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Research Article

STUDY TO EVALUATE THE RELATIONSHIP OF RAISED PSA AND PROSTATIC PATHOLOGY PATTERNS IN INDIAN POPULATION

Sandeep Kumar, Rajeev Sood and *Khushbu Katarya
Punjab Institute of Medical Sciences, Punjab, India
**Author for Correspondence*

ABSTRACT

The incidence of PCa (prostatic carcinoma) varies from country to country, with the highest incidence being found in the Western world and the lowest in Asian countries. The incidence and prevalence of prostatitis and BPH in Asian countries seems to be comparable to Western countries, but this does not hold for PCa. However, unlike in other prostate diseases, PSA has a key role in the diagnosis and management of PCa. In spite of India constituting a large proportion of the world's population, there are a few indexed publications from India regarding the histopathological findings of prostatic biopsy in men with elevated PSA. Indians being ethnically distinct we sought to determine the distribution of prostatic pathology in patients with raised serum PSA levels in our hospital based practice. This prospective observational study was carried out in department of urology, PGIMER, Dr. RML hospital, New Delhi between 1st November 2013 to 31st March 2015. All male patients between the ages of 50-80 years, presenting with raised PSA(>2.5-20 ng/ml) even after minimum 3 weeks of antibiotic administration were included in this study. Patients with active UTI, painful anorectal condition, severe comorbidity, significant coagulopathy and history of acute urinary retention, instrumentation, urethral surgery were excluded. All patient undergone TRUS guided 12-core prostatic biopsy on outpatient basis. The effect of age, prostate volume, serum PSA and DRE on histopathology analysed. All statistical analyses were performed on SPSS 20 (Chicago, USA) and excel 2010. A total of 257 patients screened during the defined period. Out of which 83 patients were excluded from study as their serum PSA level decreased to <2.5 ng/ml after giving antibiotics as defined in the protocol. Rest 174 patients underwent TRUS-guided 12 core prostate biopsy. The mean age was 68.66 ± 7.04 years. The mean prostate volume was 53.44 ± 25.05 ml. The mean PSA was 7.16 ± 4.25 ng/ml. All patients underwent 12-core biopsies. Abnormal DRE was noted in 11.49 % of the cohort. The overall cancer detection rate was 13.79% (24 patients). For patients who had prostate cancer upon TRUS-guided prostate biopsy, the commonest Gleason score was 7 (37.49%). BPH was the most common histological lesion encountered (148cases–85.05%). BPH was associated with prostatitis in 67 pt. (38.50%), while exclusive BPH was present in 81 patients (46.55%). In patients with malignant histopathology 21(87.50%) of pt. had PSA ≥ 7.2ng/ml and 23(95.83%) pt. had PSA ≥5.1ng/ml.Upon both univariate and multivariate logistic regression analyses smaller prostate volume, abnormal DRE were significantly associated with increased risk of prostate cancer detection. P value <0.05 was considered as significant in this study. Rising serum PSA value was significantly associated with increased chances of adenocarcinoma prostate in only first two groups i.e. 2.50-4.00 and 4.01-10.00 ng/ml. Age was found not associated with increased risk of cancer detection in both univariate and multivariate logistic regression model. In the patient population in urology OPD at a tertiary centre the incidence of adenocarcinoma prostate is lower even in elevated PSA. While prostatitis constitutes a significant proportion (38.50% in this study). So, a course of broad spectrum antibiotic is useful in excluding a significant number of patients from unnecessary biopsy which is not in line with the white paper published in AUA (American urology association) guidelines 2014. As 95.83% of adenocarcinoma pt. had serum PSA ≥5.1ng/ml, a higher cut off value of serum PSA may be more useful in Indian population. Although, further prospective studies involving different and larger population and longer duration will be needed to support and confirm these findings.

INTRODUCTION

One of the most important diagnostic tools used to detect prostate cancer is prostate-specific antigen (PSA), yet increased PSA alone does not reflect the presence of prostate cancer. Other pathological

prostatic conditions such as prostatitis and benign prostatic hyperplasia (BPH) or prostate manipulation (e.g., prostate massage, prostate biopsy, transurethral resection) may also increase the level of PSA. However, unlike in other prostate diseases, PSA has a key role in the diagnosis and management of prostate cancer. The incidence of prostate cancer varies from country to country, with the highest incidence being found in the Western world and the lowest in Asian countries. Owing to the low incidence of prostate cancer, there could be different views regarding the use of PSA in Asian countries, especially for the early detection/screening of prostate cancer.

