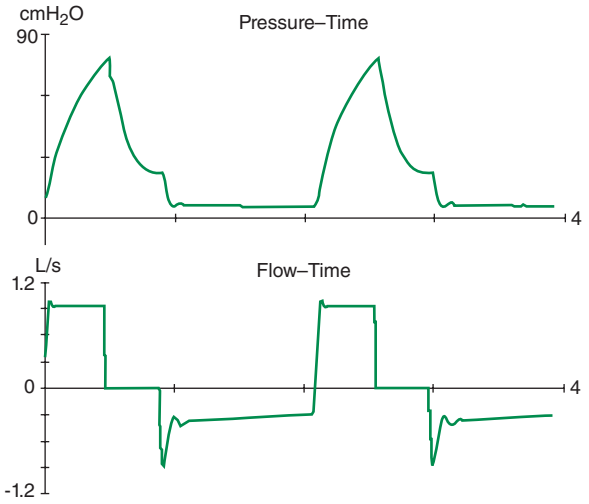

FIGURE 321-6 Increased airway resistance with auto-PEEP. The top waveform (airway pressure vs. time) shows a large difference between the peak airway pressure (80 cmH_2O) and the plateau airway pressure (20 cmH_2O). The bottom waveform (flow vs. time) demonstrates airflow throughout expiration (reflected by the flow tracing on the negative portion of the abscissa) that persists up to the next inspiratory effort.

not concomitantly increased. Abnormally increased V_{O_2} in peripheral tissues may be caused by problems such as fever, agitation, shivering, and thyrotoxicosis.

The pulmonary artery catheter originally was designed as a tool to guide therapy for acute myocardial infarction but has been used in the ICU for evaluation and treatment of a variety of other conditions, such as ARDS, septic shock, congestive heart failure, and acute renal failure. This device has never been validated as a tool associated with reduction in morbidity and mortality rates. Indeed, despite numerous prospective studies, mortality or morbidity rate benefits associated with use of the pulmonary artery catheter have never been reported in any setting. Accordingly, it appears that routine pulmonary artery catheterization is not indicated as a means of monitoring and characterizing circulatory status in most critically ill patients.

Static measurements of circulatory parameters (e.g., CVP, PCWP) do not provide reliable information on the circulatory status of critically ill patients. In contrast, dynamic assessments measuring the impact of breathing on the circulation are more reliable predictors of responsiveness to IV fluid administration. A decrease in CVP of >1 mmHg during inspiration in a spontaneously breathing patient may predict an increase in cardiac output after IV fluid administration. Similarly, a changing pulse pressure during mechanical ventilation has been shown to predict an increase in cardiac output after IV fluid administration in patients with septic shock.

PREVENTION OF COMPLICATIONS OF CRITICAL ILLNESS

SEPSIS IN THE CRITICAL CARE UNIT

(See also Chap. 325) Sepsis, defined as the presence of SIRS in the setting of known or suspected infection, is a significant problem in the care of critically ill patients, who often progress to severe sepsis with the failure of one or more organs. Sepsis is the leading cause of death in noncoronary ICUs in the United States, with case rates expected to increase as the population ages and a higher percentage of people are vulnerable to infection.

NOSOCOMIAL INFECTIONS IN THE ICU

Many therapeutic interventions in the ICU are invasive and predispose patients to infectious complications. These interventions include endotracheal intubation, indwelling vascular catheters, transurethral bladder catheters, and other catheters placed into sterile body cavities (e.g., tube thoracostomy, percutaneous intraabdominal drainage catheterization). The longer such devices remain in place, the more prone to these infections patients become. For example, ventilator-associated pneumonia correlates strongly with the duration of intubation and mechanical ventilation. Therefore, an important aspect of preventive care is the timely removal of invasive devices as soon as they are no longer needed. Moreover, multidrug-resistant organisms are commonplace in the ICU.

Infection control is critical in the ICU. Care bundles, which include measures such as frequent hand washing, are effective but underutilized strategies. Other components of care bundles, such as protective isolation of patients colonized or infected by drug-resistant organisms, are also commonly used. Silver-coated endotracheal tubes reportedly reduce the incidence of ventilator-associated pneumonia. Studies evaluating multifaceted, evidence-based strategies to decrease catheter-related bloodstream infections have shown improved outcomes with strict adherence to measures such as hand washing, full-barrier precautions during catheter insertion, chlorhexidine skin preparation, avoidance of the femoral site, and timely catheter removal.

DEEP VENOUS THROMBOSIS (DVT)

(See also Chap. 300) All ICU patients are at high risk for this complication because of their predilection for immobility. Therefore, all should receive some form of prophylaxis against DVT. The most commonly employed forms of prophylaxis are subcutaneous low-dose heparin injections and sequential compression devices for the lower extremities. Observational studies report an alarming incidence of DVTs despite the use of these standard prophylactic regimens. Furthermore, heparin prophylaxis may result in heparin-induced thrombocytopenia, another nosocomial complication in critically ill patients.

Low-molecular-weight heparins such as enoxaparin are more effective than unfractionated heparin for DVT prophylaxis in high-risk patients (e.g., those undergoing orthopedic surgery) and are associated with a lower incidence of heparin-induced thrombocytopenia. Fondaparinux, a selective factor Xa inhibitor, is even more effective than enoxaparin in high-risk orthopedic patients.

STRESS ULCERS

Prophylaxis against stress ulcers is frequently administered in most ICUs; typically, histamine-2 antagonists or proton pump inhibitors are given. Available data suggest that high-risk patients, such as those with coagulopathy, shock, or respiratory failure requiring mechanical ventilation, benefit from such prophylactic treatment.

NUTRITION AND GLYCEMIC CONTROL

These are important issues that may be associated with respiratory failure, impaired wound healing, and dysfunctional immune response in critically ill patients. Early enteral feeding is reasonable, though no data are available to suggest that this treatment improves patient outcome per se. Certainly, enteral feeding, if possible, is preferred over parenteral nutrition, which is associated with numerous complications, including hyperglycemia, fatty liver, cholestasis, and sepsis. When parenteral feeding is necessary to supplement enteral nutrition, delaying this intervention until day 8 in the ICU results in better recovery and fewer ICU-related complications. Tight glucose control is an area of controversy in critical care. Although one study showed a significant mortality benefit when glucose levels were aggressively normalized in a large group of surgical ICU patients, more recent data for a large population of both medical and surgical ICU patients suggested that tight glucose control resulted in increased rates of mortality.

ICU-ACQUIRED WEAKNESS

ICU-acquired weakness occurs frequently in patients who survive critical illness, particularly those with SIRS and/or sepsis. Both neuropathies and myopathies have been described, most commonly after ~1 week in the ICU. The mechanisms behind ICU-acquired weakness syndromes are poorly understood. Intensive insulin therapy may reduce polyneuropathy in critical illness. Very early physical and occupational therapy in mechanically ventilated patients reportedly results in significant improvements in functional independence at hospital