Chapter 6: Patient And Personal Safety

Infection Control

Dental procedures involve working in a contaminated field. This contamination comes from oral bacteria as well as environmental bacteria. In cats, particularly, there are a number of viruses that are spread through saliva such as FIV and Feline leukemia. The risk of cross-contaminating patients with bacteria, viruses and foreign body fluids from other patients makes equipment cleaning very important. Human dentists have developed aggressive infection control procedures in response to the risk of spreading HIV and hepatitis among patients and staff. Many of these protocols can and should be adopted by veterinary hospitals.

In light of the growing need for infection control, most dental equipment is now manufactured to withstand a variety of disinfection and sterilization procedures. For each piece of equipment, the reader is encouraged to read the manufactures' recommendations carefully to avoid damaging equipment. Some items are not autoclavable, others should not go in an ultrasonic instrument bath and so on. For equipment that is not sterilizable, disposable plastic infection barrier materials, such as tray sleeves, are available.

At all costs, we must reduce the risks of treatment to our patients and ourselves.

Prior to sterilization, instruments must be cleaned and prepared. In general, at the end of a procedure, equipment should be rinsed and wiped to remove gross debris while being careful to avoid injury from sharp edges and points. If instruments are going to sit for a time prior to cleaning, they should soak in a holding solution to prevent drying of blood and other contaminants. The safest and most efficient method for cleaning most instruments is in an ultrasonic instrument bath using a detergent solution. During sonication, the lid should be on the cleaner to prevent aerosolization of the cleaning fluid into the workspace. Use of a disinfecting solution also helps keep the work area clean and safe. At the end of the cycle, the instruments should be rinsed thoroughly in water and laid out to dry. Use of surgical milk, especially for hinged and sharp instruments, helps prevent corrosion and keeps hinges working freely.

Methods of sterilization available include steam under pressure, chemical vapor, dry heat and cold sterilization solutions. Of these, steam under pressure is the most common and accessible in veterinary practice. It has the advantages of efficacy and reliability, safety to staff and acceptable speed. Chemical vapors must be handled carefully, dry heat is unacceptable for most hand pieces and cold sterilization can take many hours to achieve sterilization and is unacceptable for hand pieces. Whichever method is used, be sure to follow all manufacture's recommendations carefully to ensure desired results.

Let's Get Cooking

The most certain way of sterilizing stainless steel instruments is with super-heated steam under pressure. This can be achieved in an autoclave or a pressure cooker.

The vast majority of dental hand instruments are designed to be autoclaved, which is what human dentists do routinely. After the instruments have been cleaned to remove gross debris, they should be sharpened. Now they are ready to be sterilized.

To reduce the length of time required to achieve sterilization, you might package your instruments in autoclave film or envelopes, instead of bulky cloth wraps. In this way, if you have just two instrument packs, one can be getting sterilized while the other is in use. You can still service several patients a day and each one will have a fresh pack.

If you are concerned that your delicate instruments will get damaged being wrapped up together, there are inexpensive instrument trays available that are autoclavable. They have a number of individual compartments to keep the instruments separate during handling.

I hear some of you saying that you only have one of each instrument and cannot afford to purchase doubles or triples of everything. Well, you can and here is why. Dental hand instruments, even with the best care, have a finite life span. Let us say that in your practice, a curette will last one year. Over a three-year period, you will need to buy three of them. If you buy three today and use each one on every third case, each will last three years. Therefore, in a three-year period, you will still have bought three curettes; the difference is, they were all bought at today's prices, and so this method can actually save you a few pennies.

The same logic can be applied to extraction forceps, elevators, bone files, prophy angles, burs and just about any other piece of equipment.

If you can't stand the heat...

There are some items that do not lend themselves to steam sterilization. Some mouth gags, for instance, have plastic inserts that might melt in an autoclave (gags with rubber inserts are autoclavable).

