# Advances in Radiation Oncology

**New policy and regulation for a Radiology-Oncology Center at the time of Covid-19 outbreak in Tehran-Iran**

--Manuscript Draft--

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| Abstract:          | On February 19th, 2020 first case of infected patient with COVID-19 was announced. The number of infected patients increased rapidly. All health care centers faced an extremely challenging situation in Iran. They had to take new regulation and approach in order to keep their patients and staff safe whilst giving service to the society. Patients diagnosed with malignancy are at higher risk for infection with COVID-19 and poorer prognosis. Pardis Noor Radiology-Oncology center is a private center located in Tehran composed of different departments including radiotherapy and chemotherapy. Soon after the outbreak we changed our rules and regulation for our patients and staff. This is a report from a private Radiology-Oncology center in Tehran at the time of COVID-19 outbreak. |
New policy and regulation for a Radiology-Oncology Center at the time of Covid-19 outbreak in Tehran-Iran

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Introduction

On February 19th, 2020 the Ministry of Health of Iran¹,² announced the first case of an infected patient with COVID-19 (CoronaVirus Disease-2019). On March 11th WHO (World Health Organization) declared COVID-19 a pandemic and a public health emergency. The number of infected patients increased dramatically in Iran and throughout the world.

The infection chain rapidly progressed through almost all provinces of the country.¹,²

The most affected provinces were Gilan (a northern province located along the Caspian Sea), Tehran and Qom. During the first month of outbreak, there were 18,407 confirmed cases, 1,284 mortalities, and over 5,979 recovered cases in Iran.¹

Schools and universities were ordered to close soon after the detection of the first cases in Qom.¹

Major restrictions for inter-city trips were put in place.
As of March 23rd, in Iran, there have been 23,049 positive patients, 1,812 deaths, and 8,376 recovered from COVID-19 infection (Figure 1).

In this challenging time, all health care centers in Iran face an emergency.

Tehran is the capital of Iran. It is a metropolitan city with an area of 730 sq.km. Tehran’s population is approximately 13 million in the city and 23 million in the larger metropolitan area of greater Tehran. There are 13 radiotherapy centers in Tehran (6 in public sector and 7 in private sector). These centers are distributed all over the city and cover different geographical area of Tehran. There are total of 22 linear accelerator in Tehran.

Each health center has to implement major changes in its organization. We present here our policy and recommendations in a private Radiology-Oncology Center.

Description and Perspectives:
Pardis Noor Radiology-Oncology Center is a private cancer center located in Tehran. This center opened in 2009. It has three main branches in Tehran. (Table 1) It consists of Departments of Diagnostic Radiology, Interventional Radiology, Nuclear Medicine, Radiotherapy unit and Chemotherapy ward. Figure 2 shows the locations of these three branches on the map in city of Tehran.

Quickly after the announcement of COVID-19 outbreak in Iran, we decided to implement new rules and principles for our personnel and visitors. As a health care center, we have the responsibility to maintain service as well as to keep our staff and patients safe. We also have the responsibility to give awareness and education to our society, about the outbreak in this challenging time.

One of the highest risk groups for COVID-19 infection are patients who are diagnosed with malignancy and have received treatment for cancer or are under treatment of cancer such as chemotherapy or radiotherapy. We decided to develop policies in order to maintain the best service possible to our patients diagnosed with malignant disease.

We defined our major goals for actions as follows:
1. Decreasing the chance of exposure of clinic’s staff
2. Assurance of accurate and sustained delivery of radiation therapy to patients
3. Decreasing the chance of exposure of patients and visitors who visit the clinic
4. Educating patients and visitors for signs and symptoms of COVID-19 and general screening of the population visiting the clinic
5. Guiding and giving appropriate recommendation and treatment if a person is found infected.

Target populations for the changing policies were:
1. Patients
2. Staff and Personnel
3. Visitors (patients’ family and companions)

Soon after the announcement of COVID-19 outbreak, our center faced increasing requests for Chest CT scans. This raised the concern of exposure of our high-risk patients to COVID-19. Hence, we decided to dedicate one branch (Pardis Noor Salamat located in the center of Tehran) to COVID-19 suspected cases and spare two other branches. This first move was followed by other plans and actions to prepare our oncology wards in this challenging situation.

Pardis Noor Niloo Radiology-Oncology Center:

We developed multiple policies for the Pardis Noor Niloo Center and radiotherapy and chemotherapy ward as well as diagnostic and interventional radiology. Table 2 shows the different divisions of Pardis Noor Niloo Radiology-Oncology branch.
We reduced the working hours of radiology department in this branch to two days per week.

