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Original Article

Does prostatitis increase the risk of prostate cancer? A meta-analysis

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Abstract: Inflammation might play an important role in the pathogenesis of cancers such as those of the stomach, liver and bladder. Therefore, in order to clarify whether prostatitis can increase the risk of prostate cancer (PCa), we performed this meta-analysis to determine the possible correlation between prostatitis and the risk of PCa. A systematic search was performed using the PubMed, Embase, Medline, and Web of Science databases and the China National Knowledge Infrastructure (CNKI) through September 3, 2016. This meta-analysis was conducted with STATA version 12.0 statistical software. The strength of the association expressed as odds ratio (OR) and 95% confidence interval (CI). A total of 27 previous publications consisting of 15,762 cases and 92,547 controls were involved in this meta-analysis. Prostatitis was significantly associated with an increased risk of PCa in the overall population (OR=1.74, 95% CI=1.46-2.07, *P*=0.000). In the stratified analysis by geographical region, significant association were found among Asian population (OR=3.54, 95% CI=2.60-4.82, *P*=0.000). Notably, associations were also uncovered in almost all other subgroup analyses, such as decade of publication, type of controls, etc. No significant publication bias was found in this meta-analysis (*P*=0.823 for Egger's test and *P*=0.559 for Begg's test). It appears to be an association between prostatitis and PCa risk, especially in Asian population. Given that the decreasing incidence of prostatitis has a number of other health benefits, patients should be encouraged to seek treatment for prostatitis to enhance their overall health and decrease their risk of PCa.

Keywords: Prostate cancer, prostatitis, inflammation, meta-analysis

Introduction

Prostate cancer (PCa) is the most common malignant neoplasm in men in developed countries and responsible for 180,890 new cases and 26,120 deaths in the United States in 2016 [1]. Approximately 20% of all human cancers in adults are attributable to chronic inflammation and/or chronic inflammatory conditions [2] caused by infectious agents or other environmental factors. Persistent inflammation has been hypothesized to contribute to the dedifferentiation of the prostatic epithelium and progression from prostatic intraepithelial neoplasia (PIN) to invasive cancer. A similar mechanism is implicated in other cancers, including gastric carcinoma, hepatic carcinoma, and colorectal cancer [2-6]. Emerging evidence suggests a potential correlation between prostatitis and PCa and prostatitis is increasingly recognized as a risk factor for the development of PCa [7-9]. However, several studies have indicated that histological inflammation may decrease the ability to detect PCa in subsequent biopsy specimens [10-12]. Moreira *et al* [13] suggested that the rates of PCa detection on repeat biopsies in men with acute and/or chronic baseline inflammation were decreased by nearly 30%.

The diagnostic criteria for prostatitis were defined according to the Irani grading system. Irani *et al* [14] proposed that the inflammatory cells generated from prostatic tissue can be classified by the histological grading and aggressiveness of prostatic inflammation and based on the extension and effect of inflammatory cells (**Table 1**). In order to standardize the diagnostic criteria for prostatitis, the National Institutes of Health (NIH) published a consensus statement on the classification of prostatitis [15] that divided the diagnosis into four cat-

Table 1. Histological grading and aggressiveness of prostatic inflammation

Grade	Histological grading	Grade	Histological aggressiveness
0	No inflammatory cells	0	No contact between inflammatory cells and glandular epithelium
1	Scattered inflammatory cell infiltrate without nodules	1	Contact between inflammation and epithelium
2	Non-confluent lymphoid nodules	2	Interstitial infiltrate with glandular disruption
3	Large inflammatory areas with confluence	3	Glandular disruption on >25%

Table 2. Classification of prostatitis according to the NIH criteria

NIH category	Symptomatic	Acute/ Chronic	Bacteria in EPS	Leukocytes in EPS
I	Y	Acute	Y	Y
II	Y	Chronic	Y	Y
IIIa	Y	Chronic	N	Y
IIIb	Y	Chronic	N	N
IV	N	Chronic	N	N

Y represents Yes; N represents No.

egories: acute bacterial prostatitis (category I), chronic bacterial prostatitis (category II), CP/CPPS (category III), and asymptomatic inflammatory prostatitis (category IV) (**Table 2**).