For gags, there are three options. One is to place them in your cold sterilization solution for the required time (usually about 6 to 24 hours). The next is to remove the inserts and cold sterilize them while autoclaving the rest of the gag. This latter method requires having extra inserts on hand to use while others are left to soak for the necessary length of time. The third option is to replace the inserts with autoclavable rubber inserts. The tops of vacutainer tubes work well.

If you have an electric low speed hand piece, you must be careful. The electric motor is in the hand piece and must not be allowed to get wet. However, the removable nose cone on the end of the motor housing and the majority of good quality prophy and contra angles are all autoclavable. Be sure to read and follow manufacturers' recommendations regarding pre-autoclaving preparation and post-sterilization lubrication requirements.

Most air driven hand pieces are autoclavable. Repeated autoclaving does tend to reduce a hand piece's life span, so read the owner's manual carefully to minimize this effect. Research is on going to develop hand pieces that will suffer no adverse effects from frequent autoclaving.

> Always read the manufacturer's instructions on instrument care and equipment maintenance.

Few, if any, air driven hand pieces can withstand cold sterilization because they are very prone to corrosion in their internal workings. Nor do they tolerate dry heat. The only alternative to steam is to simply wipe the surface with a disinfectant. It is not the best solution, but it is better than nothing.

With regard to disinfectants, Clinical Research Associates tested several. They are like Consumers Report for dental products and procedures. The criteria they used were inactivation of tuberculosis organisms and poliovirus in three minutes or less in the absence and presence of heavy bioburden. Of the fifteen disinfectants used by dentists responding to a CRA survey, only two passed this test. They were Decident and Lysol spray; both contain ethyl alcohol and phenolics.

To increase the effectiveness of the disinfectant, the hand piece can be wrapped in a paper towel soaked in it to increase contact time. Be careful though, as some disinfectants will corrode internal parts if they get inside.

Some of the sundry items used in dentistry are single use. This would include prophy cups and certain prophy angles. These items cannot be adequately decontaminated and so each patient should get a new one.

> If it is disposable, dispose of it.

If you purchase prophy paste in bulk pots, dispense a small amount into a disposable dappen dish, a sterile glass dappen dish or the end of a fresh tongue depressor for each patient. This prevents contamination of the large pot by dipping a dirty prophy cup into it. To keep air-borne contamination from ruining your bulk pot, replace the lid as soon as you have dispensed enough for the case at hand. Another way to avoid cross contamination through paste is to purchase it in sealed, pre-measured, single use dishes. It may cost a bit more, but it is very convenient.

Safety

There is an old medical saying, *"there are some patients we cannot help, but there are none we cannot harm."*

Traditionally, veterinarians have approached dentistry with a rather cavalier attitude. In an attempt to correct this, the topics covered in these pages deal with safety, for you and your patients. Some owners are skeptical about the need for veterinary dental care, and you will have to use all your charm and sales ability to get these people to book their animal for the first procedure. If, as a result of lax safety protocols, the animal develops a complication, you will have your hands full dealing with both a sick animal and a client who has lost confidence in your abilities.

Quite aside from covering your own backside, the safety precautions outlined are in the best interests of your patients, co-workers and yourself.

Mouth Gags & Props

I would like to return to the subject of mouth gags for a while. They are helpful in many dental procedures, but are often not used properly.

The purpose of a gag is to safely hold the patient's mouth open to allow access to all parts of the mouth. The portion of the gag that contacts the teeth is supposed to be plastic or rubber. This is to prevent chipping of the cuspal enamel of the contact teeth. Often, the rubber or plastic inserts are lost long before the gag is ready to be replaced. Therefore, there are many gags in use that cause the teeth to come in direct contact with the metal parts of the gag. The potential for damage to teeth is great and so this practice should be discouraged.

There are a few remedies for this problem. One is to replace the gag as soon as the inserts are lost. A cheaper solution is to replace the inserts. I have used bathtub silicone to fashion new inserts, but any firm rubber that can be shaped and soaked in disinfectant should work well. Try the stopper from a vacutainer tube or get replacements from the manufacturer. For small feline gags, the rubber plunger from a 3ml syringe works well. These replacements are cheap, available and autoclavable.

