

## PAPER

## PATHOLOGY/BIOLOGY

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## Trends in Domestic Animal Medico-Legal Pathology Cases Submitted to a Veterinary Diagnostic Laboratory 1998–2010\*

**ABSTRACT:** Pathologists at veterinary diagnostic laboratories receive medico-legal cases from a variety of animal species for postmortem examination. A search of computerized records of the Animal Health Laboratory, University of Guelph, Guelph, Ontario, Canada from 1998 to 2010 identified 1706 medicolegal cases. These were categorized according to the history as criminal investigations, anesthetic-related deaths, insurance, litigation, malpractice cases, and regulatory cases. Statistically significant linear trends in the proportion of medicolegal cases for all animals and criminal cases for companion animals were identified over the 12 year period. Companion animals had significantly greater odds of being a medico-legal case in all categories except for insurance and regulatory cases, compared to noncompanion animals. Based on pathology reports for the 271 criminal cases, 43.1% were consistent with neglect, 29.2% were compatible with non-accidental injury, 4.80% were poisonings, 10.7% were deemed to be due to natural disease, and 11.43% were inconclusive.

**KEYWORDS:** forensic science, medicolegal, forensic pathology, animal abuse, animal neglect, insurance, litigation, legal, malpractice, anesthetic-related death, veterinary, veterinarian

Pathologists at veterinary diagnostic laboratories receive medico-legal cases from a variety of species for postmortem examination, in addition to routine cases submitted for diagnosis of natural disease. Compared to traditional postmortems which are usually performed for diagnosis of natural disease, medicolegal postmortems require additional rigorous and detailed documentation to withstand the intense scrutiny of the judicial system. Over the past decade, there has been a discernible growth in the literature on veterinary forensic pathology, medicine, and science (1–5). The International Veterinary Forensic Sciences Association (IVFSA) (<http://www.ivf-sa.org/> [accessed May 17, 2011]), formed in 2007, has been at the forefront, educating veterinarians and law enforcement personnel in all aspects of veterinary forensic investigations. The purpose of this paper is to identify if there is a concomitant increase in medicolegal cases submitted to a veterinary diagnostic laboratory for postmortem examination. The Animal Health Laboratory (AHL), University of Guelph, Guelph, Ontario, Canada is a full-service veterinary diagnostic laboratory that receives submissions from veterinarians in the province of Ontario, Canada including the Veterinary Teaching Hospital of the Ontario Veterinary College, University of Guelph.

### Methods

Medicolegal cases submitted from domestic animals for postmortem examination were retrieved from the AHL computerized records from 1998 to 2010. Potential medicolegal cases were identified by

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searching for law enforcement submitters, humane societies, key words in the history (litigation, legal, malpractice, anesthetic, trauma, gun, bullet, kick, beat, neglect, emaciation, strangulation, hang, police, gunshot, stab, insurance, abuse, criminal, violent, violence), and the pathology diagnoses. Key fields identifying the submission as a litigation, insurance, anesthetic-related death, or regulatory case were also searched. The latter are racehorses that died or were euthanized within a prescribed period of training or racing and are submitted by the Ontario Racing Commission (ORC) for further investigation (6). The inclusion of anesthetic-related deaths may be unique to the province of Ontario as the Veterinarians Act states that if an animal has died unexpectedly or from an anesthetic, the veterinarian must inform the client about the availability of a postmortem through a veterinarian independent of the attending veterinarian (7). The AHL receives all horses submitted by the ORC for postmortem and an unknown percentage of all anesthetic and sudden deaths from referring veterinarians as some veterinary practitioners may perform the postmortem at the request of the client.

For the purposes of statistical analysis, animal species were categorized as companion or non-companion animals (Table 1). Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated using Stata/IC11.1 (Copyright 2009 StataCorp LP Statistics/Data Analysis StataCorp, College Station, TX) to determine the strength of association (8) of medicolegal case category and animal category. A chi-square for linear trend in the annual proportion of all medicolegal cases and the proportion of criminal cases in companion animals was calculated with EpiInfo6 (CDC, Atlanta, GA). Statistical significance is given at  $p < 0.05$ .

