Conclusions—Despite incontinence being such an important prognostic feature, there are many gaps in our knowledge of the relationship of stroke and incontinence, particularly fecal incontinence. There are almost no studies on the influence of achieving continence on outcome or how this might be brought about. This article reviews the literature on this important topic and highlights deficiencies in our knowledge and areas of future research. (Stroke. 1998;29:524-528.)

Key Words: urinary incontinence ▪ fecal incontinence ▪ stroke outcome ▪ neurology

There is a high prevalence of urinary incontinence in stroke survivors that is associated with the size of the infarct or cerebral hemorrhage and to the mortality, morbidity, and discharge destination of the survivor. Such urinary incontinence causes considerable distress to stroke survivors and caregivers alike, worsening morale and influencing the ability to achieve optimum recovery.

Despite the importance of the association of urinary incontinence with stroke, until recently there were relatively few reports on possible neurological sites affected in such stroke survivors, on bladder characteristics, or on the effect of nonneurological disabilities and cognitive impairment on the prevalence of incontinence. Moreover, the effect of treating urinary incontinence in stroke survivors has been almost entirely ignored apart from a few reports in Japanese journals.1-3 "The treatment of fecal incontinence in stroke survivors has hardly warranted a mention, despite the fact that its presence can predict outcomes and cause decreased morale in caregivers and sufferers.

The purpose of this article is to review current knowledge of the association between urinary and fecal incontinence and stroke. In view of the dearth of information on fecal incontinence in stroke survivors, the article will necessarily concentrate mostly on urinary incontinence. Other urinary tract symptoms are experienced by stroke survivors, but most authors do not comment on such symptoms and concentrate on incontinence. Studies that examine predictors of stroke severity focus on urinary incontinence entirely, whereas only those investigating stroke survivors with urodynamics also comment on obstructive symptoms.4-6 This review therefore focuses mainly on urinary incontinence as a symptom but recognizes the importance of other socially disabling lower urinary tract symptoms.

Prevalence of Stroke
A typical health authority of 250 000 persons can expect 500 new stroke cases and 1000 recurrent stroke cases each year, and at any one time there will be approximately 1500 survivors of stroke living in the community, of whom around 750 will have a significant level of disability.7 Indeed, stroke is the major cause of severe chronic disability in the UK, accounting for 4% of the total National Health Service budget,8,9 with stroke patients occupying approximately 12% of beds on general medical wards and 12% of stroke survivors becoming institutionalized within 1 year.7 Wolfe and colleagues10 reported that of 386 UK first-time stroke patients, 78% were treated in the hospital, particularly those who were younger and those who were incontinent. This shows that a large percentage of persons suffering from stroke are admitted to the hospital.

Prevalence of Incontinence
Daily incontinence, not only caused by a stroke, is common, affecting 1 in 20 persons aged under 65 years, increasing to 1 in 12 in those over 75 years of age.11 An average-size general practice of 2200 patients would include approximately 25 persons under the age of 75 years and 15 persons 75 or over with significant urinary incontinence, in addition to those in long-term care.11 The prevalence of urinary incontinence...
Prevalence of Urinary Incontinence After Stroke

<table>
<thead>
<tr>
<th>Authors</th>
<th>Publication Date</th>
<th>Sample Size</th>
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<th>Source of Sample</th>
<th>Time</th>
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<td>&lt;65</td>
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HA indicates hospital admission; AA, acute assessment (between 0 and 7 d); Dch, discharge.

Onset of Incontinence in Stroke Survivors

The main complication in comparing different studies that look at the prevalence of incontinence in stroke survivors is the definition of any incontinence. The apparent association between stroke and incontinence of urine is further complicated by premorbid and late-onset urinary incontinence, which few studies define. Late-onset urinary incontinence may be associated with the natural progression of conditions associated with urinary incontinence per se or with further strokes. Brocklehurst et al found in their study that 6 additional survivors at a 3-year follow-up became incontinent of urine, 4 of whom subsequently died. Only 1 of 12 reports that specifically sought a link between stroke or brain injury and incontinence investigated the prevalence of premorbid incontinence. This article suggests that 17% of 151 stroke survivors may have had incontinence before their stroke. The presence of premorbid incontinence is clearly important because it affects the apparent prevalence of incontinence due to stroke and because survivors who have premorbid incontinence may be very different from those who become incontinent after the stroke, with different morbidity and mortality. The rela-
tionship between stroke and incontinence may not only be in one direction.

