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Avian Lumps and Bumps: Clinical and Histological Findings Associated with Avian Tumours, a Preliminary Review

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Introduction

Whilst there are a number of individual case reports of neoplasia in a variety avian species, limited information reviewing the prevalence of tumours in birds is available (e.g. Reece, 1992; Reavill, 2004; Nemeth *et al.*, 2016); and even when available they generally relates to the occurrence of neoplasia within a particular group of birds (e.g. chickens, Campbell, 1969 & 1982, Reece, 1996; ducks, Rigadon, 1972). This presentation will summarise preliminary data regarding the clinical and histological findings associated with naturally occurring solid tumours in birds presenting to an avian veterinary practice in Melbourne, Victoria.

Materials and Methods

Over a 2.5-year period (December 2014-May 2016) 49 patients with clinically suspected neoplasia had samples of naturally occurring tumours submitted for histopathology (ASAP Laboratories, Mulgrave, Victoria) for review by a single pathologist (RP). Of these, 37 were post mortem samples taken at autopsy and 12 were tissue samples submitted from surgical biopsies. The clinical histories of the patients were compiled and presenting signs were compared with the histopathological diagnoses.

Results

Suspected neoplasms were submitted from 49 birds. Of this group, 25 were psittacine birds (51%; comprising 13 budgerigars, 5 cockatiels, two Sulphur-crested Cockatoos, one princess parrot, one alexandrine parakeet, one galah, one rainbow lorikeet and one superb parrot); 18 were chickens (37%); four were ducks (8%), one passerine bird (2%; a canary) and one pigeon (2%) were included.

33 of the 49 samples (67%) examined were histologically confirmed as neoplasms. A total of 26 types of neoplasm in 10 species were identified, comprising 16 psittacine birds, 11 chickens, 4 ducks, one passerine bird, and one pigeon (Table 1). Overall, 90% (n=30) of the tumours examined were determined to be malignant and 10% (n=3) were benign.

During the study period, a total of 2506 individual patients were seen by the practice. These comprised 482 budgerigars, 356 cockatiels, 106 sulphur crested cockatoos, 14 princess parrots, 34 Alexandrine parakeets, 74 galahs, 122 rainbow lorikeets, two superb parrots, 466 chickens, 41 ducks, 85 canaries, and 40 pigeons. A total of 684 birds of other species were seen during the study period; neoplasms were not identified in these individuals or species. The overall prevalence of neoplasia in the study population (n=1822) was 1.8%, broken down for individual orders as follows: psittacine birds 7.7%; passerine birds 1.1%; galliformes 2.4%; anseriformes 9.8%; and columbidae 2.5%.

Neoplasm incidence by body system and species

A summary of the incidence of neoplasms according to the body system and avian order affected is shown in Figure 1.

The reproductive tract was the most commonly affected body system by neoplastic disease processes (Figure 1). 31% (n=10) of neoplasms identified oc-

curred primarily within the reproductive tract. Oviductal adenocarcinoma was the most common tumour of the reproductive tract (30%; n=3), and the most commonly identified tumour in female birds overall. Ovarian adenocarcinoma (n=1), oviductal leiomyosarcoma (n=1) and ovarian lymphoma (n=1) were also detected. In male birds, Sertoli cell tumours (20%; n=2) were the most commonly identified reproductive neoplasm. A Leydig cell tumour (n=1) and a seminoma (n=1) were also identified. Of the ten reproductive system tumours identified, three (two oviductal adenocarcinomas and one ovarian lymphoma) occurred in chickens; three (two Sertoli cell tumours and one ovarian adenocarcinoma) occurred in ducks; two (one Leydig cell tumour and one ovarian leiomyosarcoma) occurred in budgerigars; one (an ovarian adenocarcinoma) occurred in a sulphur crested cockatoo; and one (a semino-

