TECHNICAL NOTE

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The Use of Cadaver Dogs in Locating Scattered, Scavenged Human Remains: Preliminary Field Test Results

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ABSTRACT: Specially trained air scent detection canines (*Canis familiaris*) are commonly used by law enforcement to detect narcotics, explosives or contraband, and by fire investigators to detect the presence of accelerants. Dogs are also used by police, military, and civilian groups to locate lost or missing persons, as well as victims of natural or mass disasters. A further subspecialty is ''cadaver'' searching, or the use of canines to locate buried or concealed human remains. Recent forensic investigations in central Alberta demonstrated that the use of cadaver dogs could be expanded to include locating partial, scattered human remains dispersed by repeated animal scavenging. Eight dog-and-handler teams participated in a two-month training program using human and animal remains in various stages of decay as scent sources. Ten blind field tests were then conducted which simulated actual search conditions. Recovery rates ranged between 57% and 100%, indicating that properly trained cadaver dogs can make significant contributions in the location and recovery of scattered human remains.

KEYWORDS: forensic science, canine scent detection, canine reliability, decomposition, cadaver

Research on the efficacy of scent detection dogs has been limited, and the bulk of the literature consists of anecdotal reports in nonrefereed journals (1). Scientific studies have focused primarily on accelerant detection (1–3) and the validity of scent detection lineups (4,5). Previous reports on the use of cadaver dogs have focused exclusively on their use in detecting burials (6,7) and contain only anecdotal case reports [6] or preliminary results (7).

Recent forensic investigations in the Edmonton, Alberta region using air scent detection dogs to recover animal-scavenged human remains indicate that the role of the cadaver dog could be expanded to include locating scattered body elements. Postmortem animal activity resulting in widely dispersed remains is a common component of cases involving outdoor, decomposed remains in the region (8). Recovery in these cases is often confounded by thick coverings of snow or leaf litter which further conceal the remains. Three recent cases involving extended postmortem intervals (PMI) and widely scattered human remains demonstrated that air scent detection dogs effectively located dispersed remains but that additional training would be required. A research and training program was then developed to examine the use of cadaver dogs in search strategies involving dispersed remains.

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Materials and Methods

Eight dog-and-handler teams volunteered to participate in the training and research program. The breed and experience level of each dog are given in Table 1. One team consisted of a Royal Canadian Mounted Police (RCMP) officer and his service dog; the remaining teams were members of the RCMP Civilian Search and Rescue Service Dog Program (9). Weekly training sessions began in late November 1997 and continued until the end of January 1998. During training sessions, each team was given a separate search area and the handlers were advised of the number and type of articles hidden in their areas. If all articles were not found during the initial search, handlers were advised of the location of the missing articles and directed the dogs to those items. Search area size varied during the training sessions, ranging from 10 by 10 m^2 to 60 by 60 m^2. Scent sources (referred to by the dog handlers as ''hides'') were placed between 1 h and 1 day prior to the search.

The field trials consisted of blind searches in which the handlers were not informed as to the number or type of hides. Search areas were consistently 20 m by 20 m. Separate search areas were provided for each team and different locations were used for each field test; no search areas were used more than once to avoid contamination. Scent sources were randomly placed within each area by the author a minimum of 24 h prior to the search. No scent sources were buried during the testing, however, all hides were not visible to the handlers or dogs. All items were concealed by leaf litter, ground cover, snow (care was taken to avoid leaving footprints to the hides) and water. All items were handled and placed in the search areas using large metal tongs. A total of ten field trials were conducted from February through April, 1998. A summary of the environmental and weather conditions and scent sources for each training session and field trial is given in Table 2.

Scent sources included dry human and animal bone, sterile gauze or cotton soaked in human decompositional fluid (collected at autopsy) and placed in perforated plastic or metal containers, and small articles and clothing saturated in decay fluids then dried. All bone used had been desiccated, but had not been boiled or chemically treated. Fluid containers were prepared using latex gloves. No artificial or ''pseudo'' scents (10) were used in this testing. All hides and scent sources were used one time only to avoid scent contamination.

