ORIGINAL ARTICLE

Prevalence of Symptomatic BPE Among Malaysian Men Aged 50 and Above Attending Screening During Prostate Health Awareness Campaign

G C Teh, FRCS, R M Sahabudin, MD, T C Lim, FRCS, W L Chong, FRCS, S Woo, FRCS, M Mohan, FRCS, A Khairullah, FRCS, P Abrams P, MD*, Institute of Urology, Kuala Lumpur Hospital, Malaysia, *Bristol Urological Institute, Southmead Hospital, Bristol, UK

Summary

Objective: To study the prevalence of symptomatic BPE among Malaysian men age 50 and above attending prostate health awareness campaign and to identify differences in prevalence between different ethnic groups residing within metropolitan Kuala Lumpur.

Materials and Methods: Demographic data and the completed International Prostate Symptom Score (IPSS), maximal uroflow rate (Qmax) and prostate size of volunteers, aged 50 and above, who attended the prostate health awareness campaign were analyzed. Subjects with known prostate diseases or prostate surgery, bladder disorders and neurological disorders were excluded.

Results: 2086 volunteers attended the campaign. 575 men fulfilled the inclusion criteria and their demographic data, IPSS; peak flow rate and prostate volume were analysed. Overall, 18.9% and 39.6% of the men were severely and moderately symptomatic, respectively. The prevalence of moderate to severe lower urinary tract symptoms (LUTS) in Malays, Chinese and Indians were 70%, 59% and 50% respectively ($p=0.004$). The commonest bothersome symptoms were nocturia (56%), frequency (50.4%) and sense of incomplete voiding (43.5%). The mean peak flow rate of the subjects was 15.4ml/s. 20.9% and 55.2% of the subjects had peak flow less than 10ml/sec and 15ml/sec respectively. The mean prostate size was 25.1cc. There is no significant difference in term of maximal flow rate and prostate size among Malays, Chinese and Indians in Malaysia. A good correlation was found between the total symptom score and the single disease-specific quality of life question ($r=0.69$, $p<0.001$). The correlation between IPSS and peak flow rate ($r=-0.22$, $p<0.001$) and prostate volume ($r=0.11$, $p=0.009$) was weak. There was no correlation between IPSS and age ($r=0.06$, $p=0.17$). The prevalence of symptomatic benign prostate enlargement (BPE) was 39.3%. The prevalence increased 8% per decade from 41.7% for men aged 50 to 59 to 65.4% for men aged 70 or more. There is no significant difference in prevalence of symptomatic BPE among the three ethnic groups. The Prevalence of BPO was 15.8%.

Conclusion: The correlation between symptom score, maximal flow rate and prostate size was poor and one cannot predict the value of one parameter by knowing one or more of the other parameters. There is a high prevalence of LUTS suggestive of benign prostatic obstruction in the apparently healthy Malaysian aged 50 and above attending the prostate health awareness campaign.

Key Words: BPE, Prevalence, Prostate size

Introduction

Ever since Garraway et al published their first population based study on prevalence of "BPH" in 1991[1], there have been quite a number of community-based study on the prevalence of this condition in the population. The majority of these studies were conducted in western countries. At the 4th International Consultation on Benign Prostatic Hyperplasia, the committee on epidemiology and natural history of benign prostatic hyperplasia has recommended community-based study on distribution of Lower Urinary Tract Symptoms (LUTS), prostate volume and maximum uroflow rate by age on each continent and for different racial groups be done[2].

In Asia, community based studies on LUTS have been conducted in Japan, Singapore and China[3,4,5]. Malaysia is a multiracial society, which provides a unique opportunity for comparison of prevalence of the disease in different races. It was believed that the prevalence of LUTS among elderly men in the community was high and many of these men considered the symptoms that they experienced were a normal phenomenon of aging. There has not been any study on the prevalence of LUTS and Benign prostatic enlargement in Malaysia.

The main objective of our prostate health awareness week was to educate our elderly male population that lower urinary symptoms are abnormal and that treatment is readily available. At the same time, we attempted to determine the prevalence of BPE among Malaysian men and to establish if there is any difference in prevalence of disease among the three major ethnic groups i.e. Malay, Chinese and Indian. There has been considerable discussions on definitions. We favour the use of the terms LUTS, BPH (for histology), BPE (for gland enlargement) and BPO(for obstruction)[6]. We prefer the used terms such as LUTS suggestive of BPO[7], symptomatic BPE and symptomatic BPO. It is generally accepted that symptoms score should not be the sole criteria in diagnosing BPO. Various authors had incorporated prostate size, Q max and presence of lower urinary tract symptoms in their definitions of "clinical BPH" and prevalence of "BPH".