Species	Age Years)	Sex	Body System/Organ Affected	Clinical Presentation	Histological Diagnosis
Budgerigar (*Melopsittacus undulatus*)	6	F	Renal	Leg paresis	Renal carcinoma
Chicken (*Gallus gallus domesticus*)	3	F	Renal	Lameness	Renal lymphoma
Budgerigar	4	M	Reproductive	Leg paresis	Leydig cell tumour
Budgerigar	8	F	Reproductive	Coelomic distension Dyspnoea	Oviductal leiomyosarcoma
Chicken	6	F	Reproductive	Lethargy Soft shelled eggs	Oviductal adenocarcinoma with carcinomatosis
Chicken	1	F	Reproductive	Inappetance Coelomic distension	Oviductal adenocarcinoma with carcinomatosis
Chicken	4	F	Reproductive	Lethargy Loose faeces Crop distension	Ovarian lymphoma
Sulphur Crested Cockatoo (*Cacatua galerita*)	33	F	Reproductive	Loose faeces Coelomic distension	Ovarian adenocarcinoma
Alexandrine parakeet (*Psittacula eupatria*)	15	M	Reproductive	Dyspnoea Coelomic distension Collapse (haemabdomen)	Seminoma
Duck (*Anas platyrhynchos*)	8	M	Reproductive	Weight loss Lethargy Inappetance	Bilateral Sertoli cell tumour; liver metastasis
Duck	11	M	Reproductive	Weight loss Lethargy Inappetance	Bilateral Sertoli cell tumour
Duck	4	F	Reproductive	Coelomic distension	Ovarian adenocarcinoma
Chicken	2	F	GIT	Dyspnoea Coelomic distension Inappetance	Intestinal carcinomatosis with reproductive tract spread
Chicken	3	F	GIT	Coelomic distension Lethargy	Intestinal adenocarcinoma with carcinomatosis
Chicken	3	F	GIT	Coelomic distension Soft shelled eggs	Intestinal adenocarcinoma with carcinomatosis
Duck	17	F	GIT	Pallor Polydipsia Inappetance	Intestinal adenocarcinoma with carcinomatosis

Species	Age (Years)	Sex	Body System/Organ Affected	Clinical Presentation	Histological Diagnosis
Chicken	1.5	F	Pancreas	Regurgitation Blood in faeces Crop distension Inappetance	Pancreatic carcinoma
Chicken	2	F	Pancreas	Lethargy	Pancreatic carcinoma
Budgerigar	8	M	Integument	Ulcerated mass (neck)	Basal cell tumour
Budgerigar	6	M	Integument	Ulcerated mass (neck)	Cutaneous lymphoma
Budgerigar	10	M	Integument	Ulcerated masses (multiple, diffuse)	Cutaneous lymphoma
Budgerigar	1.5	M	Integument	Enlarged, ulcerated uropygial gland	Squamous cell carcinoma
Superb parrot (*Polytelis swainsonii*)	8	M	Integument	Ulcerated mass (inguinal region)	Sarcoma (unknown origin)
Canary (*Serinus canaria domestica*)	3	M	Integument	Mass on carpus	Fibrosarcoma
Galah (*Eolophus roseicapilla*)	23	M	Integument	Ulcerated mass (inguinal region)	Lipoma
Cockatiel (*Nymphicus hollandicus*)	9	M	Ocular/Respiratory	Sneezing Ocular discharge Exophthalmos	Lacrimal/nasal sinus carcinoma
Chicken	7 weeks	F	Respiratory	Sudden death	Lymphoma (lung)
Cockatiel	13.5	M	Liver	Lethargy Dyspnoea	Hepatocellular carcinoma
Budgerigar	8.5	M	Spleen	Lethargy Polyuria Coelomic distension	Sarcoma (probable haemangiosarcoma)
Pigeon (*Columba livia*)	12	F	Musculoskeletal	Leg mass	Sarcoma (probable Rhabdomyosarcoma)
Budgerigar	11	F	Musculoskeletal	Respiratory noise Subcutaneous mass (neck region) Wing droop	Sarcoma (probable Rhabdomyosarcoma)
Chicken	0.5	F	Thyroid	Neck mass	Lymphoma (thyroid)
Budgerigar	7	M	Thyroid	Respiratory noise	Adenoma

