

Isolation and Characterization of Bacterial Infections from Patients with Prostate Cancer

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Abstract

Background: This study aimed to identify the most common bacterial isolation that were correlated with patients suffering from prostate cancer. **Materials and Methods:** During the period extending between (November 2021 to April 2022) from the Imam Hussain Center for Oncological and Hematological Diseases Directorate, urine samples were obtained from so suspected patients suffering from prostate cancer (PCa), their age were ranged from 51 to 80 years. Collected 50 urine sample. The technique utilized for identifying bacterial species was the Vitek 2 system. Out of 50 urine samples tested, it was determined that (58%) had non-significant bacterial growth and (42%) had significant bacterial growth. **Results:** The results of bacterial isolates were (81%) of *Escherichia coli*, (14.3%) of *Enterobacter cloacae* and (4.7%) of *Klebsiella pneumoniae*. The most growth of *E. coli* isolates was within 8-10 Gleason score group (56%), this indicates that this category (Gs 8-10) is a risk factor and an encouragement for the growth of *E. coli* in prostate patients. The results of the present study showed that *E. coli* and *Enterococcus* are present in large number relatively in the urine of patients with PCa. Increased levels of these two bacteria in the urine could be a sign that PCa patients experience a significant degree of inflammation. Current study showed that Gleason score (8-10) with 25 patients (50%); and documented increasing prostate specific antigen in age group (70-79) years. also, the results revealed there were 17 (34%) patients within the overweight group and severe Gleason scores (8-10) that may indicate that being overweight is a risk factor for the severity of PCa. **Conclusion:** Gleason score (8-10) was the most prevalent in patients with PCa. Age group (70-79) years was the more than age group suffering from PCa. *Escherichia coli* isolates were most distribution among the patients.

Keywords: Prostate cancer, PSA, Prostatitis, Gleason scores, Bacteria

1. Introduction

The prostate is a male sex accessory gland that surrounds the urethra and produces fluids to the ejaculate. The prostate is a gland that rests in the pelvis next to the bladder and rectum. It is partially encased in a capsule made of collagen, elastin, and smooth muscle, and the urethral sphincter mechanism is located at the apex of the gland (1).

The second most frequent form of cancer in men overall is PCa. Therefore, research into understanding the factors and mechanisms associated with PCa pathogenesis, etiology, and disease progression is of greatest importance (2). In Iraq, between 2000 and 2015, a total of 4770 PCa cases were reported (except Kurdish region), which accounted for approximately 4.08% of the cancer cases among men, and PCa ranked as the most common type of men cancer. The Age-specific incidence rates (ASIRs) rise steadily from age 50-59, the highest rates are in the 70 to 79 age group (3). Risk factors are contributed for PCa; men older than 55 years have an increased risk of having damage occur to the genetic material (DNA) (4), the male smokers have higher levels of testosterone (5) and certain metabolic changes in obese men may raise the risk of PCa (6).

High levels of Prostate Specific Antigen (PSA) indicate a greater likelihood of PCa (7).

Regardless of the patient's treatment, the Gleason system, which is currently the most popular system for grading PCa, has been shown to be an effective predictor of the patient's prognosis. The Gleason grading system is unique in that it is based entirely on the tumor's architectural characteristics (8).

Bacterial prostatitis (BP) is typically caused by an infection from a member of the Enterobacteriaceae family, but other organism families can be responsible and are more likely in certain high-risk populations. The most common isolate from urine cultures and the direct cause in the majority of cases (approximately 50 to 90%) is *Escherichia coli* (9).

Acute Bp is caused by the same organisms that cause most urinary tract infections. Most cases (87%) involve gram-negative bacteria from the family Enterobacteriaceae. Other common Gram-negative organisms include *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Klebsiella*, *Enterococcus* spp., and *Serratia* spp. *Enterococcus* spp. account for up to 10% of cases of acute prostatitis (10). The most frequent urological condition seen in young men is chronic prostatitis syndrome, which is also a significant urological condition in men over the age of 50 (11).

Aimed this study for isolation and identification bacterial isolates from patients suffering from PCa.

