Pre-anaesthetic screening of geriatric dogs

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ABSTRACT

Pre-anaesthetic screening has been advocated as a valuable tool for improving anaesthetic safety and determining anaesthetic risk. This study was done determine whether pre-anaesthetic screening result in cancellation of anaesthesia and the diagnosis of new clinical conditions in geriatric dogs. One hundred and one dogs older than 7 years of age provided informed owner consent were included in the study. Each dog was weighed, and its temperature, pulse and respiration recorded. An abdominal palpation, examination of the mouth, including capillary refill time and mucous membranes, auscultation, body condition and habitus was performed and assessed. A cephalic catheter was placed and blood drawn for pre-anaesthetic testing. A micro-haematocrit tube was filled and the packed cell volume determined. The blood placed was in a test tube, centrifuged and then analysed on an in-house blood analyser. Alkaline phosphatase, alanine transferase, urea, creatinine, glucose and total protein were determined. A urine sample was then obtained by cystocentesis, catheterisation or free-flow for analysis. The urine specific gravity was determined with a refractometer. A small quantity of urine was then placed on a dip stick. Any new diagnoses made during the pre-anaesthetic screening were recorded. The average age of the dogs was 10.99 ± 2.44 years and the weight was 19.64 ± 15.78 kg. There were 13 dogs with pre-existing medical conditions. A total of 30 new diagnoses were made on the basis of the pre-anaesthetic screening. The most common conditions were neoplasia, chronic kidney disease and Cushing's disease. Of the 30 patients with a new diagnosis, 13 did not undergo anaesthesia as result of the new diagnosis. From this study it can be concluded that screening of geriatric patients is important and that sub-clinical disease could be present in nearly 30 % of these patients. The value of screening before anaesthesia is perhaps more questionable in terms of anaesthetic practice but it is an appropriate time to perform such an evaluation. The value of pre-anaesthetic screening in veterinary anaesthesia still needs to be evaluated in terms of appropriate outcome variables.

Key words: chronic kidney disease, Cushing's disease, dogs, geriatric, hyperadrenocorticism, neoplasia, pre-anaesthetic, screening.

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INTRODUCTION

In the 1960s and 1970s the impetus to use screening tests in human medicine started[7]. The assumption made was that frequent testing would allow the diagnosis of disease in the pre-clinical phase, allowing for early interventions and better control of disease[7]. The scientific evidence supporting this approach was largely lacking at the time[7]. Evidence does support the use of specific or selective tests but not broad screening tests as excessive testing results in the pre-anaesthetic setting[7]. Laboratory tests are not predictive of outcomes in anaesthesia[7].

The American Society of Anesthesiologists (ASA) has used evidence and outcomes models to establish practice guidelines[6,8]. These practice guidelines include guidelines for pre-anaesthetic screening[8]. When the ASA Task Force reviewed guidelines for pre-anaesthetic screening, a total of 1200 articles was found[8]. However, fewer than 200 articles qualified as original studies and fewer than 20 satisfied the criteria for evidence-based medicine[7,8]. In human medicine, battery testing has been used owing to a lack of clear definitions, insufficient information, the belief that voluminous information enhances safety and reduces physicians' liability[8].

In a human study of 19980 tests, only 2223 revealed abnormal values of which 223 resulted in further tests or a new diagnosis[8]. In another study of 2000 patients, only 0.22 % of tests conducted had an impact on peri-operative management[8]. It is therefore recommended in human medicine that tests should be carried out for conditions that are medically relevant using procedures that are highly sensitive and specific[8]. Tests should be performed on the expectation that the results will be relevant to anaesthesia and surgery[8] and that current medical conditions are optimally managed[7]. Criteria for the selection of a test are a positive clinical finding, the need for baseline values because of expected changes and to exclude important high-risk conditions that are prevalent[7]. Screening tests in asymptomatic patients should be performed for conditions that are reasonably prevalent and significant, with tests that have acceptable sensitivity and specificity[7].

In human medicine an increased risk of morbidity and mortality is seen in elderly patients with high ASA risk classification undergoing major or emergency surgery with large fluid shifts with co-existing disease (cardiac, renal, hepatic, diabetes) and poor functional capacity[4]. It has been proposed that the pre-anaesthetic assessment of geriatrics focuses on cardiac, pulmonary, renal and hepatic functioning[4].