Meta-analysis can explore the authentic and comprehensive effects via statistical analyses, which provide a relatively accurate estimation. A previous meta-analysis [16] involving 20 studies has been conducted, which demonstrates that there is a significant positive relationship between prostatitis and prostate cancer. The aim of this study was to conduct an updated systematic review and meta-analysis to accurately evaluate the magnitude of the association between prostatitis and PCa. If this study indicates that prostatitis is associated with a significant increase in the risk of PCa, we can encourage patients to seek treatment for prostatitis to decrease their risk of PCa.

Materials and methods

Inclusion criteria and exclusion criteria

We included studies that met the following criteria: 1) case-control or cohort studies addressing the association between prostatitis and PCa; 2) reporting the relative risk (RR), odds ratio (OR), and 95% confidence interval (CI) or that acquired sufficient information to calculate these values; and 3) utilizing histological diagnosis/evaluation of PCa. Studies that met the following criteria were considered unqualified: 1) articles not reporting association between prostatitis and PCa; 2) duplicating previous publications (when multiple reports were published from the same population, only the most recent or complete publications were included); 3) review or meta-analysis articles; or 4) comments, letters, case reports, and meeting.

Search strategy

We identified studies by a computerized search of the PubMed, Embase, Medline, and Web of Science databases and the CNKI using the following terms: “prostatitis or prostate inflammation or CP” and “prostate cancer or prostate carcinoma or prostatic neoplasms or PCa”. The last search was performed in September 3, 2016. No language restrictions were used in this meta-analysis. All reviews and cross-referenced studies from retrieved articles were screened for inclusion.

Data extraction and quality assessment

The data was independently extracted from each article meeting the inclusion and exclusion criteria by three authors (HY Ding, S Fan and L Zhang). Any disagreement between the other 2 authors was resolved by consensus among all authors. As required, some information not found in the articles was obtained by questioning the principal researchers by e-mail. The following information was extracted from each study: first author, year of publication, study country, type of controls, source of data, data collection period, the number of cases and controls, age, OR and 95% CI. Type of controls was defined as hospital-based and population-based studies.

The Cochrane Collaboration Reviewer’s Handbook 5.3 was applied to assess the methodological quality of these studies. The quality assessment for each article was conducted independently by two authors (L Zhang and ZY Hao). Any disagreement was settled by consensus among all authors. Overall, the quality of these studies’ methodology was high. The pooled risk of bias assessment for the 27 studies is shown in **Figure 1**.

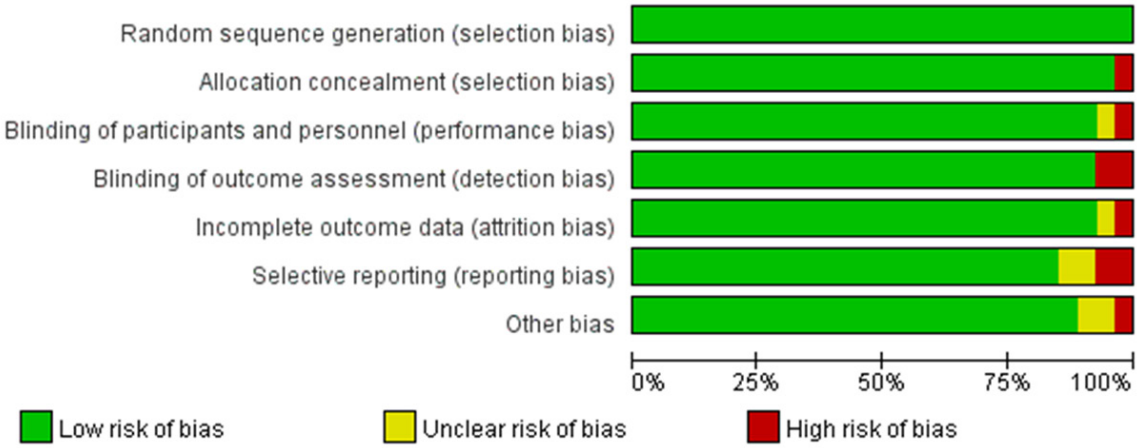

Figure 1. Risk of bias graph: over quality assessment for the selected studies.