Prostate cancer (PCa) is the most common malignancy in males and the second leading cause of male cancer death in the US (Jemal *et al.,* 2009). The incidence of PCa varies from country to country, with the highest incidence being found in the Western world and the lowest in Asian countries (Ferlay *et al.,* 2004). According to GLOBOCAN 2002, a global epidemiological study, the incidence of PCa in Asian countries is much lower than those in Western countries (Ferlay *et al.,* 2004). Among South East Asian countries, Indonesia supposedly has the highest incidence. Also, there is a difference in the prevalence and the rate of disease per 100,000 population between races, where once again the Asian/Pacific Islander race group in the US has the lowest prevalence (0.7871%) compared with Blacks (2.2927%), who had the highest prevalence, followed by Whites (1.5071%) (Horner *et al.,* 2008).

In Indonesia, based on data from CiptoMangunkusumo Hospital (CMH) and the Dharmais Cancer Center (DCC), the incidence and prevalence of PCa have increased by a factor of 2.5 from 1995 to 2004 (Umbas, 2005).

The incidence and prevalence of prostatitis and BPH in Asian countries seems to be comparable to Western countries, but this does not hold for PCa (Homma *et al.,* 1997). However, unlike in other prostate diseases, PSA has a key role in the diagnosis and management of PCa.

Despite, India constituting a large proportion of the world's population, there are a few indexed publications from India regarding the histopathological findings of prostatic biopsy in men with elevated PSA.

Indians being ethnically distinct we sought to determine the distribution of prostatic pathology in patients with raised serum PSA levels in our hospital based practice.

MATERIALS AND METHODS

This prospective observational study was carried out in department of urology, PGIMER, Dr. RML hospital, New Delhi between 1st November 2013 to 31st March 2015. All male patients of 50-80 years of age presenting to the urology outpatient department with raised PSA (>2.5-20 ng/ml) were enrolled after proper information and counseling. Patient particulars, any significant history, clinical examination including DRE (digital rectal examination), prostate volume, basic hematological and urine investigation and serum PSA were recorded. The serum PSA estimations were carried out with radiometric assay technique.

Patient with PSA >2.5 ng/ml received antibiotic treatment for minimum 3 weeks. After 3 weeks, serum PSA was evaluated again. If PSA was < 2.5 pt. excluded from study whereas if it was still >2.5 ng/ml, a TRUS guided 12-core prostatic biopsy.

Prior approval was obtained from the Institutional Ethics Committee.

TRUS-guided prostate biopsy was done as an outpatient procedure. Written informed consent was obtained for inclusion in the study. 10 mg Bisacodyl was taken orally by pt. the night before biopsy and ciprofloxacin 500 taken 1 hour before TRUS guided prostatic biopsy. Ciprofloxacin was continued for 3 days along with oral analgesics. Patients taking anticoagulants and anti-platelets were advised to stop medication 5 days prior to biopsy. Pt. was kept in left lateral position with thighs and hips flexed at 90 degree. Periprostatic nerve block using 1% lignocaine done under TRUS guidance. TRUS imaging of the prostate was done with the patient with a Pro Focus UltraView-2202 (BK Medical ApS, Herlev, Denmark) using a biplane transrectal probe (6–12 MHz). Spring driven biopsy gun (Cook surgical 18G/20cm) was used.

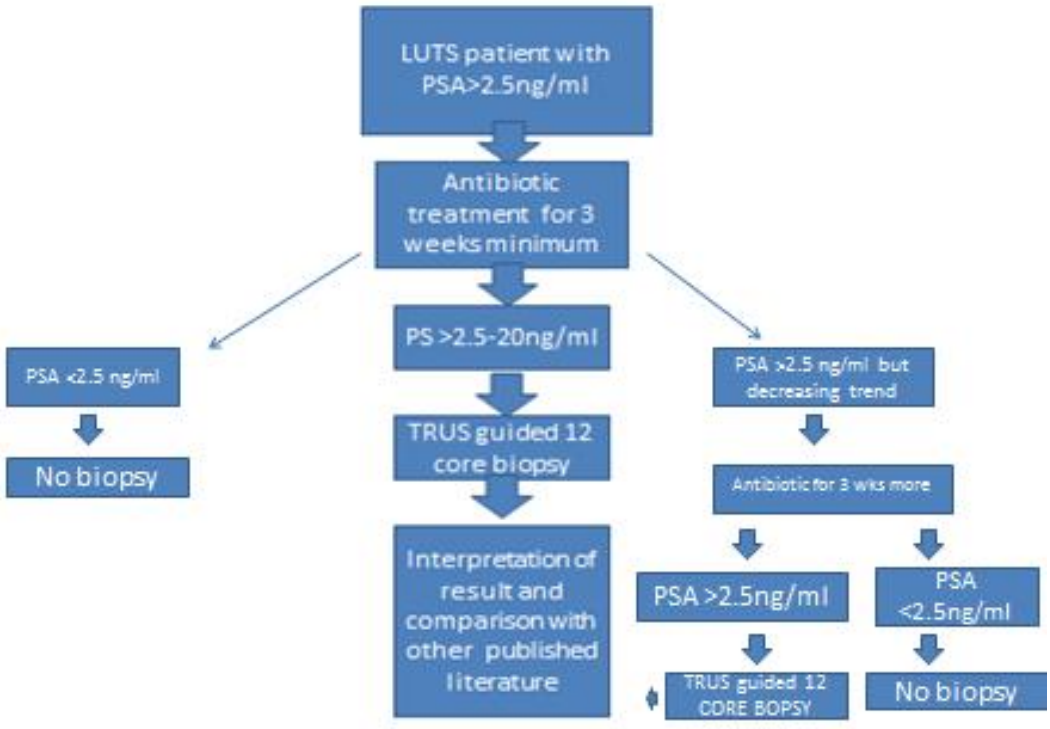
12-core biopsy taken in all cases.

