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Strategies to Flatten the Curve during the COVID-19 Pandemic in Radiation Oncology: Experience from a Large Tertiary Cancer Center --Manuscript Draft--

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Abstract:	

**Strategies to Flatten the Curve during the COVID-19 Pandemic in Radiation Oncology: Experience
from a Large Tertiary Cancer Center**

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Running Title: Strategies to Flatten the Curve in Radiation Oncology during the COVID-19 Pandemic

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2 **from a Large Tertiary Cancer Center**

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30 **Introduction:**

31 In December 2019, severe respiratory cases detected in Wuhan, China were found to be
32 associated with the novel coronavirus, SARS-CoV-2 (COVID-19). This outbreak quickly escalated into an
33 international healthcare emergency. The World Health Organization (WHO) declared the COVID-19
34 outbreak a global pandemic on March 11, 2020; the United States declared a national emergency on
35 March 13, 2020. A multi-institutional retrospective study¹ from Wuhan found that the 18 of 1590 COVID-
36 19 patients with cancer, compared to non-cancer patients, were at higher risk for being admitted to the
37 intensive care unit, requiring ventilation, and death (39 vs 8%). Though this early report was limited by
38 small sample size, oncologists have found themselves weighing the urgency of treating cancer patients
39 against risk for exposure to COVID-19.

40 During this pandemic, minimizing exposure risk for cancer patients and healthcare personnel is of
41 utmost importance. Radiation therapy (RT) is an integral component of many patients' oncologic
42 treatment. RT typically involves daily sessions over several weeks with numerous exchanges at an
43 individual level between patients, physicians, nurses, radiation therapists (RTTs), and more. Each
44 weekday at our large tertiary cancer center, the Division of Radiation Oncology (RO) treats approximately
45 450 patients on 17 machines at our main campus, 105 patients on 5 machines at our proton center, and
46 175 patients on 9 machines at four regional locations. Given this volume, a well-coordinated approach
47 based on a factual communication and full engagement of personnel was and remains essential to
48 implement "social distancing" effectively during the COVID-19 pandemic to reduce exposure to patients
49 and staff.

50 On March 4, 2020, an interdisciplinary taskforce was formed within the Division of RO with the
51 goal of mitigating risk of exposure among patients and staff and optimizing resource utilization and
52 allocation. Disease-site specific section chiefs, center medical directors, quality officers, nursing, RTTs,
53 physicists, and administrative leadership meet daily via teleconference to develop policies based on facts
54 gathered from the institution, state, and official medical organizations, with final approval by the Division
55 Head. This critical information was disseminated to individual sections and groups through smaller daily
56 'team huddles.' Here, we present steps taken to date to flatten the curve at a tertiary cancer center
57 **(Figure 1).**

58 **Reducing On-Treatment Patient Volume**

59 An intentional plan was made to reduce the on-treatment patient volume (OTPV). The taskforce
60 felt that reducing OTPV would help the division operate in a sustainable manner, in anticipation of
61 potential staff shortages due to illness or quarantine. Also, decreasing OTPV would reduce exposure to
62 patients, RTTs, and clinic staff. The following steps were taken to reduce patient volume:

- 63 • Hypofractionation was encouraged when clinically appropriate, such as single fraction treatments
64 for palliation of bone metastases ^{2,3}, or short course RT in five fractions for preoperative treatment
65 of rectal cancer ⁴⁻⁸. Each section developed disease-site specific evidence-based guidelines on
66 hypofractionation.
- 67 • Patients with no immediate oncologic need for RT were deferred, after approval from a
68 multidisciplinary team.
- 69 • Patients were distributed between the main campus and the institution's regional locations when
70 feasible to standardize reduced treatment hours across all centers. and most acutely reduce
71 patient numbers at main hospital campus.
- 72 • Out-of-state patients were encouraged to receive treatments locally when feasible.
- 73 • To lower patient throughput, interval between simulation and RT start was set at a minimum of
74 two weeks, with exceptions for clinically-urgent situations. The next available treatment start was
75 also limited by available time slots within established treatment hours.

76 Our efforts to decrease OTPV were complemented by similar efforts by other cancer specialties. The
77 OTPV was reduced by more than 25% over two weeks and was projected to decrease further in the
78 coming weeks (as of this writing) in anticipation of the expected local COVID-19 peak.

79

80 **Social Distancing**

81 Policies were established at the institutional and divisional levels to minimize patient-staff and
82 staff-staff interactions. These efforts were aided by a "stay home, work safe" order for the county issued
83 on March 24, 2020 and echoed by an order from the state Governor on March 31, 2020. Steps for social
84 distancing included:

- 85 • Visitors were prohibited from accompanying patients to clinic/RT areas.