With this in mind, the value of routine pre-anaesthetic screening in veterinary patients needs to be questioned. No veterinary articles dealing with the issue of pre-anaesthetic screening tests in geriatric patients could be found by the author. An abstract dealing with pre-anaesthetic screening of dog and cats of all ages has been presented[11]. This study was undertaken to determine the value of carrying out pre-anaesthetic screening tests in a veterinary private practice setting that routinely conducts these tests on geriatric patients. Two major aspects were evaluated: did the screening tests result in cancellation/postponement of anaesthesia and did the screening tests result in a new diagnosis.

MATERIALS AND METHODS

An observational study was carried out on a 101 consecutive canine patients presented to a private practice for anaesthesia. Patients were only included if they were 7 years or older and the owner had given informed consent for a pre-anaesthetic panel, urine analysis, packed cell volume (PCV) and anaesthesia. The pre-anaesthetic panel, urine analysis and PCV was hospital policy for all patients 7 years and older. No further ethical approval was

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required due to the observational nature of the study and that informed consent was obtained from the owners for all tests conducted on the patients.

At admittance of the patients into hospital, a signed consent form for the procedure, anaesthesia and pre-anaesthetic testing was obtained from the owner or owner's representative. During the admittance process the owner was asked if any medical conditions were present and if any concurrent medication was being administered to the dog. The answers were recorded on the admittance form along with any other specific request the owner may have had (pedicure, grooming, vaccination, etc). The dog was then weighed and admitted to the hospital for a clinical examination and laboratory tests. Temperature, pulse and respiration were measured and recorded. Abdominal palpation, examination of the mouth including capillary refill time and mucous membranes, auscultation, body condition and habitus were conducted and recorded. A cephalic catheter was placed and blood drawn for pre-anaesthetic testing. A micro-haematocrit tube was filled and the packed cell volume determined (StatSpin, InstaVet, Northriding). The blood placed in a test tube was centrifuged and then analysed on an in-house blood analyser (Vet-Test, Idexx, InstaVet). Alkaline phosphatase (ALP), alanine transferase (ALT), urea, creatinine, glucose and total protein (Pre-anaesthetic Panel, Idexx) were determined. A urine sample was then obtained by cystocentesis, catheterisation or free-flow for analysis. The urine specific gravity was determined with a refractometer (Refractometer, Hawksley, London). A small quantity of urine was then placed on a dip stick (Combur-9, Roche Products, Isando). Any new diagnoses made during the pre-anaesthetic screening were recorded. The owner was informed of any new condition that was identified and was given the opportunity to reconsider consent for anaesthesia.

All data collected was entered into a spreadsheet (Microsoft Office Excel 2003, Microsoft Corporation, Redmond). Statistical analysis was performed with the functions available in the spreadsheet and a statistical package (SigmaStat, Jandel Corporation, San Rafael). Statistical significance was set at a $P < 0.05$.

Descriptive statistics were determined for the group as a whole. The data was then divided into 2 groups based on those in which a new diagnosis was made based on the pre-anaesthetic screening process. The results were then compared between groups. Normality of distribution for numerical data was determined by Kolmogorov-Smirnov tests. The results were not normally distributed, with exceptions of heart rate and temperature. A *t*-test was used for normally distributed data and Mann-Whitney Rank Sum Test for the remainder of parameters. Non-numerical data (e.g. urine dipstick results) was ranked and the Mann-Whitney Rank Sum Test was used. A 2nd division was made based on those that did or did not receive anaesthesia as a result of the pre-anaesthetic screening process. Some patients' medical condition precluded anaesthesia, required further investigation or required stabilisation before anaesthesia could be conducted. These were considered to have been denied anaesthesia based on the pre-anaesthetic screening and were recorded as such. If the owner voluntary withdrew consent for anaesthesia but in the opinion of the author anaesthesia could still have been conduct they were recorded as anaesthetised. If anaesthesia was conducted on the day of admittance but a minor medical condition required correction before anaesthesia (e.g. dehydration) the patient was considered to have undergone anaesthesia. Again these results were not normally distributed except for heart rate and temperature. Similar statistical tests were used.

