Breeders and veterinarians share two great fears: the first and most devastating is the loss of a bitch “in whelp”. The second is the loss of a litter or an overwhelming number of pups.

A 10% to 40% loss of pups is reported to be a “normal loss”. This staggering figure is difficult to substantiate and sources do not always indicate if it includes loss from conception to 12 weeks of age or from birth to 12 weeks of age. Losses that exceed 10% warrant veterinary investigation. If an underlying cause can be determined, the remaining pups in that litter as well as pups in subsequent litters can be protected. Under the best circumstances, we must recognize that there will be unavoidable losses. Neonates are fragile; disorders that are mild in an adult or slight alterations in environment often have much more severe consequences in the neonate.

Teamwork with the breeder-client is essential. To develop the client-staff team, you can:
1. Coach your team to ask the “right” questions on the telephone.

<table>
<thead>
<tr>
<th>Reason for appointment</th>
<th>Puppies that are sick, crying inosolably, having vomiting, diarrhea or coughing, losing weight, dehydrated or dying.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How soon to schedule appointment/urgency</td>
<td>Sick babies are always urgent enough to see the day the client calls, immediately if possible.</td>
</tr>
</tbody>
</table>
| Request client to bring with them to appointment | 1. The entire litter  
2. A way to keep them warm and safe in transit  
3. The mother of the litter  
4. Sheets of data on puppies or kittens weights, temps, vaccinations, worming, meds, diet fed etc  
5. Always bring all the dead pups or kittens they have for examination and possible testing  
6. Fresh fecal sample |
| To ask client before appointment | 1. Weights of pups  
2. Urine color of pups  
3. Temperatures of pups |
| Special instructions client should know about their appointment | Keep the live pups or kittens warm in transit by using a heating pad, an ice chest lined and covered with a towel to prop the lid open. A thermometer to monitor temperature. |

2. Teach your client how to monitor the whelping and pups in the early postpartum period. Objective measurements including rectal temperature, urine color, and weight gain are easily quantified and charted. Trends can alert you early on if there is a problem. Pups should be identified by a marking system or photography—avoid neckbands.
## Normal puppy development from birth to six weeks

<table>
<thead>
<tr>
<th>What is normal?</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Weeks 3-4</th>
<th>Weeks 5-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature, rectal</td>
<td>96 - 98 °F</td>
<td>96-99 °F</td>
<td>100 °F</td>
<td>100 - 101 °F</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>75 to 80 °F</td>
<td>70 to 80 °F</td>
<td>70 to 75 °F</td>
<td>65 to 75 °F</td>
</tr>
<tr>
<td>Contact surface</td>
<td>90 to 95 °F</td>
<td>85 to 90 °F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate &amp; blood pressure</td>
<td>200 to 240 beats per min</td>
<td>200 to 240 beats per min, sinus rhythm</td>
<td>160 to 200 beats per min, sinus rhythm</td>
<td>Varies with breed, sinus rhythm</td>
</tr>
<tr>
<td>Blood volume</td>
<td>75 ml/kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab values</td>
<td>PCV = to dam (42-48%)</td>
<td>Total Protein and Albumin</td>
<td>PCV = 24%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TP 5-6 gm/dl</td>
<td>TP 4.1</td>
<td>ALP - Increased up to 4000 IU/L due to bone growth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BUN 7-10 mg/dl</td>
<td>Albumin lower at 2.1</td>
<td>Mild proteinuria normal up to 6 weeks of age</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glucose 40-60 mg/dl</td>
<td></td>
<td>Electrolytes Normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>15-35/min</td>
<td>15-35/min</td>
<td>15-25/min</td>
<td>15-25/min</td>
</tr>
<tr>
<td>Mucus membranes color/CRT</td>
<td>Pink to hyperemic if recently nursed</td>
<td>Pink/1 second</td>
<td>Pink/1 second</td>
<td>Pink/1 second</td>
</tr>
<tr>
<td>Urine color</td>
<td>Very pale yellow, &lt;1.020</td>
<td>Very pale yellow, &lt;1.020</td>
<td>Pale yellow</td>
<td>Pale to moderate yellow</td>
</tr>
<tr>
<td>Weight</td>
<td>May lose up to 10% in the first 3 days.</td>
<td>Gaining 5 to 10% daily, many double birth weight by day 10. Calculate weight gain of 2 -4 gm/day/kg anticipated adult weight.</td>
<td>Calculate weight gain of 1 -4 gm/day/kg anticipated adult weight.</td>
<td>Calculate weight gain of 1 -4 gm/day/kg anticipated adult weight.</td>
</tr>
<tr>
<td></td>
<td>Birth weight: Toy 100-200 gms; Large 400-500 gms; Giant 700 gms</td>
<td>Calculate weight gain of 2 -4 gm/day/kg anticipated adult weight.</td>
<td>Giant and large breed at faster rate than small breeds.</td>
<td>Walking, climbing, playing, may bark, begin to explore environment, mouthing. Normal postural reflexes.</td>
</tr>
<tr>
<td>Attitude</td>
<td>Quiet, cry infrequently.</td>
<td>Quiet</td>
<td>Quiet, more active</td>
<td>Start to develop “personalities”,</td>
</tr>
<tr>
<td>Vision and hearing</td>
<td>No vision but blink with bright light. Limited hearing.</td>
<td>None to limited vision and hearing, menace present but slow initially. Limited hearing.</td>
<td>Vision blurry, pupillary light reflex present within 24 hours of eyelids opening, respond to</td>
<td>Approaching full vision and hearing.</td>
</tr>
<tr>
<td>Teeth</td>
<td>None</td>
<td>None</td>
<td>Deciduous incisors &amp; canine erupt</td>
<td>Deciduous premolars erupt</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>------</td>
<td>-------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Breeder’s interaction</td>
<td>Assure pups are nursing, supplement if necessary. 1 to 2 times daily take and record temp, weight, urine &amp; stool character. Stimulate urination and defecation if not done by mother. Start Early Neurologic Stimulation days 3-16.</td>
<td>Assure pups are nursing, supplement if necessary. Daily temp take and record, weight, urine &amp; stool character. Continue early neurologic stimulation day 3-16</td>
<td>Continue to assure pups are thriving, begin to enrich environment by variation of toys, surfaces.</td>
<td>Continue to assure pups are thriving, continue to enrich environment. Lots of human interaction for socialization</td>
</tr>
<tr>
<td>Veterinary care</td>
<td>Assess &amp; treat if not thriving, taildocks and dewclaws prior to 5th day if appropriate for breed.</td>
<td>Assess &amp; treat if not thriving. Dispense pyrantel pamoate to use on day 14 after birth.</td>
<td>Assess &amp; treat if not thriving. Dispense pyrantel pamoate to use on day 28 after birth.</td>
<td>Veterinary wellness visit – assess pups for any abnormalities to allow breeder to sell pup with full disclosure. First vaccinations (DAPPv) end of 7th week. Dispense pyrantel pamoate to use on day 42 after birth.</td>
</tr>
<tr>
<td>Food and water</td>
<td>Nursing only. If supplementing, 60 ml/lb/24 hours divided by 12, fed every 2 hours.</td>
<td>Nursing only. If supplementing, 70 ml/lb/24 hours divided by 8, fed every 3 hours.</td>
<td>Offer water, then gruel to start weaning. If supplementing, 90 ml/lb/24 hours divided by 6, fed every 4 hours.</td>
<td>Teething. Many pups weaned, on full food and water, some still nurse for social interaction.</td>
</tr>
</tbody>
</table>