Materials and Methods

We conducted a Prostate Health Awareness campaign from 3rd - 8th Aug 1998 at the urology clinic of Kuala Lumpur Hospital. All men of aged 50 and above were encouraged to attend the campaign. In order to create maximal public awareness, the campaign was announced in TV, radio and all the major newspapers in four languages. All the subjects who attended the clinic had their demographic data and relevant medical history taken. Serum prostatic specific antigen (PSA) was determined by using the Abbott (Asyxmm test). All of them were given International Prostate Symptoms Score (IPSS) questionnaire which include a single item question on quality of life (QoL) (Appendix 1) presented in three languages i.e. English, Mandarin and Bahasa Malaysia. The subjects were encouraged to answer the questionnaire by themselves; however, if they encountered any difficulty in understanding the questions, they were guided by a nurse or doctor. The subjects also underwent uroflow assessment using Dantec Urodyn 1000 flowmeter. The men were not

specifically asked to come to the clinic with a full bladder but were instructed to void only when the bladder was full. Post-void residual volume was then assessed using portable ultrasound BladderScan BVI 2500. Residual volume measured by this simple ultrasound machine had been shown to have good correlation with residual urine measured by catheterisation[8]. All the subjects were interviewed by a urologist or medical officer to clarify his urinary symptoms and to identify any significant medical history. Digital rectal examination was then performed to assess the symmetry and consistency of the prostate gland and presence of irregularity or nodularity. Subjects with odd registration number were offered transrectal ultrasonography (TRUS) to assess the prostate size. The orthogonal method (prostate volume = 0.52 x Length x Height x width) was used to calculate the volume of prostate[9].

The prostate was considered enlarged (BPE) if the volume was greater than 20cc. Severity of Lower Urinary Symptoms (LUTS) was classified into three categories according to the total I-PSS score (Mild symptom = total I-PSS 7 or less, moderate symptom = total I-PSS of 8 - 19, and severe symptom=total I-PSS of 20 - 35)[2].

A case of symptomatic BPE was defined as an individual whose prostate size was 20cc or more on transrectal ultrasonography with an IPSS score of 8 or more. A case of BPO was defined by presence of prostate volume of more than 20ml and Q max of less than 10ml/sec giving a prediction of bladder outlet obstruction in 90%[10].

Inclusion criteria

1. All volunteers who were of the age of 50 years or more.
2. Individuals who had completed the International Prostatic Symptoms Score (IPSS) Questionnaire, undergone transrectal ultrasound assessment of prostate volume and had their uroflow rate assessed (voided volume of at least 150cc) were included in the study.

Exclusion criteria

1. Subjects who were known to have prostatic diseases, bladder tumour, bladder stone, urethral stricture or trauma to the lower urinary tract
2. subjects who were taking anticholinergic or alpha blockers
3. Subjects with neurological disorders i. e. paraplegic, cerebrovascular accident and Parkinsonism.

Statistical analysis

Pearson product moment correlation coefficient was used to calculate the relations between age and prostate volume and Q max. Spearman's correlation coefficients (r) were used to evaluate the relations between total I-PSS and age, QoL score, prostate volume and Q max. Analysis of variance was used to analyze the difference of mean Q max and prostate volume between groups. Kruskal-Wallis test was used to compare I-PSS between groups. The level of statistical significance was set at p=0.05 (two-tailed)

Results

Demographic data

A total of 2086 men had attended the prostate health survey. The majority of them came from the federal capital and its suburbs. Of the 1043 subjects with odd registration number, 907 men agreed to have TRUS to assess their prostate size; whereas 136 subjects refused to have TRUS after digital rectal examination. Out of these 907 subjects, 32 were excluded because their age were less than 50, 7 cannot tolerate the procedure. 227 subjects were excluded because of voided volume of less than 150cc, 60 subjects had known prostatic diseases and 3 subjects were later proven to have ca prostate on prostatic biopsy. 578 men who fulfilled the inclusion criteria were to be included in this study. There were 150 Malay (27.6%), 195 Chinese (33.2%), 230 (39.2%) Indian and 3 other races. As the number of other races was too small, they were excluded

