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Circulating 25-Hydroxyvitamin D Levels and Risk of Prostate Cancer: An Updated Meta-Analysis of Population-Based Cohort Studies

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Abstract

A previous Meta-Analysis (MA) in 2018 reported that highest circulating 25 hydroxyvitamin D (25(OH)D) concentration was associated with increased risk of prostate cancer in 16 nested case-control studies, not in 3 cohort studies. In addition, wrong extracted information was found in the forest plot of the MA. The aim was to conduct an Updated Meta-Analysis (UMA) of cohort studies for investigating an association between circulating 25(OH)D levels and risk of prostate cancer. Additional articles were selected from cited lists based on selected studies from previous MAs using citation discovery tools provided by PubMed. A fixed effect model was applied if I-squared value was less than 50%. A funnel plot and Egger's test were used to evaluate a publication bias. Of 5 cohorts, the summary RRs [and their 95% confidence intervals] (I-squared value) were 1.20 [1.14-1.27] (19.0%). Egger's test showed that there was not a publication bias (*P*=0.317). This UMA of cohort studies supported the higher level of serum vitamin D was associated with an increased risk of prostate cancer.

Keywords: Vitamin D; Prostate neoplasm; Risk factors; Systematic review; Meta-analysis

Abbreviations

25(OH)D: 25-Hydroxyvitamin D; CDT: Citation Discovery Tools; CI: Confidence Interval; HLM: the Highest versus Lowest Method; ICM: Interval Collapsing Method; logRR: logarithm Relative Risk; RR: Relative Risk; SElogOR: Standard Error of logarithm Relative risk; sRR: summary Relative Risk; SR : Systematic Review; UMA: Updated Meta-Analysis

Introduction

Prostate cancer is one of the most common cancer in East Asian men [1,2] as well as Western men [3]. In addition, the prevalence of prostate cancer between East Asian and Western men is becoming similar [4]. These epidemiological facts suggest that environmental factors may play an important risk or preventive factor [1,5].

In the last several decades, vitamin D has been known to be involved in differentiation, proliferation, and apoptosis of cell biology [6]. Based on these, several meta-analyses have been reported that circulating vitamin D level was associated with risk of breast cancer [7], colo-rectal cancer [8], kidney cancer [9], bladder cancer [10] and thyroid cancer [11], as well as prostate cancer [12,13].

Yin et al., [12] published in 2009 was the first meta-analysis on the association between circulating 25-hydroxyvitamin D (25(OH)D) and risk of prostate cancer. The summary effect size from 10 selected studies did not show a statistical significance. However, Gao et al., [13] published in 2018 concluded that highest 25(OH)D concentration was associated with increased risk of prostate cancer based on summary RR (sRR) and 95% Confidence Intervals (CI) as 1.15 (1.06-1.24). The statistical significance was shown in sRR from 16 nested case-control studies (1.15, 95% CI: 1.06-1.25), but not in sRR from 3 cohort studies (1.08, 95% CI: 0.78-1.49). The authors pointed out the reason as the small number of selected studies. This inference could be supported by Travis et al., [14], because this nested case-control study using individual participant data from 19 prospective studies also concluded that circulating 25(OH)D was positively associated with risk for total prostate cancer.

Meanwhile, extracted RR and 95% CI of Barnett et al., [15] in the forest plot of Gao et al., [13]

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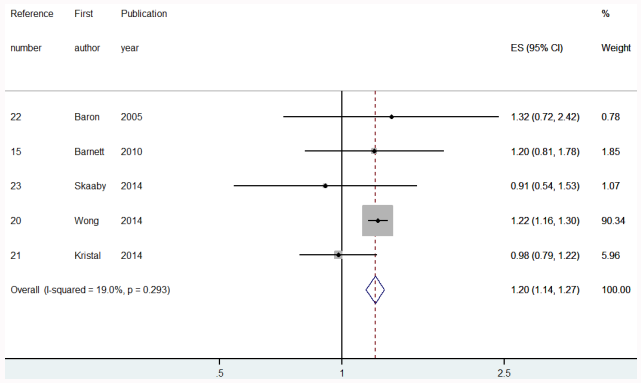

Figure 1: Forest plot for estimating the summary Effect Size (ES) using fixed effect model.