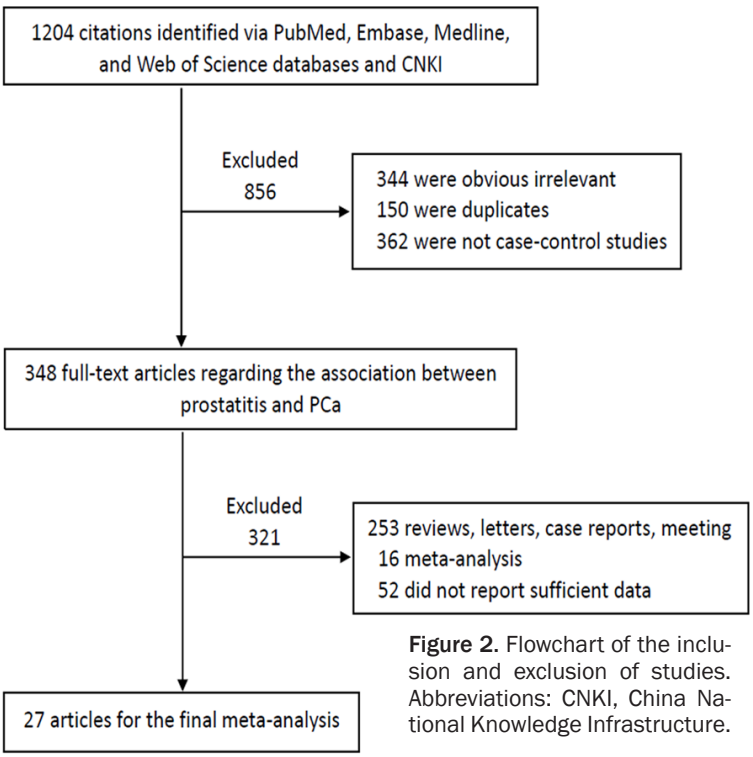

Figure 2. Flowchart of the inclusion and exclusion of studies. Abbreviations: CNKI, China National Knowledge Infrastructure.

Statistical analysis

We explored the relationship of prostatitis and PCa using STATA version 12.0 (StataCorp LP, College Station, USA). OR and 95% CI were performed to determine the strength of the evidence for the association between prostatitis and PCa. We calculated the pooled OR in each article using a fixed-effects model of the Mantel-Haenszel method [17] and using random-effects models of the DerSimonian and Laird method [18]. In light of the article heterogeneity, we calculated the OR estimates using random-effects models. Meanwhile, article heterogeneity was measured by the Q test and the I^2 statistic (I^2<25%, no heterogeneity; I^2 25%-50%, moderate heterogeneity; I^2>50%, extreme heterogeneity) [19]. The heterogeneity of studies was considered statistically significant when I^2>50% or P<0.1 for the Q test. We utilized one-way sensitivity analyses that served as a stratification factor for the stability of the results. Potential publication bias was assessed by the Begg's funnel plot and Egger's publication bias plot, P value <0.05 was considered statistically significant bias [20].

Results

Literature search

The search strategy retrieved 1,204 citations identified through PubMed, CBM, Embase, and the CNKI, of which 856 were excluded from analysis after the first screening according to the correlation, case-control studies and duplicate reportage. There are 348 available full-text articles regarding the association between prostatitis and PCa. 321 were excluded from analysis after a second screening based on