(Adapted from Hoskins JD: Small animal pediatric medicine. Tufts Animal Expo; North Grafton, MA. 2002.)

**Abnormal findings in the first two weeks**

Many pups lose weight in the first 24 hours—but this should not exceed 10% of their total body weight. After the initial loss, weight gain should be 5 to 10% of their birth weight daily. Pups should gain 2 to 4 g/day/kg of anticipated adult weight. Many breeders want the birth weight to double in the first seven to ten days. Most pups should be receiving all of their fluid and nutritional needs by nursing. Careful monitoring of rectal temperature, weight gain, urine color, and overall well-being will indicate if some or all the pups require supplemental feeding.

Despite the varied disorders in newborns, their clinical signs may be so similar that they do not help distinguish the cause. The most obvious complaint is incessant crying or mewing. This grabs the attention of even the most inattentive owner and bitch, but may not identify the sickest pups. Sick puppies move very little, and make no or weak efforts to nurse. They do not twitch while sleeping. Sick pups are often separated in the whelping box from littermates, not cuddled in the group. They are not
gaining weight or worse, are losing. Body temperature is below 94 °F (this is a chilled pup who should not be fed milk until warmed to 96°F) or above 98ºF (this is a fever in a neonate). If the rectal temperature of all pups is high, this may either indicate all the pups are sick or that the environmental temperature is too high. Urine color on a dry cotton ball is an obvious color of yellow. Milk may flow from the nostrils of pups with cleft palates.

Sick pups have a look and “feel” that can be difficult to describe. The general appearance is unthrifty and either overly active or overly still. When picked up, they feel limp and scrawny. Frequently, there is a history of prolonged labor. If a breeder says there is something wrong, but they can’t describe it fully, believe them and have the litter come in for evaluation and treatment.

If a pup seems to be sick or abnormal, take a rectal temperature. If below 96ºF, warm the pup inside the breeder’s shirt or carefully with an external heat source. A heating pad covered with a towel, hot water bottle, or sock filled with heated white rice can be used, but care must be taken to avoid burning, overheating or warming too quickly. Diarrhea, nasal discharge, inflammation of the umbilicus, and/or sloughing of the toes and/or tail tips are early symptoms of illness in newborns.

Advanced in-home care—the breeder as the health care provider
Breeder skills and supplies

A well-educated breeder paired with a well-educated veterinary staff and a veterinarian willing to learn from their breeder-clients make a formidable team. Veterinarians and veterinary staff can learn as much from their breeder-clients as they can learn from us.

The most essential step in good record keeping is to be able to definitively identify each individual in a litter. This is useful for several reasons, including tracking health, weight gain, monitoring medical care, and identifying the purchaser.

For pups born at the veterinary hospital: there are several techniques that can be used for tracking individuals in the litter. With one system, sterile colored hand-towels are used to receive the neonates during a cesarean section. This allows birth order and each pup’s immediate neonatal care to be more easily recorded following resuscitation. The towel color is translated into permanent marker or nail polish and the information is mapped onto a uterine diagram with one copy maintained in the hospital record and one copy provided to the owner. This information may become vital in monitoring an at-risk pup more carefully or establishing a diagnosis of illness in a newborn.

Basic equipment for clients and veterinary clinics to have for whelping:
1. Record keeping system.
2. Method to re-mark puppy’s identification.
3. Room thermometer to track temperature at the puppy’s surface.
4. Rectal thermometer, digital is ideal, to monitor the bitch’s and pup’s temperatures.
5. Scale to weigh pups. This should weigh in ounces or grams.
6. Cotton balls to check urine color of pups.
7. Feeding tube and appropriate syringes if supplementation is necessary.
8. Formula to feed, if supplementation is necessary.
9. Tincture of iodine to dip the umbilicus in at birth two and eight hours postpartum.
10. Chlorhexidine disinfectant solution to disinfect surfaces in the whelping and nursery areas.
11. Bulb syringe and Dee Lee mucus trap.
12. Laundry basket or ice chest (do not seal with the lid and monitor temperature to prevent overheating or chilling) to keep pups in during daily evaluation; makes sorting who is done and who is not easier and faster.
13. Heating pads, rice bags, or Snuggle Safe®.
14. Towels, blankets, tarps and flannel-backed vinyl table cloths to keep the pups and room sanitary.
Causes of neonatal mortality

There is no specific disorder known as “fading puppy syndrome”. Early recognition and effective medical care can significantly reduce neonatal illness and death. This can be divided by age range into three time periods. First are problems that occurred in utero or during whelping (from pre-birth to two weeks of age); second are problems that occur early in the postpartum period (from two to five weeks of age); and third are those in the postweaning period (from five to 12 weeks of age). Common causes of neonatal illnesses include: dystocia, physiologic or nutritional causes, environmental causes including poor husbandry, genetic and congenital causes, trauma, teratogens and toxins, infectious diseases (viral and bacterial), parasites, and failure of passive immunity transfer.

Aiding lactation in the dam

Commonly, a bitch may require several days to lactate sufficiently to support a litter without assistance. The bitch may be allowed to eat food that is not ordinarily part of her normal diet. She must be fed a diet that contains carbohydrates to lactate well. Fluid therapy can be useful in improving lactation. Subcutaneous fluids can be administered at the hospital or by the clients at home.

