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Converting a Small Surgical Team into a Pandemic Response Team for an Isolated Population

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The novel coronavirus (COVID-19) has posed a challenge for the world's healthcare system. Even in locations where resources are otherwise plenty, there are current challenges providing adequate care. Throughout the world though, there are small teams of physicians that are responsible for managing the health of significant populations with already limited resources. The purpose of this article is to describe our response to help providers tasked with caring for isolated populations. This article discusses the method and challenges facing a small surgical team tasked with preparing for and treating the novel infectious disease process, COVID-19. The team is responsible for caring for an isolated population, with limited supplies, and medical evacuation limitations.

COVID-19 is a highly infectious disease with a long incubation period and high estimated transmission rate.¹ The active duty military population is relatively young and healthy, but is supported by civilian personnel of various ages in many locations throughout the world.² In some locations, the civilian population may exceed the military members they are supporting. The military trains and equips medical teams to provide care for these troops in austere locations. Military operations are generally more focused on treating trauma and performing damage control surgery, rather than handling large-scale infectious disease processes. In the authors' team, there is a surgeon, emergency medicine physician, certified nurse anesthetist, intensive care nurse, scrub technician, and a medical planner. The challenge is changing from a damage control team into an infectious disease containment and treatment team. This transition to a new primary medical mission in the face of a pandemic is

applicable to any small medical team tasked with taking care of isolated populations.

Planning, prevention, and quarantine phase

A unified approach is critical to reduce friction points within any response. If possible, assignment of a competent director or team is ideal. The director or team must coordinate between both medical and nonmedical personnel to provide instructions and education, and ensure communication between all elements. An effective plan is not possible without understanding of the local mission/goals/critical activities and requirements. In a military environment, the mission must continue, and routine medical interventions must be altered. During the authors' planning, there were multiple commanders and lines of authority, therefore, coordination was challenging, and the response was significantly slower and the quality degraded. Frequent communication is required by all responsible parties.

Prevention is the first step if the disease has not already affected the isolated population. Population education is essential, and a public information campaign to spread credible information on prevention and identification of disease is required. Screening entry points is another critical step in attempting to prevent introduction of the disease. This requires knowledge of the nature of the infectious disease and local societal entry points and systems. For COVID-19, all patients entering the facility are questioned on origin, destination, close contact with sick individuals, and current symptoms. Identification of symptoms by either medical or nonmedical personnel is possible. In medical resource-constrained environments, it may be necessary to train nonmedical personnel to perform basic medical functions like screening. Centralized suspected exposure reporting is required, with any suspected individuals calling or reporting to designated locations where medical personnel can don personal protective equipment (PPE) and clinically assess the probability of infection (Fig. 1).

Testing for a specific and new pathogen in a small isolated population is likely not available. Testing may also

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be unnecessary. For COVID-19, the primary symptoms are fever and cough.³ If several people develop similar symptoms in a narrow timeframe, COVID-19 can be clinically diagnosed. It is important to test for other diseases with similar symptom presentation if possible. In our area of operation, influenza and malaria remain prevalent and testable.⁴ Testing for these other common disease processes should be carried out as long as feasible.

If high risk groups are identified without symptoms, quarantine is required.⁵ This involves isolating personnel from the base population while monitoring for symptoms. Ideally, cohorts of people should enter and be isolated in groups to ensure people entering quarantine together are not potentially contaminated by others entering quarantine later. If others enter the quarantine cohort later, the quarantine duration should reset. Cohort quarantine may not be possible due to limitations in housing and support for multiple individual groups. If possible, entry into the population by new people should be batched based off the duration of required quarantine. For example, with COVID-19, individuals would only be able to join the population every 14 days to allow for the previous quarantined cohort to vacate the segregated infrastructure for quarantined personnel. When this cannot be supported and individuals will join at various dates, the best option we have found is “restriction of movement.”⁶ During restriction of movement, at-risk populations are segregated only to certain locations at specific times as best as possible, to reduce exposure at communal points such as recreation, hygiene (bathing and toilet), and dining facilities. Particularly high-risk populations (known exposure, travel from high-risk

countries, etc) will go into traditional quarantine. Self-monitoring and personnel tracking are ongoing during restriction of movement, and any signs of infection are immediately reported.

Evacuation to a higher level of care must be planned, even if ultimately unavailable. During a pandemic, there will be significant strain on any evacuation system, both civilian and military. A trigger point must be identified that is early enough to allow for salvage of the patient, but not too early to overstress the evacuation system. For COVID-19, we identified the need for oxygen. On review of published timelines for COVID-19 infections, this provides approximately 1 to 2 days to identify evacuation before a segment of this population develops acute respiratory distress syndrome (ARDS) and other complications.^{7,8}

Factors and challenges that complicate the movement of potential COVID-19 patients include the time needed to move the evacuation platform to the patient, the number of patients needing evacuation, the severity of the patients, the availability of air ambulances or military aircraft, the composition of the en route medical team(s), and the ability to gain overflight and landing approval for emergency landings or stops for fuel along the planned flight. Each leg of the evacuation route must be approved by the host country and may require political engagement with the host nation through Department of State representatives. Exposure risks to clinicians, pilots, and other crew members en route, especially if they have underlying health conditions that predispose them to complications from COVID-19 infection, must factor into planning, especially if they are being transported in an aircraft not normally configured for medical

Figure 1. Evaluation algorithm for the screening medical provider without the ability to test for COVID-19.