Table 3. Studies analyzing the association between prostatitis and PCa

First author	Year	Country	Type of controls	Source of data	Data collection period	Cases/ Controls	Age	OR (95% CI)
Boehm K et al [21]	2016	Germany	PB	Interview	2005-2012	1,884/1,965	<76	1.81 (1.44-2.27)
Rybicki BA et al [22]	2015	USA	HB	Medical record	1/1990-12/2002	574/574	All	0.96 (0.71-1.31)
Spence AR et al [23]	2014	Canada	PB	Interview	2005-2009	1,555/1,586	40-79	1.83 (1.44-2.34)
Wright JL et al [24]	2012	USA	PB	Interview	1/1993-12/1996 1/2002-12/2005	1,754/1,645	35-74	1.62 (1.29-2.03)
Chao C et al [25]	2010	USA	PB	Questionnaire	2002-2007	1,559/75,384	45-69	1.33 (1.12-1.59)
Weinmann S et al [26]	2010	USA	PB	Medical record	1974-2000	768/929	45-84	1.0 (0.79-1.4)
Daniels NA et al [27]	2009	USA	HB	Medical record	1996-2006	65/195	51-99	0.36 (0.04-2.97)
Huang WY et al [28]	2008	USA	PB	Interview	9/1993-7/2001	868/1,283	60-69	1.32 (0.96-1.82)
Delongchamps NB et al [29]	2008	USA	HB	Medical record	Unknown	22/145	31-92	0.42 (0.17-1.04)
Liu CK et al [30]	2007	People's Republic of China	HB	Questionnaire	1/2000-6/2006	40/168	40-86	4.76 (1.85-12.19)
Stucliffe S et al [31]	2007	USA	PB	Interview	1986-1995	691/691	40-75	1.29 (1.0-1.7)
Sarma AV et al [8]	2006	USA	PB	Interview	1996-2001	129/703	40-79	4.93 (2.79-8.74)
Pelucchi C et al [32]	2006	Italy	HB	Interview	1985-1992	280/689	<80	0.53 (0.10-2.68)
Petel DA et al [33]	2005	USA	PB	Interview	1996-1998	700/604	50-74	1.8 (1.1-2.9)
Fernandez L et al [34]	2005	Cuba	HB	Interview	1998-2000	271/253	<84	1.4 (0.9-2.1)
Rothman I et al [35]	2004	USA	PB	Interview	1/1993-12/1996	750/702	40-64	1.56 (1.10-2.22)
Roberts RO et al [36]	2004	USA	PB	Medical record	1/1980-12/1996	409/803	70 (median age)	1.7 (1.10-2.6)
Ritchie JM et al [37]	2003	USA	HB	Interview	5/2000-5/2001	58/99	44-85	3.44 (1.30-9.13)
Rosenblatt KA et al [7]	2001	USA	PB	Interview	1993-1996	753/703	40-64	1.48 (1.04-2.10)
An N et al [38]	2000	People's Republic of China	HB	Interview	8/1997-11/1999	96/288	50-80	3.41 (2.07-5.63)
Zhu K et al [39]	1996	USA	PB	Medical record	1/1989-12/1991	175/258	40-69	1.1 (0.6-2.2)
Wang RT et al [40]	1996	People's Republic of China	HB	Questionnaire	1989-1991	138/636	40-80	4.94 (2.87-8.49)
John EM et al [41]	1995	USA	PB	Interview	1/1987-12/1991	1,642/1,636	65-84	2.81 (2.32-3.41)
Hiatt RA et al [42]	1994	USA	PB	Medical record	1978-1985	238/238	>30	1.1 (0.5-2.3)
Wei Q et al [43]	1994	People's Republic of China	HB	Interview	Unknown	27/54	All	4.12 (1.2-14.2)
Honda GD et al [44]	1988	USA	PB	Interview	1/1979-2/1985	216/216	≤60	2.2 (1.2-4.3)
Mishina T et al [45]	1985	Japan	PB	Questionnaire	1976	100/100	45-89	1.64 (0.69-3.92)

HB, hospital-based; PB, population-based; OR, odds ratio; CI, confidence interval.

