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An investigation into the relationship between prostate size, peak urinary flow rate and male erectile dysfunction

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This study sought to identify whether a true relationship exists between benign prostatatic hyperplasia (BPH) and erectile dysfunction (ED). In a community-based study, 427 men underwent transrectal ultrasound (TRUS), uroflow studies and a questionnaire concerning erectile function. ED had a significant correlation to age ($r = 0.19$, $P < 0.001$). But comparisons of prostate volume and analysis of maximum flow rate showed no significant difference between three erectile functional groups; ranging from no ED to complete ED, (one way analysis of variance). However when these two parameters were correlated to age a significant association was found to exist (log prostate volume; $r = 0.26$, $P < 0.001$, log maximum flow rate; $r = -0.13$, $P = 0.02$). Prostate size and uroflow studies show no correlation with ED, but ED and BPH had a significant correlation with ageing. This makes a direct association between male ED and BPH unlikely but supports the theory that the association between the two pathologies could be due instead to the common link of ageing. *International Journal of Impotence Research* (2001) **13,** 322–325.

Keywords: BPH; erectile dysfunction; flow rate; prostate volume

Introduction

In the last few years various authors have raised the suggestion of a relationship between benign prostatic hyperplasia (BPH) and male erectile dysfunction (ED).[1–3] This work has ranged from epidemiological studies[4] to discovering structural changes in animal models.[5] Nevertheless it is still difficult to confirm an association between the two conditions. This is not surprising as it is not easy to prove causation of a single disease let alone to confirm a link between two disease processes. Added to this are the additional intricacies that the pathophysiology of BPH has still not been elucidated completely and that of ED is often multifactorial.

As both conditions also have strong associations with ageing we sought to identify if a real relationship exists between BPH and ED or whether ageing could be the common link between the two.

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Materials and methods

Men aged between 55 and 70 y were identified from the patient lists in 11 GP clinics. They were invited by personalised letter to attend a community clinic for a health check primarily to investigate prostate disease. Volunteers who decided to attend the clinic underwent a structured interview using a standardised questionnaire. Questions included the patient's age, ethnicity, marital status, religion, occupation, detailed alcohol and smoking history, personal medical history (including drug history), family medical history, fertility and subjective state of erectile function. In this the attendee was asked to grade whether he was always able to attain a penile erection sufficient for satisfactory sexual activity (no ED), whether he was never able (complete ED) or whether he fell between the two criteria (intermediate). Venesection was performed to assess the serum prostate specific antigen (PSA) level using the Hybritech Tandem R ImmunoRadioMetric Assay. Digital rectal examination (DRE) was performed by an urologist. If the DRE was abnormal or the serum PSA greater than 4.0 ng/ml the volunteer was selected for further investigation of prostatic disease. These included an urinary flow rate studies and transrectal ultrasound (TRUS) prostate volume measurement using a Bruel and Kjaer 1846 ultrasound unit with a 7 MHz multiplanar probe. The

prostate was measured using the calibration and measurement software provided, which is based on the prolate ellipse calculation proposed by Lee *et al*.[6] The results of the prostatic volume and urinary flow rates were converted to the log value to correct for skewed distribution and analysed using logistic regression and variance analysis software from the Statistical Package for the Social Sciences program (SPSS Inc, Chicago, IL, USA).

Results

Of 4060 men who were invited, 2064 attended the clinics and 2002 men answered all the questions included in this survey (97% response rate of attendees). Married men made up 87% of the group. Complete ED, defined as the complete inability to achieve an erection, occurred in 265 men (13.2%) and had a significant correlation with ageing ($r=0.19$, $P<0.001$). There was no difference in ED rate depending on whether an abnormal serum PSA value or a normal serum PSA was found (comparison of variance, $P=0.732$). In the 404 men, who had undergone TRUS, prostate volume was found to correlate significantly to age (log prostate volume; $r=0.26$, $P<0.001$, see Figure 1). In the 325 men who provided representative urinary flow rates, with voided volumes of over 150 ml, the maximum urinary flow rate had a significant inverse correlation to ageing (log maximum flow rate $r=-0.13$, $P=0.02$, see Figure 2).

When an analysis of the prostate volume and urinary flow rate were made with reference to ED, the log prostate volume showed no significant difference between the three groups of erectile function (one way analysis of variance, $P<0.75$, see Figure 3) and the analysis of maximum flow rates also showed no significant difference between the three groups ($P<0.69$, see Figure 4).

