



**A COMPREHENSIVE REVIEW OF PHARMACEUTICAL AND SURGICAL
INTERVENTIONS OF PROSTATE CANCER**

Angelos Soukovelos*

*Corresponding Author: Angelos Soukovelos

Article Received on 17/06/2021

Article Revised on 07/07/2021

Article Accepted on 27/07/2021

ABSTRACT

Prostate cancer is the second major cause of death in men in the United States. Prostate cancer is developed from the prostate glands, which produce semen in men's gonads. Semen contains spermatozoa. Seminal fluid plays an important role in the movements of sperms. Along with the seminal fluid, Sperms flow through the epididymis to vas deference and urethra. Seminal fluid provides an alkaline environment, which protects sperms from the acidic environment in the vagina by allowing a successful fertilization process. On both sides of the prostate glands, there are two smaller glands named seminal vesicles. During radical prostatectomies, if these glands are removed, the patient will become infertile because he will not be able to produce seminal fluid which is an important platform for the survival of sperms. This type of cancer is seen in people of older age more than 66 years. People who are more susceptible to develop disease shows some inclined risk factors at the age of 40. These risk factors increase the chances of developing prostate cancer. If there are any signs of developing the disease, most physicians recommend mandatory screening to deal with this cancer type at age of 40-45 years. However, if there are not predisposing signs, then they recommend this screening at the age of 50. Mandatory screening helps to identify cancer-causing Prostate-specific agent PSA in the human blood. Although this screening technique is not 100% guaranteed, still it can predict risk factors and if the PSA test is abnormal, patients will go for further analysis. Several types of pharmaceutical interventions are developed recently for cancer treatment. For diagnosis of prostate cancer, and Digital Rectal Examination is another method that is widely used all over the world. Androgen Deprivation Therapy is also the most common type of treatment. Several surgical interventions are developed which are used to resect cancer completely. Numerous radical prostatectomies are present but their use depends on what type of cancer is and where the cancer is widely spread.

INTRODUCTION AND BACKGROUND

In the United States, prostate cancer is the second leading cause of death and is the most common type of cancer among men. In the United States, one out of nine men is diagnosed with this type of non-cutaneous prostate cancer in their life. The incidence rate of prostate cancer varied from place to place. However, it is more common in the United States, Scandinavia and Canada than in other countries.

Despite the high ratio of people diagnosed with this, its mortality rate is comparatively low and only some patients die from this disease. In 2016, ACS reported, out of 180,890 patients, the standard mortality rate in the United States is 26, 000 people die of this cancer every year.

National cancer institute of America reported about 11% of American males are diagnosed with prostate cancer. One out of 41 patients dies from this disease. As age increases, their chances of developing cancer is also

increased. However, as men become older, the aggressive nature of prostate cancer decrease and becomes less fatal with age.

The prostate gland is a dense, fibrous muscular gland located directly at the inferior portion of the bladder. Out of total seminal fluid, the third part is produced by prostate glands, which are present in the male pelvis. Seminal fluid contains secretions including supporting enzymes and proteins which are released from prostate glands to nourish the sperms. In seminal fluid, sperms are moved through seminal vesicles to the penis through this fluid. This cancer mostly affects the peripheral zone of prostate glands.

There are various types of prostate cancer but most common type is Adenocarcinoma. About 99% of prostate cancer patients are diagnosed with Adenocarcinoma. It has further two types, acinar adenocarcinoma and ductal adenocarcinoma, acinar

adenocarcinoma is more common than ductal adenocarcinoma.

If there are early symptoms, cancer will be diagnosed with prostate-specific antigen PSA and transrectal ultrasound-guided prostate biopsies.

The primary reason for screening prostate cancer is the detection of early stages. Early screening prevents morbidity and mortality rate from increasing.

Susceptibility to developing prostate cancer increases, if a family member is diagnosed with this earlier. Family heredity is the primary risk factor for this disease and screening is highly recommended by doctors.

Risk factors for developing prostate cancer

Smoking, obesity, ethnicity, diet, race and age are the most common reasons which establish the risk of prostate cancer. It is more common in African-American men than in other races.