Oxytocin can aid in milk letdown. Metoclopramide or domperidone can help increase lactation. Oxytocin and metoclopramide may be used simultaneously. The metoclopramide dosage is 0.2 to 0.4 mg/kg subcutaneously or by mouth (tablets or syrup) three times a day as indicated for up to seven days. Metoclopramide is contraindicated in any bitch with gastrointestinal hemorrhage, gastrointestinal obstruction or perforation, a hypersensitivity to the drug, or a seizure disorder.

Excellent maternal nutrition is essential to support pregnancy and lactation. A high quality commercial dog food – pregnancy, puppy and performance diets are currently recommended. She should be at an ideal body condition prior to pregnancy. During the first four weeks of pregnancy, no diet changes or increase in quantity is indicated. During the last five weeks of pregnancy, she will benefit from an increase of 20% to 50%, depending on the size of litter she is expected to have. No nutritional supplements are necessary if she is fed a commercially available diet for puppies, performance or pregnancy. Uncooked diets put the pups at risk of developing bacterial and parasitic conditions.

Neonatal examination, supportive care, symptoms, and diagnostic work-up

The importance of an office visit – assistance when they need it most; veterinary intervention can be the difference between life and death for the neonate. This needs to be offered on an emergency basis because sick pups can deteriorate quickly when they become ill.

Handling the newborn at the veterinary hospital should be done with great care. Two disinfected laundry baskets with a heat source and towel should be ready prior to the arrival of the client. The pups can be moved from one basket to the next as they are handled to prevent confusion regarding which pup has been examined and treated.

All staff should wash their hands thoroughly and wear examination gloves prior to touching the pups. The examination room should not have recently been used by a patient with a potentially contagious disease. A circulating water blanket or heating pad should be placed under a clean towel as an examination surface. Although the bitch should be present for an examination (to evaluate for a retained pup or placenta, metritis, mastitis, or other illness), she may be more comfortable in another room during examination and treatment of the pups.

The physical examination should be similar to that of any patient. Vital signs including rectal temperature, heart rate, respiratory rate, and mucus membrane color/capillary refill time should be taken. Urine color (including urine specific gravity) and stool character should be evaluated.

Remember, puppies can have most of the same diagnostics used on adults – blood chemistries, complete blood counts, ultrasound and radiographic imaging. Different normal values must be applied, and diagnostics and treatments must be modified, but they are just small dogs in many respects and their small size and immaturity should not put off the veterinarian as the diagnostic plan is developed. Many of the in-house veterinary chemistry and blood count analyzers now use such a small blood volume that nearly any size patient can be evaluated safely.
Supportive care or “treat for the treatable”

Neonatal and pediatric patients can be treated with the following protocol (unless there is a contraindication) until they return to a clinically normal state or a diagnosis can be confirmed, allowing for a specific protocol. These patients are fragile and deteriorate so quickly when ill that treatment should be initiated while diagnostics are pending. Sick neonates symptoms include constant crying, weakness, abdominal distention or pain, anorexia, poor weight gain, poor nursing, restlessness, and isolation. None of these symptoms are pathognomonic for the underlying cause. Assume the sick neonate has a treatable disease and initiate care until proven otherwise.

<table>
<thead>
<tr>
<th>Summary of empirical treatment of the sick neonatal puppy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the sick individual(s) and initiate diagnostics</td>
</tr>
<tr>
<td>1. Oxygen</td>
</tr>
<tr>
<td>2. Warm the hypothermic pups slowly until rectal temperature reaches 96°F</td>
</tr>
<tr>
<td>3. Provide nutritional support in the form of tube feeding formula or IV/PO/IO glucose</td>
</tr>
<tr>
<td>4. Fluid therapy PO/IO/SQ</td>
</tr>
<tr>
<td>5. Antibiotic therapy &amp; topical treatment of the umbilicus</td>
</tr>
<tr>
<td>6. Plasma or serum administration</td>
</tr>
<tr>
<td>7. Transfuse</td>
</tr>
<tr>
<td>8. Vitamin K</td>
</tr>
<tr>
<td>9. Hygiene and elimination</td>
</tr>
<tr>
<td>Reintroduce normal diet – nursing, tube feeding, puppy food</td>
</tr>
<tr>
<td>Continue to carefully monitor with temp/weight/urine color twice daily</td>
</tr>
<tr>
<td>Consider hand-raisong the pup(s) and using empirical antibiotics and supportive care on the entire litter if no source of infection can be found.</td>
</tr>
</tbody>
</table>

Oxygen. Hypoxia is common in the newborn. Intubation and ventilation may be necessary immediately following birth. Oxygen therapy can improve the status of any sick puppy. Pups born prematurely, that aspirate amniotic fluid or meconium, or that are traumatized or oxygen-deprived at birth, will benefit from supplemental oxygen therapy.

Supplemental oxygen can be administered by nasal cannula or placement of an IV catheter in the trachea, if only one pup is affected. There are many techniques for constructing an oxygen chamber. Oxygen concentrators can also be used to deliver a continuous supply of oxygen. The greatest limitation to oxygen use is restriction of the treatment group of pups from association with their dam and littermates.

Thermal support. Normal body temperature for newborns is 96 to 98°F, rising one degree a week until four weeks of age, when they can maintain their own body temperature.

A rectal and room thermometer must be available for monitoring the pups. Thermal support is frequently necessary. Great care is needed at the hospital, during transport, and at home to prevent chilling or overheating. The right combination of warmth and ventilation is essential. The ideal ambient temperature for a litter and the bitch is 70°F with a relative humidity of 55 to 65%. Ambient temperatures of 85 to 90°F are only necessary for orphaned or sick pups or those removed from the care of the bitch.

Newborn pups cannot maintain their own body temperature without an adequate ambient temperature along with the bitch and littermates for thermal support. A healthy newborn can only maintain a body temperature of 12°F above the ambient temperature. A sick newborn is even more vulnerable to hypothermia. The newborn’s inability to shiver and lack of peripheral vasoconstriction leave them dependent on an external heat source for maintenance of a safe core temperature. This situation is exacerbated by their lack of body fat and a relatively large surface area allowing for heat loss.
Poor mothering skills, such as moving the pups out of the warm whelping area, pushing a sick pup aside, or excessive licking of the pups is a common cause of chilling, which leads to illness.

It is essential to avoid overheating puppies that are in a confined space with no ability to move away from the heat source. A range of temperatures and space should be provided which allows the pups to move closer to or away from the heat source. It is possible to kill pups in a short time by overheating and dehydration, and careful monitoring is essential. Heat sources include heating pads, heat lamps, heated microwave pads, heated rice bags, incubators, and hot water bottles.

