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Review

Epidemiology of clinical benign prostatic hyperplasia

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Abstract Clinical benign prostatic hyperplasia (BPH) is one of the most common diseases in ageing men and the most common cause of lower urinary tract symptoms (LUTS). The prevalence of BPH increases after the age of 40 years, with a prevalence of 8%–60% at age 90 years. Some data have suggested that there is decreased risk among the Asians compared to the western white population. Genetics, diet and life style may play a role here. Recent reports suggest the strong relationship of clinical BPH with metabolic syndrome and erectile dysfunction, as well as the possible role of inflammation as a cause of the prostatic hyperplasia. Lifestyle changes including exercise and diet are important strategies in controlling this common ailment.

1. Introduction

Clinical benign prostatic hyperplasia (BPH) is one of the most common diseases in ageing men which can lead to lower urinary tract symptoms (LUTS). The relation between clinical BPH and LUTS is complex, because not all men with clinical BPH develop LUTS and not all men with LUTS have clinical BPH.

Hence, a better strategy to prevent and delay the onset and development of clinical BPH is to understand the epidemiology of the disease and possible control of the disease in the population.

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2. Prevalence of BPH

2.1. Age

The prevalence of BPH rises markedly with increased age. Autopsy studies have observed a histological prevalence of 8%, 50%, and 80% in the 4th, 6th, and 9th decades of life, respectively [1]. Observational studies from Europe, US, and Asia have also demonstrated older age to be a risk factor for clinical BPH onset and progression [2–4]. Furthermore the prostate volume increases with age based on data from the Krimpen and Baltimore Longitudinal Study of Aging suggesting a prostate growth rate of 2.0%–2.5% per year in older men [5,6]. Continued prostate growth is a risk factor for LUTS progression and larger prostates are associated with benign prostatic enlargement (BPE) and

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increased risks of clinical BPH progression, urinary retention and need for prostate surgery [7].

2.2. Race

No clear patterns have emerged with respect to BPH risk and race. Observational studies comparing black, Asian and white men have produced variable results. Studies of black men in the US have observed an increased prostate transition zone and total volume compared with white men [8,9]. Large analyses of the US Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial and the Health Professionals Follow-Up Study observed no differences in clinical BPH risk between black and white men. Some data have suggested a decreased risk of clinical BPH in Asian compared with white men [10].

2.3. Genetics

Evidence suggests a strong genetic component to BPH. A case control analysis, in which men below 64 years underwent surgery for BPH, noted that male relatives and brothers had a 4-fold and 6-fold increase, respectively of age-specific risks for BPH surgery [11]. These investigators further estimated that 50% of men below 60 years undergoing surgery for BPH had a heritable form of disease. In a subsequent study, they observed that heritable disease was associated with larger prostate volume and younger age of onset compared with sporadic BPH [12]. These and other findings suggest an autosomal dominant pattern of inheritance [13].

2.4. Lifestyle

It has increasingly been observed that modifiable lifestyle factors substantially influence the natural history of BPH.

2.4.1. Diet

There are some indications that both macronutrients and micronutrients may affect the risk of BPH although the patterns are inconsistent. For macronutrients, increased total energy intake, energy-adjusted total protein intake, red meat, fat, milk and dairy products, cereals, bread, poultry and starch all potentially increase the risks of clinical BPH and BPH surgery, while vegetables, fruits, polyunsaturated fatty acids, linoleic acid and vitamin D potentially decrease the risk of BPH [14,15]. With respect to micronutrients, higher circulating concentrations of vitamin E, lycopene, selenium and carotene have been inversely associated with BPH. Zinc has been associated with both increased and decreased risk [14–16].

2.4.2. Physical activity

Increased physical activity and exercise have been consistently linked to decreased risks of BPH surgery, clinical BPH, histological BPH and LUTS [14,17]. A meta-analysis of 11 published studies ($n = 43\,083$) indicated that moderate-to-vigorous physical activity reduced the risk of BPH by as much as 25% relative to a sedentary lifestyle, with the magnitude of the protective effect increasing with higher levels of activity [18].

2.4.3. Alcohol

Like exercise, moderate alcohol intake also appears to be protective against multiple outcomes related to BPH. A meta-analysis of 19 published studies ($n = 120\,091$) observed up to a 35% decreased likelihood of BPH among men who drank daily [19].

