Original Article

J Chin Med Assoc
2004;67:136-140

Nocturnal Enuresis in Older Adults

Alpha Dian-Yu Lin
Alex Tong-Long Lin
Kuang-Kuo Chen
Luke Sien-Shih Chang

Division of Urology, Department of Surgery, Taipei Veterans General Hospital, and Division of Urology, National Yang-Ming University School of Medicine, Taipei, Taiwan, R.O.C.

Key Words
geriatrics;
nocturia;
nocturnal enuresis;
sleep

Background. Nocturnal enuresis is uncommon in older adults. The paucity of literature about this problem prompts us to review our cases to determine the management strategy.

Methods. Six older adults, including 2 females and 4 males, were evaluated for refractory nocturnal enuresis. Only 2 of them had minor daytime urge symptom. Most of them had failed in the treatment using anticholinergics and/or alpha-adrenergic blocker. Evaluation consisted of detailed medical history, voiding diary, and urodynamic studies. Clinical follow-up persisted for 12 months. We define nocturnal polyuria as nighttime urine amount being more than 35% of total daily urine amount. Bladder outlet obstruction in men was diagnosed based on the definition described by International Continence Society.

Results. The average age was 71 years (range 61-84). The average duration of the symptom was 3.1 months (range 0.5-6). Two patients had bladder outlet obstruction. Four patients used hypnotics for insomnia, which might result in difficult awakening on bladder distension. Nocturnal polyuria was found in 3 patients. Most patients had multiple factors contributing to their nocturnal enuresis except 1, who was found to have an enlarged prostate with chronic bladder distension. Specific treatments were given based on the causes for each patient. Hypnotics were discontinued for a certain meanwhile in some patients. Nocturnal polyuria was managed with afternoon diuretic or bedtime desmopressin. Bedtime anticholinergic agent was used in patients with detrusor overactivity. The patient with enlarged prostate and urinary retention was managed with indwelling catheter followed by elective transurethral prostatectomy. All patients were dry in the night following the treatment.

Conclusions. Nocturnal enuresis in older adult is usually multi-factorial. Hypnotic usage and nocturnal polyuria are frequently overlooked. Detailed investigation is necessary to identify the causes. Tailored treatment may achieve satisfactory results.

Nocturnal enuresis is defined as "voiding that occurs during sleep".[1] It is classified as primary persistent or recurrent, or secondary adult onset.[2] Although there are plenty of papers discussing nocturnal enuresis in children, only a few focus on nocturnal enuresis in older adults. Burgio *et al.* have reported that the prevalence of nocturnal enuresis in community-dwelling older adults is 2.1%.[3] By reviewing urodynamic record, Sakamoto *et al.* found the prevalence rate of 0.02% (8/3277) for adult onset nocturnal enuresis, but without daytime incontinence.[4] McGrother *et al.* reported that 2.4% of older people (75 years of age or older) living at home had nocturnal enuresis.[5] These figures indicate that nocturnal enuresis is uncommon among older adults; but it associates with poorer therapeutic outcomes compared with the more common forms of daytime incontinence.[3] In contrast to the large volumes of research on treatment of daytime incontinence, there is little investigation on the treatment of nighttime incontinence in older adults. Therefore, it is mandatory to a good strategy to handle this problem. By reviewing our experiences, this study determines causes and the treatment plan of nocturnal enuresis in older adults.

METHODS

Six old adults, including 2 females and 4 males, with

Received: June 30, 2003.
Accepted: January 12, 2004.

Correspondence to: Alex Tong-Long Lin, MD, PhD, Division of Urology, Department of Surgery, Taipei Veterans General Hospital, 201, Sec. 2, Shih-Pai Road, Taipei 112, Taiwan.
Tel: +886-2-2875-7519 ext 307; Fax: +886-2-2875-7540; E-mail: lintl@vghtpe.gov.tw

an average age of 71 years (range 61-84) were evaluated for refractory nocturnal enuresis. Two of them had minor daytime urge symptom. Most of them have failed in the treatment using anticholinergics and/or alpha-adrenergic blocker. Evaluation consisted of detailed medical history, 3-day voiding diary, uroflowmetry and cystometry. We define nocturnal polyuria as nighttime urine amount being more than 35% of total daily urine amount.[6] Bladder outlet obstruction in men and detrusor overactivity were diagnosed based on the definition proposed by International Continence Society (ICS).[7]

