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Effect of aging on quality of nocturnal erections: evaluation with NPTR testing

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Nocturnal penile tumescence and rigidity testing (NPTR) has traditionally been performed to distinguish psychogenic from organic impotence. However, considerable lack of uniformly accepted normative data for NPTR readings makes the reproducibility of the method questionable. In this study, we try to evaluate the impact of aging as independent criteria for quality of erectile episodes. A total of 455 patients (ages 20–71 y) whose initial complaints were erectile dysfunction underwent two nights NPTR measurement with Rigiscan device. After analyzing the data, 353 men out of 455 were regarded as having normal NPTR recordings. The number of normal erectile episodes (erectile episode of penile tip rigidity greater than 60% more than 10 min duration), RAU Tip, RAU Base, TAU Tip, TAU Base, Average event rigidity of Tip (%), Average event rigidity of Base (%) and Duration of erectile episodes $\geq$60% minute were re-evaluated with regard to five age groups (group I: $<$30 y; group II: 30–39 y; group III: 40–49 y; group IV: 50–59 y; group V: $\geq$60 y). The mean values of erectile episodes in the age groups were as follows: group I, 2.46; group II, 2.28; group III, 2.40; group IV, 1.58; group V, 1.27. When we analyzed the groups between themselves, we observed statistically significant difference after the age of 50 y. The mean erectile episodes in patients younger than 50 y were 2.37 (s.d.: 1.50), whereas 1.49 (s.d.: 1.15) in patients older than 50 y ($P<0.001$). We also observed statistically significant difference at all of the above-mentioned NPTR parameters with regard to age. The results of our study showed that aging negatively influence quality of nocturnal erections especially after 50 y and we suggest that age needs to be taken into account in the diagnostic interpretation of NPTR testing.
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Introduction

Nocturnal penile tumescence (NPT) monitoring was the first objective test to diagnose erectile dysfunction (ED). NPT occurs in all healthy men during rapid eye movement (REM) sleep. Karacan *et al*[1] and Fisher *et al*[2] recognized its usefulness in evaluating male impotency in 1970. Monitoring is based on the assumption that nocturnal erections use the same neural and vascular pathways as sexually stimulated erections. In 1985, the Rigiscan device was introduced as an economical home-monitoring device that allowed men to be assessed in their normal surroundings.[3]

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However, since that time controversy remains about the diagnostic accuracy of the NPT evaluations. Informal normal criteria for the evaluation of Rigiscan values were initially provided by the manufacturer based on 500 men.[4] These criteria included three to six erectile episodes during 8 h of sleep, a change in circumference of at least 3 cm at the base and 2 cm at the tip of the penis and tip rigidity greater than 70% 10–15 min in duration. The latter criterion, known in the literature as the best erectile event, is most commonly used by clinicians to evaluate NPT readings.

The proposed normal criteria have been questioned by many investigators because data on the normal healthy population are limited. There have been several published studies looking for the correlation of Rigiscan values and final diagnosis of ED;[5] establishing a quantitative method to assess NPT rigidity recordings[6] and finally testing the reproducibility of evaluation criteria of NPTR readings[7] and the impact of sexual intercourse on those readings in young volunteers.[8] However, there is

still a considerable lack of normative data for NPTR and this makes the clinical value of the different parameters questionable.

In this study, we investigated the impact of aging as independent criteria for number of erectile episodes and whole NPTR data.

Materials and methods

Between 1997 and 2002, a total of 455 consecutive men who presented to our clinic for evaluation of ED underwent two nights NPTR measurement with Rigiscan device. Our clinical guideline for the evaluation of erectile dysfunction is as follows: sexual history, physical examination, analysis of serum glucose level and then at least two nights of NPTR testing. If this testing is abnormal, we continue evaluation with serum biochemical analyses including serum testosterone and prolactin levels, color flow Doppler ultrasonography of the penis and cavernosometry – cavernosography and neurological tests in selected cases. The Rigiscan monitoring device was applied on the patient's penis to record changes in penile tumescence and radial rigidity during the whole duration of each