Table 3 shows the number of patients who visited Pardis Noor Niloo branch within the first week before the outbreak (week -1), first week after the outbreak and third week after the outbreak (week +3)
We started to have fever screening for all visitors and patients at the entrance. If anyone had body temperature $\geq 37.7$ C, they then were put in a designated isolated waiting area. They had to see a physician before going ahead for their appointment. The physician was responsible for deciding if suspected cases were able to receive the service that they were initially planned to receive or if the patient should be referred for additional tests such as virology polymerase chain reaction (PCR) test, blood work or chest CT scan. If necessary, the patient was referred to an external COVID-19 dedicated clinic (Iran Ministry of Health has published a list of dedicated clinics for suspected cases of COVID-19 infection\cite{1}). If these patients were deemed to receive any service in the center, they would wear a gown on top of their clothes, wear masks and gloves as well. A detailed flowchart shows how we make decisions at time of screening (Figure 3). This flowchart is based on Iran Ministry of Health recommendation booklet for outpatient clinics at the time of outbreak. This booklet was published on March 8th, 2020 and is available online.\cite{1}

Hand sanitizers were available at the entrance and at all stations. Cleaning hands was mandatory before entrance and exit. Frequent (every half an hour) disinfecting all the surfaces, chairs and floors was in place. Staff had to change their clothes after coming to work and before going out of the building.

**Waiting area changes:**

To ensure physical distancing, all patients and visitors were advised to sit with at least a chair in between them. If we faced limits in the capacity of our waiting area, we would advise the visitors and patient’s family to stay in the car or outside the building. We provided an isolated waiting area for anyone who was found to have a fever (before seeing the physician or administration staff) or reported a cough or unexpected malaise or myalgia. All suspected cases had to wear mask and gown on top of their clothes.

**Radiotherapy Department:**

Radiation treatment is an integral part of cancer treatment. About 50\% of all patients who are diagnosed with cancer will require radiation treatment at some point in their treatment.\cite{4}

Radiotherapy is a complex multidisciplinary treatment that requires close coordination between different groups of health care workers, including Radiation Oncologists, Medical Physicists, Radiation Technicians and Dosimetrists.
Pardis Noor Niloo is the Oncology branch of Pardis Noor Radiology-Oncology Complex. It is located in northern east of Tehran. It is divided into 11 floors with an area of 2,500 sqm. In this branch we have a single unit of ARTIST Siemens Linear Accelerator with dual high energy photons (6 and 18MV). The unit is customized with Multi Leaf Collimator, Electronic Portal Imaging and Cone Beam CT.

We implemented new rules and regulations in order to decrease the chance of exposure of our patients and staff; meanwhile, we deliver an accurate and sustained radiation treatment to our patients. Figures (4-6)

**Outpatient Clinics:**

Clinics were open during the outbreak. Radiation Oncologists had to wear a surgical mask during the visit and physical exam. Physical distancing in the waiting area and clinic were met. However, the following modifications were implemented in order to decrease the chance of spreading COVID-19 virus:

**A. New Consults:**

Many Radiotherapy centers have started to modify the indications and scheduling of radiation treatment.\(^5\,6\,7\)

To have a systematic approach to make decisions for our new patients, we developed a structured table so that decision making in clinics can be more homogenous. (Table 4)

We started to use and refer to the guideline recently published.\(^8\)

Radiation treatment is avoided in our patient population whenever possible. If not, it is deferred or shortened when possible.

All palliative treatments were and will be delivered through a hypofractionationed regimen (Either 5 or 1 fraction) until the outbreak is over. Breast cancer adjuvant radiotherapy treatment is one example planned to be delivered through a hypofractionationed regimen. At the time of COVID-19 outbreak we treat all breast cancer patients with 40Gy in 15 fractions (adopted from UK Consensus Statement)\(^9\)

**B. Follow-up patients:**

Most follow-up visits were performed through phone and video calls, unless physician felt that patient needed to be visited, then a visit would be arranged.
This would include any new complaint, sign or symptom that warrants a detailed physical exam. (For example: A new lump in breast for patients with history of breast cancer or a new lump in neck for patients with history of head and neck cancer)

If there was not a concerning symptom or new complaint, follow up procedures such as colonoscopy for patients with colorectal cancer; endoscopic physical exam for patients with history of head and neck cancer and imaging requests were all deferred (For example: One can defer brain MRI for patients with history of glioblastoma multiforme or chest CT scan for patients with history of lung cancer)

C. Patients under treatment:

Unless patients had a major side effect (like in head and neck cancer radiation treatment), they were advised to leave the building after the treatment. Hence, almost all weekly visits for patients under treatment were cancelled. A direct line, as well as direct WhatsApp line, to a Radiation Oncologist was provided for all patients so that they could report any complication they have. WhatsApp is a common messaging service in Iran and most people are familiar using it. We didn’t experience any issue using these measures.