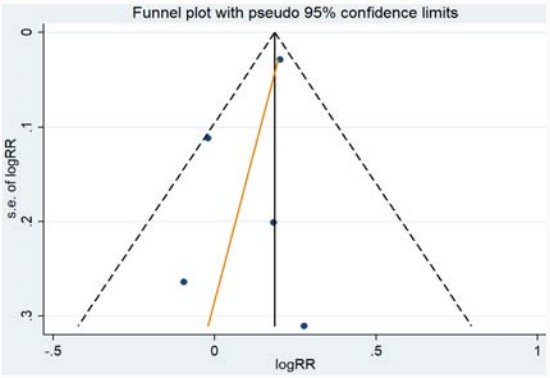

Figure 2: Funnel plot for 5 cohorts (*P*-value of Egger's test = 0.317).

was not on all subject but on the group having Gleason 7 and more. Thus, the aim was to conduct an Updated Meta-Analysis (UMA) of relevant cohort studies for investigating an association between circulating 25(OH)D levels and risk of prostate cancer.

Materials and Methods

According to the aim of this study to update the previous meta-analysis [13], it was necessary to add relevant studies that were published after the meta-analysis were performed. From the studies selected in Yin et al., [12] and Gao et al., [13], a search list was made using the 'cited by' option as Citation Discovery Tools (CDT) provided by PubMed [16]. The end of the search period was as the end of April 2019. And then relevant studies were selected by the selection criteria as a prospective follow-up study of prostate cancer risk that obtained circulating 25(OH)D levels at constructing a cohort and used a population-based cohort design.

From the selected studies, the RR and 95% CI was extracted using the 'Highest versus Lowest' Method (HLM), only extracting data for the group with the highest 25(OH)D compared to the lowest [17,18]. In cases not using the group of lowest level as the reference, the inverse values were obtained. The logarithm RR (logRR) and standard error of logRR (SElogRR) of each study was calculated from the extracted values.

Level of heterogeneity was assessed using the I-square value (%). A fixed effect model was applied for I-squared value less than 50% [19]. To examine a publication bias, Egger's test was performed with constructing a funnel plot. The statistical significance level was set to 0.05.

Results

A total 456 studies citing the 11 studies in Yin et al., [12] and 19 studies in Gao et al., [13] were retrieved using the CDT of PubMed. Of them, two cohort studies [20,21] that satisfied the selection criteria were selected additionally. They had been published before December 2016 as the end date for search in Gao et al., [13]. Thus 5 cohort studies [15,20-23] were selected finally to conduct this UMA. The extracted logRR and SElogRR of 5 cohort studies by HLM were shown in Table 1.

The sRR [95% CI] (I-squared value, %) of 5 cohorts was 1.20 [1.14-1.27] (19.0) (Figure 1). Egger's test showed that there was not a publication bias (*P*=0.317) (Figure 2). Two studies suggested the separated results by Gleason score <7 and 7+ [15,21]. The sRR [95% CI] (I-squared value, %) of Gleason score <7 and 7+ were 1.06 [0.67-1.68] (52.4) and 1.03 [0.81-1.31] (0.0%), respectively.

Table 1: Summary of the extracted information of 5 cohort studies by highest versus lowest method*.

Reference number	First Author	Publication Year	logRR	SElogRR
22	Baron	2005	0.278	0.310
15	Barnett	2010	0.182	0.201
23	Skaaby	2014	-0.095	0.264
20	Wong	2014	0.203	0.029
21	Kristal	2014	-0.020	0.112

*logRR: logarithm Relative Risk; SElogRR: Standard Error of logarithm Relative Risk

Discussion

The results from 5 cohort studies suggested that highest 25(OH)D level was associated with increased risk of prostate cancer. Comparing with sRR of Gao et al., [13], sRR of this UMA showed the statistical significance with the same direction of sRR and narrower CIs.

Interestingly, higher level of circulating 25(OH)D was associated with increased risk of prostate cancer. In other words, vitamin D seems to be a promoting effect in prostate cancer, even though vitamin D is known as a potential anticancer agent [24,25]. It could be explained that 25(OH)D may be a marker of some factors that related to the risk of prostate cancer like as insulin-like growth factor I [13]. However, Brändstedt et al., [26] reported that higher level of pre-diagnostic 25(OH)D improved survival in prostate cancer patients. Thus, further studies for establishing mechanism of the association are needed [27].