Table I
Subjects of Different Age Groups According to Race

Age (Years)	Malay (n=150)	Chinese (n=195)	Indian (n=230)	All (n=575)
50 - 59	58.0%	55.9%	49.1%	53.7%
60 - 69	36.0%	35.9%	45.2%	39.7%
70+	6.0%	8.2%	5.7%	6.6%

Table II
Mean, Median and Interquartile Ranges for IPSS by Age Category

		IPSS		
Age (Years)	No.	Mean(±SE)	Median	Interquartile Range
50 - 59	309	11.0(±0.5)	9.0	4.0 - 16.8
60 - 69	228	11.8(±0.6)	9.0	5.0 - 18.0
70+	38	11.3(±1.3)	11.0	5.0 - 14.0

p value 0.68

p values for the IPSS between age groups refers to the Kruskal-Wallis test

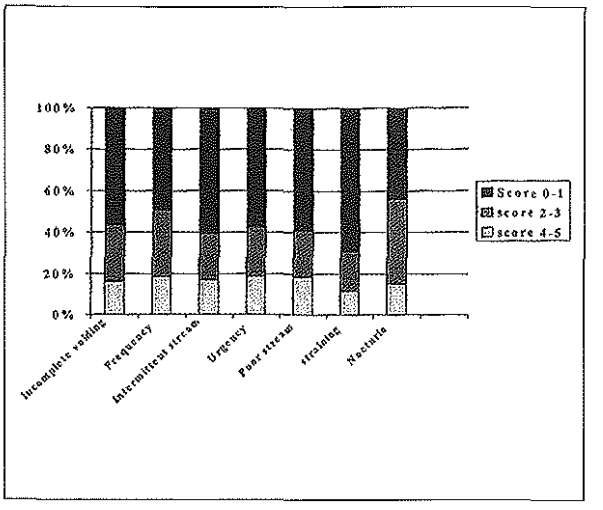

Fig. 1: Individual symptom score for 575 subjects.

Nocturia (56%) was the commonest symptom noted in the population; this was followed by frequency (50.4%), sense of incomplete voiding (43.5%), urgency (42.5%), poor stream.

from the study. The mean age was 59.3 (SD = 6.18, 95% CI = 58.8 to 59.8) years. The age distribution of the subjects according to race is shown in Table I. The mean age for Malay, Chinese and Indian were 58.5,59.5 and 59.7 years respectively (F ratio = 1.59, p = 0.19).

Symptom score and quality of life score

337 (58.6%) subjects had moderate to severe symptoms when assessed by IPSS questionnaire. 228 subjects (39.6%) had moderate symptoms whereas another 109 subjects (18.9%) had severe symptoms. Prevalence of moderate to severe LUTS increase from 48.2% at the 6th decade to 57.9% at the 7th decade and reached 64.1% at the 8th decade. The distribution of individual symptoms is shown in Fig. 1 and total symptoms score in three consecutive age groups is shown in Table II. We noticed little variation of proportion of subjects with moderate and severe symptoms in the different age groups. There was no correlation between age and IPSS (r =0.06 p = 0.17). However there was a statistical significant difference in the proportion of subjects with moderate to severe LUTS among the different races (Chi square = 15.46, DF = 4,p = 0.004). Malay has the highest prevalence of moderate to severe LUTS (70.0%), Chinese was in between (59.0%) and Indian has the lowest prevalence of (50.0%). Table III.

Table III
Distribution of IPSS According to Race

	IPSS		
	<8	8-19	20-35
Malay	30.0% (45)	47.3%(71)	22.7%(34)
Chinese	41.0% (80)	41.0%(80)	18.0%(35)
Indian	50.0%(115)	32.6%(75)	17.4%(40)

The distribution of QOL score of the 575 subjects is shown in Fig. 2. There was a strong correlation between Quality of Life score (QOL) and IPSS (r=0.69, 95% CI=0.64 to 0.73) which was highly significant (p<0.001).

Prostate Volume

The distribution of prostate volume of the 575 subjects is shown in Fig. 3.

The average prostate size was 25.1cc (SD=12.57, 95% CI=24.0 to 26.0) and the median prostate volume was 22.9ml. 358 (62.6%) subjects had prostate size greater than 20ml whereas 131 subjects had prostate gland greater than 30 ml.

The mean prostate volume for age group of 50-59, 60 - 69 and 70+ were 23.0, 27.0cc and 30.1cc respectively. There was a weak correlation between age and prostate volume (r = 0.16, p<0.001). The mean prostate volume for Malay, Chinese and Indian were 24.2cc, 26.3cc and 24.6cc respectively. This difference is not statistically significant (p = 0.37).