Treatment Unit:

We reduced the CT simulation sessions to two days per week. We kept, at maximum, two radiation technicians (RT) at the time of each patient’s treatment working on the treatment machines. RTs had to wear air-tight waterproof clothes, provided by the center. Before and after each patient, all immobilization devices, as well as RT’s hands and front clothes and sleeves are disinfected using an alcohol based solution. The treatment machine coach is always covered with a one-time use cover sheet. We change this after all patients.

All patients were asked if they had any symptoms of cough, myalgia, malaise and fever. This was an extra screening on top of screening at the entrance. If the answer to any of the questions was positive, the patient was treated with a mask, gown on top of his/her own clothes. Then it would be arranged for the patient to visit the in-house physician.

A thorough history of possible exposure, signs and symptoms for COVID-19 infection would be performed. Any required test (PCR test for COVID-19, CBC, CRP and or chest CT scan) would be ordered.10
If a patient at any time of the treatment was confirmed to have COVID-19 by virology test or CT-Scan findings (as well as clinical symptoms), the radiation treatment would be ceased, and the patient was referred to a dedicated clinic for assessment and quarantine. (Iran Ministry of Health has published a list of dedicated clinics for suspected cases of COVID-19 infection\textsuperscript{1}) Radiation treatment would be re-started after patient virology test is negative. The decision to continue the treatment after the quarantine is finished, is made by Radiation Oncologist based on the type of cancer, the number of days left and number of days of interruption. For some patients, some changes to their treatment plan to account for missed days might be made. This will be decided by Radiation Oncologist and responsible physicist.

**Physics and Dosimetry:**

Physicians could review CT images of patients from home. If any consult was needed with a radiologist or other specialists, it would be done through phone or video call. External access to treatment planning and contouring is not still available in our center. However, to practise physical and social distancing, different rooms are dedicated to physicians for contouring and to physicists for treatment planning.

In the medical physics department, we also tried to find ways to practise physical distancing of at least 1.5m. The staff is distributed in separate working (long) shifts to minimize their exposure in an enclosed space in the planning room. All staff is required to change their clothes after coming to work and before going out of the building. Special strategies were taken to decrease the workload and decrease staff stay at the center. The annual quality assurance check of our center is presently postponed for two months. Monthly mechanical tests for the linear accelerators, lasers and treatment couch are all performed by a single medical physicist. We stopped using physical wedges to decrease treatment time and presence of RTs in the treatment room. Virtual wedges continue to be used.

**Chemotherapy Department:**
We have adopted a few strategies in the chemotherapy ward in COVID-19 outbreak. The distance between all beds in chemotherapy unit is set to be at least 1.5m. We limit the number of patient companions to maximum one person and preferably none. We started to refuse to accept any patients from other cities. We refer them to the nearest facility close to their home city. Outpatient regimens are now preferred to reduce the time of hospitalization. In cases that are eligible for up-front surgery like Breast Cancer or Sarcoma, neoadjuvant chemotherapy is omitted. For patients with history of neutropenia, dose adjustment should be done. Because of the shortage of blood supply, in the patients with borderline serum hemoglobin ($\leq 9$gr/dl), dose adjustment should be done.

**Radiology Department:**

After day 5 of the outbreak, the team decided to reduce the radiology department working schedule to 2 days per week. This included both CT simulations and diagnostic radiology. We also implemented a policy to disinfect the MRI and CT Scanner. At the end of the day all surfaces of the diagnostic machines are disinfected with Deconex solution. If Deconex is not available, we use Kodan solution (Kodan contains 2 and 1-propanol; biphenyl; hydrogen peroxide and water). If a patient is referred to have a CT Chest or CXR regardless of the indication or symptom, s/he would be seated in an isolated area. S/he should also wear a mask and gown on top of her/his clothes. The images were all reviewed quickly so if there were suspicious findings, an urgent report by the radiologist would be done. An urgent consultation with a physician would be arranged.

**Summary:**

All healthcare workers faced an extremely challenging situation following the announcement of outbreak in Iran. Emergency medicine specialists, internists, infectious disease specialists and respirologists, as well as nurses working with them, experienced a huge burden of workload and emotional stress. Many of our colleagues had to isolate themselves in hospital for a few days before switching their shifts, to keep their family safe. We have, sadly lost, many colleagues in different departments including physicians, nurses, radiology technicians, administration workers and laboratory technicians.

Patients who are diagnosed with malignant disease or those who have received therapy for cancer are at higher risk for COVID-19 infection and have a poorer prognosis. This will will be a further challenge to radiation oncologists whilst taking care of their patients.