The merit of this UMA was to use CDT of PubMed in order to add relevant cohorts [16], instead of using the combination of keywords. In consequence, two studies [20,21] published in 2014 could be added. They had to be selected in Gao et al., [13] because the meta-analysis defined the end date for search as December 2016. While the limitations of this UMA were as same as the previous MA [13], sRR of this UMA had a statistical significance. The main reasons were by increased number of selected studies and by the highest weight of Wong et al., [20] in the forest plot (Figure 1).

Recently, some meta-analyses to evaluate the association between some single-nucleotide polymorphisms of Vitamin D Receptor (VDR) gene and risk of prostate cancer have been reported [28-30]. The background of them are that the action of vitamin D is mediated by VDR [31], but these results are inconsistent. Specifically, Bsm I

polymorphism as one of the most frequently researched variants was not associated with prostate cancer of Gleason score <7 and 7+ [30]. But the nested case-control studies of individual participant data showed that circulating 25(OH)D was associated with a non-aggressive prostate cancer, but not with aggressive disease [14]. From 2 studies [15,21] suggesting results separated by Gleason score, both sRR in <7 and 7+ had not a statistical significance.

Conclusion

Despite above considerations, this UMA results supported that the higher level of serum vitamin D might be associated with an increased risk of prostate cancer. It will be necessary to conduct an UMA that add further relevant cohorts by extending the end date for search.