The CDC (centre of disease control and prevention) has stated that the most common reason for prostate cancer is age, there are greater chances of getting prostate cancer if the man is above the 60s.

A professional study about the age-specific incidence shows Akola which says that prostate cancer affects a man sharply at the age of 55. It continues to grow and attain its peak at the age of 70 to 74 years. After 74 years of age, cancer began to squeeze slightly.

After an age, we can say that race and ethnicity is the most common risk of prostate cancer. In African-Americans, the risk of getting affected by prostate cancer is about 60% higher than in Caucasian males. The risk of death is twice that of other Men.

The African males living in America are more likely to get cancer at a very young age. In this condition, the cancer growth becomes more severe by the time it was discovered.



Risk factors of prostate cancer

Clinical symptoms

Chronic pain in the pelvis, hips and back are clinical symptoms for metastatic prostate cancer. This condition is so-called pott's disease because it is associated with vertebrae. Potts disease also affects the spinal cord by squeezing, which results from unresponsiveness or irritable of inferior edges.

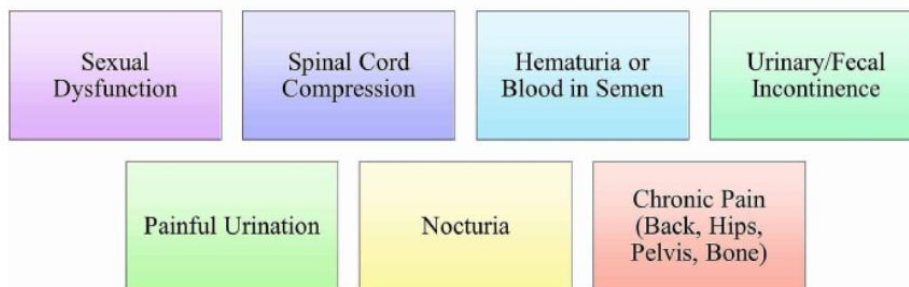
Sexual dysfunction is also a clinical symptom of prostate cancer. The patient feels erectile dysfunction after developing this disease.

A patient can have hematuria in the early stages of developing the disease. It is the condition when blood comes with urine. The prostate becomes stretched and it causes compression on the urethra. It produces irritation in the urinary bladder. Incontinence and stress are

developed in the urinary bladder which is an early symptom of predicting cancer. Depending on the size and location of the prostate tumour, it also causes pain during urination.

About 25% of patients with prostate cancer suffer from severe nocturia, which is urination at night. When the prostate becomes enlarged, it causes closure of the urethra. As a result of this, the urinary bladder contracts and becomes rigid and fails to force the urine stream outside.

Due to notorious problems, patients face sleep deprivation due to increase urination frequency throughout the night and it becomes more painful. The process of ejaculation becomes painful due to compression of the urethra in the prostate glands.



Determination of prostate cancer and where it has spread

If a person is diagnosed with prostate cancer the first thing that physicians do is to determine where it has spread and what is the stage of this cancer.

Prostate cancer can spread to other areas of the body beyond the prostate part.

There are the following types of different tests for scanning cancer.

1. **Ultrasounds scanning**
2. **Magnetic resonance imaging (MRI)**
3. **Bones scanning**
4. **Computerized tomography**
5. **Positron emissions tomography Scan (PET)**

Not all these tests are necessary for a cancer patient. However, physicians will suggest which type of test patients should have depending on your situation. The stages of prostate cancer are identified by using Roman numbers from stage I to stage IV. The lowest number office stage indicates that cancer is present only in the prostate parts. The other three stages indicate that it is spread into other areas of the body as well.

Method of Diagnosing prostate cancer

1. Transrectal biopsy of prostate cancer

If there are risk factors or symptoms of developing a tumor, the screening is done. If there are some

abnormalities detected in screening, there are further processes to confirm the disease.

- **Magnetic resonance imaging (MRI)**

It is the type of test which shows a detailed picture of the disease. Most physicians recommend MRI for better planning of procedures to remove tumour cells.

- **Ultrasound**

In transit rectal ultrasound test, a cigar-shaped probe is used which is inserted into the patient's rectum. Sound waves are used by the probe, which produces the prostate gland's images.

