EVALUATION OF SETUP UNCERTAINTY IN RADIOTHERAPY OF PELVIC CANCER

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ABSTRACT

Background: The most important event of radiation treatment (RT) is to dependably expand the positions to the target volume while limiting the side effects to the normal tissues. Thusly, day by day treatment arrangement is considered as a basic necessity in RT for an exact positions and setup accuracy for treatment.

Aim of work: To measure the between fragmentary arrangement blunders and 3D vector lengths and compute CTV-PTV edge for various treatment destinations, for example, head and neck (H&N), cerebrum, pelvic and prostate by electronic entrance pictures direction and decide the ideal PTV edges.

Patient and Methods: This is phase 2 study aiming to evaluate setup uncertainty related to pelvic cancer radiotherapy in the Clinical Oncology and Nuclear Medicine Department, at Al Hussein hospital, Al-Azhar University and to estimate how large planning target volume margins are needed in the Pelvic.

Results: the mean variation for action level for plan is 3.3 mm (1SD) for pelvic. The greatness of precise and irregular mistakes for pelvic in our investigation are comparable or not exactly different examinations. To contrast the outcomes and other distributed investigation, we have considered PTV (90, 95,) margin. In our investigation, the determined CTV-PTV edge for pelvis patient in the vertical, longitudinal and Lateral Variations from is center position were 4.12 mm, 4.62 mm and 3.23 mm, individually.

Conclusion: The consequences of this examination are distinctive to the discoveries of current work. In the present work, we have changed the isocenter in the fourth portion, which brought about decrease of the efficient mistakes. Another distinction can be ascribed to the recurrence of online confirmation.

Keywords: Radiotherapy; Pelvis Tumors; uncertainties in Setup.

INTRODUCTION

The point of radiation treatment (RT) is to dependably expand the portion to the objective while limiting the poisonous quality to the typical tissues. Thusly, day by day treatment arrangement is considered as a basic necessity in RT for an exact portion conveyance. The arranging planning target volume (PTV) is characterized as the clinical target volume (CTV) in addition to an edge to represent the inclusion of target volume (CTV) in addition to an edge to represent the inclusion of target volume. The arranging planning target volume (PTV) is considered as a basic necessity in RT for an exact positions and setup accuracy for treatment.

Arrangement vulnerabilities can be isolated into two classes: efficient blunders and arbitrary errors. Whereas the irregular mistakes obscure the portion dispersion, the methodical part of blunders prompts a move of the aggregate portion appropriation comparative with the objective. The efficient blunders are reproducible predictable mistakes, happening in a similar bearing and extent yet arbitrary (everyday) blunders can change in course, size and are eccentric. The methodical blunders as opposed to the irregular mistakes are increasingly perilous in light of the fact that they influence all treatment meetings. In this way, methodical mistakes may prompt the repeat of the tumor or genuine harm in ordinary organs.

The across the board accessibility of EPIDs has prompted it be a powerful apparatus to diminish arrangement blunders. Right now, blunders assessment is doing utilizing an entrance picture and a carefully recreated radiograph (DRR). The goal of this examination was...
to measure the between fragmentary arrangement blunders and 3D vector lengths and compute CTV-PTV edge for various treatment destinations, for example, head and neck (H&N), cerebrum, pelvic and prostate by electronic entrance pictures direction and decide the ideal PTV edges.

**TECHNIQUES AND MATERIALS**

**Patients Selection:**

This is phase 2 study aiming to evaluate setup uncertainty related to pelvic cancer radiotherapy in the Clinical Oncology and Nuclear Medicine Department, at Al Hussein hospital, Al-Azhar University and to estimate how large planning target volume margins are needed in the Pelvic Cancer Radiation Therapy when the 2D imaging is used for frequent setup verification. Between May 2017 to end of 2019 – 40 patients

**Treatment Simulation and Planning:**

At our establishment, pelvis patients didn’t utilize immobilization only utilizing embedded 3 fiducially lead markers. The pelvic patients needed to exhaust rectum and had a full bladder reenactment and treatment meetings) before figured tomography (CT) arranging and day by day treatment. For all pelvic malignant patients were examined in head first recumbent position with laser pillars direction in CT plan for pelvic cases, EPIs were performed for the initial 3 successive treatment divisions. Online arrangement mistake amendment was accomplished for these three portions. At the fourth division, patients were moved to the new iso-center, with normal removals in the initial three parts and were followed once week by week from that point.

The whole study group going to receive preoperative pelvic radiation therapy. Localization, immobilization, and simulation: - During simulation and treatment, the patient is prone with a full bladder to decrease the small intestinal dose, rectal and vaginal markers are used during simulation. The laser localization system is used to put a 3 radio opaque marks for position reproducibility, these marks are used as references for repositioning of the patient for treatment delivery. The patient then scanned by CT scan machine from the ischial tuberosities up to the lower border of L5 with cuts interval 5mm (GE Lightspeed GE Healthcare).