Table 1: Summary of neoplasms detected in 33 birds from an avian veterinary practice in Melbourne, Victoria from January 2014 to May 2016

ma) occurred in an Alexandrine parakeet (Table 1). Tumours affecting the integument were the second most frequently observed type of neoplasm, with an incidence of 21.2% (n=7) (Figure 1). Six different neoplasms affecting the skin were identified; four were malignant. Cutaneous lymphoma was identified in two birds, with one case of squamous cell carcinoma, a fibrosarcoma, an anaplastic sarcoma, a lipoma and a follicular cyst identified, respectively. Skin neoplasms were most commonly identified in bud-

gerigars, with 57% of the identified skin tumours occurring in this species. Both incidences of cutaneous lymphoma occurred in budgerigars, as well as one uropygial gland squamous cell carcinoma and one basal cell tumour (feather folliculoma). One lipoma was identified in a galah and a cutaneous fibrosarcoma was detected in a canary. In addition, an anaplastic sarcoma of undeterminable histogenesis was identified in a superb parrot.

The gastrointestinal tract (GIT) was the third most common organ system affected by neoplasia in this study, comprising 12% of the total. A total of four neoplasms affecting the gastrointestinal tract were identified; all were malignant and were seen in chickens and ducks (Figure 1). These comprised three cases of intestinal adenocarcinoma and one case of carcinomatosis of GIT origin (i.e. a presumed intestinal adenocarcinoma, with spread throughout the coelomic cavity). Two cases (6%) of pancreatic carcinoma were also identified; both occurred in chickens (Table 1).

Two birds with tumours involving the kidneys were identified, comprising 6% of the total number of neoplasms. One of these was a carcinoma in a budgerigar, the other a lymphoma in a chicken.

A further 6% of the overall tumours identified comprised neoplasms affecting the musculoskeletal system (n=2). Whilst the musculoskeletal tumours identified were both sarcomas and likely to be of skeletal muscle origin (rhabdomyosarcomas), one occurred in a pigeon, and the other in a budgerigar. In the budgerigar, the malignancy was present throughout the dermis and subcutis, disrupted the skeletal muscles and bone, and was present throughout the medullary cavity as well as surrounding and infiltrating the aorta (Table 1).

The thyroid gland was involved in two cases examined in this study (6%). A single case of thyroid adenoma was identified in a budgerigar, and a case of lymphoma involving the thyroid gland was detected in a chicken.

Chickens were the only species affected by neoplasia of the respiratory system, accounting for 3% of the overall tumours detected. A single case of lymphoma involving the lung was detected. Additionally, a single case of carcinoma affecting the eye and nasal sinus of a cockatiel was identified.

A single tumour affecting the liver was identified, comprising 3% of the overall neoplasms identified.

