ABSTRACT

Objectives. To review the definition of the overactive bladder and to summarize the results of epidemiologic studies on this specific disorder as well as urinary incontinence (UI) in general.

Methods. From a literature search covering the time period from 1954 through 1995, 48 epidemiologic studies and several other publications dealing with the prevalence and natural history of UI were reviewed. A metaanalysis of reported data was performed with respect to incontinence definitions, investigation methods, home country of survey, sex, and age groups.

Results. Differences in definitions of incontinence, target populations, and study design in different investigations resulted in inhomogeneity and difficulties of comparing the available data. By grouping the studies with respect to similarities in the above-mentioned criteria and analyzing the results for each group of studies, an attempt was made to understand the great variation of reported results. Differences in prevalence of incontinence were identified for all examined groups of studies and for distinct ethnic populations. Scarce information about incidence, spontaneous remission rates, and risk factors was used to elucidate the natural history of UI in women and men.

Conclusions. Although generally accepted definitions of the overactive bladder specifically and UI in general are highly desirable, they have not yet been established. Such definitions should comprise aspects of severity and demonstrability of the condition, bother factor, and impact on quality of life. Moreover, basic requirements for epidemiologic surveys of incontinence, such as validation of questionnaire results, need to be defined and standardized to create a sensible basis for useful epidemiologic studies in the future.

A uniformly accepted definition of the overactive bladder would be highly desirable to facilitate the comparison of data from various epidemiologic studies. Although many of the criteria for such a definition are fulfilled by the International Continence Society (ICS) standards, several issues remain unresolved. As a result, the epidemiologic studies conducted to date have suffered from a lack of conformity with regard to the definition of overactive bladder. These differences have undermined the ability to compare data across studies and validate the results.

DEFINITION OF THE OVERACTIVE BLADDER

According to the ICS, the term overactive bladder refers to the storage phase of the bladder only, not to micturition, and is diagnosed by urodynamics (specifically, filling cystometry). The disorder is characterized by involuntary detrusor contractions that may occur spontaneously or may be provoked (by rapid filling, alterations of posture, coughing, walking, jumping, etc.) while the patient is attempting to suppress them. The overactive bladder is referred to as unstable when the etiology is non-neurogenic and as hyperreflexic when the etiology is clearly neurogenic.

Involuntary detrusor contractions (which are usually phasic) may, rarely, be asymptomatic; more often, they are associated with a desire to void, urgency, and urge incontinence. The associated clinical conditions are called motor urgency and motor urge incontinence, whether primary or secondary to conditions such as urinary tract infection or bladder outlet obstruction in benign prostatic hypertrophy.

The major difference between the unstable detrusor and the hyperreflexic detrusor is that the latter condition clearly involves a neurologic dis-
order. The origin of the hyperreflexic detrusor may be either supraspinal or spinal disease or injury. Involuntary detrusor contractions occur during the filling phase and, on urodynamic studies, may appear similar to those observed in the unstable detrusor. In the case of a supraspinal etiology, the clinical condition is, again, one of motor urgency or motor urge incontinence. Therefore, in the individual patient, it may be difficult to differentiate between nonneurogenic and supraspinal neurogenic etiology. The hyperreflexic detrusor has also been referred to as the hypertonic, systolic, uninhibited, spastic, or automatic detrusor; these latter terms should no longer be used.

Urgency is defined as a strong desire to void. Urge incontinence is defined as the involuntary loss of urine associated with urgency due to an overactive detrusor (resulting in “motor urgency” or “motor urge incontinence”). The terms “sensory urgency” or “sensory urge incontinence” imply a lack of a demonstrable involuntary bladder contraction on fill in cystometry, which does not exclude the possibility of relevant pathology. Reflex incontinence, which results from spinal cord injury, is defined as an involuntary loss of urine due to detrusor hyperreflexia or urethral relaxation. It is important to note that in this case there is an absence of sensation.

