Correlation Between Increased BMI, Metabolic Syndrome, and Benign Prostatic Hyperplasia in Young Obese Males: A Comprehensive Review

Abstract

Background: Benign prostatic hyperplasia is a prevalent condition affecting men, with risk factors such as age, lifestyle, inflammation, sex hormones, and genetics. However, the link between metabolic syndrome and BPH has gained attention, particularly among young, obese males under 40.

Literature Review: This review explores the incidence and impact of increased body mass index and metabolic syndrome in causing benign prostatic hyperplasia (BPH) in young, obese males, particularly those under 40 years old. The connection between BPH and MetS was first noted over twenty years ago by Hammarsten and colleagues, who found a direct correlation between Mets components and prostate volume. Subsequent studies in the United States and the United Kingdom corroborated these findings, showing that young males with three or more MetS components have a higher risk of developing BPH. Studies employing the American Urological Association Symptom Index indicated that men with mild lower urinary tract symptoms (LUTS) significantly increased MetS prevalence among men under 40 years old. Research in Asia has highlighted a growing incidence of LUTS, correlating with increased blood pressure, fasting blood glucose, and increased BMI. A meta-analysis found a 28% higher chance of developing BPH among men with higher BMI, and Obese persons were found to have a chance of having an enlarged prostate that was three and a half times higher than the average. Besides BMI, Various studies have examined other clinical markers associated with obesity, such as dyslipidemia and elevated serum insulin levels, which have been linked to increased prostate growth rates.

Conclusion: These findings underscore the need for further research to understand the mechanisms and address the disparities in BPH prevalence among different racial and ethnic groups. Addressing obesity and MetS through lifestyle modifications and medical interventions could potentially reduce BPH incidence in young, obese males.

Keywords: Benign Prostate Hyperplasia, Metabolic Syndrome, Body Mass Index, BMI

Introduction

Benign prostatic hyperplasia is a prevalent and distressing condition that affects men(1). It is estimated that approximately 25 percent of men under the age of 40 and approximately 70 percent of men over the age of 70 have BPH(2). Five general categories of risk factors for BPH exist at the population level. Other categories include inflammation, modifiable lifestyle factors, sex steroid hormones and genetics in addition to age(3). However, neither of these risk factors has yet been agreed upon as a definitive cause of BPH incidence or progression(3).

Metabolic syndrome is a complex illness that poses a significant socioeconomic burden and is widely recognized as a global epidemic(4, 34, 35). MetS is characterized by a combination of factors that greatly increase the likelihood of developing coronary heart disease(4). The main features of this condition include dysregulated glucose homeostasis, elevated blood pressure, and dyslipidemia(4). However, abdominal obesity and insulin resistance have emerged as key manifestations of the syndrome.

Studies on BPH often overlook ethnic/racial prevalence. However, research has shown that men under 40 from minority groups, such asAfrican Americans and Hispanics, face a higher risk of developing BPH(5). In addition, numerous studies have examined the impact of metabolic syndrome and obesity on BPH, specifically looking at factors such as hyperlipidemia, waist circumference, obesity, high blood sugar, and hypertension (36, 37). According to this study, it has been found that metabolic diseases, increased BMI, and obesity are potential risk factors for BPH(6, 7). Although increased BMI is common among African Americans and Hispanics(8), there is still much to learn about the connection between increased BMI and BPH in these communities and the reasons behind the disparities.

There is a hypothesis that suggests that obesity can potentially trigger the development of BPH. This hypothesis proposes that pro-inflammatory states caused by obesity can lead to reactive

changes in the stromal and epithelial microenvironment(9). These changes can be observed through alterations in the expression of genes related to inflammatory response, as well as cell development and growth (9). However, the impact of metabolic diseases and obesity on BPH molecular and pathologic profiles remains uncertain, particularly in medically underserved populations such as HAs(9).

The purpose of this review is to explore the incidence of increased BMI and metabolic syndrome in causing benign prostatic hyperplasia in young, obese males, especially those who are under 40 years old.This review investigates a critical gap in our understanding of BPH risk factors by focusing on young, obese males under 40. While prior research has firmly established a connection between BPH and metabolic syndrome in older men, the influence of these factors on BPH development in a younger demographic remains relatively unexplored. By specifically examining this under-investigated population, this review sheds light on potential BPH risk factors that may emerge earlier in life and paves the way for the development of earlier interventions to prevent or manage BPH in young men.

