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Original article

Association between male pattern baldness and prostate disease: A meta-analysis

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Abstract

Background: Male pattern baldness (MPB) has been associated with an increased risk of prostate cancer (PC) as well as benign prostatic hyperplasia (BPH). We performed a meta-analysis to quantitatively determine the level of risk of PC and BPH in individuals with baldness.

Methods: A systematic literature search was conducted using several databases. We calculated pooled odds ratios (OR) and 95% CIs.

Results: In total, 17 studies comprising 68,448 participants were eligible for the meta-analysis and showed that MPB is associated with an increased risk of aggressive PC (OR = 1.59; 95% CI: 1.36–1.86; $P < 0.001$) as well as BPH (OR = 1.26; 95% CI: 1.05–1.51; $P = 0.01$). There was statistically significant association between vertex baldness and PC (OR = 1.18; 95% CI: 1.05–1.32; $P = 0.006$). No statistically significant association between vertex, frontal plus vertex hair loss pattern, and BPH were identified.

Conclusions: MPB is associated with an increased risk of PC and BPH. Despite our findings, further studies, preferably prospective cohort studies, are required to better elucidate these relationships and to advance knowledge in this field.

Keywords: Baldness; Androgenetic alopecia; Prostate cancer; Benign prostatic hyperplasia

1. Introduction

Male pattern baldness (MPB) is the most common cause of hair loss mediated by systemic androgens and genetic factors, which affects up to 70% of men and increases with age [1]. Androgens and the androgen receptor are required for expression of the male phenotype. However, MPB is an androgen-independent genetic disorder which is induced via the activation of androgen receptor in hair follicles by dihydrotestosterone. Inhibition of dihydrotestosterone production can suppress the progression of MPB which can explain the phenomenon that eunuchs do not develop baldness if castrated before the age of 25 [2]. Androgens have also been strongly implicated in the carcinogenesis of prostate cancer (PC) and the development and maintenance of benign prostatic hyperplasia (BPH) [3,4]. In addition, previous studies identified that finasteride, a 5α-reductase inhibitor, is the main agents for MPB and BPH because of they respond to the inhibition of 5α-reductase. Therefore, MPB seems to share similarly pathologic mechanisms with PC and BPH for aging and androgen influence.

PC is one of the most commonly diagnosed cancers and one of the most common causes of cancer related death in developed countries. Although some risk factors have been established for PC, they collectively explain only a fraction of the disease occurrence. Therefore, additional research to improve our understanding of the etiology of PC is needed. Several studies have investigated the relationship between MPB and PC and have yielded inconsistent results [5–9].

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Recently, a meta-analysis [10] reported vertex baldness (but not frontal baldness) to be associated with an increased risk of PC, however, it only included 7 studies in its analysis and did not consider the relationship between MPB and BPH. Therefore, the aim of this study is to conduct a comprehensive meta-analysis of existing studies to confirm the association of MPB with PC and BPH.

2. Methods

This study protocol was approved by the institutional review board at the West China School of Medicine before initiation and it did not need ethical standard statement.

2.1. Data sources and searches

A systematic literature search in the MEDLINE, EMBASE, and Cochrane databases was conducted to identify relevant studies which reported the association of MPB with the risk of PC and BPH published up to January 2017. Additional manual searches were made using the reference lists from relevant studies to retrieve other papers relevant to our topic.

2.2. Data extraction and study quality

Two reviewers reviewed the full texts of the included studies which met the following inclusion criteria were included in the meta-analysis: (1) The risk point estimate was reported as an odds ratio (OR) with the 95% CI, or the data were presented such that a OR and 95% CI could be calculated; (2) the study had a cohort design or retrospective case-control design or randomized control design; (3) the study evaluated MPB with PC or BPH; and (4) the study language was published in English. Studies that did not meet the earlier criteria were excluded. Data were extracted via a standardized data extraction form, collecting information on the year of publication, country, study design, number of cases and controls, type of alopecia, severity of alopecia, and PC stage, when available. The methodological quality of included studies was assessed by 2 authors using the Downs and Black tool for both randomized controlled trials and nonrandomized controlled trial [11]. In general, the score ranges were grouped into the following 4 quality levels: excellent (26–28), good (20–25), fair (15–19), and poor (<14).

2.3. Statistical analysis and meta-analysis

Heterogeneity, that is, the proportion of variability across studies was assessed using Cochran's Q statistic and quantified using the I^2 statistic. If high heterogeneity ($I^2 > 50$) was found, influence analysis (one kind method of sensitivity analysis) would be performed. We would take out included studies one by one ("leave one out") to see which study influenced the heterogeneity of the meta-analysis. Pooled estimates were calculated omitting one study at a time. For all statistical analyses, a 2-sided $P < 0.05$ was considered statistically significant. Data analysis were performed with Review Manager Software (RevMan v.5.2, Cochrane Collaboration, Oxford, UK).

3. Results

3.1. Characteristics of studies

A Preferred Reporting Items of Systematic Reviews and meta-analyses (PRISMA) [12] flowchart of screening and selection results shown in Fig. 1. Using our prespecified search strategy, 203 extracts were retrieved and 7 additional citations were obtained through reference lists. From 210 studies initially identified, 25 were considered potentially suitable. After a full-text review, 17 studies [5–9,13–24] with 68,448 participants met inclusion criteria and were included in the final analysis (Fig. 1). General study characteristics were presented in Table 1. Of the 17 studies, 12 was about PC [5–9,13–18,24] (2 were cohort studies), 6 was about BPH [15,19–23] (1 reported both PC and BPH [15]). Seven studies included in this meta-analysis evaluated baldness patterns at different ages [5–9,13,16]. Table 2 shows the association between different types of MPB and PC or BPH in every included study.

3.2. Association between MPB and PC

We examined the relationship between any pattern baldness and the risk of PC using data from 11 studies. There was no significant association between any pattern baldness and PC risk (OR = 1.05; 95% CI: 0.98–1.12; $P = 0.19$) (Fig. 2A). Meta-analysis of 5 case-control studies revealed statistically significant association between any pattern baldness and aggressive PC (OR = 1.60; 95% CI: 1.37–1.86; $P < 0.001$; $I^2 = 0\%$) (Fig. 2B). The later inclusion of the study by Zhou et al. [18] as the "leave one out" sensitivity analysis (influence analysis), the pooled results did not change substantially (OR = 1.48; 95% CI: 1.18–1.85; $P = 0.0006$), however, it introduced significant heterogeneity into the analysis ($I^2 = 65\%$) (Supplemental Fig. 1). Therefore, we excluded it from the analysis. There were 5 case-control studies evaluated the association between baldness and nonaggressive PC. We found no statistically significant association between them (OR = 1.04; 95% CI: 0.92–1.19; $P = 0.52$; $I^2 = 18\%$) (Fig. 2C).

3.3. Frontal baldness and risk of PC

Meta-analysis of 10 studies revealed no statistically significant association between frontal baldness and PC (OR = 0.98; 95% CI: 0.90–1.06; $P = 0.56$; $I^2 = 23\%$) (Fig. 3A). The later inclusion of the study by Thomas et al.