2. Prostate biopsy

It is a technique in which a physician takes a sample of prostate tissue by using a needle. A sample is collected by inserting a needle into the prostate and it is sent to laboratories for further analysis.

Pharmacological treatment/ management for prostate cancer

Certain types of pharmaceuticals can be recommended to a patient depending on their cancer stages. It depends on if our goal is to control cancer or relieve some symptoms. The healthcare professionals suggest some medications listed in this table.

Pharmaceutical treatments currently approved for prostate cancer

Chemotherapy Drugs	Androgen Deprivation Therapy	Bone Metastasis	Radiopharmaceuticals
Cabazataxel	Abiraterone Acetate	Alendronate	Radium 223
Docetaxel	Apalutamide	Denosumab	
Mitoxantrone	Bicalutamide	Pamidronate	
	Buserelin Acetate	Zoledronic Acid	
	Cyproterone Acetate		
	Degarelix Acetate		
	Enzalutamide		
	Flutamide		
	Goserelin Acetate		
	Histreltin Acetate		
	Leuprolide Acetate		
	Triptorelin Pamoate		

To manage the metastatic disease the inhibition of AR is the major activity to be done and it is very beneficial.

Previous investigations reported that deprivation of Androgens causes G₀-G₁ cell cycle. Also, the androgen enhances the proliferation and stimulates the expression of the G₁-S regulatory protein.

After that, the prostatic adenocarcinomas response was very poor for the standard chemotherapy and because of this reason androgen therapy remains the first line for the intervention of metastatic condition.

A vast amount of patients responds very well to ADT, the current tumors are being noted to develop two or three times within the median time. The growth of tumors like these is called, "castrate-resistant prostate cancer (CRPC)."

The medical castration of gonadotropin hormones agonist (GnRH-As) the patient with prostate cancer is dated back to 1982 with goserelin and leuprolide which are usually used as GnRH.-A.

If we talk about the long term treatment with the help of GNRH-A, supplants and which will affect pulsatile

endogenous physiologically and it will downregulate the receptors of the pituitary gland leading to the castration level of the testosterone within 2 to 3 weeks.

In some other cases, the androgen receptor antagonist like bicalutamide, flutamide and nilutamide is used alone or combine with castration to stop the effects of androgens. Unfortunately, if the advanced prostate cancer chamber forms the androgen-independent with following testosterone castration and secondary statement of hormones with androgen receptor antagonist or some ketoconazole is used for the treatment.

Surgical Treatment and Management for prostate tumor

3. Prostatectomy incisions

Surgical interventions include the process in which prostate glands are removed through radical prostatectomy. Lymph bulges and some nearby tissues of prostate glands are also removed from prostatectomy incisions.

Sometimes doctors recommend prostate surgeries to remove advanced prostate cancer combined with additional management.



Surgeons, to access prostate tissues use the following technique

4. Small incision abdomen technique

It is the most commonly used surgical technique for the removal of prostate cancer. A mechanical device is used as a surgical instrument that is inserted into the abdomen through several small incisions during robot-assisted laparoscopic prostatectomy. It is an easy process as robots are guided by remotes for the use of most surgical instruments.

5. Long incision abdomen technique

This approach is rarely used and sometimes physicians recommend it depending on the patient situation. In this

process, the surgeon makes a long incision to the lower side of the abdomen to access the prostate gland and remove the tumor during retro pubic surgeries.

