Anaesthesia and analgesia for dogs and cats in South Africa undergoing sterilisation and with osteoarthritis – An update from 2000

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ABSTRACT

A survey was conducted in 2000 into the use of analgesic drugs by veterinarians in South Africa. This survey was repeated in 2005 to establish whether the use of analgesic drugs has increased and which analgesic drugs are being used for acute pain and osteoarthritis. The number of sterilisations performed and the number of new cases of osteoarthritis in dogs and cats was estimated. It is estimated that approximately 260 000 cats are operated on each year in South Africa and that 150 000 cats are sterilised. Five hundred thousand dogs undergo surgery, of which 242 000 are sterilised. It appears that the number of surgical procedures performed in South Africa has decreased. The estimated death rate following anaesthesia has remained unchanged at 1:1004. Overall, the use of analgesics by South African veterinarians has increased significantly. Fifty-six per cent of cats and 74 % of dogs were given peri-operative analgesics but this increased to 94 % and 84 % after including pre-anaesthetic medications with analgesic properties. The use of opioids (morphine and buprenorphine) and propofol has increased significantly. Approximately 253 000 dogs and 33 000 cats with osteoarthritis are seen by veterinarians in South Africa annually. The recognition by veterinarians of osteoarthritis in cats appears to be poor and is in need of attention. Carprofen and glucosamine/chondroitin are the most commonly used agents for the treatment of osteoarthritis. Details of the drugs used by veterinarians are given. Knowledge of analgesic drugs has increased significantly over the last 5 years. Continuing education is thought to have played an important role in the changes reported in this study.

Key words: anaesthesia, analgesia, canine, continuing education, feline, mortality, osteoarthritis, South Africa, survey.

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INTRODUCTION

A survey conducted into the use of analgesics by South African Veterinarians in 2000 indicated that 86.3 % of cats and 80.75 % of dogs did not specifically receive analgesics after routine sterilisation[4]. Since then, new analgesic agents have been introduced onto the South African market and numerous continuing education opportunities were used to promote analgesia. The present survey was undertaken to determine if the use of analgesic drugs during routine sterilisation of companion animals has increased in South Africa over the last 5 years. In addition, the use of analgesic agents for the treatment osteoarthritis was assessed.

MATERIALS AND METHODS

Sales representatives of a pharmaceutical company distributed 600 questionnaires to veterinary practices in South Africa between July and December 2005. The questionnaires were completed by veterinarians and returned to the author by post. The sales representatives followed up 6 weeks later and encouraged veterinarians to return the questionnaire. The respondents were asked to estimate the number of cats and dogs seen for sterilisation, surgery and osteoarthritis per week and the number of animals that died under anaesthesia per year. In the questionaire 'Sterilisation' referred all animals undergoing either castration or ovariohysterectomy, 'Surgery' included any type of surgery for which anaesthesia was required (including sterilisations) and 'Osteoarthritis' included any animal considered to have osteoarthritis (regardless of diagnostic method). A list of pre-medications, analgesic and anaesthetic drugs available in South Africa was provided and the respondent was asked which drugs were given routinely during sterilisations (ovariohysterectomy only) of dogs and cats. Then questions on analgesic agents used for the treatment of acute pain and osteoarthritis in dogs and cats then followed. Acute pain was defined as any painful condition of less than 1 month's duration which notably affected the animal's quality of life and required treatment. Several phenylbutazone-containing drugs are available in South Africa, and they were grouped together under the heading 'Phenylbutazone'. [The questionnaire is available on request from the author.]

The data were entered into a spreadsheet (Excel 2003 SR-2, Microsoft Corporation). Combinations of medications (NSAIDs and opioids) were often used by veterinarians or 2 or more NSAIDs or opioids were indicated as commonly used by them. Tables and descriptive statistics were used to summarize the data. The data from the surveys conducted in 2000[3,4] were compared with the current data where relevant. Statical analysis was performed with SigmaStat for Windows, Version 2.00 (Jandel Corporation). Statistical significance was set at $P < 0.05$. The 2000 to 2005 surgical, sterilisation, anaesthetic/analgesic drug knowledge and mortality data were compared using the Mann-Whitney Rank Sum Test.