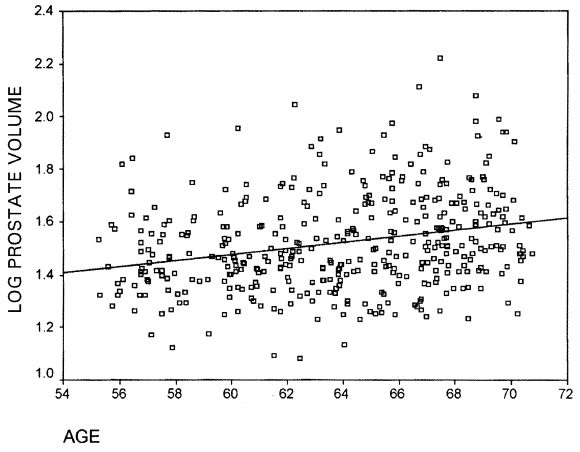

Figure 1 Demonstrating the significant correlation between log prostate volume to age ($r=0.26$, $P<0.001$).

Discussion

Treatments for prostatic disease have been implicated in the causation of ED.[7–9] However, many men develop ED during the progress of their lower urinary tract symptoms, before such treatment and this has lead to the suggestion of a relationship between the two conditions.

This study set out to identify, if any association exists between ED and BPH by measuring prostate size using TRUS. Urinary flow rates were also performed, as Diokno *et al* found an interrupted urinary stream to be strongly associated with

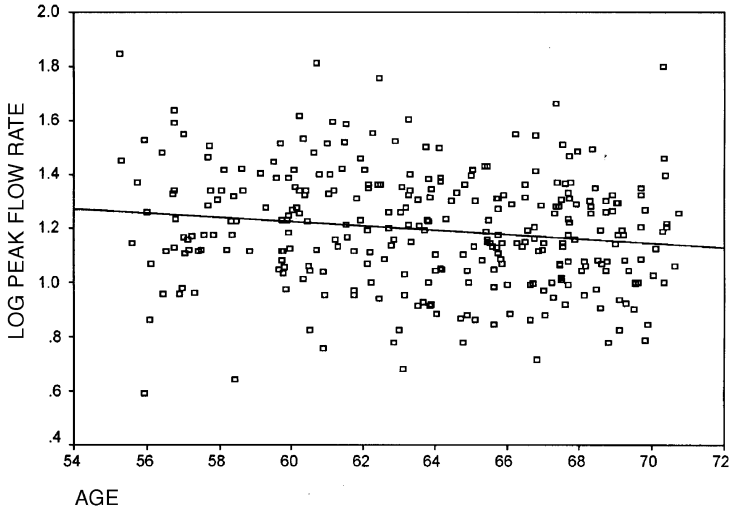

Figure 2 Demonstrating the significant inverse correlation of log maximum urinary flow rate to age ($r=0.13$, $P<0.02$).

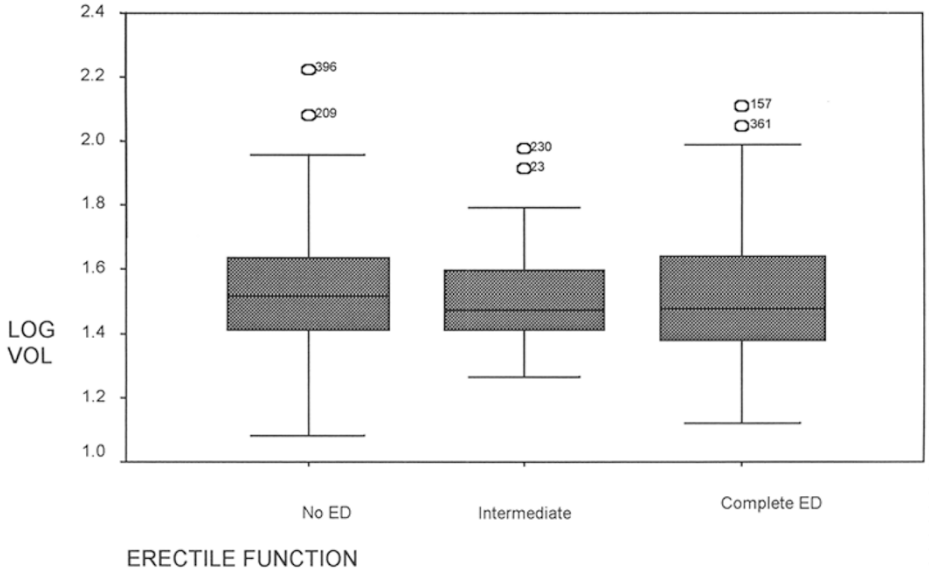

Figure 3 Analysis of variance showing no significant difference ($P < 0.75$) between log prostate volume and the three grades of erectile function.

