**MONITORING TEMPERATURE**

Of the three most common anesthetic complications (hypothermia, hypotension, hypoventilation), hypothermia is the easiest to document without the aid of expensive equipment. All that is needed is a hand held thermometer. Rectal temperature is usually 1° to 2°F lower than core temperature due to loss of muscle tone. It may be lower during procedures that expose the peri-rectal tissues: caudal abdominal, perineal, etc. Tympanic membrane temperatures can be very accurate because the middle ear shares the same vascular supply as the hypothalamus. However, ear thermometers can be technically challenging to use properly in most species. Esophageal readings reflect the temperature of the great vessels. Other methods of monitoring temperature: oral, axillary, and skin surface are not accurate.

Almost all patients that are sedated or anesthetized will lose body temperature. The exceptions are the Nordic breeds of dog (Husky, Malamute, Samoyed, etc.) that may actually become hyperthermic under general anesthesia. Some patients develop hypothermia so severe that normal physiology is wrecked.

The skin surface temperature rises and falls with the environmental temperature. Core body temperature is closely regulated by the hypothalamus. There are three tissue layers designed to insulate the body and prevent heat loss. These consist of the skin, subcutaneous fat, and hair. These layers are more or less efficient in different patients depending upon their thickness. Heat transfer through the insulating layers and to the environment occurs in two stages. In stage one, heat is transferred from the core to the skin. In stage two, heat is lost to the environment by radiation, conduction, convection, and evaporation.

In awake animals, there are several reactions to cold. Behavioral reactions include seeking shelter and curling up. Physiologic reactions also occur. These include piloerection, vasoconstriction, and shivering. Piloerection increases the depth of insulation by forming a stagnant layer of air around the animal. Vasoconstriction of the skin arterioles and arteriovenous anastomoses limits heat loss from the extremities. Shivering increases heat production in all muscle groups. There is also a chemical excitation for heat production. This includes the release of epinephrine, norepinephrine, and thyroxin. The anesthetic drugs effect the thermoregulatory center and all compensatory reactions are abolished during sedation and anesthesia.

Causes of inadvertent hypothermia include:

- General anesthesia: All anesthetics decrease the threshold for thermoregulatory vasoconstriction
- Basal metabolic rate is decreased
- Muscle tone is decreased
- Operating room temperature is often well below body temperature
- Skin prep solutions at room temperature and evaporation
- Cold irrigation solutions at room temperature and evaporation
- IV fluids at room temperature
- Exposed serous surfaces: Evaporation
- Prolonged surgical procedures: Patients become more unstable and continue to cool as anesthesia time increases
- Patient becomes wet during anesthesia: Urine, flush, bathed

It is in the best interest of all patients (except those needing deliberate hypothermia) to be kept normothermic pre-operatively, during anesthesia and post-operatively. Post-operative shivering will increase oxygen consumption by as much 200% to 600% at a time when lung and circulatory function may not be optimal. Post-operative shivering also increases intraocular pressure, increases intracranial pressure, and increases wound pain. Hemorrhage may be increased by the disruption of clots. Carbon dioxide production is greatly increased and may cause acidemia. Ventilation may be decreased, leading to hypoxemia (tissue hypoxia). Hypothermia must be differentiated form post-operative pain, which may also cause shivering.
The prevention of inadvertent hypothermia is more desirable than trying to re-warm patients once they become cold. Effective re-warming cannot happen unless 60% of body surface area is in contact with an external heat source.

Desirable methods for preventing inadvertent hypothermia include:

- Controlling ambient temperature: Keep the OR temperature at least 75°F
- Insulate patients using bubble wrap, plastic wrap, or warm blankets
- Warm skin prep and irrigation solutions
- Warm all intravenous fluids
- Forced air heat exchange blanket like the Bair Hugger®
- Keep patients dry or actively dry them post-operatively: Hand held blow dryer (monitor by hand to prevent burn)
- Placing socks on patients

There are other available methods for providing an external heat source, but they are not desirable due to the potential for thermal injury or electrocution. Radiant heaters or heat lamps ("French Fry" lamps) cannot be easily regulated and can cause severe thermal injury to the skin. Electric heating pads and electric heating boards can develop hot spots or become wet and shock / electrocute a patient. Hot water bottles can be used provided that they are not above 107°F and are removed when they become cool.

