

Voiding Posture as a Novel Determinant of Postmicturition Dribble: Insights from a Nationwide Epidemiological Survey

Sadafumi Tomioka

Nagoya University

Yoshihisa Matsukawa

yamatsukawa@nagoya-u.jp

Nagoya University

Tsuyoshi Majima

Aichi Medical University

Kyosuke Hattori

Nagoya University

Yushi Naito

Nagoya University

Tomokazu Kimura

Nagoya University

Yoshiyuki Kojima

Fukushima Medical University

Noritoshi Sekido

Toho University Ohashi Medical Center

Takahiko Mitsui

University of Yamanashi Hospital

Naoya Masumori

Sapporo Medical University

Shusuke Akamatsu

Nagoya University

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Abstract

Purpose

To investigate factors associated with postmicturition dribble (PMD) across a wide age spectrum of men, with particular emphasis on behavioral and functional determinants beyond conventional mechanisms related to lower urinary tract symptoms (LUTS).

Methods

This was a subanalysis of a nationwide web-based epidemiological survey conducted by the Japanese Continence Society. Overall, 3,122 men aged 20–99 years were included. PMD was assessed using a standardized questionnaire, and demographic, clinical, lifestyle, and LUTS-related variables, including voiding posture and erectile dysfunction, were analyzed. Multivariable logistic regression analysis was performed to identify independent factors associated with PMD in the overall cohort and in men aged ≤ 50 years.

Results

PMD was reported by 467 (15.0%) men. Among 1,450 men aged ≤ 50 years, PMD was present in 12.8%, despite low prevalences of benign prostatic hyperplasia (2.3%) and overactive bladder (7.1%). In the overall cohort, older age, frailty, erectile dysfunction, intermittent urinary stream, and abdominal straining at the end of voiding were independently associated with PMD. Multivariable analysis showed that erectile dysfunction (adjusted odds ratio [OR]: 1.40, 95% confidence interval [CI]: 1.07–1.82) and frailty (adjusted OR: 1.76, 95% CI: 1.11–2.78) were significant non-LUTS-related factors associated with PMD. In men aged ≤ 50 years, sitting voiding posture (adjusted OR: 1.59, 95% CI: 1.04–2.45) emerged as an independent PMD predictor.

Conclusions

PMD is a common multifactorial condition that affects men across age groups. In younger men, PMD appears to be influenced not only by LUTS-related factors but also by behavioral factors, including voiding posture.

Introduction

Postmicturition dribble (PMD) is defined as involuntary urine leakage occurring immediately after completion of micturition, often resulting in persistent underwear dampness and considerable bother [1]. Although PMD is common in men and may impair health-related quality of life to a degree comparable to, or even greater than, other lower urinary tract symptoms (LUTS), it remains under-recognized in both

clinical practice and research. One reason for this is that PMD is not included in widely used symptom assessment tools for male LUTS, such as the International Prostate Symptom Score. As a result, epidemiological data on its prevalence and associated factors remain limited.

PMD has traditionally been regarded as a symptom related to aging, benign prostatic hyperplasia (BPH), or voiding dysfunction. Previous epidemiological studies conducted in Western and Asian populations have shown that PMD becomes more common with advancing age [2–6]. For example, Maserejian et al. reported an age-dependent increase in PMD prevalence, while also noting that approximately 10% of men in their 30s experienced the symptom [3]. These observations suggest that PMD cannot be explained solely by age-related prostatic enlargement or overt lower urinary tract dysfunction. However, most prior studies have been limited by relatively small sample sizes, regional populations, or incomplete adjustment for potential confounders. Consequently, the determinants of PMD, particularly those beyond conventional LUTS-related mechanisms, remain poorly understood.

In 2023, the Japanese Continence Society conducted a large-scale nationwide epidemiological survey of LUTS in the general adult population [7]. This dataset provided a unique opportunity to characterize PMD across a broad age range. The survey demonstrated not only an age-dependent increase in PMD prevalence, but also a surprisingly high prevalence among younger men. More than 20% of men in their 20s and 30s reported experiencing PMD at least once, and approximately 12% of men aged ≤ 50 years reported PMD at least once per week, despite their relatively low risk of clinically significant BPH or other age-related LUTS. These findings raise the possibility that behavioral, functional, or general health-related factors may contribute to PMD, particularly in younger men.

