Search-and-rescue dogs: an overview for veterinarians

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The use of dogs for **search and rescue (SAR)** was first recorded in the 1800s, but anecdotal evidence suggests that they may have been used 200 years earlier.[1] Stories of heroic dogs during **World War (WW)** I and WWII represent some of the modern manifestations of organized SAR. These military dogs, known as ambulance and Red Cross dogs, were used on the battlefield to locate the wounded and deliver first aid supplies.[1] Today, civilian SAR training conducted in the United States is largely based on methods used to train the military dogs in WWII.[1] Since WWII, more than 150 SAR teams have been established in North America.[2]

Canine SAR teams in the United States are composed of specially trained search dogs and their human partners, who are often referred to as canine handlers. The handler commonly is also the owner, trainer, guardian, and companion of the SAR dog. Most canine SAR teams are composed of volunteers, and the dogs are personal pets as well as working partners. Depending on their specific training, teams are prepared to respond to crime scenes, accidents, missing person incidents, and natural and man-made disasters. The teams train and work in a wide variety of environments.

Although most SAR dogs belong to working, herding, retrieving, or sporting breeds, dogs of numerous breeds, including mixed breeds, can be successful in SAR work. Important characteristics in a potential SAR dog are termed hunt drive, prey drive, and ball drive. A dog with high hunt drive will search for a hidden toy for prolonged periods without giving up or turning to the handler for assistance. A dog with high prey drive enjoys the chase and will enthusiastically pursue a person who runs away to hide or chase a toy that is dragged behind a handler. A dog with high ball drive is one in which a toy is extremely important, and the dog will play with and pursue the toy to the exclusion of any distractions. These qualities help predict the willingness and ability of a dog to search unendingly for a victim until he or she is found. Additionally, good candidates for SAR work are dogs that have good temperaments; rely on scent rather than visual contact for identifying prey; and are trainable, inquisitive, friendly, and need a purpose or focus for their energy. Dogs with high drive, which are desirable in SAR work, may not adjust well to a sedentary life style and therefore often are relinquished to animal shelters. Such dogs have the potential to be excellent SAR dogs.

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Scent and the Sense of Smell

The use of dogs in search activities takes advantage of dogs' keen sense of smell. The exact nature of scent is the topic of current scientific investigation; however, loosely defined, scent is considered to be a combination of chemicals that a dog can learn or be trained to identify. For example, hunting dogs identify specific animal scents, narcotics dogs identify narcotic scents, bomb dogs identify scents of explosives, and SAR dogs identify human scents. The distinctive scent that emanates from a live human is generated from continuous shedding of tiny flakes of skin mixed with perspiration (watery and oily secretions). This material is called scurf. In addition to oils and watery secretions, scurf also carries many odors from a person's clothing, shampoo, soap, deodorant, perfume, and other materials. Combined, these chemicals produce the scent fingerprint that appears to be unique to a single person. When a person dies, the unique scent emitted by that individual undergoes an almost immediate transformation to a more generic scent associated with the loss of aerobic metabolism and proliferation of bacteria. Although a human does not notice the change until it is well advanced, a dog can immediately recognize the change in odor and accurately discriminate between live scent and cadaver scent.[3] Although live scent is individual, cadaver scent is nonspecific and changes chemically over time during the different stages of decomposition of the body.[3]

Scent is most concentrated at its source (ie, the victim). The scent spreads and becomes progressively less concentrated, forming a scent cone. Scent pools form when air is stagnant around the source. Factors such as wind, air temperature, humidity, soil temperature, and terrain can affect the scent cone or scent pool and where and how far it is dispersed.[3] Wind can be channeled by obstructions and rapidly disperse scent in unexpected directions. The handler's understanding of the dynamics of wind currents is a critical part of the teamwork involved in a successful search.

Classification of SAR Dogs

The 3 major categories of search dogs are tracking, trailing, and air scenting. These categories are defined by the exact manner in which the dog has been trained to locate a person. Tracking dogs work while harnessed and on a leash, keep their nose to the ground, and follow the actual tracks left by the victim.[1] These dogs are usually scent specific, requiring a scent article containing the unique smell of the person being sought. This scent article may be a piece of clothing, bedding, car seat, or even a location where the person was known to stand for a period of time. Because these dogs follow the exact path walked by the missing person, it is theorized that they are following a trail made by both human scent and environmental disturbances (eg, crushed vegetation).