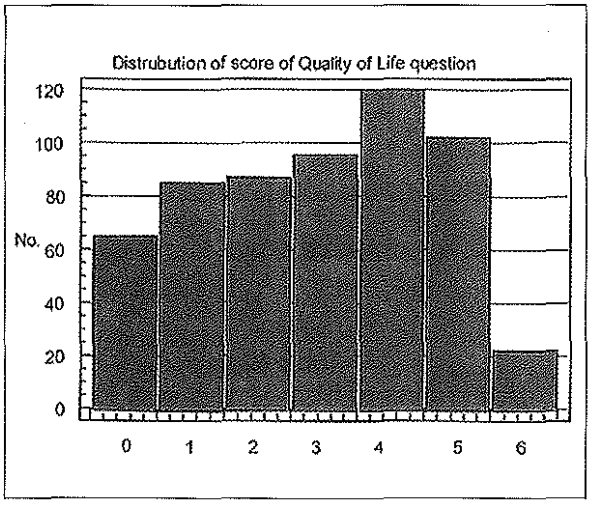

Fig. 2: Distribution of Quality of Life score of 575 subjects.

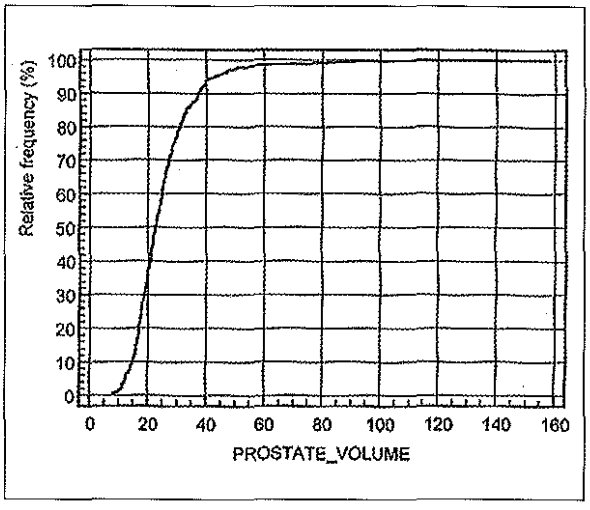

Fig. 3: Distribution of prostate volume of 575 subjects.

Median 22.9ml, 1st and 3rd quartile are 17.7 and 27.7ml

Urodynamic Parameter

The mean Qmax for the population was 15.4cc/sec (SD = 6.86, 95% CI = 14.8 to 15.9). 20.9% and 55.2% of the subjects had peak flow rate of less than 10cc/s and 15cc/s respectively. The peak flow rate were further classified into 3 categories less than 10cc/sec, 10 - 14.9cc/sec and 15cc/sec or more. The distribution of the peak flow rate according to race was shown in Table IV. There were 120 subjects (20.9%) with Qmax of less than 10cc per sec. There was no statistically significant difference in the distribution of Qmax in all the three races. The mean peak flow rates for Malay, Chinese and Indian were 15.1cc/s, 16.0cc/s and 15.0 cc/s respectively. There was a positive correlation between total voided volume and Qmax (r = 0.44, 95% CI = 0.37 to 0.50) which was statistically significant (p<0.0001). There was a negative correlation between Qmax and age (r= -0.17, p<0.0001). The mean Qmax for the age groups of 50 - 59,60 - 69 and 70+ were 16.1cc/s, 14.8cc/s and 12.4cc/s respectively. The difference was statistically significant (F-ratio = 6.33, p = 0.002). There was no correlation between residual volume and severity of sense of incomplete voiding (IPSS question 1) (r = 0.06,p = 0.12).

Table IV
Distribution of Subjects According to Peak Flow Rate

		Peak Flow Rate (cc/s)				
	No	**mean**	**SD**	**<10**	**10 - 14.9**	**15 or more**
All	575	15.4	6.86	20.9%(120)	34.3%(197)	44.9%(258)
Malay	150	15.1	7.23	27.3%(41)	30.7%(46)	42.0%(63)
Chinese	195	16.0	7.10	17.4%(34)	31.8%(62)	50.8%(99)
Indian	230	15.0	6.38	19.6%(45)	38.7%(89)	41.7%(96)