The sites of the 12 cores were as follows: 1. right basal lateral 2. right basal medial 3. right mid lateral 4. right mid medial 5. right apical lateral 6. right apical medial 7. left basal lateral 8. left basal medial 9. left mid lateral 10. left mid medial 11. left apical lateral 12. left apical medial.

All specimens were kept in individual bottles with 10% formalin and labelled separately and sent to the pathology department for histopathological examination.

Patients with PSA< 2.5 ng/ml at initial presentation or achieved after antibiotic administration, those with PSA >20ng/ml even after antibiotic administration or those having active UTI or H/O acute urinary retention, catheterization, instrumentation, urethral surgery in last 2 weeks or any other painful anorectal condition were excluded from the study. Patients with significant coagulopathy (INR>1.5) or on Immunosuppression therapy or history of concurrent, non-prostatic malignancy in last 2 years were also excluded. Continuous variables were expressed as mean values with standard deviations and categorical variables were expressed as percentages of the cohort. The cancer detection rate and the Gleason score pattern being detected were expressed as a percentage of the patients with the corresponding DRE finding and PSA range. In the logistic regression analyses, $P < 0.05$ was considered to be statistically significant. All statistical analyses were performed with Excel statistical analysis (Ver 2010), medcal version 12.000 and SPSS version 20.0 (SPSS Inc., Chicago, IL, USA).

Algorithm



RESULTS AND DISCUSSION

Results

A total of 257 pt. screened during the defined period. Out of which 83 patients were excluded from study as their serum PSA level decreased to <2.5 ng/ml after giving antibiotics as defined in the protocol. Rest 174 patients underwent TRUS-guided 12 core prostate biopsy from 1st November 2013 to 31st March 2015. It consisted of 51 patients (15.07%) with PSA 2.50-4.00 ng ml^{-}, 88 patients (59.52%) with PSA 4.01-10.00 ng ml^{-1}, 35 patients (25.39%) with PSA 10.1-20 ng ml^{-1}. The mean age was 68.66 ± 7.04

years. The mean estimated prostate volume was 53.44 ± 25.05 ml. Abnormal DRE was noted in 11.49 % of the cohort. The mean PSA was 7.16 ± 4.25 ng/ml. All pt. underwent 12-core biopsies. The overall cancer detection rate was 13.79%. For patients who had prostate cancer upon TRUS-guided prostate biopsy, the commonest Gleason score was 7 (37.49%), followed by Gleason score of 6 and 8 in 29.16% each (Table 1).

Complications related to TRUS guided biopsy were noted in 17(9.77%) patients included transient mild hematuria lasting for >2 days in 12 patients (6.89%) and hematospermia lasting up to 2 months in 2 (1.14%). Urinary retention developed in one patient requiring per urethral indwelling catheter for 4 days. 2 pt. developed febrile UTI for which he was admitted and treated with parenteral antibiotics and other conservative measures.

BPH was the most common histological lesion encountered (148 cases–85.05%) [Table 1]. BPH was associated with prostatitis in 67 pt. (38.50%), while exclusive BPH was present in 81 pt.

ASAP (atypical small acinar proliferation) found in 2 (1.14%) cases only.

Adenocarcinoma prostate was present in 24 (13.79%) pt. only.

Table 1: Incidence of Prostatic Pathology

Incidence of Prostatic Disorders		No. of pt.	% Age
BPH		81	46.55
BPH +BASAL CELL HYPERPLASIA		81	46.55
BPH ± prostatitis		148	85.05
Prostatitis		67	38.50
ASAP		2	1.14
ADENOCARCINOMA		24	13.79
GS-5		1	0.57
GS-6		7	4.02
	3+4	7	4.02
GS-7	4+3	2	1.14
GS-8		7	4.02

In the present study BPH, prostatitis and ASAP were most common in 7th decade while carcinoma of prostate was most common in the 8th decade of life. Mean age for BPH was 68.62±6.39 years (50-80yrs) while for carcinoma 71.12±16.22 years (54-80 yrs.) found. Mean age for prostatitis was 67.86±7.21 years (51-80yrs).