Sleep was assessed by self-rating of sleep quality (very good to very bad) and the number of hours of actual sleep they got at night. They were asked about the frequency with which they used sleep medication and the type of medication.[3]

RESULTS

The average duration of the symptom was 3.1 months (range 0.5-6). The patients' characteristics are summarized in the Table 1. Summary of the causes and the strategies are depicted in Table 2. Two patients had bladder outlet obstruction. Four patients used hypnotics for insomnia, which may result in difficult awakening on bladder distension. Nocturnal polyuria was found in 3 patients. Most patients had multiple factors contributing to their nocturnal enuresis except 1 (case No. 5) who was found to have an enlarged prostate with chronic bladder distension.

Specific treatments were given based on the causes for each patient. Hypnotics were discontinued or its dosage was reduced. Nocturnal polyuria was managed with bedtime desmopressin (DDAVP, 0.1-0.2 mg), or a diuretic, furosemide 40 mg, 6 hours before bedtime. Bedtime anticholinergic agent, including tolterodine or oxybutynin, was used on patients with detrusor overactivity. The patient with enlarged prostate and urinary retention was managed with indwelling catheter followed by elective transurethral prostatectomy. All patients were dry in the night following the treatment.

DISCUSSION

Our observation shows that nocturnal enuresis in older adults is usually secondary to multiple factors. Except case No. 5, all patients had at least two reasons leading to enuresis. This easily explains why simple measures, such as using anticholinergics alone, fail to cure the enuresis.

Nocturia is common in the older adults and is associated with poor sleep, irregular heart beats, diabetes and stroke.[8] Poor nocturnal bladder capacity as well as increased nocturnal urine production in the aged people also induces nocturia.[6] Although nocturia is common, nocturnal enuresis is uncommon in older adults.

Table 1. Patients' demographics

Case No.	1	2	3	4	5	6
Age (Y/O)	66	72	61	73	84	70
Gender	F	F	M	M	M	M
Duration of the symptom (months)	6	0.5	6	2	1	3

Table 2. Causes and treatments of nocturnal enuresis

Case No.	1	2	3	4	5	6
Detrusor overactivity	+	+	+	-	-	+
Bladder outlet obstruction	-	-	-	-	+	+
Hypnotics usage	+	+	+	+	-	-
Nocturnal polyuria	-	+	-	+	-	+
Treatments[a]	(1), (2)	(1), (2), (3)	(1), (2)	(1), (3)	TURP[b]	(4), (5)

[a]: (1) Reduce hypnotics; (2) Bedtime tolterodine; (3) Desmopressin; (4) Furosemide; (5) Alfuzosin.
[b]: TURP = Transurethal resection of prostate.

We notice that 4 of our patients used hypnotics. Some patients initially had nocturia only with an impaired sleep quality. Hypnotics were thus prescribed aiming them to improve sleep quality, but with an unexpected occurrence of nocturnal enuresis. Deep sleep induced by hypnotics may interfere with the normal awakening response to bladder fullness, resulting in enuresis when the bladder contracts during sleep.[3] Discontinuance or decreasing dosage of hypnotics may restore the awareness of bladder distension to awake the patients for toileting. For patients with true insomnia, hypnotics can still be used if other factors causing enuresis are properly controlled. For example, patients taking hypnotics will only have nocturia at most instead of enuresis if their detrusor overactivity is well treated with anticholinergics and adequate bladder capacity is obtained.

