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Anaesthetic Management Practices for Routine Surgeries in Small Animal Practice in Nigeria

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ABSTRACT

The study evaluated the anaesthetic management practices for routine surgeries in small animals in Nigeria with the aim of assessing the current anaesthetic protocols and monitoring standards by small animal practitioners. Pre-tested, structured questionnaires were administered to 83 small animal practice representatives in 13 states of Nigeria using purposive sampling method. Data generated were entered into excel spread sheet and analyzed using descriptive statistics. Questions included enquiries about practice type and location, number of doctors in the practice, surgical case load, pre anaesthetic patient evaluation, induction and anaesthetic maintenance agents, anaesthetic monitoring and personnel in charge of anaesthesia, anaesthetic record keeping, anaesthetic mortality, possession of an anaesthetic machine. The results of the study showed that xylazine/atropine are the most frequently used drugs for premedication in dogs and cats. Dexmedetomidine, butorphanol and buprenorphine are rarely used. Induction and maintenance of anaesthesia are mainly done with xylazine/ketamine combination. Anaesthetic record keeping and patient monitoring are poorly done. Respiratory rate is the most commonly monitored parameter. Some practices (20.5%) obtain comprehensive haematology and serum chemistry profiles as part of pre anaesthetic patient evaluation. Only few (0.09%) of participating practices have anaesthetic machines. Wound suturing (69.9%) is the most performed surgical procedure while open fracture reduction (0.94%) is the least. A high percentage (66.3%) attributed no death to anaesthesia in the past one year. In conclusion, anaesthetic practice still mostly relies on the use of injectable anaesthetics and with less use of recent advancements in global practice of veterinary anaesthesia in terms of drugs, equipment and personnel. Cost and drug availability are the major constraints.

Key words: Small animal, anaesthetic practices, challenge, mortality

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1. INTRODUCTION

Anaesthetic management of veterinary patients remains a challenge in developing countries due to unavailability of equipment, drugs and skilled personnel (Eyarefe and Oguntoye, 2015). As a result, injectable anaesthesia is used by a vast majority of practice in conditions where in inhalatory anaesthesia would have been more suitable. Anaesthesia is germane to clinical medicine. It is a reversible process of depression of the central nervous system (CNS) with drugs that produce unconsciousness and a reduced or absent response to noxious stimuli (Jones 2001). Anaesthesia administered via inhalatory, injectable or locoregional route is used routinely in veterinary practice for prevention of awareness and response to pain, provision of restraint and immobility of an animal patient and relaxation of skeletal muscles in some specific procedures including imaging (Clarke *et al.,* 2014).

Injectable anaesthesia, although increasing in popularity due to ease of administration, minimal cost of equipment and low potential for environmental pollution, has some major drawbacks. Once injected, the drugs cannot be removed from the body, and elimination/cessation of action depend on rate of metabolism that is further influenced by the patient's basal metabolic rate and health status of biotransformation and excretory organs (liver and kidneys) (Mc Kelvey and Hollingshead, 2000; Clarke *et al*., 2014). The safety also depends on strict control of the dose and accurate estimation of the animal's weight. This is usually a major issue in critically ill and geriatric animals where safe doses are difficult to estimate, and doses for healthy young animals may constitute an overdose (Clarke *et al*., 2014). Overdose with injectable agents in such scenario can be fatal in the absence of reversal drugs and of simple equipment for resuscitation and the administration of oxygen which are hard to come by in many poor resource settings of developing countries.

Majority of inhalation anaesthetic agents undergo a minimal amount of metabolism and excreted via the lungs in an unchanged state. If an overdose does occur, the animal can be ventilated with oxygen, and the expired gases can be vented, which means that resuscitation is usually rapid and effective (Clarke *et al*., 2014). Inhalation anesthetics in gas samples can be readily measured continuously. Measurement of inhalation anaesthetic concentration enhances the precision and safety of anaesthetic management beyond the extent commonly possible with injectable anaesthetic agents (Steffey *et al*., 2015). Despite this comparative advantage of inhalation over injectable anaesthesia, the high cost of its delivery apparatus is a limiting factor to its use in poor resource settings (Curro, 2008; Eyarefe and Oguntoye, 2015).