Several issues concerning the definition of the overactive bladder are unresolved. Although the ICS has dropped limitations on the amplitude of contractions (such as >15 cm H2O), the question remains as to whether truly insignificant contractions exist. It is also unclear whether urodynamic filling should be “physiological” (as in ambulatory urodynamics) or provocative. If the latter, the question remains as to the degree of provocation that should be required: a change in position, change in bladder filling rates, coughing or straining, or the ice-water test. Also of concern is the question of whether a low dynamic (functional) compliance reflects a specific type of detrusor instability or a completely different condition. Furthermore, the question has been raised as to whether detrusor instability should be considered a normal condition unless it causes symptoms (i.e., urgency, urge incontinence) or upper urinary tract problems. Some evidence suggests that detrusor instability, with or without symptoms, may affect the results of surgery (such as transurethral resection of the prostate, bladder neck incision, or surgery for stress incontinence).

At present, therefore, some good definitions of the overactive bladder and related entities are available, but many questions remain to be addressed by future research.

**EPIDEMIOLOGIC STUDIES**

Numerous studies have shed light on the epidemiology of the overactive bladder and urinary incontinence (UI) in general. These highly embarrassing conditions are among the most common health problems, especially in elderly women; they also occur frequently in men. In most Western countries, costs to health care systems for the diagnosis and therapy of UI are comparable to those for diabetes mellitus (J.W. Thöröff, personal communication, 1997). The modern trend in medicine is to place more emphasis on primary health care because prevention is much less costly than healing. An understanding of the risk factors, natural history, incidence, and spontaneous remission rates of these disorders is imperative if effective prevention is to be achieved in the future.

**METHODS AND DEFINITIONS**

We identified 48 epidemiologic surveys conducted between 1954 and 1995, as well as several additional articles on the prevalence and natural history of UI by using numerous databases of the medical literature. For metaanalysis of prevalence data, the studies were grouped and the results were analyzed with respect to incontinence definitions, home country of survey, study design (methodology), and target populations. Mean, median, standard deviation, and range of prevalence were calculated for the pooled prevalence data. On the basis of this metaanalysis, an attempt was made to recognize reasons for well-known divergences in the published epidemiologic data.

**DEFINITION OF UI**

In the reviewed literature, several definitions of UI were used and some of the epidemiologic studies did not define their perception of incontinence at all. Diokno et al. defined incontinence as “any uncontrolled urine loss in the prior 12 months without regard to severity” (definition I). Thomas et al. used a definition of incontinence that includes information regarding the number of incontinence episodes (more than two in a month) (definition II). In 1976, the ICS defined incontinence as “a condition in which involuntary loss of urine is a social or hygienic problem and is objectively demonstrable” (definition III). Quantity or frequency of urine loss are not within the scope of this definition. If the definition of incontinence was stated in the reviewed prevalence studies, it mostly referred to one of the above-cited definitions; however, modifications were sometimes introduced with respect to frequency of urine loss.

**CLASSIFICATION OF INCONTINENCE TYPES**

In contrast to the variety of incontinence definitions, there is little disagreement about the different types of incontinence, such as “stress” incontinence and “urge” incontinence. However, one has to differentiate between several perceptions of incontinence:

1. Incontinence being a symptom taken from medical history.
2. Incontinence being a sign obtained during clinical examination with physical provocation, and
3. Incontinence being a urodynamically proven condition.

Most reviewed studies perceived and classified incontinence only as a symptom, as only questionnaires were used for
the investigations. Only a small number of surveys used the objectively demonstrable sign of incontinence.5-16 Moreover, urodynamically validated inquiries were very rare.19

According to the ICS terminology, stress incontinence is "involuntary urethral loss of urine when the intravesical pressure exceeds the maximum urethral pressure but in the absence of detrusor activity." Stress incontinence is a problem of insufficient restricting forces generated by sphincters and urethral resistance when abdominal pressure is increased due to physical exercise ("stress"). Accordingly, for evaluation of the symptom "stress incontinence," one has to ask for involuntary loss of urine associated with coughing, laughing, sneezing, or physical exercise. Most reviewed inquiries used positive answers to these kinds of questions to classify a urinary leakage as stress incontinence. However, urodynamic studies have been able to demonstrate that stress conditions like coughing and sneezing may also trigger involuntary detrusor contractions compatible with the diagnosis of motor urge incontinence. This proportion of cases will be misclassified if only symptoms are used for classification of UI.