Table 4. Stratified analyses of the pooled association between prostatitis and PCa

Variables	Group (n)	Cases/Controls	OR (95% CI)	P	Heterogeneity	
					I^2 (%)	P^h
	Overall (27)	15,762/92,547	1.74 (1.46, 2.07)[a]	0.000[a]	81.0%	0.000
			1.68 (1.57, 1.79)[b]	0.000[b]		
Publication year	2010's (6)	8,094/82,083	1.42 (1.15, 1.74)	0.001	78.9%	0.000
			1.46 (1.33, 1.61)	0.000		
	2000's (14)	5,132/7,326	1.76 (1.34, 2.30)	0.000	76.2%	0.000
			1.62 (1.44, 1.82)	0.000		
	1990's (5)	2,220/2,822	2.29 (1.31, 4.00)	0.004	78.5%	0.001
			2.65 (2.24, 3.14)	0.000		
	1980's (2)	316/316	2.17 (1.35, 3.51)	0.001	0.00%	0.543
			2.18 (1.35, 3.51)	0.001		
Geographical region	European (2)	2164/2654	1.40 (0.56, 3.54)	0.472	46.6%	0.171
			1.79 (1.43, 2.23)	0.000		
	North America (19)	12926/88394	1.56 (1.29, 1.90)	0.000	82.5%	0.000
			1.62 (1.50, 1.74)	0.000		
	South America (1)	271/253	1.43 (1.00, 2.04)	0.051	-	-
			1.43 (1.00, 2.04)	0.051		
	Asian (5)	401/1246	3.64 (2.58, 5.12)	0.000	15.0%	0.319
			3.54 (2.60, 4.82)	0.000		
Type of controls	HB (10)	1571/3101	1.82 (1.07, 3.10)	0.027	84.4%	0.000
			1.55 (1.30, 1.86)	0.000		
	PB (17)	14191/89446	1.69 (1.42, 2.01)	0.000	79.9%	0000
			1.70 (1.58, 1.83)	0.000		
Source of data	Interview (16)	11674/13117	1.95 (1.62, 2.34)	0.000	76.3%	0.000
			1.89 (1.74, 2.05)	0.000		
	Medical record (7)	2251/3142	1.02 (0.80, 1.31)	0.858	39.1%	0.131
			1.03 (0.87, 1.21)	0.752		
	Questionnaire (4)	1837/76288	2.68 (1.27, 5.68)	0.010	86.8%	0.000
			1.67 (1.43, 1.96)	0.000		
Simple size	≥500 (12)	13498/87702	1.54 (1.28, 1.86)	0.000	83.7%	0.000
			1.62 (1.51, 1.74)	0.000		
	<500 (15)	2264/4845	1.99 (1.38, 2.87)	0.000	76.8%	0.000
			2.01 (1.71, 2.37)	0.000		

HB, hospital-based; PB, population-based; OR, odds ratio; CI, confidence interval; P^h = *P* value of heterogeneity test; a, random-effects model was used when heterogeneity P^h<0.05; b, fixed-effects model was when heterogeneity P^h>0.05.

article types and data. Finally, A total of 27 articles met the inclusion criteria (**Figure 2**) [7, 8, 21-45].

Study characteristics

We found 27 articles that assessed the association between prostatitis and PCa. Of the 27 studies, 23 were written in English and four were published in Chinese. The sample sizes ranged from 22 to 75,384 patients. The 17 population-based case-control studies included 14,191 cases and 89,446 controls. Meanwhile, the 10 hospital-based case-control studies contained 1,571 cases and 3,101 controls. All cancerous specimens were histologically confirmed. **Table 3** displays the main characteristics of the 17 population-based case-control studies and the 10 hospital-based case-control studies, documenting first authors, publication year, country, type of controls, source of data, data collection period, number of cases/controls, age of patients, and the estimated OR and 95% CI for each individual study.

