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illness and trauma. Evidence-based medicine is highly suited in the practice of ICU if we use these cytokine markers to develop protocols and treatments that will modulate specific cellular dysfunction. This will tell us if elevations of some cytokines are destructive or protective. We most develop easy, economical assays for cytokines and introduce them to widespread clinical practice. Once they are used in such widespread practice, there will be exponential growth in our ability to care for patients. The field of cellular medicine will only grow as more and more investigation and physicians in clinical practice add to our growing understanding of how specific patients react to specific stimuli and how these physiologic responses are regulated.

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SARS, Pneumothorax, and Our Response to Epidemics

In late 2002, the severe acute respiratory syndrome (SARS) coronavirus (CoV) jumped from feral animals to humans in the Guangdong province of China. This CoV strain had the capacity to spread from person to person, and many of the infected people became severely ill with SARS. The official toll from the multifocal epidemic that ensued was 8,422 cases and 816 deaths on five continents.[1] This startling epidemic demonstrated the continuing risk of zoonotic diseases for humans and the awesome potential for emerging diseases to wreak havoc around the globe. SARS brought several ethical issues associated with new, severe epidemic diseases into sharp focus.

In this issue of *CHEST* (see page 2345), Sihoe et al describe an important clinical feature of SARS, and they raise an important ethical issue that faces clinicians caring for patients with new infectious diseases. Clinical details were reported for six cases of spontaneous pneumothorax that occurred among 356 patients with SARS at two Hong Kong hospitals, an incidence of 1.7%. Secondary pneumothorax developed in other patients who were receiving mechanical ventilation or who had catheters inserted into veins near the pleura. Two of the six patients had pneumomediastinum, an uncommon but characteristic sign of SARS.[2]

In these six cases, pneumothoraces were bilateral in three patients, mechanical ventilation was indicated in three patients, and two patients died. Air leaks or recurrences occurred in all four patients who accepted chest tubes; the other two patients refused chest tubes. These air leaks took 14 to 31 days (mean of 23.5 days) to resolve. The concentrations of peripheral leukocytes and serum lactate dehydrogenase in patients with SARS and pneumothorax were greater than in other patients with SARS in Hong Kong, which supported the clinical perception that pneumothorax was associated with more severe disease. These complications reflected the severe pathologic changes in lung tissues and strong pulmonary and systemic inflammatory responses that accompany SARS.[3]

All six patients reported in this issue had received glucocorticoids. This reflected the opinions of several clinicians around the world who believed that early treatment with glucocorticoids improves outcomes from SARS.[3] Glucocorticoid therapy may have interfered with lung healing in ways that predisposed to pneumothorax in these patients. The risk of this complication may be acceptable if in fact glucocorticoids improve outcomes in most patients,

but a properly controlled trial of the use of glucocorticoids in SARS has not been done.

The six patients reported by Sihoe et al were managed conservatively. Several had complications that are considered indications for thoracoscopic repair in patients with primary pneumothorax, including bilateral pneumothorax, recurrent pneumothorax, or persistent air leaks.[4] None of the patients had procedures to repair their pneumothoraces. Several reasons for avoiding surgical repair were discussed, including reluctance on the part of two patients to accept invasive procedures, severe illness in some patients, and the risk of spread of SARS CoV within the operating room from patients to operating room staff.

That concern for the risk for operating room staff dissuaded physicians from repairing air leaks raises an important ethical issue for physicians. The responses of physicians who have faced risks from contagion throughout history have been mixed. Many physicians fled epidemics of plague that swept repeatedly across Europe.[5] During an epidemic of yellow fever in Philadelphia in 1793, some physicians stayed and performed heroically while others fled.[5] As medicine became a rigorous scientific discipline in the twentieth century, physicians gained increased respect and power, and the medical profession became more cohesive and developed integrated, widely accepted ethical codes. A social contract developed between physicians and society, whereby in return for substantial income, high social prestige, and professional autonomy, physicians are expected to go to great lengths to provide optimal care even in perilous times.[6] This social contract exists throughout the world. Section 29.1 of the Professional Code and Conduct for the Guidance of Registered Medical Practitioners of the Medical Council of Hong Kong reads in part, "All patients, including those with serious contagious/infectious diseases, are entitled to timely and appropriate investigations and treatment."[7] The American Medical Association Declaration of Professional Responsibility reads in part, "We, the members of the world community of physicians, solemnly commit ourselves to: . . . (3) Treat the sick and injured with competence and compassion and without prejudice; and (4) Apply our knowledge and skills when needed, though doing so may put us at risk. . . . "[8]