Urge incontinence, the second most common type of UI, is characterized by urge associated with an involuntary loss of urine. Urge incontinence may be subdivided into motor urge incontinence, in which uninhibited detrusor contractions are associated with the sensation of urge, and sensory urge incontinence, in which the sensation of urge is not associated with such contractions. Sphincters and urethral resistance are intact. To identify urge incontinence, patients should be asked for urinary loss preceded by a sensation of urge or for precipitated, uncontrollable voiding with little or no warning time beforehand. Whereas almost every reviewed incontinence survey asked for symptoms of stress incontinence, only approximately half the studies used questions specific for identifying urge incontinence.

DEFINITIONS OF PREVALENCE AND INCIDENCE

The prevalence of incontinence is defined as the number of total cases at a certain point of time. Incidence is the number of new cases over a certain time period (e.g., 1 year). Thus, prevalence gives a static view of the total magnitude of a problem, whereas incidence studies may be used to describe a dynamic development.

RESULTS AND DISCUSSION

PREVALENCE OF UI

Prevalence by Age. The reported prevalence data are presented for different age groups of the investigated populations with special reference to incontinence in males, if reported. There are epidemiologic studies on a healthy population <30 years old, middle-aged persons between 30 and 60 years old, elderly persons >60 years old, and institutionalized impaired patients. The results will be reported separately for each age group.

YOUNG, HEALTHY PERSONS (<30 YEARS OLD). In 1954, Nemir and Middleton reported that 52% of 1,327 nulliparous female college students 17 to 24 years of age experienced occasional stress incontinence, but only 1 out of every 20 students examined reported urine loss on a regular basis.20 Similar data were presented by Wolin in 1969.21 A total of 4,200 healthy nursing students 17 to 25 years of age answered his questionnaire, and 51% reported sporadic episodes of stress incontinence. Comparable to the study by Nemir and Middleton, only 16% had major or regular urine loss.

Nevertheless, in the literature a 51% prevalence of incontinence is repeatedly cited from their studies. Furthermore, it has to be noted that neither study was validated by objective studies such as clinical examination, pad test, or urodynamic investigation.

Three unvalidated studies dealt with incontinence in males <30 years of age.3,22,23 The reported prevalences ranged from 6.1% to 10%, with a mean of 8.3% ± 2.0%. Thomas et al. conducted the largest incontinence survey, with 3,012 healthy males <30 years old out of a total of more than 18,000 women and men of all age groups.3

MIDDLE-AGED PERSONS (30 TO 60 YEARS OLD). In 10 reviewed studies, the reported prevalence of incontinence ranged from 14% to 41%, with a mean of 24.5%5,19,24-31 It is of interest that only in this age group was the mean prevalence from questionnaire-only based surveys lower (21.5%) than that from surveys using questionnaires and additional studies of validation (29%). Burgio et al. interviewed 541 healthy middle-aged women between 42 and 50 years of age without further verification of their statements.24 A total of 30.7% of the participants complained about incontinence on a regular basis (at least once per month). Lam et al. mailed a questionnaire, without further validation of the results, to 2,631 women aged 30 to 59 years and reported a much lower prevalence of 17%,25 which is another example of the high variability of the analyzed prevalence data.

Only two studies of middle-aged women included objective data.5,19 The prevalence of incontinence in these two studies was 29% ± 9.9%. Hörting et al. used a combination of interview and urogynecologic examination to investigate the prevalence of urine loss in 45-year-old women from an average Danish population.5 The other validated survey, performed by Lagro-Janssen et al., was of Dutch origin and consisted of interviews and complete urodynamic evaluations in 110 women.19

Another five studies presented data about the prevalence of incontinence among middle-aged men,3,13,22,23,27 but only one of them validated its questionnaire-based results.13 The median prevalence of UI was reported to be 5.7% ± 4.0%, with a total range of 2% to 12%. According to the results of two studies examining incontinence prevalences for men <30 years old and 30 to 60 years old,3,22 a remarkable decline in prevalence seemed to occur with age; this may be explained by spontaneous remission of enuresis, which may have been misinterpreted as incontinence by the responders to the questionnaires.

