



DISEASE IN WILDLIFE OR EXOTIC SPECIES

Cutaneous and Subcutaneous Soft Tissue Tumours in Snakes: A Retrospective Study of 33 Cases

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Summary

Cutaneous and subcutaneous soft tissue tumours have been rarely described in detail in snakes. Several malignant entities show strikingly similar histological patterns and therefore the term soft tissue sarcoma (STS) has become a standard histopathological diagnosis. The present study characterizes soft tissue tumours in 33 snakes. Samples included 29 surgically excised masses and four carcasses. Additionally, six animals were humanely destroyed and submitted for necropsy examination following tumour recurrence. Benign neoplasms ($n = 8$) were described as lipomas of varying differentiation. Recurrence was observed in two of five snakes in which the clinical course was recorded. Malignant neoplasms ($n = 25$) were diagnosed as STS and graded according to a three-point system previously applied to canine STS. Five (20%) of the primary tumours were classified as grade 1, eleven (44%) as grade 2 and nine (36%) as grade 3 sarcomas. Clinically, recurrence of STS was observed in 11 of 17 cases with available follow-up information. Pathologically, multiple cutaneous metastases were found in one grass snake (*Natrix natrix*), while visceral metastases were observed in one carpet python (*Morelia spilota*) and two corn snakes (*Pantherophis guttatus*). Metastatic risk appears to increase with histological grade. Surgical excision generally represents the current therapy of choice for STS. This study includes the first reports of conventional lipomas in a ribbon snake (*Thamnophis radix*), angioliipomas in a black-headed python (*Aspidites melanocephalus*) and a corn snake as well as of STS in a Jamaican boa (*Epicrates subflavus*), emerald tree boa (*Corallus caninus*), grass snake (*N. natrix*), African house snake (*Lamprophis fuliginosus*), California kingsnake (*Lampropeltis getula californiae*) and common garter snake (*Thamnophis sirtalis*).

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Introduction

Reptiles are popular pets and the medical care of these animals is an important activity in veterinary medicine. There are varying reports on the incidence of neoplasia in reptiles. Several authors have reported that neoplasia accounts for 0.5–9.8% of all pathological conditions diagnosed in these animals, with the lower numbers found in older literature (Effron *et al.*, 1977; Ippen and Schröder, 1977; Garner *et al.*, 2004; Sinn, 2004). Snakes (Serpentes) are generally thought to be affected most frequently (Effron *et al.*,

1977; Garner *et al.*, 2004; Sinn, 2004). Cutaneous and subcutaneous soft tissue tumours have only been described sporadically in snakes. Therefore, comprehensive reports with detailed clinical and histopathological descriptions are rare.

Benign soft tissue tumours have been reported in various species of snakes and include several lipomas (Burkert *et al.*, 2002; Cassali *et al.*, 2004; Garner *et al.*, 2004; Mauldin and Done, 2006), two haemangiomas (Hubbard and Fletcher, 1982; Garner *et al.*, 2004), two fibromas (Effron *et al.*, 1977; Ippen and Schröder, 1977), one myxoma (Barten and Frye, 1981) and one rhabdomyoma (Ippen and Schröder, 1977). Corn snakes

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(*Pantherophis guttatus*) are considered to be overrepresented for the occurrence of lipomas (Burkert *et al.*, 2002; Garner *et al.*, 2004; Mauldin and Done, 2006).