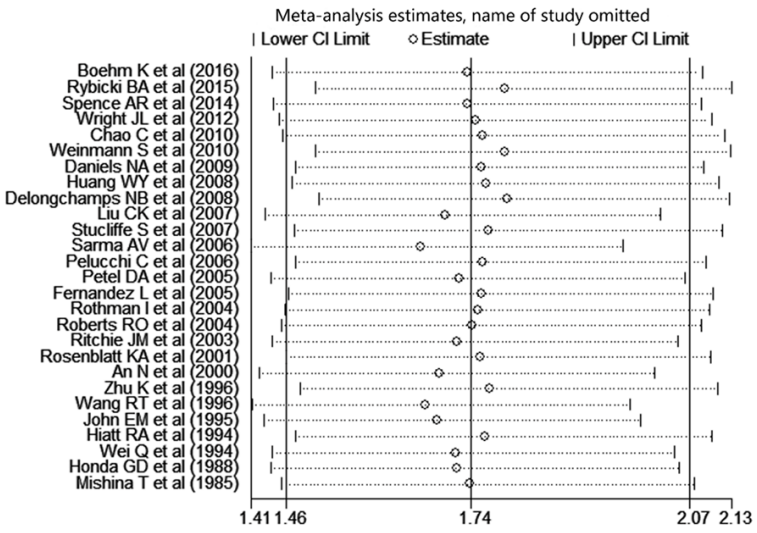

Figure 3. Sensitivity analysis of the pooled association between prostatitis and PCa. Abbreviations: CI, confidence interval.

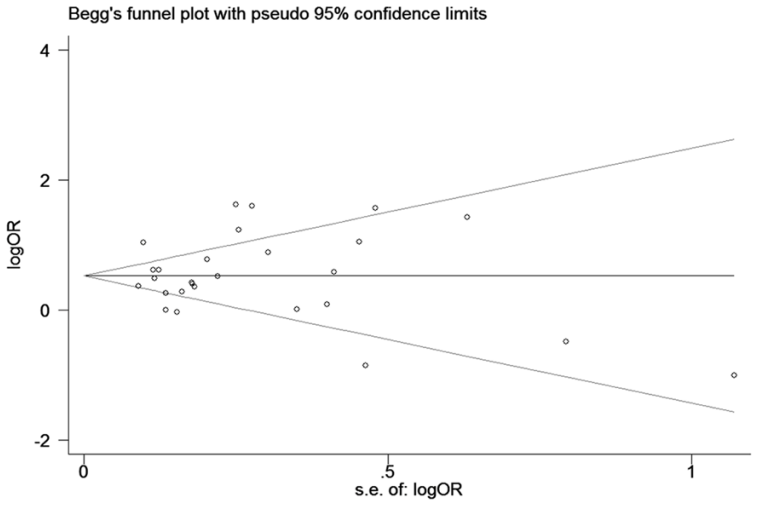

Figure 4. Begg's funnel plots to examine publication bias in the association between prostatitis and PCa. Abbreviations: Log OR, natural logarithm of OR; s.e. of: log OR, standard error of the log OR.

Overall analysis of these studies

The association between prostatitis and the risk of PCa was analyzed in 27 studies with a total of 15,762 cases and 92,547 controls. The pooled OR=1.68 and the 95% CI=1.57-1.79 with the fixed-effects model, while the OR=1.74 and 95% CI=1.46-2.07 with the random-effects model. However, there was significant heterogeneity among these studies (I^2=81%, *P*=0.000). When significant heterogeneity was present (I^2>50%, *P*<0.1), we used a random-effects model. Prostatitis was significantly associated with an increased risk of PCa (OR=1.74, 95% CI=1.46-2.07, *P*=0.000) (**Table 4**).

Subgroup analysis

The subgroup analyses were based on 27 studies according to decade of publication, geographical region, type of controls, source of data, and sample size (**Table 4**). Based on the decade of publication (2010's, 2000's, 1990's, 1980's), the pooled OR were all significant in both the fixed-effects and random-effects models. Except for studies from the 1980's (I^2=0.00%, *P*=0.543), there was significant heterogeneity among these studies. However, statistically significant association between prostatitis and PCa were found in each of the four decades (OR=1.42, 95% CI=1.15-1.74, *P*=0.001 for 2010's; OR=1.76, 95% CI=1.34-2.30 *P*=0.000 for 2000's; OR=2.29, 95% CI=1.31-4.00 *P*=0.004 for 1990's).

Subgroup analyses were also performed based on geographical region. A significant association was found in Asian population (OR=3.54, 95% CI=2.60-4.82, *P*=0.000). Nevertheless, there was high degree of heterogeneity in North American population (I^2=82.5%, *P*=0.000). Only one study [34] evaluated the association between prostatitis and the risk of PCa in South America, and there was no significant association (OR=1.43, 95% CI=1.00-2.04, *P*=0.051).