Chi square = 8.81, p=0.06

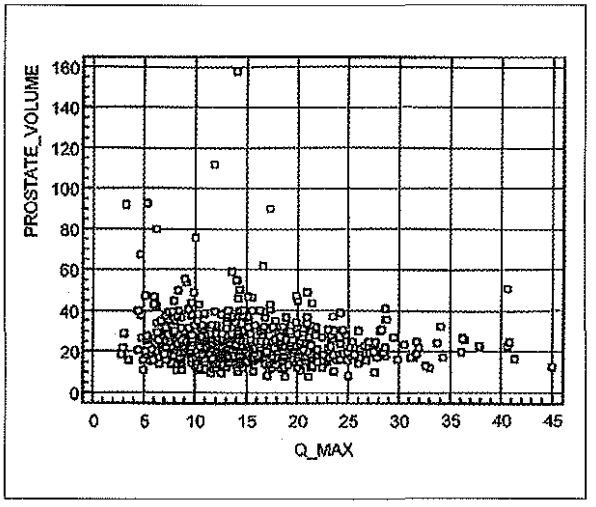

Fig 4: Relationship between prostate volume and maximal flow rate (Q max).
Correlation coefficient = -0.14, p<0.001

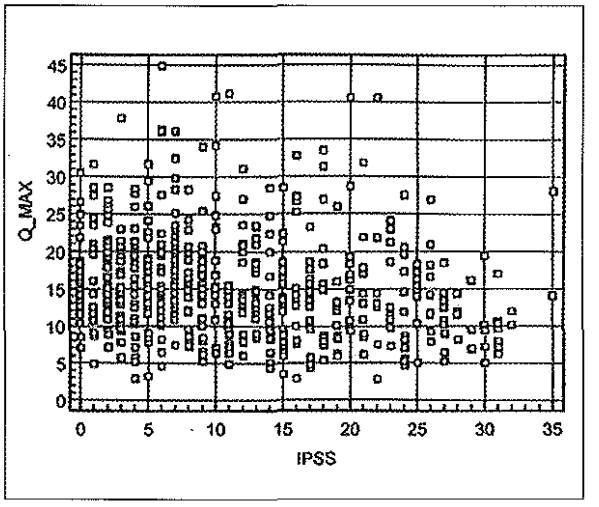

Fig. 5: Relationship between IPSS and Q max
Correlation coefficient =-0.224, p<0.05

Scatter graphs demonstrating the pairwise relationships of IPSS, prostate volume and Q max are shown in Fig. 4, 5 and 6. The correlation between prostate volume and IPSS (correlation coefficient = 0.109) was of similar magnitude to the inverse relationship between prostate volume and peak urinary flow rate (correlation coefficient = -0.14). The correlation between IPSS and Qmax was somewhat stronger (correlation coefficient = -0.22). All pairwise correlations were statistically significant ($p<0.05$).

Symptomatic BPE

358 subjects (62.3%) have prostate volume of more than 20ml. There were 226 (39.3%) who fulfilled the criteria of symptomatic BPE. The prevalence of symptomatic BPE for Malay, Chinese and Indian were 52.7%, 39.3% and 30.4% respectively Although there is a higher prevalence of symptomatic BPE among Malay as compared to Chinese and Indian, this has not reach statistical significance (p=0.052).

The mean age of subject with and without symptomatic BPE were 60.1 and 58.8 respectively. The difference was statistically significant

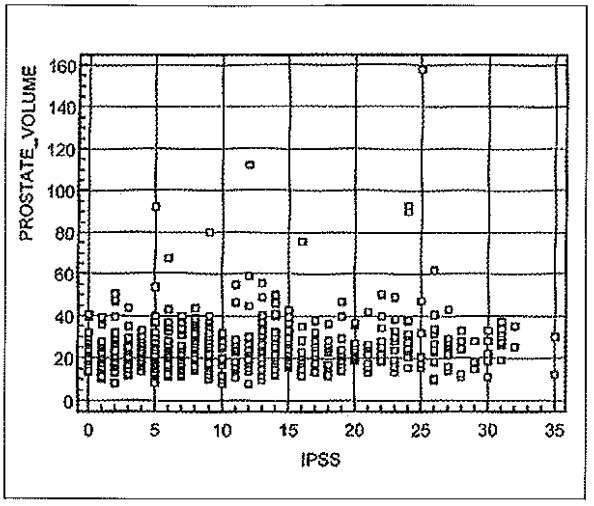

Fig. 6: Relationship between prostate volume and IPSS
Correlation coefficient = 0.109, p< 0.05

(t=2.488, p<0.01). The mean Qmax of the subjects with symptomatic BPE (13.84 ± 6.87ml/sec) was significantly (P<0.0001) lower than those without significant LUTS or BPE (16.34 ± 6.68ml/sec). The median QOL score of those with symptomatic BPE was 4 as compare to 2 for those without symptomatic BPE.

