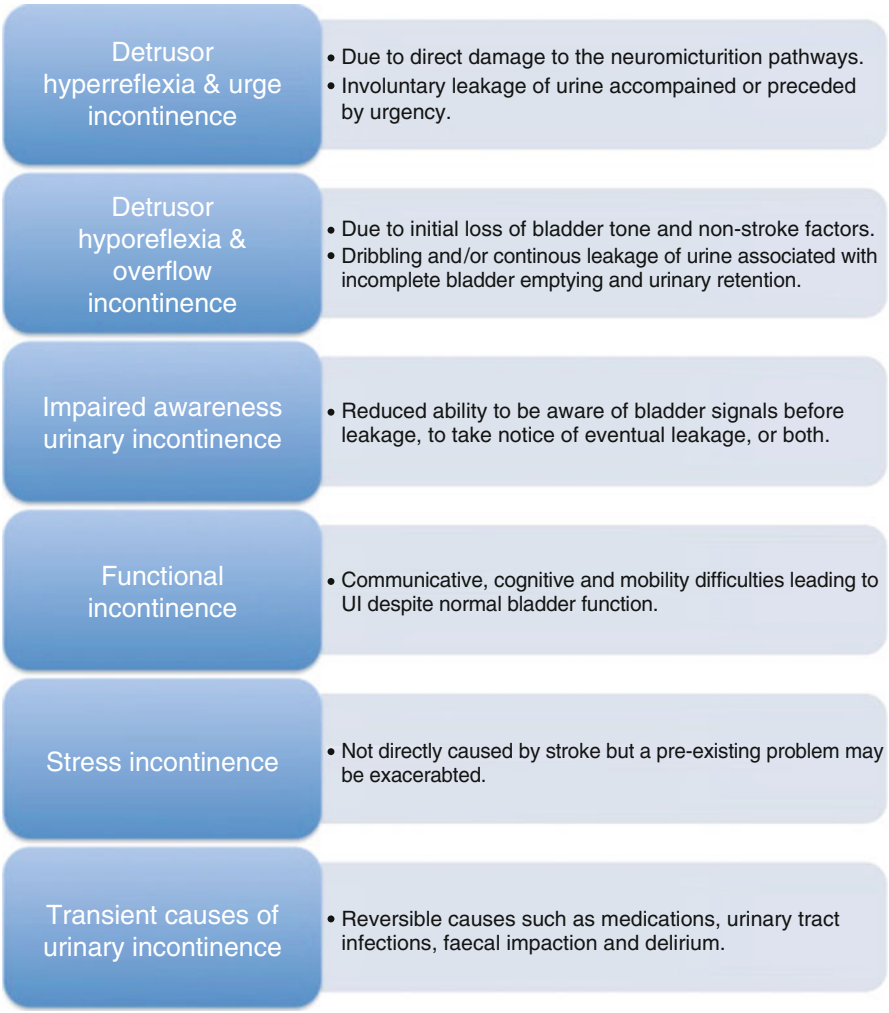

Fig. 8.2 Schematic diagram representing the causes and types of post-stroke urinary incontinence (From Mehdi et al. [80]. © 2013 John Wiley & Sons Ltd. With permission from John Wiley and Sons)

prevalence rates of this condition, ranging from 37 to 90 % [15, 34, 35]. There is inconclusive data associating the site of the stroke lesion and the development of urge incontinence; however, lesions in the frontal lobe have been suggested [34, 36].

Detrusor Hyporeflexia with Overflow Incontinence

This type of post-stroke incontinence has been reported in various studies, with prevalence rates ranging from 21 % to 35 % [15, 17, 32, 37]. It has been postulated that detrusor hyporeflexia may occur after an acute stroke because of an initial loss

of bladder tone. However, in most of these studies, non-stroke factors were also present such as use of anticholinergic medications or diabetic polyneuropathy, which can affect bladder tone and result in overflow incontinence [15]. Detrusor hyporeflexia results in the incomplete bladder emptying, resulting in large post-void residual urine volumes (>100 ml) and subsequent symptoms of dribbling and/or continuous leakage of urine. The resultant urinary retention may occur acutely, and is usually very painful, or it may be chronic, developing over a longer period of time, in which case it is usually painless. In all cases of urinary retention, constipation must be excluded as a causative factor.

Impaired-Awareness Urinary Incontinence

A few prospective hospital-based trials have explored the concept of impaired awareness of urinary incontinence in acute stroke patients [36, 38, 39]. This type of incontinence has been defined as "Urinary incontinence with reduced ability to be aware of bladder signals before leakage, to take notice of eventual leakage, or both" [39]. In a cohort of 65 patients, more than half were found to have impaired awareness of their symptoms, ranging from slight unawareness to anosognosia. The authors reported that this type of incontinence appeared to be an independent risk factor for poor outcome both at 3 months and 1 year following stroke [38, 39]. When compared to patients with urge incontinence, it was found that those with impaired awareness had a greater frequency of parietal stroke lesions and, less frequently, frontal lesions. This finding was consistent with the known role of the parietal and temporal lobes in correctly identifying and validating signals in a given social circumstance, compared to the volitional role of the frontal lobe structures in the conscious recognition of afferent bladder signals.

Functional Incontinence

Stroke-related factors, such as cognitive, communicative, or mobility difficulties, may impact indirectly on the patient's ability to maintain effective toileting skills despite normal bladder function [5, 7, 15]. The resulting "functional" incontinence has been significantly associated with aphasia and/or cognitive impairment [15]. In another study, the following stroke-related factors were reported on multivariate analysis to be significantly associated with initial urinary incontinence: visual field defects, dysphagia, motor weakness, and age over 75 years.

Stress Incontinence

This type of incontinence does not occur as a direct consequence of stroke; however, stroke-related factors might aggravate a pre-existing condition. Stress incontinence occurs upon exertion (standing, coughing, and sneezing) and it is primarily the consequence of weakness of the pelvic floor muscles [4]. Reduced pelvic

muscle tone and motor weakness resulting from an acute stroke can lead to greater exertional efforts in toileting, exacerbating pre-existing stress incontinence. Acute stroke can also be complicated by aspiration pneumonia, and the resulting cough may also aggravate this type of incontinence [40].