RESULTS

One hundred and ten questionnaires were returned. One questionnaire was rejected owing to incomplete information; 109 were therefore analysed and this represents a response rate of 18.3 %.

A total of 8.28 ± 6.32 cats underwent surgery while 4.7 ± 3.3 were sterilised per week. The number of cats that underwent surgery decreased ($P < 0.008$) while the number of cats that were sterilised remained unchanged ($P = 0.222$) from 2000. There were 15.97 ± 12.6 dogs that underwent surgery while 7.76 ± 6.12 dogs were sterilised. The number of dogs that underwent surgery decreased from 2000 and this was almost statistically significant ($P = 0.054$), while the number of dogs sterilised remained unchanged ($P = 0.395$). When these figures are extrapolated to the number of veterinary practices in South Africa, it is estimated that 260 000 cats undergo general surgery and 150 000 are sterilised annually, and that

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500 000 dogs undergo surgery and 242 000 are sterilised annually. Mortality under anaesthesia was 1.27 ± 1.67 (range 0–12) animals per respondent per year. The estimated mortality under anaesthesia was 1:1004. Twenty-nine practices reported no deaths while 52 reported 1 or more deaths per annum. No statistical difference was found between the 2000 and 2005 mortality data.

On average, 8.11 ± 8.09 dogs with osteoarthritis were seen per week while 1.06 ± 1.38 cats were seen. It is estimated that 253 000 dogs and 33 000 cats with osteoarthritis are seen annually by veterinarians. The number of dogs sterilised did not differ significantly ($P = 0.417$) from the number of dogs with osteoarthritis.

Fifty-six per cent (61/109) of cats received analgesics for sterilisation but this increased to 93.6 % (102/109) after premedications and induction agents with analgesic properties were included. The number of agents used in cats has increased considerably since 2000. The drugs used for cats are listed in Table 1. Most cats (53.2 %) did not receive postoperative analgesics. Drugs used for the management of acute pain in cats are given in Table 2. The agents used for the management of osteoarthritis in cats are listed in Table 3.

Seventy-four per cent (81/109) of dogs received analgesia as part of the anaesthetic management for sterilisation. This increased to 83.5 % (91/109) after premedications and anaesthetic agents with analgesic properties were included. Postoperative analgesics were not given to 29.4 % of the dogs. The pre-medications, anaesthetic and analgesic agents given are listed in Table 4. Drugs used for the control of acute pain in dogs are given in Table 5. A list of the agents used for the management of osteoarthritis is given in Table 6. A comparison of agents used for acute pain in dogs and cats between 2000 and 2005 is given in Table 7.

Veterinarians' ability to recognise drugs with analgesic properties has improved considerably since 2000. These data are presented in Table 8.

Table 1: **Pre-medication, anaesthetic and analgesic drugs used in cats for sterilisation.**

	2005		2000	
	n	%	*n*	%
Pre-medication				
Xylazine	40	36.70	70	43.48
Acetylpromazine	27	24.77	51	31.68
Medetomidine	21	19.27	14	8.70
Atropine	17	15.60	35	21.74
None	17	15.60	20	12.42
Carprofen	15	13.76		
Morphine	5	4.59		
Diazepam	5	4.59		
Buprenorphine	4	3.67		
Butorphanol	4	3.67		
Meloxicam	3	2.75		
Ketoprofen	2	1.83		
Penicillin	1	0.92	7	4.35
Vedaprofen	1	0.92		
Ketamine/xylazine	0	0	4	2.48
Ketamine/medetomidine	0	0.00	1	0.62
Pethidine	0	0.00	3	1.86
Alphaxalone/alphadalone	0	0	1	0.62
Induction agent				
Propofol	46	42.20	5	3.11
Ketamine/medetomidine	34	31.19		
Thiopentone	29	26.61	55	34.16
Ketamine/xylazine	13	11.93	2	1.24
Alphaxalone/alphadolone	10	9.17	87	54.04
Ketamine	9	8.26	6	3.73
Pentobarbitone	3	2.75	1	0.62
Isoflurane	2	1.83	5	3.11
Phenobarbitone	2	1.83		
Halothane	2	1.83		
Medetomidine	1	0.92		
Diazepam/Ketamine	1	0.92		
Tiletamine/Zolazepam	1	0.92		
Metomidate	1	0.92		
Maintenance agent				
Halothane	53	48.62	57	35.40
Thiopentone	20	18.35	34	21.12
Isoflurane	20	18.35	1	0.62
Propofol	19	17.43		
Ketamine/medetomidine	16	14.68		
Alphaxalone/alphadolone	5	4.59	65	40.37
Ketamine	5	4.59	4	2.48
None	4	3.67		
Ketamine/xylazine	3	2.75		
Pentobarbitone	2	1.83		
Medetomidine	1	0.92		
Tiletamine/zolazepam	1	0.92		
Enflurane	1	0.92		
Xylazine	1	0.92		
Post-operative analgesic				
None	58	53.21		
Ketoprofen	25	22.94		
Carprofen	19	17.43		
Morphine	9	8.26		
Phenylbutazone	7	6.42		
Meloxicam	5	4.59		
Buprenorphine	4	3.67		
Ketamine	2	1.83		
Butorphanol	2	1.83		
Antisedan	1	0.92		