ELDERLY PERSONS (>60 YEARS OLD). A total of 12
epidemiologic studies dealt with UI in healthy elderly women >60 years of age. The reported prevalences ranged from 4.5% to 44%, with a mean of 23.5%. Half the studies presented prevalence data confirmed by physical investigation (17.5% ± 12.6%); this figure is significantly below the prevalence reported in the nonvalidated surveys (31.5% ± 13.85%). The studies of Lee et al.7 and Hellström et al.6 illustrate the spectrum of results. Hellström et al. investigated incontinence problems among 974 noninstitutionalized, 85-year-old men and women in the city of Göteborg, Sweden. The reported prevalence of 43.2% was confirmed by the use of pad tests. In contrast, in 919 elderly Singaporeans ≥65 years old, Lee et al. reported a 4.6% prevalence of incontinence verified by physical examination.7

Most studies of UI in men focused on individuals >60 years old. More than one-third were validated studies.9,13,14 Meta-analysis of the published data reveals a mean prevalence of 14.45% ± 7.2%, which is the highest of all age groups. The prevalence values ranged from 4.6% to 24%. The study by Lagace, with 2,830 participants, reported very high prevalences not only for elderly men (22%), but also for the other age groups (10% for men <30 years old and 12% for men 30 to 60 years old).23 These results may be explained by the broad definition of incontinence used in this study ("any degree of incontinence in the past 12 months") and a lack of objective validation of their questionnaire data.

Considering the reported prevalences for all age groups mentioned above, involuntary loss of urine is less common in men than in women, regardless of age (Fig. 1). Development of UI with age reveals a surprisingly high prevalence in young adults that declines in the following decades but then reaches a maximum in the senium (Fig. 2).

Prevalence in Institutionalized and Impaired Patients. All four reviewed studies reporting incontinence prevalences of institutionalized, impaired women were validated surveys.8-10,12 However, the prevalence of incontinence ranged from 22% to 90%, with a mean of 55.7% ± 25.13%, which is probably related to the use of different definitions of UI. Hansen et al. examined 278 female residents of Danish nursing homes and reported a 58.5% prevalence of UI, but did not report their definition of incontinence.8 Mohide et al.,9 who used the ICS definition of incontinence, studied 2,801 Canadian patients receiving home care services because of age and immobility and reported a 22% prevalence of UI. McLaren et al. defined every occasional loss of urine during the investigation period as UI and reported a 90.6% prevalence in 128 psychogeriatric hospitalized female patients.10

Two of the above-mentioned studies also contained data on UI in impaired men. Mohide et al.,9 who investigated patients of both sexes, reported for men nearly the same incontinence prevalence (22%) as Sier et al.12 (23%), who examined 363 male and female patients ≥65 years old who had been admitted to an acute care hospital for assorted reasons. According to their results, the prevalence of UI among impaired, hospitalized male patients was only half the reported prevalence for women of the same age and health status (44%).

Prevalence by Survey Parameters. The prevalences of UI from the different studies were analyzed with regard to different criteria (UI definition, origin of survey, and survey methodology). This approach allows for judgment of survey bias and provides an explanation for the wide range of study results.

Prevalence by Definitions of UI. As expected, studies that used the broadest definition of UI also reported the highest prevalence rates. A total of 22 of the reviewed surveys defined incontinence as any uncontrolled loss of urine without respect to frequency, severity, or bother factor.6,9,13,14,18,28,43 Four of these studies confirmed their results by objective investigations.6,13,14 The mean reported prevalence for UI of any severity and frequency in men was 15.06% ± 7.2%, with a range of 5% to 24% (Fig. 4).