The proportion of subjects with symptomatic BPE for age group 50 - 59, 60 - 69 and 70 or more were 35.0% 43.0% and 52.6% respectively. The prevalence of symptomatic BPE increased 8% per decade, however this was not statistically significant (Chi square test X2 = 6.58 DF = 2,p = 0.06)

There were 91 subjects (15.8%) with BPO with a mean age of 61.2 years. 72 of them had moderate to severe LUTS (79.1%).

Discussion

The 3rd and 4th International Consultation on BPH had recommended community based study to be conducted in various geographical area and in different races to give a clearer global picture on the prevalence of this disease in the community. Although there had been quite a number of community-based studies on prevalence of BPE, there was no study on this subject in Malaysia. Malaysia is a multiracial community with Malay, Chinese and Indian being the three major ethnic groups which constitute more than 90% of the total population.; thus it provides a unique opportunity to study not only the prevalence of disease in the community but also to look at disease prevalence among the different ethnic groups within the same geographical area.

To understand better the frequency and distribution of BPE in the population there is a demand for a clinically relevant and valid case definition. Using histological criteria, Berry *et al.* showed that the prevalence of histological BPH in men at autopsy rises progressively with age and is present in 82% of men aged 71 - 80 years[11]. Confirmation of the high prevalence of "BPH" in the community was provided by the Baltimore Longitudinal Study of Aging[12]. By age 60 years, nearly 60% of men in this cohort had "clinical BPH". Age adjusted prevalence of "BPH" in community based study varies from 7.5% to 40% depends on the definition of "BPH" adopted by the authors and the sampling method of the population[1,13,14,15]. Garraway et al defined "BPH" as enlargement of the prostate gland of equivalent weight or more than 20gm in presence of symptoms and/or maximum flow or less than 15ml/s without evidence of malignancy[1]. In a study among Spanish men 40 years and older by Chicharro-Molero *et al*, "BPH" was defined as I-PSS greater than 7, maximum flow less than 15ml/s and a prostate size greater than 30 gm[13]. Similarly, in the series of Bosch *et al* from the Netherlands, "BPH" was defined based on symptoms, urinary flow and prostate size[15].

Berry *et al.* had observed in their collected autopsy series that men with no histological evidence of BPH had prostate glands weighing around 20gm plus or minus 6gm through all decennial age groups up to 71 - 80 years[11]. This finding along with the International prostate symptoms score and

uroflowmetry were used as a basis to try to establish a working definition of symptomatic BPE and symptomatic BPO. We define a case of symptomatic BPE as a subject who has prostate gland of more than 20cc with moderate to severe lower urinary tract symptoms (IPSS >7). A man with symptomatic BPO is defined as having I-PSS >7 and a Q max of less than 10ml/s. For men with a Q max of 10 -14.9ml/s the chance of obstruction is 67%[16]: these men if symptomatic fit well the International Consultation on BPH term-"LUTS suggestive of BPO"7.

The presence study is a volunteer based study. Like any other health campaign, it tends to attract volunteers who are either having bothersome symptoms, or had been diagnosed to have some forms of lower urinary tract disorders. We tried to minimized these biases by excluding subjects who have been diagnosed to have prostate diseases, other lower urinary tract disorders (bladder stones, neurogenic bladder) and conditions or medications that will cause similar lower urinary tract symptoms. We also excluded subjects with carcinoma of prostate by PSA, DRE and prostate biopsy if indicated.

With this limitation in mind, we expect the prevalence of disease will be somewhat higher than that of community based study but lower than study with its sample drawn from hospital clinics.

Symptoms and Quality of life score

There is a high prevalence of LUTS (58.6%) among Malaysian men age 50 and above in our study and this is comparable to a similar study done in Singapore by Tay KP *et al* in 199618 who reported prevalence of 67.6%. Despite having moderate to severe LUTS, these men never seek any medical advise about it. This is partly due to the fact that many elderly men consider presence of lower urinary symptoms as part of aging and do not seek medical advice until their symptoms become intolerable or develop acute retention of urine.