Transient Causes of Urinary Incontinence

These transient causes are potentially reversible and, if present, it is imperative that they are adequately addressed. The pneumonic "DIAPPERS" illustrates these causes [41]:

- **D**elirium
- **I**nfection—urinary tract or chest infections
- **A**trophic urethritis/vaginitis—thin, sore skin may be contributing to the incontinence
- **P**harmaceuticals—antimuscarinics, diuretics, sedatives
- **P**sychiatric
- **E**xcess urine output—large fluid intake, caffeinated drinks
- **R**estricted mobility—arthritis pains, fear of falling
- **S**tool impaction

Assessment of Post-stroke Urinary Incontinence

Initial Assessment at Admission

All stroke units should have an agreed protocol for the assessment of urinary incontinence. Firstly, all patients admitted to hospital following an acute stroke should undergo a basic assessment of their bladder function to identify any problems. This initial assessment can be carried out by nursing staff and should include a urine dipstick to identify the presence of a urinary tract infection. If bladder problems are identified, then a full continence assessment should be undertaken to identify the type of urinary incontinence and any contributing factors.

Comprehensive Assessment of Continence

This should be undertaken as soon a bladder problem such as urinary incontinence is identified. It is important to appreciate that this is a personal assessment regarding a potentially sensitive topic, which requires both time and privacy. Although there are very few studies evaluating the different assessment processes used, Table 8.2 outlines a framework for the assessment of urinary incontinence. This assessment should guide the development of a suitable treatment strategy tailored to the individual patient's needs.

Table 8.2 Assessment strategy to identify and evaluate post-stroke urinary incontinence

Assessment	Rationale
Basic nursing assessment within 24 h of admission	To identify those patients who are incontinent of urine
History taking	
Onset and duration of symptoms? Urgency? Dribbling? Are symptoms related to a specific activity? e.g. coughing, sneezing Pre-existing incontinence? Associated bowel symptoms? Medications (diuretics, anticholinergics, oestrogens, sedatives, antidepressants) Fluid intake? Medical history—diabetes, recurrent urinary tract infections, and dementia Cognitive abilities? Functional capacity: dexterity, mobility, and aids Effect on quality of life?	To determine the type of urinary incontinence To plan appropriate management strategies To determine problems caused by UI and/or contributing to it
Clinical assessment	
Clinical examination: neurological and abdominal examination, rectal and pelvic examinations Urinary frequency and volume charting for 5–7 days Fluid intake charting Bowel chart	To assess for a palpable bladder suggestive of urinary retention, constipation and/or any prolapse, atrophy, or signs of infection To assess current pattern of voiding and bladder capacity To determine if symptoms are worse at particular times of the day—to plan schedule for prompted voiding To assess number and types of drinks To assess for constipation
Functional capacity of toilet skills [17]	To assess ability to get to a toilet or request for help
	To assess ability to manage clothing and maintain appropriate posture to allow micturition
Initial Investigations	
Urinalysis Post-void residual volumes using a bladder scanner	Evidence of urinary tract infection Evidence of incomplete emptying and urinary retention
Transient causes of UI	
Pneumonic: DIAPPERS [58] **D**elirium **I**nfection **A**trophic urethritis/vaginitis **P**harmaceuticals **P**sychiatric **E**xcess urine output **R**estricted mobility **S**tool impaction	To identify and address any reversible causes
Consideration of non-neurological causes of UI	Consider causes such as chronic chest infections leading to continual strain on the urethral sphincter due to coughing, or polyuria in diabetes, for example

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Detailed Bladder History

Table 8.2 illustrates the key components of the clinical history, which must be ascertained in all patients with urinary incontinence. It is essential to establish whether there were any pre-existing bladder problems prior to the stroke. Any previous gynaecological or urological procedures undertaken must also be noted, as they may impact on the current bladder complaints. Co-existing conditions such as diabetes, multiple sclerosis, spinal injuries, and dementia may also contribute to urinary incontinence. A full medication history must also be sought, as several drugs have been associated with bladder problems, including the following: antimuscarinic agents (urinary retention and constipation), diuretics (polyuria), sedatives (mobility problems and confusion), calcium channel antagonists (urinary retention and constipation), opiates (urinary retention, constipation, confusion, and reduced mobility), and cholinesterase inhibitors (increase bladder contractility). In addition to the questions outlined in Table 8.2, specific bladder-related questions should be included in the history to identify the presence of the following symptoms:

- *Urgency:* is there an insuppressible desire to void and difficulties reaching the toilet in time?
- *Frequency:* how often does the patient need to urinate in a period of 24 h?
- *Nocturia*: how often does the patient need to urinate overnight?
- *Hesitancy:* is there any difficulties initiating urine flow?
- *Poor stream:* is the flow of urine weak and slow or intermittent?
- *Straining:* does the patient need to strain to empty their bladder?
- *Symptoms of incomplete bladder emptying:* any dribbling of urine or a continuous leakage?
- *Dysuria:* any pain on passing urine?
- *Leakage of urine on exertion:* any incontinence upon coughing, sneezing, laughing?

These questions will help to determine the type of urinary incontinence, the severity, and pattern of the symptoms and will enable the healthcare professional to plan an appropriate treatment strategy.

Finally, social and environmental factors must also be assessed, although this could be done in the latter stages of the patient's admission, closer to the time of discharge. These factors include the impact of incontinence on the patient's social activities, work life, and sexual relationships.

Clinical Assessment

Clinical assessment of a patient with urinary incontinence should include the following:

1. *Abdominal examination:* to assess for the presence of a palpable bladder, indicating urinary retention, masses, and relevant surgical scars.
2. *Neurological examination:* to assess the severity of functional impairment resulting from the stroke and how this will impact on the patient's toileting abilities.

3. *Pelvic examination:* to assess for the presence of any vaginal prolapse, the general skin condition of the groin/perineum, and the presence of any atrophy.
4. *Rectal examination:* to assess for faecal loading suggesting constipation, which may contribute to incomplete bladder emptying and subsequent urinary retention.

Functional Assessment of Toileting Skills

A patient's ability to actually use a toilet may be affected by stroke, and therefore an evaluation of this is imperative as part of the continence assessment. Both physical and cognitive difficulties may contribute, and these should be formally assessed using validated standardised tests such as the Mini Mental State Examination [42]. Key components of this assessment should include the following information:

- Ability to physically mobilise to and locate the toilet or use hand-held urinals
- Ability or motivation to request for assistance to use the toilet if this is required
- Ability to independently remove clothing once toilet is reached
- Ability to maintain an appropriate posture to allow micturition to occur

Frequency and Volume Charting (Bladder Diaries)

This assessment method is very important for all patients suffering from urinary incontinence. It involves recording the frequency and volume of all fluid intake and of all urine output over a minimum of 3 days. The optimum duration that a bladder diary should be kept is unclear from clinical studies; however, this assessment method is useful in determining the best schedule for bladder training strategies [4]. The chart should inform the healthcare professional regarding the following:

- Number and types of drinks
- The timing of fluid intake
- Voiding patterns: frequency, volume, timing, nocturia
- Bladder capacity

This information also provides a useful baseline against which to measure improvements after interventions have been initiated. Patients should be encouraged to take responsibility for completing their own chart; however, this may not be possible due to manual or cognitive difficulties.