3. Metabolic syndrome

3.1. Obesity

Studies have consistently observed that increased adiposity is positively associated with prostate volume—the greater the amount of adiposity, the greater the prostate volume. Body weight, body mass index (BMI), and waist circumference have all been positively associated with prostate volume in multiple different study populations [20–22]. In the Baltimore Longitudinal Study of Aging, each 1 kg/m^2 increase in BMI corresponded to a 0.41 mL increase in prostate volume and obese participants (BMI > 35 kg/m^2) had a 3.5-fold increased risk of prostate enlargement compared to non-obese (BMI < 25 kg/m^2) participants [20]. Epidemiological evidence also demonstrates that obesity increases the risks of BPH surgery, urinary symptom progression and initiation of BPH medical therapy [23,24].

3.2. Diabetes and disruptions in glucose homeostasis

Physician-diagnosed diabetes, increased serum insulin and elevated fasting plasma glucose have been associated with increased prostate size and increased risk of prostate enlargement, clinical BPH and BPH surgery [14,25,26].

3.3. Lipids

There are relatively little data on potential associations between lipids and BPH. Some studies have shown positive associations while others did not find any association between them [14,18].

4. Erectile dysfunction

There is overwhelming evidence to support that erectile dysfunction (ED) and LUTS are related [27–30]. Common underlying pathophysiology between these two conditions have been hypothesized but there is no indication that one condition precedes the other [31].

5. Inflammation

It is likely that inflammation plays a role in the development and progression of BPH as evidenced by the strong links between BPH and histological inflammation in specimens obtained from prostate biopsies and BPH surgery. Furthermore, inflammatory cytokines are over-expressed in BPH tissues [32–34]. The underlying causes of prostatic inflammation remains unclear although there are several hypotheses: 1) response to tissue damage because of

infection, 2) autoimmune response, 3) obesity and abdominal fat, because of excess production of inflammatory cytokines from adipose tissue.

Inflammation has been implicated as a primary stimulus for prostate carcinogenesis and it is possible that BPH represents a non-malignant pathway of unregulated prostate growth promoted by oxidative stress, inflammatory mediators and insulin growth factors.

It would be reasonable to hypothesize then, that inhibition of inflammatory pathways would potentially attenuate BPH risk. In the Olmsted cohort, men who reported daily non-steroidal anti-inflammatory drug (NSAID) or statin use had significantly decreased risks of both low urinary flow rate and prostate volume enlargement [35,36]. However, use of NSAIDs was not associated with decreased risk of clinical BPH in other large cohorts [37,38].

As inflammation is thought to be involved in the pathogenesis of LUTS, the presence of inflammatory markers may be used as objective risk factors for LUTS. This was demonstrated by Choi et al. [39], who found significantly greater high-sensitivity C-reactive protein (hsCRP) levels in men with moderate to severe LUTS than in men with mild or no LUTS. However, in their study of men from a urology clinic, Chang et al. did not find a relationship between hsCRP and LUTS, leaving the usefulness of hsCRP open to debate [40].

6. Conclusion

With a changing demographic profile and an increasingly ageing population in almost all societies, it is inevitable that this disorder will become even more prevalent and a major challenge for all health care systems in the future. Apart from medications, one important strategy is advice on exercise and diet, encouraging the patient to self-manage his disease. This may help to reduce the need for surgery with its many possible side effects and long term recurrence.

Conflicts of interest

The author declares no conflict of interest.

