

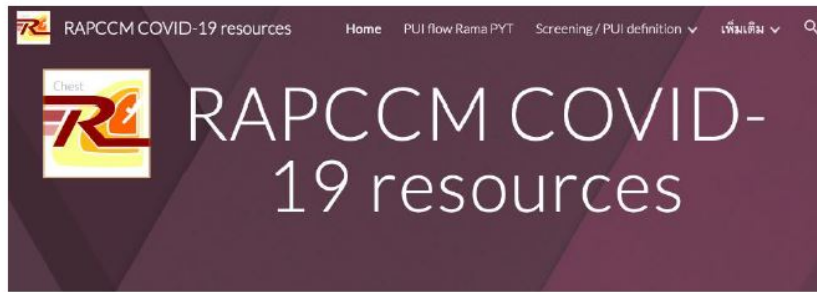
# My Seven Days with COVID-19: A Week in the Life of a Fellow Fighting the COVID-19 Pandemic

The year 2020 was the year that the whole world had forever changed from the outbreak of COVID-19. As we all know, the spreading of COVID-19 began at the end of 2019 and became a pandemic around February 2020. Thailand is the first country outside of China that found a case of COVID-19 and led to the closure of the country in April to control the outbreak. Probably the luck is on our side, the efforts we put in to control the disease are working and we have had 4,000 cases in total with 60 casualties at the end of November. We might not have extreme experiences like health care workers in countries with enormous number of cases, still what we had learned here is a kind of “new-normal” which I would like to share with everyone today.

During that particular period, I was working and being trained in the pulmonary and critical care medicine fellowship program of Ramathibodi Hospital, one of the largest medical schools in Thailand. Our institute took major parts in screening and caring for COVID-19 patients in Bangkok, the capital city of Thailand which had the largest number of population and the toll of the cases in the country. With the location situated in the middle of the city and the infrastructure that aged over 50 years, we had a limited capacity of negative pressure rooms and a very challenge situation for infection control. Fortunately, we have had a new developing health facility, the Chakri Naruebodindra Medical Institute (CNMI), which was located in a 100-acre suburban area and was planned to be a teaching hospital network for our Faculty of Medicine. The constructions of the campus, including the hospital buildings had begun within less than 5 years and the facilities have been well-planned with enough negative pressure rooms to accommodate up to 30-50 air-borne isolation patients at once.

Although the institute was in its beginning phase and still hadn't run at its full capacity, partly due to lack of personnel, we decided to transfer all of our patients with positive test for SARS-CoV2 to CNMI. To solve the staffing problem, the internal medicine department would send “backup” teams to join the CNMI personnel every week. We will come back to those details later.

Dealing with a novel, highly contagious virus was not easy. Even in the largest medical schools, there was a lack of knowledge, experiences and of course, a shortage of medical resources from the worldwide surge of demands. To prepare for the upcoming of the “big wave”, our team, led by my professors and instructors in pulmonary medicine came up with pre-planned practical guidelines for both of our centers, Ramathibodi Hospital and CNMI. Being one of the fellows, we also took parts in writing the guidelines before publishing it online to be used as a reference for our personnel. We had hands-on trainings of how to properly don and doff the personal protective equipment (PPE) and also discussed the information of COVID-19 in our weekly topic review sessions.



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- แนวทางเหล่านี้เป็นเพียงข้อเสนอแนะที่ควรปฏิบัติตามอย่างเคร่งครัดภายใต้สถานการณ์ที่ไม่สามารถนำแนวทางในเว็บไซต์นี้ไปอ้างอิงทางกฎหมายได้
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**PUI flow (Ramathibodi PYT)**

*Figure1: A screenshot of the website accommodating practical guidelines at Ramathibodi Hospital*



*Figure2: Practicing essential procedures needed for protection of the spread.*

Even with all of those being done in advance, when we had our first ARDS patient from COVID-19, there were lots of difficulties. We needed to keep the balance between close monitoring and personnel protection during the care of the case and especially during the transfer of the patient to CNMI. With this first ARDS case, I was assigned to take care of this patient and accommodated him during

the transfer between our centers. Although, as a pulmonary fellow, taking care of ARDS patient would be a familiar situation in hospital settings, it was a completely different scenario when we had to transfer the patient, especially the one on air-borne isolation. At the time, we had limited supplies of PPE and needed to be very sufficient. I had to wear the PPE gown during the preparation and the transfer for more than seven hours without being switched with the other doctors. However, this was a good learning experience. I've learned how to properly transfer the ARDS patients on air-borne isolation. The tubing must be strapped and wrapped to prevent a leakage. I also had the opportunity to peek at the CNMI ICU, a place I would have to go working in a short future.



