European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 07, 2020

Screening Of Prostate Specific Antigen (Psa) For The Detection Of Prostate Cancer And Its Prevalence In Jammu Region

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ABSTRACT
Prostate cancer is the most frequently detected non-cutaneous cancer in men. Prostate cancer is screened by using a biomarker that is prostate specific antigen and other prostate related problems. Not only the hereditary features are involved but also includes dietary factors, ecological factors also accountable for the progress of prostate cancer. Radical prostectomy is the most common therapy for small group of patients with high grade tumours. Early detection of PSA reduces the frequency rate of prostate cancer. Mostly prostate abnormalities are seen in among male patients above the age of 50 or older. In worldwide population the epidemiology of prostate cancer is high in western countries and less in Asian countries. In this project data was collected from the year Aug 2014 – April 2015. A total of 150 males had screened with PSA and out of total population 70 were found high level of PSA. Digital rectal examination and biopsy was performed on abnormal those patients sample whose PSA is raised. After examine their test I came to know that out of 70 samples 10 got prostate cancer. During the study period it was found that there will be 15-16% (1 year) hike in prostate cancer cases in Jammu district.

1. INTRODUCTION

The human prostate is a male accessory sex gland. It is chestnut shaped like structure, located in the basement of the pelvis and surrounds the neck area of the bladder and urethra.[1] Urethra plays a role in two main purposes urination and ejaculation. The weight of the healthy prostate is around 11grams, ranging between 7-16grams.[2] A thin vascularized fibrous sheath with encloses prostate gland along with a fibro muscular layer continues smooth muscle that surround the bladder. This fibro muscular layer extends and divides the prostate gland into different zones.[3-4] It allows running the prostatic fluid into urethra during ejaculation. These secretions are responsible for liquefying semen and trigger the sperm motility. The proteins rich prostatic secretions change the environment of the vagina and hold the sperm in the female reproductive part for survival.[5] The main hormone which is secreted by the

male reproductive organ is testosterone which is responsible for synthesizing Dihydrotestosterone in the peripheral tissue. Dihydrotestosterone responsible for supervise the prostate gland.

The function of the prostate gland is to store the seminal fluid. The prostate gland secretes small amount of alkaline fluid that makes 25% seminal fluid which allows the sperm to swim freely. Due to the alkalinity, it changes the vaginal tract environment which is acidic in nature and allows the sperm to stay viable in female reproductive part.

Prostate Structure

The structure of prostate is divided into two different regions zones or lobes. The zones are further divided into;

Peripheral zone (PZ): Approximately 70% part of the prostate are develop in this zone that encircles the urethra. In the peripheral zone there is 80% chances to develop prostatic cancer.

Central zone (CZ): 25% part of the prostate are formed in this zone surrounding the ejaculatory ducts and approximately 2.5% chances of prostatic cancers develop in this region. Malignancies that establish here are more intrusive.[6]

Transition Zone(TZ): 20% of prostatic cancers develop in transition zone (TZ) which encircles the proximal urethra. Sometimes enlargement of the transition zone arise benign prostatic hyperplasia. Anterior fibro-muscular zone is the final zone comprises of muscle and fibrous tissue only.

Prostate carcinogenesis (PCa)

Malignancies are defined as uncontrolled production and subsequent spreading of cells to other parts of the body. All types of cell in the body that sustains such malignant changes and develops into cancers. Due to the unregulated cell division, the normal cell convert into the tumor cell that invades firstly into the localized area then spread into the surrounding tissue then spread via lymphatic system and vascular system to various other parts of the body.[7-8] Balance between the proliferation and cell death cycle is disturbed by unregulated division of cancer cells. This process is disrupted by mutation in DNA that causes cell to divide rapidly and multiply at higher rate. The arising mass can either be benign or malignant.

PIN (Prostatic intraepithelial neoplasia) is the probable predecessor of prostatic carcinoma. It is responsible for the abnormal growth of epithelial cells that line the prostate gland. The irregular spaced of epithelial cells are characterized low grade of PIN. Nuclei becomes hyper chromatic (with elevated chromatin) and pleomorphism (variation in size and shape). Higher level of hyper chromatism and pleomorphism are found when the PIN is in high grade. Cluster round cells simulating a raspberry shape that distinguish the PIN from adenocarcinoma.[9] The increase risk for adenocarcinoma can be advice by presence of PIN.