DISCUSSION

The response rate in this survey (18 %, $n = 109$) was lower than in the previous survey (27 %, $n = 160$)[3,4] In a recent French survey a response rate of 49 % was achieved, with most respondents being younger[2], and in New Zealand a response rate of 28 % has been reported[6]. The lower response rate in the present study represents a weakness, and may have resulted in the over- or underestimation of the number of patients undergoing procedures and the use of analgesic drugs in South Africa. Another limitation is the survey nature of the present study which inherently relies on the respondents. It is nevertheless considered that the data fairly represent the changes that have occurred over the last 5 years.

The number of sterilisations has remained unchanged. The number of cats

Table 2: **Analgesics used for acute pain in cats.**

Analgesic	*n*	%
Morphine	45	41.28
Carprofen	44	40.37
Ketoprofen	40	36.70
Buprenorphine	27	24.77
Meloxicam	12	11.01
Phenylbutazone	8	7.34
Pethidine	6	5.50
Butorphanol	4	3.67
None	4	3.67
Ketamine	3	2.75
Flunixin meglumine	1	0.92
Dexamethasone	1	0.92
Prednisolone	1	0.92
Vedaprofen	1	0.92
Medetomidine	1	0.92

Table 3: **Agents used for the management of osteoarthritis in cats.**

Agent	*n*	%
Carprofen	44	44.00
Glucosamine/chondroitin	37	37.00
Prednisolone	37	37.00
Meloxicam	30	30.00
Ketoprofen	30	30.00
None	8	8.00
Green lipid	3	3.00
Methylprednisolone	2	2.00
Athridese	1	1.00
Royal Canin Senior S/O©	1	1.00
Ponstan	1	1.00
Vedaprofen	1	1.00
Aspirin	1	1.00
Omega 3	1	1.00
Ibuprofen	1	1.00

undergoing surgery has decreased significantly, while the number of dogs also decreased although not significantly so. The mix (companion animal, large animal, equine or mixed practice) and the size (based on number of clients) of practices were similar to the study in 2000 (data not given) and hence these factors are thought not to play an important role.

The number of dogs seen with osteoarthritis was equal to the number of dog sterilised. Sterilisation constituted 53.8 % of private practitioners' and 61.9 % of an academic hospital's surgical workload[5]. This study did not specifically evaluate the workload as a result of osteoarthritis[5] but based on the data collected in the present study, it should equal the sterilisation workload. Based on this, osteoarthritis should form an integral part of the education and training of veterinarians. This study did not assess the number of sterilisations or cases of osteoarthritis in relation to entire practices' workload and hence the importance of these conditions in terms of total practice load was not assessed.