Nocturnal polyuria is an important factor of nocturnal enuresis. It can be caused by daytime fluid accumulation followed at night by mobilization of excess fluid. Congestive heart failure, renal functional impairment or any reason causing edema of lower limb during daytime may result in mobilization of excess fluid with recumbency.[3] Although our patients with nocturnal polyuria did not have overt heart failure, the possibility of subclinical cardiac insufficiency cannot be ruled out. Subclinical heart failure may cause nocturnal polyuria which was associated with higher plasma atrial natriuretic peptide (hANP) as proposed by Fujikawa *et al.*[9] Other mechanisms, such as inadequate nighttime anti-diuretic hormone (ADH) level and disturbed renin-angiotensin-aldosterone system, may also contribute to nocturnal polyuria.[10]

Both diuretics and desmopressin work well for nocturnal polyuria.[6,9] Reynard *et al*. used furosemide 6 hours before bedtime to mobilize the fluid before sleep to successfully reduce nocturnal urine volume and nocturnal urinary frequency.[11] One of our patients was well managed with this method. Desmopressin also shows to be safe and effective in the treatment of severe nocturia in patients over 65 years of age.[12,13] Three of our patients found to have nocturnal polyuria were all well managed using desmopressin to reduce nocturnal urine volume.

Detrusor overactivity is common in our patients. Five of 6 patients had urodynamically proved detrusor overactivity. In spite of treatment with anticholinergics, their nocturnal enuresis still persisted. The satisfactory results with anticholinergics can only be obtained by reducing hypnotics and controlling nighttime urine volume. This finding highlights the importance of documenting all contributing factors and combining several specified treatments in managing nocturnal enuresis in older adults.

One of our patients had severe bladder outlet ob-

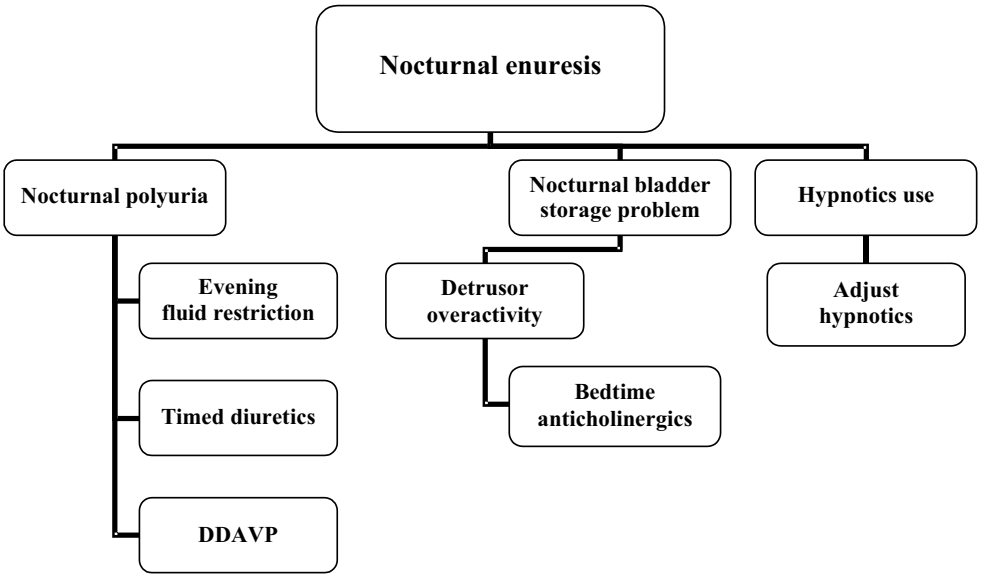

Fig. 1. Algorithm for treating nocturnal enuresis in older adults.

struction with clinical manifestation of nocturnal enuresis. Sakamoto *et al.* also have similar finding of 8 patients with adult onset nocturnal enuresis, who had severe urethral obstruction secondary to benign prostatic hyperplasia (BPH).[4] Transurethral resection of the prostate (TURP) made significant improvement in resolving nocturnal enuresis in these patients. Our case No. 5 also had severe bladder outlet obstruction (BOO) due to BPH. After TURP was carried out, there was no more enuresis in the following period. It is still unknown how BOO causes nocturnal enuresis. It has been hypothesized that low bladder compliance may trigger unstable bladder contractions during sleep to result in enuresis.[4]

It is interesting to notify that 2 of our patients had history of adolescent enuresis. Case No. 4 had persistent nocturnal enuresis till 28 years of age, which cured spontaneously. Case No. 6 had nocturnal enuresis till 20 years of age, which also cured spontaneously. We found no information on the relationship between adolescent enuresis and older enuresis in the literature. Nevertheless, inquiry of history of adolescent enuresis in the evaluation of nocturnal enuresis in older adults may be recommended, and further investigation in their relationship is warranted.