A trailing dog works on or off leash and is also scent specific, requiring a scent article. The trailing dog follows the scent and works within a few feet of the person's track.[1] These dogs exclusively follow human scent that has drifted to the ground, sometimes a substantial distance from the path actually walked by the person being sought. Although an uncontaminated track or trail is always easier to follow, these dogs, if properly trained, can find a person even after substantial contamination has occurred from other persons walking over the victim's track or trail. Both tracking and trailing dogs work best if there is no one else in the search area.

Conversely, air-scenting dogs are capable of working effectively while other teams are in the same search area. They also have the unique advantage of working off leash, are able to cover large areas of ground, and are not hindered by water. These dogs are able to locate scent from a living person or from a human cadaver, depending on their training. An air scenting dog is more flexible than a tracking or trailing dog in that it does not require a scent article or a trail to follow. The dog sniffs the air to identify the human scent, and once it recognizes this scent, the dog follows the scent to its source. These dogs will quickly recognize when they lose human scent, reversing their direction until they return to the scent cone. Working into the wind, the air scent handler will typically search an area in a grid pattern. In addition to the preponderance of air scenting dogs in SAR, air scenting is also the primary search method in dogs trained to find specific scents such as explosives, drugs, or evidence in a crime scene.

Typically, SAR teams can also be classified according to the environment in which they work, such as urban or disaster, wilderness or large area search, evidence or small area search, water, or avalanche.[1] Teams can also be classified according to rescue (termed live find teams), in which dogs are trained to identify live victims, or recovery (termed cadaver teams), in which dogs are trained to identify human remains. Some dogs are trained to identify and discriminate both live victims and human remains.

SAR Dog Training

Regardless of the type of SAR, the training is extensive. Most dogs spend 12 to 18 months in training, typically training 20 h/wk or more. Standards for certification of SAR dogs vary by certifying organization; however, the **National Association for Search and Rescue Inc (NASAR)** has established voluntary qualification standards for disaster,[4] cadaver,[5] and water search.[6] Any dog deploying with a **Federal Emergency Management Agency (FEMA) Urban Search and Rescue (USAR)** team must be trained to find live victims and pass rigorous certification evaluations based on FEMA's standards.[7] Certain states also require that SAR dogs pass state certification testing before they are allowed to work on a search. Although some states provide information on the Internet, individuals interested in obtaining information about state requirements for SAR should contact their local or state emergency operations center.

Socialization is fundamental to training a SAR dog. Dogs are taken out in public and acclimated to as many different experiences and people as possible. Obedience and the ability of the dog to respond to directional commands are important as well, because off-leash control is essential in SAR. Athleticism and agility are crucial for dogs trained to search in urban and wilderness environments. Dogs are trained to move carefully and confidently on surfaces that by nature they would avoid. Urban SAR dogs spend a great deal of training time on rubble, which may include old cars, unsteady surfaces, chain link fences, rebar, and broken concrete. Urban SAR dogs are expected to navigate tunnels, climb ladders, and be able to rappel (with the handler) from buildings. Unlike patrol dogs, aggression toward humans or other animals is not tolerated in SAR dogs.

When a SAR dog is given a command to *go find*, it is a game of hide-and-seek for the dog. The dog is trained to locate the victim and alert the handler to the find by a focused bark (a bark alert in which the dog continues barking without distraction until signaled by the handler to stop), sitting (passive alert), digging (aggressive alert), or returning to the handler and leading them back to the victim (termed a refind). A successful find earns the dog a reward of a toy, tug of war, or food.