*Figure3: The transfer of our first COVID-19 ARDS patient. We need to wear PPE at all times and care must be taken to prevent the air tubing from disconnection.*

### **Seven days of “If you were me, what would you do?”**

As mentioned above, everyone from the department of internal medicine would have to take a rotation of one week each to work at CNMI. This included the staff, fellows, and internal medicine residents. In each rotation, there would be a “specialist” team for taking care of severe patients in the ICU. The team consisted of one of the staff from the critical care medicine, one from the pulmonary medicine, one of the cardiology/nephrology/critical care fellow, and, as you could have guessed, a pulmonary and critical care fellow (me). At the time for my turn, there were more than a hundred COVID-19 patients in cohort wards and 10 COVID-19 ARDS patients in ICUs. We had 2 more vacant operable negative-pressure ICU rooms at that time (due to the limit of our staffing), limited doses of Favipiravir (our first-choice agent), less than 5 doses of the probably beneficial Tocilizumab, while there were unpredictable numbers of patients about to get worse. I was assigned to work in one of the ICUs with patients who were admitted during the last week, and accompanied by a pulmonary-critical instructor and an internal medicine resident. With that, here goes my seven-day story.

## **Sunday**

As soon as I got on duty, I had received a notification that a 44-year-old Thai male with COVID-19 pneumonia and pulmonary emboli in multiple pulmonary arteries had ongoing dyspnea and hemoptysis. He was at 28th day of illness, currently in the intermediate ward, already received Hydroxychloroquine, Azithromycin, Darunavir/ritonavir and Favipiravir (the regimen we used at that time) and anticoagulants for his pulmonary embolism. His condition had been improved for a while and the CXR findings was stable. Today, the patient had a respiratory rate of 32-35/min and the SpO2 was 88% while using the oxygen mask with bag at 10 lpm. His clinical, however, looked very good and not in distress. I was not sure if this was a symptom of worsening pneumonia / pulmonary embolism (at day 28?) or was it just a "happy hypoxemia" we had read in the literature. In many recommendations, early intubation in COVID-19 pneumonia may provide better clinical outcomes and reduce the risk of infection from emergency intubation. Should we intubate this patient? *If you were me, what would you do?*

### **What we did...**

I decided to move this patient to the ICU to observe the breathing more closely. With a new chest xray, I found that there was basal lung atelectasis and development of fibrosis in major areas of the lungs. After adjusting the patient's posture into a semi-upright position and continuing oxygen therapy, his clinical symptoms improved and the respiratory rate reduced to 24 /min the following day. After a discussion with my professor and more research through articles, I've learned that in the late period of the infection (especially after four weeks), the chance of developing ARDS was minimal. The problem arises in this late-phase would be more often the complications from the disease, such as atelectasis or lung fibrosis.

## **Monday**

This morning, I cared for a 39-year-old Thai male patient who weighed 95 kg and was diagnosed with COVID-19 ARDS. He had received the drugs in the same regimen with the previous patient mentioned above. His chest x-ray was, however, worsening and high fever persisted. He initially used high flow nasal cannula, but later had to be intubated due to worsening lung function and seizures. There was also persistent lymphopenia and increasing levels of inflammatory markers, including Interleukin-6 and CRP. The team decided to enroll him in a study that prescribe intravenous Tocilizumab. One day later, he had a few erythematous rashes on his arms. Was Tocilizumab the cause of the rash, or was it one of the manifestations of COVID-19? *If you were me, what would you do?*

### **What we did...**

The most common cause of a rash occurring after a drug administration would be a drug adverse event or allergy. This holds true and has been reported with Tocilizumab. For this patient, some nurses noticed that he had a faint rash before administration of the drugs, but it was initially missed due to the limited physical examination via the patient's isolation. The rash could be triggered by other culprit drugs or even be a rash from SARs-CoV2 itself which has been reported in a form of viral exanthem. Some data available at that time also reported about a thrombocytopenic purpura-like rash.