To date, few studies have comprehensively evaluated the multifactorial determinants of PMD, and to our knowledge, no large-scale population-based study has systematically examined a broad range of PMD-associated demographic, clinical, lifestyle, and functional factors. Therefore, the present study aimed to identify factors associated with PMD in Japanese men using data from a nationwide epidemiological survey, with particular emphasis on behavioral and non-LUTS-related factors. We also sought to clarify whether the factors associated with PMD differ between the overall male population and younger men, in whom classical age-related mechanisms are less likely to predominate.

Methods

Study design and participants

This study was a sub-analysis of a nationwide web-based epidemiological survey on LUTS conducted by the Japanese Continence Society. The survey targeted individuals aged 20–99 years who provided informed consent and responded independently to an online questionnaire. The study protocol was approved by the Board of Directors of the Japanese Continence Society and the institutional review board (IRB) of Nagoya University Graduate School of Medicine. (IRB approval number: 2025-0068)

Definition of PMD

PMD was assessed using the following question: “During the past month, have you experienced urine leakage after you finished urinating?” Participants who responded, “not at all” or “less than once per week,” were classified as the non-PMD group, whereas those who responded, “once or more per week,” “about once per day,” “several times per day,” or “always,” were classified as the PMD group.

Assessment of associated factors

To identify factors associated with PMD, associations between PMD status and participant characteristics, as well as other LUTS, were evaluated. The variables assessed included demographic, clinical, lifestyle, and LUTS-related factors. Because PMD was also observed in younger men with a relatively low prevalence of clinically significant LUTS, a separate subgroup analysis was performed in younger participants (men aged ≤ 50 years) to explore factors associated with PMD in this population.

The participant characteristics included age, frailty status, exercise habits, comorbid medical conditions (hypertension, dyslipidemia, and diabetes mellitus), fecal incontinence, alcohol consumption, smoking status, erectile function, and voiding posture (standing or sitting). LUTS-related variables included a weak urinary stream, an intermittent stream, straining during voiding (at initiation, during voiding, and at terminal voiding), and an overactive bladder (OAB). Frailty was defined as the presence of all three of the following conditions: unintentional weight loss of 2–3 kg within 6 months, decreased walking speed, and at least one fall within the past year [8]. Regular exercise was defined as engaging in physical activity at least once a week. Alcohol consumption was defined as drinking alcohol for at least half of the days in a week, and current smoking status was classified as a positive smoking history. Erectile dysfunction was defined as the persistent inability to achieve and/or maintain an erection sufficient for satisfactory sexual performance [9]. Each LUTS component was considered present if the symptoms occurred at least once per week. OAB was defined according to the Japanese diagnostic criteria [10], namely the occurrence of a urinary urgency episode at least once per week and a total Overactive Bladder Symptom Score of ≥ 3 .

Statistical analysis

Baseline characteristics were compared between participants with and without PMD. Categorical variables were analyzed using the chi-square test, and continuous variables were analyzed using the Student’s *t*-test or the Mann–Whitney *U* test, as appropriate. Univariable logistic regression analysis was performed to assess the associations between PMD and each clinical-, lifestyle-, and LUTS-related variable. Variables showing statistical significance in the univariable analysis or those considered clinically relevant were subsequently included in multivariable logistic regression models to identify independent risk factors for PMD. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were determined. Further, a subgroup analysis was conducted among younger participants without LUTS to explore PMD-specific risk factors independent of other LUTS. All statistical tests were two-sided, and a

p-value of < 0.05 was considered significant. Statistical analyses were performed using SPSS software version 31 (IBM Corporation, Armonk, NY, USA).

Results

Overall, 3,122 men were enrolled. The median age, body mass index (BMI), and performance status (PS) were 53 (range, 20–99) years, 22.9 (range, 10.2–34.8) kg/m², and 0 (range, 0–4), respectively. Information regarding medical comorbidities, alcohol consumption, smoking status, physical activity, and frailty is summarized in Table 1. BPH was observed in 234 (7.5%) patients, and PMD was identified in 467 (15.0%). The age-specific PMD prevalence is shown in Fig. 1. Although PMD prevalence increased with advancing age, the condition was also observed in approximately 12% of men aged ≤ 50 years.