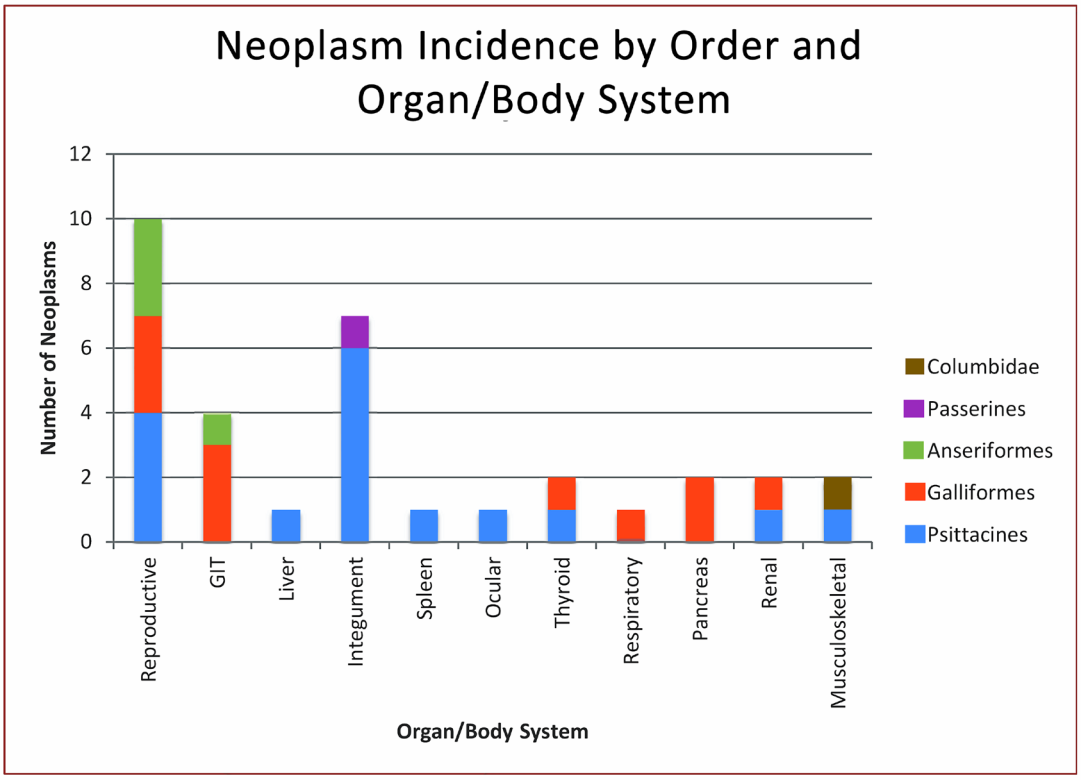

Figure 1: Incidence of neoplasms detected in 33 birds with tissue samples submitted for histopathology at an avian veterinary practice in Melbourne, Victoria, January 2014 to May 2016, by Order and body system