Table 4: **Pre-medications, anaesthetic and analgesic agents used in dogs for sterilisations.**

	2005		2000	
	n	%	*n*	%
Pre-medication				
Acetylpromazine	77	70.64	134	83.23
Atropine	31	28.44	64	39.75
Xylazine	33	30.28	14	8.70
Carprofen	24	22.02		
Morphine	18	16.51		
Medetomidine	18	16.51	4	2.48
Butorphanol	3	2.75		
Meloxicam	3	2.75		
Buprenorphine	3	2.75		
None	2	1.83	8	4.97
Diazepam	2	1.83	6	3.73
Penicillin	1	0.92		
Flunixin	1	0.92	1	0.62
Induction agent				
Thiopentone	89	81.65	157	97.52
Propofol	49	44.95		
Phenobarbitone	6	5.50		
Pentobarbitone	5	4.59	3	1.86
Halothane	3	2.75	1	0.62
Diazepam/ketamine	1	0.92		
Ketamine/xylazine	1	0.92		
Tiletamine/zolazepam	1	0.92		
Ketamine/medetomidine	1	0.92		
Isoflurane	1	0.92		
Ketamine	1	0.92		
Maintenance				
Halothane	75	68.81	105	65.22
Thiopentone	32	29.36	56	34.78
Isoflurane	27	24.77		
Propofol	11	10.09		
Pentobarbitone	2	1.83		
Tiletamine/zolazepam	1	0.92		
Enflurane	1	0.92		
Phenobarbitone	1	0.92		
Post-operative analgesic				
Carprofen	63	57.80		
None	32	29.36		
Ketoprofen	17	15.60		
Morphine	11	10.09		
Phenylbutazone	8	7.34		
Meloxicam	7	6.42		
Buprenorphine	2	1.83		
Ibuprofen	1	0.92		
Ketamine	1	0.92		
Vedaprofen	1	0.92		
Piroxicam	1	0.92		
Yohimbine	1	0.92		

Unfortunately, the number of cats diagnosed with osteoarthritis was small and was clearly an under-diagnosis of the condition. This is based on the relative number of cats and dogs sterilised to the number of cases of osteoarthritis, assuming an equitable age distribution. In a study of 292 cats older than 1 year, 22 % had signs of osteoarthritis[1]. Most cats with osteoarthritis were older than 8 years[1]. Osteoarthritis is as common a disease in geriatric cats as it is in dogs. Elbows may be the most commonly affected joints in cats but bilateral symmetry was also common, suggesting congenital, developmental, systemic disease or chronic overuse as causes[1]. Most cats may show no clinical signs of osteoarthritis, making the diagnosis of this condition difficult[1].

Xylazine has remained the most popular pre-anaesthetic agent for cats while the use of medetomidine has increased. The use of acetylpromazine in cats has decreased. Alphaxalone/alphadolone was previously the most popular anaesthetic induction agent in cats[3]. This agent is no longer distributed in South Africa. Propofol is now the most commonly used

Table 5: **Analgesics used for acute pain in dogs.**

Analgesic	*n*	%
Carprofen	86	78.90
Morphine	67	61.47
Buprenorphine	23	21.10
Ketoprofen	20	18.35
Flunixin meglumine	12	11.01
Phenylbutazone	12	11.01
Meloxicam	10	9.17
Pethidine	10	9.17
Butorphanol	4	3.67
Ibuprofen	2	1.83
Dexamethasone	1	0.92
Fentanyl	1	0.92
Piroxicam	1	0.92
Vedaprofen	1	0.92

Table 6: **Agents used for the management of osteoarthritis in dogs.**

Agent	*n*	%
Carprofen	109	100.00
Glucosamine/chondroitin	72	66.06
Meloxicam	24	22.02
Prednisolone	21	19.27
Piroxicam	10	9.17
Ketoprofen	10	9.17
Aspirin	5	4.59
Phenylbutazone	5	4.59
Ibuprofen	4	3.67
Hills JD©	3	2.75
Green Lipid Mussel Extract	1	0.92
Arthridese	1	0.92
Dextromethorphan	1	0.92
Methylprednisolone	1	0.92
Dexamethasone	1	0.92
Firocoxib	1	0.92
Tramadol	1	0.92
Omega 3	1	0.92

agent followed by medetomidine/ketamine, thiopentone and xylazine/ketamine. The use of alpha$_2$-agonist/ketamine combinations has increased. The use of halothane for the maintenance of general anaesthesia has increased while the use of thiopentone remains essentially unchanged. The use of analgesics in cats has increased significantly since 2000[3]. This can be seen as an increased use of pre-operative and post-operative analgesics. Unfortunately, most cats (53 %) do not receive post-operative analgesics; this is alaborated upon below.