Deployment Basics

When SAR dogs are needed, the dog-and-handler team is deployed at the request of and search under the direction of local law enforcement and emergency service agencies. The frequency of deployment is highly variable depending on the local needs and the type of SAR training. For example, some dogs, despite years of training, may be deployed only once or twice in their lifetime. Although police or fire departments may use their own canine SAR teams, most teams are composed of volunteers who work locally with organized search groups or nationally with FEMA's USAR Task Forces. There are presently 28 USAR Task Forces that can be deployed anywhere in the United States and, in a few circumstances, internationally. Federal Task Forces are composed of rescue, search, medical, and technical teams.[8] The medical support team, consisting of physicians and emergency medical technicians, is charged with medical care of the 63 deployed Task Force members and the 4 SAR dogs on each team. Presently, the

FEMA Task Forces do not include an official position for a veterinarian; however, several Task Forces have recognized the importance of veterinary care for the SAR dogs and have adopted means to include veterinarians on their rosters. Veterinarians should be proactive in becoming involved with the FEMA Task Forces and educating the public and Task Force leaders to the vital role of veterinary care for these dogs.

For the first time, during the September 11, 2001, large-scale deployment of SAR dogs to New York, veterinarians of the **Veterinary Medical Assistance Teams (VMAT)** provided medical support for the urban SAR dogs[9] and the cadaver recovery dogs. However, there is no formal agreement to provide veterinary care for the USAR dogs, either by officially including veterinarians on the Task Force roster or by linking the VMAT teams to the USAR teams. Some organized search groups are fortunate enough to have veterinarians as handlers or volunteers. In any disaster or emergency setting, local SAR resources will be used before state or national resources, and as in the September 11th response, numerous local veterinarians will participate in the medical support of the SAR dogs.[9] It is therefore important that veterinarians be familiar with the special medical requirements and health risks of the SAR dogs, even if they are not directly associated with a SAR team. Knowledge of the training and work performed by the dogs will further enable the veterinarian to predict and meet the special needs of these working dogs.

Veterinary Considerations

Selection of a potential SAR dog—The intensive training requirements, stressful working conditions, environmental exposures, and importance of the work performed by SAR dogs results in special veterinary considerations. Although these dogs locate the victim through their sense of smell, they must be physically able to negotiate dangerous terrain; recognize dangers; and climb, jump, and crawl to reach the victim. Veterinarians are encouraged to be proactive with SAR teams. The amount of time invested in training these dogs is tremendous, and potential SAR dogs should be screened for problems that may limit their working ability.

In general, military working dogs are lost from service because of old age, orthopedic problems, cancer, lack of aggression, or excessive aggression.[10] There are no published studies providing reasons for early retirement of guide dogs; however, during the training phase, failure to complete the program is frequently related to behavioral or temperament problems (eg, fear of strangers, lack of confidence, being distractible, excessive aggression, dominance, fear of thunder or noise, being overly protective, excitability, fear of stairs, and urination when approached).[11] There are currently no reports of either medical or behavioral reasons for SAR dogs to fail to attain training standards or to retire from service.

In a large recent study[12] of 927 military working dogs, development of osteoarthritis was identified as the leading reason for euthanasia. Although the effect of osteoarthritis on lost work days or early retirement in working dogs has not been well documented, early radiographic evaluation of hip laxity is recommended.[13,14] Veterinarians should counsel handlers regarding the likelihood of hip dysplasia and its influence on the dog's ability to work for the duration of a potential SAR career. Handlers may be advised to consider another puppy that is at lower risk of developing hip dysplasia before investing years of SAR training.

Elbow dysplasia is also a problem in many working and potential SAR dogs that may limit the working life of the dog. Appropriate radiographic evaluation should be performed, particularly in breeds with a genetic predisposition to this disease (eg, Labrador Retrievers and German Shepherd Dogs). Veterinarians should counsel handlers on the potential limitations of dogs with evidence of elbow dysplasia and recommend against training dogs with elbow dysplasia for SAR work.

A prospective SAR dog must have athletic potential. Therefore, in addition to a sound musculoskeletal system, the dog must be free of cardiovascular and respiratory abnormalities. Brachycephalic breeds and dogs with malformations of the nares or trachea are unlikely to be able to perform to the athletic standard required of SAR dogs. Because many of the dogs rely on a bark alert, diseases or injuries of the larynx and vocal folds could interfere with the dog's performance. Development of laryngeal paralysis may cause loss of a normal bark (used for alerting the handler) and may put the dog at risk for heat exhaustion because of inefficient panting.