General anaesthesia (injectable or inhalatory) carries risk that influences patient morbidity and mortality rates (Brodbelt *et al*., 2009). A higher anaesthetic related death than in humans has been reported in veterinary medicine (Carter and Story, 2013). Current estimates suggest that approximately 0.1-0.2% of healthy and 0.5-2% of sick dogs and cats die of an anaesthetic related death (Brodbelt, 2009). Apart from mortality, several complications including hypotension, hypothermia, hypoxaemia and hypoventilation may also be associated with anaesthesia (Truchettti, 2019). Some contributory factors to anaesthetic complications include patient physical status, age, poor patient monitoring, breed predisposition and endotracheal intubation difficulty especially in cats (Brodbelt, 2009, Truchettti, 2019). Nigeria currently has a growing small animal veterinary practice with need for standard anaesthetic care for surgical procedures. There is a dearth of information on the current anaesthetic practice in the country. This survey was therefore carried out to assess the routine anaesthetic management practices by veterinary surgeons in Nigeria as a way of evaluating the challenges, comparing with current global standards and suggestions of practical ways of improving on anaesthesia service delivery in the country.

2. MATERIALS AND METHODS

Survey instrument design, pre-test and reliability: A structured pre-tested questionnaire with Cronbach alpha of 0.65 was developed to evaluate the routine anaesthesia management practices by veterinarians in Nigeria. The questionnaire consisted of twelve parts with questions pertaining to: Clinician's demography, practice type, practice location and number of doctors in the practice. Assessment of surgical case load; Frequency of some selected procedures; Pre-anaesthetic procedures; induction methods and agents; anaesthetic maintenance agents; anaesthetic monitoring; Personnel in charge of anaesthesia; Personnel in charge of anaesthetic monitoring; Anaesthetic records; Anaesthetic mortality and Enquiry about possession of an anaesthetic machine. The Likert's scale was adopted as respondent indicator for the study. A draft version of the questionnaire was validated through experienced veterinarians and their comments used to modify the final version of the instrument.

Instrument administration: The questionnaires were administered between December 2016 and March 2017. Some of the questionnaires were administered at state's Veterinary Medical Association meetings and conferences while others were delivered to clinicians at their practice locations.

Enrolment Criteria: Veterinary practitioners in small and mixed practice were enrolled. One questionnaire was served to each practice even when more than one clinician works in the same clinic or hospital. Incompletely filled questionnaires were not used in the analysis.
Data analysis: The responses (Practitioners' bio-data and questions) were coded and entered into Microsoft windows excel spread sheet (Version 2010). Data generated within each section were presented in percentages.

3. RESULTS

Demography, location and practice type of respondents: Eighty-three completely filled questionnaires from veterinary clinics and hospitals spread across 13 states of the country were analyzed. Practice representatives consisted of 62 males (74.7%) and 21 females, (25.3%). Most clinics and hospitals (58.6%) operated mixed practice (small and large animals), while 40% handle small animal patients alone with 1.4% handling only large animal patients. Many of the practices have only one doctor (99.9%.); a few have two to five doctors (0.1%) while none had more than six doctors.

Assessment of Surgical Case load: Many of the respondents (90%) handle mostly medical cases and handle only minor surgical procedures (50.6%). Thirty-eight (38.6%) refer their major surgical cases. A high number of respondents (67.5%) handle at least one surgical case per month while only 36.1% handle at least one surgery per week (Table 4).

Assessment of Frequency of some selected surgical procedures: When asked for surgeries performed at least once a month, open fracture reduction is done the least frequently (9.4% practitioners); ovariohysterectomy and cherry eye repair (18.1%), closed fracture reduction (22.9%), laparotomies (32%), other surgeries (47%), orchidectomy (60.2%) and wound repair (suturing 69.9%) (Table 5).

Assessment of pre-anaesthetic patient evaluation before surgeries
Full haematology is requested by 28.92% practitioners; both full haematology and serum chemistry are requested by 20.5%. (Table 6).

Assessment of drugs used for premedication
The most frequently used drugs for premedication in dogs and cats are xylazine (dogs 89.2%, cats 14.52%) and atropine (dogs 84.3%, cats 18.1%). Other drugs are: chlorpromazine (dogs-24.1%, cats 6%); acepromazine (dogs 12%, cats 7.2%). Infrequently used drugs or drugs not used at all include dexmedetomidine, butorphanol and buprenorphine (Table 7).