Radiation therapy is a multidisciplinary treatment. We are dependent on our physicists, radiation therapists and nurses. We, as radiation oncologists, are aware of limited human resources that we are facing. We are trying diligently to decrease the chance of virus spread in our center.
We are dedicated, however, to keep our patients and staff safe whilst offering sustaining treatment to our patients. This report is a summary of the approach and precautions that we as a private sector in Tehran are taking to reach this goal. An international guideline for best practices in oncology clinics facing COVID-19 would best serve our cancer patients all over the world in this challenging time of the health history.

Acknowledgement:
We appreciate help of all staff, administration, our radiation technicians and physicists in this challenging time. We specially thank Dr Soraya Salmanian and Dr Sara Abdollahi for their help, guidance and contribution in care of our patients and scheduling our policies.

References:
2- www.who.int (Mar 24th, 2020)
7- Han et al; Radiotherapy care during a major outbreak of COVID-19 in Wuhan; Advances in Radiation Oncology
8- Simcock et al, COVID-19: Global Radiation Oncology’s Targeted Response for Pandemic Preparedness, Clinical & Translation Radiation Oncology; https://doi.org/10.1016/j.ctro.2020.03.009
9- Postoperative radiotherapy for breast cancer: UK consensus statements; November 2016; The Royal College of Radiologists; Clinical Oncology group
10- Guan et al. Clinical Characteristics of Coronavirus Disease 2019 in China; NEJM, Mar 2020; DOI: 10.1056/NEJMoa2002032
Table 1

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<td>West</td>
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<td>Central area and South</td>
<td>Diagnostic and interventional radiology, Medical Laboratory</td>
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<td>Pardis Noor Niloo</td>
<td>North</td>
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Table 1- Names, locations, and departments of each branch of Pardis Noor Radiology-Oncology Center.
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<thead>
<tr>
<th>Departments</th>
<th>Radiotherapy Ward</th>
<th>Outpatient Clinic</th>
<th>Treatment Unit</th>
<th>Physics and dosimetry group</th>
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<td>Diagnostic Radiology</td>
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Table 2
Departments of Pardis Noor Niloo (North Eastern Branch of Pardis Noor Radiology-Oncology Center)
Table 3
Number of visits into of Pardis Noor Niloo Radiology-Oncology center (North-Eastern branch) within the week before, first week and third week after the outbreak (Rules were implemented at the end of first week). Number of patients visiting this center in week +3 is reduced 50% comparing to week -1.
Goals of treatment | Types of treatment | Examples of treatment | Decision Making for RT
---|---|---|---
Curative | Radical | Head and Neck Ca, Cervix Ca | 1
Adjuvant | | Breast Ca, Sarcoma, Head and Neck Ca, Moderate and high risk Prostate Ca, Endometrial Ca | 2
Neoadjuvant | | Rectal Ca, Sarcoma | 2
Palliative | Emergency | Cord Compression SVCO, Life threatening bleeding | 1
Pain Control | | Bone metastasis, Multiple brain metastasis | 3

Table 4

1) Not to defer the treatment unless a reasonable alternative exists. (For example one can start hormone therapy for intermediate and high risk prostate cancer and defer radiation treatment for couple of weeks) If decision is made to start RT (For example, nasopharyngeal ca), extensive education for hand hygiene and physical distancing should be given directly by radiation oncologist. All patients should have access to hot-line to ask questions and report symptoms. Whenever possible, hypofractionated regimen should be used.

2) Categorize the evidence behind the indication of RT and absolute benefit of the treatment. Categorize if there is survival benefit from RT versus local control benefit (For example boost in breast radiation therapy can be omitted). Assess if any alternative exists to defer or replace radiation therapy. Prioritise with age, other comorbidities of the patient. Radiation treatment can be deferred for some time. (For example radiation treatment might be canceled for elderly patients with early stage breast ca) Some cases will be deferred or cancelled in this category.

3) Defer the treatment and try to use alternatives such as medical treatment for pain control, or use steroid for multiple brain metastasis.

** Please note technique of stereotactic ablative body radiation or stereotactic radiosurgery for brain lesions is not available in Iran.
Figure 1
From: [http://behdasht.gov.ir](http://behdasht.gov.ir)
As of March 23rd: Total death due to Covid-19 in Iran: 1812, Recovered: 8376, Infected: 23049
Figure 2
From: maps.google.com
Search: Pardis Noor in Tehran
Locations of three branches of Pardis Noor Radiology-Oncology Centre
Figure 3 Flowchart for decision making after screening patients, visitors and staff at the entrance.
Translation: Please do not sit on this seat to follow required social distancing.
Figures 4-6 Pardis Noor Radiology Oncology center with new regulations for physical distancing and staff and patient safety