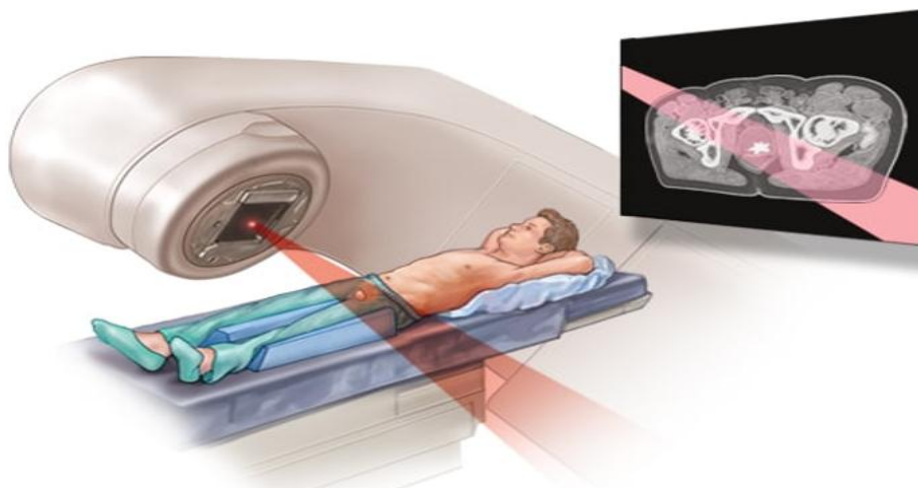
Radiation therapies

In this process, strong radiations are used to remove tumor cells. There are two radiation therapies which include:

- **External beam radiation therapy (EBRT)**

External beam radiation therapy is a process when radiations comes from external of the body. The patient is laid on a table. High dose radiations are such as protons, or X-rays or that emerge from a machine fitted

around the patient's body. This technique is used for the tumors which is confined to specific areas.

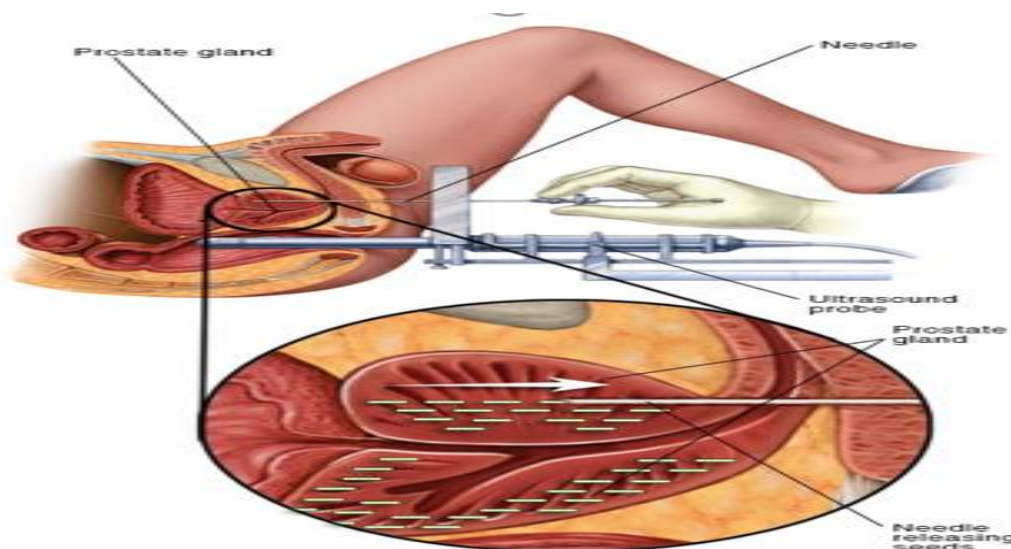


After surgeries, this process is also used to destroy cancer cells, if there are a risk of cancer coming back. Physicians recommend beam radiation therapies to completely kill cancer cells and to stop spreading cancer to other areas such as lungs, and bones.

This process is done five times a week but some physicians recommend high-powered radiation to decrease the time duration of radiation therapies.

6. Internal radiation brachytherapy

It involves radioactive sources, which is implanted inside the prostate tissues having cancer cells. Radioactive source of rice sized is inserted which produces radiation for a long time in prostate and shrink cancer cells. This therapy is used when cancer is confined to the prostate part.



Destroying tissues through freezing or heating process

Freezing: The freezing process involves using cold gas to the cancerous part of prostate tissue through cryotherapy. Cancer cells are destroyed along with some nearby tissues.

Heating: on heating prostate tissues process, heat is given to destroy small prostate tumors through high intensity focused ultrasound (HIFU) treatment.

Hormone therapy to stop prostate cancer

Male testosterone hormone promotes cancer-producing cells. Some pharmaceuticals are used to stop producing male testosterone hormones. Hormonal therapies are used to decrease the growth of cancer cells. These therapies are used before doing radiation therapies to increase the effectiveness of treatment.