Assessment of drugs used for anaesthetic induction
Xylazine/ketamine combination is the most used for induction of anaesthesia in dogs (83.1%) and cats (25.3%). This is followed by diazepam/ketamine (dogs, 36.1% and cats, 12%), and pentobarbitone (dogs, 18.1% and cats, 3.6%). Other drugs used in dogs in decreasing order include: thiopentone (13.3%), propofol (8.4%), gaseous agent (isoflurane or halothane), 3.6%), and in cats in decreasing order include: Propofol (2.4%), gaseous (2.4%) and thiopentone (1.2%) (Table 8).

Assessment of drugs used for anaesthetic maintenance
Anaesthesia is most frequently maintained with ketamine in both dogs (37.3%) and cats (16.9); Xylazine / Ketamine in dogs (59%), cats (12%); diazepam / ketamine in dogs 30.1 %, cats (7.2); pentobarbitone in dogs (22.9), cats (3.6%); propofol in dogs (8.4%), cats (3.6%), gas in dogs (4.8%), cats (3.6%). (Table 9).

Assessment of patient monitoring during anaesthesia
A high number of respondents (84.4%) monitor vital parameters: respiratory rate (90.1%), temperature (84.1%) and heart rate (67.5%) intraoperatively. Pulse rate and neurologic reflexes are monitored intraoperatively by 67.5%; capillary refill time (CRT) (51.8%) respondents. A few respondents (0.1%) use multiparameter patient monitor. (Table 10).

Assessment of personnel in charge of anaesthesia
In majority (61.5%) of the practices anaesthetists are veterinary surgeons with no specialization status. Only 0.06% practices have board certified anaesthetists as the personnel in charge of anaesthesia. A few practices (7.2%) have closely supervised animal health technologists in charge of anaesthetic administration and monitoring while 3.6% use non-technical but trained staff (Table 11).

Assessment of anesthetic record keeping
Half of the respondents said they keep anaesthetic record for every anaesthetic patient (Table 13)

Assessment of anaesthetic complications
Respondent veterinarians had recorded some anaesthesia associated death (Table 12). Greater proportion of the respondents (66.3%) attributed no death to anaesthetic complications in the past one year, 10.8% attributed one death to anaesthesia, 10.8% attributed 2 deaths to anaesthesia in the past one year.

4. **DISCUSSION**

The result of this survey showed that xylazine is the most commonly used agent for premedication of dogs and cats and xylazine/ketamine combination for induction and maintenance of anaesthesia in the two species. This finding is significant because the use of xylazine in small animals has largely been superseded with the more alpha 2 selective agonists dexmedetomidine and medetomidine which are therefore relatively safer (better cardiovascular safety) than xylazine in these species (Murrell, 2016). Most of the clinics and hospitals surveyed handle majorly small animals especially dogs (table 2). This might be because the survey was carried out in cities where dogs are used for security purposes as observed previously (Eyarefe and Oyetayo, 2016).

Whereas xylazine and atropine are the most frequently used drugs for premedication in dogs and cats by practices surveyed, none of those practices use buprenorphine in either species (Table 4). Only one practice uses butorphanol in dogs while no practice uses it for cat premedication. The reason for no or low usage of these opioids may be due to unavailability of these drugs (Oguntoye and Eyarefe, 2017). Opioids are currently the most used analgesics for perioperative pain prevention and treatment and are a vital component of current multimodal analgesic protocols (Dyson, 2008; Gurney, 2012, Marcfalane, 2018). Chlorpromazine is the second most commonly used premedicant in dogs and fourth most used in cats (Table 7).

Chlorpromazine was used extensively in veterinary practice but has largely been replaced with acepromazine. Acepromazine is the only currently licensed phenothiazine for use in small animals in the United Kingdom (Murrel, 2016). In a similar survey in South Africa, acepromazine is the most used premedicant in small animals (Joubert, 2012). Although the actions and side effects of chlorpromazine are similar to those of acepromazine, it is less potent (Clarke *et al*., 2014). Nevertheless, results from this study showed that chlorpromazine is still used in Nigeria. The reason for this may be the ready availability of this member of the phenothiazine group of drugs in the study location. Chlorpromazine is also used as antipsychotics in man (Orellana *et al*., 2006) and thus found in many pharmacies across the country. In the surveyed practices, anaesthetic induction and maintenance are mostly carried out using injectable agents despite the better acclaimed safety with inhalation agents (Furtado and Andrade, 2013) over injectables for anaesthetic maintenance especially for protracted procedures (Mc Kelvey and Hollingshead, 2000).