References

1. Ha Chung B, Horie S, Chiong E. The incidence, mortality, and risk factors of prostate cancer in Asian men. Prostate Int. 2019; 7: 1-8.
2. Jung KW, Won YJ, Kong HJ, Lee ES. Cancer Statistics in Korea: Incidence, Mortality, Survival, and Prevalence in 2016. Cancer Res Treat. 2019; 51: 417-430.
3. Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global cancer statistics, 2012. CA Cancer J Clin. 2015; 65: 87-108.
4. Monn MF, Tatem AJ, Cheng L. Prevalence and management of prostate cancer among East Asian men: Current trends and future perspectives. Urol Oncol. 2016; 34: 58.
5. Stewart RW, Lizama S, Peairs K, Sateia HF, Choi Y. Screening for prostate cancer. Semin Oncol. 2017; 44: 47-56.
6. Holick MF. Vitamin D and sunlight: strategies for cancer prevention and other health benefits. Clin J Am Soc Nephrol. 2008; 3: 1548-1554.
7. Estébanez N, Gómez-Acebo I, Palazuelos C, Llorca J, Dierssen-Sotos T. Vitamin D exposure and Risk of Breast Cancer: a meta-analysis. Sci Rep. 2018; 8: 9039.
8. Yin L, Grandi N, Raum E, Haug U, Arndt V, Brenner H. Meta-analysis: Serum vitamin D and colorectal adenoma risk. Prev Med. 2011; 53: 10-16.
9. Darling AL, Abar L, Norat T. WCRF-AICR continuous update project: Systematic literature review of prospective studies on circulating 25-hydroxyvitamin D and kidney cancer risk. J Steroid Biochem Mol Biol. 2016; 164: 85-89.
10. Zhao Y, Chen C, Pan W, Gao M, He W, Mao R, et al. Comparative efficacy of vitamin D status in reducing the risk of bladder cancer: A systematic review and network meta-analysis. Nutrition. 2016; 32: 515-523.
11. Zhao J, Wang H, Zhang Z, Zhou X, Yao J, Zhang R, et al. Vitamin D deficiency as a risk factor for thyroid cancer: A meta-analysis of case-control studies. Nutrition. 2019; 57: 5-11.
12. Yin L, Raum E, Haug U, Arndt V, Brenner H. Meta-analysis of longitudinal studies: Serum vitamin D and prostate cancer risk. Cancer Epidemiol. 2009; 33: 435-445.
13. Gao J, Wei W, Wang G, Zhou H, Fu Y, Liu N. Circulating vitamin D concentration and risk of prostate cancer: a dose-response meta-analysis of prospective studies. Ther Clin Risk Manag. 2018; 14: 95-104.
14. Travis RC, Perez-Cornago A, Appleby PN, Albanes D, Joshu CE, Lutsey PL, et al. A Collaborative Analysis of Individual Participant Data from 19 Prospective Studies Assesses Circulating Vitamin D and Prostate Cancer Risk. Cancer Res. 2019; 79: 274-285.
15. Barnett CM, Nielson CM, Shannon J, Chan JM, Shikany JM, Bauer DC, et al. Serum 25-OH vitamin D levels and risk of developing prostate cancer in older men. Cancer Causes Control. 2010; 21: 1297-1303.
16. Bae JM, Kim EH. Citation Discovery Tools for Conducting Adaptive Meta-analyses to Update Systematic Reviews. J Prev Med Public Health. 2016; 49: 129-133.
17. Bae JM. Comparison of methods of extracting information for meta-analysis of observational studies in nutritional epidemiology. Epidemiol Health. 2016; 38: e2016003.
18. Bae JM. Reinterpretation of the results of a pooled analysis of dietary carotenoid intake and breast cancer risk by using the interval collapsing method. Epidemiol Health. 2016; 38: e2016024.
19. Harris RJ, Bradburn MJ, Deeks JJ, Harborad RM, Altman DG, Sterne JAC. Metan: Fixed- and random-effects meta-analysis. Stata J. 2008; 8: 3-28.
20. Wong YY, Hyde Z, McCaul KA, Yeap BB, Golledge J, Hankey GJ, et al. In older men, lower plasma 25-hydroxyvitamin D is associated with reduced incidence of prostate, but not colorectal or lung cancer. PLoS One. 2014; 9: e99954.
21. Kristal AR, Till C, Song X, Tangen CM, Goodman PJ, Neuhauser ML, et al. Plasma vitamin D and prostate cancer risk: results from the Selenium and Vitamin E Cancer Prevention Trial. Cancer Epidemiol Biomarkers Prev. 2014; 23: 1494-1504.
22. Baron JA, Beach M, Wallace K, Grau MV, Sandler RS, Mandel JS, et al. Risk of prostate cancer in a randomized clinical trial of calcium supplementation. Cancer Epidemiol Biomarkers Prev. 2005;14: 586-589.
23. Skaaby T, Husemoen LL, Thuesen BH, Pisinger C, Jørgensen T, Roswall N, et al. Prospective population-based study of the association between serum 25-hydroxyvitamin-D levels and the incidence of specific types of cancer. Cancer Epidemiol Biomarkers Prev. 2014; 23: 1220-1229.
24. Chakraborti CK. Vitamin D as a promising anticancer agent. Indian J Pharmacol. 2011; 43: 113-120.
25. Ma Y, Johnson CS, Trump DL. Mechanistic Insights of Vitamin D Anticancer Effects. Vitam Horm. 2016; 100: 395-431.
26. Brändstedt J, Almquist M, Manjer J, Malm J. Vitamin D, PTH, and calcium in relation to survival following prostate cancer. Cancer Causes Control. 2016; 27: 669-677.
27. Ahn J, Park S, Zuniga B, Bera A, Song CS, Chatterjee B. Vitamin D in Prostate Cancer. Vitam Horm. 2016; 100: 321-355.
28. Ntais C, Polycarpou A, Ioannidis JP. Vitamin D Receptor Gene Polymorphisms and Risk of Prostate Cancer: A Meta-analysis. Cancer Epidemiol Biomarkers Prev. 2003; 12: 1395-1402.
29. Berndt SI, Dodson JL, Huang WY, Nicodemus KK. A systematic review of vitamin D receptor gene polymorphisms and prostate cancer risk. J Urol. 2006; 175: 1613-1623.
30. Kang S, Zhao Y, Wang L, Liu J, Chen X, Liu X, et al. Lack of association between the risk of prostate cancer and vitamin D receptor Bsm I polymorphism: a meta-analysis of 27 published studies. Cancer Manag Res. 2018; 10: 2377-2387.
31. Carlberg C. Molecular endocrinology of vitamin D on the epigenome level. Mol Cell Endocrinol. 2017; 453: 14-21.