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Original Article

Determination of Pre/Post Treatment Changes in Prostate Specific Antigen Levels in Patients with Acute Prostatitis

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HIGHLIGHTS

• Duration of treatment can be effective in reducing the level of PSA in patients with acute prostatitis.
• There was a significant relationship between age and primary PSA at the beginning of diagnosis and PSA reduction.
• There is a significant relationship between age and duration of treatment.

ABSTRACT

Introduction
Given that studies on the association between pre/post-treatment prostate specific antigen (PSA) levels in acute prostatitis are limited and investigations in men from different communities are few, the present study aimed to determine the pre/post-treatment changes in PSA levels in patients with acute prostatitis.

Methods
The current cross-sectional study was conducted in 2020 on a population of men with acute prostatitis. The patients were then referred to a laboratory to measure PSA levels for a definitive diagnosis of acute prostatitis. Prostate volume was determined using ultrasound. Afterward, drug treatment was started for the patient, followed by monitoring. The PSA levels were re-measured, and prostate volume was recorded after treatment. Patient information included patient profile, age, date of the first visit, PSA level at the baseline (before treatment), diagnosis of acute prostatitis, time to start treatment, time to end treatment, PSA level after treatment, and prostate volume.

Results
The mean and standard deviation of the age of these patients was 59.90 ± 6.31 years old. The results showed a significant relationship between age and primary PSA at the beginning of diagnosis and PSA reduction (P-value<0.05). There is a significant relationship between age and duration of treatment (P-value=0.001). The duration of treatment was significantly related to the reduction of PSA, the amount of primary PSA at the beginning of diagnosis, and the amount of secondary PSA after treatment (P-value<0.05).

Conclusions
The study's findings can be concluded that the duration of treatment can effectively reduce the level of PSA in patients with acute prostatitis. Extensive studies with a control group for future studies are recommended.

Keywords: Treatment; Prostate Specific Antigen; Acute Prostatitis

Introduction

Acute prostatitis refers to an acute bacterial infection of the prostate gland. It is a severe medical condition and is considered part of emergency surgeries in the kidney and urinary tract in terms of diagnosis and treatment. Prostatitis can occur in both acute and chronic forms in men. Acute prostatitis should be distinguished from other forms of chronic prostatitis and chronic pelvic pain syndrome. Since the microbial strains causing acute prostatitis are the same as the strains involved in urinary tract infections (UTIs), further research in this area is of particular importance to the male population. Acute

prostatitis commonly coincides most often with UTIs and may also occur with sexually transmitted infections (STIs) such as gonorrhea or chlamydia (1-4).

Prostatitis is a group of conditions such as infectious diseases (acute or chronic bacterial prostatitis), chronic pelvic pain syndrome (CPPS), and asymptomatic inflammatory prostatitis (1). Due to the importance and vital role of the prostate in men's health in any society, the Association for the International Classification of Diseases (ICD) has classified prostatitis into four syndrome categories. The first category is acute bacterial prostatitis (ABP), presenting with an acute urinary tract infection (UTI). The second category is chronic bacterial prostatitis (CBP), persistent bacterial infection of the prostate gland that results in recurrent UTIs (RUTI) caused by the same bacterial strains. The third category is chronic prostatitis/ chronic pelvic pain syndrome (CP/CPPS), characterized by chronic pelvic pain symptoms in the absence of UTI, including pain in the genitourinary system, voiding dysfunction, and sexual dysfunction, which reduces the quality of life (QoL). This category has two subtypes: inflammatory IIIa sub-category refers to leukocytes in the semen, expressed prostatic secretions, post-prostate massage urine specimen; and non-inflammatory IIIb sub-category refers to the presence of pelvic pain but no signs of inflammation in the genitourinary system. The fourth category is asymptomatic inflammatory prostatitis (AIP), in which, despite having no genitourinary tract symptoms, there is evidence of inflammation in the prostate tissue or semen (2, 5). Accordingly, more attention to the course of the disease in the category of acute bacterial infection, or acute prostatitis, is very significant and valuable to prevent the progression of the disease.

The prevalence rate of prostatitis symptoms among men varies from 2.2% to 9.7% and averages 8.7% (6-8). Prostatitis accounts for about 8% of referrals to urologists and more than 1% to general practitioners (9). In 2000, the estimated cost of diagnosing and treating prostatitis was about $ 4 million (10, 11).