Regarding the seizure, there were many possibilities, such as: from the drugs cocktail we had been using, to the neurological manifestation of SARs-CoV2. A very high level of inflammatory cytokines in combination with multiple organ system involvement could be the cause. Reviewing of the chart also revealed that Levetiracetam was given to control seizure at the proximity period to the occurrence of the rash and could even be the real culprit. In this patient, the severity of respiratory failure significantly improved after receiving Tocilizumab and the rash gradually subsided with supportive treatment.

## **Tuesday**

Today, I met a 58-year-old Thai female patient with diabetes and obesity with a BMI of 31 kg/m<sup>2</sup>. She was diagnosed with COVID-19 pneumonia and had been given the standard treatment regimen that we prescribed. The symptoms continued to progress during an 8-day duration post-treatment. She also happened to have cardiomegaly but the echocardiogram showed LVEF of 60-70 percent, with normal RV systolic function. In the early stages, she was treated in the cohort ward as an acute decompensated heart failure, receiving diuretics without any improvement. She required a high flow nasal cannula and her chest x-ray rapidly progressed to ARDS along with rapidly increasing CRP and IL-6 levels. CT scan of the chest revealed peripheral ground-glass opacity and consolidation, compatible with COVID-19 pattern. The patient got early intubation, Tocilizumab was given, and she was moved to the ICU. I was assigned to assess the volume status in this patient and inserted the central venous catheter. Due to the problem of condensation in the ventilator circuit (uncorrectable by using heated-wire tubing), the temperature in the isolation room was set to be quite warm. This gave rise to a new problem: a condensate on the face shield of the personnel in PPE. This was a very challenging situation, as I had to insert a central venous catheter with another layer of sterile coat over the regular PPE and an N-95 mask. The more heat I felt, the faster I breathed and more condensate was formed inside my face shield. It reached the point that I couldn't see things clearly and unable to use the ultrasound to guide the procedure. Luckily enough, with much struggling, I was able to complete the procedure without any complication.

After the procedure, we still had trouble setting up a ventilator for this patient. Our protocol originally used the PEEP/FiO<sub>2</sub> table to choose the level of PEEP in order to decrease the time the personnel had to contact with patients. This patient was very hypoxemic after setting up the ventilator by the PEEP/FiO<sub>2</sub> method. *If you were me, what would you do?*

### **What we did...**

We went back in the room to re-assess the patient. Using the lung ultrasound and the low-flow inflation method, finally we had found that the patient had the "airway closure" phenomenon, resulting from her obesity and lung leakage. The PEEP level was then set at 14 cmH<sub>2</sub>O (the measured opening pressure) and the oxygenation improved significantly. This case again emphasized the importance of balancing between selecting protocolized treatments to reduce the personnel exposure and the tailored-made treatments requiring more assessment.

## **Wednesday**

To care for the COVID-19 patients in the ICU during the pandemic with limited resources and shortage of PPE, we had to weigh the risks and benefits of a routine daily visit. The risk of health care workers increased if they had to contact the patients for a longer time. We tried to limit the number of personnel and the number of cycles of the patient care. However, critically ill patients could be unstable and need close monitoring. *If you were me, what would you do?*

### **What we did...**

Since our ventilators display could not be detached and relocated to the outside of the isolation room, in case we need minor adjustment of the ventilator, we would ask for the nurse who went inside for a routine care or for IV administration to change the settings for us. We then used binoculars to examine the numeric and waveforms on the ventilator screen. We later installed a small IP camera to capture and broadcast the ventilator screen along with the patient's appearance to the external display. In addition,

when the intercom at the central station could not be conveniently used, we summoned the walky-talky to communicate with personnel inside the isolation room.