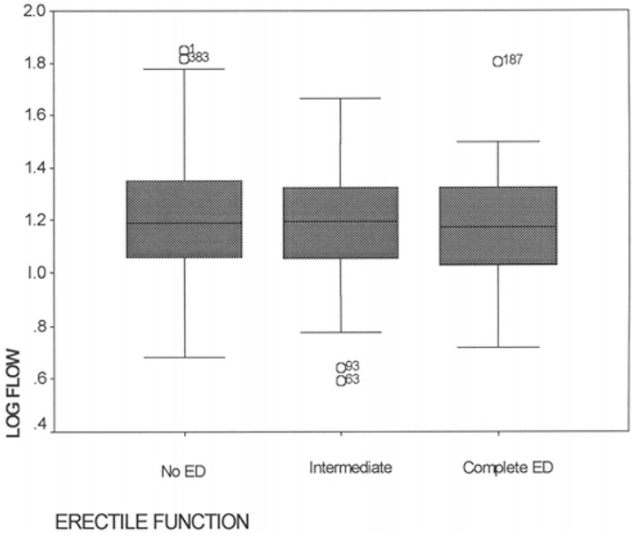

Figure 4 Analysis of variance showing no significant difference ($P < 0.69$) between maximum urinary flow rate and the three grades of erectile function.

impotence.[10] On analysing both these parameters we were unable to identify any direct relationship to ED.

Increase in age was significantly correlated to prostatic enlargement and decreased urinary flow rates. This is predictable as adenoma formation in the prostate is known to increase with age[11] and lower urinary tract symptoms (LUTS) suggestive of outflow obstruction due to prostatic enlargement similarly increase with ageing.[12] Age was the most strongly associated variable to ED in this and many other studies.[10,13] This could be due to a variety of reasons. Diseases commonly leading to ED such as arteriosclerosis and diabetes have a much higher incidence in the elderly population.[14,15] The use of medications increases with age and these can be the cause of ED in up to 25% of patients.[16] Endocrine, psychological and social factors could also play a part.[17,18] There appeared to be no skewing of data due to the method of referral for further assessment as the distribution of ED in those with normal and abnormal serum PSA values was similar.

No attempt was made in our study to use symptoms scores and correlate these with ED. This is because instruments such as the International Prostate Symptom (IPS) score or the American Urological Association (AUA) symptom index cannot establish the diagnosis of BPH as other urinary disorders can also generate high IPS scores.[19] Investigators have also demonstrated poor correlation to prostate size[20] and pressure flow urodynamics[21] so our study instead used TRUS measurement of prostate size and maximum urinary flow rate, mindful of the fact that epidemiological and clinical studies have demonstrated that the relationship between prostatic size and lower urinary tract symptoms is not completely linear.[19]

Other investigators have used symptom scores in the investigation of BPH and ED. The PREDICT study of 1098 men found a significant relationship between the IPS scores and ED.[4] But on closer examination of the data, the only areas of significance were completing an erection and satisfaction. Important areas of sexual function such as gaining interest, deriving the sexual act and keeping an erection showed no correlation to the IPS scores and

were unaffected by increasing LUTS. Namasivayam *et al*,[3] in a smaller study of 140 men, confirmed this when they found no correlation between MED and the IPS scores, in categories concerning sex drive and quality of erection.

In addition to the difficulty of using symptom scores to identify BPH there is the compounding fact that often no action is taken to control for effect of age in these studies. Of the researchers mentioned above, the PREDICT investigators were the only group to take this into account in the analysis and show that their findings were independent of age.[4]

Further research in this field should include this in the data analysis as ageing has the strongest association with both conditions and therefore must be controlled before any lesser associations can be said to truly exist.

Urinary symptoms secondary to BPH may be associated with poor sexual function as a result of sleep disturbance or psychological anxiety. But evidence for this is scarce. Researchers from Leeds did find that scores from an impact index for BPH (BPHII) correlated significantly, but weakly, with all aspects of sexual function.[3]

However Pearlman and Kobashi[22] questioned 2800 patients and found that that the frequency of intercourse remains unaffected by the presence of BPH and other studies also found no association with the two conditions. Malatinsky *et al* found that 15% of men with BPH cease having sexual intercourse[23] which corresponds to the expected ED in this age group.[13] And Bowers *et al*, from a contrary viewpoint, found no difference in urological symptoms in potent and impotent men.[24] Our study also found no direct link between abnormal urinary flow rates or increasing prostate size and ED. But instead supports the theory that ageing is the common factor linking ED and BPH. .

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