Thomas et al.3 and eight other studies defined incontinence as any uncontrolled loss of urine that occurs at least twice a month without regard to severity or bother factor.7,9,13,14,19,22,24,43 Four of these nine studies confirmed their results by further investigations.7,13,14,19 Since these studies seemed to focus on a somewhat more severe form of female incontinence, the prevalence rates were lower than in the above-mentioned studies, ranging from 4.5% to 37%, with a mean of 18% ± 12.7%. Six of these studies also reported on male UI.7,9,13,14,22 Two-thirds of them used objective tests in addition to interrogative investigations.7,13,14 The prevalence data were significantly lower than those referring to incontinence definition I (a mean of 6.8% ± 6.9%, with a range of 1.6% to 22%). This supports the hypothesis that stricter definitions for incontinence and validation of questionnaire-based epidemiologic data result in lower prevalence numbers.

Prevalences reported by nine studies using the ICS definition5,15-17,25,26,35,44,45 (four with validated findings9,12-17) ranged from 12% to 44%, with a
mean of 23.61% ± 8.92%, and thus are in between the results of the other studies. No studies have reported incontinence prevalences for men according to the ICS definitions.

Eight of the analyzed studies either did not report their definition of incontinence or used definitions different from the ones mentioned above. Three of these included physical examination. This group of studies revealed the highest mean prevalence with the largest standard deviation (38.1% ± 26.3%). The wide range (12% to 90%) of results reflects the structural heterogeneity of this group. As the only two studies dealing with male incontinence were lacking a clear definition, no sensible conclusions can be drawn from their results apart from the fact that the prevalence range of 7.5% to 17.3% is very wide (mean, 12.4% ± 6.9%).

PREVALENCE BY COUNTRY OF ORIGIN. The majority of US epidemiologic studies did not give great attention to validation of the results of interviews or questionnaires. Only two of the 13 surveys reviewed verified their data by further examinations (Fig. 5). Validated results were presented by more than one-third of the reviewed surveys from continental Europe (7/19), the United Kingdom (3/8), and other countries (3/8) such as Singapore, Pakistan, Tunisia, New Zealand, and Japan. This may be another reason for differences in prevalences between the United States and Europe. As expected, and as shown in Fig. 6, studies based only on questionnaires or interviews tended to overestimate the prevalence of female UI, with a median...
prevalence of 37% (range 12% to 52%) in the United States, 26% (range 12% to 58.5%) in continental Europe, and 28.7% (range 8% to 90%) in the United Kingdom. Prevalences of UI from other than European and North American countries had a lower range (4.6% to 50%; median 20.5%). The question of whether these differences relate to social, hygienic, cultural, or economic factors remains unanswered.

To a certain degree, the prevalence data on female UI are mirrored by the results of studies of male UI. The highest prevalences and the lowest share of validated studies were from the United States (mean 15.8% ± 6.7%; range 6% to 23%). However, one European study of male incontinence reported a 24% prevalence. In contrast to the prevalence rates reported for females, surveys from the United Kingdom revealed lower prevalences for men (mean 4.6% ± 2.2%; range 1.6% to 6.9%) than from any other country.3,13,22,27 The published prevalence rates from countries other than the United States or those in Europe7,14,18,34 are low (mean 8.5% ± 6%; range 4.6% to 17.3%), but are higher than the rates in Britain (Fig. 7).

Prevalence by Survey Method. The size of epidemiologic studies is limited if the methodology is complex and includes validating procedures for the results of questionnaires. The less complicated the study design, the more study subjects can be reached and investigated. This hypothesis can be proved by analysis of 40 published studies. A total of 33 interrogative (questionnaire or interview) surveys without further investigations3,17-48 had a significantly higher study size (median 1,500 subjects; range 267 to 18,000 subjects) than 15 validated surveys5-19 (median 920 subjects; range 110 to 7,450 subjects) (Fig. 8). Moreover, the reported prevalences of UI were different for both types of surveys. As shown in Fig. 9, nonvalidated prevalences were higher (median, 29.5%; range, 8% to 53%) than validated ones (median, 23.5%; range, 4.6% to 90%), suggesting exaggerated prevalences if results of questionnaires or interviews were not verified by objective tests.