Another problem with gags is the tendency to have only one or two sizes to choose from in your dental kit. By placing a large gag in a small mouth, the mouth will be forced open too wide. This has a tendency to cause problems with the temporomandibular joints. The solution is to have several sizes on hand. Select the gag that is best fitted to the patient to allow the access you need without unduly stressing the TMJ. This also ensures that you have enough gags so that each patient can have a properly decontaminated one.

For patients who have too few anterior teeth to place in the gag, you can use mouth props.

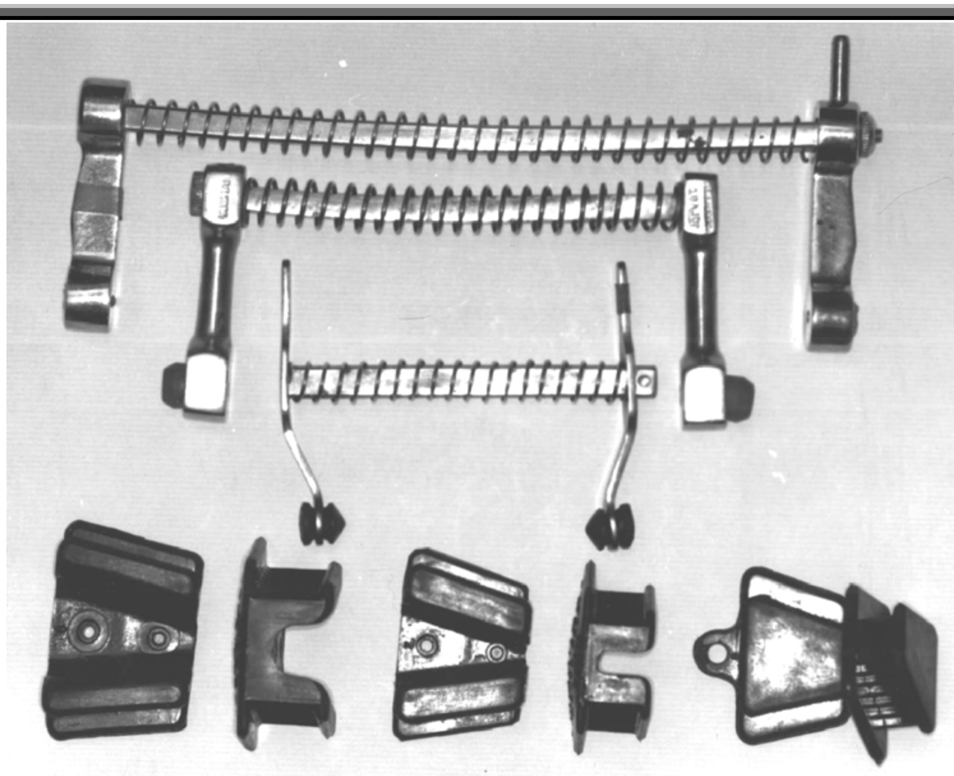

Figure #6.1. Selection of mouth gags (top) and mouth props (bottom). Gags are placed between upper and lower canine teeth. Props are placed between upper and lower posterior teeth. Use the smallest size possible for each case. Autoclave between patients. The medium gag has 10ml vacutainer tube tops as inserts. The feline gag has 3 ml syringe plunger tips as inserts.

Available in a variety of sizes and autoclavable, these rubber-on-metal wedges are placed in the back of the mouth to hold it open.

I do not use a gag or a prop on most cases, preferring to let the mouth lie open passively. If you do use a gag or prop, take it out periodically during the procedure to let the muscles relax.

Endotracheal Tubes

All dental work must be done under general anesthesia. I will not go into detail here, but anyone who tells you differently does not know how to do a proper dental procedure. It simply is not possible to reach under the gum line circumferentially around each of the teeth in a conscious animal.

With the animal anesthetized, a properly fitting, cuffed endotracheal tube must be used. The main reason for this is patient safety.