While BPH and prostatitis decreased in 8th decade the incidence of carcinoma increased 4 times in 8th decade.

BPH including prostatitis was the largest group of pt. in this study (148 cases (85.05%)). Mean serum PSA was 7.23 ng/ml for this group of patients (range 2.5-20ng/ml). Maximum incidence of BPH occurred in PSA range 4.01-10.00 (49.32%).

Adenocarcinoma was diagnosed in 24 patients. Mean S.PSA was 9.82ng/ml for this group of patients, minimum value of PSA was 2.50 and maximum value was 18.96.

On plotting the histopathology of adenocarcinoma prostate against serum PSA it was found that 21(87.50%) of pt. had PSA ≥ 7.2ng/ml and 23(95.83%) pt. had PSA ≥5.1ng/ml.

Sixty seven patients were having prostatitis, mean S.PSA of this group was 6.21ng/ml, minimum value of PSA was 2.84 and maximum value was 18.10 (Figure 1).

BPH without prostatitis was diagnosed in 81 pt., mean S.PSA -7.23 ng/ml, minimum value of PSA was 2.50 and maximum value was 20.00 (Figure 1).

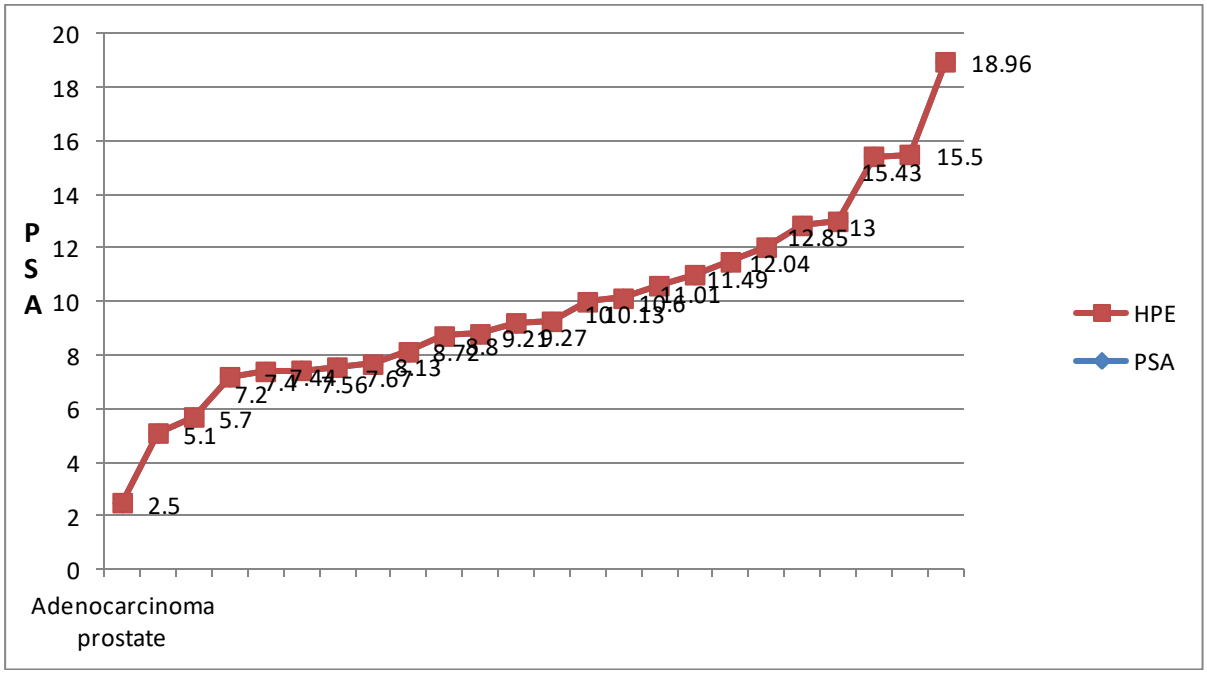


Figure 1

On dividing this cohort on the basis of PSA level most of the adenocarcinoma pt.(13) belonged to PSA group 4.01-10.00. In the PSA group 10.01-20.00 the no. of adenocarcinoma pt. slightly decrease i.e. 10 pt. (Figure 1). BPH and prostatitis was also highest in the PSA group 4.01-10.00 but their number decreased markedly on increasing serum PSA. ASAP was found in only PSA group 4.01-10.00.