Investigations

Urinalysis

Urine dipstick testing is essential in all patients with urinary incontinence, especially to detect the presence of a urinary tract infection. The current NICE recommendations on interpreting urinalysis findings suggest that treatment should be

definitely initiated if the patient is symptomatic and both leucocytes and nitrites are positive. If either leucocytes or nitrites are positive then treatment with an appropriate antibiotic should be considered if the patient is symptomatic. A midstream urine specimen should always be sent [4]. Other findings such as glycosuria may indicate the presence of other contributing conditions such as diabetes.

Bladder Scan

This is a non-invasive accurate method of estimating post-void residual urine volumes. Post-void residual urine is associated with various complications, such as an increased risk of urinary tract infections and with urinary incontinence. A cut-off value of >100 ml of post-void urine has been suggested as a trigger to prompt further investigations and consider interventions, especially in symptomatic individuals [43, 44].

Treatment Strategies to Promote Continence

Interventions to promote continence in stroke patients can be labour intensive, requiring a proactive structured approach by the multidisciplinary team. Even before a full systematic continence assessment is undertaken, healthcare professionals should ensure the following measures are available to acute stroke patients:

- Easy access to a nurse call bell or picture cards
- Access to hand-held urinals for individuals who are unable to mobilise to the toilet
- Be offered absorbent pads if unable to hold a urinal, which may help with confidence and provide comfort; however, the use of pads should be promptly reviewed on full continence assessment.

Realistic aims must be discussed with the patient, and although treatment plans should be directed to achieve continence, this may not be possible in all cases. The term "dependent continence" has been used to describe the process of achieving dryness with containment devices such as absorbent pads or appliances, medications, or with toileting assistance using commodes, bedpans, or hand-held urinals [45].

Evidence-Based Interventions

There is a paucity of good-quality clinical trials evaluating the effectiveness of interventions in post-stroke urinary incontinence. A recent meta-analysis described 12 randomised controlled trials with a total of 724 patients, investigating treatment strategies of urinary incontinence following stroke [46]. The main findings from these trials have been summarised in Table 8.3; however, conclusions are limited by small sample sizes with wide confidence intervals and failures to account for

Table 8.3 Randomised controlled trials of interventions to treat post-stroke urinary incontinence

Study	Subjects and study design	Results	Conclusions
Behavioural interventions			
Lewis et al. (1990) [47] $n=23$	Comparison of sensory-motor biofeedback plus timed voiding in 11 patients versus timed voiding alone in 12 patients. All subjects suffered from urge urinary incontinence	Fewer incontinence episodes in the intervention group [WMD 2.20, 95 % CI 0.12–4.28]	Larger trials are needed to evaluate the effectiveness of this intervention
Gelber et al. (1997) [48] $n=18$	Comparison of timed voiding in 8 patients versus voiding on request [interpreted as usual care] in 10 patients	Data obtained were too few for any useful analysis	No conclusions could be drawn as insufficient data was obtained
Tibaek et al. (2007) [49] $n=26$	Comparison of the impact of an intensive pelvic floor-training programme in 26 women with mixed stress/urge UI versus usual care [general rehabilitation]	No significant difference found on either the mean number of incontinence episodes [WMD −1.00, 95 % CI −2.74–0.74] or on impact on quality of life as measured by the mean score on the SF36 Health Survey Questionnaire	Insufficient evidence to advocate the use of pelvic floor training in mixed stress/urge UI post-stroke
Specialised professional input			
Wikander et al. (1998) [50] $n=34$	Hospital-based prospective comparison of patients randomly allocated to a ward using conventional methods of rehabilitation [$n=13$] or to a ward practicing rehabilitation based on assessment using the Functional Independence Measure [FIM] [$n=21$]. All patients were assessed on admission and on discharge	Twenty patients in the intervention group regained continence before discharge compared to 3 in the control group [$p<0.01$] Greater improvement in functional well-being in the intervention group compared to the control group [$p<0.01$]	Rehabilitation based on use of FIM may reduce rates of urinary incontinence and enhance functional well-being better than conventional methods of rehabilitation [although small sample size and lack of blinding of outcome measures]

(continued)

Table 8.3 (continued)

Study	Subjects and study design	Results	Conclusions
Brittain et al. (2000) [51] $n=232$	Community-based prospective comparison of care by a Continence Nurse Practitioner of 152 patients including assessment and treatment versus usual care provided by the General Practitioner of 80 patients	Rate of incontinence lower in the intervention group [40/73 vs. 31/48 RR 0.85 CI 0.63–1.14] Reduced number of urinary symptoms in the intervention group at 3 months [$p<0.01$] and at 6 months [$p=0.06$]	Specialised input and individualised care plans may reduce the number of urinary symptoms [although confidence intervals were wide, not fully reported and wide definition of UI used]
Complementary therapy			
Chu et al. (1997) [52] $n=60$	Comparison of scalp acupuncture in 30 patients versus usual care [which included receiving acupuncture combined with nursing care] in 30 patients	A reduction in urinary frequency and incontinence in 90.3 % in the intervention group [p 0.05–0.001]. No results reported for the control group	Insufficient results reported to draw conclusions
Zhou et al. (1999) [53] $n=80$	Prospective comparison of the use of eye and scalp acupuncture in 40 patients versus no acupuncture in 40 patients	Lower rates of UI reported in the intervention group [18/40 vs. 32/40]	Acupuncture may be an effective intervention in post-stroke UI; however, quality of study is questionable as minimal methodological detail is reported
Zhang et al. (2002) [54] $n=60$	Comparison of acupuncture in 36 patients versus usual care using mannite and other unspecified medicines in 28 patients	Lower rates of UI reported in the intervention group [6/36 vs. 26/28]	Acupuncture may be an effective intervention in post-stroke UI; however, the quality of study is questionable as minimal methodological detail is reported
Liu et al. (2006) [55] $n=75$	Comparison of ginger-salt partitioned moxibustion plus routine acupuncture in 39 patients versus routine acupuncture in 36 patients	Significant difference reported in the intervention group on mean voiding frequency [WMD −5.57, 95 % CI −7.00 to −4.14] and on mean nighttime voiding frequency [WMD −3.18, 95 % CI −3.95 to −2.41]	This may be an effective intervention however the quality of study is questionable as minimal methodological detail is reported

