



# “Importance of Bladder Protocol in the Treatment of Prostrate Cancer during Radiotherapy”



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## Abstract

Thanks to the advancement of medical science, deadly disease like Ca. Prostrate can be treated and controlled with early diagnosis. And the use to Radiotherapy provides painless and accurate treatment in managing this disease. During Radiotherapy, following “bladder protocol” can improve the outcome of the disease. The main aim of following Bladder Protocol is to push the organs and structure lying above the bladder so that Radiation dose to those structures can be avoided and lesser complications will be seen in those patients. This in turn will lead to a better quality life for the patient after the treatment. Here we will discuss more about the disease, the treatment (Radiotherapy) modality, and the importance of bladder protocol during radiotherapy using data of 10 patients of different hospitals all over India. And also discuss the average radiation dose, average age group of the disease and the average bladder protocol duration followed in various hospitals.

**keywords:** Bladder Protocol; Radiotherapy; Prostate Cancer; EBRT; SRS; SRT IMRT; IGRT; 3DCRT

## Introduction

Prostate is an exocrine gland found in male reproductive system. The function of the prostate is to secrete a slightly alkaline fluid, milky or white in appearance, that in humans usually constitutes roughly 30% of the volume of the semen along with spermatozoa and seminal vesicle fluid. Semen is made alkaline overall with the secretions from the other contributing glands, including, at least, the seminal vesicle fluid. The alkalinity of semen helps neutralize the acidity of the vaginal tract, prolonging the lifespan of sperm. The prostatic fluid is expelled in the first ejaculate fractions, together with most of the spermatozoa. In comparison with the few spermatozoa expelled together with mainly seminal vesicular fluid, those expelled in prostatic fluid have better motility, longer survival and better protection of the genetic material.

## Prostate Cancer

Prostate cancer is the development of cancer in the prostate, a gland in the male reproductive system [1]. Most prostate cancers are slow growing; however, some grow relatively quickly. The cancer cells may spread from the prostate to other area of the body, particularly in the bones and lymph nodes. It may initially cause no symptoms [2]. In later stages, it can lead to difficulty in urinating, blood in the urine or pain in the pelvis, back or when urinating. Other late symptoms may include feeling tired due to low levels of red blood cells.

## Causes

Doctors know that prostate cancer begins when some cells in your prostate become abnormal. Mutations in the abnormal cells' DNA cause the cells to grow and divide more rapidly than normal cells do [3]. The abnormal cells continue living, when other cells would die. The accumulating abnormal cells form a tumor that can grow to invade nearby tissue [4,5]. Some abnormal cells can also break off and spread (metastasize) to other parts of the body. Factors that increase the risk of prostate cancer include: older age, a family history of the disease and race. About 99% of cases occur in males over the age of 50. And relatives having disease increase the risk two to three folds.

## Complications

Complications of prostate cancer include:

- i. **Cancer that Spreads (Metastasizes):** Prostate cancer can spread to nearby organs, such as your bladder, or travel through your bloodstream or lymphatic system to your bones or other organs. Prostate cancer that spreads to the bones can cause pain and broken bones. Once prostate cancer has spread to other areas of the body, it may still respond to treatment and may be controlled, but it's unlikely to be cured.
- ii. **Incontinence:** Both prostate cancer and its treatment can cause urinary incontinence. Treatment for incontinence

depends on the type you have; how severe it is and the likelihood it will improve over time. Treatment options may include medications, catheters and surgery.

**iii. Erectile Dysfunction:** Erectile dysfunction can result from prostate cancer or its treatment, including surgery, radiation or hormone treatments. Medications, vacuum devices that assist in achieving erection and surgery are available to treat erectile dysfunction.

### Methodology

During Radiotherapy accuracy and positioning is the most important factor to determine the treatment outcome. Correct positioning leads to greater accuracy. And accuracy aims for maximum dose to the tumor and minimum dose to the nearby organs. Maximum dose to tumor can be achieved by the total dose planned by the oncologist and minimum dose to nearby structures can be attained by careful planning of the dose delivered per fraction with the help of multileaf collimators (MLCs). Also, there is another protocol (Full Bladder Protocol) that is advised to the patient to follow.