Acetylpromazine remains the most commonly used premedication in dogs but the use of xylazine and medetomidine has increased. Thiopentone remains the most common induction agent but propofol is now used by almost 50 % of veterinarians. Alpha$_2$-agonist/ketamine combinations were not commonly used in dogs. Halothane and thiopentone remain the 2 most commonly used maintenance agents. Isoflurane is now used by more veterinarians for the maintenance of anaesthesia. Again, the use of analgesics has increased significantly. NSAIDs were the most popular drugs used, led by carprofen. In the previous survey, carprofen had not yet been registered in South Africa. Just under one-third of dogs do not receive post-operative analgesics.

Table 7: **Comparison of analgesics used for acute in pain in dogs and cats between 2005 and 2000.**

Drug	2005		2000	
	n	%	*n*	%
Carprofen	130	60.75	1	0.62
Morphine	112	52.34	8	4.97
Ketoprofen	60	28.04	3	1.86
Buprenorphine	50	23.36	23	14.29
Meloxicam	22	10.28	1	0.62
Phenylbutazone	20	9.35	79	49.07
Pethidine	16	7.48	41	25.47
Flunixin meglumine	13	6.07	87	54.04
Butorphanol	8	3.74	5	3.11
None	4	1.87	5	3.11
Ketamine	3	1.40		
Dexamethasone	2	0.93		
Ibuprofen	2	0.93	2	1.24
Vedaprofen	2	0.93		
Fentanyl	1	0.47		
Medetomidine	1	0.47	3	1.86
Piroxicam	1	0.47	1	0.62
Prednisolone	1	0.47	2	1.24
Aspirin			7	4.35
Oxymorphone			2	1.24
Methadone			1	0.62
Xylazine			1	0.62

The use of analgesic agents has increased significantly in South Africa. With this increased use, an increase in the number of agents used has been seen over the last 5 years. Opioids, which were not commonly used either in cats or dogs for acute pain, are now used by over 60 % of the practitioners surveyed. Previously it had been pointed out that the use of opioid analgesics is impeded by the legal requirements[2,4], but in spite of this veterinarians are now prepared to use opioids. In France, low use of opioids to control pain has recently been reported[2]. The use of morphine and buprenorphine in South Africa is similar to that in New Zealand[6]. Butorphanol is not registered in South Africa but a number of practitioners use the agent in dogs and cats. NSAIDs are still the most commonly used agents. Previously flunixin meglumine and phenylbutazone were the most popular[4]. Carprofen is now the most popular followed by ketoprofen and meloxicam. During the last 5 years, carprofen, a veterinary ethical ketoprofen, and vedaprofen have been registered in South Africa. With registration of these products numerous continuing education opportunities have been used to encourage the use of NSAIDs for pain control. Ketoprofen is currently the only registered product for the control of pain in cats. None of the other NSAIDs used in cats (carprofen, meloxicam, vedaprofen, phenylbutazone, flunixin) are registered for use these animals. In New Zealand, carprofen, ketoprofen and meloxicam are also the most popular NSAIDs[6]. Firocoxib was launched in South Africa during this survey and a single reply was received from a practitioner who started using it. The registration of new products is likely to again lead to a change in the use of drugs. The low use of analgesics post-operatively represents an ethical dilemma as the treatment of pain is mandatory.

This is the 1st time that use of agents for the treatment of osteoarthritis has been reported on in South Africa. Carprofen and glucosamine/chondroitin were the most commonly used in dogs. With regard to cats a more mixed set results was obtained with no particular agent dominating. This may be the result of no veterinary ethical products having been registered for long-term use in cats, the poor tolerance of cats to NSAIDs, the lack of product knowledge by veterinarians and the limited amount of information available on the long-term management of cats with osteoarthritis. Prednisolone was a commonly used agent in both dogs and cats.

