



## Editorial

## Managing the COVID-19 Pandemic as a National Radiation Oncology Centre in Singapore

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## Abstract

COVID-19, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was declared a global pandemic in March 2020. It has impacted the world medically, financially, politically and socially, with countries such as China and Italy adopting a full lockdown of their cities to mitigate the transmission. The current mortality rate is 5.4%, with 1 056 159 people infected worldwide. The disease is reminiscent of SARS in 2002, from which the healthcare system of Singapore has garnered many lessons and applied them in the current climate. As a result of the high transmissibility of the virus, hospitals in Singapore have reduced clinic loads and elective treatments to halt propagation of the virus and also to allow redistribution of healthcare workforce to the frontline. Cancer patients, who are often immunocompromised, are at risk of contracting the disease and becoming seriously ill. At the same time, delaying treatment such as radiotherapy in cancer patients can be detrimental. Here, we describe our experience as a large radiation oncology department in Singapore, including the challenges we encountered and how we managed our patient flow.

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**Key words:** COVID-19; pandemic; radiation oncology; radiotherapy; SARS-CoV-2; Singapore

## Introduction

On 23 January 2020, Singapore reported its first imported case of the novel coronavirus infection, officially named COVID-19, which was later declared a global pandemic by the World Health Organization (WHO) [1]. The causative virus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was thought to have originated from a seafood market selling wildlife in Wuhan, Hubei Province, China. Since its emergence in December 2019, it has infected 1 056 159 people across 208 countries, with a fatality rate of 5.4% [2].

As it is highly infective, many countries have adopted measures to curb its transmission, including a full lockdown of large cities. Healthcare systems across the globe are currently facing immense strain, having to manage the rapidly increasing numbers of unwell COVID-19 patients

while continuing with emergency and essential medical care to those not infected. For cancer patients, the situation has been particularly challenging, as they are at higher risk of contracting the disease and becoming seriously ill [3], but at the same time, cancer treatment for most of these patients could not be deferred for too long.

## Lessons Learned from SARS

The SARS epidemic caused by the SARS-CoV virus in 2003 remains a fresh memory for many healthcare workers in Singapore. It infected more than 8000 people across 26 countries and claimed almost 800 lives [4]. In Singapore, 238 people were infected, 40% of whom were healthcare workers [5].

Having suffered from a strain on the healthcare system at that time, Singapore responded by building the National Centre for Infectious Disease and enhanced emergency protocols for disease outbreaks to better equip itself for future epidemics, such as the Middle East respiratory

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syndrome (MERS) and H1N1, which followed on in the last decade.

As COVID-19 shares similar features to SARS, the experience provided important lessons in handling the COVID-19 outbreak. At the hospital level, all visitors' temperatures were checked and health declaration forms completed at each hospital's entrances. Any suspected cases were quickly isolated for further assessment. Within our radiation oncology department, the workforce was split into two teams. Patient-fronting staff were required to wear surgical masks at all times. Within the cancer centre, instead of running simultaneous single subspecialty oncology clinics, it was restructured so that different subspecialties were housed in one clinic area to prevent the quarantine of an entire subspecialty team in the event one member becomes infected.

Despite being one of the earliest and worst hit countries at the onset of the COVID-19 pandemic, the swift response, stringent guidelines and open communication with the public meant that we were able to slow down the rise in cases. This prevented the healthcare system from being overwhelmed and bought us time to further ramp up the healthcare infrastructure and redistribute medical manpower to meet the increase in demand. Here, we detail our response to the national threat as a national radiation oncology centre. Our workflow integrated government protocols, WHO recommendations and position statements from oncology associations [6].

## The Division of Radiation Oncology Set-up

The Division of Radiation Oncology is a clinical division of the National Cancer Centre Singapore (NCCS), the largest comprehensive cancer treatment and research facility in Singapore. It is affiliated with the largest hospital in the nation, the Singapore General Hospital (SGH). Besides radiation oncology, NCCS also houses the outpatient services for other clinical divisions, including medical oncology, surgical oncology, oncologic imaging and palliative medicine.

The division serves about 61% of the country's population who require radiotherapy, treating about 280–300 patients per day, including inpatients from SGH and other hospitals within the healthcare cluster. There are, in total, nine linear accelerators. The set-up of the division is unique to the country. It consists of two treatment sites: B1 in the basement of the main SGH building and B2 in the basement of NCCS. Each site is supported by separate ancillary services, mould rooms and computed tomography simulators. They are also each managed by a separate workforce consisting of radiation therapists, medical dosimetrists, physicists and nurses, while radiation oncology doctors cross-cover both sites. Radiation oncologists also service outpatient clinics and multidisciplinary tumour board meetings in other hospitals of the cluster, such as the KK Women's and Children's Hospital (KKWCH) and Changi General Hospital (CGH).