In order to make a dosimetric comparison, IMRT treatment plans were generated for the same thirty patients. Acute effects and late effects in addition potential complications of treatment were explained clearly to all patient, the study was approved by the university ethics committee. Varian - eclipse planning system version 15.7 was used as an algorithm for planning. Body was contoured generated automatically and surrounding critical structures were contoured manually. Clinical Target Volume (CTV), Planning Target Volume (PTV) was created by a 10 mm expansion around CTV in all directions. Target and critical organ delineations were performed by the same radiation oncologist. To perform Dosimetric evaluation for treatment plan in terms of: Planning target volume (PTV) coverage, Organs at risk (OAR) dose.Conformity index (CI), Homogeneity index (HI).

At that point, the online arrangement mistake amendment would apply if remedy was required. For patients with prostate malignant growth, EPIs were completed a few times each week since we needed to assess the adequacy of fiducial marker-based position check during pelvis EBRT just because at our organization. Hence, online arrangement blunder revision was done for pelvis patients. Coordinating DRRs and entrance pictures were performed utilizing the life structures coordinating programming (ARIA-record and confirm system).

For study the arrangement blunders, the dislodging in two translational ways were surveyed in each field. The symmetrical entry pictures were coordinated utilizing the unmistakable hard tourist spots with their separate DRRs. The activity level was the relocation more noteworthy than 3 mm in pelvic cases along one course in which remedied utilizing the Linac love seat shifts or by rectifying the patient situation to coordinate the ning step. Cut thickness was 5 mm in all cases for CT.

The treatment Iso-Center. At that point, new entryway pictures were obtained. Persistent arrangement blunders were evaluated along three translational bearings (vertical (Y), longitudinal (Z) and horizontal (X)).

**Measurements:**

The deliberate and arbitrary mistakes were determined utilizing the dislodging in three translational ways. For pelvic cases, the orderly blunders were characterized as deviations between the arranged patient position and original patient situation of initial three back to back treatment divisions. The arbitrary blunders were characterized as deviations between various treatment portions taken week after week during a course of the treatment. Standard deviation (SD) of the orderly blunders (Σ) and SD of the irregular mistakes (σ) were dissected. For prostate malignancy patients, Σ alludes to SD of every individual mean, and σ is resolved through the root mean square of the individual SD of all patients. Likewise, we measured the recurrence of 3D vector lengths and determined the greatness of 3D vector utilizing.

**Follow UP during treatment sessions:**

Observing of patient situating can be performed by EPID. Accordingly, any adjustments in the treatment iso-center will be rectified. In the present investigation, we assessed the between partial set up mistakes for different treatment locales of 73 patients utilizing EPID. For the pelvic cases, about 84%, 77% and 77% of the arrangement relocations were under 3.52 mm in the vertical, longitudinal and horizontal headings, individually (the outcomes are not appeared).

Generally, the methodical to pelvic locales in light of the fact that these treatment destinations are inflexible and everyday varieties in set up geometry
are insignificant.\footnote{In general, these issues were low at our establishment. Moreover, if these elements were watched, we completed another CT arranging with an adjustment in level of patient adjustment.}

There are different elements which can prompt arrangement vulnerabilities for the pelvic and prostate cases. Target volume position in pelvic and prostate malignancy can change attributable to intestinal development and differ filling in the bladder and rectum.\footnote{In the meantime, skin imprints can undoubtedly move in these treatment locales, and can prompt arrangement blunder.\footnote{Utilizing flimsy lines on the patient's skin just as great modified skin fiducial markers and exactness of laser room can decrease arrangement deviations in theories treatment destinations.}}

**RESULTS**

Table for Systematic error calculated and Random calculated for All patient over all whole period of treatment.

<table>
<thead>
<tr>
<th>Direction</th>
<th>LAT</th>
<th>VRT</th>
<th>LONG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic Error (mm)</td>
<td>1.52</td>
<td>0.94</td>
<td>1.23</td>
</tr>
<tr>
<td>Random Error (mm)</td>
<td>1.89</td>
<td>1.56</td>
<td>2.05</td>
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Table 1: The Calculated Systematic Error (mm) and Random Error (mm) for 59 Patient during all sessions

**Fig. 1:** the variation in different directions for each patient for iso-center position.

**Fig. 2:** The Mean deviation of pelvis shift in different directions during all treatment sessions for 59 patients for longitudinal (cm), Lateral and Vertical (mm)
The consequences of this examination are distinctive to the discoveries of current work. In the present work, we have changed the iso-center in the fourth portion, which brought about a decrease of the efficient mistakes. Another distinction can be ascribed to the recurrence of online confirmation.

The margin to be added to the clinical target volume (CTV) to account for setup uncertainties will depend on whether it is possible to identify patients with significant translational variations, and to eliminate these displacements from routine treatments. The choice to eliminate these variations and to use a smaller CTV margin will have to be accompanied by stringent frequent position verification methods and repositioning.

**REFERENCES**