In addition to their role in managing the physical well-being of search dogs, veterinarians may be called upon to participate in early behavioral evaluations to help handlers select appropriate dogs and help identify or prevent problem behaviors. Behavioral screening may help identify dogs with anxiety or fear-related aggression, traits which are not suited to SAR work. In addition, behavioral screening may help select high-drive yet even-tempered and emotionally adaptable dogs. An ideal collaboration in the effort to select successful SAR dogs might include a veterinarian, veterinary or certified applied behaviorist, and experienced SAR handlers.

Smell—Environmental factors, drugs, chemicals, and the physical condition and health of the dog may all influence a dog's ability to smell and therefore its ability to work. Only recently has there been progress in understanding the sense of smell.[15-17] The ability to recognize and discriminate novel scents results from a molecular strategy similar to that found in the humoral immune system.[17] Low-molecular-mass organic chemicals termed odorants dissolve in the mucus that covers the nasal membranes, bind to specific **G-protein-coupled-receptors (GPCRs)** on the nonmotile cilia of the olfactory sensory neurons, and initiate the signal transduction of smell. Minimally, receptor binding of the odorants leads to activation of G proteins, increased intracellular cyclic adenosine monophosphate, opening of Na^+ and Ca^{2+} channels (Na^+ and Ca^{2+} move into the cell), and development of an action potential. Odorant-binding proteins are secreted in the mucus, which may facilitate the interaction between odorants and the GPCRs or, alternatively, sequester odorants

and prevent them from interacting with the GPCRs. When a dog sniffs, the scent-containing air fills the nasal cavity and circulates in small eddies among the turbinates, increasing the chances of the odorants contacting the extensive surface area of the olfactory epithelium. There are approximately 1,500 individual genes for the olfactory receptor family of GPCRs in mice.[16] It has been suggested that the large number of genes, expression of single alleles of the gene, graded responses to odorants, and combinations of responding receptors contribute to the potential discrimination of over 1,000,000 unique odors. An individual's scent fingerprint is made up of a unique combination of multiple odors, and therefore, the number of individuals that can be discriminated is almost unlimited. Interestingly, based on the limited number of genes investigated, there does not appear to be a genetic difference in olfactory receptors among different breeds of dogs.[18] The phenotypic difference among breeds in scenting ability may be a function of variations in available olfactory epithelial surface area. Odorants must dissolve in the mucus prior to binding the olfactory receptors; therefore, drying of the nasal membranes caused by drugs, environmental conditions, or dehydration can reduce the ability to detect scent. The handler should be instructed in proper preventive medicine to maintain hydration (encouraging rests and drinking) and irrigate the eyes and nose with sterile ophthalmic solutions[19] (to remove debris and irritants) at regular intervals, depending on the particulate contamination, level of smoke or irritant, and humidity of the working environment. These simple tasks will not only decrease the risk of adverse events, but will increase the ability of the dog to perform its job.

In humans, many drugs are reported to inhibit smell and taste.[20] In dogs, there is evidence that glucocorticoids diminish scent perception.[21] Doxycycline has also been suggested to cause decreased scent perception in dogs.[a] Little is known about the ability of other drugs and chemicals to interfere with olfaction in dogs. Research is needed to determine the effects of many pharmaceuticals, biologics, and chemicals on the scenting ability of dogs. Despite a lack of scientific evidence, many SAR handlers are concerned about the potential effects that medications and chemicals may have on their dog's sense of smell. Veterinarians should carefully weigh the potential risks and benefits of medications and treatments in these dogs. If a particular agent is known to affect smell, or has a high potential of interfering with olfactory function, alternative interventions should be used. If no alternative treatments are available or continued work during treatment would place the dog at risk, it may be necessary to withdraw the dog from search activity for the duration of treatment.