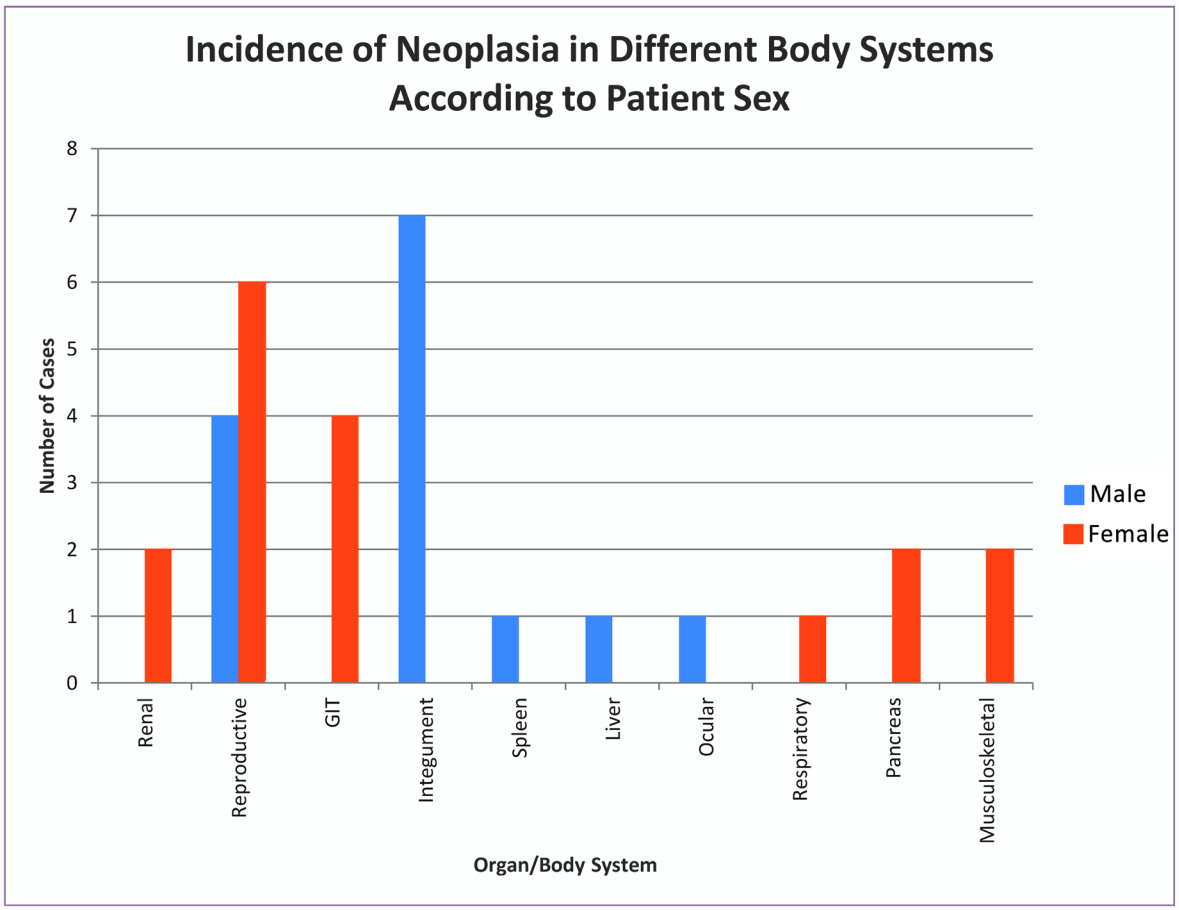

Figure 2: Incidence of neoplasia according to body system affected in 33 birds with tissues submitted for histopathology at an avian veterinary practice in Melbourne, Victoria, January 2014 to May 2016, by sex

This was a hepatocellular carcinoma in a cockatiel.

Effect of Sex

Female birds represented 18 of the 33 tumours identified on histopathology (54.5%), with 15 tumours identified in male birds (45.5%). Of the 15 samples where no neoplastic process was identified, 10 (66.7%) were female and 5 (33.3%) were male. In the case where the tissue sample was too necrotic to identify whether a neoplastic process was present, the bird was female.

Only reproductive neoplasia was present in both female and male birds (Figure 2), with all other neoplasms affecting only one sex. Musculoskeletal, pancreatic, respiratory, GIT and renal tumours only occurred in female birds in the study population, whilst integumentary, ocular, liver, and splenic neoplasms were only seen in male birds (Figure 2). Reproductive tract neoplasia was the most common form of neoplasia seen in female birds (33.3%; n=6), and tumours of the integument were the most prevalent neoplasms in male birds (46.6%; n=7).

Clinical signs associated with neoplasms

17 of the 33 birds displayed multiple clinical signs associated with a single neoplastic process. Coelomic distension (with or without ascites) was the most common clinical sign shown by the birds assessed in this study, and was present in 10 birds (30%). Coelomic distension was shown by 50% of birds (n=5) with reproductive tract tumours, 75% of birds (n=3) with GIT tumours, 50% of birds (n=1) with pancreatic tumours and in the single case of splenic neoplasia.

Ulcerated skin masses were associated with 6 of the 7 (86%) integumentary tumours documented. In 4 of these cases the tumours identified were malignant (cutaneous lymphoma, squamous cell carcinoma and anaplastic sarcoma), whilst two birds demonstrated ulcerated skin masses associated with benign processes (one basal cell tumour/feather folliculoma

and one lipoma).

Inappetence was a clinical feature associated with neoplasia in 6 of the 33 birds (18%). Inappetence was shown by 30% of birds with reproductive tract tumours (n=3), 50% of birds with GIT neoplasms (n=2) and 50% of birds with pancreatic neoplasms (n=2).

Dyspnoea was present in four birds and was associated with reproductive tract neoplasia (n=2), gastrointestinal neoplasia (n=1) and liver neoplasia (n=1).

Soft-shelled eggs were seen in 2 birds, and were associated with both reproductive tract (n=1) and GIT (n=1) neoplasia. Additionally, changes to the faecal component of the droppings (either loose faeces or the presence of blood in the faeces) were associated with 20% (n=2) of reproductive tract and 50% (n=1) of pancreatic neoplasms, but were not seen in any of the cases of GIT neoplasia.

Lameness or leg paresis was seen in 9% (n=3) of birds, and was associated with both cases of renal neoplasia and 1 case (10%) of reproductive tract neoplasia. Musculoskeletal tumours were associated with the presence of a subcutaneous mass, present in both cases documented.

Polydipsia was seen in one case of GIT neoplasia. Polyuria was identified in one bird, associated with a splenic neoplasm.