Incontinence as a single symptom may be too exclusive, and lower urinary and fecal tract symptoms could deliver a better indication of urinary symptoms in stroke survivors. For example, a stroke survivor with bladder instability may not complain of urinary incontinence but of frequency and nocturia.

Neurological Lesions and Urinary Incontinence

The involvement of the frontal lobe in bladder control is frequently cited in the literature. In 1964 Andrews and Nathan pointed out that a region in the frontal lobe was important in the higher control of micturition and defecation. Their lengthy investigation in selected cases that included cerebral tumors, intracranial aneurysms, brain injury, and leukotomies suggested that frontal lobe damage was liable to cause urinary dysfunction. Gerber et al included 51 patients with unilateral ischemic hemispheric stroke and excluded patients with bilateral brain damage, brain stem stroke, and any previous urological surgery and patients with a history of previous stroke. They found an association between patients with poststroke urinary incontinence and those with large infarcts, aphasia, cognitive impairment, and functional disability. Burney et al linked the frontal and temporal lobes and internal capsule to urinary incontinence after stroke, but they failed to identify which of the patients presented with urinary symptoms. Further studies have identified the frontal cortex or the frontoparietal lobes as being associated with urinary dysfunction after stroke, and only one study failed to find any such association. However, a recent study confirms that the size of the stroke is more important, whereas the side of the stroke is not. Only the occipital lobe seems to be free of any connection with urinary incontinence.

Bladder Characteristics in Stroke Survivors With Incontinence

Urinary incontinence in stroke survivors may not be due to the stroke lesion per se but may have been there premorbidly from nonurological causes (see below). It is the authors’ experience that the prevalence of poststroke incontinence and other lower urinary tract symptoms are high in this population. If an accurate history cannot be obtained and if nonurological causes of incontinence have been excluded, further investigations of the urological symptoms are indicated. Abdominal ultrasound importantly excludes retention, but it can also assess whether bladder stones or other urinary tract pathology, such as carcinoma, is present. Urodynamic examination may reveal an overactive or underactive detrusor muscle and help to decide whether outflow obstruction is present, but a cooperative patient is necessary for the latter and investigators should be aware of the presence of detrusor instability in continent, healthy persons. Any results from urodynamic examinations therefore need to be interpreted in the light of the survivor’s symptoms and holistic condition.

There is no uniformity in the type of bladder lesion diagnosed on urodynamic studies in stroke survivors. Studies have revealed that incontinence in stroke survivors may be due to diagnoses similar to those found in incontinent persons without stroke. There appears to be a majority of survivors with detrusor dysfunction (hyperreflexia or hyporeflexia). Outflow obstruction is common but detrusor sphincter dys-synergia is not. Hyperreflexia, if new, is probably due to the stroke lesion itself. Normal storage and emptying of urine is dependent on a number of reflexes of increasing complexity as the spinal cord is ascended. Damage to the brain can induce bladder overactivity by reducing suprapontine inhibition. Detrusor sphincter dyssynergia arises from spinal lesions and therefore is uncommon in stroke survivors, and if present it is unlikely to be due to an intracerebral lesion.

Nonurogenital Causes of Incontinence

There are other nonphysiological barriers to maintaining continence, such as communication and mobility. To remain continent a person must be able to appreciate the need to void, communicate their need to a caregiver, be motivated, be able to bear weight or assist in transferring to a toilet or commode or use an appropriate appliance, to delay voiding until the appropriate time, and to initiate voluntary voiding. Dysphagia, aphasia, and impaired cognitive and functional ability are all correlated with urinary incontinence, but so too are nonurological complications of stroke such as fecal impaction, drug therapy, or increased solute load. Any drug with α-adrenoceptor blocking action will worsen the urethral sphincter weakness, whereas anticholinergic drugs may precipitate retention. Diuretics may lead to detrusor contraction by causing rapid bladder filling, and stroke itself may worsen diabetic control, increasing glycosuria. Finally, urinary tract infection and low estrogen levels in postmenopausal women contribute to poor bladder and sphincter control.