- 86 • Multidisciplinary conferences and administrative meetings occurred through teleconferences.
- 87 • In-person meetings of >5 people were prohibited and individuals were expected to be >6 feet apart
- 88 for any person-to-person interactions.
- 89 • RTTs significantly reduced cross-coverage of treatment machines and a plan for rotating therapist
- 90 coverage was implemented.
- 91 • Work from home: Administrative and research staff currently work exclusively from home (as of this
- 92 writing). Physician, physicists, advanced practice providers, nurses, dosimetrists and patient
- 93 schedule coordinators work in the hospital only on certain weekdays. All site-specific services and
- 94 regional centers have developed a “doctor-of-the-day” model with 1-2 physicians providing all clinical
- 95 coverage. Trainees work from home, except when covering night/weekend call and brachytherapy
- 96 cases. As of April 3, 2020, of >1000 employees in the Division of RO, 49% work from home, 27%
- 97 work part-time at home and on-site, and 24% work full-time on-site. Technical support was provided
- 98 to enable work from home.

99 All bench research laboratories were closed at the institutional level

100 **Patients and Workforce Safety**

101 Screening: At an institutional level, entry points for patients and employees were separated. Before

102 entering the institution, patients and employees were required to attest that they do not have symptoms

103 associated with COVID-19, have their temperature taken, wear a mask, and clean hands.

104

105 Personal Protective Equipment (PPE): All employees and patients were required to wear a surgical mask

106 at all times while on campus. Additionally, RTTs were required to wear goggles when at increased risk of

107 particulate exposure from handling of head and neck immobilization devices. Implementing these

108 approaches goes beyond the Center for Disease Control and Prevention (CDC) guidelines, but was felt to

109 be necessary to protect patients and the workforce. Employees were required to wear additional PPE,

110 such as gowns, gloves, respirator masks, and goggles, as needed based on institutional and CDC

111 guidelines.

112

113 Tracer Team: Within the RO division, a tracer team was established. This team had daily virtual meetings
114 to monitor persons under investigation (PUI) for COVID-19, trace these patients' points of contact with
115 clinical staff, facilitate referrals to Employee Health, and execute guideline-based quarantine measures
116 when required.

117
118 Out-of-State Patients: At the institutional level, out-of-state patients were required to undergo a 14-day
119 home quarantine prior to being seen or treated. These patients were instructed not to leave the state on
120 weekends, as they might have to re-quarantine leading to RT interruption. Travel to XXX by air/land was
121 allowed within the 14-day period. Exceptions to the 14-day quarantine requirement were allowed for
122 oncologic emergencies.

123

124 **Outpatient Clinics**

125 A planned effort was made to reduce the volume of patients in clinics to protect patients and clinical staff
126 from exposure.

127

128 Consultations: Consultations that did not require immediate input from RO were deferred for two months,
129 e.g., for a patient that would receive induction chemotherapy prior to planned RT initiation, or for disease
130 sites with data suggesting no harm in delay⁹. Consultations were cancelled for patients for whom RT
131 would not be recommended based on multidisciplinary discussion. Patients that could be treated locally
132 were referred to local centers.

133

134 Follow-Ups: Follow-ups were rescheduled by 2-6 months, unless immediate evaluation was felt to be
135 necessary for assessment of treatment response or toxicity. These appointments may occur in-person. In
136 select cases, patients were asked to follow-up with their local oncologists.

137

138 Weekly Sees: Patient were seen for weekly see visits (on-treatment visits) via a telemedicine platform to
139 limit provider-patient contact. In-person evaluations were conducted when clinically necessary. During
140 weekly see visits, vital signs were collected only when requested by physicians, rather than routinely, in

141 order to reduce provider-patient contact time. Nursing education on symptom management was provided
142 by phone in most cases.

143

144 Brachytherapy: The brachytherapy program was consolidated into two locations with gynecologic
145 brachytherapy being performed in the operating room and prostate brachytherapy in the RO computed
146 tomography (CT) suite. As of April 6th, 2020, all patients were tested for COVID-19 and confirmed to be
147 negative prior to anesthesia.

148

149 **Inpatient Consultations**

150 RT is shown to be effective in treating painful bone metastases and several oncologic
151 emergencies such as cord compression¹⁰, brain metastases^{11,12}, SVC syndrome/airway obstruction^{13,14},
152 and bleeding¹⁵⁻¹⁷. During the COVID-19 pandemic, a full understanding of prognosis and goals of RT
153 should be especially emphasized for inpatients evaluated for RT. For patients who require RT while
154 inpatient, a hypofractionated course of RT should strongly be considered given many abbreviated
155 regimens in the palliative setting have been found to be non-inferior to multifractionated courses.

156 The taskforce developed guidelines for management of inpatient consults, based on exposure
157 risk and need for treatment. For patients with known COVID-19 positive disease or PUI for COVID-19,
158 evaluation and treatment recommendations were based on review of medical records and imaging,
159 without conducting an in-person evaluation. Exceptions were considered for patients with rapidly
160 progressing, life-threatening conditions where RT had significant likelihood of benefit. In these cases,
161 there was both an expectation of rapid reversal of symptoms from RT and freedom from imminent death
162 due to cancer. If exposure risk was felt to be high or if RT was not indicated, then recommendations were
163 given based on data from medical records and imaging, without conducting an in-person evaluation.
164 However, if exposure risk was deemed to be low and RT was indicated, then an in-person evaluation was
165 conducted.