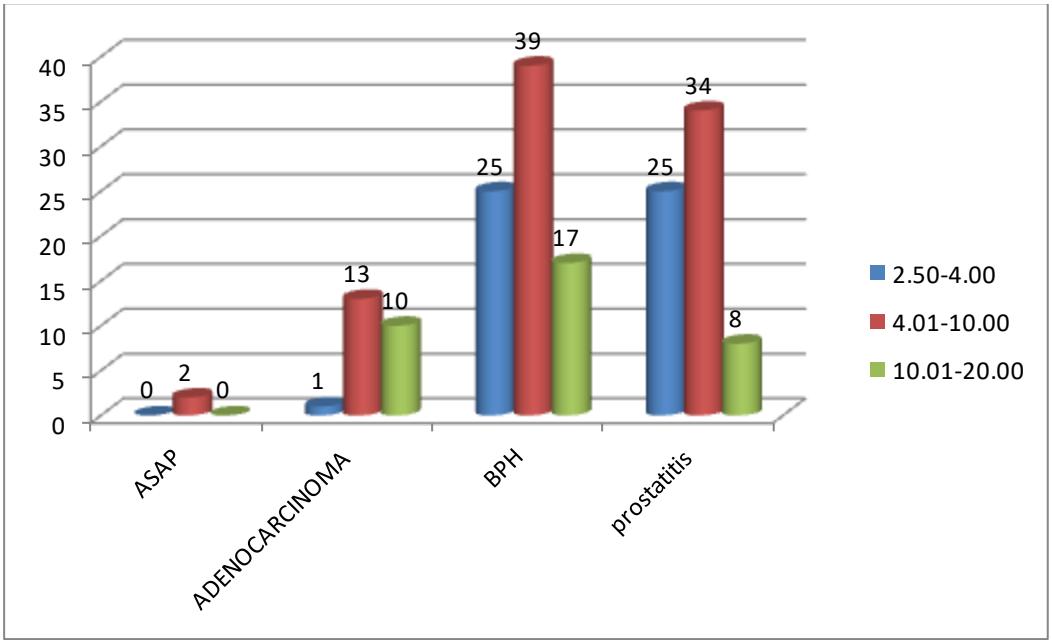


Figure 2: Prostatic Disorders and Serum PSA Levels

Upon both univariate and multivariate logistic regression analyses (Table 4), smaller prostate volume, presence of abnormal DRE finding and greater serum PSA were significantly associated with increased

risk of prostate cancer detection. Age was found not associated with increased risk of cancer detection in both univariate and multivariate logistic regression model. P value <0.05 was considered as significant in this study.

Rising serum PSA value was significantly associated with increased chances of adenocarcinoma prostate in only first two groups i.e. 2.50-4.00 and 4.01-10.00 ng/ml.

Table 2: Univariate and Multivariate Logistic Regression Analyses in Predicting Prostate Cancer Detection upon TRUS Prostate Biopsy of Whole Cohort

		OR (95% CI)		P
Univariate logistic regression model				
	Age	1.065	(0.995-1.139)	0.068
	DRE	5.750	(2.046-16.163)	0.001
	Prostate vol(cc)	0.969	(0.946-0.993)	0.011
	PSA	1.159	(1.057-1.272)	0.002
Multivariate logistic regression model				
	DRE	4.760	(1.473-15.383)	0.009
	Prostate vol(cc)	0.967	(0.943-0.992)	0.010
	PSA			
	2.50-4.00	1.00(ref.)		0.021
	4.01-10.00	0.048(0.005-0.426)		0.006
	10.01-20.00	0.495(0.173-01.411)		0.188

Discussion

The role of PSA in prostate cancer diagnosis has been extensively investigated especially for deciding the need for TRUS-guided prostate biopsy. Due to the significant differences between ethnicities, it would not be appropriate to counsel Indian men regarding elevated PSA level and the probability of having prostate cancer using western data. There is a need for Indian-specific data and the present study was designed to look into prostate cancer detection upon TRUS-guided biopsy in relation to DRE and PSA level specifically in the Indian population.

Abnormal DRE was found in 20 (11.49%) pt. in this study. Out of those 08 patients had Ca P on final histopathology. Interestingly, 16 pts with normal DRE eventually were discovered with CaP. DRE was found to be significantly associated with histopathology of adenocarcinoma in this study in both univariate and multivariate logistic regression (P-0.001, 0.009 respectively). Odd ratio of finding carcinoma prostate in presence of abnormal DRE (OR) was 5.750 and 4.760 in univariate and multivariate logistic regression respectively. On review of literature studies reported higher prevalence of abnormal DRE compared to our studies. Other non-Asian studies reported similar rates as ours.