Pharmacotherapy			
Judge et al. (1969) [56] $n=13$	Cross over trial comparing the use of oestrogen [quinestradol 0.25 mg 4 times a day] against placebo in 13 females admitted to long-stay geriatric hospitals	Results reported separately for patients with mild or severe incontinence. Combined results were not statistically significant [paired samples means −3.88 95 % CI −8.42–0.66]	Insufficient evidence to support use of this intervention in post-stroke UI
Gelber et al. (1997) [48] $n=19$	Comparison of timed voiding in 10 patients versus the use of Oxybutinin in 9 patients. All subjects were reported to have urinary incontinence and bladder hyper-reflexia	Data obtained were too few for any useful analysis	No conclusions could be drawn as insufficient data was obtained
Zhu et al. (2003) [57] $n=80$	Hospital-based study comparing the use of meclofenoxate plus salvia miltirrhiza in 40 patients versus salvia miltirrhiza alone in 40 patients	Fewer patients were reported to have urinary symptoms in the meclofenoxate group [9/40 vs. 27/40, RR 0.33, 95 % CI 0.18–0.62]	There may be a role for this intervention in post-stroke UI; however, larger studies are required

patients' pre-existing urinary incontinence in nine of the trials [47–57]. The authors of the meta-analysis concluded that there was insufficient data from these trials to guide practice; however, there was some evidence that adopting a structured approach to assessment and management and specialist continence nursing input may be beneficial. This structured approach using individually tailored interventions has been supported by the findings of several other studies [58–61]. One such trial demonstrated a 67 % success rate in regaining continence within 30 days of stroke [58].

As there is limited stroke-specific research to guide continence care after stroke, universal principles in managing different types of urinary incontinence may be adopted [3, 4].

Scheduled Voiding Regimens

Scheduled toileting regimens are a form of behavioural therapy used in management of urge, functional, and mixed incontinence [61]. They include the following voiding programmes:

- Bladder training
- Habit training
- Prompted voiding
- Timed voiding

The effectiveness of these voiding programmes has been evaluated in multiple studies, and overall they have demonstrated reduced episodes of incontinence and improved bladder-function control [61–63]. Table 8.4 outlines the approach for each of these schedules and highlights suitable patients for which they may be appropriate.

Table 8.4 Scheduled voiding regimens

Voiding regimen	Technique	Suitable patients
Bladder training [63]	Gradually increase intervals between voiding until an acceptable interval is reached	Urge incontinence/detrusor overactivity
		Patient must be motivated and cognitively able to participate in this regimen
Habit training [68]	Voiding intervals are based on the patient's own habits and planned at times prior to the patient's incontinence episodes	Functional incontinence
		Useful in patients with cognitive impairment
Timed voiding [67]	Fixed voiding schedule, every 2–4 h, which remains unchanged and ensures regular bladder emptying	Functional incontinence
		Impaired awareness urinary incontinence
Prompted voiding [65]	The patient is prompted to void at regular intervals; however, they are only assisted to the toilet if there is a positive response	Functional incontinence

Management of Urge Incontinence and Detrusor Overactivity

Several strategies have been suggested to improve symptoms of urgency and frequency associated with detrusor overactivity. The following interventions may be employed to manage this type of incontinence:

Bladder Training

There is evidence indicating that this voiding schedule is beneficial in patients with urge incontinence [4, 62]. It is dependent on high levels of motivation in both the patient and the healthcare professional, and the patient must be cognitively intact. Information is obtained regarding the patient's voiding behaviour using a baseline frequency and volume chart. This is used to design a voiding schedule that involves gradually increasing the interval between voiding, initially by 15–30 min only. This interval is gradually increased further until a satisfactory pattern is reached, with the patient remaining dry and holding on for 2- to 3-h intervals. Ongoing frequency and volume charting can be used to formally monitor progress using this technique. Current guidelines advocate that this technique should be attempted for at least 6 weeks prior to considering other measures [4].

Medications

If bladder-training techniques alone do not produce a satisfactory response, then a combined approach using an antimuscarinic agent should be considered. These drugs inhibit the neurotransmitter acetylcholine, which interferes with the parasympathetic innervation of the detrusor muscle, reducing the frequency of involuntary contractions. Current NICE guidelines recommend the following agents as first line:

1. Oxybutynin (immediate release)
2. Tolterodine (immediate release)
3. Darifenacin (once-daily preparation)

The lowest recommended dose should be administered, and the patient should be aware of potential side effects such as dry mouth, constipation, blurred vision, and urinary retention [4]. Therefore, it is important that a post-void bladder scan is undertaken prior to commencing this medication to ensure that problematic incomplete bladder emptying (>100 ml residual) is not already present. All patients should be reviewed after 4 weeks to evaluate if there has been any benefit in using these agents [4].

Lifestyle Changes

Excess caffeine intake and citrus fruit may exacerbate urge incontinence, and therefore some patients may benefit from limiting or excluding these substances from their diet. Clinical evidence supporting this theory is, however, limited [64].

Management of Functional Incontinence

The management of this type of incontinence must be directed by the outcome of the functional assessment of toileting skills (see previous section). The stroke may have caused physical, communication, and/or cognitive impairment, which may be contributing to incontinence. Strategies should be adopted to address these impairments and their impact on toileting skills. Key components of managing functional incontinence include:

- *Mobility issues*. Strategies used to facilitate access to the toilet include use of a wheelchair or a walking aid. Hand-held urinals are available for both men and women, and absorbent gels can be used within the urinal to prevent spillage if dexterity is an issue. Clothing that is easy to remove such as Velcro fly fastening or loose trousers should be incorporated into the treatment plan.
- *Cognitive/communications/visual issues*. Picture cards, large sign posting, and colour codes are examples of strategies that could be adopted to help patients recognise the location of the toilet.
- *Voiding schedules*. These include the following:
  - *Prompted voiding*. This involves prompting the patient to void at regular intervals; however, they are only assisted to the toilet if there is a positive response to the prompt, i.e. a request for help [65].
  - *Timed voiding*. This is a fixed voiding schedule, every 2–4 h, which remains unchanged and ensures regular bladder emptying. This is particularly useful in patients with impaired-awareness urinary incontinence [66].
  - *Habit training*. A voiding schedule is created based on the patient's own habits, using information derived from the frequency and volume chart. Voiding intervals are planned at times prior to the patient's incontinence episodes. This voiding schedule is particularly useful in patients with cognitive impairment [67].

Management of Detrusor Hyporeflexia with Overflow Incontinence

As previously described, the main consequence of detrusor hyporeflexia is incomplete bladder emptying, leading to urinary retention. This may occur acutely or chronically, and both situations need to be urgently addressed. In the case of acute retention, an in/out catheterisation technique to drain the bladder could be used. Regular bladder scanning should then be undertaken to monitor for recurrence. If retention of more than 400 ml of urine occurs, catheterisation should be repeated [40].