It is important to monitor a patient's temperature closely because of the possibility of overshoot. Hyperthermia during surgery or re-warming can occur because the blood vessels in the periphery are vasodilated due to the anesthetic drugs. Heat is easily transferred to the core when peripheral vessels are vasodilated. The adverse effects of hyperthermia are also numerous and can be detrimental to a patient's well-being.

**MONITORING CIRCULATION DURING ANESTHESIA**

The objective of monitoring circulation is to ensure adequate circulatory function and adequate blood flow to vital organs and tissues. Adequate blood flow is determined by cardiac output (CO) which is determined by heart rate (HR), stroke volume (SV), preload (adequate volume), afterload (peripheral vascular resistance (PVR), and synergy of contraction. Arterial blood pressure (ABP) is the product of CO, vascular capacity and blood volume. Adequate arterial blood pressure establishes adequate perfusion for the brain, heart and other organs. Because anesthetic drugs compromise the cardiovascular system in a dose-dependent manner, it is very important to avoid excessive hypotension. Hypotension may lead to serious anesthetic morbidity like kidney failure, blindness and memory deficits.

There are several physiologic parameters that relate to circulation. When they are observed and evaluated together, a determination if circulation is adequate or insufficient (to maintain tissue health) may be made. Methods to evaluate the cardiovascular system may be as simple as auscultation, palpation and direct visualization, or they may be more complicated using various electronic or non-electronic monitors.

**Methods:**

1. Palpation of peripheral pulse to determine rate, rhythm and quality
2. Evaluation of mucous membrane (MM) color and capillary refill time (CRT)
3. Auscultation of heart beat (stethoscope; esophageal stethoscope or other audible heart monitor)
4. Continuous (audible heart monitor) or intermittent monitoring of the heart rate and rhythm
5. Pulse oximetry to determine the % hemoglobin saturation (SpO₂)
6. Electrocardiogram (ECG) continuous display for detection of arrhythmias
7. Blood pressure:
   a. Non-invasive or indirect: oscillometric or Doppler ultrasonic flow detector
b. Invasive or direct: arterial catheter connected to an aneroid manometer or to a transducer and oscilloscope

**PERIPHERAL PULSES AND MUCOUS MEMBRANE COLOR**

Palpation of peripheral pulse and evaluation of mucous membrane (MM) color and capillary refill time (CRT) should be routine for every case in addition to monitoring with any equipment. Palpation of pulses will determine heart rate and rhythm. Pulse quality is assessed as a crude indication of perfusion. Pulse pressure, the difference between systolic and diastolic pressure, should be evaluated for rate, rhythm and quality before and immediately after induction as well as periodically during anesthesia and recovery. The quality of pulse may provide a rough indication of stroke volume. A pink mucous membrane color and rapid CRT suggests adequate perfusion although it is only relatively reliable and non-specific for good perfusion.

Pulse quality, although important to assess, is not always a good reflection of ABP. A patient with a wide pulse pressure (moderate systolic, low diastolic) may have a more prominent pulse than one with a narrow pulse pressure (high systolic, high diastolic). Access to pulses, especially femoral, may be limited during surgery. The quality of lingual pulses is not always reliable. Obesity may make palpation of pulses difficult to assess, especially in cats.

Pale MM could be due to low CO, poor perfusion, anemia, vasoconstriction or hypothermia. Pink or red MM may be normal or an indication of sepsis and/or vasodilation. CRT is not a sensitive indicator of perfusion status but does provide information about overall patient well-being.

**PULSE QUALITY**

Assessing pulse quality frequently is imperative in unstable, shocky emergency patients. Palpating the femoral pulse enables assessment of pulse quality, which is the difference between the systolic and diastolic pressures. Pulse palpation, quality, and duration are a gross estimate of blood pressure and, indirectly, stroke volume. In a normal healthy animal, the pulses should be strong and synchronous, with a palpable pulse for each heart beat (therefore, make sure that you are simultaneously ausculting your patient and palpating for femoral pulses). A palpable femoral pulse is consistent with systolic blood pressure of at least 60 mm Hg. A palpable dorsal metatarsal pulse is consistent with a systolic blood pressure of at least 90 mm Hg, and can be used as a basic "poor man's Dinamap," particularly during volume resuscitation. Poor femoral pulses typically indicate profound hypotension and should be treated aggressively and appropriately.

**AUSCULTATION OF THE HEART**

Auscultation of heart beat using a stethoscope or esophageal stethoscope gives information about heart rate and rhythm but not necessarily cardiac output. The heart beat may be monitored continuously with an audible heart monitor or intermittently. This method can be valuable as a primary monitor or as a secondary "backup" to other monitors.