Prevalence by Ethnicity. Several authors commented on ethnic and societal differences in the prevalence of female UI. Lara and Nacey reported a significantly higher prevalence of incontinence in Maori women than in European women, which was explained by a higher parity of Maori women.43 A very low prevalence was reported from Singapore (4.5%), suggesting an ethnic advantage of the women >65 years old who were studied.14 The racial differentiation of the investigated population in Singapore revealed incontinence rates of 1.1% for Malay, 1.6% for Indian, and 5.2% for Chi-
Females

Mixed incontinence 29%
Stress incontinence 49%
Urge incontinence 22%

Males

Stress incontinence 8%
Mixed incontinence 19%
Urge incontinence 73%

FIGURE 10. Median relative share of incontinence subtypes in women.

FIGURE 11. Median relative share of incontinence subtypes in men.

Chinese Singaporeans. Burgio et al. found UI more frequently in white than in black women,24 which Knobel related to a shorter urethra, weaker pelvic floor muscles, and a lower positioned bladder neck in white women.49

A higher prevalence of incontinence in industrialized countries seems to be attributed to toilet habits.46 Pakistani females using a commode type of toilet were reported to have a higher incontinence rate (28.5%) than those voiding in a squatting posture (12.3%).

Prevalence by Type of Incontinence. When female incontinence was classified by symptoms or urodynamics in 21 of the 48 studies,2,5-7,11,13,16,19,22,24,26,28,32,36,38,41,43-45 stress incontinence was predominant. As shown in Fig. 10, nearly half the women with UI suffered from the symptoms of stress incontinence (49%). Urge incontinence, which is predominant in men, accounted for only 22% in women. A total of 29% of women had mixed incontinence. However, this has to be noted that the incidence of urge incontinence increases with age and reaches a maximum in the sixth decade.50

Because of differences in pathologic anatomy and the pathophysiology of UI in men (predominantly bladder irritation due to benign prostatic hypertrophy), there is a different distribution of incontinence subtypes. As shown in Fig. 11, six studies revealed a predominance of urge incontinence in men (73.3%), followed by mixed forms of incontinence (19.1%), and stress incontinence (7.6%),2,13,14,22,32

Natural History

The natural history of a condition constitutes its epidemiologic development without intervention and can be characterized by incidence, development with age, spontaneous remission, and risk factors.

Incidence of UI. Incidence rates of UI are even more difficult to evaluate than prevalence rates. One must conduct repeated surveys of the same population over a certain time period. The study cohorts have to be large enough to compensate for dropouts by migration, refusal to cooperate, or death. This might be the reason for the limited availability of reliable data on the incidence of UI.

Elving et al.26 evaluated incidence rates for different incontinence definitions and cumulative incidences of consecutive life spans. In their survey, 3,114 Danish women were randomly selected among 30- to 59-year-old female citizens of the municipality of Aarhus and were mailed a questionnaire on their experience of UI throughout adult life. The investigators compared two definitions of UI: a broad definition that declares any episode of involuntary loss of urine as UI (definition I) and the ICS definition, which requires objective demonstrability and the presence of a hygienic or social problem for uncontrolled loss of urine to be acknowledged as UI (definition III). Their findings showed a steady increase in the incidence of UI with age, independent of the definition used (Figs. 12 and 13). Unfortunately, they investigated only women aged 30 through 59 years, so it remained unclear whether there is a further increase, stagnation, or decline in the incidence of incontinence in elderly women, as presumed by Jeffcoate et al.50 However, there is no clear relationship between the prevalence of incontinence and age. Brocklehurst27 and Yarnell et al.11 reported a steady increase in prevalence with age, whereas Harrison and Memel found an increase in prevalence with age up to the fifth decade followed by a decline thereafter.38
Elving et al.\textsuperscript{26} reported an overall increase in the incidence of UI between ages of 45 and 59 years, but a change in the incidence of different incontinence types. The incidence of stress incontinence per year decreased from 0.55\% to 0.43\% with age, whereas the incidence of urge incontinence increased from 0.08\% to 0.2\% (Fig. 14).

Spotty information on the incidence of UI was presented by other authors whose reports mostly lacked specification of methodology and whose results varied widely. Small and very specific survey cohorts (eg, young pregnant women during the first trimester) and age restrictions (eg, women >60 years old) do provide information about specific population subgroups, but do not allow generalization of results.