Based on our experiences and literature reports, we develop an algorithm for treating nocturnal enuresis in older adults (Fig. 1). A very important part of the evaluation is detailed history, including questions about voiding behavior, medical and neurological abnormalities and sleep disturbance, as well as information on relevant surgery or previous urinary infection.[1] Voiding diary (frequency-volume charts) is the most valuable instrument for diagnosing nocturia in the elderly men.[14] Additionally, medication history of hypnotics should be obtained. Urodynamic studies are usually necessary to verify the existence of detrusor overactivity or bladder outlet obstruction.

Using this algorithm, we identify the multi-factorial nature of nocturnal enuresis in older adults. Too deep sedation by hypnotics, detrusor overactivity, nocturnal polyuria and severe bladder outlet obstruction are the common contributing factors. Treatments targeting each component in individual patient are required to insure success.

In conclusion, nocturnal enuresis in older adult is usually multi-factorial. Nocturia is the basic component of enuresis. Hypnotic usage and nocturnal polyuria are frequently overlooked. Multi-modality treatment to nocturnal polyuria, detrusor overactivity and sleep disturbance may reach effective outcome. Detailed investigation is necessary to identify the causes. Tailored treatment may achieve satisfactory results.

REFERENCES

1. van Kerrebroeck P, Abrams P, Chaikin D, Donovan J, Fonda D, Jackson S, *et al.* Standardisation Sub-committee of the International Continence. The standardisation of terminology in nocturia: report from the Standardisation Sub-committee of the International Continence Society. *Neurourol Urodyn* 2002;21:179-83.
2. Koff, SA. Enuresis. In: Walsh, Patrick C. eds., *Campbell's Urology, 7th ed.* Philadelphia: W. B. Saunders, 1998:2065.
3. Burgio KL, LocherJL, Ives DG, Hardin JM, Newman AB, Kuller LH. Nocturnal enuresis in community-dwelling older adults. *J Am Geriatr Soc* 1996;44:139-43.
4. Sakamoto K, Blaivas JG. Adult onset nocturnal enuresis. *J Urol* 2001;165:1914-7.
5. McGrother CW, Castleden CM, Duffin H, Clarke M. A profile of disordered micturition in the elderly at home. *Age Aging* 1987;16:105-10.
6. Weiss JP, Blaivas JG. Nocturia. *J Urol* 2000;163:5-12.
7. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, *et al.* The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. *Neurourol Urodyn* 2002;21:167-78.
8. Asplund R. Nocturia in relation to sleep, somatic diseases and medical treatment in the elderly. *Br J Urol* 2002;90:533-6.
9. Fujikawa K, Kasahara M, Matsui Y, Takeuchi H. Human atrial natriuretic peptide is a useful criterion in treatment of nocturia. *Scand J Urol Nephrol* 2001;35:310-3.
10. Miller M. Nocturnal polyuria in older people: pathophysiology and clinical implications. *J Am Geriatr Soc* 2000;48:1321-9.
11. Reynard JM, Cannon A, Yang Q, Abrams P. A novel therapy for nocturnal polyuria: a double-blind randomized trial of frusemide against placebo. *Br J Urol* 1998;81:215-8.
12. Kuo HC. Efficacy of desmopressin in treatment of refractory nocturia in patients older than 65 years. *Urology* 2002;59: 485-9.
13. Cannon A, Carter PG, McConnell AA, Abrams P. Desmopressin

in the treatment of nocturnal polyuria in the male. *Br J Urol* 1999;84:20-4.

14. Blanker MH, Bernsen RM, Bosch JL, Thomas S, Groeneveld FP, Prins A, *et al*. Relation between nocturnal voiding frequency and nocturnal urine production in older men: a population-based study. *Urology* 2002;60:612-6.