### Results

Overall, the 1706 medicolegal cases identified represent 5% of the AHL postmortem cases from 1998 to 2010. Twenty-eight

TABLE 1—Species of animals submitted as medicolegal post-mortem cases, categorized as companion and noncompanion animals, and the relative percentages of medicolegal cases and total post-mortem submissions by species, Animal Health Laboratory, 1998–2010.

Species	Non-Companion Animals	Companion Animals	Total (%) of Medicolegal Cases	Percentage of Post-Mortem Cases for Species (%)
Equine (regulatory)	734		734 (43.02)	17.14
Equine (non-regulatory)	323		323 (18.93)	7.58
Canine		271	271 (15.89)	9.12
Feline		180	180 (10.55)	15.49
Bovine	117		117 (6.86)	1.86
Other	23*	24†	47 (2.75)	Not done
Chicken	12		12 (0.70)	0.55
Porcine	11		11 (0.64)	0.25
Ovine	9		9 (0.53)	0.64
Caprine	2		2 (0.12)	0.41
Total	1231	475	1706	

\*Rabbits, deer, chinchilla, alpaca, waterfowl, ring-billed gull.

†Rabbits, ferrets, hamster, reptile, psittacine birds.

percent ( $n = 475$ ) of medicolegal cases were companion animals, predominantly dogs and cats, with a small number of pet rodents, reptiles and birds (Table 1). Non-companion animals were primarily livestock, and 62% ( $n = 1057$ ) of all medicolegal cases submitted were horses.

Categories of medicolegal cases for companion and non-companion are presented in Table 2. Companion and non-companion animals were submitted for all of the medicolegal categories, except for the equine regulatory cases (Table 2). The majority of the criminal cases, anesthetic-related cases, litigation, and malpractice cases submitted were companion animals, whereas insurance and regulatory cases were primarily non-companion animals (Table 2). Data for the equine regulatory cases and anesthetic-related deaths are published elsewhere (9,10).

Within all medicolegal cases, companion animals were more likely to have been submitted as a criminal case (OR = 17.03, 95% CI [12.23, 23.88]), anesthetic-related death (OR = 36.32, 95% CI [22.72, 60.78]), malpractice case (OR = 6.65, 95% CI [2.42, 21.04]), or for litigation investigations (OR = 7.83, 95% CI [3.91, 16.74]) than were non-companion animals. Horses submitted for medicolegal non-regulatory postmortems were 31.56 (95% CI [20.69, 48.96]) times more likely than other species to be submitted for insurance purposes. Similarly, cattle (OR = 15.63, 95% CI [9.56, 26.47]) and swine (OR = 7.81, 95% CI [1.86, 45.82]) were also more likely to be submitted for insurance purposes compared to other species.

TABLE 2—Number of cases for each medicolegal case subcategory based on history for non-companion and companion animals submitted for post-mortem to the Animal Health Laboratory, University of Guelph, 1998–2010.

Medico-Legal Category	Noncompanion Animals	Companion Animals	Total (%)
Regulatory	734		734 (43.02)
Insurance	405	29	434 (25.44)
Criminal	57	214	271 (15.89)
Anesthetic	22	189	211 (12.37)
Litigation	10	28	38 (2.23)
Malpractice	3	15	18 (1.06)
Total	1231	475	1706 (100.00)

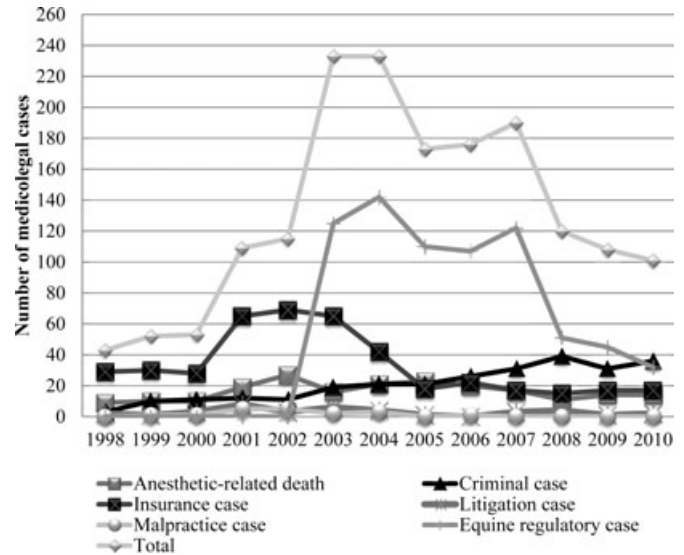


FIG. 1—Number of post-mortem medicolegal cases submitted to the Animal Health Laboratory, University of Guelph, 1998–2010.