Early during the AIDS epidemic, some physicians refused to provide care or perform invasive procedures for patients with HIV infection or AIDS. Many responded by reaffirming that all patients, including those with HIV infection or AIDS, deserve the best possible care.[5,9,10] The AIDS epidemic made clear that providers do not always know when patients have latent or subclinical infections, and this led to adoption of universal precautions whereby reasonable infection control practices are followed for all patients.

During the SARS epidemic, the expectation that optimal care would be provided for all patients was fulfilled by thousands of providers. It was clear early on that cases were occurring in health-care workers. By the end of the epidemic, approximately 30% of reported cases were in health-care workers, and some died.[11] We know now that the primary mode of spread was by respiratory droplets, but that fomites and aerosolized feces also spread the virus under some circumstances. The rate of spread from most people with SARS to household or casual contacts was only moderate. Occasionally, large numbers of people became infected from single ill individuals, so called "superspreading events" that remain poorly understood. The potential for spread was substantial within the health-care setting, but we know now that intensive but widely available, practical infection control measures effectively prevented transmission.[12–14] A case control study in Hong Kong found that personnel who used gowns, masks, and gloves, and washed their hands regularly did not come down with SARS while other personnel who were less scrupulous did become ill.[14] In multivariate analysis, wearing masks (N95 or surgical masks) was the single practice that seemed to be protective. By analogy, other frightening epidemic viral diseases like Ebola or Lassa fever have spread from patients to health-care workers when modern infection control practices have not been followed or have not been possible because of lack of resources in underdeveloped countries. However, when supplies and equipment widely available in developed countries have been provided and infection control practices have been followed, health-care workers have been protected.[15–17]

During the SARS epidemic, providers were at risk from emergency departments to ICUs.[18] Providers at greatest risk included those who cared for undiagnosed patients and those who cared for patients who were breathing and coughing without masks or endotracheal tubes that could contain their secretions. There may be substantial risks to those who perform bronchoscopy.[19] It seems likely that the risks of performing invasive procedures in a well-equipped operating room are not substantially greater than the risks to personnel in many other settings and may be less. In an operating room, patients who would undergo thoracic surgery would likely be intubated and secretions could be contained fairly effectively. It seems unlikely that most surgical procedures would generate substantial aerosols that could not be contained and would pose a risk to operating room staff.

The ethical questions surrounding whether surgical procedures should be performed in patients with SARS are distinct from the decision about whether they would benefit patients. The striking inflammation and necrosis that occurs in lungs, especially those with pneumothorax may decrease the success rate or lead to new leaks. The success rate of pneumothorax repair should be studied if sufficient numbers of SARS cases occur in the future.

The clinical and ethical decisions faced by health-care workers, public health workers, and others during the SARS epidemic were difficult and had to be made in the face of a frightening epidemic. However, epidemics of new and emerging diseases are sufficiently common that we should use the lessons learned from this and other situations to help prepare ourselves for future challenges.[20–22] In the SARS epidemic and others like it, the risk was greatest to providers before it was clear that they were faced with a new disease. When it became clear that people were faced with a new transmissible disease and after strict infection control practices were implemented, those who followed these practices were protected. Optimal care of patients with a new infectious disease may entail invasive tests or surgical procedures. Rational steps should be taken to reduce risks whenever possible. If multiple management or treatment options are available and they can be expected to result in equivalent, optimal patient outcomes, options that pose lesser risks to health-care providers should be selected. The overriding principle for our patients and our profession is that that we must provide the best possible care to patients. Informed by the lessons of SARS and other epidemic or emerging diseases, we can be comforted by the fact that adherence to reasonable infection control practices available in modern clinics or hospitals will protect us very well.

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