Although a change in heart rhythm may be noted and an arrhythmia may be suspected, the type of arrhythmia cannot be specifically identified and this is important if treatment is warranted. Auscultation is an insensitive indicator of hemodynamic changes.

**PULSE OXIMETRY**

Although the primary purpose of pulse oximetry is to determine the percent oxygen saturation of hemoglobin, it also provides a continuous display of pulse rate. The pulse oximeter detects pulsatile flow in a capillary bed to determine pulse rate and saturation. It does not give an indication of blood pressure. The pulse oximeter often fails in situations of poor pulse quality. Poor pulse quality can be due to hypothermia, poor perfusion and vasoconstriction, the acquisition of a signal and therefore the reliability of the pulse oximeter often fail.

**NON-INVASIVE ARTERIAL BLOOD PRESSURE**

Non-invasive blood pressure (NIBP) is usually measured indirectly by either sphygmomanometry utilizing a Doppler ultrasound or by oscillometric technique. With either technique, the cuff should be placed snugly around the appendage but not be applied overly tight. If it is applied too tightly, the pressure readings will be lower than the actual pressure because the cuff is partially occluding the
artery on its own. If the cuff is too loose, the pressure measurements will be falsely elevated because the cuff will need to be excessively inflated to occlude arterial blood flow. The cuff width should be 40% limb circumference for measurements to be accurate.

Normal values for arterial blood pressure in mammals are:

- Systolic: 110 to 160 mm Hg
- Diastolic: 70 to 90 mm Hg
- Mean: 70 to 90 mm Hg - Mean of at least 60 mm Hg

Oscillometric methods of obtaining ABP have been demonstrated to be fairly precise in most species under normal circumstances. Despite some inaccuracies under certain conditions, trends can be followed and decreasing ABP would be a signal to intervene with corrective measures. It is not always reliable in small patients (< 2 to 3 kg) due to patient size limitations alone. The strength of the arterial pressure wave must traverse the arterial wall, subcutaneous tissues, skin, hair or fur, the cuff wall, and travel through the lumen of the pressure line to meet the transducer interface. Damping of the signal may occur at any of these locations, causing failure to read the signal adequately.

The technique is least accurate in the face of profound hypotension, when vessels are small or constricted, and during bradycardia. Motion will also interfere with accurate measurement. Accuracy of blood pressure measurement is also dependent upon the cardiac cycle. Extremes of HR and/or irregular rhythms often prevent acquisition of BP readings. Also, extremes in BP and vasoconstriction may also result in lack of acquisition or precision.

Some oscillometric monitors actually cycle and display readings even when the cuff is no longer applied to the patient. This underscores the importance of intermittent tactile assessment of the patient and never sole reliance on machines. It is also important to recognize that patient status is unknown between cycling intervals. Some oscillometric monitors are less reliable for cats and small dogs and are not useful in small exotics, birds and reptiles.

Arterial blood pressure gives an indirect assessment of organ perfusion. Arterial blood pressure is the primary factor determining cerebral, coronary, and hepatic perfusion. Therapeutic intervention is usually necessary if the mean pressure falls below 60 mm Hg in dogs or the systolic pressure falls below 100 mm Hg in cats. The most serious adverse effect of hypotension is decreased oxygen delivery to tissues. Anaerobic metabolism is precipitated and acidemia and acidosis will develop. Ischemic organ damage will occur within minutes in the kidney, liver, and brain.

Causes of hypotension include relative or absolute hypovolemia, shock, sepsis, and drug effects: propofol, inhalant anesthetics, and barbiturates.

Hypertension may occasionally be seen in anesthetic patients. Hypertension associated with chronic renal failure may diminish, or completely resolve, while patients are anesthetized. This is due to the potent vasodilatory actions of the anesthetic drugs. Anesthetic associated causes of hypertension (systolic > 20 kPa, or 150 mm Hg) include pain, hypercarbia, fever, catecholamine release, and drug effects: ketamine, alpha-2 agonists.

**MONITORING THE ELECTROCARDIOGRAM**

An electrocardiogram (commonly referred to as ECG or EKG), is a measurement of the electrical activity of the heart. The electrocardiogram rhythm strip is a valuable method to evaluate cardiac electrical rate and rhythm. It is the only means to specifically identify arrhythmias. Changes in waveform morphology on the ECG can imply derangements in oxygenation such as hypoxia / ischemia (ST changes) or electrolyte imbalances such as hyperkalemia (T, P wave morphology). Abnormal alterations in the ECG can indicate one or more of several heart-related conditions. Conditions that are not heart conditions may also cause changes in the ECG. Arrhythmias are detrimental because they alter circulation, decrease tissue perfusion and indicate decreased cardiac health.