In New Zealand, practitioners indicated that continuing education lectures and experience gained in practice were valuable sources of information for recognis-

Table 8: **Changes in knowledge of agents.**

Agent	2005		2000		Statistical significance
	% Yes*	% No	% Yes	% No	
NSAID					
Aspirin	**93.46**	6.54	**49.07**	50.93	***P* = <0.001**
Dipyrone	**14.02**	85.98	**5.59**	94.41	*P* = 0.242
Flunixin meglumine	**92.52**	7.48	**83.23**	16.77	*P* = 0.197
Ibuprofen	**87.85**	12.15	**34.16**	65.84	***P* = <0.001**
Ketoprofen	**85.05**	14.95	**3.73**	96.27	***P* = <0.001**
Meloxicam	**88.79**	11.21	**23.60**	76.40	***P* = <0.001**
Phenylbutazone	**79.44**	20.56	**69.57**	30.43	*P* = 0.171
Piroxicam	**76.64**	23.36	**18.63**	81.37	***P* = <0.001**
Average	**77.22**	22.78	**35.95**	64.05	
Opioid					
Buprenorphine	**76.64**	23.36	**14.29**	85.71	***P* = <0.001**
Butorphanol	**57.94**	42.06	**6.21**	93.79	***P* = <0.001**
Etorphine	**38.32**	61.68	**2.48**	97.52	***P* = <0.001**
Fentanyl	**66.36**	33.64	**3.73**	96.27	***P* = <0.001**
Morphine	**98.13**	1.87	**20.50**	79.50	***P* = <0.001**
Pethidine	**95.33**	4.67	**44.10**	55.90	***P* = <0.001**
Average	**72.12**	27.88	**15.22**	84.78	
Pre-medication					
Acetylpromazine	2.80	**97.20**	8.70	**91.30**	*P* = 0.414
Atropine	0.93	**99.07**	4.97	**95.03**	*P* = 0.576
Medetomidine	**58.88**	41.12	**11.18**	88.82	***P* = <0.001**
Valium	3.74	**96.26**	9.94	**90.06**	*P* = 0.390
Xylazine	**55.14**	44.86	**24.22**	75.78	***P* = <0.001**
Anaesthetic agent					
Etomidate	14.02	**85.98**	0.62	**99.38**	*P* = 0.063
Halothane	7.48	**92.52**	9.32	**90.68**	*P* = 0.799
Isoflurane	8.41	**91.59**	1.24	**98.76**	*P* = 0.320
Ketamine	**45.79**	54.21	12.42	87.58	***P* = <0.001**
Metomidate	26.17	**73.83**	1.24	**98.76**	***P* = <0.001**
Pentobarbitone	5.61	**94.39**	6.83	**93.17**	*P* = 0.866
Phenobarbitone	3.74	**96.26**	4.35	**95.65**	*P* = 0.933
Propofol	2.80	**97.20**	2.48	**97.52**	*P* = 0.411
Saffan	8.41	**91.59**	10.56	**89.44**	*P* = 0.766
Thiopentone	12.15	**87.85**	14.29	**85.71**	*P* = 0.768
Tiletamine/Zolazepam	**18.69**	81.31	3.73	96.27	***P* = 0.038**

*Yes indicates that the drug had analgesic properties while No indicates none. The bold print indicates the correct answer for the agents having analgesic properties or not and statistically significant values.

ing and treating pain[6]. New Zealand veterinarians also believed that regional lectures and seminars, review articles in journals and national lectures and seminars would be vital for furthering their knowledge of the treatment of pain in animals[6]. In France the use of opioids in dogs increased after veterinarians attended continuing education sessions[2], and they were more likely to use carprofen[2]. The present survey showed a significant increase in veterinarians' ability to identify drugs with analgesic properties and an increase in the use of analgesics (Table 8). Since 2000, over 54 continuing education opportunities throughout South Africa have been used to promote pain management, i.e. almost once a week.

Mortality under anaesthesia in South Africa has remained unchanged over the last 5 years. Very little continuing education has been provided in this field over the last 5 years. Improvement of general anaesthetic practice through continuing education should be promoted in the future.

In conclusion, pain management has improved significantly over the last 5 years. The use of opioid drugs has increased significantly as well as the number of drugs available. However, feline analgesia, osteoarthritis and post-operative pain management are stiil in need of atention.

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