2. Materials and Methods

Collection of samples was carried out in one place (the Imam Hussain Center for Oncological and Hematological Diseases Kerbala) during the period of the current study. Urine samples were obtained from 50 patients with PCa at different stages of cancer. They were between the ages of 35 and 80. These patients were divided based on their age, cancer stage, and bacteria type.

Patients who had been diagnosed with PCa each approximately 10 milliliters of their clean-catch midstream urine collected from them and stored in sterile containers. In the medical laboratory, each urine sample was immediately inoculated onto common culture media (MacConkey and Blood agar). After that, conventional methods were used to incubate the samples aerobically at 37 °C for 24 to 48 hours.

Following the completion of the manual biochemical tests for the bacterial isolates that were required in order to identify the bacteria if Gram-positive bacteria or Gram-negative bacteria, a fully automated VITEK-2 compact system was utilized in order to determine the bacterial species.

3. Statistical analysis

For the statistical analysis of the data, the SPSS program was utilized. The quantitative results are presented as the mean standard deviation. The Pearson's χ^2 test was utilized in order to investigate the correlations that existed between the various factors. The Pearson correlation was used to explain the nature and strength of the relationship that exists between the variables (R). A significance level of 0.05 was used for the tests.

4. Results and Discussion

Patients diagnosed with PCa are the focus of this study. The ages of the patients ranged from 50 to 85 years, and they were classified into four groups according to their ages. As shown in table 1, the age groups with most patients were 60-69 years (34 %) and 70-79 years (46 %) years. These findings were in agreed with those of Dr. Patrick, who found that in the United States of America, over 65 % of all PCa cases are diagnosed in males over the age of 65 years, with a diagnosis age of 69 being the average for men (12).

During the current study, it was founded that 22 patients (44 %) had hypertension, whereas only 18 patients (36 %) had diabetes. In addition, the findings demonstrated that 38% of patients were smokers, 6% of patients suffered from renal disease, and 6% of patients had a family history of PCa.

Out of 50 patients, 41 (83%) are taking hormonal therapy, 6 (12%) with chemotherapy, and 3 (6%) patients were without treatment. Patients who have a family history of the disease are at an increased risk

of developing PCa, and this risk can increase by two to three times when first-degree relatives develop the disease. Numerous epidemiologic studies have connected the risk of PCa to several variables, including age, ethnicity, family history, insulin-like growth factors, way of life, food, and occupational and environmental exposures. Results from epidemiological, in vivo, in vitro, and preliminary clinical investigations showed that specific dietary supplements and items may help prevent PCa. To investigate and identify the risk factors and preventative measures of PCa development, more research is still required. In order to reduce the risks and prevent PCa, it is crucial for clinicians to corroborate these facts (13).

Table 1. Demographic distribution of Patients with PCa.

Variation	No. (%)
Studied population	
Patient	50 (100%)
Gender	
Male	50 (100 %)
Age-group (Years)	
(50-59)	7 (14%)
(60-69)	17 (34%)
(70-79)	23 (46%)
(80-89)	3 (6%)
Hypertension	
Hypertensive	22 (44 %)
Non-hypertensive	28 (56 %)
Gleason scores	
Score \leq 6	8 (16%)
score 7	17(34%)
score 8-10	25 (50%)
Diabetes mellitus (DM)	
With DM	18 (36 %)
Without DM	32 (64 %)
Smoking	
Smokers	24 (48%)
Non-smokers	26 (52%)
Renal disease	
With Renal disease	3 (6%)
Without Renal disease	47 (94%)
Family history	
With Family history	3 (6%)
Without Family history	47(94%)
Therapy	
Chemotherapy	6 (12%)
hormonal therapy	41 (82%)
Without therapy (new)	3 (6%)

The results of our current study showed a high rate of PCa among those who smoked (48%), so smoking can be considered a risk factor associated with the occurrence of PCa. This conclusion is supported by data from several studies suggesting an association between smoking and aggressive PCa, although the pathophysiology underlying this association remains unclear (14).