We did not observe any correlation between age and symptom score. There were significant differences in median symptoms score among the three races with the Malay having the highest median symptoms score of 13, follow by Chinese 9 and Indian 8 although there was no significant different in mean prostate size and mean peak uroflow rate among the three races. The lack of correlation between IPSS score and age suggests that LUTS may not be related to disease processes associated with aging.

A good correlation was found between the total symptom score and the single disease-specific quality of life question (QoL) that is included in the IPSS (r = 0.70). There was weak correlation (r = between the IPSS and total prostate volume and between the IPSS and physiological measures such as peak flow rate. The Correlation between symptoms and Qmax was equally low as reported by Garraway *et al*[1] and Bosch *et al*[14]. However the correlation we observed were lower than that reported in the Olmsted County's study, which reported correlation between prostate volume and IPSS as 0.185 and between IPSS and Qmax as -0.35[12]. This observation suggests that one cannot predict the presence of bladder outlet obstruction from the severity of LUTS or presence of prostate enlargement alone.

Uroflow rate

In the 4th consultation on BPH, flow rate recording has been identified as a reproducible way to quantify the strength of the urinary stream. It is recommended that treatment of "BPH" be based on at least two flow rate recording with volume of >150ml each. In the presence study, reading of uroflow was taken from a single measurement because of logistic problem. Abrams There was no significant difference in Qmax between the different races. There was a weak correlation between Qmax and prostate size. There is a negative correlation between peak flow rate with age. Peak flow rate decreases about 1.8cc/sec per decade after age of 50. Despite the

inherent weakness of the flow rate measurement in the presence study, the observation we obtained were comparable to those reported in the literature[21].

Prostate volume

Serial planimetry is the most accurate means of calculating the volume of the prostate[19]. However it is tedious and requires long examination time to draw serial circumference lines at each step. We adopted the orthogonal plane method to calculate the prostate volume based on the formula for volume of prolate ellipsoid because of the balance of convenience and accuracy although the volumes obtained by orthogonal method typically underestimates true volume by 10 - 30%[9]. The formula V = 0.52 x L x W x H is used. The correlation between prostate volume and age was 0.16 and was statistically significant (p = 0.0001). This was much higher than reported by Munekado Kojima et al (r = 0.07)[20]. The median prostate size in the population studied was 22.9ml is lower than that observed by Cynthia JG *et al*[1] in a community based study in America. The median prostate size reported in their study was 26.4ml.

Symptomatic BPE and BPO

The prevalence of symptomatic BPE (39.3%) and BPO (15.8%) in our study was comparable to those reported in the literature. The observed prevalence could be falsely high because of the inherent bias in sample selection. Health campaign tends to attract subjects who are either symptomatic or more health conscious thus lead to the high prevalence of symptomatic BPE in our study. Nevertheless, this study will provide an upper bound to the estimate of the true prevalence of the disease in the community.

Our study has some limitations. First, at the time the study was conducted, the IPSS score in the three local languages were not validated in the local community; this will to some degree limit its accuracy and validity in measuring the severity of LUTS in the population. We tried to minimize this shortcoming by using medical staffs of various races to help the subjects answering the questionnaire. Second, the volunteer-based nature of this study will tend to draw a sample which is more homogenous than expected in the general population. This biased sample could have resulted in a much smaller range of values for the IPSS being observed which lead to the low correlation between IPSS and age.

Conclusion

There is no significant difference in the prostate size, peak flow rate and prevalence of symptomatic BPE among all the three races in Malaysia. The correlation between age, prostate size, symptoms score and peak flow rate is weak. There is a modest correlation between Q max, IPSS and prostate volume. Quality of life score correlates well with the total symptoms score. There is a high prevalence of symptomatic BPE and BPO in the studied population and these individuals had never seek any medical advice about it. Thus we need to continue to educate the public, the elderly men in particular, that LUTS is not necessary part of the normal aging process rather it frequently signify presence of underlying bladder or prostatic pathology which is treatable. In order to determine the true prevalence of symptomatic BPE, BPO and its social and health impact, validation of the translated versions of IPSS questionnaire in local languages needs to be conducted first followed by community based study.