Clinical signs associated with the tumour of the ocular/nasolacrimal region included exophthalmos and sneezing. An audible respiratory noise was present in two patients, associated with a thyroid adenoma and a sarcoma affecting the muscles of the proximal wing and pectoral girdle, respectively.

Non-specific signs associated with the gastrointestinal tract included regurgitation and crop distension. Crop distension was seen in one patient, associated with a reproductive tract tumour. Regurgitation was also identified in a single bird, associated with a pancreatic carcinoma. Generalised non-specific clinical signs noted in patients with neoplasia in this study included lethargy, weight loss and pallor. Lethargy was shown by 6% (n=2) of patients, and was seen in one patient with a tumour of the reproductive tract, and one patient with a splenic tumour, respectively. Weight loss also was seen in 6% (n=2) of patients, and was associated with reproductive tract neoplasia in both cases. Pallor was demonstrated by one patient with a gastrointestinal tract tumour.

A single patient presented collapsed. This was associated with a seminoma with intracoelomic haemorrhage. Sudden death was noted in one case, and was associated with a lymphoma affecting the lung.

Discussion

This report presents preliminary findings of a study investigating the incidence of naturally occurring neoplasms in pet and aviary birds presented to an avian veterinary practice in Melbourne, Victoria. One of its major limitations is the low number of samples included in the study. In addition, due to constraints associated with owner wishes (e.g. permission for autopsy in dead or euthanized birds, and permission to submit surgical biopsies for histopathology), the data presented likely represent and under estimation of the true incidence of neoplasia in the birds presented to this practice. Therefore, it has not been possible to estimate true prevalence of the neoplasms detected. Work is ongoing to expand on our existing findings.

The overall prevalence of neoplasia in the study population was 1.8% (n=1822). Neoplasia was diagnosed in 33 birds (67% of total submissions) of 10 species, with 90% deemed malignant. Few studies on the prevalence of neoplasia in birds are available, but this represents a lower prevalence of neoplasia compared to previous reports (9%; Nemeth et al. 2016). However, our population had a higher incidence of malignancy compared to previous work (79%; Nemeth et al. 2016). This may represent differences in the avian population between the USA and Australia, or may associated with the smaller sample size of this study.

Our data suggest that overall incidence of neoplasia in the study population was slightly higher in female birds compared to male birds. Neoplasia of the reproductive tract was the only form of neoplasia present in both sexes in this study. Whilst our data suggest that musculoskeletal, pancreatic, respiratory, GIT and renal tumours were more common in female birds, and neoplasia of the integument, eye, liver, and spleen were more common in male birds, this likely represents the low number of birds with these tumours detected (often just a single bird) rather than an overall sex predilection within study population.

In this study, neoplasms of the reproductive tract

were the most common type of neoplasia detected. A variety of neoplasms in both male and female birds were described, including Leydig cell tumours, seminomas, and Sertoli cell tumours in male birds; and ovarian and oviductal adenocarcinoma, oviductal leiomyosarcoma and ovarian lymphoma in female birds. The most common type of reproductive tract tumour identified was oviductal adenocarcinoma, followed by Sertoli cell testicular tumours. Previous reports (Latimer, 1994; Schmidt et al., 2015) have described that granulosa cell tumours are the most common ovarian neoplasm in companion birds, but in the present study the only ovarian tumour detected was an adenocarcinoma. Our results were in partial agreement with earlier work suggesting that ovarian and oviductal neoplasms were most common in budgerigars, cockatiels, and gallinaceous birds (Bowles, 2002; Reavill, 2004); in the present study there were no incidences of reproductive tract tumours in cockatiels. Additionally, ducks comprised a significant proportion (30%) of the overall reported number of reproductive tract neoplasms in the present study. In a survey of naturally occurring neoplasms in birds in Victoria, Reece (1992) reported 15 cases of reproductive tract neoplasia, of which 3 (20%) were ducks. This difference may represent the distinction between the two populations of birds studied, with the earlier work focusing on both wild and domestic birds presenting to a pathology laboratory, excluding chickens, whilst the present report represents a pet and aviary bird population. In commercial fowl, Reece (1996) determined a prevalence of 5.6% of non-lymphoid reproductive neoplasms, which is comparable to the 6% determined in the present study.