Complete postmortems with ancillary testing including histopathology and/or radiology, bacteriology, virology, toxicology, serology, and clinical pathology were done on all animals and only the results for the criminal cases are included in this paper. Based on pathology reports for the 271 criminal cases, 117 (43.1%) were consistent with neglect, 79 (29.2%) were compatible with non-accidental injury (NAI), including two cases of sexual abuse, 13 (4.80%) were poisoning, 29 (10.7%) were deemed to be due to natural disease, and 31 (11.43%) were inconclusive. Of the 79 cases of NAI, the majority (52%) were solely blunt force trauma, which on occasion was accompanied by sharp force injury, gun-shot, or asphyxia. Asphyxias included ligature and manual strangulations, smoke inhalation/carbon monoxide toxicity and suffocation. Sexual abuse was identified in a mature ewe and a female Yorkshire Terrier.

Categories of medicolegal case submissions by year are presented in Fig. 1. Criminal cases are the only medicolegal case category that consistently increased over the 12 year period. From 1998 to 2010 there was a statistically significant chi-square for linear trend in the proportion of all pathology submissions that were medicolegal cases ( $p < 0.05$ ) and for the proportion of companion animal criminal cases submitted to AHL pathology ( $p < 0.05$ ).

## Discussion

Medicolegal cases comprised 5.0% of the total domestic animal postmortem submissions to the AHL from 1998 to 2010. Almost 25% of horses, 15% of cats, and 10% of dogs submitted for postmortem were medicolegal cases. During this period, there was a statistically significant linear trend in all medicolegal submissions. Much of the increase in non-companion animals was due to the implementation of the equine death registry by the ORC in 2003, in which racehorses that die or are euthanized within a prescribed period of time from racing or training are submitted to the AHL for postmortem (6).

While insurance, litigation, malpractice cases, and postmortems for anesthetic-related deaths have modestly increased since 1998, there has been a gradual, consistent, and statistically significant linear trend in criminal cases submitted for postmortem examination

and ancillary testing. Reasons for this are speculative and may be due to a combination of factors including changes to the justice system, increased media attention, the relationship between animal cruelty and domestic violence (11,12), and increased professional and public interest. In 2008, the federal Criminal Code of Canada was amended to no longer classify animal cruelty as property crime and enables judges to impose increased penalties for these crimes (13). The provincial Ontario Society Prevention of the Cruelty of Animals Act (14), was also amended in 2008, to include mandatory reporting by veterinarians of suspected or confirmed animal abuse.

Increased recognition of forensic medicine and pathology as distinct entities in veterinary medicine is evinced by the number of publications on these topics (1–5) and the formation of the IVFSA. Additionally, the 63rd annual scientific meeting of the AAFC in Chicago, 2011, included a workshop on veterinary forensic science.

Except for the equine regulatory cases, companion and non-companion animals were submitted as criminal, insurance, litigation, malpractice cases, and anesthetic-related deaths. Horses, cattle, and swine were more likely to be submitted for insurance purposes than for other medicolegal causes. Companion animals, which were predominantly dogs and cats, had significantly greater odds of being a criminal case, litigation, malpractice, or anesthetic-related death than non-companion animals within the 1706 medicolegal cases. While no animal species was exempt from animal abuse or neglect, there was a statistically significant association of abuse and neglect in medicolegal cases of companion animals compared to non-companion animals.

A review of pathology reports for the 271 cases submitted as criminal investigations, identified that most had lesions consistent with neglect, NAI, or poisoning. A survey of veterinarians in the United Kingdom in 2001 concluded that NAI in animals was remarkably similar to NAI in children (15). Veterinarians must be aware that abused animals may be sentinels for domestic/child abuse and, that as children or adolescents, violent offenders often abused animals before escalating to crimes against people (3). The veterinarian's role in identifying and reporting animal abuse, may in some cases, extend beyond the individual animal and provide a larger societal role in identifying abusers and even preventing domestic violence.