References

1. Garraway WM, Collins GN, Lee RJ. High prevalence of benign prostatic hypertrophy in the community. Lancet 1991; 338: 469-71.
2. Oishi K, Boyle P, Barry MJ *et al.* Epidemiology and Natural History of Benign Prostatic Hyperplasia. In Edited by Denis L, Griffiths K, Khoury S *et al* eds, Proceedings of 4th International Consultation on Benign Prostatic Hyperplasia 1997; 51.
3. Tsukamoto, T., Kumamoto, Y., Masumori, *et al.*: Prevalence of prostatism in Japanese men in a community-based study with comparison to a similar American study. J. Urol. 1995; 154: 391.
4. Homma Y, Kawabe K, Tsukamoto T, *et al*: Epidemiologic survey of lower urinary of tract symptoms in Asia and Australia using the international prostate symptom score. Int J Urol 1997; 4 (1): 40-6.
5. Tan HY, Choo WC, Archibald C and Esuvaranthan K : Community based study of prostatic symptoms in Singapore. J Urol 1997; 157(3): 890-3.
6. P. Abrams: New word for old: Lower urinary tract symptoms for "prostatism". BMJ 1994; 308: 929-30.
7. Dennis L, McConnell J, Yoshida O, *et al.* The evaluation and treatment of lower urinary tract symptoms (LUTS) suggestive of Benign Prostatic Obstruction. 4th International Consultation on BPH Recommendations of the International Scientific Committee 1997; 669-84.
8. Graham M, Coombes and Richard J, Millard. The accuracy of portable ultrasound scanning in the measurement of residual urine volume. J Urol 1994; 152: 2083-5.
9. Koyanagi T, Artibani W, Correa R *et al.* Initial diagnostic Evaluation of Men with Lower Urinary Tract Symptoms. In Dennis L, Griffiths K, Khoury S *et al* eds, Proceedings of 4th International Consultation on Benign Prostatic Hyperplasia 1997; 232-4.
10. Abrams P, Bruskewitz R, de la Rosette R *et al.* The diagnosis of Bladder Outlet Obstruction: Urodynamics. In A.T.K. Cockett, Khoury S, Aso Y *et al* eds, Proceedings of 3rd International Consultation on Benign Prostatic Hyperplasia 1995; 297-367.
11. Berry SJ, Coffey DS, Walsh PC, Ewing LL. The development of human benign prostatic hyperplasia with age. J Urol 1984; 132: 474-9.
12. Arrighi HM, Metter EJ, Guess HA, Fozzard JL. Natural history of benign prostatic hyperplasia and risk of prostatectomy, the Baltimore longitudinal study of aging. Urology 1991; Suppl. 35: 4-8.
13. Chicharro-Molero JA, Burgos-Rodriguez R, Sanchez-Cruz JJ, Del Rosal-samaniego JM, Rodero-Carcia P and rodriguex-Vellejo JM. Prevalence of Benign Prostatic Hyperplasia in Spanish men 40 years old or older. J. Urol. 1998; 159: 878-82.
14. Bosch JLHR, Hopn WCJ, Kirkels WJ and Schroder FH: The International Prostate Symptom Score in a community-based sample of men between 55 and 74 years of age: prevalence and correlation of symptoms with age, prostate volume, flow rate and residual urine volume. Br J Urol 1995; 75(5): 622-30.
15. Bosch JLHR, Hopn WCJ, Kirkels WJ and Schroder FH. Natural history of benign prostatic hyperplasia: appropriate case definition and estimation of its prevalence in the community. Urology 1995; 46: 34.
16. Mah P, Lim C, Abrams Z, Abrams P. Are urinary flow studies adequate for the investigation of older men with lower urinary tract symptoms. Proceedings of the 25th Annual ICS meeting, Sydney 1995.
17. Chute CG, Panser LA, Girman CJ, Oesterling JE, Guess HA, Jacobsen SJ, Lieber MM. The prevalence of Prostatism: a population-based survey of urinary symptoms. J Urol 1993; 150: 85.
18. Tay KP, Chin CM, Lim PH, Chang HC. Prostate screening - the Singapore experience. Int J Urol 1996; 3(2): 102-7.
19. Littrup JP, Williams CR, Egglin TK, Kane RA: Determination of prostate volume with transrectal US for cancer screening. Part II. Accuracy of in vitro and in vivo comparison of different methods. Radiology 1991; 179: 49-53.
20. Kojima M, Naya Y, Inoue W, *et al.* The American Urological Association Symptom Index for Benign Prostatic Hyperplasia as a function of age, volume and ultrasonic appearance of the prostate. J Urol 1997; 157(6): 2160-5.
21. Cynthia JG, Steven JJ, *et al.* Natural History of Prostatism: Relationship among symptoms, prostate volume and peak urinary flow rate. J Urol 1995; 153(5): 1510-5.