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The Clinical and Radiological Evaluation of Firearm Injuries in Dogs

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Abstract: *This study was carried out in 19 dogs referred to Firat University Animal Hospital, Department of Surgery. The results were evaluated by using clinical findings, radiographical abnormalities, surgical or conservative management and outcome. In conclusion, the first goal in the treatment is to support the respiratory and cardiovascular system. Radiographic examination should not be neglected. Because it gives important clues about the operation options. Sometimes a single projectile causes death of animal, but too many projectiles may not cause a lethal effect in the animal. In the long term, too many projectiles can lead to lead (Pb) poisoning. Also in the long term, the projectiles may cause tumor formation in invasion areas. For the prevention of firearm injuries in animal, the application of penal sanctions is required.*
Keywords: *Firearm injuries, radiology, dog.*

I. Introduction

Firearm injuries represent a small amount of traumatic injuries when compared with the other causes of trauma (motor-vehicle collision, high-rise syndrome, and bite wounds) in veterinary clinics (1-3). Injuries are generally caused by bullets or pellets shot from handguns, hunting rifles or shotguns, and air gun pellet (4,5,6). Shooting at animals is predominantly performed during hunting (7). On the other hand some dogs wounding by gunshot because of working in military (8). Management of firearm wounds in small animal patients can be problematic, primarily because of the variations in the firearm used and the exact nature of the wound inflicted (9,10). The size of a firearm wound depends on the projectile type, its velocity at impact, and the type of tissue affected by the projectile (11).

In treating firearm wounds, it is essential to use diagnostic imaging techniques due to the specificity of each shot. One should consider the fragmentation of projectiles, secondary projectiles and potential contamination of a wound with the elements introduced by a projectile (7,12,13). Antibiotic therapy and prophylaxis of infections with anaerobic organisms should be the standard, as projectiles always contaminate a wound and the conditions inside it favour the growth of pathogenic microorganisms (14,15). Surgical treatment remains mandatory in cases of penetrating abdominal wounds, especially with disruption of hollow organs; in thoracic injuries unsuccessfully managed with medical therapy; and in extremity injuries requiring internal fixation (16,17). The objective of this study was to assess radiological and surgical findings, surgical management and outcome of firearm injuries in dogs.

II. Material And Methods

The material of this study was composed from 19 dogs brought to Firat University Animal Hospital, Department of Surgery. The data retrieved included: breed, age, gender of the patient, area of the projectiles, clinical findings, radiographically abnormalities, surgical or conservative management and outcome. Radiographs were reviewed for each case, and projectile position according to body region, number and type of projectile, bone fractures, and wounds related to projectile were recorded. Conservative treatments, surgical and orthopedic applications were routinely performed.

III. Result And Discussion

In the anamnesis from patient owners, dogs usually have lameness and hemorrhage together with general malformation. Some animal owners hadn't any idea the etiology of these symptoms and some they said that they hit their own dog accidentally while recovering from the other dogs attack. And some animal owners said the reason of these shots were hostility of neighbors or to protect from dog attacks.

Cases of breed, age, gender, area of the projectiles, clinical findings, radiographically abnormalities, surgical or conservative management and outcome the presented in Table 1.

Table 1: Cases of breed, age, gender, area of the projectiles, clinical findings, radiographically abnormalities, surgical or conservative management and outcome.