Progress of the Stroke Survivor With Incontinence

Incontinence is a marker for stroke severity because of its association with death and disability and its influence on the place of discharge of stroke survivors. Those who remain continent in the first few days after stroke experience lower mortality. Of patients who experience urinary incontinence, 52% are dead within 6 months compared with 7% of patients who remain continent. Similarly, for fecal incontinence the risk of death is greater. Of stroke patients who experience fecal incontinence, 59% are dead within 6 months compared with 7% of patients who initially had no fecal incontinence. Anderson et al reported that the relative risk of death within 1 year in their 321 acute stroke patients was 3.9 if they had had incontinence (95% confidence interval, 1.4 to 10.6). The definition of urinary incontinence used in this study was broad and included patients who had accidents or those who needed general help or needed an indwelling catheter during admission to the hospital. None of these studies made a distinction between urinary incontinence that began before or after onset of stroke, and some recruited their sample from hospital admissions, perhaps biasing their sample toward those more severely affected.

A number of studies have shown that urinary incontinence is not only an active predictor of survival but also of recovery. For example, initial incontinence in first-time stroke survivors younger than 75 years was the best single predictor of severe or
moderate disability at 3 months, with a sensitivity of 60% and specificity of 78%. This study gathered information on mobility status before the stroke, which was taken into account during analysis. A Danish study reported a significant relationship between the presence of urinary incontinence and length of hospital stay, circumstances of discharge, and mobility. Barer found that stroke outcome was so much better in those who remained or became continent that it seems possible that recovery of continence may promote morale and self-esteem that could actually hasten overall recovery. Although Barer was referring to the early stages of stroke recovery, the possibility of an association between continence, morale, and function in stroke survivors at a later stage after their stroke remains an untested hypothesis. There has been little work on how urinary incontinence may affect the psychosocial experience of a stroke survivor and how changes in this may result from treatment.

The place of discharge is also related to incontinence, with the latter increasing the chance of being placed in institutional care. Ween et al reported that 46% of 145 stroke survivors with incontinence returned to their own home after hospitalization compared with 79% of 278 continent stroke survivors. Only 15% of those initially continent after their stroke were later admitted to a nursing home compared with 38% of the incontinent group.

Why Is Urinary Incontinence Such a Good Predictor of Stroke Severity?

Urinary incontinence is a marker of stroke severity. It is not surprisingly closely related to coma, which itself is also a predictor of death and disability. However, even in those patients who are conscious after a stroke, incontinence is related to outcome. Wade and Hewer found in their study of hospitalized stroke patients that both a depressed level of consciousness and urinary incontinence in conscious patients were related to the severity of the stroke. Urinary incontinence may be a good predictor of stroke severity because of its relationship with infarct size and intracerebral hemorrhage, but it also may have a more subtle effect on morale and therefore influence response to rehabilitation. Stroke is often followed by depression and feelings of apathy, which can have adverse effects on a person's "normal" voiding behavior. Furthermore, the relationship of urinary continence with the central nervous system is complex. Not only may specific centers controlling micturition be affected but also other nonurological centers in the central nervous system, such as those affecting speech and mobility. These are also known to be related to outcome and are important also for a continent state.

Treatment

Because there is no clear understanding of the types and causes of incontinence associated with stroke, it is perhaps not surprising that the treatment of incontinence in stroke survivors has not been adequately addressed despite the magnitude and severity of the problem. The few studies that exist, almost entirely derived from the Japanese academic press, indicate the potential benefits of treating incontinence in stroke survivors. One benefit may be in transurethral resection of the prostate in men with outflow obstruction in whom conservative management techniques have failed. A further two small studies suggested that very considerable improvements and cure of incontinence followed a range of pharmacological, toileting regimen, surgical, catheterization, and behavioral therapies.

Based on the published evidence for treating nonstroke survivors with incontinence, physiotherapy and bladder-retraining programs are found to cure or very significantly improve incontinence. This, however, has not been investigated in a stroke population. A study is required to test treatments for incontinence in a sample of stroke survivors to see whether these patients can also be cured or made socially continent. Barer's hypothesis that recovery of continence in stroke survivors could lead to a more favorable outcome in the whole stroke survival and recovery process also needs to be tested.

Caregivers of incontinent stroke survivors attract even less academic interest, and the few available studies vary in the degree to which they report how stressful or problematic for the carers the incontinence is in the stroke survivors. Some indicate that urinary incontinence may influence the carers to seek residential care for the stroke survivor. The impact on the caregiver of treating the urinary incontinence in the stroke survivor remains unknown, but it is worthy of further research because so many of those stroke survivors who return home could not do so if they were to live alone.

The whole area of treating incontinence in stroke survivors and its effect both on the survivor and the caregiver is in need of further investigation. Not only could the quality of life for both be considerably improved, but also the cost of untreated incontinence could be reduced.

References
