discharge as well as in reduced durations of mechanical ventilation and delirium.

ANEMIA

Studies have shown that most ICU patients are anemic as a result of chronic inflammation. Phlebotomy also contributes to ICU anemia. A large multicenter study involving patients in many different ICU settings challenged the conventional notion that a hemoglobin level of 100 g/L (10 g/dL) is needed in critically ill patients, with similar outcomes noted in those whose transfusion trigger was 7 g/dL. Red blood cell transfusion is associated with impairment of immune function and increased risk of infections as well as of ARDS and volume overload, all of which may explain the findings in this study. Recently, a conservative transfusion strategy enhanced survival among patients with active upper gastrointestinal hemorrhage.

ACUTE RENAL FAILURE

(See also Chap. 334) Acute renal failure occurs in a significant percentage of critically ill patients. The most common underlying etiology is acute tubular necrosis, usually precipitated by hypoperfusion and/or nephrotoxic agents. Currently, no pharmacologic agents are available for prevention of renal injury in critical illness. Studies have shown convincingly that low-dose dopamine is *not* effective in protecting the kidneys from acute injury.

NEUROLOGIC DYSFUNCTION IN CRITICALLY ILL PATIENTS

DELIRIUM

(See also Chaps. 34 and 328) This state is defined by (1) an acute onset of changes or fluctuations in mental status, (2) inattention, (3) disorganized thinking, and (4) an altered level of consciousness (i.e., a state other than alertness). Delirium is reported to occur in a wide range of mechanically ventilated ICU patients and can be detected by the Confusion Assessment Method (CAM)-ICU or the Intensive Care Delirium Screening Checklist. These tools are used to ask patients to answer simple questions and perform simple tasks and can be used readily at the bedside. The differential diagnosis of delirium in ICU patients is broad and includes infectious etiologies (including sepsis), medications (particularly sedatives and analgesics), drug withdrawal, metabolic/electrolyte derangements, intracranial pathology (e.g., stroke, intracranial hemorrhage), seizures, hypoxia, hypertensive crisis, shock, and vitamin deficiencies (particularly thiamine). Patients with ICU delirium have increases in length of hospital stay, time on mechanical ventilation, cognitive impairment at hospital discharge, and 6-month mortality rate. Interventions to reduce ICU delirium are limited. The sedative dexmedetomidine has been less strongly associated with ICU delirium than midazolam. In addition, as mentioned above, very early physical and occupational therapy in mechanically ventilated patients has been demonstrated to reduce delirium.

ANOXIC CEREBRAL INJURY

(See also Chap. 330) This condition is common after cardiac arrest and often results in severe and permanent brain injury in survivors. Active cooling of patients after cardiac arrest has been shown to improve neurologic outcomes. Therefore, patients who present to the ICU after circulatory arrest from ventricular fibrillation or pulseless ventricular tachycardia should be actively cooled to achieve a core body temperature of 32–34°C.

STROKE

(See also Chap. 446) Stroke is a common cause of neurologic critical illness. Hypertension must be managed carefully, since abrupt reductions in blood pressure may be associated with further brain ischemia and injury. Acute ischemic stroke treated with tissue plasminogen activator (tPA) has an improved neurologic outcome when treatment is given within 3 h of onset of symptoms. The mortality rate is not reduced when tPA is compared with placebo, despite the improved neurologic outcome. The risk of cerebral hemorrhage is significantly higher in patients given tPA. No benefit is seen when tPA therapy is given beyond 3 h after symptom onset. Heparin has not been convincingly shown to improve outcomes in patients with acute ischemic stroke. Decompressive craniectomy is a surgical procedure that relieves increased intracranial pressure in the setting of space-occupying brain lesions or brain swelling from stroke; available evidence suggests that this procedure may improve survival among select patients (≤55 years or age), albeit at a cost of increased disability for some.

SUBARACHNOID HEMORRHAGE

(See also Chap. 446) Subarachnoid hemorrhage may occur secondary to aneurysm rupture and is often complicated by cerebral vasospasm, re-bleeding, and hydrocephalus. Vasospasm can be detected by either transcranial Doppler assessment or cerebral angiography; it is typically treated with the calcium channel blocker nimodipine, aggressive IV fluid administration, and therapy aimed at increasing blood pressure, typically with vasoactive drugs such as phenylephrine. The IV fluids and vasoactive drugs (hypertensive hypervolemic therapy) are used to overcome the cerebral vasospasm. Early surgical clipping or endovascular coiling of aneurysms is advocated to prevent complications related to re-bleeding. Hydrocephalus, typically heralded by a decreased level of consciousness, may require ventriculostomy drainage.

STATUS EPILEPTICUS

(See also Chap. 445) Recurrent or relentless seizure activity is a medical emergency. Cessation of seizure activity is required to prevent irreversible neurologic injury. Lorazepam is the most effective benzodiazepine for treating status epilepticus and is the treatment of choice for controlling seizures acutely. Phenytoin or fosphenytoin should be given concomitantly since lorazepam has a short half-life. Other drugs, such as gabapentin, carbamazepine, and phenobarbital, should be reserved for patients with contraindications to phenytoin (e.g., allergy or pregnancy) or ongoing seizures despite phenytoin.

BRAIN DEATH

(See also Chap. 330) Although deaths of critically ill patients usually are attributable to irreversible cessation of circulatory and respiratory function, a diagnosis of death also may be established by irreversible cessation of all functions of the entire brain, including the brainstem, even if circulatory and respiratory functions remain intact on artificial life support. Such a diagnosis requires demonstration of the absence of cerebral function (no response to any external stimulus) and brainstem functions (e.g., unreactive pupils, lack of ocular movement in response to head turning or ice-water irrigation of ear canals, positive apnea test [no drive to breathe]). Absence of brain function must have an established cause and be permanent without possibility of recovery; a sedative effect, hypothermia, hypoxemia, neuromuscular paralysis, and severe hypotension must be ruled out. If there is uncertainty about the cause of coma, studies of cerebral blood flow and electroencephalography should be performed.

WITHHOLDING OR WITHDRAWING CARE

(See also Chap. 10) Withholding or withdrawal of care occurs commonly in the ICU setting. The Task Force on Ethics of the Society of Critical Care Medicine reported that it is ethically sound to withhold or withdraw care if a patient or the patient's surrogate makes such a request or if the physician judges that the goals of therapy are not achievable. Since all medical treatments are justified by their expected benefits, the loss of such an expectation justifies the act of withdrawing or withholding such treatment; these two actions are judged to be fundamentally similar. An underlying stipulation derived from this report is that an informed patient should have his or her wishes respected with regard to life-sustaining therapy. Implicit in this stipulation is the need to ensure that patients are thoroughly and accurately informed regarding the plausibility and expected results of various therapies.

The act of informing patients and/or surrogate decision-makers is the responsibility of the physician and other health care providers. If a patient or surrogate desires therapy deemed futile by the treating physician, the physician is not obligated ethically to provide such treatment. Rather, arrangements may be made to transfer the patient's care to another care provider. Whether the decision to withdraw