This may be due to lack of possession of the delivery apparatus for gaseous anesthesia. Only 8 practices out of the 83 surveyed have anaesthetic machines. Previous studies have shown the preference of injectable anaesthetics in resource poor settings due to the expensive nature of the delivery apparatus of inhalation anaesthetics (Curro, 1998; Eyarefe and Oguntoye, 2015). The anaesthetic machine not only delivers an anaesthetic agent, but is also used to assess ventilation (through observation of the reservoir bag expanding and collapsing), to control ventilation when required, and to supplement oxygen; thus providing better physiologic support for the patient (Clarke *et al*., 2014). Pentobarbitone is used for induction

and maintenance of anaesthesia in dogs and cats by some practitioners (Tables 8 and 9). This barbiturate is no longer used in clinical anaesthesia because of hangover effect and associated long recovery (Berry, 2015; Kastner, 2016).

The health status of a patient has a direct influence on anaesthetic choice. A pre-anaesthetic evaluation is essential and sometimes, only laboratory tests can identify some latent conditions that may influence anaesthetic safety (Clarke *et al*., 2014). The cardiovascular depressant effects of propofol for example, are well tolerated in healthy animals, but these effects may be more problematic in high-risk patients with intrinsic cardiac disease as well as in those with systemic disease (Short and Bufalari, 2008). Only 20.5% of the surveyed practices obtain comprehensive haematology and serum chemistry tests. Maybe because majority of them only perform minor surgeries including orchidectomies and wound suturings (Table 3). The non-performance of major surgeries may also be responsible for the low number of practices that recorded any anaesthetic death in the past one year (Table 12).

In addition, responses were based on ability of the respondents' memory and not from examined case records which were poorly kept. Recent studies have shown a reduction in anaesthesia related deaths in dogs and cats in more developed climes (Moon *et al*., 1998; Jones, 2001, Brodelt, 2009). Associated risk factors for anaesthetic complications were patient health status, age, weight, and procedure type and urgency (Brodelt, 2009). Patient monitoring is germane to anesthetic outcome and patient safety (Truchettti, 2019). Many of the facilities lack modern patient monitoring tools and specialized personnel (Tables 10 and 11). Patients that have pulse and pulse oximetry monitoring are 5 times less likely to die than patients without any monitoring (Truchettti, 2019). Studies in human medicine also showed that the use of a capnograph with a pulse oximeter could prevent up to 93% of complications during anaesthesia. The need for skilled and dedicated staff for anaesthesia monitoring, and the use of, at least, a pulse oximeter, a capnograph, an ECG, a blood pressure monitor and a thermometer have been recommended (Truchettti, 2019).

5. CONCLUSION

In conclusion, anaesthetic management practice in Nigeria still relies more on the use of injectable anaesthetics and with less use of recent advancements in global practice of veterinary anaesthesia in terms of drugs, equipment and personnel. Cost and drug availability are major constraints.

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APPENDIX

Table 1: Demographic data of Respondents

Sex	N	%
Male	62	74.7
Female	21	25.3

Table 2: Type of practice

Type of Practice	**N**	**%**
Small animal	34	41.5
Mixed	48	58.5

Table 3: Practice location

State	**N**	**%**
Abia	1	1.2
Akwa	1	1.2
Benue	1	1.2
Delta	1	1.2
Ekiti	6	7.2
Enugu	1	1.2
FCT	11	13.3
Lagos	14	16.9
Nasarawa	1	1.2
Ogun	6	7.2
Ondo	8	9.6
Oyo	17	20.5
Rivers	15	18.1

Table 4. Surgical case load enquiry

Statement	N	%
You handle at least one surgery per week	30	36.1
You handle at least one surgery per month	56	67.5
You handle mostly medical cases	75	90.4
You handle only minor surgical procedures	42	50.6
You refer your major surgical cases	32	38.6