The ECG represents only electrical activity of the heart. It provides no information about mechanical activity (quality of contraction, cardiac output (CO), blood pressure, perfusion). Electrical-mechanical dissociation, a form of cardiac arrest where there is only electrical activity and no CO, may
demonstrate only subtle changes on the ECG. A certain amount of expertise must be acquired to precisely interpret the ECG and to distinguish artifacts from actual waveforms.

**ECG Leads**

The heart’s electrical activity produces an electric current that radiates from the heart through the surrounding tissues and out to the skin. The electrodes attached on the skin surface sense the electric current and transmit that signal to the monitor, creating the ECG waveform. By placing electrodes at specific locations on the body (chest, arms, and legs), a graphic representation, or tracing, of the electrical activity can be obtained. Myocardial depolarization causes heart muscle contraction and blood ejection. Repolarization is the time when the muscle relaxes and the heart fills with blood, readying for the next contraction. The ECG shows the exact sequence of electrical events occurring in the cardiac cells throughout that process.

Different leads provide different information because they enable the heart to be looked at electrically from different vantage points. The three leads most commonly used are Lead I, Lead II, and Lead III. The next most common are AVR (augmented vector right), AVL (augmented vector left), and AVF (augmented vector foot). The different leads simply look at electrical activity across the heart at a different angle.

Lead II is the most commonly monitored lead. It looks at electrical activity from the right front leg, across the body, down to the left rear limb. Lead I provides a view of the heart that shows current moving from the right front leg to the left front leg. Lead III shows the current moving from the left rear limb to the left front limb. The positive or negative deflection of the waveform is related to how the leads view the current and how the monitor displays that signal.

The exact placement of the leads on the body (chest vs. limbs) influences the amplitude (height) of the ECG complex waveforms. It can also create subtle differences in their appearance compared to what is often displayed in books as "normal". However, the only thing necessary to display readable waveforms is to place the leads in a triangle around the heart, making sure the leads are placed in correct relation to each other:

- White: Right front
- Black: Left front
- Red: Left rear

The normal ECG waveform is usually very recognizable. The meaning of the individual components is below:

- The first little upward notch of the ECG tracing is called the "P wave." The P wave indicates that the atria are contracting to pump out blood.
- The next part of the tracing is a short downward section connected to a tall upward section. This next part is called the "QRS complex." This part indicates that the ventricles are contracting to pump out blood.
- The next short upward segment is called the "ST segment." The ST segment indicates the amount of time from the end of the contraction of the ventricles to the beginning of the rest period before the ventricles begin to contract for the next beat.
- The next upward curve is called the "T wave." The T wave indicates the resting period of the ventricles, ventricular repolarization.

When the ECG is evaluated, the size and length of each part of the ECG is examined. Variations in size and length of the different parts of the tracing may be significant. The tracing for each lead of the ECG will look different, but will have the same basic components as described above. Each lead is "looking" at a specific part of the heart, so variations in a lead may indicate a problem with the part of the heart associated with the lead.

Normally, as the electrical impulse moves through the heart, the heart will contract. Each contraction represents one heartbeat. The atria contract a fraction of a second before the ventricles so
their blood empties into the ventricles before the ventricles contract. Upon occasion, electrical myocardial activity will not cause contraction strong enough to eject blood, resulting in pulseless activity. Another presentation is when muscle contraction occurs so quickly after the last beat, the heart does not have time to adequately fill before contracting, resulting in an ineffective cardiac output (volume) and diminished or absent pulse.

**MONITORING VENTILATION**

The objective of monitoring ventilation is to ensure that the patient's breathing is adequately maintained. Although there are several basic methods of assessing the adequacy of ventilation, the single most useful indicator is PaCO\(_2\) from blood gas analysis. Where this is not available, measurement of CO\(_2\) in the expired gas (Capnography) provides a good estimation of PaCO\(_2\). Other methods of observation are helpful when no objective data related to the elimination of carbon dioxide is available.