Table 1
Baseline characteristics of the study population

Variable	n (%)
Hypertension	796 (25.5)
Dyslipidemia	383 (12.3)
Diabetes mellitus	325 (10.4)
Coronary artery disease	132 (4.2)
Heart failure	86 (2.8)
Chronic kidney disease	86 (2.8)
Cerebral hemorrhage / cerebral infarction	95 (3.0)
Neurological disorders	61 (2.0)
Spinal disorders	84 (2.7)
Obstructive sleep apnea syndrome (OSAS)	152 (4.9)
Benign prostatic hyperplasia	234 (7.5)
Constipation	270 (8.6)
Fecal incontinence	85 (2.7)
Depression / anxiety disorder	204 (6.5)
Insomnia	222 (7.1)
Alcohol consumption (yes)	1,590 (50.9)
Current smoking	727 (23.3)
Regular exercise (yes)	1,755 (56.2)
Frailty (present)	165 (5.3)
Erectile dysfunction (present)	763 (24.4)

The results of the univariable and multivariable analyses evaluating PMD-associated factors are presented in Table 2. The univariable analysis showed that patient-related factors, including older age, impaired PS, frailty, diabetes mellitus, hypertension, dyslipidemia, and erectile dysfunction, were significantly associated PMD. Regarding LUTS-related factors, a weak urinary stream, abdominal straining during voiding, and an OAB were also significantly associated with PMD. The multivariable analysis showed that older age, frailty, and erectile dysfunction were independently associated with PMD. Furthermore, an intermittent urinary stream and abdominal straining at the end of voiding were identified as independent PMD predictors.

Table 2
Univariable and multivariable analyses of factors associated with post-micturition dribble

	Univariate		Multivariate	
	p	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)
Age (per 1-year increase)	0.004	1.008 (1.003–1.014)		
PS (per one-grade increase)	< 0.001	1.42 (1.25–1.62)		
BMI (per 1 kg/m ² increase)	0.347	1.01 (0.99–1.02)		
Frailty	< 0.001	2.56 (1.77–3.67)	0.016	1.76 (1.11–2.78)
Regular exercise	0.129	1.17 (0.96–1.44)		
Hypertension	< 0.001	1.67 (1.35–2.08)		
Diabetes mellitus	< 0.001	2.07 (1.56–2.74)		
Dyslipidemia	< 0.001	1.79 (1.36–2.34)		
Fecal incontinence	< 0.001	4.91 (3.08–7.80)		
Alcohol consumption	0.016	1.28 (1.04–1.57)		
Smoking	0.953	1.01 (0.78–1.25)		
Erectile dysfunction	< 0.001	1.95 (1.57–2.42)	0.015	1.40 (1.07–1.82)
Voiding posture (sitting)	0.451	1.08 (0.88–1.33)		
Overactive bladder	< 0.001	5.88 (4.58–7.55)	< 0.001	2.53 (1.81–3.53)
Weak urinary stream	< 0.001	4.67 (3.79–5.77)	< 0.001	1.91 (1.41–2.61)
Intermittent stream	< 0.001	6.12 (4.91–7.62)	< 0.001	2.16 (1.58–2.96)
Straining (at initiation)	< 0.001	5.42 (4.32–6.81)		
Straining (during voiding)	< 0.001	5.76 (4.55–7.28)		
Straining (at terminal voiding)	< 0.001	7.07 (5.68–8.82)	< 0.001	3.40 (2.46–4.70)

Subsequently, a subgroup analysis was performed in men aged ≤ 50 years. This subgroup comprised 1,450 patients, with a median age and BMI of 38 (range, 20–50) years and 22.5 (range, 16.2–35.9) kg/m², respectively. Patient characteristics and LUTS-related variables are summarized in Table 3. PMD was present in 186 patients (12.8%), whereas the prevalences of BPH and OAB were low (2.3% and 7.1%, respectively); 847 (58.4%) reported a habitual sitting voiding posture. The factors associated with PMD in men aged ≤ 50 years are shown in Table 4. In the univariable analysis, similar to that in the overall cohort, patient-related factors such as impaired PS, frailty, diabetes mellitus, hypertension, dyslipidemia,

and erectile dysfunction were significantly associated with PMD. LUTS-related factors, including a weak urinary stream, abdominal straining during voiding, and an OAB, were also significantly associated with PMD. The multivariable analysis showed that an intermittent urinary stream and abdominal straining at the end of voiding remained independently associated with PMD. Notably, sitting voiding posture also emerged as an independent factor associated with PMD in this younger subgroup (adjusted odds OR 1.59, 95% CI 1.04–2.45).