Table 5. Frequency of various selected procedures

Statement	N	%
You perform wound repair (suturing) at least once a month	58	69.9
You perform orchidectomy at least once a month	50	60.2
You perform ovariohysterectomy at least once a month	15	18.0
You perform laparotomies at least once a month	17	20.5
You perform cherry eye repair at least once a month	15	28.1
You perform closed fracture reduction at least once a month	19	22.9
You perform open fracture reduction at least once a month	7	8.4
You perform other surgeries at least once a month	39	46.9

Table 6. Pre anaesthetic evaluation enquiry

Test	N	%
Full haematology only (complete blood count)	24	28.9
Full haematology and Serum biochemistry, BUN, Creatinine, urinalysis	17	20.5

Table 7. Premedicant drug enquiry

Premedicant (Dog)	N	%
Acepromazine	10	12.0
Chlorpromazine	20	24.1
Xylazine	74	89.2
Medetomidine	4	4.8
Dexmedetomidine	1	1.2
Atropine	70	84.3
Butorphanol	1	1.2
Buprenorphine	----	----
Others	4	4.8

Premedicant (Cat)	N	%
Acepromazine	6	7.2
Chlorpromazine	5	6.0
Xylazine	12	14.5
Medetomidine	11	13.3
Dexmedetomidine	3	3.6
Atropine	15	18.1
Butorphanol	--	----
Buprenorphine	--	----
Others	2	2.4

Table 8: Induction Agent Enquiry

Induction (Dog)	N	%
Induction by mask	3	3.6
Thlopentone	11	13.3
Pentobarbitone	15	18.1
Propofol	7	8.4
Diazepam/ketamine	30	36.1
Xylazine/Ketamine	69	83.1
Others	4	4.8

Induction (Cat)	N	%
Induction by mask	2	2.4
Thlopentone	1	1.2
Pentobarbitone	3	3.6
Propofol	2	2.4
Diazepam/ketamine	10	12.0
Xylazine/Ketamine	21	25.3
Others	4	4.8

Table 9: Maintenance Enquiry

Agent (Dog)	N	%
Halothane	2	2.4
Isoflurane	2	2.4
Propofol	7	8.4
Pentobarbitone	19	22.9
Ketamine	31	37.3
Xylazine/Ketamine	49	59.0
Diazepam/Ketamine	25	30.1
Others	1	1.2

Agent (Cat)	N	%
Halothane	1	1.2
Isoflurane	2	2.4
Propofol	3	3.6
Pentobarbitone	3	3.6
Ketamine	14	16.9
Xylazine/Ketamine	10	12.0
Diazepam/Ketamine	6	7.2
Others	2	2.4

Table 10: Enquiry about anaesthetic monitoring

Statement	N	%
You monitor temperature intraoperatively	70	84.4
You monitor respiratory rate intraoperatively	75	90.4
You monitor heart rate intraoperatively	65	78.3
You monitor pulse rate intraoperatively	56	67.5
You monitor capillary refill time intraoperatively	43	51.8
You monitor using multiparameter patient monitor	17	20.5
You monitor reflexes	56	67.5
ECG	83	100.0

Table 11. Enquiry about personnel in charge of anaesthesia administration and monitoring

Personnel	N	%
Trained Veterinary anaesthesiologist	6	11.0
Veterinary surgeon	68	81.9
Animal health technologist	6	7.2
Non-technical but trained staff	3	3.6

Table 12 Enquiry about estimated number of deaths attributed to anaesthetic complications in the past one year recorded by the responding veterinarians.

Number of death	N	%
None	55	66.3
1	9	10.8
2	9	10.8
3	4	4.8
4	1	1.2
5	1	1.2
10	3	3.6
25	1	1.2
Total	83	100.0

Table 13: Enquiry about keeping of anaesthetic record

	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)	Mean	Std. Dev
You keep anaesthetic record during every case	31(35.6)	27(31.0)	9(10.3)	9(10.3)	2.67	1.387
You keep anaesthetic record only during difficult cases	9(10.3)	11(12.6)	23(26.4)	21(24.1)	1.56	1.291
You sometimes keep anaesthetic records	7(8.0)	18(20.7)	18(20.7)	24(26.7)	1.63	1.268
You never keep anaesthetic records	5(5.7)	7 (8.0)	26(29.9)	26(29.9)	1.37	1.132

Table 14: Enquiry about possession of an anaesthetic machine

Do you have an anaesthetic machine		%
Yes	75	90.37
No	8	9.63
Total	83	100.0