Hörting et al. from Denmark, who performed interviews and pelvic examinations in 515 women 45 years of age, reported a 30\% incidence of UI after hysterectomy and a 21\% incidence in the presence of uterine prolapse without surgical treatment.\textsuperscript{5}

By interview and physical examination, Bayer disclosed a 14\% prevalence of UI in 542 healthy women aged 16 to 45 years.\textsuperscript{28} During the first half of pregnancy, 49\% of these women developed some degree of stress incontinence. This high incidence of UI was followed by a 86.2\% spontaneous remission rate after delivery.

In a prospective study, Diokno et al. noticed a 22.4\% incidence of incontinence in 1 year among women ≥64 years old.\textsuperscript{2} Herzog and Fultz estimated that 20\% of women ≥60 years of age develop incontinence during 1 year.\textsuperscript{32,33} Their results are compatible with several American studies, including Diokno’s survey, but are in contrast to the results of the investigations of Campbell et al. from New Zealand, who found a 7\% incidence of incontinence over 4 years for women between 65 and 69 years of age.\textsuperscript{18} Koyano et al. reported from Japan a similar low incidence of incontinence (10\%) over a 5-year period in 2,567 women >65 years of age.\textsuperscript{34} Elving et al. reported a 1.3\% incidence per year for women 55 to 59 years old\textsuperscript{26} even though they used the same incontinence definition as Diokno et al.\textsuperscript{2} Comparing the high US incidences of incontinence with the low incidences of other countries, a predisposition of elderly Americans must be assumed. However, the study of Burgio et al. in 541 healthy, middle-aged women revealed a 3-year incidence of 8\%, which is nearly as low as in the studies of Campbell et al.\textsuperscript{18} and Koyano et al.\textsuperscript{34} The lowest incidence rate, of 11\% over a period of 20 years, was published by Molander et al. from Sweden, who investigated a random sample of 4,206 women aged 65 to 85 years.\textsuperscript{16}

Spontaneous Remission of UI. Because evaluation of spontaneous remission rates requires cross-examination of several interviews from the same study population over a period of time, study design is very complex and usable data are rare. Campbell et al. found a spontaneous remission rate of 13\% over 4 years among New Zealand women who had been incontinent.\textsuperscript{18} From Michigan, a 4-times-higher yearly spontaneous remission rate of 12\% was reported for incontinent women ≥60 years of age.\textsuperscript{51}
Risk Factors for UI. A variety of risk factors for developing UI have been identified as the result of intensive epidemiologic research over the past decades. These risk factors can be classified into constitutional, urodynamic, neurologic, and behavioral.

Obesity, white race, and advanced age are judged to be constitutional risk factors of incontinence, although some authors deny the direct correlation between age and the incidence of UI.47 Cystocele, uterine prolapse, and impaired function of the levator muscles are commonly cited urodynamic risk factors.3,5,52 On the other side, hysterectomy, other gynecologic pelvic surgery, and the use of vaginal pessaries for correction of cystocele are reported to cause involuntary loss of urine.5,15,50,52-56 Estrogen deficiency and excess progesterone during pregnancy are reported to predispose to the development of stress incontinence.28 The question of whether postmenopausal estrogen deficiency causes stress incontinence is a matter of controversy.3,5,15,16,35 The number of deliveries correlates with the degree of pelvic floor relaxation and incontinence.5,29 Urodynamic infections constitute an additional risk factor for developing incontinence, which is related to the female pelvis.57 Neurologic risk factors such as stroke, paraplegia, paralysis agitans, immobility, and cognitive impairment are related to urge incontinence or detrusor hyperreflexia rather than to stress incontinence.10,18,32 Urinary infections, hypnotic drugs, and bowel problems such as flatulence may cause urge incontinence.57

Behavioral risk factors for incontinence include abuse of caffeine, alcohol, or tobacco; low physical activity in daily life; psychosocial disorders; and societal toilet habits.18,24,34,46,50