Development and Progression of prostate cancer

In developed nations, prostate cancer is the second most common analyzed cancer and the third most common cancer leading to death.[10] Near about 1 out of 8 men at the age of 75 years and 1 out of 5 men at the age of 85 years will develop prostate cancer in the year 2006.[11] A study conducted in 2007 by Collins and its coworkers described the origin of prostate cancer from the glandular epithelium and the origin of tumor cells from luminal although both are dependent upon androgens and represent luminal cell marker but increasing evidence from the research studies depict the derivation of cancer cells is less from differentiated stem cells.[12-13] Most prostate cancers are assorted and multifocal, suggesting that various neoplastic foci have emerged and evolved autonomously.[14] The genetic modification results in the growth of malignant cells. Due to additional alterations, malignant tumors

expand that firstly constrained to the prostate, but ultimately enter the prostate capsule, attack on neighbouring tissues and eventually form metastases.[15]

Molecular Changes

Cancer always generates from single somatic cells and by the action of many genetic changes it leads to a change in both phenotype and genotype.[16] Cancer leading to mutations mostly rise in the genes that are associated in the cell growth or cell death regulation.[17] Complexity or more than 100 types of cancer and their difference subtypes make it more difficult to point out the origin of the disease. Extensive research done from the past two decades on molecular, biochemical and cellular process depicts how normal cells transforms or changes into the malignant cells. Cell division of normal cells is under limitation that is, they first monitor the suitable external environment and then undergo cell division if necessities, in contrast to this cancerous cell have their own signals which set them free from the growth limitation of normal cells, so they divide and grow abnormally. Second capability is somewhat same as the previous stage, these cancerous cells have antigrowth signals i.e. they don't receive signals to inhibit or to stop growth. Third feature or character of cancerous cell is the capability of assisting the growth since normal cells after complete cell division stops replicating, this phenomenon is controlled by telomeres. Telomeres are the segment of DNA or shortened by each round of DNA replication. This shortening of DNA doesn't allow cell to undergo further cell division and finally leads to cell death (apoptosis), but this phenomenon cannot be found in cancerous cell because of the ability to maintain the length of telomere. The next capability is the evasion of apoptosis done by gene P53. Gene P53 is often found mutated in cancer cells, thus does not leading to normal apoptosis. Angiogenesis, have the role for providing oxygen and nutrients to the tumor cells and the last but not the least capability is invasion in tissue and metastasis, in this cancerous cells get attached to other cells and spread throughout the body.[18]

Benign prostatic hyperplasia

Benign prostatic hyperplasia also called BPH (benign prostatic hypertrophy), a disorder known as inflamed prostate gland. It is the most common prostate problem, BPH is not the cancer but the symptoms of BPH is quite similar to those of prostate cancer. The over growth of epithelial lumps and stroma tissue in the transition zone of the prostate leads to enlargement of prostate, the condition called BPH.[19] The two risk factor advanced age and circulating hormone (androgen) are responsible for developing for BPH.[20] Due to the enlargement of prostate gland, the urethra becomes compress and pressure will increased within the bladder causing frequently contraction and less amount of urine is present, by this the bladder is not able to emptifying itself and cause many other problem.

Androgen and estrogen are two sex steroid hormones are responsible for regulation of prostate and these are important for the prostate cell growth. Estrogen is originated through the stromal aromatization of androgen and estrogen: androgen ratio increases in BPH patients.[21-22] Due to advanced age of men, levels of testosterone decreases and estrogen increases in blood. As per the studies conducted increased concentrations of the estrogen increases the proliferation and differentiation of smooth muscle cells, which leads to BPH.[23] Aromatase inhibitors such as testolactone are anti-estrogens, which is used for the treatment of BPH patients. These antiestrogens have a role for preventing the androgen to estrogen.[24] Androgenic steroid testosterone is converted into Dihydrotestosterone (DHT) which is important for the function of secretory epithelial cells; this conversion is catalyzed by 5α-reductase isoenzyme type 1 and 2. 5α-reductase type 1 is most often found in liver and skin but less amount in prostate. Type -2 is most prevalent in prostate. 5α-reductase type-2 is responsible for converting the androgenic steroid testosterone to Dihydrotestosterone (DHT) in prostate gland. In BPH condition, higher activity of 5α-reductase has been demonstrated as compared

to normal tissue.[25-27] Finasteride, a 5α-reductase type2 inhibitor has been used for the treatment of BPH patients.[28-32]

2. MATERIALS AND METHODS

Data collection

Data of prostate cancer and BPH is collected from Super specialty hospital in Jammu. Data was collected from the year 2014 and 2015, approximately 150 male patients 50 years of age or older had screened till now who had prostate related problems and PSA is the initiator biomarker which is used for the detection of prostate abnormalities.