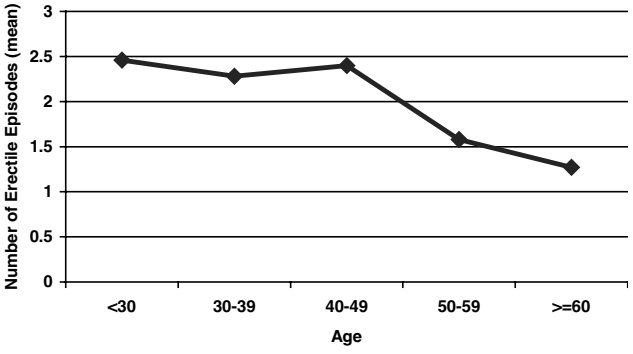

Figure 1 Mean number of erectile episodes with regard to age groups.

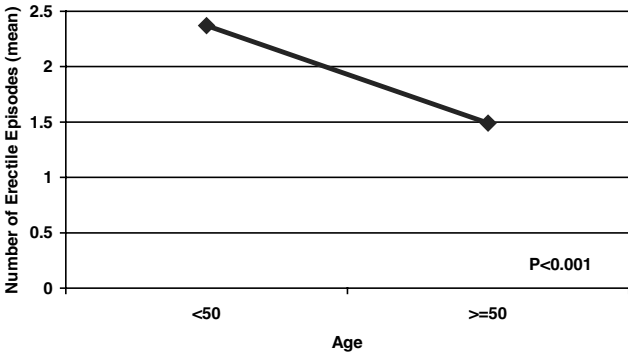

Figure 2 Mean number of erectile episodes with regard to 50 y cutoff.

Table 1 All NPTR parameters with regard to age groups

NPTR parameters	*< 30 y*		*30–39 y*		*40–49 y*		*50–59 y*		*≥ 60 y*	
	$\bar{X} \pm s.d.$	*Median (min–max)*	$\bar{X} \pm s.d.$	*Median (min–max)*	$\bar{X} \pm s.d.$	*Median (min–max)*	$\bar{X} \pm s.d.$	*Median (min–max)*	$\bar{X} \pm s.d.$	*Median (min–max)*
Number of erectile episodes	2.46±1.51	2 (1–4)	2.28±1.28	2 (1–3)	2.40±1.77	2 (1–4)	1.58±1.18	1 (1–3)	1.27±1.07	1 (1–2)
RAU Tip	71.4±32.5	74 (5–125)	45.4±26.9	45 (1–95)	55.11±28.5	55 (8–106)	13.9±11.7	10 (6–39)	9.8±9.5	7.5 (1–25)
RAU Base	78.0±32.7	79 (22–141)	55.5±28.3	51 (14–104)	57.3±29.6	54 (8–108)	15.3±11.0	15 (10–43)	11.6±8.7	10 (2–24)
TAU Tip	34.9±16.6	41 (3–53)	21.8±12.4	20 (1–53)	30.2±19.8	23 (3–63)	7.5±7.7	6 (4–27)	5±3.2	6 (1–9)
TAU Base	50±29.2	44 (9–115)	34.4±19.6	34 (4–88)	43.2±27.2	39 (6–96)	9.2±6.3	9 (4–22)	5±3.3	6 (1–9)
Average event rigidity of Tip (%)	55.1±21.7	61 (12–87)	49±18.3	50 (9–87)	54.5±17.3	56 (19–79)	26.3±21.9	20 (15–90)	27.8±11.0	26 (16–84)
Average event rigidity of Base (%)	62.3±15.6	65 (38–82)	63.8±16.0	64 (33–99)	59.7±18.0	61 (18–93)	33.4±23.4	30 (10–86)	30.5±12.4	30 (14–50)
Duration of erectile episodes ≥60% min	66.0±31.9	66 (10–110)	41.2±27.6	42 (12–100)	55.9±28.7	59 (10–104)	15.5±10.8	14 (10–36)	10±3.6	12 (10–18)

Kruskal–Wallis test; multiple comparison test.