> You **must** use a cuffed endo-tracheal tube!

As you go about the job of scaling, curetting, polishing and sulcar lavage, you will be filling the oral cavity with a lot of contaminated fluid and debris, especially calculus. The prone, anesthetized animal is at risk of having this debris flow passively into the trachea and down into the airways where aspiration pneumonia may develop. The occlusion of the airways with a cuffed tube helps to prevent this.

You can take this precaution one step further. To prevent fluid and debris from pooling in the oro-pharynx and flowing into the naso-pharynx, place paper towel or gauze sponges in the back of the mouth. When these become soaked, replace them. Just be sure that all packing has been removed before you recover the animal from anesthesia. Tying brightly coloured string around the gauzes and having the end of the string hang out of the mouth provides both a highly visible reminder and a means of retrieving the packing.

The other reason for using a proper endotracheal tube is for the safety of the operator. A loose tube allows anesthetic gases to be exhaled around the tube. The dental operator has her/his face very close to the patient's mouth where any stray anesthetic gases will be inhaled by that person.

Other safety notes

When scaling calculus from teeth, you will be liberating a large number of bacteria, as well as solid chunks of debris. If you are using a mechanical scaler, there will be a highly contaminated aerosol emanating from the instrument and extending to form a sphere roughly four feet in radius. Anything within four feet of the instrument is going to be covered in oral bacteria and debris at the end of the procedure.

To protect yourself from infection, you should always wear a surgical mask and glasses when doing any dental work. If you do not, oral bacteria will get up your nose (or in you mouth if you are a mouth breather) and into your conjunctiva. This could just lead to headaches, runny nose and itchy eyes or it could lead to serious respiratory and ocular disease. A close friend of mine was attempting to extract a cat's tooth when the crown fractured. A fragment of the crown struck him in the eye and perforated his cornea. He was told by his ophthalmologist that he was extremely lucky to retain vision in that eye. He now wears prescription squash goggles for all dental procedures.

You may have to remove your glasses periodically to wipe the outside surface, but if you are not wearing your glasses, all that garbage is going into your eyes.

If you find, as I did, that your glasses fog up when you wear a mask, all you need do is get some anti-fogging solution. This can be purchased at any store that sells scuba equipment, from a hardware store or optometrist. Alternately, Anti-Fogging surgical masks are available and work well.

Another safety precaution is to wear gloves for all dental procedures. This is to prevent oral bacteria from causing nail bed infections or infection in any open wounds on your hands.

For most dental cases, it is necessary to roll the patient from side to side as you scale and curette, then polish and lavage. All this rolling back and forth can be tiresome and it is tempting to do it the easy way (i.e., rolling them over on their backs).

The preferred method for repositioning during a dental procedure is to roll belly-under. It is more cumbersome and may require two people for a large dog, but it is worth the extra effort. If you repeatedly roll an animal over on its back, especially a large, deep-chested dog, there is a real risk of torsing abdominal organs.

Another different friend of mine tried to tell his colleagues of this danger but they did not heed his warning. That same week, a large dog developed a gastric torsion as a complication of a dental prophylaxis. Emergency laporotomy saved the dog, but a little extra care during the dental procedure could have prevented a life threatening emergency, the need for a painful, time consuming and expensive surgery and a very embarrassing situation.

Prevention of hypothermia in cats during routine oral hygiene procedures.

The following paper was published in the Canadian Veterinary Journal in May of 1997. It is reprinted here with the kind permission of the Canadian Veterinary Medical Association. (By the way, I wrote it).

Hypothermia has long been recognized as a complication of general anesthesia in human and veterinary patients (1, 2). The incidence and prevention of hypothermia during routine dental procedures in cats has not yet been investigated. This study was designed to determine if hypothermia was a risk for cats undergoing routine dental procedures and, if so, to investigate a method of preventing it.

