



NEOPLASTIC DISEASE

The Swiss Canine Cancer Registry: A Retrospective Study on the Occurrence of Tumours in Dogs in Switzerland from 1955 to 2008

K. Grüntzig^{*}, R. Graf^{*}, M. Hässig[†], M. Welle[‡], D. Meier[§], G. Lott[¶],
D. Erni[#], N. S. Schenker[¶], F. Guscelli[¶], G. Boo^{||}, K. Axhausen^{††,*},
S. Fabrikant^{††}, G. Folkers^{*} and A. Pospischil^{¶,*}

** Collegium Helveticum, Universität Zürich und Eidgenössische Technische Hochschule Zürich (ETHZ), † Departement Nutztiere Universität Zürich, Zürich, ‡ Institut für Tierpathologie Universität Bern, Bern, § Zyto-Histo Diagnostics, Freienstein, || Geographisches Institut, Universität Zürich, ¶ Institut für Veterinärpathologie Universität Zürich, Zürich, # FocusedPublishing GmbH, CH-8332 Russikon and †† Institut für Verkehrsplanung und Transportsysteme (IVT), ETHZ, Zürich, Switzerland*

Summary

Diagnostic records are a key feature of any cancer epidemiology, prevention or control strategy for man and animals. Therefore, the information stored in human and animal cancer registries is essential for undertaking comparative epidemiological, pathogenic and therapeutic research. This study presents the Swiss Canine Cancer Registry, containing case data compiled between 1955 and 2008. The data consist of pathology diagnostic records issued by three veterinary diagnostic laboratories in Switzerland. The tumours were classified according to the guidelines of the International Classification of Oncology for Humans on the basis of tumour type, malignancy and body location. The dogs were classified according to breed, age, sex, neuter status and place of residence. The diagnostic data were correlated with data on the Swiss general dog population and the incidence of cancer in dogs was thus investigated. A total of 67,943 tumours were diagnosed in 121,963 dogs and 47.07% of these were malignant. The most common tumour location was the skin (37.05%), followed by mammary glands (23.55%) and soft tissue (13.66%). The most common tumour diagnoses were epithelial (38.45%), mesenchymal (35.10%) and lymphoid tumours (13.23%). The results are compared with data in other canine registries and similarities in tumour distribution and incidence are noted. It is hoped that this study will mark the beginning of continuous registration of dog tumours in Switzerland, which, in turn, will serve as a reference for research in the fields of animal and human oncology.

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Introduction

Cancer is a leading cause of death in man and dogs (Pinho *et al.*, 2012); however, current medical research is hampered by the complex biology of the disease. Murine cancer models are highly standardized and have contributed tremendously to knowledge of cancer mechanisms and treatment regimes, but such models are often limited in representing spe-

cific aspects of spontaneously arising human cancer such as long time latency, recurrence and metastasis (Porello *et al.*, 2006; Thamm and Dow, 2009; Martić-Kehl *et al.*, 2012; Ranieri *et al.*, 2013). Such information is best derived from cancer registries, which provide data on the epidemiology of cancer over space and time. In many countries, human cancer registration has been practiced since the 1940s (Bronden *et al.*, 2007).

Companion animal cancer registries were introduced in the 1960s, following increasing mortality

Correspondence to: A. Pospischil (e-mail: apos@vetpath.uzh.ch).

due to spontaneously arising tumours. The study of companion animal tumours offers benefits not only for animal epidemiology, but also for comparative epidemiological, pathogenic and therapeutic research. Companion animals have a life span that allows them to develop tumours resembling equivalent human cancers in their morphology and biological behaviour. Companion animals also benefit from oncological therapies that are used in human medicine. Companion animals share the same environment as their owners and can therefore act as sentinels for recognition of environmental factors implicated in oncogenesis (Bukowski and Wartenberg, 1997; Backer *et al.*, 2001; Gamlem *et al.*, 2008; Marconato *et al.*, 2009; Bettini *et al.*, 2010). Companion animals, and dogs in particular, share significantly more of their genome with man than do rodents (Pinho *et al.*, 2012). Therefore, investigations of spontaneously arising cancer in dogs can provide a partial alternative to animal testing (Bukowski and Wartenberg, 1997; Thamm and Dow, 2009).