Methodology

For this literature review, we conducted a thorough narrative analysis and explored a wide range of topics by examining studies with different levels of complexity and design. We conducted our search between Feb 2001 and May 2023 in the databases Science Direct, MEDLINE, and CINAHL, using the MeSH terms 'Benign Prostatic Hyperplasia AND Body Mass Index AND Metabolic Syndrome AND Young Adult'. We intentionally chose to use MeSH terms instead of the author's keywords, as they are provided by database specialists and serve as more robust identifiers of the content. MEDLINE is a part of Pubmed. However, due to the limited number of search results found in PubMed, we made the decision to include searches in both databases. This is because MEDLINE, being established in 1946, predates PubMed, which was established in 1996. Numerous duplicated papers were removed.

We only considered articles written in English that were based on empirical research or were review articles to provide context for our findings. We specifically included studies that focused on young, obese males under 40 years old. Articles were carefully reviewed and any paper that did not specifically examine the connection between BMI, metabolic syndrome, and benign prostatic hyperplasia were excluded.

We removed articles based on our selection criteria. After removing duplicates, the abstracts of the remaining articles were reviewed by two researchers. At last, we examined the subset of 19 articles.

Epidemiology of MetS in men under 40 with BPH

The first time that researchers noticed a connection between BPH and metabolic syndrome (MetS) was over twenty years ago(1). In a study that was considered to be groundbreaking, Hammarsten and colleagues found that there is a direct connection between the volume of the prostate and the various components of Metabolic Syndrome in men who have BPH(10). In the United States, a comprehensive investigation was conducted on the population, with a particular emphasis on 2372 male participants(11). This study sheds light on the connection between metabolic illnesses and the development of BPH. The findings of the study indicate that males below 40 years of age who have three or more components of the Mets are at a greater risk of developing BPH. The presence of a history of hypertension, low-density lipoprotein, and high-density lipoprotein were all found to be associated with substantial positive correlations.

In a study, males ranging in age from 18 to 50 years were included as participants(12). Using the American Urological Association Symptom Index, the researchers rated the symptoms that they were experiencing in their lower urinary tract. The index was divided into three categories: none (0-1), mild (2-7), and moderate or severe (8-35). Revised NCEP-ATP III standards were utilized to define the Mets. A substantial rise of approximately forty percent in the prevalence of MetS was observed in those who had mild LUTS. On the other hand, the group that had moderate to severe LUTS did not show any further signs of increasing. The significance of these relationships was found to be more pronounced in males who were younger than fifty years old. According to the findings of a study that was carried out in the United Kingdom, it was shown that a large number of men who had BPH also had MetS, with a prevalence rate consisting of 26.5%(13). When compared to men who do not have clinical BPH, those who do have clinical BPH do have a 37% higher risk of acquiring metabolic syndrome.

In the coming years, it is projected that the incidence of LUTS will increase all across the world, especially in Asia(14). A high incidence rate of 44.8% was observed in Asia in 2008, and this

percentage has now climbed to 45.5% in 2018(14). When taking into account the increasing systolic blood pressure, increasing levels of fasting blood glucose, and increasing levels of BMI in Asian men, it is of the utmost importance to acknowledge the considerable impact that this has on the prevalence of metabolic syndrome and the regional burden of the disease in this community.

The incidence of increased BMI and metabolic syndrome in causing benign prostatic hyperplasia in young, obese males under 40 years old

The United States of America is currently facing a major problem with obesity, which is scientifically defined as having a body mass index (BMI) that is greater than 30 (15). The prevalence has been increasing at a rate that is cause for concern, and it is currently affecting 36.8% of persons aged 40 to 59 and 31% of those aged 60 or older(16). The prevalence of obesity in men has seen a significant increase in recent years. From 1999 to 2000, it stood at 27.5%, but from 2003 to 2004, it had risen to 31.1%(15). According to the statistics it was shown that there were no variations in the prevalence of individuals with an increased body mass index (BMI) or obesity among males of different racial backgrounds(16).

As the number of people struggling with obesity continues to rise in the United States, so does the prevalence of obesity-related disorders like dyslipidemia, hypertension, and blood pressure(17). Men frequently receive a diagnosis of metabolic syndrome according to the Adult Treatment Panel III (ATPIII) criteria. This includes having three or more of the following: “blood pressure that is higher than 135/85, a waist circumference that is greater than 102 centimeters, triglyceride levels that are higher than 1.7 mmol/L, low levels of high-density lipoprotein (HDL) that are below 1.0 mmol/L, and fasting plasma glucose levels that are higher than 6.1 mmol/L(18).

BPH is also highly influenced by another metabolic syndrome component, increased central adiposity, as measured by waist circumference (19).