Ten privately owned cats were selected for the study. The cats ranged in age from 6 mo. to 5 y (mean 2.8 y) (Table 1). Each cat was clinically healthy with no history of illness or previous medical treatment, with the exception of 1 barn cat that was infested with roundworms, hookworms and tapeworms. This condition was treated at the completion of the study. Each cat underwent 2 procedures, at least 2 weeks apart that were as similar as possible, except for the method used to conserve body temperature. Order of treatment was randomized such that 5 cats received treatment A followed by B and 5 received treatment B followed by A. Hence, each cat acted as its own control.

All cats were premedicated with a mixture of butorphanol, acepromazine and glycopyrolate (BAG*) at approximately 0.5 ml/kg body weight (BW) intramuscularly (IM). All cats except for #2 and #5 received preoperative sodium ampicillin (Ampicillin Sodium, Novopharm, Toronto, Ontario) at a dose of 11 to 22 mg/kg BW IM. Induction was by one of;

a) intravenous (IV) injection of 2.5% sodium thiopental (Pentothal, Abbott Laboratories Ltd., Montreal, Quebec) to effect,

b) IV injection of 2.5% sodium thiopental followed by isoflurane (Aerrane, Ohmeda Pharmaceutical Products, Mississauga, Ontario) administered via face mask,

c) isoflurane in an induction chamber (Table 1).

All cats were intubated with a 4 mm inside diameter orotracheal tube (Matrx Medical, Orchard Park, New York). Maintenance of anesthesia was achieved with isoflurane and oxygen using a Bain non-rebreathing system (Cpram Breathing Circuit, Dryden Corporation, Indianapolis, Indiana).

Treatment A consisted of thorough oral hygiene procedure under general anesthesia, while taking steps to maintain body temperature. Three cats also required some dental extractions. Treatment B consisted of an actual or simulated oral hygiene procedure using an identical anesthetic regimen, but with no efforts to maintain body temperature. During treatment B, 1 cat received endodontic treatment on a maxillary canine tooth and 2 had dental extractions.

Although the actual duration of treatments were not always identical, only those temperature readings with a corresponding measurement in the alternate treatment were used. In this study, the amount of water, in ml, sprayed into the mouth was measure in all cats (Table 1).

During treatment A, the surgical table top (a metal grate) was covered with a sheet of reflective insulating material consisting of 2 layers of bubble pack laminated between layers of aluminum foil (Relectix™ Insulation, Reflectix Inc. Markleville, Indiana). A

* 2mg/ml butorphanol tartrate (Torbugesic, Ayerst Laboratories, Montreal, Quebec) + 0.5 mg/ml acepromazine maleate (Atravet, Ayerst Laboratories, Montreal, Quebec), + 0.1 mg/ml glycopyrolate (Robinul, Wyeth-Ayerst Canada Inc., Montreal, Quebec)

circulating-water heating pad (K-Module, Baxter Healthcare Corp., Valencia, California) was placed on top of this and then covered by a surgical drape. The patient was kept dry by placing it in a plastic bag with only the head protruding though a hole cut in the bottom. The cat in the bag was placed on the surgical drape and then covered by a synthetic sheepskin blanket and another layer of Reflectix™. The tubing for the Bain system was passed through the cocoon to warm the inspired gases. The top layers of the cocoon were removed briefly at least twice during each procedure to allow repositioning of the patient.

During treatment B, the surgical tabletop (metal grate) was covered by a surgical drape. The patient was placed directly on the drape and left uncovered. No attempt was made to prevent the oral lavage water from soaking the head and neck of the patient.

During both procedures, core body temperature was monitored with an esophageal thermometer (Sonotemp 400/700 Monitor, Sheridan Catheter Corp., Argyle, New York), which was placed after induction of general anesthesia.

The tabulated data were plotted and subjected to an assessment of normality and equality of variance ("analysis of residuals") and a randomized complete blocks design (paired t-test).