Intermittent Catheterisation

This can be useful in patients suffering from chronic retention of urine. It requires the patient or their carer to intermittently insert a urinary catheter into the bladder to ensure urine volumes are maintained below 500 ml [21]. The required frequency to achieve this will vary from individual and can be determined by using a frequency and volume chart. This technique should only be used if post-void residual volumes as determined by bladder scanning are greater than 100 ml. If residual volumes fall consistently below 100 ml, then this technique should be abandoned. Intermittent catheterisation may be inappropriate in the following cases: urethral trauma, pain issues, distorted anatomy, or if the technique is unacceptable to the patient or their carer.

Long-Term Catheterisation

As previously discussed, the results of the National Sentinel Stroke Audit (2010) revealed that many patients are catheterised unnecessarily without a clear reason indicated. Urinary incontinence alone is NOT an indication for an indwelling catheter. Urinary catheters are associated with a number of complications [68]:

1. Catheter-associated urinary tract infection
2. Urethral damage—urethritis, erosions, creation of a false passage, urethral fistulas
3. Encrustations—mineral deposition within the catheter biofilm, which can lead to catheter blockage
4. Bladder stones

In some cases, however, a long-term catheter (more than 14 days) is required. This is usually made of silicone, hydrogel-coated latex, or silicone elastomer-coated latex [40]. Patients must be educated on how to manage the catheter at home and when to seek help. In some cases it may be appropriate to use a catheter valve as an alternative to free drainage. This allows some stimulation of the bladder by allowing it to fill in the usual manner. Although the evidence is limited, it has been suggested that catheter valves can improve bladder tone and capacity and are useful in patients who have the ability to manipulate the valve and empty the catheter regularly [69].

Management of Stress Incontinence

Treatment strategies for stress incontinence are focused around improving pelvic floor muscle strength and tone [4, 70]. Not all patients will be able to partake in a pelvic floor exercise programme and a continence specialist must individually assess this.

Containment Devices

Unfortunately, despite the above measures, some patients remain incontinent, and in this group of patients the aim of therapy should be to achieve dryness-dependent continence. Containment devices can significantly help to improve a patient's quality of life. They include the following:

- Absorbent pads: the correct size and the most suitable variety used (e.g. all in one, pull-ups, inserts) [40].
- Penile sheaths are also an option for men.

Implications for Further Research

There is insufficient evidence to guide clinical practice regarding which treatment strategies work best for the various types of post-stroke urinary incontinence. Robust clinical trials are needed in this area to allow evidence-based protocols to be developed specifically for the stroke patient population. A large multi-centre randomised trial, ICONS: Identifying Continence Options after Stroke, is currently in progress evaluating the effectiveness of a systematic voiding programme for the management of urinary incontinence after stroke [71]. The voiding programme includes interventions such as bladder training, habit training, timed voiding, prompted voiding, and pelvic floor muscle exercises. The results of this study are awaited and will hopefully enable evidence-based management protocols to be developed for post-stroke urinary incontinence.

Bowel Complications

Bowel problems such as constipation and faecal incontinence are usually the result of functional impairment following stroke rather than direct neurological damage. Bowel problems can be extremely distressing and may result in social isolation.

Epidemiology

It is widely recognised that bowel dysfunction is common problem following stroke [18, 72–74]. One study demonstrated that constipation affected 60 % of patients admitted to a stroke rehabilitation ward [18]. Faecal incontinence is also a significant problem affecting 30–40 % of individuals immediately after stroke, 11 % at 3 months, 10–19 % at 6 months, 11 % at 1 year, and around 15 % at 3 years [18, 72, 73]. Faecal incontinence has been associated with worse outcomes following stroke.

In one study of over 800 stroke patients, faecal incontinence at 3 months was associated with an increased risk of institutionalisation and greater mortality rates within 1 year [74].

Causes of Bowel Problems Following Stroke

Post-stroke bowel complications are usually due to functional impairments affecting toileting abilities rather than direct effects of the stroke lesion [73]. In one study investigating the natural history of post-stroke faecal incontinence, it was found that requiring assistance to use the toilet was the strongest predictor for the development of faecal incontinence at 3 months following stroke [73]. Other stroke-related functional risk factors include the following: mobility issues, impaired manual dexterity, vision problems, communication difficulties due to speech disturbances, cognitive problems, and depression [73–75]. Overflow faecal incontinence may also occur in stroke patients resulting from constipation and faecal impaction. Interestingly, there is some evidence to suggest that post-stroke faecal incontinence may be a transient condition. In one large clinical trial, 35 % of patients incontinent at 3 months regained continence at the 1-year time point [73].

Constipation may occur due to delayed colonic transit times as a result of reduced mobility [18]. Other functional impairments and psychological factors may also contribute. A community-based study showed that use of anticholinergic agents was independently associated with the development of post-stroke faecal incontinence [73].

Assessment of Post-stroke Bowel Problems

The assessment of bowel problems can be potentially embarrassing for the patient, and therefore the subject must be addressed in a sensitive manner. An initial assessment of bowel function is essential for all stroke patients in identifying a potential problem. If a bowel complication is found, a comprehensive assessment is then required to address the following issues:

1. Identify the type of problem: constipation, faecal incontinence, or both
2. Identify the underlying cause
3. Identify any contributory factors

Detailed History of Bowel Habits

It is important to identify the presence of any pre-existing bowel problems such as constipation. The healthcare professional should enquire about the patient's "normal" bowel habits and this should be used as a baseline of normal bowel

function for that individual. A medication history is also important, especially the use of laxatives, anticholinergics, and nonsteroidal anti-inflammatories, which have been associated with an increased risk of faecal incontinence.

Clinical Assessment

The following examinations may be helpful in assessing stroke patients with bowel complaints:

1. Abdominal examination—palpation may reveal signs of constipation
2. Digital rectal examination—this will identify rectal loading, faecal impaction, and stool consistency, although an empty rectum does not exclude constipation
3. Perineal and groin examination—observe for rectal prolapse, irritable perineal skin, anal fissures, and haemorrhoids

A functional assessment of the patient's toileting skills is also important in a similar manner to that previously described for urinary incontinence.

Bowel Habit Diary

A bowel diary should be kept for all stroke patients recording information on frequency, colour, and consistency of the stool. The Bristol stool scale is a useful tool for assessing the type and consistency of the stool [76]. A food and fluid chart are also useful assessment measures to identify contributory factors such as a lack of fibre intake.

Treatment Strategies

The most likely cause of bowel complications in stroke patients is due to functional impairments as a consequence of the stroke. It is thus necessary for an individually tailored treatment care plan to be formulated, taking into consideration the patient's specific disabilities. Education of patients and their carers is paramount in managing this disabling condition.

