BLADDER FILLING PROTOCOL FOR PROSTATE RT : HOW FULL?

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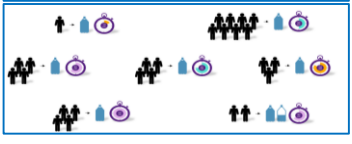
Aims: Bladder filling can determine displacements and deformations of prostate. For this reason, the patient must follow a preparation before each radiotherapy session.
The purpose of this work was:

1) to study patients who had records of their preparation;
2) to analyze filling and maintenance of the bladder volume;
3) to verify the preparation related to a better reproducibility; and
4) to submit a dedicated protocol.

Materials and Methods: A retrospective study was carried out on 26 patients with prostate cancer, who also had a recorded bladder preparation; the amount of water drank by the patient varied between ½ liter and ¾ liter in a period of time between 10 and 60 min (table I) before computed tomography (CT) and treatment. For each patient the bladder was contoured both in the simulation CT (CT sim) and in all the cone-beam CTs (CBCTs) acquired during the treatment (excluding those where the total visualization of the bladder was not possible). The Eclipse treatment planning system (TPS) was used for contouring. The filling volumes and the maximum diameters were recorded in the 3 axes and the mean of the fillings, the standard deviation, the minimum and the maximum filling for each patient were calculated. In total, 423 bladders were contoured and examined.

Table I: amount of water drank by the patient in a period of time between 10 and 60 min before computed tomography (CT) or treatment.

number of patients per different preparation	Preparation
1	½ lt in 10 min
8	½ lt in 30 min
4	½ lt in 40 min
4	½ lt in 45 min
3	½ lt in 50 min
4	½ lt in 60 min
2	¾ lt in 40 min



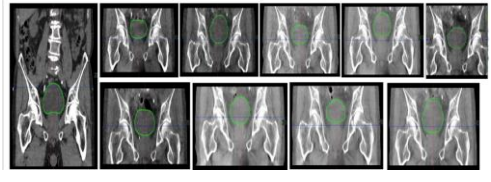
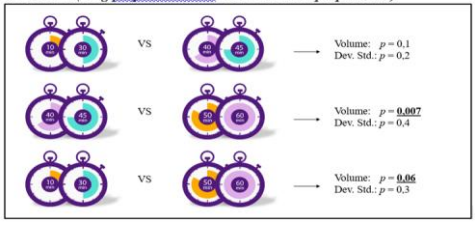


Figure 2: Fisher's and Student's t tests for volumes and for standard deviations (long preparations vs short-medium preparation)



Results: According to the data collected, the patients were divided into seven groups according to preparations. None of the groups showed a better filling reproducibility.
The average volume was 200 ± 70ml.
Larger volume of bladders at the CT sim are not kept during treatment.
11/26 (42%) had a greater filling in the first session of treatment compared to the CT sim; on the contrary, 15/26 (58%) presented a decreased bladder volume (up to 25% for 7 patients and over 50% for 8 patients). The trend of bladder volumes during the treatment showed no correlations in 19 cases, increasing trends in 5 cases and a decreasing trend in 2 cases. Further tests were carried out on three groups based on short (10-30 min), medium (40-45 min) and long preparations (50-60 min). On these, Fisher's and Student's t tests were performed, both for volumes and for standard deviations, coming to the conclusion that long preparations (50-60 min) lead to more empty bladders than short-medium ones.
No differences were seen with the t-test

Conclusions: Average volumes of 200 ml were recorded with a variability of 70 ml. In most cases, the bladder volume decreased between the CT sim and the first session, even by over 50%. Short-medium preparations (10/45 min) led to larger volume than long preparations (50/60); none of the groups showed a better filling reproducibility; however, each preparation protocol leads to a stability of the bladder volume.

As a result of our study, a standardized protocol with short preparation was proposed as follow:
Refrain from urinating and from drinking, if not absolutely necessary, for 2 h,
then drink 0.5 l of water in 5 min, 30 min before the CT sim or session.
This protocol is introduced to the patient on the first visit;
the patient is asked to train the bladder filling before CT sim.