Table 3
Baseline characteristics of men aged ≤ 50 years

Variable	n (%)
Post-micturition dribble (PMD)	186 (12.8)
Hypertension	150 (10.3)
Dyslipidemia	95 (6.6)
Diabetes mellitus	71 (4.9)
Coronary artery disease	36 (2.5)
Heart failure	39 (2.7)
Chronic kidney disease	31 (2.1)
Cerebral hemorrhage / cerebral infarction	27 (1.9)
Neurological disorders	30 (2.1)
Spinal disorders	28 (1.9)
Obstructive sleep apnea syndrome (OSAS)	65 (4.5)
Benign prostatic hyperplasia	34 (2.3)
Constipation	106 (7.3)
Fecal incontinence	29 (2.0)
Depression / anxiety disorder	129 (8.9)
Insomnia	111 (7.7)
Alcohol consumption (yes)	657 (45.3)
Current smoking	349 (24.1)
Regular exercise (yes)	791 (54.6)
Frailty (present)	89 (6.1)
Erectile dysfunction (present)	183 (12.6)
Overactive bladder (OAB)	103 (7.1)
Decreased urinary stream	169 (11.7)
Intermittent urinary stream	159 (11.0)
Abdominal straining at voiding (initiation)	156 (10.8)
Abdominal straining during voiding	110 (7.6)
Abdominal straining at terminal voiding	165 (11.4)

Table 4
Univariable and multivariable analyses of factors associated with post-micturition dribble in men aged ≤ 50 years

	Univariate		Multivariate	
	p	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)
Age (per 1-year increase)	0.893	1.00 (0.98–1.02)		
PS (per one-grade increase)	< 0.001	1.51 (1.27–1.80)		
BMI (per 1 kg/m ² increase)	0.177	1.02 (0.99–1.06)		
Frailty	< 0.001	3.09 (1.82–5.13)		
Regular exercise	0.238	1.21 (0.88–1.68)		
Hypertension	< 0.001	2.87 (1.87–4.35)		
Diabetes mellitus	< 0.001	5.73 (3.55–9.70)		
Dyslipidemia	< 0.001	3.96 (2.42–6.37)		
Fecal incontinence	< 0.001	14.22 (6.17–34.86)		
Alcohol consumption	0.009	1.51 (1.10–2.09)		
Smoking	0.462	1.15 (0.79–1.65)		
Erectile dysfunction	< 0.001	2.19 (1.57–3.05)		
Voiding posture (sitting)	0.215	1.24 (0.88–1.74)	0.041	1.56 (1.02–2.39)
Overactive bladder	< 0.001	9.23 (5.57–15.30)	0.025	2.31 (1.11–4.81)
Weak urinary stream	< 0.001	6.40 (4.38–9.33)		
Intermittent stream	< 0.001	7.16 (4.87–10.50)	0.017	1.98 (1.13–3.47)
Straining (at initiation)	< 0.001	7.96 (5.41–11.70)		
Straining (during voiding)	< 0.001	8.05 (5.20–12.45)		
Straining (at terminal voiding)	< 0.001	10.80 (7.39–15.84)	< 0.001	4.89 (2.92–8.19)

Discussion

This large-scale population-based study was aimed at investigating PMD-associated factors across a wide age spectrum of men, with a focus on behavioral and functional determinants beyond conventional LUTS-related mechanisms. We found that PMD is a common and clinically relevant symptom across a wide age spectrum, including a substantial proportion of younger men who are otherwise considered to

be at low risk for LUTS. While PMD showed expected associations with other LUTS, such as a weak urinary stream, intermittent stream, abdominal straining, and OAB, a novel finding of this study was that voiding posture, specifically sitting during voiding, and erectile dysfunction were independently associated with PMD. These findings suggest that PMD cannot be fully explained by traditional LUTS-related mechanisms alone and that behavioral or functional factors may play a significant role, particularly in younger populations.