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References

[1] Berry SJ, Coffey DS, Walsh PC, Ewing LL. The development of human benign prostatic hyperplasia with age. J Urol 1984;132:474—9.
[2] Guess HA, Arrighi HM, Metter EJ, Fozard JL. Cumulative prevalence of prostatism matches the autopsy prevalence of benign prostatic hyperplasia. Prostate 1990;17:241—6.
[3] Kok ET, Schouten BW, Bohnen AM, Groeneveld FP, Thomas S, Bosch JL. Risk factors for lower urinary tract symptoms suggestive of benign prostatic hyperplasia in a community based population of healthy aging men: the Krimpen Study. J Urol 2009;181:710—6.
[4] Taylor BC, Wilt TJ, Fink HA, Lambert LC, Marshall LM, Hoffman AR, et al. Prevalence, severity, and health correlates of lower urinary tract symptoms among older men: the MrOS study. Urology 2006;68:804—9.
[5] Bosch JL, Tilling K, Bohnen AM, Bangma CH, Donovan JL. Establishing normal reference ranges for prostate volume change with age in the population-based Krimpen-study: prediction of future prostate volume in individual men. Prostate 2007;67:1816—24.
[6] Loeb S, Kettermann A, Carter HB, Ferrucci L, Metter EJ, Walsh PC. Prostate volume changes over time: results from the Baltimore Longitudinal Study of Aging. J Urol 2009;182:1458—62.
[7] Bosch JL, Bangma CH, Groeneveld FP, Bohnen AM. The long-term relationship between a real change in prostate volume and a significant change in lower urinary tract symptom severity in population-based men: the Krimpen study. Eur Urol 2008;53:819—27.
[8] Fowler Jr JE, Bigler SA, Kilambi NK, Land SA. Relationships between prostate-specific antigen and prostate volume in black and white men with benign prostate biopsies. Urology 1999;53:1175—8.
[9] Kaplan SA, Reis RB, Staimen VB, Te AE. Is the ratio of transition zone to total prostate volume higher in African-American men than in their Caucasian or Hispanic counterparts? Br J Urol 1998;82:804—7.
[10] Platz EA, Kawachi I, Rimm EB, Willett WC, Giovannucci E. Race, ethnicity and benign prostatic hyperplasia in the health professionals follow-up study. J Urol 2000;163:490—5.
[11] Sanda MG, Beaty TH, Stutzman RE, Childs B, Walsh PC. Genetic susceptibility of benign prostatic hyperplasia. J Urol 1994;152:115—9.
[12] Sanda MG, Doehring CB, Binkowitz B, Beaty TH, Partin AW, Hale E, et al. Clinical and biological characteristics of familial benign prostatic hyperplasia. J Urol 1997;157:876—9.
[13] Pearson JD, Lei HH, Beaty TH, Wiley KE, Isaacs SD, Isaacs WB, et al. Familial aggregation of bothersome benign prostatic hyperplasia symptoms. Urology 2003;61:781—5.
[14] Parsons JK. Modifiable risk factors for benign prostatic hyperplasia and lower urinary tract symptoms: new approaches to old problems. J Urol 2007;178:395—401.
[15] Kristal AR, Arnold KB, Schenk JM, Neuhouser ML, Goodman P, Penson DF, et al. Dietary patterns, supplement use, and the risk of symptomatic benign prostatic hyperplasia: results from the Prostate Cancer Prevention Trial. Am J Epidemiol 2008;167:925—34.
[16] Tavani A, Longoni E, Bosetti C, Maso LD, Polesel J, Montella M, et al. Intake of selected micronutrients and the risk of surgically treated benign prostatic hyperplasia: a case-control study from Italy. Eur Urol 2006;50:549—54.
[17] Fowke JH, Phillips S, Koyama T, Byerly S, Concepcion R, Motley SS, et al. Association between physical activity, lower urinary tract symptoms (LUTS) and prostate volume. BJU Int 2013;111:122—8.
[18] Parsons JK, Bergstrom J, Barrett-Connor E. Lipids, lipoproteins and the risk of benign prostatic hyperplasia in community dwelling men. BJU Int 2008;101:313—8.
[19] Parsons JK, Im R. Alcohol consumption is associated with a decreased risk of benign prostatic hyperplasia. J Urol 2009;182:1463—8.
[20] Parsons JK, Carter HB, Partin AW, Windham BG, Metter EJ, Ferrucci L, et al. Metabolic factors associated with benign prostatic hyperplasia. J Clin Endocrinol Metab 2006;91:2562—8.
[21] Joseph MA, Wei JT, Harlow SD, Cooney KA, Dunn RL, Jaffe CA, et al. Relationship of serum sex-steroid hormones and prostate volume in African American men. Prostate 2002;53:322—9.