People with chronic prostatitis experience physical, social, and psychological disorders that result in decreased quality of life (12). Prostate specific antigen (PSA) is a biomarker widely used to diagnose prostate diseases (13, 14). Elevated PSA levels in men can occur for various reasons, including prostate cancer, enlarged prostate gland or tissue due to increased cell reproduction (early stage in cancer progression), acute UTI, and bacterial prostatitis (15).

Men with chronic prostatitis reported pelvic and genital pain with or without urinary symptoms. In a study of patients with chronic prostatitis, about 50% of men had evidence of inflammation in prostatic secretions (16, 17). The PSA marker levels are generally elevated in prostate diseases. Previous studies have shown that prostatitis can reduce the rate of PSA specificity, but there is other evidence for the effect of tissue inflammation on free PSA (fPSA) levels (18-23).

Due to the recent increase in PSA use in routine screening for prostate disease and the increase in the PSA level in many disorders, especially prostatitis, there is a need to measure the serum PSA level in patients with prostatitis under various conditions. Acute prostatitis is a urological emergency in men. Accurate management of this disease is of great significance in the health of men in society, and research in this field has always been necessary for all societies. Studies in this field are limited globally, including in Iran, and such studies are valuable for men in any society to diagnose the disease and avoid unnecessary biopsies (24-27). Studies on the association between pre/ post-treatment PSA levels in acute prostatitis at different stages of the disease are limited, and investigations in men from different communities and Iran are few. The present study aimed to determine the pre/post-treatment changes in the PSA levels in patients with acute prostatitis referred to Al-Zahra Hospital affiliated with Isfahan University of Medical Sciences (Isfahan, Iran) in 2020.

Methods

The current follow-up pre/post-treatment study was conducted in 2020 on a population of men with acute prostatitis referred to Al-Zahra University Hospital of Isfahan, Iran. The census selected the patients and convenience sampling due to the limited statistical population for this disease in the mentioned center; The inclusion criterion was a history of acute prostatitis in men. Due to the small number of patients with acute prostatitis, as many patients as possible enrolled in this project. There were no exclusion criteria for patients diagnosed with acute prostatitis.

This study obtained history taking for patients after referring to the urologist according to clinical symptoms. The patient was then referred to a laboratory to measure PSA levels for a definitive diagnosis of acute prostatitis. Prostate volume was determined using ultrasound. After a urologist's definitive diagnosis of the disease, drug treatment was started for the patient, followed by monitoring. The PSA levels were re-measured, and prostate volume was recorded after treatment. Patient information included patient profile, age, date of the first visit, PSA level at the baseline (before treatment), diagnosis of acute prostatitis, time to start treatment, time to end treatment, PSA level after treatment, and prostate volume. The ethics committee approved this study of Isfahan University of Medical Sciences with the code of ethics of IR.MUI.MED.REC.1399.801. All patients were explained the methodology and objectives of the study and the confidentiality of all their information.

Statistical analysis

All the obtained information was recorded as a database

Table 1. Mean and standard deviation of the studied variables

Variables	Mean	Standard Deviation
Primary PSA at baseline	34.3527	14.56873
Secondary PSA after treatment	4.7294	3.06774
PSA reduction	29.6233	13.50266
Postate volume	59.5758	20.40367
Duration of treatment	36.7879	33.76093

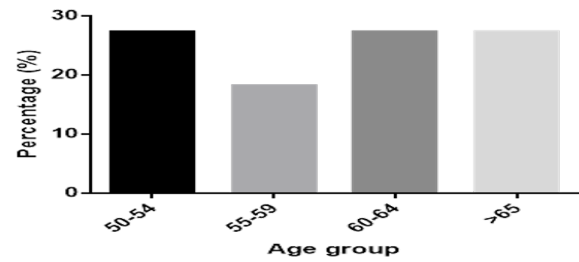Figure 1. Frequency of patients studied by age

in Excel software. Qualitative data were described by frequency and percentage and quantitative data by mean and standard deviation. Paired t-test was performed to compare quantitative variables.