Low body temperature (less than 96°F) is a very common and often life-threatening problem in the neonate. It should be suspected in any sick pup or pup that is unusually quiet or still. Bradycardia is often secondary to hypothermia, dropping the heart rate from 200 bpm to the 100 to 150 bpm range.

If pups are too warm, they are usually fussing/crying or overly active. To distinguish between the ambient temperature being too warm and a fever, all pup’s temperatures should be taken rectally. If the ambient temperature is too high, all of the pups will usually have a rectal temperature over 100°F. If only a portion of the pups have rectal temperatures over 100°F, it is more likely that the hyperthermic pups are febrile and ill. Feeding should not be attempted, by nursing, bottle or tubing, until the rectal temperature can be maintained at 96°F.

Electric heating pads intended for humans can pose a risk of thermal burn or electrocution if the dam or pups chew through the cord. Many of the newer pads have an automatic shut-off. There are several safer alternatives to the use of a heat lamp. Human neonatal incubators or whelping nests with an electric heat source are safe and very effective. Circulating hot water blankets are also a safe and can be wrapped around the pups. Hot water bottles, SnuggleSafe®, or bags/socks filled with rice or oats that can be heated in the microwave will temporarily warm the pups. Rice bags can serve as substitute littermates for singletons and can help support weak pups when they nurse. Water bottles that cool will actually draw heat from the puppies so must be monitored frequently.

A pup that becomes chilled rapidly will develop a life-threatening condition. A chilled pup does not nurse effectively. When the rectal temperature drops below 94°F, peristalsis slows. The pup is at risk of vomiting or backflow followed by aspiration pneumonia. When the rectal temperature plummets below 85°F, bacterial overgrowth occurs in the gut, often followed by sepsis, and the pup becomes hypoglycemic. If allowed to progress, the pup’s rectal temperature will approach room temperature; the pup will not move, breathing becomes almost indistinguishable, the heart rate slows and cannot be palpated, and the pup appears dead.

Nutritional support including tube feeding

Symptoms of inadequate nutrition and hypoglycemia include crying, weakness and inability to nurse effectively. The most reliable technique for nutritional support is tube feeding. It assures that the volume necessary is delivered efficiently, even if the pup is too sick to nurse.

Prior to initiating nutritional support, it is important that the rectal temperature of the pup is 96°F or slightly higher and that it is well-hydrated. Gentle and slow warming of the pup should be initiated prior to feeding to prevent ileus. Most sick neonates are also hypoglycemic. Nutritional support early in the course of treatment is critical. Once warmed, assist the pup in nursing or tube feed. There are many reasons a pup may be under nourished and dehydrated. The underlying problem needs to be addressed (sick mother, sick puppy, too large a litter), but the first thing to do is warm and supplement the pup. Feeding a pup with a rectal temperature below 96°F will result in ileus and fermentation of the milk in the gut. This leads to aspiration and perpetuates the pup’s distress. Tube feeding is recommended over bottle-feeding. Most breeders can be quickly trained to tube feed. Done correctly, it is a safe, fast and effective method. Supplemental feeding with an eyedropper or makeup sponge is dangerous and not recommended.

Low birth weight and failure to ingest colostrum has a strong correlation with failure to thrive. Pups that are 25% below the weight of the average pup in the litter are at increased risk of hypothermia, hypoglycemia, hypoxia, and septicemia. Pups that lose more than 10% of their birth weight in the first 24 hours are sick enough to seek veterinary attention. Treatment including supplemental feeding, fluid
therapy, supplemental heat, antibiotics, and possibly plasma infusion, and oxygen therapy should be initiated. Diagnostics may also be indicated.

Some pups requiring supplemental feeding have serious medical or genetic disorders. Most, however, are just off to a rough start. The least we can do is support them with the warmth and nutritional care they require. Most pups who start off poorly begin to thrive with a few feedings a day and a little extra care. Clients who are willing to invest the extra effort should be encouraged and educated to promote this. More pups are lost to starvation than to any other problem in the immediate postpartum period. Fear of tube feeding or lack of training should not be an excuse. If warming and feeding do not return the pup to normal, seek veterinary care.

The most effective way to tube feed a neonate is to pass a soft silicone feeding tube through the oral cavity into the stomach at each feeding. An NE tube can be placed and sutured into position for long-term nutritional support. Surgical placement of a pharyngostomy or esophagostomy may also be indicated for long-term feeding. This can be done with a brief anesthetic period using gas induction and/or propofol induction and maintenance. Despite the tendency of some pups to gag on the tube when fed past the second week of life, as they mature, many pups see the feeding tube and become very excited and cooperative as the tube is passed making surgical placement unnecessary. Tube feeding will not reduce the pup’s drive to suckle and stimulate the bitch to lactate. At birth or the first few days that follow, it is not possible to tell how the pup will develop. We should be very careful not to “discard” a pup for lack of nutritional support.

Puppies require 22 to 26 kcal per 100 gm of body weight for the first 12 weeks. This translates into 13 ml of formula per 100 grams of body weight per day per pup for the first seven days. This increases to 17 ml/100 gm for week two, 10 ml/100 gm body weight for week three, and 22 ml/100 gm body weight for week four. This should be divided into a minimum of four feedings per day.

Another easy to remember formula is based on the stomach capacity of the newborn, rather than a caloric intake. A neonate stomach can accommodate one ml = (one cc) of formula per one oz of body weight. However, the first several feedings should be approximately 30% lower than the calculated formula to allow for the stomach capacity to accommodate this volume. A smaller quantity should also be fed if the pup appears to have nursed. The stomach can be gently palpated prior to feeding to estimate fullness.

Puppy milk replacer formulas can be purchased commercially, made at home with a recipe, or goat’s milk can be used. The commercially available formulas are preferred as their amino acid and fat/protein ratios most closely match bitch’s milk. Pups fed homemade diets or goats milk often develop nutritional cataracts.

If a puppy is presented in a hypoglycemic crisis, an IV catheter should be placed in the jugular vein if possible (use the largest vein possible or the intraosseous (IO) route to reduce the likelihood of phlebitis). Then 1 to 2 ml/kg of 5% to 20% dextrose should be administered slowly IV. If an IV or IO catheter cannot be placed, 50% dextrose, honey or corn syrup can be rubbed onto the gums and/or administered by stomach tube when the pup is warm enough (over 96°F). Alternatively, 2.5% dextrose and 0.45% NaCl can be given subcutaneously if the IV or IO route is unavailable. For patients that present in a coma or in shock, 20% dextrose administered IV or IO should be used, but with care.