The results are summarized in Table 1. During treatment A, body temperature decreased between 0.4°C and 1.3°C (mean 0.86°C). During treatment B, body temperature decreased between 1.4°C and 2.1°C (mean 1.84°C). The difference between treatments A and B ranged from 0.7°C to 1.2°C (mean 0.98°C) In many cases, the reduction of temperature in treatment B was exactly twice that recorded in treatment A. The analysis of the data showed a statistical significance at $p \leq .05$.

The ambient room temperature during treatment A was from 20.5°C to 23.1°C (mean 21.97°C ± 0.816°C). Patient starting temperatures for treatment A ranged from 37.0°C to 37.9°C (mean 37.55°C ± 0.306°C) and final temperatures ranged from 36.4°C to 37.2°C (mean 36.69°C ± 0.238°C).

For treatment B, the ambient temperature ranged from 20.5°C to 22.9 °C (mean 21.73°C ± 1.056°C). Patient starting temperatures ranged from 36.7°C to 38.8°C (mean 37.53°C ± 0.629°C) and final temperatures ranged from 36.1°C to 34.9°C (mean 35.69°C ± 0.586°C).

Regulation of body temperature in mammals has been well described in the literature (3, 4). The use of general anesthesia is known to reduce internal heat production thus allowing heat loss (5). As well as the pharmacological effects of anesthesia, surgical preparation and procedures that expose body cavities increase heat loss through radiation and evaporation (1, 6). Other factors include heat loss to evaporation through inhalation of dry medical gases and conductive heat loss due to cold surgical tables (6). The deleterious effects of hypothermia have also been described (3-5). Several methods of heat conservation have been investigated with a view to counteracting the risk of hypothermia during prolonged anesthesia and major surgical procedures, (3, 5-10). These include the use of warmed, humidified anesthetic gases and external sources of heat such as warmed water bottles and oat bags.

A routine oral hygiene procedure is often viewed as a simple, low risk, procedure, which is often carried out by support staff. Although it requires no shaving or scrubbing, exposes no internal body cavities, and usually takes less than an hour, it does require general anesthesia. During mechanical scaling, with a sonic or ultrasonic scaler, a considerable amount of liquid is sprayed into the oral cavity to prevent thermal damage to oral structures and to rinse away debris. Following polishing of the teeth, sulcar lavage also involves the spraying of liquids into the oral cavity.

The oral cavity is highly vascular and is part of the thermoregulatory apparatus. Therefore, we postulated that even relatively short general anesthesia, when combined with copious oral lavage, might expose animals to the risk of developing hypothermia.

The results of this study indicate that, unless steps are taken to conserve body temperature, we may observe a decrease of up to 2°C in cats undergoing routine dental procedures. The results were statistically significant, but their clinical significance may be questioned. In dogs and cats, Dhupa (4) considers a core temperature from 37°C to 32°C to be mild hypothermia. Core temperatures varying from 32°C to 28°C represent moderate hypothermia and a temperature below 28°C is severe hypothermia (which is usually fatal) (4).

In the present study, none of the patients developed moderate or severe hypothermia. All animals during both treatments (with the exception of cat #1, treatment A) had body temperatures below 37.0°C at the end of treatment. Therefore, it could be said that the heat conservation measures failed to prevent the development of mild hypothermia in all but one cat, but they did result in noticeably less heat loss.

Hypothermia has numerous deleterious effects on the patient, including a reduction in the metabolism and clearance of anesthetic agents and, therefore, an increase in recovery time. Also, as body temperature decreases, the minimal alveolar concentration (MAC) of inhalation agent required to maintain a constant plane of anesthesia also goes down. If the MAC delivered is not reduced during the procedure, the patient is at risk of going into increasingly deeper planes of anesthesia. As the depth of anesthesia increases, blood pressure decreases, so the risk of inadequate renal perfusion and acute renal failure becomes a concern (11). Therefore, it is prudent to take steps to minimize heat loss. Body temperature should be monitored during dental procedures and inhalation anesthetic agents adjusted to prevent an increase in the depth of anesthesia as the patient becomes hypothermic. In addition to this, some efforts should be made to keep the patient dry and cocooned to minimize the added risks of heat loss associated with oral hygiene procedures.