Faecal Incontinence

There is limited clinical evidence for the use of specific strategies in the management of post-stroke faecal incontinence. Universally accepted treatment measures can thus be adopted to manage functional faecal incontinence following stroke [77, 78]:

1. Environmental factors: Ensure privacy by assisting patient to the toilet, either walking if possible or wheeling them on a commode.

2. Prompted toileting and, if this is unsuccessful, then scheduled toileting should be tried based on the patient's bowel habits diary.
3. If behavioural techniques fail, then a combination of loperamide and enemas may achieve bowel control.

Additionally, current guidelines recommend that individuals suffering from faecal incontinence should be offered the following containment devices: disposable body-worn pads, disposable bed pads, anal plugs (for patients who can tolerate them), skincare advice (cleansing and barrier products), advice on odour control and laundry, and disposable gloves [78].

Constipation

The treatment strategy employed to manage this complication in stroke patients will vary according to the severity of constipation. The following measures should be considered:

Positioning and timing. The morning gastro-colic reflex facilitates bowel movements, and thus patients should be encouraged to utilise the toilet during the morning, especially after a hot drink [40]. Privacy should be maintained and correct toilet positioning should be adopted. Some patients may require support from a handrail or a foot rest to maintain a sitting balance. In patients who are unable to maintain a sitting position, if possible they should be hoisted into a sitting position over a bed pan rather than left lying flat.

Dietary factors and mobility. An appropriate diet with adequate fibre and fluid intake should be maintained. Patients should be encouraged to mobilise as much as possible.

Laxatives. There are four main types of laxatives, which have different mechanisms of actions:

(a) Bulk forming (e.g. Fybogel, Normacol): These laxatives are taken with fluids and work by adsorbing liquid and swelling. The resultant bulk causes increased peristalsis, thereby reducing colon transit times. They may not be the best choice for stroke patients who may be suffering from swallowing difficulties.
(b) Stimulant (e.g. Senna, docusate, glycerol): These laxatives work within 6–12 h by stimulating the intestinal lining of the colon, which results in increased peristalsis and fluids secretion lubricating the stool. They should only be used short term, as prolonged use can lead to reduced muscle tone in the colon, potassium depletion, and dehydration.
(c) Osmotic (e.g. Movicol, Lactulose): These laxatives work by drawing water into the bowel and allow easier passage of stool. Movicol is commonly used in stroke patients as it is generally well tolerated [79].
(d) Softeners (e.g. docusate, arachis oil): These are emollient laxatives, which work by coating the stool with a layer of oil, helping it to retain water and therefore keeping it soft.

General measures that will minimise constipation include ensuring adequate hydration of patients and minimising the use of pharmaceutical agents that can precipitate constipation.

Conclusion

Bladder and bowel complications following a stroke are common, complex, and multifactorial in nature. Not only is there a strong association between these complications and worse stroke outcomes, but also they can have a devastating impact on the patient's quality of life. Although the stroke lesion itself may be contributing to the problem, it is resulting functional impairments which compound the situation further. Healthcare professionals should be aware of these complications and must be trained on assessment methods and treatment strategies. Any underlying reversible causes must be promptly addressed. It is imperative that the multidisciplinary team, in collaboration, formulates an individually tailored care plan with the patient to promote continence. This personalised care plan should outline realistic goals and be periodically reevaluated and altered according to the patient's needs. Although continence may not always be restored, several interventions can be instituted to improve the patient's quality of life, which in turn may improve their engagement with stroke rehabilitation.

Patient Questions

Q. Why am I incontinent of urine following my stroke?

A. It is fairly common following a stroke to be incontinent due to various reasons. Stroke itself can cause incontinence, and mobility and communication issues can result in what is known as functional incontinence. Other co-existing conditions such as urinary tract infection and constipation can also cause your incontinence. Your medical team should assess your condition and prescribe an appropriate plan to manage your condition.

Q. Will my incontinence get better?

A. It depends on the underlying cause for your incontinence as well as your general recovery from your stroke. If the incontinence is due to a specific issue such as infection or poor mobility, then treating the infection or improving your mobility would help you recover from incontinence. If it is due to the stroke itself, the extent of your overall recovery from stroke will determine your recovery from incontinence.

References

1. Intercollegiate Stroke Working Party. National clinical guidelines for stroke. 4th ed. London: Royal College of Physicians; 2012.
2. Intercollegiate Stroke Working party. National sentinel stroke audit 2010 round 7. London: Royal College of Physicians; 2011.
3. Abrams P, Andersson KE, Birder L, Brubaker L, Cardozo L, Chapple C, et al. Fourth international consultation on incontinence recommendations of the international scientific committee: evaluation and treatment of urinary incontinence, pelvic organ prolapse, and fecal incontinence. Neurourol Urodyn. 2010;29:213–40.
4. National Collaborating Centre for Women's and Children's Health (UK), editor. Urinary incontinence in women: the management of urinary incontinence in women. London: Royal College of Obstetricians and Gynaecologists (UK); 2013. National Institute for Health and Clinical Excellence: Guidance.
5. Brittain KR, Peet SM, Castleden CM. Stroke and incontinence. Stroke. 1998;29(2):524–8.
6. Kolominsky-Rabas PL, Hilz MJ, Neundoerfer B, Heuschmann PU. Impact of urinary incontinence after stroke: results from a prospective population-based stroke register. Neurourol Urodyn. 2003;22(4):322–7.
7. Patel M, Coshall C, Rudd AG, Wolfe CD. Natural history and effects on 2-year outcomes of urinary incontinence after stroke. Stroke. 2001;32(1):122–7.
8. Wilson D, Lowe D, Hoffman A, Rudd A, Wagg A. Urinary incontinence in stroke: results from the UK National Sentinel Audits of Stroke 1998–2004. Age Ageing. 2008;37:542–6.
9. Perry S, Shaw C, Assassa P, Dallosso H, Williams K, Brittain KR, et al. An epidemiological study to establish the prevalence of urinary symptoms and felt need in the community: the Leicestershire MRC Incontinence Study. Leicestershire MRC Incontinence Study Team. J Public Health Med. 2000;22:427–34.
10. Barratt JA. Bladder and bowel problems after stroke. Rev Clin Gerontol. 2002;12:253–67.
11. Stewart J, Dundas R, Howard RS, Rudd AG, Wolfe CDA. Ethnic differences in incidence of stroke: prospective study with stroke register. BMJ. 1999;318:967–71.
12. Rotar M, Blagus R, Jeromel M, Skrbec M, Tršinar B, Vodušek DB. Stroke patients who regain urinary continence in the first week after acute first-ever stroke have better prognosis than patients with persistent lower urinary tract dysfunction. Neurourol Urodyn. 2011;30(7):1315–8.
13. Williams MP, Srikanth V, Bird M, Thrift AG. Urinary symptoms and natural history of urinary continence after first-ever stroke—a longitudinal population-based study. Age Ageing. 2012;41(3):371–6.
14. Patel M, Coshall C, Lawrence E, Rudd AG, Wolfe CD. Recovery from poststroke urinary incontinence: associated factors and impact on outcome. J Am Geriatr Soc. 2001;49:1229–33.
15. Gelber DA, Good DC, Laven LJ, Verhulst SJ. Causes of urinary incontinence after acute hemispheric stroke. Stroke. 1993;24(3):378–82.
16. Badlani GH, Vohra S, Motola JA. Detrusor behavior in patients with dominant hemispheric strokes. Neurourol Urodyn. 1991;10(1):119–23.
17. Feder M, Heller L, Tadmor R, Snir D, Solzi P, Ring H. Urinary continence after stroke: association with cystometric profile and computerised tomography findings. Eur Neurol. 1987;27(2):101–5.
18. Nakayama H, Jørgensen HS, Pedersen PM, Raaschou HO, Olsen TS. Prevalence and risk factors of incontinence after stroke. The Copenhagen Stroke Study. Stroke. 1997;28(1):58–62.
19. Pettersen R, Wyller TB. Prognostic significance of micturition disturbances after acute stroke. J Am Geriatr Soc. 2006;54(12):1878–84.
20. Taub NA, Wolfe CD, Richardson E, Burney PG. Predicting the disability of first-time stroke sufferers at 1 year. 12-month follow-up of a population-based cohort in southeast England. Stroke. 1994;25(2):352–7.