Food should be offered as soon as the pup is alert enough to eat. Five percent dextrose can be continued IV. Prior to discharge from the hospital, the pup must be weaned off the dextrose and must be eating an appropriate diet to prevent relapse of the hypoglycemic episode.

Fluid support and methods of administration—IM, IO, IP, IV, PO, PR, and SQ

Dehydration may occur because of inadequate nursing or secondary to diarrhea and/or other illnesses. Neonates are more susceptible to dehydration because of a higher ratio of surface area to body mass and the inability of their kidneys to concentrate urine.

Hydration status can be assessed on tacky mucus membranes, history of loss and/or inadequate intake, urine with a specific gravity exceeding 1.020 or that is dark yellow in color. Hydration status of
the newborn and neonate cannot be assessed by skin turgor due to a lack of subcutaneous fat. Nearly all sick pups will benefit from fluid replacement therapy. Care should be taken to avoid over-hydration.

The fluids given by any of these routes should be warmed to body temperature (95° to 99°F or 35° to 37°C) before being administered. Neonatal fluid maintenance is 60 to 180 ml/kg of body weight per 24 hours.

If indicated, fluid loading can be initiated by using warmed fluids at a rate of 1 cc per 30 gm of body weight over five to ten minutes, continuing until the patient shows improved mucous membrane color. The fluid maintenance rate can then be increased to 30 to 50 cc/lb/24 hour period (60 to 100 cc/kg/24 hour period) based on deficit and ongoing loss. Potassium chloride can be supplemented via the fluids or orally (using KCL elixir) if the potassium is below 2.5 meq per L. The IV and IO routes are most effective for debilitated patients but are more costly, require hospitalization and separation from the dam and littermates and increased levels of veterinary skills.

**IV fluids.** The jugular vein is the largest, most accessible vein in the neonatal and pediatric patient. An IV catheter (20 g to 24 g, up to 1 inch in length) can be placed, with or without a cutdown, and sutured into place with a tape butterfly. If the skin is difficult to pierce without damaging the catheter, a 20 g needle can be used to nick the overlying skin allowing easier introduction of the catheter. The catheter can be supported with a light tape bandage, taking care to protect the patency of the catheter and the comfort of the puppy. A bandage that is too heavy and restrictive can be detrimental to the pup. In larger pups, other peripheral veins can be accessed. If the catheter is expected to be indwelling for over 12 hours, a sterile skin preparation with povidone iodine or chlorhexidine should be applied to minimize complications. To minimize clotting of the catheter if it is used intermittently, 0.5 cc of 50% dextrose can be injected into the catheter at the end of each injection cycle. Heparin should be avoided.

Fluids that can be administered via the IV route include 2.5% dextrose and 0.45% NaCl, Ringer’s solution, normal saline, dextrose 5%, hypertonic fluids such as 50% dextrose and 7% saline, hetastarch, other colloids, blood and blood products as well as drugs labeled for IV administration. Lactate cannot be metabolized by the neonate. It is better avoided if there is an alternative fluid source, but can be used if lactated Ringer’s solution is the only fluid option available.

**IO fluids.** The intrasosseous route allows rapid absorption of fluids or blood/blood products by administration directly into the vascular space. It is easier to place an IO needle than it is to cannulate a small vein on a neonatal patient. Equipment needs are simple – either a 22 gauge spinal needle or a hypodermic needle, size 20 to 25 gauge, materials for a sterile preparation, bandaging materials, and a routine IV administration setup with an extension set. The sites most commonly used are the trochanteric fossa of the femur, the tibial tuberosity, and the trochanteric fossa of the proximal humerus, taking care to avoid injuring the growth plates.

Palpation of the various sites is done to determine the location best suited for the patient. The site should be 1 cm distal to the trochanteric fossa of the femur or humerus, or 1 cm distal to the tibial tuberosity. The site is clipped and a sterile preparation is applied, taking care to avoid overuse of fluids that may cause chilling of the patient. A small bleb of lidocaine or bupivicaine can be administered if indicated by the patient’s condition, taking care to use a minimal dose as neonates have a reduced tolerance for these drugs. A small nick is made in the skin with a scalpel blade. The limb should be stabilized with the free hand cupping the stifle or other joint distal to the insertion site, and the middle finger parallel to the long bone to aid in directing the needle into the lumen. A 22 g spinal needle or a hypodermic needle is selected to suit the size of the patient’s intramedullary space. The needle is inserted by attaching an injection port to the hub to maintain sterility, then twisting the needle as it is advanced. If a hypodermic needle is used and the lumen is plugged at insertion, the first needle should be removed and a second smaller needle or IV stylet should be placed through the needle to dislodge the obstruction. The needle should feel securely seated in the bone when correctly placed. Tape the needle into place by a figure eight strip of one inch white tape around the hub of the needle, around the thigh on each side, and crossing over near the stifle. Place an antibiotic cream around the opening in the skin. Position folded gauze squares around the hub of the needle to support the needle and administration set. Tape the needle and administration set securely to the patient to avoid dislodging the needle or discomfort to the patient.
Complications from IO administration are rare. This technique does require removal of the pup from the other healthy littermates and dam.

Fluids that can be administered via the IO route include Ringer’s solution, normal saline, 5% dextrose, hypertonic fluids such as 50% dextrose and 7% saline, hetastarch, other colloids, blood and blood products ans drugs labeled for IV administration.

**SQ fluids.** Subcutaneous fluid administration is a very simple method of rehydrating a neonatal patient. The patient must be warm and have adequate peripheral circulation to pick up the fluids. This can often be done by the client at home. This route has the advantage of keeping the affected neonates with their littermates and dam. It is also more affordable for the client.

Not all fluids can be administered via the SQ route. Lactated Ringer’s solution, normal saline, 2.5% Dextrose with 0.45% NaCl, serum and plasma and drugs labeled for subcutaneous administration can be given via this route. Five percent dextrose is not recommended for administration subcutaneously. Warm the fluids to body temperature and inject them into one or two sites in the interscapular space. Injection with a 20 gauge needle and appropriate sized syringe is easier than use of a bag of fluids with a venoset. The typical dose is approximately one cc per one oz of body weight per time of administration. Overhydration can be a serious complication. Rapid or labored respirations are a symptom of overhydration and indicate that fluid therapy rates must be adjusted.

**PO fluids.** Fluids can be administered by mouth or by feeding tube, if the gut is working. This means that the rectal temperature of the pup must be over 96°F, the gut is patent (stools have been passed) and there is no ongoing vomiting.