### Full Bladder Protocol

In this protocol the patient has to first pass the urine 1 hour before his/her treatment, and then he/she has to drink 500ml of water and wait for 30mins so that the bladder will become full. And the patient is advised not to pass the urine until the end of the treatment for that very day [6]. So, this will continue daily till he/she completes the entire treatment. Here the main aim of making the bladder full is to push the organs (lying on top of the bladder) away from the radiation field planned for the tumor. This protocol will in turn help us minimize doses to organs near the tumor. This is the standard protocol, but each person is different [7,8]. It is therefore important to adapt it to the situation. For the treatments, the patient should have a comfortably full bladder, i.e. feel the urge to urinate, but be able to wait.

I have taken a list of 10 patients undergoing radiotherapy for Ca. Prostate from all over the country to compare the various factors like Total dose, total fraction, Machine Name, X ray Energy, Treatment modality, Tumor stage and Bladder protocol timing.

#### Patient 1

Patient Name: Mr Fredrick 54years

Total Dose: 76Gy/38# (2Gy/1#)

Treatment Technique: VMAT

Stage; cT3b N0 M0

Machine: Elekta Versa HD

Energy: 6MV

Total MUs: 558.4MU

Bladder protocol: 450ml, 30mins before treatment

#### Patient 2

Patient Name: Mr Shekhar 59years

Total Dose:72Gy/40# (1.8Gy/1#)

Treatment Technique: VMAT

Stage; cT3b N1 M0

Machine: Elekta Versa HD

Energy: 6MV

Total MUs: 400.5 MUs

Bladder protocol: 500 ml, 35mins before treatment

#### Patient 3

Patient Name: Mr Jagtap Narayan 61years

Total Dose: 74Gy/37# (2Gy/1#)

Treatment Technique: IMRT

Stage; pT3b N1 M0

Machine: Varian True Beam

Energy: 6MV

Total MUs: 789MUs

Bladder protocol: 500ml, 30mins before treatment

#### Patient 4

Patient Name: Mr Bhaskar 71years

Total Dose: 64Gy/32# (2Gy/1#)

Treatment Technique: IGRT

Stage: pT3b N0 M0

Machine: Tomotherapy

Energy: 6MV

Total MUs: 3886 MUs

Bladder protocol: 500ml, 35Mins before treatment

#### Patient 5

Patient Name: Mr Gangadhara 80 years

Total Dose:66Gy/36# (1.8Gy/1#)

Treatment Technique: IG-IMRT

Stage; cT3b N0 M0

Machine: Elekta Precise

Energy: 6MV

Total MUs: 786MUs

Bladder protocol: 500ml, 30 mins before treatment.

## Patient 6

Patient Name: Mr Sunil Agarwal 67 years  
Total Dose: 66Gy/33# (2Gy/1#)  
Treatment Technique: IGRT  
Stage; pT3N1M0  
Machine: Varian Trilogy TX  
Energy: 6MV  
Total MUs: 793MUs  
Bladder protocol: 600ml, 30 mins before treatment

## Patient 7

Patient Name: Mr Hasan Ahmed 61years  
Total Dose: 72Gy/40# (1.8Gy/1#)  
Treatment Technique: IMRT  
Stage; cT3b N0 M0  
Machine: Elekta Synergy  
Energy: 6MV  
Total MUs: 598 MUs  
Bladder protocol: 500 ml 30 mins before treatment

## Patient 8

Patient Name: Mr. Pramod Jaiswal 64 years  
Total Dose: 64Gy/32# (2Gy/1#)  
Treatment Technique: IMRT  
Stage; pT3b N0 M0  
Machine: Clinac iX  
Energy: 6MV  
Total MUs: 803MUs  
Bladder protocol: 450ml, 30mins before treatment

## Patient 9

Patient Name: Mr Syed Atthula 57 years  
Total Dose: 72Gy/40# (1.8Gy/1#)  
Treatment Technique: IMRT  
Stage; pT3a N0 M0  
Machine: Varian Precise  
Energy: 6MV  
Total MUs: 674MUs  
Bladder protocol: 500ml, 40mins before treatment

## Patient 10

Patient Name: Mr Francis Anthony 63 years  
Total Dose: 66Gy/33#(2Gy/1#)  
Treatment Technique: 3DCRT  
Stage; pT3b N1 M0  
Machine: Siemens Primus  
Energy: 6MV  
Total MUs: 782MUs  
Bladder protocol: 500ml, 35 mins before treatment