166

167 **Management of Patients during RT**

168 For patients with community risk of acquiring COVID-19 infection, the taskforce recommended
169 that treatment should proceed as indicated with PPE as described above. For known COVID-19 positive
170 patients, treatment was delayed until recovery from COVID-19 consistent with institutional protocol. For
171 PUI, treatment was delayed while awaiting test results, and was to resume if the test result returned
172 negative. However, exceptions were considered for patients with rapidly progressing, life-threatening
173 conditions where RT has benefit. The tracer team, which tracked all patients undergoing testing for
174 COVID-19, communicated daily with the treating physician and therapy teams to coordinate when
175 treatments should be delayed and resumed.

176

177 **Treatment of COVID-19 Positive Patients**

178 Known COVID-19 positive patients may require treatment with RT and thus, the development of
179 thoughtful instructions was needed to identify if RT can be performed. An oversight panel was created to
180 determine whether a COVID-19 positive patient would be appropriate for RT. A dedicated team of
181 volunteers, consisting of RTTs, nurses, and physicians, was formed to navigate RT in the setting of
182 COVID-19 positive patients. These volunteers were trained in appropriate PPE procedures. A specific
183 treatment machine was designated for COVID-19 positive patients and infection control protocols were
184 established. Given potential risks of exposure to other patients and clinic staff, the treatment of COVID-
185 19 positive patients will be limited to those that can benefit from RT under rapidly progressing, life-
186 threatening conditions. These patients will be considered for hypofractionation, in 1-5 fractions,
187 sequestered to a single treatment machine, and given RT at the end of business day so the room can be
188 terminally disinfected.

189

190 **Communication**

191 Institutional twice daily calls were attended by the senior leaders and relayed to the divisional
192 taskforce daily. Section leaders developed policies during daily calls and these were summarized on the
193 taskforce calls. Taskforce guidelines were conveyed to clinical faculty and staff on daily section virtual
194 huddles. In addition, regular institutional and divisional town halls were instituted by early April.

195

196 **Conclusions**

197 Response to COVID-19 spread in this large tertiary referral center included volume reduction,
198 evolving PPE recommendations, flexible clinic visit interaction types dictated by need and risk reduction,
199 and numerous social distancing strategies. Information was communicated to patients and the workforce
200 expediently and effectively, and a supportive environment was fostered for all. The guiding emphasis
201 underlying all policy changes was the use of evidence-based practices and discussion among clinical
202 experts before implementation. The COVID-19 pandemic is likely to influence oncologic management in
203 lasting ways. While the strategies provided here may evolve over time, we hope these outlined
204 considerations can assist the wider RO community as we collectively face this ongoing challenge.

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Figure 1: Considerations and Strategies to Flatten the Curve during the COVID-19 Pandemic in Radiation Oncology

Reduce On-Treatment Patient Volume	<ul style="list-style-type: none"> • Evidence-based hypofractionated RT • Deferment of RT when appropriate • Planned delays for RT starts • Redistribution of patients between main campus and regional locations
Social Distancing	<ul style="list-style-type: none"> • Visitors not allowed to accompany patients • Teleconference meetings • Work from home • Non-overlapping RTT and clinic teams
Safety of Patients and Workforce	<ul style="list-style-type: none"> • Screening of patients and hospital staff at entry points • All employees and patients required to wear surgical mask • Additional PPE# based on institutional and CDC guidelines • Tracer team • 14-day home quarantine for out-of-state patients
Outpatient Clinics	<ul style="list-style-type: none"> • Consultations that do not require immediate input deferred for 2 months • Follow ups rescheduled by 2-6 months, unless immediate evaluation needed • Weekly see visits using telemedicine platform
Inpatient Consultations	<ul style="list-style-type: none"> • Hypofractionated RT for oncologic emergencies and palliation • Deferment of RT when appropriate • Recommendations based on electronic medical review for COVID-19 positive patients and PUI
Management of Patients during RT	<ul style="list-style-type: none"> • For patients with community risk of COVID-19 infection, RT proceeds • For PUI, treatment delayed until patient tests negative.
Treatment of COVID-19 Positive Patients	<ul style="list-style-type: none"> • Specific treatment machine designated for COVID-19 positive patients • PPE training of RTTs, nurses, and physicians delivering RT • Oversight panel to determine if patient is appropriate for RT
Communication	<ul style="list-style-type: none"> • Virtual daily section huddles • Institutional and divisional town halls

#: For example, consider additional PPE for RTTs such as goggles when at increased risk of particulate exposure from handling of head and neck immobilization devices (mask, stents, bite-blocks, etc.)

Abbreviations: CDC (Center for Disease Control and Prevention); RTT (radiation therapist); PPE (personal protective equipment); RT (radiation therapy); PUI (persons under investigation)