Documented malignant tumour types include several fibrosarcomas (Effron *et al.*, 1977; Ippen and Schröder, 1977; Catao-Dias and Nichols, 1999; Chandra *et al.*, 2001; Garner *et al.*, 2004; Mauldin and Done, 2006; Orós *et al.*, 2009), few myxosarcomas (Garner *et al.*, 2004; Mauldin and Done, 2006), few malignant peripheral nerve sheath tumours or neurofibrosarcomas (Effron *et al.*, 1977; Ramis *et al.*, 1998; Garner *et al.*, 2004), few rhabdomyosarcomas (Ippen and Schröder, 1977; Catao-Dias and Nichols, 1999; Garner *et al.*, 2004), few sarcomas of unknown origin (Ippen and Schröder, 1977; Marcello *et al.*, 2002; Mauldin and Done, 2006), a single liposarcoma (Reavill *et al.*, 2002) as well as a single haemangioendothelioma (Mauldin and Done, 2006). In the largest retrospective study of the occurrence of neoplasia in reptiles, fibrosarcoma appeared to be especially prevalent in colubrids and boids, while multiple neoplasms were diagnosed as soft tissue sarcomas (STSs) (Garner *et al.*, 2004). These STSs made up the majority of all detected neoplasms ($n = 41$). Approximately one-third of those tumours were located in the skin or subcutaneous tissue, with a higher prevalence in colubrids and crotalids.

The term STS is commonly used in veterinary and human medicine (Coindre, 2006; McSporran, 2009; Dennis *et al.*, 2011) to describe several predominantly spindle cell mesenchymal tumours, presumably containing a spectrum of fibrosarcomas, myxosarcomas, neurofibrosarcomas, leiomyosarcomas, rhabdomyosarcomas and amelanotic melanomas (Garner *et al.*, 2004). These entities may show strikingly similar histological patterns, which makes them hard to distinguish when using only light microscopy. The low-grade STSs also share a biological behaviour that is considered to reflect low malignant potential, based on frequent recurrence and rare distant metastasis (McSporran, 2009). In general, soft tissue tumours are a heterogeneous group of neoplasms, ranging from lesions that are proposed to be reactive to highly malignant processes (Hendrick *et al.*, 1998).

In order to provide an accurate prognosis for human STSs, several grading schemes have been developed (Russell *et al.*, 1977; Fletcher *et al.*, 2002). In veterinary medicine, the system developed by Trojani *et al.* (1984) has become the most commonly used in dogs (McSporran, 2009; Dennis *et al.*, 2011), but this system has not been applied previously to a large number of reptiles.

Since reports of soft tissue tumours in reptiles are rare and often sparsely detailed compared with domestic animals, the purpose of this retrospective study was to characterize and compare the gross and histological features, as well as the clinical outcome, of cutaneous and subcutaneous soft tissue tumours in 33 snakes.

Materials and Methods

Animals

An archive of 392 reptilian neoplasms provided the basis for the current study. This collection contained 109 snake lesions, which were sorted by diagnosis and scanned for cutaneous and subcutaneous soft tissue tumours. Neoplasms from 33 snakes were selected for the analysis. All specimens were submitted to LABOKLIN GmbH & Co. KG for histopathological examination within a period of 12 years (2002–2014). If available, information on recurrence and metastasis was obtained retrospectively. In all cases, the snakes were presented initially to the clinicians due to skin masses that had first been noticed up to several weeks earlier. Affected animals included 18 corn snakes (*P. guttatus*), five boa constrictors (*Boa constrictor* ssp.) as well as snakes of 10 other species (Table 1). Categorization of animals as adults (Table 1) was based on clinical anamnestic information. Twenty-nine masses were surgically excised, fixed in 4% neutral buffered formalin and submitted for histopathological examination. Six snakes were humanely destroyed between 3 weeks and 26 months after initial histopathological diagnosis and the carcasses were submitted for necropsy examination. In addition, four snakes were submitted for post-mortem examination without previous histopathological examination. Necropsy examination comprised gross examination with special focus on tumour growth and metastasis and collection and fixation of representative samples.

Histopathology

Samples were processed routinely and embedded in paraffin wax. Sections were stained with haematoxylin and eosin (HE). The histological examination was performed by the first author (JD) and verified in blinded fashion by two veterinary pathologists (KH, HA) with several years of experience in reptile pathology. Diagnosis was made according to the histological features of soft tissue tumours listed by the World Health Organization for Veterinary Medicine (Hendrick *et al.*, 1998), with a special focus on growth pattern, tumour cell density, configuration of nuclei and nucleoli, quality and quantity of tumour matrix,

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