Vaccination—All SAR dogs should be vaccinated against distemper virus, adenovirus, parainfluenza virus, parvovirus, leptospiral species, and rabies virus. Canine distemper can cause acute and prolonged loss of the sense of smell.[22] Parainfluenza infection does not appear to have long-term inhibition of olfaction, but increases the threshold of detection for odorants.[23] The use of intranasally administered *Bordetella* vaccines may be considered because SAR dogs frequently interact with other dogs. However, the timing of the vaccine should be such as not to interfere with deployment activity because regulatory agencies do not require this vaccine for travel and the intranasal administration may lead to local inflammation and interference with smell. The effects of other diseases or vaccines on smell are not documented. Under most circumstances, SAR dogs are deployed with little or no advance warning, so the veterinarian should advise the handler of the potential risks and benefits of each vaccine and address any concerns the handler may have with the issue of overvaccination.

Parasite control—Many SAR dogs are deployed extensively outside of their home area, sometimes internationally, which increases the risk of exposure to unusual parasites and the diseases that they transmit. Fleas, ticks, and other biting insects are carriers of many diseases, and aggressive prevention should be instituted for all SAR dogs, particularly those with wilderness search groups. Many handlers will have concerns about the potential effects that pesticides may have on their dog's ability to smell. Veterinarians should be willing to discuss any concerns the handler may have and recommend a flea and tick preventive that best fits the needs of the dog and handler. Concerns about a product's interference with a dog's scenting ability can be resolved if handlers are encouraged to use the product on a regular basis. This allows the handler to determine whether there is a deleterious effect. Because most veterinary practices carry several flea and tick products, it should be possible to find a product that will protect the dog and satisfy the handler. Year-round heartworm prevention should be considered in all dogs because of the potential of travel to areas where heartworms are endemic. Fecal samples should be evaluated routinely, especially for dogs working in urban environments where exposure to parasites from other dogs is likely.

Nutrition—Nutritional requirements for SAR dogs have not been well defined. This is partly attributable to the great variation in age, breed, and type of work performed by SAR dogs. If the dog is on a FEMA team, the handlers must be able to carry a 3-day supply of their dog's food with them; this precludes the use of frozen or raw diets. In addition, raw diets increase risk of zoonotic organisms such as *Campylobacter* spp and *Salmonella* spp and do not belong at disaster scenes.[24] So-called natural, preservative-free diets may also be of concern when storage temperature cannot be controlled. It is also important to emphasize proper weight control for optimal performance and longevity.[25] Weight loss has been reported in dogs with prolonged search activity.[26] Therefore, while research to determine specific recommendations for nutritional needs for both maintenance and stressful periods is needed, veterinarians should encourage the use of scientifically tested diets to maintain optimum weight and performance during training. Handlers should be instructed to closely monitor body weight, food intake, and performance during SAR deployments and adjust feeding schedules or diets accordingly.

Baseline physical, laboratory, and radiographic data—There are no national standards for routine medical screenings of SAR dogs. Humans working in high-risk environments are required to have annual physical examinations and additional screening on the basis of individual risk factors.[27] Veterinarians should work with handlers and search teams to establish a regular health-screening protocol. In order to make such recommendations, a national database of SAR dog activity and medical problems should be established so that collected data can be evaluated to determine whether such screening is beneficial from a medical and economic perspective.

Neutering and gastropexy—Most female SAR dogs are neutered. This procedure is encouraged because dogs in estrus searching with other dogs create a distraction. In addition, bitches will lose several months of training and service if they are bred. Neutering of male dogs, while not as critical, is also encouraged. At the time of neutering in females or other abdominal surgery in males (eg, gastrointestinal foreign body removal), prophylactic gastropexy should be considered. With the recent development of new techniques, laparoscopic-assisted gastropexy may become a quick and minimally invasive routine prophylactic procedure in working dogs.[28] In a decision-tree-based study of prophylactic gastropexy, all breeds evaluated had a reduction in mortality rate; however, cost effectiveness was dependent on the specific breed risk of **gastric dilatation and volvulus (GDV)**.[29] The incidence of GDV in SAR dogs is not documented, but the consequences of GDV at a remote site could be devastating. In a 3-year study[30] of military working dogs, despite aggressive management measures (ie, diet, handler education, and readily available veterinary care), 31 of 914 deaths were the result of GDV. In a more recent survey of causes of death in military working dogs, GDV was the fifth most common reason for death, affecting 1 out of 11 dogs.[12] Compared with the other leading causes of death in military dogs (degenerative joint disease, cancer, spinal cord disease, and aging-related deterioration),[12] GDV is 1 condition that is preventable and can be treated successfully if recognized promptly. As with all preventive health decisions, the potential risks and benefits must be discussed. Some breeds used in SAR have such a low incidence of GDV that prophylactic gastropexy may not be a sensible choice. Regardless, handlers should be educated to recognize the signs of GDV in their dog.