**Table 1**  
National and departmental measures in response to the COVID-19 pandemic

National	Departmental	
	Healthcare workers	Patients
Restrict travel to and from China (and later, restricted travel in and out of Singapore)	All staff to undergo refresher course for PPE and PAPR	Only one accompanying person allowed (exceptions include paediatric patients)
Detailed contact tracing	All staff to wear surgical mask in hospital	Complete declaration form at hospital entrance <sup>§</sup>
Quarantine of close contacts of COVID-19 patients	Full PPE for aerosol-generating procedures, e.g. nasoendoscopy	Thermal scanner temperature check at hospital entrance
Stay Home Notice for inbound travellers*	Reduce number of patients in outpatient clinics and space out appointment timings	All patients and companion to wear surgical mask while in hospital
Social distancing <sup>†</sup>	Suspend cross-covering of satellite clinics in cluster hospitals	Postpone non-essential appointments if well
Circuit breaker <sup>‡</sup>	Conduct multidisciplinary meetings via e-mail or teleconferencing Divide teams to service each treatment site when full segregation of services activated Cancel all non-urgent leaves Check and log temperature twice daily on database	

PAPR, powered air-purifying respirator; PPE, personal protective equipment.

\* As of 20 March 2020.

† As of 27 March 2020.

‡ As of 8 April 2020.

§ Visitors must declare any recent travel history and/or symptoms (including fever, shortness of breath, cough) and/or contact with positive cases or clusters.

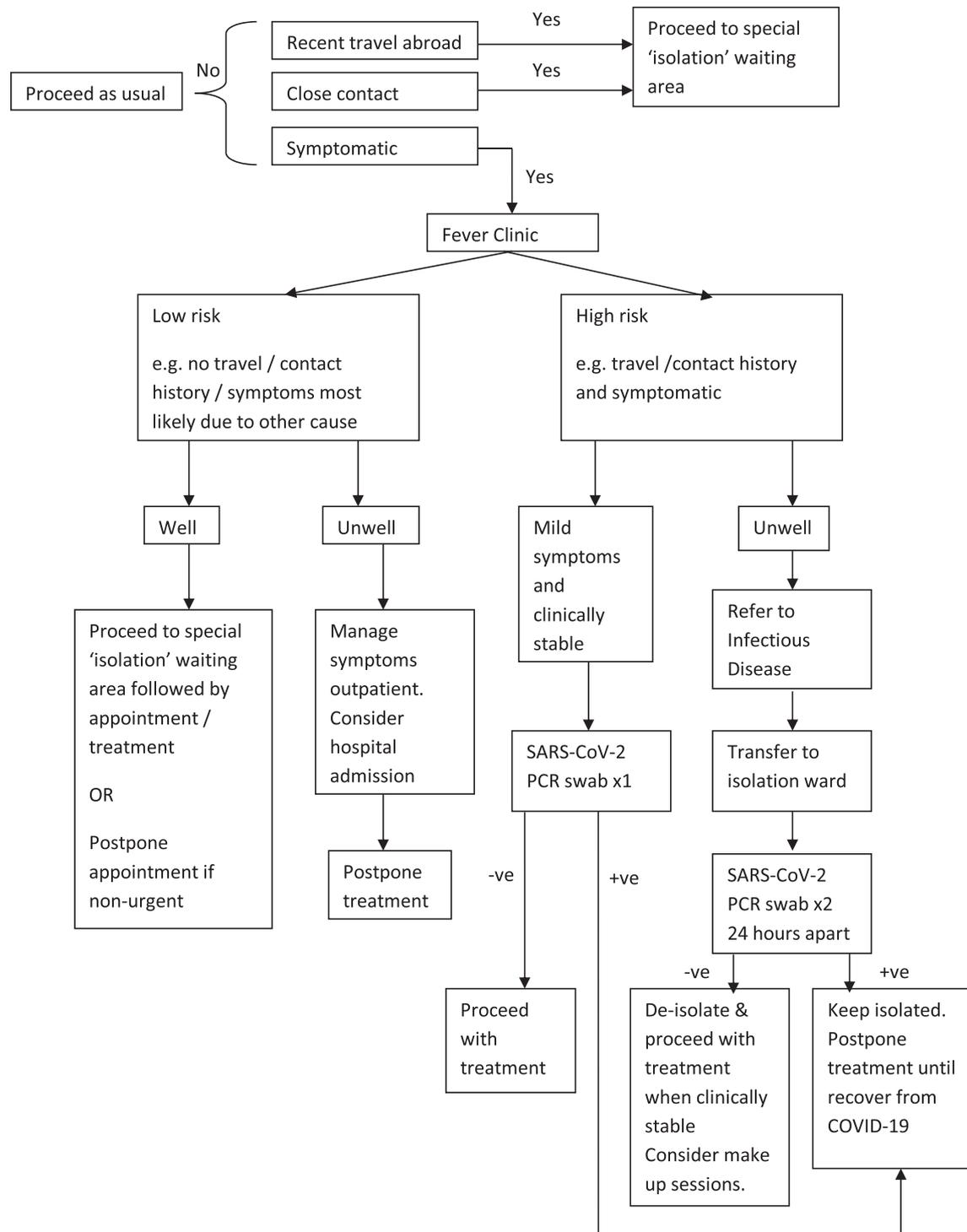


Fig 1. Flowchart showing patient's pathway after triage at hospital entrance.