No	Breed	Age	Gender	Area	Clinical Findings	Radiographical Finding	Treatment	Outcome
1	TSD	4	M	Extremity	Lameness	26 pellets	Cons.	Good
2a	TSD	2	M	Extremity	Lameness	32 pellets, radius-ulna fracture	Int. Fix	Good
2b				Thorax	Effusion	6 pellets	Cons.	
3a	TSD	3	M	Thorax	Effusion	4 pellets	Cons.	Good
3b				Cranium	---	3 pellets	Cons.	
4	GSD	5	M	Extremity	Lameness	5 pellets	Cons.	Good
5a	TSD	3	M	Extremity	Lameness	9 pellets	Cons.	Good
5b				Abdomen	Effusion	62 pellets	Cons.	
6	Kurzhaar	3	F	Extremity	Lameness	8 pellets, tibia fracture	Ext. Fix	Good
7	GSD	4	F	Thorax	Effusion	1 pellets	Cons.	Good
8a	CB	3	M	Extremity	Lameness	3 pellets, femur fracture	Int. Fix	Good
8b				Thorax	---	2 pellets	Cons.	
8c				Abdomen	---	26 pellets	Cons.	
9	TSD	5	M	Extremity	Lameness	14 pellets, tibia fracture	Int. Fix	Good
10a	TSD	3	F	Extremity	Lameness	5 pellets	Cons.	Good
10b				Thorax	---	2 pellets	Cons.	
11a	CB	2	F	Extremity	Lameness	29 pellets, tibia fracture	Int. Fix	Good
11b				Thorax	Effusion	4 pellets	Cons.	
11c				Abdomen	---	8 pellets	Cons.	
12a	CB	4	M	Extremity	Lameness	2 bullets, femur fracture	Int. Fix	Good
12b				Abdomen	---	1 pellets	Cons.	
13	TSD	3	M	Cranium	Hemorrhage	32 pellets	Pellets removed	Good
14	Kurzhaar	2	M	Extremity	Lameness	1 bullet, femur fracture	Int. Fix	Good
15a	CB	3	F	Extremity	Lameness	1 pellets	Cons.	Good
15b				Abdomen	---	1 pellets	Cons.	
16	TSD	4	M	Extremity	Lameness	1 bullet, femur fracture	Int. Fix	Good
17	TSD	2	M	Cranium	Hemorrhage	Mandible fracture	Fixation with cerclage wire	Good
18a	TSD	3	M	Extremity	Lameness	72 pellets	Cons.	Died
18b				Thorax	Effusion	12 pellets	Cons.	
19	TSD	4	M	Abdomen	---	2 bullets	Cons.	Good

TSD: Turkish shepherd dog, **GSD:** German shepherd dog, **CB:** Cross Breed, **Int. Fix:** intramedullary fixation, **Cons:** Conservative treatment, **Ext. Fix:** External Fixation

Dogs were included to this study which was having a projectile in the radiographies (Fig. 1). 11 Turkish shepherds (57.9%), 4 cross breed (21.1%), 2 German shepherd (10.5%), 2 Kurzhaar (10.5%) were included. Five female dogs (26.3%) and fourteen male dogs(73.7%) were included.

Figure 1. Appearance of pellets that have been penetrated in different areas.

Wounds are usually larger than the entrance wounds (18). In one case, it was observed that the bullet entered maxilla out of the mandible and caused a transversal fracture in the molar part of the mandible. The diameter of the wound at the exit of the bullet was larger than the entrance (Fig. 2A). The tranversal fracture in the mandible was fixated with two cerclage wire and treatment of wound on maxilla was made with open wound treatment (Fig. 2B).

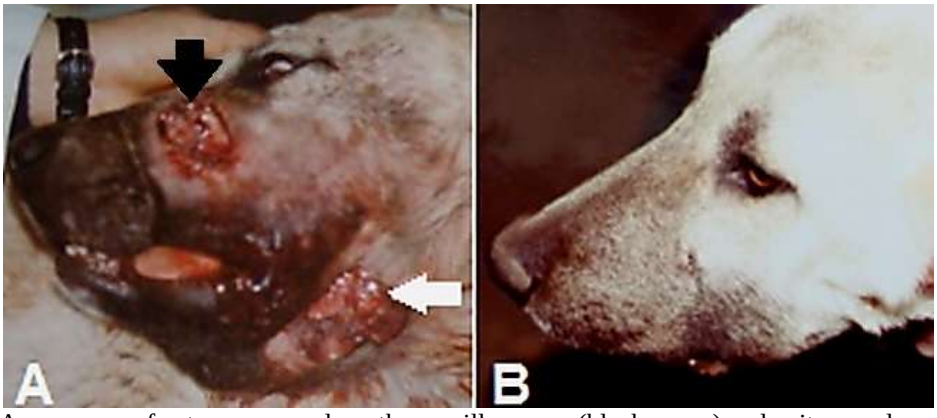

Figure 2. Appearance of entrance wound on the maxillary area (black arrow) and exit wound on mandibular area (white arrow) (**A**). Healed wounds (**B**).