The suggestion has been made that using warmed water for the spray/lavage would further reduce body heat loss. Though this was not examined in this study, it seems worthy of consideration. The problem of how to heat the water and keep it warm as it passes through the plumbing of the dental equipment would need to be addressed for each operative set-up.

Addendum:

This project was done using an air-driven sonic scaler. Since that time, I have obtained a peizo-electric scaler, which uses a much greater volume of water during a procedure. Depending on the type of scaler you have, you may be using a lot more water during a procedure than has been indicated by this research.

References:

1. Waterman A. Accidental hypothermia during anesthesia in dogs and cats. Vet Rec 1975; 96: 308-313.
2. Raffe MR, Wright M, McGrath CJ, Crimi AJ. Body temperature changes during general anesthesia in the dog and cat. Vet Anesth 1980; 7: 9-15.
3. McCurnin DM, Grier RL. Temperature control in the critical and surgical patient. In: Sattler FP, Knowles RP, Whittick WG, eds. Veterinary Critical Care. Philadelphia: Lea & Febiger, 1981: 403-414.
4. Dhupa N. Hypothermia in dogs and cats. Compend Contin Educ Pract Vet 1995; 17: 61-69.
5. Hartsfield SM. Body temperature variations associated with general anesthesia: A review. S West Vet 1979; 32: 95-99.
6. Haskins SC. Hypothermia and its prevention during general anesthesia in cats. Am J, Vet Res 1981; 42: 856-861.
7. Evans AT, Sawyer DC, Krahwinkel DJ. Effects of a warm-water blanket on development of hypothermia during small animal surgery. J Am Vet Med Assoc 1968; 163: 147-148.
8. Haskins SC, Patz BA. Effect of inspired-air warming and humidification in the prevention of hypothermia during general anesthesia in cats. Am J Vet Res 1980; 41: 1669-1673.
9. Raffe MR, Martin FB. Effect of inspired air heat and humidification on anesthetic induced hypothermia in dogs. Am J Vet Res 1983; 44: 455-458.
10. Sessler DI, McGuire J, Sessler AM. Perioperative thermal insulation. Anesthesiology 1991; 74: 875-879.
11. Soma LR. Depth of anesthesia. In: Soma LR, ed. Textbook of veterinary anesthesia. Baltimore: Williams & Wilkins, 1971: 178-187.

Table 1. Signalment, Anesthetic regimen, Procedure order, Procedure time, Volume of water used and Temperature loss data.

Cat	Age (yr)	Weight (kg)	Coat Length	BAG (ml)	Ampicillin (mg)	Induction∝	First Treatment	Duration (min)	Volume H20 (ml) A/B	Temperature Loss (°C) A/B	Temperature difference* (°C)
1	4	5.64	short	0.25	62.5	IC	B	45	200/120	0.7/2.0	1.3
2	3	4.86	short	0.25	0	IC	B	35	150/100	0.4/1.8	1.4
3	3	5.64	short	0.3	62.5	37.5 T + IM	B	30	100/100	1.0/1.8	0.8
4	3	5.91	med	0.30	62.5	25.0 T + IM	A	55	160/150	1.0/2.0	1.0
5	5	3.91	short	0.25	0	62.5 T	B	30	120/100	0.8/1.6	0.8
6	5	4.32	short	0.25	100	62.5 T	A	60	130/130	0.7/1.9	1.2
7	1.5	4.41	short	0.25	125	IC	A	50	75/75	1.1/2.0	0.9
8	0.5	2.91	short	0.20	62.5	IC	B	35	100/100	0.9/1.8	0.9
9	2	5.05	long	0.35	125	IC	A	45	160/160	0.7/1.4	0.7
10	0.5	2.05	short	0.15	62.5	IC	A	45	50/50	1.3/2.1	0.8

∝ IC = isoflurane in induction chamber

IM = isoflurane by face mask

x T = x mg of 2.5% sodium thiopental

* temperature from B - temperature from A