Results

In this study, 66 people participated in the study; the mean and standard deviation of the age of these patients was 59.90±6.31 years old. In this study, primary PSA at baseline, secondary PSA after treatment, PSA reduction, prostate volume, and duration of treatment were evaluated. The results of this study are reported in (Table 1). Also, in this study, the frequency of patients was analyzed by age; the results are shown in (Figure 1).

In this study, the age distribution was compared and analyzed in terms of primary PSA at the beginning of diagnosis, secondary PSA after treatment, PSA reduction, prostate volume, and duration of treatment (Table 2). The results showed a significant relationship between age and primary PSA at the beginning of diagnosis and PSA reduction (P-value<0.05). Also, the present findings showed a significant relationship between age and duration of treatment so that the duration of treatment increased with age and the duration of treatment was longer in the elderly group than in other groups (P-value =0.001). The present findings showed that age was not significantly associated with secondary PSA after treatment and prostate volume (P-value>0.05).

In this study, the correlation between patients' prostate volume in terms of PSA (initial onset of diagnosis - secondary after treatment and its reduction) and the correlation between duration of treatment in terms of PSA (immediate onset of diagnosis - secondary after treatment and its reduction) was examined (Table 3 and 4). Pearson correlation coefficient showed no significant relationship between prostate volume and PSA reduction, primary PSA at the beginning of diagnosis, and secondary PSA after treatment (P-value>0.05). However, the Spearman correlation coefficient showed that the duration of treatment was significantly related to PSA reduction, the amount of primary PSA at the beginning of diagnosis, and the amount of secondary PSA after treatment (P-value<0.05). In further studies, the Spearman correlation coefficient showed no significant relationship between treatment

duration and prostate volume (r=0.065, P-value=0.603).

Discussion

The purpose of this study was to determine the extent of changes in prostate-specific antigen levels in acute prostatitis before and after treatment in patients referred to Al-Zahra University Hospital of Isfahan, Iran. The study results revealed that the mean and standard deviation of the age of these patients was 59.90±6.31 years old. The results showed a significant relationship between age and primary PSA at the beginning of diagnosis and PSA reduction (P-value<0.05). There is a significant relationship between age and duration of treatment (P-value=0.001). The age was not significantly associated with secondary PSA after treatment and prostate volume (P-value>0.05). Results showed no significant relationship between prostate volume and PSA reduction, primary PSA at the beginning of diagnosis, and secondary PSA after treatment (P-value>0.05). However, the duration of treatment was significantly related to PSA reduction, the amount of primary PSA at the beginning of diagnosis, and the amount of secondary PSA after treatment (P-value<0.05). There is no significant relationship between treatment duration and prostate volume (r=0.065, P-value=0.603).

Based on the findings of this study, the correlation between treatment duration and PSA was significant. In limited studies, the relationship between PSA levels and treatment duration has been investigated, but some studies suggest that taking diuretics can reduce PSA levels over a while. A study of 156 patients with symptoms of prostatitis and treated with antibiotics showed that there was an increase in TPSA in 3.58% of patients with acute prostatitis, 5.15% of patients with chronic bacterial prostatitis, and 9.9% of patients with bacterial prostatitis, which in most patients after Treatment level is reduced. Some studies stated that when TPSA or FPSA are at high levels, the diagnosis of prostatitis should also be at the top of the list of diagnoses (16-19). In a study conducted in 2013, the effect of antibiotic therapy on the course of PSA changes was investigated. This study studied one hundred forty-five men aged 45 to 70 years with PSA between 2.5 and 10 ng/ml. The conclusion was that antibiotic treatment before transrectal prostate

Table 2. Age distribution in terms of baseline PSA, secondary PSA after treatment, PSA reduction, prostate volume and duration of treatment

| Variables | Age group | | | | | P-value |
	50-54	55-59	60-64	>65	Total	
Baseline PSA	25.07±11.42	24.90±9.81	42.76±14.73	41.52±10.87	34.35±14.56	<0.001
PSA after treatment	4.45±1.83	3.55±1.34	5.68±4.61	4.82±2.85	4.72±3.06	0.301
PSA reduction	20.61±11.17	21.35±9.40	37.07±12.45	36.69±10.67	29.62±13.50	<0.001
Prostate volume	56.00±19.05	57.50±7.64	54.55±18.45	69.55±26.48	59.57±20.40	0.105
Treatment duration	24.66±10.61	26.50±5.38	32.33±12.29	60.22±56.94	-	0.001