TABLE 1—*Performance of individual dog teams, including number of training sessions and field trials attended.*

Team	Breed	Experience	#Training	#Trials	%Recovery
1	Standard Poodle	civilian, certified	3	8	55
2	German Shepherd	civilian, certified	2	9	60
3	Yellow Labrador	civilian, certified	5	2	71
4	Doberman	civilian, certified	5	7	79
5	Mallinois	civilian, not certified	4	8	86
6	German Shepherd	civilian, certified	3	8	90
7	Border Collie	civilian, not certified	7	10	93
8	German Shepherd	RCMP, PSD #508	7	9	95

TABLE 2—*Summary of environments, field conditions, scent sources and recovery rates of training sessions and field tests.*

Test #	Environment	Weather Conditions	Scent Source	No. of Teams	%Items Found	Comments
			TRAINING SESSIONS			
T-1	open grass field—search areas 15 m^2	−5°C, light wind and snow cover	jewelery and clothing	4	100	items visible. Average search time (AST): 4 min
T-2	grass field w/trees—search areas 15 m^2	−8°C, light wind	human bone	7	77	4 teams found all items in their areas. AST: 11 min
T-3	grass field with trees—areas 10 m^2	−7°C, light snow cover, no wind	human bone	6	100	handlers knew no. of items and worked until all were found. AST: 11 min
T-4	plowed field w/1 ft wheat—areas 60 m^2	0°C, light wind	scent tubes	5	60	scent tubes not suitable. AST: 22 min
T-5	plowed field w/1 ft wheat—areas 20 m^2	−2°C, light wind	human bone/fluid containers	6	100	areas searched till all items were found. AST: 10 min
T-6	open field w/trees and grass—areas 20 m^2	2°C, light gusty wind	clothing/fluid containers	4	100	areas searched till all items found. AST: 8 min
T-7	plowed field with wheat stubble—search areas 10 m^2	−30°C, 25 cm of snow no wind	fluid bags	4	100	one dog could not search because of cold temperatures. AST: 6 min
			FIELD TRIALS (All search areas 20 m by 20 m)			
F-1	open grass field	−3°C, 15 cm of snow light wind	fluid bags/animal bone/clothing	6	100	articles placed 48 h prior AST: 18 min
F-2	plowed field with wheat stubble	−3°C, 15 cm of snow light wind	fluid bags/animal bone/clothing	6	88	articles placed 48 h prior AST: 18 min
F-3	woods	7°C, 15 cm of snow no wind, sunny	human, animal bone	8	63	articles placed 24 h prior, first time in woods. AST: 20 m
F-4	woods, dense brush	2°C, 19 cm of crusted snow, light wind	human bone	7	90	articles placed 24 h prior AST: 14 min
F-5	woods	−8°C, 20 cm crusted snow, moderate wind	human, animal bone/fluid bags	7	95	articles placed 30 h prior. AST: 12 min
F-6	woods, dense brush	−11°C, 18 cm crusted snow, gusting wind	animal bone/fluid bags	5	70	articles placed 48 h prior. AST: 13 min
F-7	woods	10°C, 8 cm melting snow, very light wind	decomp. fluid soaked in ground	5	57	deposited 48 h prior, handlers ignored alerts. AST: 13 min
F-8	open grass field	10°C, 6 cm patches of snow, very light wind	dry human bone	5	66	deposited 48 h prior, bones in water unrecov. AST: 11 min
F-9	open grass field	3°C, isolated water patches, light wind	dry human bone, fluid on ground	6	94	deposited 48 h prior, no alerts on fluid. AST: 11 min
F-10	woods, treed fields	6°C, some puddles, shifting light winds	dry human bone, fluid containers	6	86	articles deposited 48 h prior. AST: 17 min

Training the type of alert (to indicate a find) given by each dog was left to the discretion of the handler, provided the alert was aggressive and did not involve the animal touching, pawing or mouthing the hides. Examples of aggressive alerts used include barking or downing the dog. During the training sessions, the author and fellow handlers also made note of passive alerts (i.e., repeated sniffing of or urinating on unrecovered hides) to aid the handler in recognizing when the dog had found an item.

Results

Overall recovery rate for the field trials was 81%, with a per-trial recovery rate ranging from 57 to 100%. The overall recovery rate for each individual dog team ranged from 55 to 95%. Results for individual dog teams are given in Table 1. The results of the field trials are found in Table 2.

