facility equipped with antivenom instead of consulting traditional healers and thus incurring significant delays in reaching appropriate care. Attempting to capture and transport the offending snake, alive or dead, is not advised; instead, digital photographs of the snake taken from a safe distance may assist with snake identification and treatment decisions.

Incising and/or applying suction to the bite site should be avoided, as these measures are ineffective and exacerbate local tissue damage. Similarly ineffective and potentially harmful are the application of poultices, ice, and electric shock. Techniques or devices used in an effort to limit venom spread (e.g., lymphoocclusive bandages or tourniquets) are ineffective and may result in greater local tissue damage by restricting the spread of potentially necrotizing venom. Tourniquet use can result in loss of function and amputation even in the absence of envenomation.

Elapid venoms that are primarily neurotoxic and have no significant effects on local tissue may be localized by pressure-immobilization, a technique in which the entire limb is wrapped immediately with a bandage (e.g., crepe or elastic) and then immobilized. For this technique to be effective, the wrap pressure must be precise (40–70 mmHg in upper-extremity application and 55–70 mmHg in lower-extremity application) and the victim must be carried out of the field because walking generates muscle-pumping activity that—regardless of the anatomic site of the bite—will disperse venom into the systemic circulation. Pressure-immobilization should be used only in cases in which the offending snake is reliably identified and known to be primarily neurotoxic, the rescuer is skilled in pressure-wrap application, the necessary supplies are readily available, and the victim can be fully immobilized and carried to medical care—an uncommon combination of conditions, particularly in the regions of the world where such bites are most common.

HOSPITAL MANAGEMENT

In the hospital, the victim should be closely monitored (vital signs, cardiac rhythm, oxygen saturation, urine output) while a history is quickly obtained and a rapid, thorough physical examination is performed. To objectively evaluate the progression of local envenomation, the level of swelling in the bitten extremity should be marked and limb circumference should be measured every 15 min until the swelling has stabilized. During this period of observation, the extremity should be positioned at approximately heart level. Measures applied in the field (such as bandages or wraps) should be removed once IV access has been obtained, with cognizance that the release of such ligatures may result in hypotension or dysrhythmias when stagnant acidotic blood containing venom is released into the systemic circulation. Two large-bore IV lines should be established in unaffected extremities. Because of the potential for coagulopathy, venipuncture attempts should be minimized, and noncompressible sites (e.g., a subclavian vein) should be avoided. Early hypotension is due to pooling of blood in the pulmonary and splanchnic vascular beds. Later, systemic bleeding, hemolysis, and loss of intravascular volume into the soft tissues may play important roles. Fluid resuscitation with isotonic saline (20–40 mL/kg IV) should be initiated if there is any evidence of hemodynamic instability, and a trial of 5% albumin (10–20 mL/kg IV) may be given if the response to saline infusion is inadequate. Only after aggressive volume resuscitation and antivenom administration (see below) are accomplished should vasopressors (e.g., dopamine) be added. Invasive hemodynamic monitoring (central venous and/or continuous arterial pressures) can be helpful in such cases, although obtaining central vascular access is risky if coagulopathy has developed. Victims of neurotoxic envenomation should be watched carefully for evidence of cranial nerve dysfunction (e.g., ptosis) that may precede the onset of difficulty swallowing or respiratory insufficiency that necessitates definitive airway protection by endotracheal intubation.

Blood should be drawn for typing and cross-matching and for laboratory evaluation as soon as possible. Important studies include a complete blood count to determine the degree of hemorrhage or hemolysis and to identify thrombocytopenia; studies of renal and hepatic function; coagulation studies to diagnose consumptive coagulopathy; creatine kinase for suspected rhabdomyolysis; and testing of urine for blood or myoglobin. In developing regions, the 20-min whole-blood clotting test can be used to reliably diagnose coagulopathy. A few milliliters of fresh blood are placed in a new, clean, plain glass receptacle (e.g., a test tube) and left undisturbed for 20 min. The tube is then tipped once to 45° to determine whether a clot has formed. If it has not, coagulopathy is diagnosed. Arterial blood gas studies, electrocardiography, and chest radiography may be helpful in severe envenomations or when there is significant comorbidity. Any arterial puncture in the setting of coagulopathy requires great caution and must be performed at an anatomic site amenable to direct-pressure tamponade. After antivenom therapy (see below), laboratory values should be rechecked every 6 h until clinical stability is achieved. If initial laboratory values are normal, the complete blood count and coagulation studies should be repeated every hour until it is clear that no systemic envenomation has occurred.

The mainstay of treatment of a venomous snakebite resulting in significant envenomation is prompt administration of specific antivenom. Antivenoms are produced by injecting animals (generally horses or sheep) with venoms from medically important snakes. Once the stock animals develop antibodies to the venoms, their serum is harvested and the antibodies are isolated for antivenom preparation, which may involve varying degrees of digestion and purification of the IgG molecules. The goal of antivenom administration is to allow antibodies (or antibody fragments) to bind and deactivate circulating venom components before they can attach to target tissues and cause deleterious effects. Antivenoms may be monospecific (directed against a particular snake species) or polyspecific (covering several medically important species in the region) but rarely offer cross-protection against snake species other than those used in their production unless the species are known to have homologous venoms. Thus, antivenom selection must be specific for the offending snake; if the antivenom chosen does not contain antibodies to that snake's venom components, it will provide no benefit and may lead to unnecessary complications (see below). In the United States, assistance in finding appropriate antivenom can be obtained from regional poison control centers.

For victims of bites by viperids or cytotoxic elapids, indications for antivenom administration include significant progressive local findings (e.g., soft tissue swelling crossing a joint or involving more than half the bitten limb) and any evidence of systemic envenomation (systemic symptoms or signs, laboratory abnormalities). Caution must be used in determining the significance of isolated soft tissue swelling after the bite of an unidentified snake because the saliva of some relatively harmless species can cause mild edema at the bite site; in such bites, antivenoms are useless and potentially harmful. Antivenoms have limited efficacy in preventing tissue damage caused by necrotizing venoms, as venom components bind to local tissues very quickly, before antivenom administration can be initiated. Nevertheless, antivenom should be administered as soon as the need for it is identified to limit further tissue damage and systemic effects. Antivenom administration after bites by neurotoxic elapids is indicated at the first sign of any evidence of neurotoxicity (e.g., cranial nerve dysfunction, peripheral neuropathy). In general, antivenom is effective only in reversing active venom toxicity; it is of no benefit in reversing effects that already have been established (e.g., renal failure, established paralysis) and that will improve only with time and other supportive therapies.

Specific comments related to the management of venomous snakebites in the United States and Canada appear in **Table 474-1**. The package insert for the selected antivenom can be consulted regarding species covered, method of administration, starting dose, and need (if any) for re-dosing. The information in antivenom package inserts, however, is not always accurate and reliable. Whenever possible, it is advisable for treating physicians to seek advice from experts in snakebite management regarding indications for and dosing of antivenom.