*Figure4: The application of binoculars and walky-talky for patients care in COVID-19 ICU*

In the same patient from yesterday, after the ventilator had been set, overall symptoms and P/F ratio was improved. But today, in the evening, the pulse oxygen saturation level decreased to only 84-85 percent even after the FiO<sub>2</sub> had been increased. Repeated result of arterial blood gas showed the PaO<sub>2</sub> of 73 mmHg and the calculated arterial oxygen saturation from the ABG was 93 percent. *If you were me, what would you do?*

#### **What we did...**

Due to the difference between the pulse oximetry and the calculated saturation from the ABG, we suspected the methemoglobinemia. The methemoglobin level in the blood which returned on the next day showed a 5 percent level and increased to 10 percent on the following day. Her hemoglobin level was 6.9 g/dL and the peripheral blood smear was compatible with G-6-PD deficiency with acute hemolysis. We postulated that the patient had heterozygous G-6-PD deficiency gene and was exposed to an excessive oxidative stress causing by either hydroxychloroquin or by severe clinical illness. This further induced acute hemolysis and methemoglobinemia. In this patient, due to deteriorated kidney function which was a contraindication for methylene blue, we treated her by blood transfusion.

#### **Thursday**

Today, I continued paying attention to the same patient as she was the most severe patient at this time. As her P/F ratio and kidney function was worsening, we had to decide to perform prone positioning while the nephrologist suggested performing a hemodialysis (CCRT). Although it was quite a routine practice now for

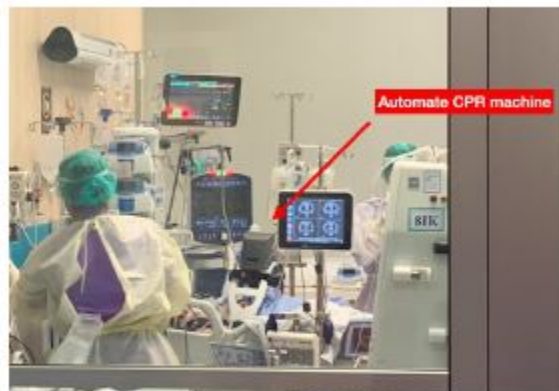
the nursing team to perform the prone position, the caring of the femoral cannula and the CRRT during prone was somewhat challenging.



*Figure 5: performing prone position in this patient*

Unluckily, although we had provided full treatments, this patient finally developed septic shock with multiorgan failure, severe metabolic acidosis and hemodynamic instability. We informed and discussed with her daughter, who was also tested positive for SARs-CoV2 and currently being observed in our cohort ward.

She seemed to need more time to cope with this extremely bad news and asked us to perform full CPR if needed. Although we knew that there would be no hope for her mother, we decided to attach the automatic CPR machine in case of emergency and planned to allow her to visit her mom for the last time. This would involve transferring her daughter to the ICU and the need to prepare more works for infection controls. *If you were me, what would you do?*



*Figure 6: the automated CPR machine attached to the patient*

### **What we did...**

Dying alone is one of the greatest fears one could have, plus managing the last goodbye can also be beneficial, not for this patient, but for her daughter's coping process. So, we let her daughter, who was wearing PPE and transferred by our personnel (also in PPE) on a wheelchair from the cohort ward, go to the ICU. Her daughter also brought a tablet to do video calls to other relatives outside of the

hospital. During the deathbed session where her daughter and relatives performing the last goodbye, the BIS level (consciousness) of the patient suddenly spiked high even with the same dosage of sedative drugs were infused. We believed that the patient was aware of this and could perceive all the messages sent to her for the last time.

Finally, we couldn't overcome the fate. I was a witness, standing there watching the lifeless body of the sick being packed through the surveillance camera. Her body was packed in a water-proof bag to prevent the spread of the disease and no one would have a chance to see her again. During my doctor life I've experienced many deaths, but this time it was different. It's the most solitary death I've ever seen. Even with sorrow, it was once-in-a-lifetime experience for me where I saw a full journey of a COVID-19 victim, from the first diagnosis to the last day of life.