Total serum PSA was also found to be significantly associated with adenocarcinoma in this study. Mean S.PSA was 9.82ng/ml for adenocarcinoma group of patients while for BPH the mean PSA was 7.23 ng/ml. Mean S.PSA of patients with prostatitis was 6.21ng/ml. This factor was also associated significantly with adenocarcinoma in this study in univariate logistic regression (P-0.002). In multivariate

logistic regression only two groups of PSA i.e.2.50-4.00 and 4.01-10.00 ng/ml were significantly associated with adenocarcinoma pathology (P-0.021, 0.006 respectively) while association with the third group of PSA i.e. 10.01-20.00 ng/ml was not significant (P-0.188).

On comparing with other studies mean serum PSA value was found lower in our study as expected. The mean age group of population in this study closely matches other important studies both Asian and western*. Prostate volume was measured by transabdominal ultrasound. Mean prostate volume was associated significantly with adenocarcinoma in both univariate and multivariate logistic regression (P-0.011, 0.010 respectively).

Out of 174 patients after giving broad spectrum antibiotics serum PSA decreased in 52 patients but in 122 patients it remained stable or increased. We observed that 19 (79.16%) out of total 24 malignancy cases belonged to the group in which PSA was either stable or increased after antibiotic administration. The cancer detection rate was 15.57% in this group. Only 5 (20.83%) patient had adenocarcinoma prostate in the group with decreased PSA post-antibiotic. Thus, cancer detection rate was only 9.61 % in this group. The mean serum PSA of the group in which PSA decreased post antibiotic administration was 8.69 (range-2.96-18.1) ng/ml, while within this group the adenocarcinoma pt. had mean serum PSA 8.63ng/ml. The mean serum PSA of the group in which PSA not decreased post antibiotic was 6.51 (range-2.50-20.00) ng/ml, while within this group the adenocarcinoma pt. had mean serum PSA 10.13 ng/ml.

This incidence of adenocarcinoma is lower than most of the Indian studies (Gupta *et al.,* 2005; Sinha *et al.,* 2011; Agnihotri *et al.,* 2014; Surya Prakash *et al.,* 2013; Naskar *et al.,* 2014). The reason of lower detection of malignancy in our study was probably due to inclusion of patients with lower value of serum PSA i.e. 2.5-20 ng/ml while most other studies have included patients with serum PSA >4 ng/ml. In a recent study in China involving 2606 patients adenocarcinoma was found in 27.6%. Including patients with much higher PSA value was probably the reason of higher cancer detection rate in Chinese study in which 8.5% population had serum PSA>50 ng/ml and another 8.2% had serum PSA 20.1-50 ng/ml. In a study done in Japan cancer detection rate was 53%. The reason for higher detection of malignancy was same as mean serum PSA value was 19.6 ng/ml in the study.

In non-Asian studies, (O'Brien *et al.,* 2010; Durkan *et al.,* 2002; Rabah and Arafa, 2010) the prevalence of cancer was even more high than most of Asian studies. In these studies also the serum PSA value (O'Brien *et al.,* 2010; Durkan *et al.,* 2002) was much higher than our study, and this is probably the reason for higher cancer detection rate in these studies.

In our study BPH (benign prostatic hyperplasia) was the most common histopathological finding (85.05%). Out of these 67(38.50%) had associated prostatitis. BPH was present in 46(88.46%) pt. in which post antibiotic decrease in serum PSA observed, out of which 22 (42.30%)pt. had associated prostatitis.

Incidence of BPH in our study closely resembles many other Indian studies (Josephine, 2014; Garg *et al.,* 2013; Agarwal *et al.,* 2004). But differs from many studies (Sinha *et al.,* 2011; Surya Prakash *et al.,* 2013; Naskar *et al.,* 2014). Naskar *et al.,* (2014) included patients who had undergone radical prostatectomy and TURP (transurethral resection of prostate) which was probably the reason of lower prevalence of benign pathology in their results. Surya Prakash *et al.,* (2013) in their study included pt. with abnormal DRE or serum PSA >4 ng/ml. As 46.30% pt. had abnormal DRE in their study and abnormal DRE is associated with increased risk of prostatic malignancy, this is probably the reason behind finding only53.56% of benign pathology.

On comparing with non-Asian studies our study resembles the study by Durkan *et al.,* (2002) (BPH-53%, Prostatitis-36%) but differs from O'Brien *et al.,* (2010) (normal prostate tissue 16.2%). As majority (90.8%) of men had PSA values greater than 4 ng/ml and mean serum PSA was 23.5 ng/ml in the study by O'Brien *et al.,* (2010) this may be the reason behind getting higher prevalence of malignancy and lower benign pathology.

Prostatitis was present in 67 (38.50%) population of our study. Out of which 3(1.72%) pt. had granulomatous prostatitis. All the prostatitis pt. had BPH also on histology. Mean age for prostatitis was 67.86 ±7.21 years (51-80 yrs). Prostatitis was most common in 7th decade (30 patients, 17.24%).