Travel documents—The potential for regional, national, and international travel increases both preventive medical needs and disease potential. Handlers with SAR dogs may need to cross state lines or use public transportation, which requires appropriate health documentation by an accredited veterinarian. Dog handlers affiliated with FEMA USAR teams and some non-FEMA teams respond nationally, and health certificates to board airplanes and cross state lines are required for their dogs. Some teams travel internationally, which may result in the need for additional documentation. Veterinarians should encourage SAR dog handlers to contact the airline they plan to travel with to determine that particular airline's regulations. An overview of most domestic airline policies can be accessed through the National Association of Search and Rescue Web site.[31] In addition, military carriers are sometimes used for FEMA teams; therefore, requirements for specific military documentation should be determined prior to deployment. Some commercial airlines only allow dogs in the cabin when they are responding to a search mission, whereas others allow dogs in the cabin for both search missions and trainings. For some airlines, the handler and dog must be responding to a disaster, whereas others simply require that the handler be on official SAR business and carrying appropriate documentation. When a SAR dog is traveling internationally, the veterinarian can aid the handler through contact with the state veterinarian to determine what requirements must be met for the dog to travel to the intended destination. For a major disaster, the veterinarian may be requested to expedite testing and documentation to meet a country's travel requirements so that the SAR dog can be rapidly deployed.

First aid—Most search missions do not have the luxury of an accompanying veterinarian. During a deployment, medical support may be inaccessible or delayed. The ability of the handler to recognize important signs of illness and perform basic and advanced first aid may make the difference in a dog's survival or ability to return to work. Veterinarians can teach handlers to evaluate vital signs in their dogs and recognize life-threatening illnesses and injuries.[32] First aid may require IV administration of fluids for treatment of shock because of trauma or GDV, trocharization or passing of a stomach tube for GDV, the Heimlich maneuver for choking, assisted respirations for respiratory arrest, or thoracic compressions for cardiac arrest. Veterinarians should work with the teams to develop a first aid kit for the field that takes into account the training of the handlers and the likely needs based on the environment and time of year.

First aid is the first step in the chain of medical care, with advanced care provided by a veterinarian as rapidly as possible for all but the most minor of injuries. First aid should never replace or substantially delay a full medical assessment by a veterinarian.

Trauma—The working environment of a SAR dog has multiple risks. Urban SAR dogs work on and in collapsed buildings and around heavy equipment. There are risks of cuts, scrapes, burns, falls from a height, injury from falling objects, vehicular accidents, and entrapment. Wilderness SAR dogs traverse numerous natural obstacles, which can lead to injury. Additionally, wild or loose animals may pose a threat in any search mission. Although SAR dogs are not aggressive by nature, the gathering of large numbers of unfamiliar dogs can result in bite injuries. At some crime scenes, urban environments, and hunting grounds, gunshot and other projectiles can be a risk. Explosions from incendiary devices or volatile chemicals can lead to blast injuries.

Treatment of trauma and injuries should follow basic emergency medicine and surgical principles; however, it is important to remember that the outcome

of treatment should be a fully functional athlete. Handlers should be taught how and when to stabilize broken bones for transportation to prevent further injury during potentially long evacuations from the wilderness or a disaster site. Ocular trauma should be treated without delay to reduce the risk of sight impairment, and referral to a veterinary ophthalmologist is encouraged for any serious ocular injuries.