Observation of thoracic wall movement is a crude method of monitoring ventilation. Changes in the respiratory pattern can indicate underlying physiologic changes in the patient. An irregular pattern may occur in any patient but is commonly observed when ketamine has been part of the anesthetic protocol. There are many limitations to this method of assessment. The surgical drapes and the surgical procedure may limit or exclude the usefulness of this method. Tidal volume may not be adequate even with an apparently normal chest movement. The rate of breathing can vary widely in normal patients of various species and can depend on drugs used, and so a trend is often of greater value than an absolute rate.

Observation of breathing bag movement can be used in addition to observation of chest wall movement or when thoracic wall movement cannot be assessed. The correct size reservoir bag must be in place for tidal volume estimations to be useful. A large bag may not demonstrate subtle changes in ventilatory pattern. Leaks in the circuit will cause a decreased excursion of the breathing bag.

Auscultation of breath sounds is useful for detection of wheezing or crackles. Either an external stethoscope or an esophageal stethoscope may be used. This method may be limited by drapes or patient positioning. The surgical procedure may exclude the usefulness of external auscultation. External auscultation may not be feasible for both sides of the chest during surgery. Sounds alone do not indicate adequate ventilation. Wheezing (old term ronchi) is recognized by the auscultation of high pitched, almost musical sounds upon inspiration. Wheezes are caused by narrowing of the airways. Airway narrowing may be caused by bronchospasm, bronchoconstriction (such as in asthma), or airway secretions like mucus. Ronchi is an old term that is no longer accepted in the literature. The term is confusing in meaning, but it still may be used clinically in some practices to describe wheezing. Ronchi was derived from the Greek word rhonkhos, meaning to snore. The course rattling sound created by snoring is very different compared to wheezing and is caused by vibration of upper airway tissues such as the soft palate, not by narrowing of airways in the bronchial tree. The proper term is wheezing when airway narrowing is ausculted.

Crackles (old term rales or crepitations) sound very similar to the crinkling of actual cellophane or the sound of Rice Crispies when milk is poured over them. They are heard on inspiration and are caused by the "popping open" of collapsed alveoli. Alveoli may be collapsed or obstructed by fluid or debris, and in disease states such as atelectasis, pulmonary edema, pneumonia, pulmonary fibrosis, bronchitis, bronchiectasis, or due to left-sided congestive heart failure. The word rales is derived from the French word râle, meaning to rattle. Audible respiratory monitors that indicate changes in temperature at the endotracheal tube adapter may be useful for alerting staff to a breathing problem. Changes in pitch are a good indication of changes in ventilation. Additionally, an audible monitor may command a faster response from staff than other methods. The sound indicates that the patient is breathing but does not indicate whether ventilation is adequate. Sounds may be difficult to hear in very small patients. A change in sound may be missed in a noisy environment.

Respirometry or spirometry (tidal volume measurement) is useful when available. Normal tidal volumes range from 10–20 ml/kg. When tidal volume measurements are combined with the respiratory rate, minute ventilation can be calculated. The respirometer is more precise if placed as close to the patient as possible rather than close to the anesthesia machine. The former position will eliminate potential changes in volume caused by a compliant circuit. The mechanical resistance of the
equipment may not allow precise measurements for very small patients. Moisture in the equipment can cause sticking of moveable parts and therefore imprecise measurements. Alveolar ventilation is not necessarily the same as minute ventilation and depends on whether the patient has an endotracheal tube in place and also on the depth of each breath.

Capnography (end-expired CO\textsubscript{2} measurement) is very useful in most patients. The CO\textsubscript{2} in expired gas is measured by infra-red spectrophotometry with either a mainstream method or on a sidestream sample of gas. For a mainstream measurement, a spectrophotometer with a transparent window is inserted across the breathing circuit at the connection with the endotracheal tube. A continuous measurement is made of the CO\textsubscript{2} in the gas flowing through the circuit. During sidestream sampling, a fine tube is connected to a port in the breathing circuit located at the endotracheal tube adapter. A small sample of gas is continuously suctioned into a gas analyzer some distance from the patient. The CO\textsubscript{2} is measured in this sample. Ideally, the capnographic waveform should be displayed to give much more information than the values alone. A few examples of such information are airway obstruction, rebreathing, leaks in the circuit, and cardiac arrest. A useful website that provides further information on capnographic waveforms and their interpretation can be found at www.capnography.com.