In women with urodynamically proven detrusor instability and coincidental congestive heart failure or coronary heart disease, administration of diuretics will frequently result in incontinence.58

According to a prospective survey, elderly women with UI had a significantly higher risk of dying during the follow-up years when compared with continent women of the same age group.34

Patient Compliance and Therapeutic Concepts

Possible Reasons for Refusal of Therapy. The high prevalence of UI stands in remarkable contrast to a low request for treatment. Only one of four continent women in the United States and one of three continent women in Europe seek the help of a physician.40,44,58 Even though the overwhelming majority (73%) of continent patients felt that it was difficult to deal with the condition of involuntary urine loss, they did not report it to their physician in many cases.58 In the questionnaire survey conducted by Harrison and Memel, 35% of the responding women worried about incontinence problems, but only 12.8% of those had consulted a physician.38 Even among women who are continent every day, only 54% visit their physician.24 Reasons for not seeking help vary; most women think that incontinence is part of normal life, whereas others judge their incontinence not to be severe or frequent enough to require treatment.24,40,43 Some are too embarrassed to visit a physician, and others worry about the costs of therapy.43,44 Some incontinent women use self-help exercise programs, and others believe that treatment is not possible or available.33,44 Only a minority of women distrust the competence of their physicians or doubt the success of therapy.44 Burgio et al. found that seeking treatment was not related to the level of education, employment status, number of children, or psychological factors, but correlated with scoring on the Framingham anger scale, suggesting a higher bother factor from incontinence in those women who sought treatment.24 Nevertheless, reported long-term results of therapy were disappointing. More than 90% of all patients treated by any method were not cured of their incontinence, and 6% of these even got worse under treatment.59

Therapy Concepts. Most women use more than one strategy to manage their incontinence problems.56 The Medical, Epidemiologic, and Social Aspects of Aging (MESA) survey conducted by Diokno et al. in Michigan revealed that 55% of women use absorbent materials as the predominant method of managing the uncontrolled loss of urine.58 In 42% of incontinent patients, immediate locating of a toilet on arrival at an unfamiliar place is the second most common strategy, followed by behavior modifications, such as timed voiding (28%), dietary modifications and restricted fluid intake (16%), pelvic floor muscle exercises (12%), and pharmacologic medications (6%). Only a small minority of patients undergo surgery.58

Conclusions

Even though UI is a common condition and the object of intensive research, there is not much conformity among epidemiologists about the prevalence, risk factors, and natural history of this condition.

We reviewed and collated data from 48 epidemiologic studies and several publications about the natural history of UI. The reviewed studies differed widely with respect to methods applied, survey populations, and results. The reported prevalences ranging from 4.5% to 53% for female incontinence and from 1.6% to 24% for male incontinence do not allow one to draw any sensible conclusions. When trying to identify reasons for the wide varia-
ety of results, we grouped the surveys according to UI definition, home country, methodology, and age of survey cohorts. We noticed that epidemiologic studies of UI suffer from a lack of conformity with regard to the definition of incontinence, survey methods, and validation of results. A sensible definition of UI should 1) stand the test of objective demonstration of urine loss, 2) relate to frequency and severity of urine loss, 3) consider the impact of subjective bother, and 4) be useful for deciding whether urologic or behavioral therapy should be recommended.

The ICS definition fulfills most of these criteria and, if applied uniformly, would probably lower the prevalence rate of UI requiring treatment to approximately 5% to 10%. Unfortunately, the Consensus Development Conference on Urinary Incontinence in Adults, which convened in 1988, left the definition problem unresolved.50,60

Little is known about the incidence, development with age, and spontaneous remission rates of UI, all of which constitute the “natural history” of the condition. Urinary incontinence is less common in men than in women and has a different pathophysiology and therefore classification (predominantly urge incontinence). For a better understanding of the problems, further epidemiologic investigations are necessary. However, if these studies are to be comparable, standardization of UI definitions, survey methods, and validation criteria will be required.

As many risk factors for the development of UI are known, public health programs should disseminate such information and draw attention to the prevention of this condition, which otherwise entails high costs of management and therapy.

REFERENCES

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