Toxicants—A SAR dog and its handler may be exposed to a large variety of contaminants (eg, asbestos and fuels), hazardous household products (eg, bleach, ammonia, and gasoline), dust, and smoke.[33-36] When internal or external chemical exposure is suspected, it is important to try to identify the chemicals. Although businesses are required to keep a list of all hazardous materials on site, this list is often unavailable during times of disaster or lacks information relevant to dogs. When no accurate list or product containers with labels are available, it can be difficult to determine the nature of the chemical to which the dog has been exposed and general decontamination principles (reduce exposure, restrict absorption, and enhance elimination) should be followed. When the nature of the chemical exposure is known, veterinarians are encouraged to consult an Animal Poison Control Center immediately for 24-hour access to recommendations for treatment. Veterinarians must always consider that a dog contaminated with a toxic chemical may act as a fomite and expose their staff to the toxin. Any dog that is suspected of external toxic exposure should be immediately decontaminated, preferably before transport to a veterinary hospital. The dog should be washed in a well-ventilated and drained area, preferably outside the building. Large amounts of water should be used to rinse chemicals from the dog, and a degreasing agent (eg, a dishwashing detergent) should be used to remove any petroleum-based products. Eyes should be rinsed with copious amounts of water or saline solution and examined for chemical burns. All individuals involved in the decontamination procedure should wear respiratory protection, eye protection, and rubber gloves, at a minimum. The extent of additional needed protection (eg, full chemical suit) will depend greatly on the nature of the chemical. When the exact nature of the chemical is unknown, individuals should err on the side of caution and wear full chemical suits.

Wilderness searches can result in unique toxin exposures to SAR dogs. In addition to chemical toxins, toxic plants and animals pose a risk. Snakes, spiders, scorpions, bees, and other animals can envenomate and potentially kill a dog. Veterinarians should be familiar with the signs of envenomations because the handler is often working at a distance from the dog and may not have witnessed the event. Snake bites and the associated fatalities are most common in the southern United States, with an estimated 15,000 dogs and cats bitten by poisonous snakes yearly in the United States.[37] The severity of snake envenomation varies with type of snake, location of bite, amount of venom injected, and time from bite to treatment. Most snake bites in humans and animals in the United States are from pit vipers (rattlesnakes, copperheads, and water moccasins).[37,38] There are, however, rare reports[39,40] of coral snake (*Micrurus fulvius fulvius*) envenomation in dogs. A commercially available equine-origin antivenin[b] is an effective part of the treatment of envenomation from all 3 species of pit vipers.[41] Coral snake envenomation requires treatment with a specific antivenin[c] that is efficacious in the treatment of eastern and Texas coral snake envenomation, but not for envenomation by the Arizona coral snake.[39] Although antivenin may be associated with risk of anaphylaxis or serum sickness (upon repeated use of this or any other equine serum-based biologic), early use in cases of envenomation has been associated with improved outcome.[41] Newer antivenin products have been introduced for treatment of envenomations in humans,[d] but experience in veterinary species is limited. Veterinarians in high-risk areas should consider stocking antivenin and becoming familiar with its use as a part of the medical management of snakebite.[41] Although SAR dog handlers should be encouraged to obtain appropriate education in the identification of snakes and other toxic animals native to their region, they should be advised not to put themselves at risk in their effort to identify the snake or other animal.

Stress—Search work can result in physical and mental stress for the dog and the handler. Although there is little information regarding common stress responses in SAR dogs, gastrointestinal signs were frequently reported in dogs responding to the September 11 disasters.[26] It is likely that stress was a major factor in this finding. Dogs may also respond to stress in their handler and develop unusual behaviors or signs of illness without any identifiable organic cause.

In times of disaster, SAR dogs are looked upon as sources of hope, courage, and comfort. Because the lives of humans are dependent on these dogs, it is extremely important that these dogs remain in excellent health. Veterinarians can aid in the preventive and health care of SAR dogs by screening them for possible medical problems before they become serious enough to prevent a dog from accomplishing its mission.

[a]Myers LJ. Department of Anatomy, Physiology and Pharmacology, College of Veterinary Medicine, Auburn University, Ala: Personal communication, 2003.

[b]Antivenin (Crotalidae) Polyvalent, Fort Dodge Animal Health, Fort Dodge, Iowa.

[c]Antivenin (*Micrurus fulvius*), Fort Dodge Animal Health, Fort Dodge, Iowa.

[d]CroFab, Protherics Inc, Nashville, Tenn.

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