If the pup is strong and has an adequate suckling response, a small “preemie” nipple and bottle or a small bottle (15 ml medi-nurser) designed to administer oral medication to infants can be used. Many pet nursers and human baby bottles are not well suited to this because the pups do not take the nipple well and the bottle is so large it is difficult to assess how much fluid the pup has taken.

Initially, a sick pup can be fed electrolytes (warmed lactated Ringer’s solution) or a 50:50 mix of milk replacer, mother’s milk extracted from the bitch, or goat’s milk combined with warmed lactated Ringer’s solution or other appropriate oral electrolyte solution. This can be administered by bottle or by feeding tube, but never by eyedropper as this is too likely to lead to aspiration. Alternatively, a 5% to 10% dextrose solution can be given by feeding tube at 0.25 ml per oz of body weight. There is a small but serious risk of aspiration or perforation of the gut when a tube is used for oral supplementation, but when done correctly, the risk is very small and the benefits are great.

**Antibiotics**

Antibiotics should be considered a first line of defense and started immediately for any sick or debilitated pup. This includes pups born distressed, with diarrhea, with meconium in the fetal fluids, or born after a protracted labor. They should be started at the first sign of illness. The decision to treat the affected pup only or the entire litter is a clinical decision and will vary from case to case. Antibiotics can be administered to neonates through the same routes that are labeled for an adult dog. Critically ill or septic pups should have antibiotics administered by injection, not by PO route.

Orally, or through a feeding tube, is a reliable route if the gut is working. The intraosseous route, which may be preferred if IV administration is not possible, can be substituted for any antibiotic labeled for IV administration. Intravenous injection into the umbilical vein can be useful if the use is indicated at birth. Subcutaneous injection can be used when the pup has adequate peripheral circulation. Intramuscular administration should be used with caution due to the small size and limited circulation of the target site. The intraperitoneal route is no longer considered appropriate for antibiotic administration.

Bacterial infections, as a primary cause of disease, as a secondary invader, and as sepsis are common in the neonate. Many of these bacteria in pups are are relatively antibiotic sensitive. This, and the immature metabolism of a neonate, make penicillin, amoxicillin, amoxicillin with clavulanic acid and cephalixin antibiotics of first choice. Ceftiofur can be used as an injectable for newborns that have had meconium in their fetal membranes.
Potentiated sulfonamides must be used with caution and only in the well-hydrated patient. This is
an appropriate drug choice in a lactating bitch with metritis, mastitis, or other bacterial infections.
Aminoglycosides are rarely indicated and should only be used based on culture and sensitivity results.
The fluoroquinolones are reported to cause defects in the formation of articular cartilage and they
are contraindicated from eight weeks to beyond eight months of age, depending on the length of the
growth phase in different breeds. Drugs in this class can probably be safely used up to four weeks, and to
eight weeks of age if absolutely necessary, but only if based on culture and sensitivity results and if there
is an adequate risk-benefit ratio (when articular cartilage damage is a better outcome than a fatal disease).
This drug class can also be used in the lactating bitch with pups under four weeks of age, but only if
necessary because there are other preferred antibiotics for this application. The tetracyclines should not
be used in pups prior to eruption of all adult dentition due to alteration of the enamel color.
The umbilicus should be closely evaluated and treated by continued dipping with tincture of
iodine. The umbilicus is a common source of infection in the neonate, causing fatal peritonitis.
The carbapenems (amoxicillin, penicillin, amoxicillin with clavulanic acid and cephalaxin),
macrolides (erythromycin and azithromycin) and lincomamines (lincomycin, clindamycin) are generally
safe choices for use in the lactating bitch, if she is not sensitive to the products. Although many drugs
cross into the milk, in no case should this be considered an adequate route of administration for antibiotics
(or any drug) to the neonate.

Passive immunity—plasma or serum

Newborn pups are dependent on ingestion of colostrum in their first 24 hours of life to develop
adequate passive immunity to carry them through their first few months of life. The passive immunity
transmitted transplacentally in the dog (and cat) is insufficient protection.
Alternatively, blood can be collected (then harvest plasma or serum) from the dam or another dog
from the same kennel. The commercially available product is harvested from health-screened dogs.
Although there are reports that suggest using non-commercial colostrum, serum, or plasma harvested
from facilities other than the breeder’s kennel, this risks introducing non-endemic diseases. The product
from the individual breeder’s kennel has the advantage of offering passive protection to the newborns to
diseases they will be exposed to in their own environment.
The dam can be used if she is physically able to withstand the associated blood loss. This is not
recommended if she has just undergone a cesarean section or is otherwise debilitated. The candidate
should be a resident of the breeder’s kennel, have not previously had a blood transfusion or a pregnancy,
be young and in peak health. A larger dog should be selected because she will be able to tolerate having a
larger volume of blood withdrawn. The average puppy will require 45 to 60 ml of whole blood (16 cc of
plasma or serum).

Administration of the plasma or serum. IgG antibodies are well absorbed when administered
subcutaneously. They can also be given IO; IP administration poses significant risk and does not offer
any benefits over SQ administration. Oral administration is inferior to SQ when comparing absorption
rates of antibodies. The published dose for a puppy is 16 cc of plasma administered SQ aseptically in
divided doses over 12 hours.
Kittens require smaller doses, 5 cc SQ three times in 12 hours, and show high levels of circulating
antibodies within 12 hours of administration.
FRESH FROZEN PLASMA FOR NEONATAL PUPPIES

1. Keep all plasma frozen until use. Take care in handling plasma as it can easily become contaminated with bacteria.

2. To thaw, carefully warm the plasma to body temperature. Only warm the tubes that will be used at each administration – keep the remaining tubes in the freezer. This is best done by placing tube against the body or in a pocket for warming. Do not heat in warm water or microwave as this will denature/damage the proteins and render the product ineffective. Gently rock the tube during thawing; do not shake.

3. The dose is 5.4 cc per puppy three times over a 24 hour period, totaling 16.2 cc per puppy. If this can be administered in the first 24 hours after birth, it can be given orally with a feeding tube. After the pups are 24 hours old, it must be given by SQ or IO injection to be effective systemically.

4. Draw 5.4 cc of warmed plasma into a 6 cc syringe. Using a feeding tube (only if the pups are less than 24 hours old) or a 20 or 22 gauge needle (for pups over 24 hours old), inject the warmed plasma. If given SQ, hold the skin pinched to prevent outflow from the injection site. If given by feeding tube, carefully follow instructions for feeding tube administration.