Data from the AHL, a veterinary diagnostic laboratory, indicates that medicolegal pathology cases have increased significantly from 1998 to 2011, particularly criminal cases of animal abuse or neglect in companion animals. Additional studies are needed to identify the reasons for this, however, it is likely that the profile of veterinary forensic medicine and pathology has reached a tipping point. It is unknown if the AHL data are representative of the medicolegal caseload in other veterinary diagnostic laboratories, however, educating undergraduate veterinary students, veterinary pathologists, and practicing veterinarians in the scientific method as it applies to forensic science is essential to ensure that veterinary forensic

science withstands the scientific and legal scrutiny applied to its medical counterpart.

## References

1. Cooper JE, Cooper ME. Forensic veterinary medicine: a rapidly evolving discipline. *Forensic Sci Med Pathol* 2008;4:75–82.
2. Merck MD. *Veterinary forensics: animal cruelty investigations*. Ames, IA: Blackwell Publishing Professional, 2007.
3. Benetato MA, Reisman R, McCobb E. The veterinarian's role in animal cruelty cases. *J Am Vet Med Assoc* 2011;238:31–4.
4. Xu H, Han W, Zhao C. A suspect horse excluded by analysis of species- and male-specific DNA and mtDNA [letter]. *Forensic Sci Int* 2011; 07:e66–8.
5. Munro R, Munro HMC. *Animal abuse and unlawful killing: forensic veterinary pathology*. Edinburgh, UK: Saunders Elsevier, 2008.
6. Ontario Racing Commission. Ontario Racing Commission, Regulatory Initiatives, Horse Death Registry, <http://www.ontarioracingcommission.ca/initiatives.aspx> (accessed May 27, 2011).
7. Government of Ontario. Veterinarians Act. R.R.O. 1990, Regulation 1093. Ontario.ca. Service Ontario e-laws, [http://www.e-laws.gov.on.ca/html/reg/english/elaws\\_regs\\_901093\\_e.htm](http://www.e-laws.gov.on.ca/html/reg/english/elaws_regs_901093_e.htm) (accessed May 27, 2011).
8. Dohoo I, Martin W, Stryhn H. *Veterinary epidemiologic research*. Charlottetown, Canada: AVC Inc., 2003.
9. DeLay J. Ontario Racing Commission death registry: 2003–2010 necropsy summaries. AHL Newsletter 2011;15:7, <http://guelphlabservices.com/files/AHL/AHL%20Newsletters/2011/ANws15-1%20Mar%202011.pdf> (accessed May 17, 2011).
10. Hazlett MJ, McEwen B. Anesthetic and perisurgical death, dogs & cats. AHL Newsletter 2008;12:24, <http://guelphlabservices.com/files/AHL/AHL%20Newsletters/2008/AHLNewsletter%20September%202008.pdf> (accessed May 17, 2011).
11. Ascione FR. Battered women's reports of their partners' and their children's cruelty to animals. In: Ascione FR, Lockwood R, editors. *Cruelty to animals and interpersonal violence*. West Lafayette, LA: Purdue University Press, 1998;290–304.
12. Jorgenson S, Maloney L. Animal abuse and the victims of domestic violence. In: Arkow P, Ascione FR, editors. *Child abuse, domestic violence, and animal abuse*. West Lafayette, LA: Purdue Research Foundation, 1999;143–58.
13. Government of Canada. Department of Justice Canada, Criminal Code C-46, Sections 445–447. <http://laws.justice.gc.ca/eng/C-46/FullText.html> (accessed May 27, 2011).
14. Government of Ontario. OSPCA Act, Ontario.ca. Service Ontario e-laws, [http://www.e-laws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90o36\\_e.htm](http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o36_e.htm) (accessed May 29, 2011).
15. Munro HMC, Thrusfield MV. 'Battered pets': non-accidental physical injuries found in dogs and cats. *J Small Anim Pract* 2001;42:279–90.

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