Tumours affecting the integument were the second most common form of neoplasia identified. Two cases of cutaneous lymphoma, a squamous cell carcinoma of the uropygial gland, a fibrosarcoma, a lipoma and an anaplastic sarcoma (of unknown histiogenesis), were detected. Reece (1992) documented that lipomas and liposarcomas were the third most prevalent type of tumour in 383 birds examined, compared with an incidence of 3% of lipomas in the current study. The most common clinical sign associated with both benign and malignant skin neoplasia in this study was the presence of a bleeding or ulcerated dermal mass. Clinicians should therefore be aware that that ulceration of a mass does not always indicate a malignant process, and therefore should not be used as a prognostic indicator. Our results are consistent with previous findings that tumours of the integument are common in birds, with a prevalence of up to 70% in some studies (Latimer, 1994).

Renal tumours were reported in a budgerigar and a chicken, both of which presented with unilateral or bilateral lameness or leg paresis. Renal adenocarcinoma is a well recognised neoplastic condition of budgerigars (Reavill, 2004). Reavill (2004) also reported that unilateral lameness was more commonly associated with renal tumours in budgerigars, along with regurgitation/vomiting and weight loss. In the present study, the chief clinical finding was bilateral leg paresis, without any weight loss or associated GIT signs. See below for a discussion on the occurrence of avian lymphoma.

All cases of GIT neoplasia reported in this study were intestinal adenocarcinomas, with evidence of transcoelomic spread/carcinomatosis. All cases of GIT neoplasia and both cases of pancreatic carcinoma were documented in chickens. In all cases, coelomic distension (in some cases with ascites) was a primary presenting sign. Dyspnoea was also often associated with GIT or pancreatic tumours, and likely represented the enlarged GIT acting as a space occupying lesion within the coelomic cavity and reducing airsac motion. Carcinomatosis, the seeding of the thoraco-coelomic cavity with neoplastic cells that subsequently proliferate, was present in all cases of intestinal adenocarcinoma reported, as well as in two cases of oviductal carcinoma. This is consistent with previous reports documenting the occurrence of carcinomatosis associated with adenocarcinomas of the reproductive tract, intestines and pancreas (Latimer, 1994).

Rhabdomyosarcomas were suspected for both cases of musculoskeletal system tumours in this study. These cases were diagnosed on the basis of cytomorphology alone; immunohistochemistry was not performed. Previous reports have described this tumour as rare in pet birds (Reavill, 2004), and there is one reported case in a pigeon (Fernandez-Bellon et al., 2003). Typical clinical signs associated with these tumours include the presence of a mass on the affected appendage that may limit limb mobility (Turell et al., 1987; Fernandez-Bellon et al., 2003). Whilst this typical appearance was demonstrated in the pigeon, the budgerigar in this report presented for an acute onset of inspiratory stridor. Radiographs revealed an invasive process causing osteolytic bone lesions in the humerus. This was confirmed on histopathology where the tumour had infiltrated into the overlying skin, bone and cardiac tissue. The inspiratory stridor resulted from external compression of

the syrinx by the tumour. Whilst uncommon in birds, rhabdomyosarcomas should be included in the differential diagnoses for both the typical and atypical clinical signs as documented in this report.

Hepatic carcinomas have been reported in several species of birds (Freeman et al., 1999), and were documented in five Australian species (a quail, a canary, a lorikeet, a lovebird and a parrot of undocumented species) by Reece (1992). There are no confirmed reports of this tumour in cockatiels. The primary clinical signs associated with the presence of the hepatocellular carcinoma were lethargy and dyspnoea, likely associated with the space-occupying effects of the enlarged liver within the coelomic cavity.

Nasal/sinus adenocarcinoma with ocular infiltration was reported in a single cockatiel. Typical clinical signs associated with this tumour include distortion of the head, exophthalmos, sneezing and nasal/ocular discharge (Reavill, 2004), of which sneezing, exophthalmos and ocular discharge were demonstrated by our patient.