Subgroup analyses were stratified by type of controls. Prostatitis was significantly associated with an increased risk of PCa according to type of controls (OR=1.82, 95% CI=1.07-3.10, *P*=0.027 for HB and OR=1.69, 95% CI=1.42-

2.01, *P*=0.000 for PB). There were statistically significant association for prostatitis and the risk of PCa in both HB and PB studies, although significant heterogeneity was present (I^2=84.4%, *P*=0.000 and I^2=79.9%, *P*=0.000, respectively).

The subgroup analyses were performed on 27 studies based on the source of data. In medical records, prostatitis was associated with an increased risk of PCa of borderline significance, and there was no significant heterogeneity (I^2=39.1%, *P*=0.131). However, no significant difference was found for prostatitis in medical records (OR=1.03, 95% CI=0.87-1.21, *P*=0.752).

Subgroup analysis was also performed based on the sample size. There was high degree of heterogeneity (I^2=83.7%, *P*=0.000 for ≥500 cases and I^2=76.8%, *P*=0.000 for <500). Prostatitis was significantly linked with an enhanced risk of PCa and produced a statistically significant difference in both groups (OR=1.54, 95% CI=1.28-1.86, *P*=0.000 for ≥500 and OR=1.99, 95% CI=1.38-2.87, *P*=0.000 for <500).

Sensitivity analyses

Sensitivity analyses were done to evaluate whether the meta-analysis pooled results of included studies were stable by removing studies. The overall pooled OR was found to be fairly stable by deleting one study at a time and observing the influence on the individual data, suggesting that the results of this meta-analysis were steady (**Figure 3**).

Publication bias

We evaluated publication bias with a Begg's funnel plot and Egger's test, which suggested no obvious evidence of publication bias (Begg's test z=0.58, *P*=0.559; Egger's test t=0.23, *P*=0.823). Meanwhile, visual inspection of the meta-analysis Begg's funnel plots revealed no significant funnel asymmetry (**Figure 4**).

Discussion

Until now, many experts started to explore prostatitis which is a risk factor for PCa, and is relatively inconclusive by many scholars [7-13]. To the best of knowledge, this meta-analysis aimed to clarify whether prostatitis can increase the risk of PCa. Meanwhile, we carried out subgroup analyses to explore the potential association between prostatitis and the risk of PCa. As a result, based on the quantitative synthesis, this meta-analysis showed the idea that prostatitis is associated with an increased risk of PCa in overall group and almost of the subgroup. Evidence has reported that compared to European American men, there is an increased incidence of inflammation in biopsy specimens from African American men [46], which suggests there is a racial and geographical difference in the prevalence of prostatitis and PCa in adult men. In the subgroup analysis of geographical region, we found a significantly increased risk of PCa in the Asian population and a slightly significant increase of risk in Europeans. Similar associations were observed for North Americans and South Americans. However, studies from South America (*P*=0.051) did not have significant results. One study representing South American patients showed increased random variations between the case and control groups, making it impossible to generate remarkable conclusions. There were seven studies in which information on prostatitis was obtained from the medical records. These studies found an insignificant association between prostatitis and PCa risk. One possible explanation for this insignificant result is the small size of the control group in the medical record studies. Alternatively, recall bias may be present in the medical studies between cases and controls. However, these studies may have not detected or under-reported cases of prostatitis, due to the asymptomatic nature of prostatitis. Meanwhile, detection bias is another potential bias, which would artificially increase the association between prostatitis and PCa risk. Studies that referred to a history of prostatitis generally did not further specify the sub-type of prostatitis, such as chronic bacterial or nonbacterial prostatitis. Thus, we did not try to distinguish between the categories of prostatitis.