RESULTS

The average age of the dog included in this study was 10.99 ± 2.44 years and the weight was 19.64 ± 15.78 kg. The distribution of breeds and sex is contained in Table 1. The procedures for which the dogs were admitted are contained in Table 2 and pre-existing medical condition by organ system is recorded in Table 3. There were 13 dogs with pre-existing medical conditions. No statistical analysis was possible on pre-existing medical conditions and they are grouped by organ system. A total of 30 new diagnoses were made on the basis of the pre-anaesthetic screening and are listed in Table 4. The neoplasia diagnosed in 9 patients consisted of 2 haemoangiosarcomas of the spleen, 2 hepatic tumours, a metastatic mammary carcinoma, a pancreatic tumour, a splenic fibrosarcoma, a leiomyosarcoma of the GIT and an unclassified abdominal tumour as a *post mortem* was declined by the owner. Renal disease was classified according to the standard classification system[9]. The stages of renal failure present were 1 stage 4, 1 stage 3, 2 stage 2, 2 stage 1 and one unclassified. In dogs with pre-existing disease, a new condition diagnosed in 4 dogs (1 dog with pyometra had chronic kidney disease; another with a cutaneous tumour also had a hepatic tumour; 1 with a long soft palate, had a collapsing trachea and hepatopathy; and 1 with a splenic tumour had atrial fibrillation). A pre-existing disease resulted in the postponement of anaesthesia in 1 dog: this dog had atrial fibrillation, was severely tachycardic at presentation and required heart rate control before elective surgery. Thirteen dogs did not undergo anaesthesia as a result of their new diagnosis. Six had further diagnostic tests performed to confirm the diagnosis (4 with Cushing's disease, 1 pyrexia, 1 hepatopathy), 4 were euthanased (2 with neoplasia and 2 with chronic kidney disease), 1 surgery was rescheduled (uroliths), 1 owner declined surgery and 1 required further treatment (atrial fibrillation).

The results of comparisons between groups are contained in Tables 5 and 6. ALP, ALT, urine protein and heart rate were found to be significantly associated with the cancellation or postponement of anaesthesia while ALP, ALT, urine SG,

Table 1: **Distribution of breed and sex** (n = 101 dogs).

Breed	***n***	**%**
X-breed	16	15.84
Maltese	15	14.85
Daschund	8	7.92
Staffordshire bull terrier	7	6.93
Spaniel	6	5.94
Labrador	5	4.95
Yorkshire terrier	5	4.95
Border collie	4	3.96
Jack Russell terrier	4	3.96
Beagle	2	1.98
Boxer	2	1.98
Bull terrier	2	1.98
Bullmastiff	2	1.98
German shepherd	2	1.98
Golden retriever	2	1.98
Great Dane	2	1.98
Miniature doberman	2	1.98
Rottweiler	2	1.98
Airedale terrier	1	0.99
Boerboel	1	0.99
Bouvier des Flanders	1	0.99
Dalmatian	1	0.99
Doberman	1	0.99
Fox terrier	1	0.99
Malamute	1	0.99
Old English sheepdog	1	0.99
Pekinese	1	0.99
Poodle miniature	1	0.99
Pug	1	0.99
Shih Tzu	1	0.99
Weimeraner	1	0.99
Sex	***n***	**%**
Female	29	28.71
Male	29	28.71
Male neutered	22	21.78
Female spayed	21	20.79

Table 2: **Procedure performed** (*n* = 101 dogs)**. Tumour removal represents small cutaneous tumours.**

Procedure	*n*	%
Dental	35	34.65
Tumour removal	34	33.66
Cruciate ligament repair	5	4.95
Castration	3	2.97
Dental & tumour removal	2	1.98
Gastroscopy	2	1.98
Intervertabral disc prolapse	2	1.98
MRI	2	1.98
Perineal hernia	2	1.98
Splenectomy	2	1.98
Cyst removal	1	0.99
Ear flush	1	0.99
Gastropexy	1	0.99
Hernia	1	0.99
Laparotomy	1	0.99
Nasal scope	1	0.99
Othaematoma	1	0.99
Ovariohysterectomy	1	0.99
Soft palate resection	1	0.99
Transtracheal aspirate	1	0.99
Vulvoplasty	1	0.99
Wound closure	1	0.99

Table 3: **Pre-existing medical conditions by organ system** (*n* = 13 dogs)**. A existing diagnosis of neoplasia excludes cutaneous tumours.**

Pre-existing conditions	*n*
Cardiac disease	4
Endocrine	2
Neurological	2
Reproductive	1
Respiratory	1
Neoplasia	1
Gastro-intestinal	1
Infectious disease	1

Table 4: **New conditions diagnosed** (*n* = 30)**. Neoplasia excludes cutaneous tumours.**

Diagnosis	*n*
Neoplasia	8
Chronic kidney disease	6
Cushing's disease	5
Hepatopathy	3
Cardiac disease	2
Uroliths	1
Chronic kidney disease & neoplasia	1
Osteoarthritis	1
Collapsed trachea	1
Gastric necrosis	1
Hypothyroid	1

urine protein and heart rate were significantly associated with diagnosis of a new clinical condition.