21. Barer DH. Continence after stroke: useful predictor or goal of therapy? Age Ageing. 1989;18:183–91.
22. Ween JE, Alexander MP, D'Esposito M, Roberts M. Incontinence after stroke in a rehabilitation setting. Outcome associations and predictive factors. Neurology. 1996;47(3):659–63.
23. Duncun PW, Zorowitz R, Bates B, Choi JY, Glasberg JJ, Graham GD, et al. Management of adult stroke rehabilitation care. Stroke. 2005;36:e100–43.
24. Brittain KR, Stroke RD. Urinary symptoms and depression in stroke survivors. Age Ageing. 1998;27 Suppl 1:72-c.
25. Wade DT, Hewer RL. Outlook after an acute stroke: urinary incontinence and loss of consciousness compared in 532 patients. Q J Med. 1985;56:601–8.
26. Brown JS, Vittinghoff E, Wyman JF. Urinary incontinence: does it increase risk for falls and fractures? Study of Osteoporotic Fractures Research Group. J Am Geriatr Soc. 2000;48(7):721.
27. Jawad SH, Ward AB, Jones P. Study of the relationship between premorbid urinary incontinence and stroke functional outcome. Clin Rehabil. 1999;13(5):447–52.
28. Fowler CJ, Griffiths D, de Groat WC. The neural control of micturition. Nat Rev Neurosci. 2008;9(6):453–66.
29. Griffiths D, Tadic SD, Schaefer W. Cerebral control of the bladder in normal and urge-incontinent women. Neuroimage. 2007;37(1):1.
30. Birder L, Drake M, de Groat W, Fowler C, Mayer E, Morrison J, et al. Neural control. In: Abrams P, Cardozo L, Khoury S, Wein A, editors. Incontinence. The 4th international consultation on incontinence. Paris: Health Publication Ltd.; 2009. p. 167–255.
31. Yoshimura K, Terada N, Matsui Y, Terai A, Kinukawa N, Arai Y. Prevalence of and risk factors for nocturia: analysis of a health screening program. Int J Urol. 2004;11(5):282–7.
32. Burney TL, Senapti M, Desai S, Choudhary ST, Badlani GH. Acute cerebrovascular accident and lower urinary tract dysfunction: a prospective correlation of the site of brain injury with urodynamic findings. J Urol. 1996;156(5):1748–50.
33. Wyndaele JJ, Castro D, Madersbacher H, et al. Neurologic urinary and faecal incontinence. In: Abrams P, Cardozo L, Khoury S, Wein A, editors. Incontinence. Paris: Health Publications Ltd; 2005. p. 1059–162.
34. Sakakibara R, Hattori T, Yasuda K. Micturitional disturbance after acute hemispheric stroke: analysis of the lesion site by CT and MRI. J Neurol Sci. 1996;137(1):47–56.
35. Chen YC, Liao YM, Kuo HC. Lower urinary tract dysfunction in stroke patients. J Taiwan Urol Assoc. 2007;18:147–50.
36. Pettersen R, Saxby BK, Wyller TB. Post stroke urinary incontinence: one-year outcome and relationships with measures of attentiveness. J Am Geriatr Soc. 2007;55(10):1571–7.
37. Kim TG, Yoo KH, Jeon SH, Lee HL, Chang SG. Effect of dominant hemispheric stroke on detrusor function in patients with lower urinary tract symptoms. Int J Urol. 2010;17(7):656–60.
38. Pettersen R, Haig Y, Nakstad PH, Wyller TB. Subtypes of urinary incontinence after stroke: relation to size and location of cerebrovascular damage. Age Ageing. 2008;37(3):324–7.
39. Pettersen R, Stien R, Wyller TB. Post-stroke urinary incontinence with impaired awareness of the need to void: clinical and urodynamic features. Br J Urol Int. 2007;99(5):1073–7.
40. Williams J, Perry L, Watkins C. Acute stroke nursing. Oxford: Blackwell and Wiley; 2010.
41. Resnick NM, Yalla SV. Management of urinary incontinence in the elderly. N Engl J Med. 1985;313(13):800–5.
42. Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189–98.
43. Tam CK, Wong KK, Yip WM. Prevalence of incomplete bladder emptying among elderly in convalescence wards: a pilot study. Asian J Gerontol Geriatr. 2006;1:66–71.
44. May M, Brookman-Amissah S, Hoschke B, Gilfrich C, Braun KP, Kendel F. Post-void residual urine as a predictor of urinary tract infection–is there a cutoff value in asymptomatic men? J Urol. 2009;181(6):2540–4.
45. Fonda D, Abrams P. Cure sometimes, help always—a “continence paradigm” for all ages and conditions. Neurourol Urodyn. 2006;2(3):290–2.