## The Division's Response to COVID-19

Before the first confirmed COVID-19 case in Singapore, a multi-agency task force was set up to manage the impending crisis. In the hospital setting, a disease outbreak taskforce was set up to coordinate the development and implementation of protocols and kept everyone updated

with regards to the rapidly evolving situation. Table 1 summarises the national and departmental response to the COVID-19 pandemic.

We have continued to treat inpatients from our affiliated hospitals that do not have in-house radiation therapy services. Of note are paediatric cases from KKWCH, which treats most of the paediatric cancer patients in Singapore.

Anaesthesia for these patients is provided by a dedicated anaesthetic team from KKWCH assigned to our SGH site.

Figure 1 depicts the pathway of patients after the hospital entrance's triage.

Should any patient who is quarantined for 14 days due to close contact with confirmed COVID-19 cases or those with a Stay Home Notice (SHN) due to recent entry from abroad as of 20 March 2020 require radiotherapy, it will be conducted in a highly controlled manner with close collaboration with the Ministry of Health. Quarantined patients will have to be specially transported by dedicated ambulances accompanied by quarantine officers. SHN patients will have to attend via private transport. They will be treated at NCCS and scheduled as the last case of the day, after all patients have left the premises. Only the bare minimum assigned staff will be allowed to be present and they must ensure full personal protective equipment (PPE) is worn. These patients will have to enter the building through dedicated pathways into an isolation waiting room. Upon completing the treatment, the isolation and treatment rooms will undergo terminal cleaning. PPE will be disposed of in biohazard bins within the room. For those who are yet to start treatment, we will defer non-urgent cases until their period of quarantine or SHN is over. At the time of writing, there are 5984 people currently quarantined in Singapore [7]. We foresee the need to prepare for a surge of both quarantined and SHN cases as more Singaporeans are returning from the increasing list of countries with high infection rates.

## Challenges Faced by the Division

There are certain challenges unique to the radiation oncology division. First, many cancer patients have symptoms due to their tumour, treatment side-effects or their immunosuppressed state, including cough, fever, fatigue and shortness of breath [8]. These are also symptoms of COVID-19. Hence, symptomatic patients irrespective of travel or contact history would have to be assessed at the fever clinic and a proportion tested to rule out COVID-19, resulting in a delay in radiotherapy treatment. Where possible, alternative therapies are sought, for example optimising medical treatment for palliative cases.

Second, in line with the department's protocol to reduce patient flow through the hospital, consultants needed to look through their patient lists to ensure only the most stable patients have their appointments postponed. In our satellite gynaecological and breast cancer clinics at KKWCH and CGH, this issue was mitigated by engaging our surgical colleagues to review recently treated patients. Patients who needed to be seen more urgently were given appointments at NCCS instead. We were also more likely to postpone a patient's appointment if they were reviewed by another specialty doctor recently and were deemed well. Telemedicine for remote consultation is being considered in the event of a prolongation of this global pandemic.

Third, although it is possible to defer any untreated non-urgent cases, deferring radiotherapy in category 1 patients (patients with rapidly proliferating tumours) can be detrimental. On a regular basis, the division treats a proportion of patients with hypofractionated regimens, such as in adjuvant radiotherapy in breast cancer patients, the CHHiP protocol in prostate cancer and single 8 Gy for palliative cases. During this pandemic, the division aims to increase the use of validated hypofractionated regimens where possible to reduce the amount of daily hospital attendance, thereby decreasing exposure to possible infection.

## Conclusion

As of 4 April 2020, Singapore had 1189 confirmed cases, 297 of whom have fully recovered and there have been six deaths [9]. There is now a second wave of imported cases from regions outside of China. Although not as deadly as SARS, COVID-19 proves to be a respectable foe due to its highly transmissible capabilities. We may have a long way to go before life returns to normalcy. Time waits for no man and for many of our cancer patients delays in treatment could result in detrimental effects, including death. Hence, we need to tailor our services accordingly to ensure that we do not compromise the safety of our cancer patients but also ensure they receive their treatment in a timely manner. We hope our experience will provide other institutions with some guidance on tackling the current pandemic.

## Conflicts of interest

The authors declare no conflicts of interest.

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