It is well known that chronic inflammation may be closely associated with the development of cancer. There is evidence which can be best exemplified by the association between chronic gastritis, gastric atrophy and the subsequent development of gastric cancer. Thus, we also assume that there are closely association between prostatitis and PCa. Recently, several epidemiological and histopathological studies have shown that inflammation may contribute

to carcinogenesis of PCa. The prevalence of prostate inflammation and PCa is at nearly epidemic levels in the United States and in "Westernized" countries [47]. De Marzo *et al* [48] demonstrated that compared with normal epithelium, the epithelial cells that proliferate in focal atrophy lesions should be defined as PIA. In morphological studies, some scholars have observed frequent transitions between PIA and proliferative atrophy with high grade prostatic intraepithelial neoplasia (PIN) lesions, which might manifest that PIA is a lesion linking inflammation and the development of PCa. Meanwhile, there are some experimental and clinical evidences that testify the hypothesis which inflammation may be one of the causes of PCa. Elkahwaji *et al* [49] investigated that there were atypical hyperplasia, dysplasia and abundant prostatic epithelial proliferation in the prostate of mice. Based on the meta-analysis by Dennis *et al* [50] there is a significant OR for PCa of 1.6 for ever having a history of prostatitis, which suggest a high association of prostatitis with PCa. Also, there are many molecular mechanisms which are responsible for the carcinogenesis process of PCa. RNA-SEL encodes an enzyme that has an important role in degrading viral RNA on viral infection. MSR1 encodes the subunits of macrophage-scavenger receptor, which can bind bacterial lipopolysaccharides. RNA-SEL (linked to HPC1 gene) and MSR1, two familial PCa genes, have linked with the possibility that infection or inflammation may lead to PCa [51, 52]. The frequent mutation of TP53 gene, a common genetic pathway, is an important finding in the transformation between PIA, high grade PIN and PCa [53]. Moreover, NKX3.1, CDKN1B and PTEN, prostate tumour-suppressor gene, are highly expressed in normal prostate epithelium and downregulated in PIA and decreased or absent in PIN and PCa [6]. Interestingly, the expression of GSTP1, which is a main defense mechanism against the oxidative genome damage, is downregulated in PCa. The change which is regulated by GSTP1 promoter CqG island hypermethylation would be vulnerable to oxidants and accumulate genome damage and then lead to PIN and PCa [54]. Tumor-associated macrophages (TAMs) are a heterogeneous group of cells, which can be generally classified into "M1" or "M2" macrophage subsets according to phenotypic and functional characteristics. Additionally, TAMs that infiltrate the tumor microenvironment play an important role in dampening anticancer immune responses, which favor tumor invasion [55]. In view of these molecular mechanisms, more precise pathogenesis was required to validate an important role of prostatitis in identifying the risk of PCa.

The limitations of this meta-analysis should be considered. First, it is hard to draw the conclusion that there is a causal relationship between prostatitis and PCa due to the lack of cohort studies. Secondly, there are additional unpublished studies that were limited by the selected electronic databases, causing inevitable publication bias. Third, although no language restrictions were used in this meta-analysis, we were unable to detect eligible studies in all other languages, which may produce language bias. Fourth, the vast majority of studies contained in this meta-analysis did not distinguish the categories of prostatitis; thus, not all types of prostatitis may be associated with prostate cancer. Moreover, other factors such as age, family history, and PSA level that are associated with the incidence of PCa should be considered. The above limitations should be addressed in future studies. Regardless of the abovementioned limitations, this meta-analysis has articulated an association between prostatitis and PCa risk.

Conclusion

This meta-analysis is a comprehensive study exploring the relationship between prostatitis and PCa. Our findings indicate that prostatitis is associated with a significant increase in the risk of PCa in overall group and almost of the subgroups. In the whole subgroup analysis of Asian population, there was a significant association between prostatitis and risk of PCa. Taking into account the result of this meta-analysis, patients should be encouraged to seek treatment for prostatitis to decrease their risk of PCa. Considering that the pooled results are based on case-control study, large, well-designed cohort studies should be used in the future to further confirm the current findings.

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Disclosure of conflict of interest

None.

Authors' contribution

HYD, SF, and CZL conceived and designed the study. LZ and ZYH researched and assessed the literature. HYD, SF and LZ performed the statistical analyses. HYD drafted and revised the manuscript. All authors read and approved the final manuscript.

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