5. Repeat two more times in the next 24 hours. Change to SQ injection if the pups have exceeded 24 hours of age before the doses are administered.

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**Transfusion.** Anemia severe enough to merit a transfusion is rare in the puppy. Neonatal isoerythrolysis, seen in some breeds of kittens, is not a condition seen in the puppy. A pup with severe anemia or a hematocrit of less than 15%, and associated symptoms, may require a whole blood transfusion. Blood is administered at a rate of 10 ml/lb of body weight over 2 hours IV or IO. The whole blood should be collected with a citrated anticoagulant and administered with a standard Millipore blood filter. Administration of blood IP should be done as a last resort only.

**Vitamin K injection.** Any neonatal pup under four days of age showing symptoms of hemorrhage (internally or externally) should have an injection of Vitamin K1 administered at the rate of 0.25 to 2.5 mg SQ or IM once. Neonates are deficient in thrombin and may show signs of hemorrhage associated with sepsis, trauma, or other illness.

**Basic hygiene and assistance with eliminations.** Pups up to four weeks of age lack the ability to urinate or defecate without assistance. Every four hours, or after each feeding, the abdomen and rectal region of each pup should be wiped in a circular motion with warm wet cotton balls to stimulate elimination. If the pups appear soiled with feces or look greasy, they should be carefully washed to reduce contamination without chilling the pups.

In some cases, the pups will have a gas accumulation in the stomach and/or intestinal tract. Gas in the stomach can be relieved by passing a feeding tube and allowing the gas to escape. This type of tube can also be passed rectally if there is gas in the colon or if an enema would benefit the pup. If there is a frothy gas or the gas is lower in the intestines, pediatric simethicone can be administered orally.

**Adjusting drug doses for the neonate.**

The dosage of most drugs needs to be adjusted for the neonate. There is no published information for most drugs and there are many physiologic differences between the neonate and the adult patient. The neonate has a relatively lower body fat and higher water content than the adult; the neonatal blood-brain-barrier is more highly permeable to drugs; the neonate has reduced albumin so has a lower protein binding of drugs; the neonate has reduced renal clearance of drugs; and the neonate has lower hepatic clearance and altered metabolism of drugs due to an immaturity of enzyme function. Even the site and type of administration in the neonate has an altered absorption rate compared to the adult; drugs administered by IM injection have a lower absorption rate and drugs administered by SQ injection and PO routes have an increased rate of absorption compared to adults. Routes of administration such as IO not used in adults are options in the neonate.
In general, drugs that are water-soluble should have the dose increased to compensate for the higher percentage of body water in the neonate. Drugs that are fat-soluble should have the dose decreased (up to 30% to 50%) to compensate for decreased clearance.

Each drug dosage should be researched and calculated based on the case. Many antibiotics have a wide margin of safety, and this needs to be considered when drugs are selected. The benefit-risk ratio of each drug should be carefully assessed and the breeder/owner should be included in this discussion. The Johns Hopkins formulary in *The Harriet Lane Handbook: A Manual for Pediatric House Officers* book is very useful and available used for a very affordable price. This focuses on drugs used in human pregnancy; the data can be extrapolated to veterinary use if necessary.

Prior to administering any drug to any patient, particularly a neonate, the following thought process is useful:

1. Is there a better alternative treatment? Do we need a drug at all? Do we need this drug?
2. Are the risks of treatments balanced by the benefits?
3. What do we know about this drug in this type of patient considering the physiology of the neonate?
4. Are there data we can use to compensate for lack of knowledge about this drug in this type of patient?
5. Do we have informed consent of the owner?
6. What parameters will we use to assess treatment success? Toxicity?
7. Should littermates also be treated?

**Key drugs, dosages and indications**

<table>
<thead>
<tr>
<th>Key Drug</th>
<th>Indication</th>
<th>Dose Range</th>
<th>Frequency</th>
<th>Route</th>
<th>Precautions</th>
<th>Reference</th>
<th>Margin of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acyclovir</td>
<td>Herpes</td>
<td>10 mg/kg As suspension</td>
<td>q 6 hrs until 3 weeks of age.</td>
<td>PO</td>
<td>Anecdotal only</td>
<td>Kampschmidt and others Unpublished observation</td>
<td>narrow</td>
</tr>
<tr>
<td>Amikacin</td>
<td>Gram negative Septicemia</td>
<td>Up to 20-25 mg/kg (with caution)</td>
<td>Q 36-48 hrs if under 6 weeks.</td>
<td>IV</td>
<td>May cause renal and ototoxicity. Reserve for suspected severe life-threatening gram negative infections. Monitor blood levels.</td>
<td>Plumb</td>
<td>narrow</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>Infection</td>
<td>6-22 mg/kg</td>
<td>q12 hr</td>
<td>PO</td>
<td></td>
<td>Various</td>
<td>wide</td>
</tr>
<tr>
<td>Amoxicillin/</td>
<td>Infection</td>
<td>12.5-25 mg/kg</td>
<td>q12 hr</td>
<td>PO</td>
<td></td>
<td>Lee</td>
<td>wide</td>
</tr>
<tr>
<td>Clavulanic Acid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampicillin</td>
<td>Infection</td>
<td>22 mg/kg</td>
<td>q 8 hr</td>
<td>IV</td>
<td></td>
<td>Lee</td>
<td>wide</td>
</tr>
<tr>
<td>Drug</td>
<td>Infection/Indication</td>
<td>Dosage</td>
<td>Dosing Frequency</td>
<td>Route</td>
<td>Notes</td>
<td></td>
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<tr>
<td>Cefazolin</td>
<td>Infection</td>
<td>10-30 mg/kg</td>
<td>q 8 hr</td>
<td>SC or IO</td>
<td>Decrease dose if diminished renal function</td>
<td>Root Kustritz</td>
<td>wide</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>Infection</td>
<td>25-50 mg/kg</td>
<td>q 8 hr</td>
<td>SC or IO</td>
<td>Root Kustritz</td>
<td>wide</td>
<td></td>
</tr>
<tr>
<td>Cephalexin</td>
<td>Infection</td>
<td>10-30 mg/kg</td>
<td>q 8-12 hr</td>
<td>PO</td>
<td>Various</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>Mycoplasmal Infection (Puppies only)</td>
<td>22 mg/kg</td>
<td>Q 8 hr (up to 7 days)</td>
<td>PO</td>
<td>Reserve for CNS disease or cases where bacteria are resistant to other antibiotics. Use minimized due to human health risk when handled.</td>
<td>Poffenberger</td>
<td>narrow</td>
</tr>
<tr>
<td>Fenbendazole</td>
<td>Anthelminthic</td>
<td>50 mg/kg</td>
<td>Q 24 hr for 3 days</td>
<td>PO</td>
<td>5 days if treating for Giardia</td>
<td>Various</td>
<td>wide</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>Infection</td>
<td>5 to 20 mg/kg per day</td>
<td>5 to 20 mg/kg q 12 hours IV for sepsis</td>
<td>PO</td>
<td>Various</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metronidazole</td>
<td>Giardia or anaerobic infection</td>
<td>30 mg/kg in pups at least 2 weeks of age.</td>
<td>q 24 hr for 7 to 10 days</td>
<td>PO</td>
<td>Various</td>
<td>Narrow</td>
<td></td>
</tr>
<tr>
<td>Pyrantel Pamoate</td>
<td>Parasites</td>
<td>5–10 mg/kg</td>
<td>Q 14 days</td>
<td>PO</td>
<td>Various</td>
<td>Wide</td>
<td></td>
</tr>
<tr>
<td>Sulfadimethoxine</td>
<td>Coccidiosis (not labeled for this use)</td>
<td>50 mg/kg first dose, then 25 mg/kg</td>
<td>Q 24 hr for 5-10 days</td>
<td>PO</td>
<td>Avoid if under 4 to 5 weeks of age. Can cause renal precipitate if patient is not well hydrated. May cause KCS or thrombocytopenia.</td>
<td>Plumb</td>
<td>Narrow</td>
</tr>
</tbody>
</table>
Drugs to avoid in neonates and pediatric patients:

<table>
<thead>
<tr>
<th>Drug name</th>
<th>Reason to avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doxycycline and tetracyclines</td>
<td>Discoloration of teeth and alteration in bone development</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>Damage to cartilage in pups over 8 weeks and under 8 months.</td>
</tr>
<tr>
<td>Griseofulvin</td>
<td>Liver damage – diminished liver clearance</td>
</tr>
<tr>
<td>Ivermectin</td>
<td>When neonates, blood-brain barrier too permeable</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>When neonates, blood-brain barrier too permeable</td>
</tr>
<tr>
<td>NSAIDS</td>
<td>In the neonate, renal function may be damaged</td>
</tr>
<tr>
<td>Long acting corticosteroids</td>
<td></td>
</tr>
</tbody>
</table>

Diagnostic testing

1. Blood tests: CBC, chemistry panel and electrolytes and titers.
2. Urinalysis: dipstick, specific gravity, organic acids to detect biochemical pathway errors at Metabolic Screening Laboratory, section of Medical Genetics of the Veterinary Hospital of the University of Pennsylvania.
3. Cultures: Viral cultures, PCRs and bacterial cultures.
4. EKG lead II
5. Radiographs and ultrasound:
6. Function testing: gastrointestinal function testing (tli), hepatic function tests (bile acids), renal clearance iohexol clearance test and urine protein creatinine ratio.
7. Postmortem examination: in house and at the reference laboratory.

Tube feeding directions

Materials
1. Goat’s milk, (pasteurized is preferred), or commercial milk replacer
2. Feeding tube, silicon or red rubber feeding tube 8 to 14 French
3. Permanent marker
4. Syringe of appropriate size with catheter tip (10 or 60 cc)
5. Puppy scale
6. Rectal thermometer

Steps
1. Establish a well-lit warm location where you can hold the pup comfortably and all materials are within reach. Be attentive and do not rush.
2. Take the puppy’s temperature rectally; do not feed unless the rectal temperature is between 96°F and 99°F. If the temperature is below 96°F, gently warm the pup before feeding.

3. On a safe surface, hold the pup with the neck extended. Hold the tapered end of the feeding tube even with the last rib of the largest pup to be fed. Lay the tube along the side of the pup, mark the tube even with the tip of the pup’s nose.

4. Fill the syringe with the calculated amount of formula or milk (20 cc/16 oz body weight or approximately 1 cc per ounce) plus 1 cc of air. Pre-warm the formula to body temperature in a warm water bath—avoid microwaving. Feedings should be administered every three to six hours as indicated by weight gain and hydration status.

5. Attach the syringe to the feeding tube.

6. With the pup fully awake, warm (over 96°F rectal temperature) lying horizontally on the chest, gently pass the tube over the center of the pups tongue, applying gentle pressure to slide the tube up to the mark. Keep the pup’s chin below its ears and pass the tube along the left side of the throat to reduce the chance of mistakenly introducing the tube into the trachea instead of the esophagus. If resistance is met, remove the tube and start over.

7. If you are right handed, cup your left hand around the back of the pup’s head and hold the tube between your index and middle finger to prevent it from moving out of the correct position while feeding. Reverse this if you are left handed.

8. BEFORE FEEDING, firmly pinch the pup on the foot or tail. If the pup vocalizes, the tube placement is correct and you can proceed with feeding. If the tube is mistakenly in the trachea, the pup will struggle but will not be able to make any sound – STOP IMMEDIATELY, REMOVE THE TUBE AND START THE PROCESS OVER.

9. With your right hand, depress the plunger on the syringe, not too quickly, delivering the calculated amount, stopping sooner should milk reflux out of the mouth or nose.

10. Flex the tube on itself to prevent milk from being aspirated into the pup’s airway. Repeat for each pup.

11. Wash syringe and tube with hot soapy water and allow to air dry until next feeding.

12. Stimulate the external anal and urinary orifices with a warm moistened cotton ball or washcloth to effect defecation and urination.
Remember the 5 p’s of safe tube feeding:
1. premeasure the tube
2. pass with the chin down
3. pass along the left side
4. pinch to assure the pup can vocalize before feeding
5. prewarm the pup and formula before feeding

**Deworming**

Recommendations by the Center for Disease Control (CDC) and Companion Animal Parasite Council (CAPC) have updated worming protocols. The CAPC website, [www.capcvet.org](http://www.capcvet.org) may be reviewed by the veterinarian and pet owner for most current recommendations.

Pups and their dams should receive their first deworming when the pups are two weeks of age. Repeat at four, six, and eight weeks, then place on monthly broad-spectrum heartworm anthelmintics that are effective against parasites with zoonotic potential.

Fecal examinations should be performed two to four times during the first year and repeated one to two times a year for adult pets. Use of fenbendazole during pregnancy will minimize transmission of roundworms and hookworms through the placenta and the milk.