PMD primarily results from urine trapping within the bulbar or prostatic urethra, which is more likely to occur in individuals with BPH or compromised urethral support structures [11, 12]. The findings of the present study are largely consistent with this established paradigm, because PMD was independently associated with abdominal straining at the end of voiding and an intermittent urinary stream, features indicative of impaired urethral emptying and dysfunctional voiding mechanics. However, an important observation in the present study was that PMD was prevalent even among younger men with low prevalences of BPH and OAB: 12–13% of men aged ≤ 50 years reported PMD. This finding challenges the traditional view that PMD is predominantly a consequence of prostatic or age-related pathology, and highlights the presence of alternative contributing factors in younger individuals. The identification of the sitting voiding posture as an independent risk factor for PMD in younger men is particularly noteworthy. To the best of our knowledge, this is the first large-scale epidemiological study to demonstrate a significant association between voiding posture and PMD.

Generally, voiding in the sitting position is considered beneficial for improving urinary flow and voiding efficiency; therefore, it is often assumed to reduce PMD likelihood. However, in the present study, an unexpected association was observed in younger men in whom sitting voiding was independently associated with a higher PMD prevalence. Therefore, although these findings should be interpreted cautiously, several plausible explanations must be considered. Previous systematic reviews evaluating the impact of voiding posture on urodynamic parameters have demonstrated that, in men with LUTS, sitting voiding is associated with improved voiding efficiency compared to standing voiding [13]. In contrast, in healthy men without significant LUTS, the voiding posture has minimal or no influence on key urodynamic measures, including maximum flow rate, post-void residual volume, and voiding time [14, 15]. In younger men without overt voiding dysfunction, sitting voiding may alter the configuration of the posterior and anterior urethra, potentially resulting in increased urethral axis angulation. Such anatomical changes could theoretically facilitate transient urine retention within the bulbar urethra, thereby predisposing individuals to PMD. Furthermore, sitting voiding may be associated with increased abdominal straining during the terminal micturition phase in some individuals, which could disrupt the coordinated control between detrusor contraction and urethral sphincter relaxation, thereby contributing to PMD development.

Another important observation in the present study is the consistent association between PMD and erectile dysfunction. This finding suggests that PMD may share common underlying pathophysiological mechanisms with erectile dysfunction, such as pelvic floor muscle dysfunction and impaired neuromuscular coordination [16]. From this perspective, PMD should not be regarded merely as a

subsidiary component of LUTS, but rather as part of a broader spectrum of male pelvic floor and genitourinary dysfunctions. Tadalafil, a phosphodiesterase type 5 inhibitor widely used for erectile dysfunction treatment, may also ameliorate PMD symptoms [17]. Although the precise mechanisms remain unclear, these observations suggest that the modulation of smooth muscle tone or pelvic floor function may represent novel therapeutic targets for PMD.

Importantly, our findings indicated that PMD is not exclusively attributable to lower urinary tract dysfunction secondary to BPH or OAB. Instead, it is frequently observed, even in younger men without overt LUTS, underscoring the need to reconsider its clinical positioning and underlying mechanisms [18]. In patients with PMD, evaluations should extend beyond conventional LUTS assessments to include sexual function and voiding posture. Furthermore, simple behavioral interventions, such as education regarding voiding techniques and pelvic floor muscle training, may represent effective low-risk strategies for symptom improvement and warrant consideration as first-line management options [19].

This study has some limitations. First, owing to its cross-sectional design, causal relationships could not be inferred, and reliance on self-reported data may have introduced recall and reporting biases. Second, objective assessments of the pelvic floor or lower urinary tract function were not available in this population-based survey. Furthermore, voiding posture was evaluated as a binary variable, and information regarding habitual versus situational voiding postures was not collected. Future prospective studies incorporating detailed symptom assessments together with objective evaluations, such as urodynamic testing, will be necessary to confirm these findings and clarify the mechanisms underlying PMD.

Conclusions

PMD is a common and multifactorial condition affecting men across all age groups. Although PMD is associated with conventional LUTS-related factors, our findings suggest that behavioral factors, particularly voiding posture, may also contribute to its occurrence in younger men. These results indicate that PMD cannot be explained solely by age-related lower urinary tract dysfunction and may require a broader, more individualized approach to assessment and management.