Table 3: Asian and Non-Asian Studies

Name of Study	Year of Study	No. of pt.	Age (yrs.)	Abnormal DRE	S.PSA	Biopsy Technique	Result
Gupta et al [6]	2003	142	49-82 (mean 64)	0	4-10 (median 6.9)	Sextant	adnoca-24%, cellular atypia-4.9%, HGPIN-2.1%
Sinha et al[7]	2011	119	48-90 (mean 67.6)	5%	>=4	10/12 core	adnoca-24%, prostatitis-25%, BPH-42%, cellular atypia-1.7%, HGPIN-6.7%,
Agnihotri et al[8]	2012	170	50-75(mean 67.5)	0	4-20(6.9)	10-12 core	adnoca-24.7%, other pathology-not mentioned
Suryaprakash et al[9]	2012	95	50-85	46.30%	>4	10/12 core	adnoca-32.6%, HGPIN-12.6%, fibroadenoleiomatous hyperplasia-32.58%, fibroadenoleiomatous hyperplasia with chr.prpstatitis-5.20%, chr.prpstatitis-15.78%
Naskar et al[12]	2008	50	mean 68.66	NA	NA	TURP/TRUS-Bx/RP	adnoca-24%, HGPIN-8%, NHP-68%
Agarwal et al[13]	2002	184	NA	NA	NA	TRUS-Bx	adenoca-13.04%, BPH-86.95%
Josephine et al[10]	2011	106	mean 65.5	NA	available in 49 pt. only	TRUS Bx/TURP	ca-P-23.58%-(adeno-80%, small cell-20%), prostatitis+BPH-25.31%, BPH-74.52%, HGPIN-1.89%,

Garg et al[11]	2011	364	mean 68.6	NA	NA	TRUS Bx/TURP/open prostatectomy	Ca-P-20.1%, BPH-78.3%, BPH+Prostatitis-32.7%, HGPIN-0.54%, RMS-0.54%, Leiomyoma-0.27%, cystadenoma-0.27%	
Teoh et al(CHINA)[14]	2013	2606	mean 68.4	23.90%	mean 71.0	10/12 core	Ca-P-27.6%	
Brien et al(Australia)[15]	2004	5145	mean 65.4	NA	Mean 23.5	mean 9 core	Ca-P-59%, HGPIN -21.7%, Normalprostate tissue -16.7% , ASAP- (3%)	cancer-59.0%, HGPIN-21.7%, ASAP+HGPIN-3.0%, normal-16.2%
Durkan et al(U.K.)[16]	2000	493	mean 68.7	36%	Median for ca-p-14.5and for non-malignant pt.-8	12 core	Ca-P-33%	cancer-33%, Prostatitis-36%, HGPIN-2%, Atypical(suspicious)-6%, BPH-53%
Ahmed al-ghazaro et al(Jordan)[17]	2003	152	median age 70	23.9%	NA	10 core	Ca-P-27.6%	cancer-27.6%
Rabah D M et al(Saudi arabia)[18]	2008	132	NA	5%	4.96	8 core	Ca-P-23.3%	cancer-39.3%
Our study	2015	174	mean 68.66	11.49%	mean 7.16	12 core	Adenocarcinoma prostate-13.79%, BPH-46.55% , prostatitis-38.50%, ASAP-1.14% BPH ± prostatitis- 85.05%	

Prostatitis was present in 22 (42.30%) pt. in which post antibiotic decrease in serum PSA observed. The similar data for the pt. in which PSA didn't decrease post antibiotic was 45 (36.88%) pt. respectively.
On comparing with other Indian studies the incidence was a bit higher in our study. On comparing with non-Asian studies our results were found to closely resemble those by Durkan *et al.,* (2002) (Prostatitis-36%). ASAP (atypical small acinar proliferation) was found in 2 (1.14%) cases only. Both the patients were in their 7th decade and fell in PSA group 4.01-10.00 ng/ml.
TRUS guided prostatic biopsy was not repeated in the patients with the negative biopsy results. They were kept under observation with follow up PSA at regular intervals, the frequency of which was decreased later on. In case of rising PSA and benign pathology re-biopsy of prostate was planned.
In the patient population presenting at a tertiary centre the incidence of adenocarcinoma prostate is lower even in elevated PSA. Prostatitis constitutes a significant proportion (38.50%). A course of broad spectrum antibiotic is useful in excluding a significant number of patients from unnecessary biopsy which is not in line with the white paper published in AUA (American urology association) guidelines 2014.
As 95.83% of adenocarcinoma pt. had serum PSA ≥5.1ng/ml, a higher cut off value of PSA may be more useful in Indian population.
Further prospective studies involving different and larger population will be needed to support and confirm these findings.