[22] Parsons JK, Sarma AV, McVary K, Wei JT. Obesity and benign prostatic hyperplasia: clinical connections, emerging etiological paradigms and future directions. J Urol 2009;182(Suppl. 6): S27—31.
[23] Parsons JK, Messer K, White M, Barrett-Connor E, Bauer DC, Marshall LM. Obesity increases and physical activity decreases lower urinary tract symptom risk in older men: the osteoporotic fractures in men study. Eur Urol 2011;60:1173—80.
[24] Kristal AR, Arnold KB, Schenk JM, Neuhouser ML, Weiss N, Goodman P, et al. Race/ethnicity, obesity, health related behaviors and the risk of symptomatic benign prostatic hyperplasia: results from the prostate cancer prevention trial. J Urol 2007;177:1395—400. quiz 1591.
[25] Sarma AV, Parsons JK, McVary K, Wei JT. Diabetes and benign prostatic hyperplasia/lower urinary tract symptoms—what do we know? J Urol 2009;182(Suppl. 6):S32—7.
[26] Gupta A, Gupta S, Pavuk M, Roehrborn CG. Anthropometric and metabolic factors and risk of benign prostatic hyperplasia: a prospective cohort study of air force veterans. Urology 2006; 68:1198—205.
[27] Rosen RC, Link CL, O'Leary MP, Giuliano F, Aiyer LP, Mollon P. Lower urinary tract symptoms and sexual health: the role of gender, lifestyle and medical comorbidities. BJU Int 2009; 103(Suppl. 3):42—7.
[28] Braun MH, Sommer F, Haupt G, Mathers MJ, Reifenrath B, Engelmann UH. Lower urinary tract symptoms and erectile dysfunction: co-morbidity or typical "Aging Male" symptoms? Results of the "Cologne Male Survey". Eur Urol 2003;44: 588—94.
[29] Ponholzer A, Temml C, Obermayr R, Madersbacher S. Association between lower urinary tract symptoms and erectile dysfunction. Urology 2004;64:772—6.
[30] El-Sakka AI. Lower urinary tract symptoms in patients with erectile dysfunction: analysis of risk factors. J Sex Med 2006; 3:144—9.
[31] McVary KT. Erectile dysfunction and lower urinary tract symptoms secondary to BPH. Eur Urol 2005;47:838—45.
[32] Nickel JC, Downey J, Young I, Boag S. Asymptomatic inflammation and/or infection in benign prostatic hyperplasia. BJU Int 1999;84:976—81.
[33] Di Silverio F, Gentile V, De Matteis A, Mariotti G, Giuseppe V, Luigi PA, et al. Distribution of inflammation, pre-malignant lesions, incidental carcinoma in histologically confirmed benign prostatic hyperplasia: a retrospective analysis. Eur Urol 2003;43:164—75.
[34] Schenk JM, Kristal AR, Neuhouser ML, Tangen CM, White E, Lin DW, et al. Biomarkers of systemic inflammation and risk of incident, symptomatic benign prostatic hyperplasia: results from the prostate cancer prevention trial. Am J Epidemiol 2010;171:571—82.
[35] St Sauver JL, Jacobson DJ, McGree ME, Lieber MM, Jacobsen SJ. Protective association between nonsteroidal anti inflammatory drug use and measures of benign prostatic hyperplasia. Am J Epidemiol 2006;164:760—8.
[36] St Sauver JL, Jacobsen SJ, Jacobson DJ, McGree ME, Girman CJ, Nehra A, et al. Statin use and decreased risk of benign prostatic enlargement and lower urinary tract symptoms. BJU Int 2011;107:443—50.
[37] Schenk JM, Calip GS, Tangen CM, Goodman P, Parsons JK, Thompson IM, et al. Indications for and use of nonsteroidal anti inflammatory drugs and the risk of incident, symptomatic benign prostatic hyperplasia: results from the prostate cancer prevention trial. Am J Epidemiol 2012;176:156—63.
[38] Sutcliffe S, Grubb Iii RL, Platz EA, Ragard LR, Riley TL, Kazin SS, et al. Non-steroidal anti-inflammatory drug use and the risk of benign prostatic hyperplasia-related outcomes and nocturia in the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial. BJU Int 2012;110:1050—9.
[39] Choi WS, Lee WK, Lee SH, Lee SK, Cho ST, Kim DH. Is high-sensitivity C-reactive protein associated with lower urinary tract symptoms in aging men? Results from the hallym aging study. Korean J Urol 2012;53:335—41.
[40] Chang IH, Oh SY, Kim SC. A possible relationship between testosterone and lower urinary tract symptoms in men. J Urol 2009;182:215—20.