## Data Analysis

With the above data we can see different types of approaches to eradicate the tumor. The treatment techniques are also different in different centers across India. Treatment technique also depends on the treatment machine. With the help of the advancement in radiotherapy the oncologist plans the best possible radiotherapy plan. And following the bladder protocol regularly and properly, the patients will minimize the side effects and the doses to the organs near the tumor [9]. With such approach there will be an impact on the treatment outcome [10,11]. Resulting in better 5 years survival and complete recovery of the patient. Prostate cancer is the second most common cause of cancer and the sixth leading cause of cancer death among men worldwide. Since the cause of prostate cancer is not known in most cases, we don't know how to prevent it. But we can adopt certain practices to decrease the chances of getting prostate and many other types of cancer

- a. Stay at a healthy weight.
- b. Indulge in regular physical activity (Sports).
- c. Eat at least 2½ cups of vegetables and fruits each day.
- d. Choose whole grains instead of refined grain products.
- e. Limit the intake of processed meat and red meat.
- f. Limit the alcohol intake to no more than 2 drinks per day.
- g. Reduce intake of dairy foods and diets rich in calcium.

## PSA Blood Test

PSA is a substance made by the prostate. Prostate specific antigen (PSA) blood test is mainly used as a screening test to detect prostate cancer early in asymptomatic men. But it is also done in men who have symptoms suggestive of prostate cancer. The levels of PSA are < 4nanograms/milliliter (ng/ml) in most healthy men. As PSA levels go up, the chances of having prostate cancer increase. However, a PSA level of <4 does not always guarantee exclusion of cancer; about 15% of men will still have prostate cancer on biopsy. There is about 1 in 4 chance of having prostate cancer in men with PSA between 4 and 10 ng/ml and if

PSA is >10, the chance increases to 50%. Many factors, such as age and race, can affect PSA levels. PSA levels also can be affected by

- i. Certain medical procedures.
- ii. Certain medications.
- iii. An enlarged prostate.
- iv. A prostate infection.

Because many factors can affect PSA levels, your doctor is the best person to interpret your PSA test result. Transrectal ultrasound (TRUS): A small lubricated probe is placed in the rectum to provide images of prostate on a computer screen. TRUS is used to visualize prostate if the results of DRE or PSA are abnormal. It is also used to measure the size of prostate and to obtain guided biopsy of the prostate, if indicated.

### Prostate Biopsy

If the doctor suspects that you might have prostate cancer based on the symptoms and/or the results of early detection tests (DRE and/or PSA), he would perform a biopsy of the prostate under transrectal ultrasound guidance. The biopsy usually takes about 10 minutes and is done in an out-patient clinic or minor OT. The biopsy is sent to the pathologist who examines it to look for any cancer cells and also to grade the cancer (Gleason's scoring/grading) for assessing the differentiation of the tumor and for prognostication [12].

You may feel some soreness at site of biopsy or notice blood in urine, stool or semen for a few days after the biopsy.

Although a confirmatory diagnosis is usually made on biopsy, the biopsies may still miss a cancer even if multiple samples are taken, if the needle does not hit the cancerous area. In such cases, a repeat biopsy may be required if your doctor strongly suspects that you may have a prostate cancer. Computed Tomography (CT) scan: may help in detecting spread of prostate cancer to nearby lymph nodes or other organs. Magnetic Resonance Imaging (MRI): can produce a clear picture of prostate and is useful to detect whether the cancer has spread outside the prostate into the seminal vesicles or nearby structures [13,14].

### Conclusion

From the data collected and proper analysis we came to know a lot of things about the second highest Cancer of the world. Some of them are:

The average Radiation dose to eradicate this disease is 69Gy. So, this means that we have to deliver a huge amount of radiation to treat this disease. Also, the average age group of the people suffering this disease ranges in-between 60-70 years.

The average Energy used to treat this disease is 6 MV. And the standard duration followed for bladder protocol is 30 mins before the commencement of the treatment and the amount of water intake is approximately 500ml. Also, with further interactions with the patients, it is evident that following bladder protocol has resulted in fewer side effects and it will surely have an impact on the 5-year survival rate.

Lastly the overall 5-year survival rate for this disease globally is 64% and with improvement in medical science we hope it will improve more than 64%.

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