The impact of obesity and illnesses connected to obesity on the development of LUTS and BPH has been the subject of a study done by a great number of organizations over the past few years(21). Nevertheless, their research has shown contradictory results. Obesity, particularly in

the abdomen region, has been proven to contribute, to varied degrees, to an elevated risk of both LUTS and BPH, according to the findings of a number of research departments and organizations. An investigation on the progression of benign prostatic hyperplasia was carried out, and it lasted from 1961 to 1982(22). With an adjusted odds ratio of 3.52 and a 95% confidence interval ranging from 1.93-6.42, it was discovered that an increased BMI is a significant predictor of a clinical diagnosis of BPH. Adedew et al. (23) conducted a subsequent study in which they studied the relationship between increased BMI and LUTS. According to this research, aBMI of greater than 25 beyond the age of 25 was found to be negatively associated with lower urinary tract syndrome (LUTS), given that the odds ratio is 1.90 and the confidence range extends from 0.89 to 4.05. Also, it was noticed that males who had a waist circumference that was greater than 102 centimeters had a greater risk of developing LUTS in comparison to those who had a waist circumference that was smaller. According to the calculations, the odds ratio was found to be 1.48, and the confidence interval for the 95% range was between 0.87 and 2.54. According to the data, a higher risk of symptoms related to the lower urinary system may be associated with increasing weight and collecting fat around the abdomen in adulthood. On the other hand, it is possible that these findings do not apply to everyone. In a study that was carried out by Joseph et al. (24), the modifiable risk factors for LUTS in black men were investigated. They took a sample of 708 men under 40 years old and found that there was no correlation between having a higher body mass index and an increased incidence of lower urinary tract syndrome (LUTS).

Prostate volume increased by 0.41 mL for every kg/m2 rise in BMI in the Baltimore Longitudinal Study of Ageing. Compared to non-obese individuals, obese persons had a three-and-a-half times greater likelihood of having an enlarged prostate(25).Additionally, rather than focusing just on BMI, some researchers and physicians have investigated a wider range of clinical markers associated with obesity(26). To this goal, Hammarsten and colleagues (27) used ultrasound to monitor the growth rates of the prostate in 307 men under 40 who were diagnosed with LUTS. Greater annual prostate growth rates were shown to be connected with higher fasting plasma levels, dyslipidemia, waist circumference, and elevated BMI. In a case-control study, Dahle et al. (28)compared twenty-two men who were hospitalized for surgery related to benign prostatic hyperplasia to thirty-two healthy men who were chosen at random. They found that a significant association existed between an increased risk of abdominal obesity and BPH, as well

as elevated serum insulin levels. In their study, both the cases and the controls had a BMI that was significantly lower than the definitions of obesity in the United States, with an average BMI of roughly 22.

Obesity causes an elevation in aromatase activity, resulting in higher levels of estradiol. This, in turn, hampers the production of testosterone and secretion of gonadotropins. This cycle of hypogonadal obesity leads to an increasing ratio of oestrogen to androgen, ultimately resulting in a hypogonadal state(29).

Visceral adipose tissues release a range of bioactive substances called adipocytokines. These substances have the potential to cause insulin resistance, atherogenic and other inflammatory effects(30). Visceral fat accumulation leads to a decrease in adiponectin levels, which in turn promotes fatty acid oxidation in the muscle and glucose metabolism. This also improves insulin sensitivity, as supported by studies(31).

In the Baltimore Longitudinal Study of Ageing, there was a correlation between an increase in BMI and an increase in prostate volume. Participants who were obese had a significantly higher risk of developing an enlarged prostate compared to those who were not obese(25).

The relationship between LUTS and obesity has been a topic of debate until the findings of the Health Professionals Follow-up Study became available. This study involved a significant number of participants and followed them for an extended period of time. The study found a strong link between higher BMI and weight gain from a young age, and the development and worsening of lower urinary tract symptoms(32).

According to a recent multi-center prospective study, it was found that central obesity (WC > 102 cm) played a significant role in the persistence of storage symptoms after surgical treatment for BPH(33).

Conclusion

This narrative review examined research on the connection between increased BMI, metabolic syndrome, and BPH in young, obese males under 40. The findings suggest a positive correlation, with higher BMI and metabolic syndrome presence increasing the risk of BPH. Studies indicate that young men with three or more metabolic syndrome components are especially susceptible.

However, some inconsistencies exist. Future research should investigate these discrepancies, such as the observed lack of correlation between BMI and LUTS in African American men. Elucidating the biological mechanisms underlying this connection is also crucial.

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