Researchers observed that male smokers were shown to have increased levels of the hormones androsterone and testosterone in their blood, which may enhance their chance of developing PCa or accelerate the growth of the disease. There may also

be a connection between smoking and hormonal imbalances; It was found that male smokers have higher levels of androsterone and testosterone in their blood, which may increase their risk of developing PCa or speed up the disease's progression (15, 16).

The results from the table (2) showed the mean age of Gleason scores ≤ 6, 7, and 8 - 10 was 69.62 ± 4.13, 69.58 ± 6.35, and 67.88 ± 8.03 respectively. The statistical analysis revealed that there were no significant differences in mean age between different Gleason score groups in the patients with PCa.

Table (2): The differences in means of age between different Gleason scores groups in the patients with PCa

Gleason scores	Age			
	Mean ± SD	Minimum	Maximum	p-value
Score ≤6	69.62±4.13	65	74	0.689
Score 7	69.58±6.35	58	80	
Score 8-10	67.88±8.03	51	80	
Total	68.74±6.93	51	80	

These results agreed with (17), that in a study of a total of 268 patients were diagnosed with PCa; 40 to 94 years old was the age range. The median age was found to be 68 years old, with an interquartile range of 15 years. An interquartile range of 7 scores and an average Gleason score of 8 were determined. The Gleason score and the age of the patients at the time

of diagnosis had a weakly negative correlation (R = - 0.013, p = 0.832).

Tumor score, considered one of the histologic features for clinical end prediction, may contribute to improvement in patients prognosis (18); there for Gleason grade is the best indicators for diagnosis PCa in men (19). The Gleason system is an architectural grading scale that runs from 1 (highly distinguished) to 5 (Poorly differentiated) and was first presented in 1974 (20). The major and secondary patterns are added to determine the GS, which has a scale from 2 to 10. It has long been recognized that people with GS ≥ 7 are more likely to experience biochemical recurrence and extra prostatic extension (21). However, more recent evidence revealed that the way GS was applied has altered, which has affected how scores are distributed over time (22). Furthermore, research employing surrogate end points has revealed that there is a wide range in the prognosis for GS 7 cancers (23).

The results from the table (3) showed there are no significant differences between age groups and the presence of *E. coli* (p = 0.893), *E. cloacae* (P = 0.319) and *K. pneumoniae* (0.745) in patients with PCa. The distribution of 14 isolates of *E. coli* within the age groups from 60 to 79, while the other three isolates were distributed among the other groups, the distribution of *E. cloacae* isolates within the age groups from 50 to 69 years, and the distribution of *K. pneumoniae* isolate within the age groups from 70-79.

Table (3) Distribution of *E. coli*, *E. cloacae* and *K. pneumoniae* isolates in prostatic patients according to age groups

Age group (Year)	<i>E. coli</i>				<i>E. cloacae</i>				<i>K. pneumoniae</i>			
	Positive		Negative		Positive		Negative		Positive		Negative	
	N	%	N	%	N	%	N	%	N	%	N	%
50-59	2	4	5	10	1	2	6	12	0	0	7	14
60-69	7	14	10	20	2	4	15	30	0	0	17	34
70-79	7	14	16	32	0	0	23	46	1	2	22	44
80-89	1	2	2	4	0	0	3	6	0	0	3	6
Total	17	34	33	66	3	6	47	94	1	2	49	98
p-value	0.893				0.319				0.745			

Various malignancies are known to be promoted by inflammation, in part because of altered microenvironments brought on by bacterial infections. However, it is unclear exactly how microbiota in urine and PCa are related (24).

Urinary tract infections, which can lead to chronic Bp, are usually linked to gram-negative enteric bacteria such as *E. coli*, *Pseudomonas aeruginosa*, and *Enterococcus* (25). Additionally, higher levels of pro-inflammatory cytokines linked to the initiation and progression of cancer are seen in *E. coli* and *Enterococcus* infections (26, 27). Therefore, it seems sense to suggest that chronic Bp brought on by bacteria may heighten proinflammatory responses that may aid in the development of PCa (28).

Ethical approval

In the present study, their urine samples were taken from them after asking and their medical history was

determined through a questionnaire as well as from the database of the Imam Hussain Center for Oncological and Hematological Diseases Directorate.

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