*Figure 7: the body was kept in the water-proof bag*

### **Friday**

Today, a 58-year-old Thai man who had been in the ICU for several days, received two sessions of prone positioning and was now improving, developed recurrent episodes of lung atelectasis. The nurses reported that his secretion was not copious but rather "sticky". Lung ultrasonography showed "lung pulse" which associated with atelectasis. I've performed a few chest percussion, postural drainage, and vibration therapy, but the result didn't last long and the atelectasis recurred. In normal situation, bronchial toilet via fiber-optic bronchoscope (FOB) would be our first-choice of investigation and treatment. However, performing FOB is one of the most aerosol-generating procedure and in COVID-19 patient this will pose a very high risk to us. *If you were me, what would you do?*

### **What we did...**

Letting patient had recurrent atelectasis would have delayed the weaning process and increased the risk of superimposed infection. We decided to perform bronchoscopy to assess the secretion and the abnormalities in the airway. Under the supervision of the infection control team, my professor and I dressed up in full PPE with powered air-purification respirator and went in the patient room to do the procedure. Initially, we planned to place an acrylic box with a hole to pass the scope over the patient to act as one more layer of protection. However, this didn't work because the length of the disposable bronchoscope was shorter than the regular FOB that we've been tested with this box and thus the box had to be removed. In the real situation, and under the PPE, everything could be complicated. I've



learned from this experience that everything should be simulated and tested before the real use in the negative pressure room. Through the bronchoscope, we had found only scanty, sticky secretion. About 600 mL of saline lavage was performed. The patients became non-eventful after the procedure and no atelectasis occurred again. He was able to be extubated during the following week.



*Figure 8: my professor and I performing the bronchoscope*

### **Saturday**

Today we were caring a patient who had been moved into the ICU since yesterday. He was a Thai male with body weight of 105 kg and the BMI of 36 kg/m<sup>2</sup> diagnosed with COVID-19 pneumonia. He had progressed to ARDS even after our standard regimen treatment. After we had decided to early intubate him yesterday, the ventilation went smoothly and the P/F ratio was improved. This morning, however, the patient became agitated despite the same dosage of sedation and we had found that there the tidal volume markedly dropped and the end tidal CO<sub>2</sub> level was abnormally high. *If you were me, what would you do?*

### **What we did...**

My professor and I quickly donned the PPE and went into the room. We found that there was a combined bacterial and heated-moisture exchanger (HME) filter left connected between the endotracheal tube and the ventilator circuit. This was placed by the anesthesiologist during the intubation but had not been removed afterward. The filter sat there overnight with the active humidification being in used, resulted in a built-up of water drops inside. In the morning, the resistance of the filter went up to the point of (almost) complete obstruction. This was an important lesson: even in patients at risk of spreading the infection, the basic ventilator care must always be kept in mind. We applied a checklist with the mnemonic “FAST HUGS BID” to be used in daily patient care.

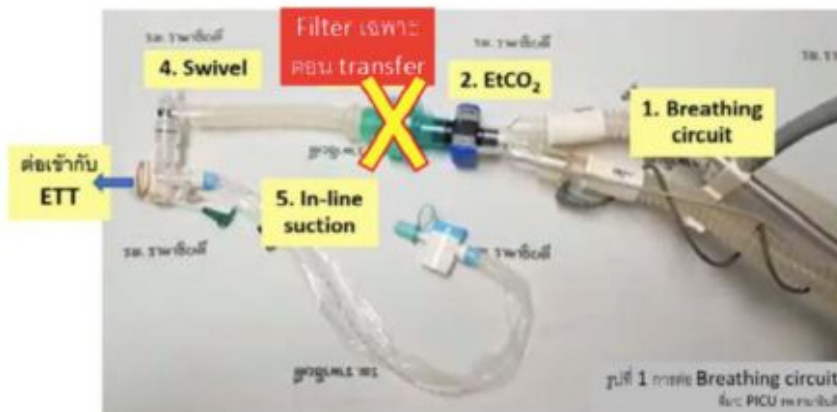


Figure 9: Bacterial / HME filter (red) which must be removed when connect to the active humidification system of the ventilator