Present study

The study was conducted from of Jan –April, in which total of 150 men over the age of 50 years was involved in the study. These men had prostate related problems and PSA is the initiator biomarker which is used for the detection of prostate abnormalities. The level of PSA indicates that whether patients is normal or have BPH or prostate cancer. Level of PSA is diagnosed via blood. Blood sample was collected from vein and then incubate at room temperature or in incubator, serum is separated by centrifuge machine. Then the sample is proceeding for analyzing that was performed by ABOTT ARCHITECT AUTOANALYSER. Along with blood, person's personnel history was also collected and found that mostly the males are smokers or ex-smokers.

Method

The blood sample was taken from 150 male patient's and PSA test done using ARCHITECT auto-analyzer. The instrument is based on chemiluminescent emission to determine the quantity of total PSA in the sample.

3. RESULTS AND DISCUSSIONS

A prospective study was conducted to validate the role of PSA in the detection of prostate cancer. A total of 150 men above the age of 50 years contributed in the study. The result showed that 70 persons who had abnormal level of PSA. PSA level should not indicate the occurrence or absenteeism of prostate cancer. Prostatic biopsy is required for the confirmation of cancer. 70 patients who were non malignant and 10 patients who had prostate cancer this result was confirmed by biopsy. In table 1.3 level of PSA are shown in normal, cancer and in BPH.

Table 1.3 reveals out of 150, 70 patients screened had high PSA level and these abnormal patients i.e. 70 had further screened then among the screened ones 10 patients had Prostate carcinoma comparatively high level of PSA. Table 1.4 it indicates that out of screened 70 patients, having a history of smoking with comparatively high level of PSA.

Prevalence of prostate cancer in Jammu region

According to the study, data was conducted from the year Aug.2014-April 2015 and approx. 150 men had screened with PSA and out of total population 70 persons who had high PSA level.

Total population screened – 150

No. of malignant or cancer patients -10

Prevalence of prostate cancer in Jammu region is 6.6% and by this the hypothetical prediction will develop for prostate cancer.

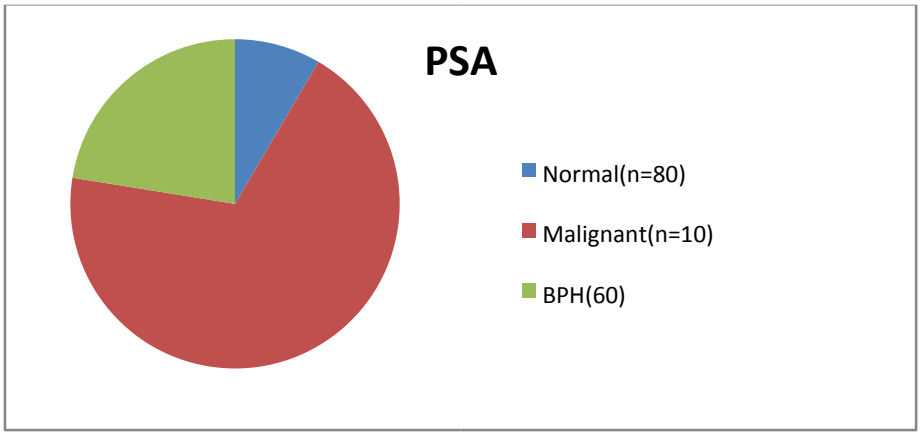
Category 1	PSA (mean)