Healthy	Quarantined	Isolated
-Segregated hygiene facilities	-Segregated hygiene facilities	-Segregated hygiene facilities
-Social distancing (2 m)	-Social distancing (2 m)	-Restricted and enforced movement within isolation area only
-Telework when able	-Telework when able	-Only infected individuals or medical personnel with proper personal protective equipment permitted to enter
-Closed communal sites and minimal gatherings	-Enforced restriction of movement within quarantined areas only	-Medical evaluation and treatment of patients to maximum capability
-Prohibited from travel to quarantined or isolated areas	-Self-monitoring for evidence of infection	-Discharge back to healthy population when criteria met
	-Move to Isolation with evidence of infection after medical review	
	-Discharge back to healthy population when quarantined time has elapsed (14 days with COVID-19) and symptoms have not presented	

Figure 2. Overview of 3 separate populations and requirements for each population.

evacuation. Pre-movement intubation and establishment of a deliberate airway may be needed before movement.

Treatment phase

Surgical teams are equipped to deal with trauma, with most equipment and supplies designed to directly care for the injured patient. These teams are built for damage control surgery and rapid evacuation and therefore, are not equipped for long-term inpatient care. Other small teams with specific missions may be in a similar situation that requires using equipment and skills for a different purpose. The first step is to inventory all equipment and identify a means of monitoring, supporting, and treating the likely life-threatening disease process. For COVID-19, respiratory failure is the greatest immediate threat to life. To support this process, a source of oxygen, ventilation, nutrition, and hydration is required. Identify how each requirement can be met, even if it would not be standard in a high resource environment. For example, the authors' team considered that when sedation runs out, emergency cricothyroidotomy kits would be required to serve as tracheostomies. Feeding could be done through open gastric tubes using excess rubber catheters if nasogastric tubes are unavailable. Expected populations to be treated at various severities should be identified, and additional supplies and personal protective equipment (PPE) should be acquired as soon as possible. Finally, a limit to what can be done must be identified and, if required, triage of medical resources needs to be evaluated by the medical team. In our

team, we can only provide a maximum of 45% to 50% fraction of inspired oxygen (FiO_2) and are limited in means to treat sepsis, multiorgan failure, and adult respiratory distress syndrome (ARDS). If a patient exceeds the capabilities, resources may have to be shunted to any additional patients who have a more survivable disease process.

During the treatment phase, 3 separate populations of patients must be maintained: healthy, quarantined, and infected populations (Fig. 2).⁹ Once a suspected case is clinically diagnosed, that patient is placed into isolation to reduce the risk of spread to any uninfected personnel. As with quarantine, ideally, this person is segregated completely, with separate hygiene facilities and food brought to the patient for the duration of treatment. They do require assessment, but this can be done face-to-face, verbally, virtually, by phone or e-mail if the patient remains clinically stable. Special consideration should also be discussed for patient laundry and trash removal. A method to enforce the separate populations of patients is required.

Protection of the treating personnel is required.¹⁰ With limited personal protection equipment, rationing should be done for only medical personnel. If required, personnel will have to reuse equipment. Cloth garments have been considered along with a disinfection plan per published guidelines.¹¹ Throughout the camp, dutiful cleanliness is required using germicidal agents such as 0.1% hypochlorite solution and disinfecting laundry using soap and hot water. If medical treatment team members are infected,

they should remain on duty as long as physically able, but will be restricted to the isolated population. If excess medical providers are present, treatment teams should be identified, and only those on the treatment teams should be permitted in the tent. When members of the treatment team are infected, the healthy remaining team members can fill in the gaps; this will help prevent continuous exposure to all medical personnel. It is important to communicate to all stakeholders when the medical team's capabilities have changed and ensure all team members are transparent with their current abilities.

The intubated patient with ARDS requires nutrition, hydration, and ventilation support in addition to standard nursing practices. In order to provide the sedation over long periods of time, conservation of resources is required. In our experience, ketamine provides the most concentrated method of sedation. Using a ketamine drip starting at 2.5 mcg/kg/min and titrated to a Richmond Agitation-Sedation Scale (RASS) of -1, we avoid the rapid consumption of propofol or benzodiazepine stores. Similarly, with nutrition and hydration, alternatives such as free water flushes rather than intravenous fluids, or ground food rather than prepared tube feed should be considered.

Discharge phase

Clinical discharge criteria are required without the means to test. This allows affected populations to re-enter the population and resume daily tasks. The criteria should be long enough to reduce risk of viral spread, but not too long to prevent sustainment of critical activities. For COVID-19, an appropriate discharge plan is reduction of symptoms, improvement in chest x-ray findings if imaging available, and afebrile without anti-pyretics for 3 days.¹² If materials allow, the patient is given a mask to wear until symptoms resolve and is instructed to maintain social distancing when possible until the pandemic is over.¹³

CONCLUSIONS

Planning and succeeding in a resource-constrained environment without outside support is a challenging endeavor. Changing from a surgery-focused team or another specialty team to an infectious disease response team takes a paradigm shift. Success can be achieved by planning and using all available resources within the limitations of the care environment.

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Acquisition of data: Hall

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Drafting of manuscript: Hall, Morrow, Monsaert, Wilson, Dixon

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