Routine Care for ICU COVID-patient	
Check Lists	Issues
Vital signs	- Keep MAP $\geq$ 65 mmHg, พิจารณา early vasopressor, check cardiac dysfunction if unexplained hypotension
Lung mechanic	- ถ้า on pressure mode: routinely check exhaled tidal volume (TV) - ถ้า TV drop มากกว่า 50 ml notify check tube, น้ำจืดใน circuit, secretion obstruction, sedation, paralysis
Gas exchange	- Keep Oxygen Saturation $>$ 95% การปรับ FiO2 ในกรณีที่ไม่มีสาเหตุมาจากระดับความรุนแรง nursing care - ถ้ามี desaturation: check tube, น้ำจืดใน circuit, secretion obstruction, sedation, paralysis
Routine Care for ICU Care	
F: Fluid therapy and Feeding	Keep fluid balance balancing AKI and ARDS, Early vasopressor
A: Airway	ต้อง check strap tube size position ของ ET tube -ก่อนและหลัง reposition prone (be mast !!!), ทุกครั้งที่ move ผู้ป่วย, แขนขา tube วางอยู่ใน position ถูกต้อง - แขนงอไว้ 90 องศา position ของ ETT ชิ่งลงในหลอดลม Patient: strap ET tube ที่มุมข้อศอกบนเตียง ET tube อาจขยับขึ้นไปได้ถ้าบนเตียง ถ้า ET tube ขยับงอหลอดลมได้ยาก ด้วยข้อไขข้อนิ้ววางให้มั่นคงข้างเดียวกับกับที่ strap
S: Sedation	- Keep BIS 39-40 - พิจารณาใช้ Neuromuscular blocking agent under weaning under pressure support (closed circuit) ที่ day 5 ถึง 7 ของการใส่ท่อช่วยหายใจ
T: Thromboprophylaxis	- Start Enoxaparin 0.4 ml SC QD ถ้าไม่มี contraindication (หากไต GFR $<$ 30) - Check PE, RV dysfunction if unexplained hypoxemia
H: Head up	- Head up position (30 degree) if intubated
U: Ulcer prophylaxis	- Consider drug interaction from PPI
G: Glucose control	- Keep BG ระหว่าง 180 mg/dl โดยทั่วไปให้ long-acting insulin และพิกัดที่ชัดเจนของ BG และ พิกัด insulin ปล่อย
S: Secretion Suctioning	- ใช้ in-line suction และการวัดการเกิด secretion obstruction - Add mucolytic drugs เช่น N-acetyl cysteine ทุกครั้งที่ใส่ ET tube - ระวัง exhaled tidal volume ของน้ำจืดที่มี secretion obstruction ระบาด
B: Bowel care	
I: Indwelling catheter	- Check A-line, peripheral line, central line ที่วางบนร่างกายของผู้ป่วย มีหรือไม่มี peripheral line ด้วย
D: Drug interaction	- QT prolongation: check QTC-q 1 hr เสร็จแล้ว QTC > 500 notify นพ. - De-escalation antibiotic discussion with ID

Figure 10: Applying the "FAST HUGS BID" in our COVID-19 ICU

### Another Sunday (Extra!)

This day was the last day of my rotation at CNMI and I had received a female case in quarantine. She was a nurse taking care of COVID-19 patients (the same role as mine), but she had contacted an index patient tested positive for SARS-CoV2 without protection. Her two previous PCR test results were

negative. Today, in a quarantine unit, she reported dyspnea and developed rapid breathing. The clinician in charge was unsure about exertional hypoxemia and a “mild” generalized motor weakness, although her chest x-ray was normal. She had been transferred to ICU for close observation. She developed shortness of breath with a respiratory rate around 30-35 /min. *If you were me, what would you do?*

#### **What we did...**

After moved into a negative pressure room in the ICU. An arterial blood gas was performed and revealed normal alveolar-arterial gradient with normal arterial oxygenation. The repeated PCR from nasal swab for COVID-19 was negative. We gave some light sedative medication and afterward she could have a rest and her pulse oxygen saturation levels was normal.

Stress and anxiety in medical personnel are important issues that should not be overlooked. This has been mentioned around the world during this pandemic. The inadequate of PPE supplies could also worsen the situation. When I performed the bronchoscope with COVID-19 case, I’m in the highest level of protection, but when the nurses performed the routine care, they were allowed to be on the lower level of protection. When the best PPE was not available for all, we have to decide how much risk is acceptable. As a fellow in training, I’d never been concerned about the mental health issues of the medical workers before, until the world-changing virus stirred this up to our attention.

#### **Conclusion**

For me, being involved in preparations to deal with the outbreak and applying the knowledge we’ve learned to the real situations helped elucidated the role of pulmonologists and critical care physicians to a very clear picture. Now the situation in Thailand is rather mild and in controlled, but no one knows what will happen in the future. It will be best if there would be no “second wave” of COVID-19 in Thailand. But if that really occurs, at least I’m more readily prepared this time!