Discussion

Previous reports suggest that environmental factors, primarily temperature, significantly affect dog performance (7). Decreases in the dog's ability to scent have been noted at temperatures exceeding 29°C and it has been suggested that dogs may be unable to locate scent sources under snow or in freezing temperatures (7). Results from this study indicate that low ambient temperature and snow depth appear to have no effect on the dog's performance. For example, one training session (T-7, Table 2) took place with ambient temperatures at −30°C and with sources located under 25 cm of snow. Although one dog was unable to search because the conditions caused pain in its paws, the remaining teams recovered 100% of the hides. Snow depth and conditions also did not appear to hinder dog performance. Trials/tests conducted on days with greater snow depths (T-7, F-4, F-5 from Table 2) had impressive recovery rates (90 to 100%), while searches conducted in less or no snow resulted in lower recovery rates. Written handler comments at the end of each exercise support these findings, indicating that the dogs will bury their noses in the snow and use scent contained within air pockets to locate the source. Findings presented here represent cold weather results only; moderate and warm weather climate testing is ongoing and will be reported separately.

Factors that did appear to affect team performance in this study include familiarity with scent source and experience in specific types of search area terrain. The decomposition of a body is a dynamic process, producing a variety of scents as decay progresses from bloating through skeletonization (11) and, ideally, training should familiarize the dog with the full range of decay scents from fresh to bone. Attempts were made during the field trials to introduce the dogs to progressively older, drier human bones (representing an increasing PMI). The reduced overall recovery rate seen in the eighth field trial (F-8, Table 2) is due, in part, to the introduction of old, dry human bone to which the dogs had not been previously exposed. A previous study indicates that a dog's ability to match the odors of different body parts from one person may be a result of training focusing on the common elements (12). This type of cadaver searching may represent a further test of a dog's ability to recognize similar yet differing odors from a single source; additional research is required to determine which decay elements the dogs are capable of recognizing.

Scent source type also influenced team performance. Dry bone elicited the strongest, most aggressive alerts from the dogs. Human bone was consistently found by all dogs, while several of the dogs gave only passive alerts or did not respond to animal bone. Human bone was the primary training scent source during this program and this may explain the discrepancy. Strong, consistent alerts were also given to clothing, although the previous search-and-rescue training of all the dogs prior to the cadaver training may explain their familiarity with recovering clothing articles. Response to animal bone and decompositional fluid scent sources varied among the dogs and may be reflective of the level and consistency of a dog's training. Climatic conditions must also be taken into account when using fluid-based scent sources; freezing temperatures may have affected or restricted odor distribution from the decompositional fluid. Results from warm weather testing may help in understanding these findings. Finally, the plastic scent tubes used in training session 4 (T-4, Table 2) were unsuitable for cadaver training as the tube shape was similar to the play reward toys many handlers used and the dogs continually retrieved the tubes.

Previous experience with specific environmental conditions also increases the likelihood of recovery. For example, the dogs had received no prior training in small article searching in shallow water and the first bones placed in puddles during the eighth field trial (F-8, Table 2) were not recovered. The dogs were directed to the submerged bones and, in the subsequent two field trials (F-9, F-10, Table 2), hides located in water were quickly located. A similar decrease in overall recovery rate was seen in the third field trial (F-3, Table 2) in which the teams were first introduced to searching in a dense wooded area.

Handler error or inexperience also played a role in overall recovery rates. The low recovery rate seen in the seventh field trial (F-7, Table 2) resulted from handlers repeatedly ignoring the alerts or indications given by their dogs. In this trial, 30 cc of decompositional fluid was deposited directly onto the soil at various locations within each search area. The dogs, having been exposed to the scent previously on small articles, indicated the areas, yet the handlers ignored the alerts because they were unable to locate any visible scent source.

Scenes involving decomposed, scavenged remains are complex and variable. Postmortem insect and animal activity can result in both dry and fleshed elements being recovered from a single body (13). Repeated canid scavenging can result in widespread dispersal of remains across varying terrain (14). Scent sources and environmental conditions were purposefully varied throughout the field tests to simulate this diversity. Results indicate the need for a thorough training program which would expose both dog and handler to a wide range of variables in terms of both body elements and scene terrain. Recommendations and guidelines for training scattered-remains cadaver dogs have been published separately (15).

Conclusions

Field test results presented indicate that properly trained cadaver dogs are an efficient, reliable tool in search strategies involving scattered, scavenged human remains. Dog teams can quickly and thoroughly search large areas, greatly reducing the amount of time and manpower required to maximize recovery of body elements.

The results of this training/research program have been used to develop cadaver dog certification guidelines for the RCMP Civilian Search and Rescue Service Dog Program, the first such certification program in Canada.

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