1. Use of medicines to stop producing testosterone completely

Medicines like a gonadotropin-releasing hormone (GnRH) and luteinizing hormone-releasing hormone

(LHRH) are commonly used to stop testosterone production.

2. Use of medicines to stop testosterone from reaching cancerous cells

Along with LHRH, anti-androgens are given to stop the growth of cancer cells.

3. Testicle removing surgeries

Some surgeons recommended testicle-removing surgeries to stop the growth of testosterone immediately. They permanently remove testicles. Mostly doctors do not suggest this therapy as it is not reversible.

Chemotherapy

Chemotherapy drugs such as **Mitoxantrone**, **Docetaxel**, **Cabazitaxel**, and **Estramustine** are used to abolish continuously growing cancer cells. Chemotherapy drugs are in the form of injections or capsules. Although the response of prostatic adenocarcinomas is poor for chemotherapy. Androgen ablation therapy remains priority of intervention aimed at metastatic situations. Chemotherapy is suggested only when hormonal therapy fails to stop growing cancer or when the cancer is spread to other areas.



Targeted drug therapy

There are certain types of medicines that are designed to detect specific abnormalities in Cancer. Targeted based medicines chunk the irregularities in cancer cells and destroy them. Targeted drugs are also used as an option when patients when he is not responding to hormonal therapy in recurrent prostate cancer.

Immunotherapy

It uses the immune system to fight cancer cells. The immune system of the body does not detect cancer cells because these cells produce some type of proteins that are not detected by the immune system. The medicines are given to hinder with this progression.

Use of immunotherapy drugs to identify the cancer cells

Medicines are to patients to boost the immune system and help them to identify and attack prostatic cancer given cells.

Genetic engineering on cells to fight cancer

It is a process in which the cells from patients bodies are taken and these are modified in the laboratory by genetic engineering to fight with prostate cancer and these are inserted back into the body. This therapy is used as an option when hormone therapy does not respond to cancer cells.

DISCUSSION

This cancer is developed when the death rate of cells are not at equilibrium with the rate of cell division and the cell continues to grow into a tumor. Prostate cancer has various types and only 1-5% of cancers cases are other types. Adenocarcinoma is the most common type of prostate cancer. This type of cancer is developed in prostate fluid in the form of granular particles. Out of acinar adenocarcinoma and ductal adenocarcinoma, acinar adenocarcinoma is the most common type. The risk factors that contribute to the developed disease are food, background, and hormonal changes.

There are several techniques to treat prostate cancer such as radiation therapy, hormonal therapy, chemotherapy and immunotherapy. Radiation therapy is a good choice to treat prostate cancer at an early stage

CONCLUSION

As there is a high effective rate of prostate cancer in the United States, but then the death rate continues to remain low. The reason behind that is the people of the United States are well aware of the screening method. Even with the low death ratio, prostate cancer is one of the leading reasons for deaths of Mens' in America. One out of the nine men is affected by prostate cancer and diagnosed in the United States. The prostate gland is located approximately at the top-notch of the bladder, anterior

attached to the rectum and it has 2 small glands on it's both sides which are called the seminal vesicles.

The proximity of the seminal vesicles of the prostate glands is closed and due to it cancer spread two seminal vesical and it may also be removed while doing the radical prostatectomies. Many risk factors are associated with prostate cancer. Like, being aged is greatest risk. There are more chances for men's to develop prostate cancer as they continue to get older. If we talked about the studies being on prostate cancer around the globe, The Western world is likely to get more cases of prostate cancer. The prostate adenocarcinoma case is the most common type of prostate cancer seen in men's. Maybe in somewhere cases the other types are being presented. If there is genetic variability amongst some other types of prostate cancer do require further study, the radical prostatectomies known as the ultimate treatment of cancer because the surgeon and health experts can take out cancer completely and their surrounding tissues. In this case, the type used is dependent on the extensive nature of cancer or the classifying system. The surgery is discontinued because the decision is made on metastasis as it already occurred. Some of the surgeries and interventions are paired with pharmaceutical intervention to help complete the eradication of cancer. Prostate cancer types of diagnosing cancer have kind of risks and some adverse effects. These methods need more research and experienced surgeons attempting to diagnose cancer.