REFERENCES

Agarwal MS, Sinha S, Juyal S and Gupta AK (2004). Measurement of serum PSA in benign and malignant enlargements of prostate in Indian population: Relevance of PSAD in intermediate range PSA. *Indian Journal of Urology* **20** 138-43.
Agnihotri S, Mittal RD, Ahmad S and Mandhani A (2014). Free to total serum prostate specific antigen ratio in symptomatic men does not help in differentiating benign from malignant disease of the prostate. *Indian Journal of Urology* [serial online] **30** 28-32.
Al-Ghazo MA, Ghalayini IF and Matalka II (2005). Ultrasound-guided transrectal extended prostate biopsy: a prospective study. *Asian Journal of Andrology* **7** (2) 165–169.
Durkan GC, Sheikh N, Johnson P, Hildreth AJ and Greene DR (2002). Improving prostate cancer detection with an extended-core transrectal ultrasonography-guided prostate biopsy protocol. *BJU International* **89**(1) 33-9.
Ferlay J, Bray F, Pisani P and Parkin DM (2004). *GLOBOCAN 2002: Cancer Incidence, Mortality and Prevalence Worldwide IARC Cancer Base No. 5, Version 2.0*, (IARC Press: Lyon, France).
Garg M, Kaur G, Malhotra V and Garg R (2013). Histopathological spectrum of 364 prostatic specimens including immunohistochemistry with special reference to grey zone lesions. *Prostate International* **1**(4) 146-151. doi:10.12954/PI.13026.
Gupta NP, Ansari MS and Dass SC (2005). Transrectal ultrasound guided biopsy for detecting early prostate cancer: An Indian experience. *Indian Journal of Cancer* **42** 151-4.
Homma Y, Kawabe K, Tsukamoto T, Yamanaka H, Okada K, Okajima E *et al.*, (1997). Epidemiologic survey of lower urinary tract symptoms in Asia and Australia using the International Prostate Symptom Score. *International Journal of Urology* **4** 40–46.
Horner MJ, Ries LAG, Krapcho M, Neyman N, Aminou R, Howlader N *et al.*, (2008). *SEER Cancer Statistics Review, 1975–2006,* (Bethesda, MD: National Cancer Institute).
Jemal A, Siegel R, Ward E, Hao Y, Xu J and Thun MJ *et al.*, (2009). Cancer Statistics. *CA: A Cancer Journal for Clinicians* **59** 225–249.
Josephine A (2014). Clinicopathological Study of Prostatic Biopsies. *Journal of Clinical and Diagnostic Research: JCDR* **8**(9) FC04-FC06.
Naskar S, Kundu SK, Bhattacharyya NK, Bhattacharyya PK and Kundu AK (2014). A study to correlate histopathology, biochemical marker and immunohistochemical expression of sex-steroid receptors in prostatic growth. *Indian Journal of Medical and Paediatric Oncology: Official Journal of Indian Society of Medical & Paediatric Oncology* **35**(1) 40-43. doi:10.4103/0971-5851.133719.

O'Brien BA, Brown AL, Shannon T and Cohen RJ (2010). Prostate biopsy in western Australia 1998-2004. *Prostate Cancer and Prostatic Diseases* **13**(3) 263-9.

Rabah DM and Arafa MA (2010). Prostate cancer screening in a Saudi population: an explanatory trial study. *Prostate Cancer and Prostatic Diseases* **13**(2) 191-4.

Sinha S, Siriguri SR, Kanakmedala SK and Bikkasani K (2011). Prostate biopsy findings in Indian men: A hospital-based study. *Indian Journal of Cancer* **48** 175-80.

Surya Prakash V, Chandra Mohan G, Venkata Krishnaiah S, Vijay Kumar V, Ramesh Babu G, Vijaya Bhaskar Reddy G *et al.*, (2013). Ten-core versus 16-core transrectal ultrasonography guided prostate biopsy for detection of prostatic carcinoma: a prospective comparative study in Indian population. *Prostate International* **1**(4) 163-168.

Teoh JY, Yuen SK, Tsu JH, Wong CK, Ho BS, Ng AT *et al.*, (2015). Prostate cancer detection upon transrectal ultrasound-guided biopsy in relation to digital rectal examination and prostate-specific antigen level: what to expect in the Chinese population ? *Asian Journal of Andrology* **17**(5) 821-5. Available: http://www.ajandrology.com/preprintarticle.asp?id=144945 -DOI: 10.4103/1008-682X.144945, [Accessed 2015 May 19].

Umbas R (2005). Characteristic and treatment of prostate cancer in Jakarta: a ten years observation. *Indonesian Journal of Surgery* **33** 107–114.