There were projectiles in extremity 14 (46.7%), in the abdominal cavity 6 (20%), in thoracic cavity 7 (23.3%), in cranium 3 (10%) cases. Thirteen (68.4%) dogs had been shot during hunting or other reasons with shotguns. Five (26.3%) dogs had a single perforating gunshot wound and one (5.3%) dog had been shot by air gun (Fig. 1C).

Extremity fractures were present in 8 dogs (42.1%): 4 dogs had a femur fracture, 3 dogs had a tibia fracture and 1 dog had a radius-ulna fracture (Fig. 1D). Lameness was noticed in 14, effusion was noticed in 6 patients. One patient had a severe hemorrhage in submandibular region.

In surgical exploration 7 case operated by using internal fixation method one case was operated by using external fixation method. So many projectiles can removed from the subcutaneous tissue which patient wounded from sub-mandibular area (Fig. 1A). Not surgery used for the abdomen and thoracic wounds because of no severe symptoms was occur (Fig. 1B). Only conservative treatment was sufficient. All patients' treatment consist of intravenous fluids, parenteral antibiotic, analgesic and non-steroidal anti-inflammatory drugs. In this study, 18 (94.7%) dogs survived and 1 (5.3%) dogs did not survive. Projectile injuries in 2 or more body regions were observed in 9 (47.4%) dogs, whereas in 9 (47.4%) dogs, projectile was found in only 1 region. No projectile was found in one case (5.2%). In this study, hunting accidents were the reason of only 10.5% of the firearm injuries may because of the professionalism of the hunters. Capak et al. (1) in their study hunting accident were the reason of 12,7% is same as our datas.

There was a predominance of male dogs 73.7% in our study we associate male predominance to the influence of sex hormones, causing frequent unsupervised roaming of male dogs during female estrus. This is an agreement with earlier retrospective studies related to trauma in dogs (1,19,20). We recorded shotgun injuries in 68.4% of injured dogs and, interestingly, among those, we record only one dog mortality. This can be explained by a shotgun pellet pattern that is typically diffuse, especially when shot from a longer distance, and that often causes low-grade injuries (1,2,10)

Lameness was the most common abnormality 63.6%, effusion was the second abnormality 27.3%, and hemorrhage was the third abnormality 9.1% in our study. In a retrospective veterinary study effusion percentage was found like our study second most common abnormality (21). Air gun pellets when fired from a distance, penetrate only the skin and the immediate underlying tissue (6). In this study, it was determined that the air gun pellet was under skin in the thoracic region. Injured cases with air gun pellets have been reported (6,22,23). Also was reported retrobulbar lymphoma associated with an air gun pellet (23). The release of air gun use will increase the number of cases. For this reason, legal regulations related to the use of air guns are needed.

IV. Conclusion

The first goal in the treatment is to support the respiratory and cardiovascular system. Radiographic examination should not be neglected. Because it gives important clues about the operation options. Sometimes a single projectile causes death of animal, but too many projectiles may not cause a lethal effect in the animal. In the long term, too many projectiles can lead to lead (Pb) poisoning. Also in the long term, the projectiles may cause tumor formation in invasion areas.

For the prevention of firearm injuries in animal, the application of penal sanctions is required. Especially during the mating season, the dogs are leaving the place they are in, and they are entering another area. It is necessary for the animal owners to keep their dogs in their own land.

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