DISCUSSION

The American Animal Hospital Association (AAHA) has recently published guidelines on screening of geriatric dogs and cats[2]. The ideal opportunity to perform these tests is during routine health checks and before anaesthesia[2]. The intention of this study was to determine if pre-anaesthetic screening tests were viable in veterinary patients in view of the contradiction in the human literature. The AAHA guidelines recommend that a standard battery of tests be conducted before anaesthesia[2]. This contradicts the Association of Veterinary Anaesthetists (AVA) 1998 position statement for pre-anaesthetic testing[3]. The AVA advises that routine haematological and biochemistry profiles are unnecessary if an adequate clinical examination is conducted and that they constitute an unnecessary expense in healthy animals[3]. Their study was designed to target geriatric patients coming in for elective day-case procedures. This patient group was targeted as they are considered healthy and if a condition is present it would be considered sub-clinical. This was achieved in the study as 89 % of patients presented with 68 % being either a dental or cutaneous tumour removal. As these patients constituted the majority of procedures it may represent a selection bias making the results mainly applicable to this group of patients. Cases that underwent major surgery were included as they were non-urgent elective cases (2 cases each of intervertabral disk disease, perineal hernia and splenectomy, 1 case each of a gastropexy, hernia, laparotomy, soft palate resection and vulvoplasty).

A new diagnosis was made in 29.7 % of patients in this study with the most common being neoplasia, chronic kidney disease and Cushing's disease. This percentage is higher than usual in a general population of dogs and cats (11 %)[11]. Considering we have targeted an older population this is not surprising. These 3 conditions are considered common in geriatric patients[1,2,5]. In spite of the diagnosis of new conditions, more than half of the patients underwent anaesthesia. This is similar to what has been reported where only 1 out of 3 dogs and cats with an abnormality discovered after pre-anaesthetic screening had surgery postponed[11].

Table 5: **Comparison between groups of patients receiving anaesthesia and those not receiving anaesthesia after pre-anaesthetic screening. Statistically significant values are in bold.**

Parameters	Units	Anaesthesia			No anaesthesia			Statistical significance
		n	Median	25–75 %	*n*	Median	25–75 %	
Age	years	88	11	9–12.5	13	9.6	8.9–13.2	0.556
Weight	kg	88	13.6	5.9–32.8	13	17.4	6.3–36.9	0.655
Respiration	bpm	88	40	30–60	13	42	30–60	0.612
ALP	U/ℓ	88	97	62–202	13	769	380–1500	**< 0.001**
ALT	U/ℓ	88	36	23–67	13	97	45–288	**0.002**
Urea	mmol/ℓ	88	6.1	4.6–7.5	13	6	4.8–9.3	0.808
Creatinine	mmol/ℓ	88	90	75–109	13	92	78–128	0.447
Glucose	mmol/ℓ	88	6.5	6.1–6.8	13	6.7	6.0–7.1	0.450
Total protein	g/ℓ	88	71	67–75	13	70	67–76	0.907
Urine SG		88	1.031	1.023–1.040	13	1.032	1.015–1.035	0.165
Urine pH		88	6	5–6	13	6	5–7	0.377
Urine protein		88	1	1–2	13	3	1.75–3.00	**< 0.001**
Urine blood			2	1–3		3.5	2–4	0.236
PCV	%	38	53	49–58	7	50	48–51	0.316
		n	Mean	SD	*n*	Mean	SD	Statistical significance
Temperature	°C	88	38.7	0.46	13	38.9	0.61	0.211
Heart rate	bpm	88	119.9	24.10	13	137.5	40.5	**0.028**

Table 6: **Comparison between groups for those diagnosed with a new clinical condition and those not diagnosed. Statistically significant values are in bold.**

Parameters	Units	No disease			New disease			Statistical significance
		n	Median	25–75 %	*n*	Median	25–75 %	
Age	years	71	10.3	9–12.4	30	11.5	9–13.5	0.119
Weight	kg	71	12.4	5.8–33.1	30	17.2	7.1–32	0.707
Respiration	bpm	71	42	30–60	30	40	30–60	0.732
ALP	U/ℓ	71	89	60.3–155	30	370	148–769	**< 0.001**
ALT	U/ℓ	71	36	24–61.3	30	66	25.5–240.8	**0.033**
Urea	mmol/ℓ	71	6.1	4.7–7.2	30	6.3	4.5–9.5	0.448
Creatinine	mmol/ℓ	71	90	77.5–108	30	84.5	72–136	0.876
Glucose	mmol/ℓ	71	6.5	6.1–6.8	30	6.6	5.9–7.1	0.786
Total protein	g/ℓ	71	70	67–74.8	30	72.5	68–77	0.121
Urine SG		71	1.032	1.025–1040	30	1.023	1.015–1035	**0.008**
Urine pH		71	6	5–6	30	6	5–7	0.841
Urine protein		71	1	1–1.5	30	2	1–3	**0.023**
Urine blood		71	3	1–3	30	1.5	1–3	0.520
PCV	%	32	54	49–58	13	50	47.3–52.3	0.096
		n	Mean	SD	*n*	Mean	SD	Statistical significance
Temperature	°C	71	38.7	0.43	30	38.7	0.61	0.845
Heart rate	bpm	71	116.7	23.3	30	135.4	31.2	**0.001**