Table 3. Correlation of patients' prostate volume according to PSA (baseline - secondary after treatment and its reduction)

Variables	Index	Baseline PSA	PSA after treatment	PSA reduction	Prostate volume
Baseline PSA	Pearson correlation	1	.440	.979	-.150
	p-value		.000	.000	.231
PSA after treatment	Pearson correlation	.440	1	.248	-.160
	p-value	.000		.045	.199
Decreased PSA	Pearson correlation	.979	.248	1	-.125
	p-value	.000	.045		.317
Prostate volume	Pearson correlation	-.150	-.160	-.125	1
	p-value	.231	.199	·317	

Table 4. Correlation of PSA treatment duration (baseline - secondary after treatment and its reduction)

Variables	Index	Baseline PSA	PSA after treatment	PSA reduction	Treatment duration
Baseline PSA	Spearman correlation	1.000	.313	.974	.394
	p-value	·	.010	.000	.001
PSA after treatment	Spearman correlation	.313	1.000	.130	-.256
	p-value	.010	·	.299	.038
PSA reduction	Spearman correlation	.974	·130	1.000	.435
	p-value	·000	.299	·	.000
Treatment duration	Spearman correlation	.394	-.256	.435	1.000
	p-value	.001	·038	.000	·

biopsy under ultrasound could be valuable only in a small subgroup by reducing the amount of PSA (22, 28). Since Pearson's results showed a significant correlation between PSA reduction and treatment duration, it can be said that in the four age groups studied, PSA levels may return to normal after approximately the same day average. In other words, after a certain period of treatment, the PSA level is expected to return to normal for any age range after prostatitis. Of course, it is necessary to mention two points in this section. First, the passage of time and medication after this period together reduce the amount of PSA, and the effect of these two separately cannot be distinguished from the present study because, in this study, a similar group was not defined who had prostatitis did not receive medication. Then the PSA level in this group is measured. The second point is that PSA levels are expected to return to normal after each treatment period in each age group. Because PSA levels may drop abruptly in the first few weeks in response to medication, the patient continuously has continued treatment due to symptoms. The patient is then tested for PSA one or two weeks later. Given this, PSA levels are expected to return to normal at the time of testing, although PSA levels may have decreased earlier in each age group, and this study cannot differentiate this.

Based on the results of this study, the present findings showed that there is a significant relationship between age and early PSA at the beginning of diagnosis, so the amount of PSA has increased with age. According to studies to date, prostate volume and PSA levels increase with age, which is consistent with the results of other studies (29-32). In this regard, the PSA level based on the reference study of Liu et al., (32) PSA level should gradually increase with age, which confirms the present study results. On the other hand, there is no significant relationship between age and secondary PSA after treatment in this study. There is also a significant relationship between age and

PSA reduction. This result and its extension to the present study and patients with prostatitis can be said, considering that the PSA level in the elderly groups is significantly higher and the PSA level after treatment is almost similar to other groups. Hence, in the elderly group, In response to prostatitis, they have higher PSA levels, which may be due to the larger prostate than other age groups. Therefore, it can be said that the more significant decrease in PSA in the elderly may be due to higher initial PSA levels. It can also be noted that the direct relationship between prostate volume and age and the lack of a significant relationship with the duration of treatment and PSA levels seem pretty logical. This means that older men have larger prostates from the beginning, and antibiotic treatment reduces the size of the prostate and eventually returns to its primary (baseline) state.

Conclusions
Based on the study's findings, it can be concluded that the duration of treatment can be effective in reducing the level of PSA in patients with acute prostatitis. Extensive studies with a control group for future studies are recommended.

Authors' contributions
All authors contributed equally.

Acknowledgments

Conflict of interest
All authors declare that there is no potential competing or conflict of interest.

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Ethics statement
This study was approved by the ethics committee of Isfahan University of Medical Sciences with the code of ethics of IR.MUI.MED.REC.1399.801.

Data availability
Data will be provided on request.

Abbreviations
CPPS   Chronic pelvic pain syndrome
PSA   Prostate specific antigen
UTI   Urinary tract infection

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