Table 2 All NPTR parameters with regard to 50 y cutoff

NPTR parameters	*Age < 50 (n = 276) 78.2%*		*Age ≥ 50 (n = 77) 21.8%*		P-*value*
	$\bar{X} \pm s.d.$	*Median (min–max)*	$\bar{X} \pm s.d.$	*Median (min–max)*	
Number of erectile episodes	2.37 ± 1.50	2 (1–5)	1.49 ± 1.15	1 (1–3)	<0.001
RAU Tip	53.8 ± 29.9	52.5 (1–195)	12.9 ± 11.2	9.5 (10–39)	<0.001
RAU Base	60.9 ± 30.5	56.5 (8–141)	14.5 ± 10.5	14.5 (6–43)	<0.001
TAU Tip	27.1 ± 16.4	23 (8–63)	12.4 ± + 6.5	12 (9–27)	<0.001
TAU Base	40.2 ± 24.6	35 (4–115)	14.2 ± 6.0	14 (6–22)	<0.001
Average event rigidity of Tip (%)	51.9 ± 18.7	53 (9–87)	26.6 ± 19.7	23.5 (20–96)	<0.001
Average event rigidity of Base (%)	62.3 ± 16.3	63 (18–99)	32.6 ± 21.2	30 (10–86)	<0.001
Duration of erectile episodes ≥60% min	50.7 ± 30.2	51.5 (10–110)	18.8 ± 9.6	18 (10–36)	<0.001

Mann–whitney *U*-test.

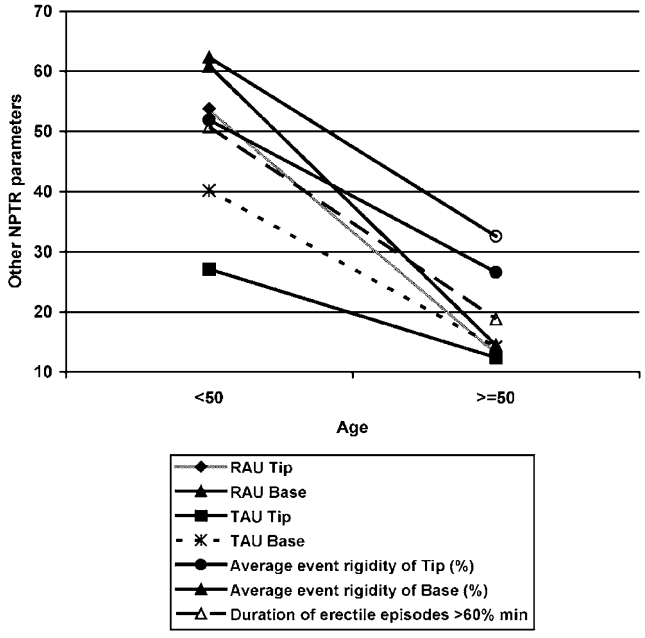

Figure 3 All NPTR parameters (other than number of erectile episodes) with regard to 50 y cutoff.

night. Patients were invited to go to bed at their usual time, at least 2 h after the end of a meal without the intake of any alcoholic and caffeine-containing beverages as well as any kind of medication. After each monitoring period all data were transferred to a personal computer, and data were analyzed with Rigiscan plus software version 4.0. The software recognizes an erectile event if there is a 20% increase in base loop circumference 3 min or more in duration. Sessions less than 5 h duration were excluded from further analyses. A normal result is defined as one nocturnal erection with a change in penile circumference of at least 3 cm at the base and 2 cm at the tip of the penis and a tip rigidity of at least 60% sustained for at least 10 min. After analyzing the data, 353 patients out of 455 were regarded as having normal NPTR recordings. Therefore, the study group comprised 353 patients (mean age: 47.1 y, range 20–71) with normal NPTR testing were re-evaluated with regard to five age groups: Group I, <30 y ($n = 81$; 22.9%); Group II, 30–39 y ($n = 116$; 32.9%); Group III, 40–49 y ($n = 79$; 22.4%); Group IV, 50–59 y ($n = 55$; 15.6%) and Group V, >60 y ($n = 22$; 6.2%).