In this study, a single incidence of a thyroid adenoma was present in a budgerigar, and a single case of lymphoma with thyroid involvement in a chicken was described, corresponding to the rarity of these neoplasms in birds (Wadsworth and Jones, 1979). Thyroid adenomas and adenocarcinomas have been described as the primary type of neoplasms affecting the thyroid glands of birds (Wadsworth and Jones, 1979; Reece, 1992; Reavill, 2004; Schmidt et al., 2015). The thyroid gland may also be involved as part of a multicentric lymphoma (Reavill, 2004) (see below). Reavill (2004) reported that thyroid adenomas were more common than malignant tumours, and were commonly clinically associated with an inspiratory wheeze or click, as occurred in the case described. This noise is a response to the unilateral swelling of the affected gland impinging on the respiratory tract. Reavill (2004) also reported that regurgitation may be associated with thyroid tumours in birds, but this was not seen in either case in the present study. Previous work has identified thyroid neoplasia as most common in budgerigars and cockatiels (Schmidt et al., 2015), which is supported by our findings.

An anaplastic sarcoma of the spleen (suspected to be haemangiosarcoma) was reported in a male budgerigar. Haemangiosarcomas are rarely described as affecting the spleen in birds, with the exception of budgerigars (Schmidt et al., 2015). The splenic enlargement caused by the tumour in this case resulted in clinically apparent dyspnoea.

Multicentric lymphoma is the most common lymphoma reported in psittacine and passerine birds (Reavill, 2004; Schmidt et al., 2015) and poultry (Campbell, 1969; Reece, 1996). Lymphoma in pet birds is generally characterised by diffuse or nodular involvement (Reavill, 2004; Schmidt et al., 2015). Commonly affected organs include the spleen, liver, kidneys, pancreas, skin, bone marrow, GIT, thyroid gland, oviduct, testes, brain, mesentery, trachea, fat and periorbital tissues (Schmidt et al., 2015). Lymphoid neoplasias have been reported in several species including budgerigars (Reavill, 2004), as supported by our findings. In poultry, lymphomas associated with herpesvirus (Marek's Disease) and retrovirus (leukosis) are extremely common in chickens (Campbell, 1969, 1982; Reece, 1996), but there is no evidence to support a viral aetiology for lymphoma in companion birds (Schmidt et al., 2015). Reece (1996) found an 80% prevalence (n=2281) of lymphoma in domestic fowl, and in the same survey found only a single case of intestinal adenocarcinoma and three cases of pancreatic adenocarcinoma. This is in contrast to our findings suggesting that intestinal adenocarcinoma is more common than lymphoma in chickens in the study population. This may represent bias due to the much lower sample size in our study, a change in prevalence in tumour types in chickens since earlier work, or a variation in tumour prevalence between commercial and domestic poultry populations.

Our data suggest that in avian practice, neoplastic processes affecting the GIT, reproductive tract, liver should be considered when presented with coelomic distension (with or without ascites) in a patient. Clinicians should also take into account that the occurrence of an audible respiratory noise may represent compression of the respiratory tract by an external mass, rather than a primary respiratory disease. Abnormalities of gait may be associated with tumours affecting the kidneys or reproductive tract, as well as primary musculoskeletal disorders. Additionally, signs traditionally associated with primary reproductive tract disease (including neoplasia) such as laying soft-shelled eggs, may represent GIT neoplasia, especially in poultry. Clinicians should be mindful that non-specific signs such as lethargy, inappetence and weight loss are frequently associated with neoplastic processes in birds.

As discussed, a wide variety of clinical signs may be

associated with the presence of neoplastic disease in avian patients. 30% of the tissue samples submitted as part of this project were not histologically classified as neoplasms, despite their gross appearance as suspected neoplastic processes. Histopathology is critical in the determination of whether a grossly apparent tumour is in fact a neoplasm, and if so whether the process is benign or malignant, although in some cases only post-mortem diagnosis will be possible. Clinicians should have a knowledge of the pathology of neoplasia in order to understand neoplastic conditions and the limitations of histopathological assessment with regards to neoplasia (Ehrhart et al., 2015). It is essential that clinicians and veterinary pathologists work together to determine the optimal treatments for their patients.

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