46. Thomas LH, Cross S, Barrett J, French B, Leathley M, Sutton CJ, et al. Treatment of urinary incontinence after stroke in adults. Cochrane Database Syst Rev. 2008;(1):CD004462. doi:10.1002/14651858.CD004462.pub3.
47. Lewis AM, Travis ML, Gordon AL, et al. Sensory-motor biofeedback for the treatment of urinary urge incontinence following stroke [Abstract]. Clin Res. 1990;38(1):A10.
48. Gelber DA, Swords L. Treatment of post-stroke urinary incontinence [Abstract]. J Neurol Rehabil. 1997;11(2):131.
49. Tibaek S, Gard G, Jensen R. Is there a long-lasting effect of pelvic floor muscle training in women with urinary incontinence after ischemic stroke? Int Urogynecol J. 2007;18:281–7.
50. Wikander B, Ekelund P, Milsom I. An evaluation of multidisciplinary intervention governed by functional independence measure (FIMSM) in incontinent stroke patients. Scand J Rehabil Med. 1998;30(1):15.
51. Brittain KR, Potter JF. The treatment of urinary incontinence in stroke survivors (MS9). Report for NHS R&D Programme on Cardiovascular Disease and Stroke Project, Division of Medicine for the Elderly, Dept of Medicine, University of Leicester, in collaboration with the MRC Incontinence Study. 2000.
52. Chu M, Feng J. Discussion on treating frequent urine due to multiple cerebral embolism with scalp acupunction [Translation from Chinese]. Inf Tradit Chin Med. 1997;5:42.
53. Zhou G, Wu D. 40 examples of using eye acupuncture and electriferous scalp acupuncture to treat urinary incontinence after cerebrovascular accident. J Clin Acupunct. 1999;15(9):33–4.
54. Zhang Z, Ma F, Ma Y. Observation on the effects of acupuncture in the treatment of urinary retention due to cerebral infarction in 36 patients. Heilongjiang Med Pharm. 2002;25(3):71.
55. Liu H, Wang L. Randomized controlled study on ginger-salt partitioned moxibustion at Shenque [CV 8] on urination disorders post stroke. Chin Acupunct Moxibustion. 2006;26(9):621–4.
56. Judge TG. The use of quinestradol in elderly incontinence women, a preliminary report. Gerontol Clin. 1969;11:159–64.
57. Zhu Y, Zhu X, Zhu D, et al. Meclofenoxate in treating urinary incontinence after acute cerebral infarction. Chin J New Drugs Clin Remedies. 2003;9:520–2.
58. Herr-Wilbert IS, Imhof L, Hund-Georgiadis M, Wilbert DM. Assessment-guided therapy of urinary incontinence after stroke. Rehabil Nurs. 2010;35(6):248–53.
59. Jordan LA, Mackey E, Coughlan K, Wyer M, Allnutt N, Middleton S. Continence management in acute stroke: a survey of current practices in Australia. J Adv Nurs. 2011;67(1):94–104.
60. Chan H. Bladder management in acute care of stroke patients: a quality improvement project. J Neurosci Nurs. 1997;29(3):187.
61. Dumoulin C, Korner-Bitensky N, Tannenbaum C. Urinary incontinence after stroke: does rehabilitation make a difference? A systematic review of the effectiveness of behavioral therapy. Top Stroke Rehabil. 2005;12(3):66.
62. Wallace SA, Roe B, Williams K, Palmer M. Bladder training for urinary incontinence in adults. Cochrane Database Syst Rev. 2004;(1):CD001308.
63. Fantl JA, Wyman JF, Harkins SW, Hadley EC. Bladder training in the management of lower urinary tract dysfunction in women. A review. J Am Geriatr Soc. 1990;38:329–32.
64. Bryant C, Dowell C, Fairbrother G. Caffeine reduction to improve urinary symptoms. Br J Nurs. 2002;11:560–5.
65. Eustice S, Roe B, Paterson J. Prompted voiding for the management of urinary incontinence in adults. Cochrane Database of System Rev. 2000;(2):CD002113. doi:10.1002/14651858.CD002113.
66. Ostaszkiewicz J, Johnson L, Roe B. Timed voiding for urinary incontinence in adults. Cochrane Database of System Rev. Chichester: John Wiley and Sons Ltd; 2004. Issue 1.
67. Colling J, Owen TR, McCreedy M, Newman D. The effects of a continence program on frail community-dwelling elderly persons. Urol Nurs. 2003;23(2):117–22, 127–31.
68. Warren JW. Catheter-associated urinary tract infections. Infect Dis Clin North Am. 1997;11(3):609–22.

69. Van den Eijkel E, Griffiths P. Catheter valves for indwelling urinary catheters: a systematic review. Br J Community Nurs. 2006;11(3):111–2, 114.
70. Bo K, Talseth T, Holme I. Single blind, randomized controlled trial of pelvic floor exercises, electrical stimulation, vaginal cones, and no treatment in management of genuine stress incontinence in women. BMJ. 1999;318:487.
71. Thomas LH, Watkins CL, French B. Study protocol: ICONS: identifying continence options after stroke: a randomized trial. Trials. 2011;12:131.
72. Brocklehurst JC, Andrews K, Richards B, Laycock PJ. Incidence and correlates of incontinence in stroke patients. J Am Geriatr Soc. 1985;33:540–2.
73. Harari D, Coshall C, Rudd AG, Wolfe CD. New-onset fecal incontinence after stroke: prevalence, natural history, risk factors, and impact. Stroke. 2003;34(1):144–50.
74. Harari D, Norton C, Lockwood L, Swift C. Treatment of constipation and fecal incontinence in stroke patients: randomized controlled trial. Stroke. 2004;35:2549–55.
75. Johanson JF, Irizarry F, Doughty A. Risk factors for fecal incontinence in a nursing home population. J Clin Gastroenterol. 1997;24:156–60.
76. Heaton KW, Lewis SJ. Stool form scale as a useful guide to intestinal transit time. Scand J Gastroenterol. 1997;32(9):920–4.
77. Fonda D, DuBeau CE, Harari D, Ouslander JG, Palmer M, Roe B. Incontinence in the frail elderly. In: Abrams P, Cardozo L, Khoury S, Wein A, editors. Third international consultation on incontinence, 26–29 June 2004 Monaco. Plymouth: Health Publication Ltd./Plymbridge Distribution Ltd.; 2005. p. 1165–239.
78. NICE. Faecal incontinence. NICE guideline CG49. London: National Institute for Health and Clinical Excellence; 2007.
79. Corazziari E, Badiali D, Bazzocchi G, Bassotti G, Roselli P. Long term efficacy, safety, and tolerability of low daily doses of isosmotic polyethylene glycol electrolyte balanced solution [PMF-100] in the treatment of functional chronic constipation. Gut. 2000;46:522–6.
80. Mehdi Z, Birns J, Bhalla A. Post-stroke urinary incontinence. Int J Clin Pract. 2013;67:1128–37.