Differences among five age groups for number of erectile episodes, RAU Tip, RAU Base, TAU Tip, TAU Base, Average event rigidity of Tip (%), Average event rigidity of Base (%) and Duration of erectile episodes ≥60% (min) were evaluated by Kruskal–Wallis variance analysis. When the *P*-value from the Kruskal–Wallis test statistics is statistically significant, multiple comparison test was used to know which groups differ from which others.

Differences between two age groups for number of erectile episodes, RAU Tip, RAU Base, TAU Tip, TAU Base, Average event rigidity of Tip (%), Average event rigidity of Base (%) and Duration of erectile episodes ≥60% (min) were evaluated by Mann–Whitney *U*-test (<50 and ≥50).

Results

The number of erectile episodes (mean) in age groups were as follows: Group I, 2.46; Group II, 2.28; Group III, 2.40; Group IV, 1.58; and Group IV, 1.27. (Figure 1). We observed statistically significant difference among these groups when we take the cut off age of 50 y. Mean erectile episodes of patients younger than 50 y were 2.37 (s.d.: 1.50), whereas 1.49 (s.d.: 1.15) at patients older than 50 y ($P < 0.001$) (Figure 2). The whole NPTR parameters were analyzed and summarized in Table 1. We again observed statistically significant difference among these groups when we take the cutoff age of 50 y (Table 2, Figure 3).

Discussion

Today several tests are available for evaluating men with ED.[9] Among these methods urologists can choose two pathways: either patients goal-directed approach or the so-called full evaluation. It is generally accepted that for every patient first level of investigations, medical and psychosexual history, physical examination and appropriate laboratory tests should be carried out. Further diagnostic testing is tailored to the treatment chosen by the patient. The second level of investigations generally starts with NPT testing. As an objective, noninvasive measure of erectile activity NPT can be considered as the gold standard study to differentiate between psychogenic and organic impotence.[10] It has also become an essential research tool for the objective assessment of various pharmacological therapies. On the other hand, the usefulness of NPT measurement has been questioned by various authors. The opponents of NPT testing maintain that sexually induced erections and sleep erections are not the same. Sexually induced erections are a combination of erotic and reflex erection activity, whereas the mechanism initiating and maintaining sleep erections is unknown. Nevertheless, the difference between sleep and sexually induced erections is primarily neurological; both erections involve the same vascular and penile structural components. Also NPTR testing may not be valid in men with depression, hypogonadism, sleep disorders and neurological disease. Recently, Hatzichristou *et al*[8] showed that sexual intercourse may suppress nocturnal erectile activity and speculate about the criteria used to determine NPTR recordings. They conclude that during two consecutive nights of recordings one erectile episode of penile tip rigidity greater than 60% and more than 10 min in duration may be associated with potency. However, they also stated that currently available evaluation criteria for NPTR testing should be revised especially in the elderly population.

Kinsey *et al*[11] were among the first to document a gradual decline in male sexual activity associated with age. Epidemiological and clinical evidence also has shown a higher prevalence of erectile impotence in aging men, but whether this reflects normal physiological changes or pathological conditions is unclear.[12] There have been remarkably few studies that have evaluated NPT in healthy aging men despite the frequent use of this method for the differential diagnosis of ED. There is evidence that there is a significant decrease in sleep efficiency associated with aging, but no differences in REM sleep.

Schiavi *et al*[13] showed that there was a significant age-related decrease in frequency and duration of nocturnal erectile episodes. In our study, we try to investigate this observation by using NTPR testing with RigiScan device since Schiavi *et al* did not use this method. To our knowledge, this is the first study carried out with Rigiscan device in this subject. Our results showed that aging negatively influence the number of nocturnal erections after 50 y of age, which we observed statistically significant difference. On the other hand, other than the number of nocturnal erections, we observed statistically significant difference among all NPTR parameters (RAU Tip, RAU Base, TAU Tip, TAU Base, Average event rigidity of Tip (%), Average event rigidity of Base (%) and Duration of erectile episodes $\geq 60\%$ (min)). We suggest that age needs to be taken into account in diagnostic interpretation of NPT and age-adjusted nomogram for NPTR might be useful for the evaluation of men with all ages. This will help clinicians for evaluating either young or elder men.

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