Declarations

Acknowledgments

This study was conducted as a society-initiated research project of the Japanese Continence Society. Data were collected following approval from the Ethics Committee of Nihon University School of Medicine (Approval No. 2023-04).

Data availability statement

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

The following is the specific contributions of all authors.

Tomioka: Acquisition of data, Data analysis, Data management, Manuscript writing

Matsukawa: Protocol/project development, Acquisition of data, Data analysis, Data management, Manuscript writing

Majima: Protocol/project development, Data analysis, Critical revision of the manuscript

Hattori: Data analysis

Naito: Data management

Kimura: Acquisition of data, Critical revision of the manuscript

Kojima: Critical revision of the manuscript

Sekido: Critical revision of the manuscript

Mitsui: Critical revision of the manuscript

Masumori: Critical revision of the manuscript

Akamatsu: Manuscript editing, Supervision

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Conflict of Interest

The authors have no conflicts of interest to declare.

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Figures

Figure 1.

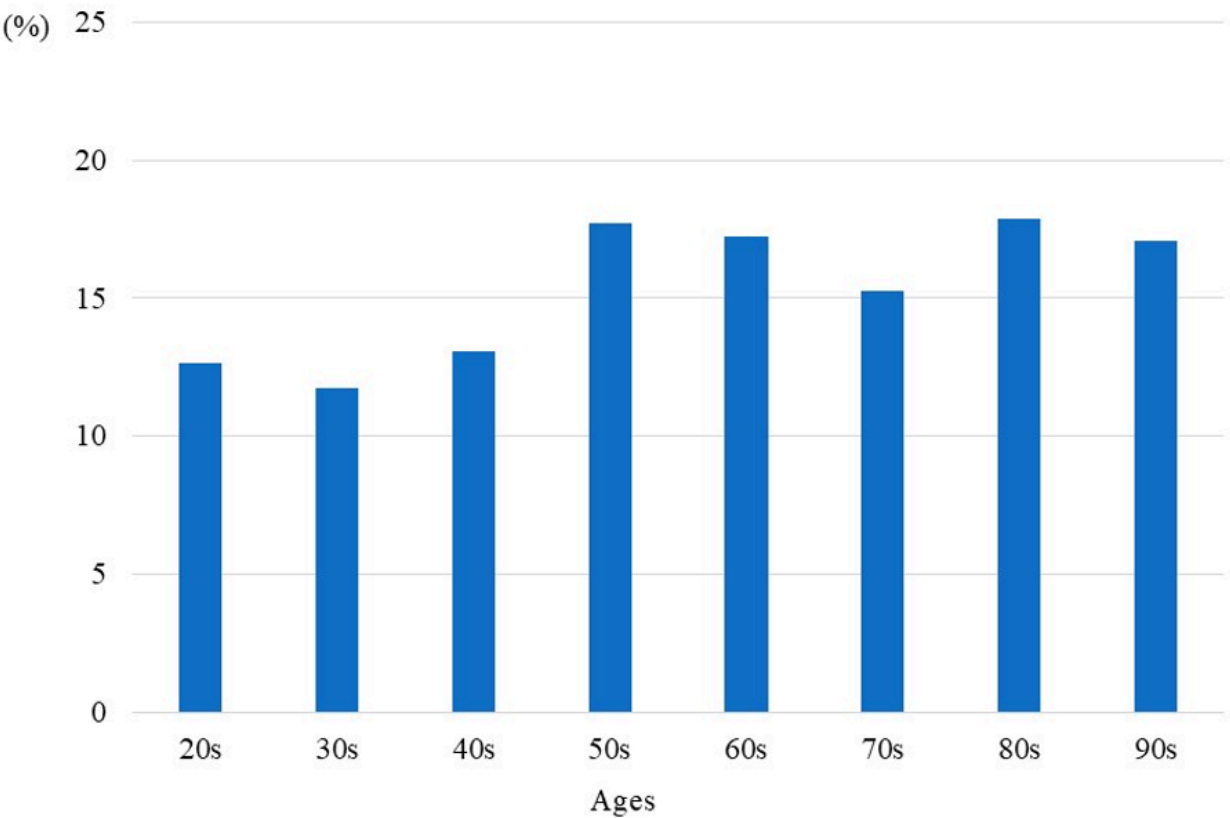


Figure 1

Prevalence of PMD by Age Group in Males