In the 1960s and 1970s three population-based animal registries were reported in the USA: the California Animal Neoplasm Registry (1963–1966; Dorn, 1967), the Kansas University Neoplasm Registry (1961–1971; Strafuss, 1976) and the Tulsa Registry of Canine and Feline Neoplasms (1972–1977; MacVean *et al.*, 1978). Since the late 1980s several animal cancer registries have been established and are still being updated: the Purdue Comparative Oncology Program (since 1979; Purdue Comparative Oncology Program, 2006), the Cancer Registry and Surveillance System for Companion Animals, Cornell (since 1980; Page, 2004), the Animal Tumour Registry of Genoa (since 1985; Merlo *et al.*, 2008), the Norwegian Cancer Project (since 1990; Gamlem *et al.*, 2008), the VetCancer Registry (since 1994; Brønden *et al.*, 2007), the Registry on Canine Tumours in Sweden/Agria (since 1995; Egenvall *et al.*, 2011), the Danish Veterinary Cancer Registry (since 2005; Brønden *et al.*, 2010), the Animal Tumour Registry of the Vicenza and Venice provinces (since 2009; Vascellari *et al.*, 2009) and the Guelph Companion Animal Cancer Epidemiologic Registry (since 2010; Nødtvedt *et al.*, 2011).

The Swiss Canine Cancer Registry (1955–2008) was assembled as part of the project ‘One Medicine – One Oncology: Incidence and Geographic Distribution of Companion Animal Cancer in Switzerland, 1955–2008’. Additionally, the project benefits from information about the general canine population at risk, since microchipping and registration of dogs in Switzerland has been compulsory since 2006. The general dog population was surveyed with an accu-

racy reaching 95% in 2008 (personal information, Gesellschaft Schweizer Tierärztinnen und Tierärzte, the Swiss Society of Veterinarians). These latest data, together with data originating from previous research on the Swiss general dog population, allows data in the registry to be analysed against the background of the total population of dogs in Switzerland (Pospischil *et al.*, 2013).

The aim of this paper is to present the Swiss Canine Cancer Registry, which was compiled between 1955 and 2008. Data consists of pathology diagnostic records issued by three veterinary diagnostic laboratories in Switzerland. The tumours were classified according to the guidelines of the International Classification of Oncology for Humans (ICD-O-3) on the basis of tumour type, malignancy and body location (WHO, 2013). The dogs were classified according to breed, age, sex, neuter status and place of residence. The analysis provides a retrospective overview of the incidence of malignant and benign neoplasms in the Swiss canine population. The findings are related to the general dog population and the tumours are characterized by type, biological behaviour, body location, age of animal and diagnostic method.

Materials and Methods

Data Source

The dog tumour registry comprises 121,963 diagnostic records provided by three veterinary diagnostic laboratories in Switzerland: the Vetsuisse Faculty, Institut für Veterinärpathologie, Zürich (IVPZ), the Institut für Tierpathologie, Bern (ITP) and the Zyto-Histo Diagnostics private veterinary diagnostic laboratory (based in Rorbas Freienstein).

The IVPZ provided three sets of diagnostic records ($n = 97,759$; 1955–2008) from canine post-mortem, biopsy and cytology samples. The datasets originated from three time periods during the history of this institution. The IVPZ-GL (1955–1964) provided 3,797 records from canine post-mortem samples. These records were originally handwritten documents that were later digitized in an Excel file. The IVPZ-SLK (1964–1988) provided 33,100 records from canine post-mortem and biopsy samples. These records were originally transcribed onto punch cards using diagnostic key words (Keydex, Fa. Royal McBee; Stünzi and Lott-Stolz, 1967) and were digitized by Scydoc, an external company based in Zug, Switzerland. The results were crosschecked using the original typed reports. The IVPZ-APPX (1987–2008) provided 60,862 records from canine post-mortem, biopsy and cytology samples. The records were stored in the electronic patient record

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