NORMAL (n=80)	2.59
MALIGNANT (n=10)	21.18
BPH (n=60)	6.89

Table 1.3 Level of PSA in cancer, normal and BPH

Category	% of PSA level
Smokers	12.13
Non smokers	10.18

Table 1.4 Level of PSA in Smokers and Non smokers



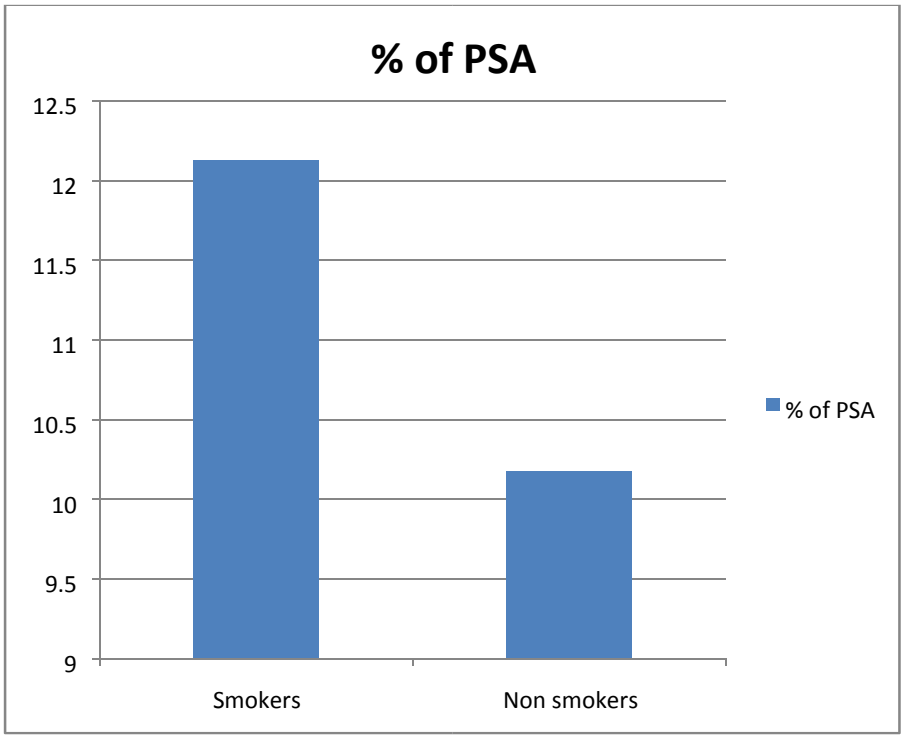


Fig.1.15.3 Level of PSA in normal, malignant and BPH

Fig.1.15.4 Percentage of PSA in smokers and non-smokers

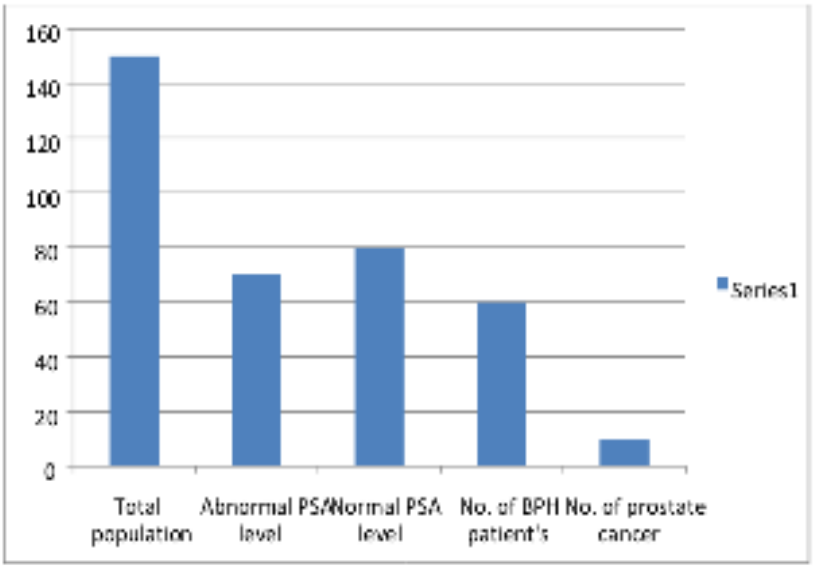


Fig 1.15.5 Prevalence of PSA in Jammu region

4. DISCUSSION

Prostate cancer is the third most leading cause of death from cancer in men after colorectal and lung cancer. Prostate specific antigen testing is used for the early detection of prostate cancer or many other prostate related abnormalities such as benign prostatic hyperplasia, prostatitis. PSA belong to human kallikrein gene family, which is serine protease with chemotrypsin like activity. PSA is secreted in the epithelial cells of the prostate gland and can be demonstrated in biopsy samples or other histological specimens using immunohistochemistry. According to the study which was done in training session, it concludes that PSA is one of the best markers for diagnosis of prostate abnormalities and by biopsy prostate cancer was diagnosed. A total of 150 men were participated in this study and with the help of PSA marker the level was analyzed. The level of PSA rises in prostate abnormalities such as in benign prostatic hyperplasia, prostate carcinoma. Since level of PSA was comparatively higher in patients with history of smoking as observed from the present study. Thus the hazards of smoking (risk factor) cannot be ignored. So, by this study we concluded that the prostate cancer is a major health problem and the incidence is gradually increased. In Netherland, 20 men's were dying every day from prostate cancer. Curative treatment of prostate cancer reduces the disease specific mortality significantly. Early screening of disease by PSA marker reduces the mortality of prostate cancer. The prevalence of prostate cancer in the studied population was 6.6%.

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