There is a high prevalence of renal dysfunction in human geriatric patients and peri-anaesthetic renal failure accounts for 20 % of deaths[4]. The prevalence of chronic kidney disease in dogs increases with age, with 20 % of dogs between 7 and 10 years of age and 45 % older than 10 years of age[9] having the condition. The actual incidence in a canine population is between 0.5 and 7 %[9]. With age there is a loss of renal mass and glomeruli and a decrease in renal blood flow[4]. Creatinine clearance decreases but serum creatinine remains normal due to a decrease in muscle mass and a decrease in urine SG[4]. The ASA recommends that geriatric patients receive serum chemistry, haemoglobin and haematocrit evaluations[4]. Urine analysis has not been found useful in human patients without pre-existing disease or clinical findings[7]. This study did not show a statistical significance for haematocrit between any of the groups but it did approach significance in those patients in which a new condition was diagnosed. Renal failure was a prevalent condition in our study and results in increased fluid loss with consequential dehydration and a rise in haematocrit. This rise is most probably the result of removal of food and water the evening before anaesthesia. Administration of intravenous fluid and allowing access to water until shortly before anaesthesia should be considered in geriatric patients, especially those with underlying renal disease. If the sample size was larger, the haematocrit may have reached statistical significance. The other weakness in this study is that haematocrit was not recorded in all patients.

Cushing's disease is commonly diagnosed in patients older than 6 years, with a mean between 9 and 11 years[10]. This would make our population a prime group for the diagnosis of Cushing's disease. A dramatic increase in ALP (>1000 U/ℓ), a mild increase in ALT (<400 U/ℓ), a decrease in urine SG (<1.020) and proteinuria is seen[10]. These 4 abnormalities in our study were significantly associated with the diagnosis of new conditions. Cushing"s disease was the third most prevalent condition and this may have influenced the results. A low urine SG and proteinuria are found in patients with chronic renal disease[9]. Hepatic tumours commonly have raised ALP and ALT[12]. This would have added to the strength of ALP, ALT, urine SG and proteinuria being associated with the diagnosis of a new disease. Hepatic mass decreases with age[4]. There is a loss of functional reserves within the liver, and this may become problematic with the stressors of anaesthesia and surgery[4]. The ASA does not advocate routine liver function testing[4]. If liver functioning testing is required, the ASA advises a coagulation test[4].

Involuntary weight loss, hypoalbuminaemia and hypocholesterolaemia are used to define malnutrition in humans[4]. In this study, total protein was approaching statistical significance for patients diagnosed with a new clinical condition; again sample size could be an issue.

From the above brief discussion, the results and values that were found to be significant reflect the tests conducted and the common diagnosis made. The question that then needs to be answered is did the new diagnosis change the management of patients in which a new diagnosis was made but still underwent anaesthesia. This study was not initially designed to address this question and ideally should be studied separately. A *post hoc* evaluation was carried out to determine if management practices did change. Raised haematocrit and chronic kidney disease was always associated with administration of fluids and rehydration of the patient before anaesthesia. The other conditions diagnosed were managed according to standard medical practice but no specific anaesthetic management changes were evident in our practice.

This study did not assess risk associated with abnormal values and outcome, nor was it designed to address cause-effect relationships. These issues need to be evaluated to determine the overall impact of pre-anaesthetic screening in veterinary patients. The value of the currently recommended tests should be questioned and alternative blood tests should be considered. An example of this would be clotting function tests to assess hepatic function instead of enzymes tests that are of limited value. Divergent diseases can result in divergent biochemical test results and a pre-anaesthetic screening panel is unlikely to cover all diseases. Good clinical judgement is required to select appropriate tests for each individual patient.

Pre-anaesthetic screening is generally well accepted by clients[11]. This study concluded that screening of geriatric patients

is important and that sub-clinical disease could be present in nearly 30 % of these patients. The value of screening before anaesthesia is perhaps more questionable in terms of anaesthetic practice but it is an appropriate time to perform such an evaluation. The value of pre-anaesthetic screening in veterinary anaesthesia still needs to be evaluated in terms of appropriate outcome variables.

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