**Hypoventilation**

Hypoventilation is one of the most common anesthetic complications encountered in veterinary practice. Monitoring blood CO\textsubscript{2} levels by arterial blood gas is the most accurate way of monitoring adequacy of ventilation. A second choice is monitoring end-tidal CO\textsubscript{2}. The pulse oximeter is actually a very poor way to assess ventilation until a patient is already in a crisis. A reservoir bag, that is the correct volume for the patient, will give some indication regarding depth of ventilation (tidal volume).

- Normal arterial CO\textsubscript{2} measured by blood gas analysis is 35 to 45 mm Hg
- Normal end-tidal CO\textsubscript{2} under anesthesia is 35 to 60 mm Hg
- An appropriately sized reservoir bag empties by 1/3 if the patient is moving their normal tidal volume of gas (10 to 15 ml/kg)

Therapy for hypoventilation is very simple: assisted or controlled ventilation. Assisted ventilation is accomplished by squeezing the reservoir bag when the patient starts to inspire. Peak inspiratory pressures (PIP) should be kept to between 20 and 25 cm H\textsubscript{2}O in healthy patients. PIP may need to be increased up to 60 cm H\textsubscript{2}O for patients with restrictive thoracic disease: pleural effusion, pneumothorax, thoracic mass, etc. Disease of the lung tissue makes it very fragile and positive pressure ventilation may easily lead to pneumothorax, even at very low PIP.

Controlled ventilation is accomplished by using a mechanical ventilator or by continuously squeezing the reservoir bag until the patient no longer is attempting to ventilate on their own: the anesthetist has taken over the duty of moving gas into and out of the lungs. There are many types of mechanical ventilators; however, the concepts are the same: ensuring an adequate tidal volume (10 to 15 ml/kg), providing an appropriate number of breaths per minute (6 to 16), and avoiding barotrauma (PIP less than 30 cm H\textsubscript{2}O).

**Trouble Shooting the End-Tidal CO\textsubscript{2} Monitor**

Values in excess of 60 mm Hg: provide assisted or controlled ventilation.

Values less than 35 mm Hg: check the patient for breathing. If the patient is ventilating, rule out hyperventilation. If the patient is ventilating normally, or appears to be hypoventilating, and ETCO\textsubscript{2} is low, then circulation to the lungs must be questioned. At this point, assess arterial blood pressure. If arterial blood pressure is adequate, then there may be profound V/Q mismatch: ventilation / perfusion mismatch. This is where gas is not reaching the alveoli in large areas of the lung that are still receiving normal blood flow; or, large areas are receiving a normal amount of gas in the alveoli but have lost their blood supply. In either case, it may be difficult to re-establish a normal ventilation / perfusion pattern. Long, deep breaths that are held for 2 to 3 seconds may help open collapsed alveoli. Improving circulation by administering IV fluids and supporting blood pressure will improve circulation to all tissues. Other causes of hypocapnia are profound hypothermia (decreased metabolism), severe acid / base disturbance, or other barrier to diffusion such as pulmonary edema or hemorrhage.
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<tr>
<th>Vital Sign</th>
<th>Normal</th>
<th>Anesthesia</th>
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| Respiration | Dog 10-36 breaths per min  
Cat 25-40 Breaths per min | Both 2-20 BPM  
No less than 8 BPM |
| Heart Rate | Dog 60-180 Beats per min  
Cat: 140-220 | 60-120 bpm  
Monitor for defects |
| SpO2 | 100 % | No lower than 95% |
| EtCo2 | 35-40 mm | 40-50 mm |
| Blood Pressure | | Systolic 80-120 mm Hg  
Diastolic 60-110  
Mean 70-90 (greater than 60mm Hg) |
| Mm CRT | Pink and <2 sec | Pink and <2 sec |
| Temperature | 99-102.5 | Need head support if below 989 degrees |

Summary

1. A well trained tech is better than any machine
2. Anesthesia causes hypothermia. Preventing a decrease in body temperature is easier than correcting it.
3. Pulse should be monitor via machine and person; the two numbers should match and make sense. Watch trends
4. If you cannot get a BP with a machine, if you can palpate a dorsal pedal pulse that is equal to a systolic BP of at least 90 mmHg. Correcting Decrease BP w fluids alone is often not possible.
5. Anesthesia causes hypoventilation. You may have to breath for the patient. End tidal CO2 is important. Enough CO2 has to build up to tell the brain to breath.
6. All Machine values need to be interpreted with the physical presentation of the patient
7. Monitor and track trends
Calculating Reservoir bag size

Tidal volume is 10-15 ml/kg and the reservoir bag needs to be 3-5 times tidal volume

For example 7 kg x 15 = 105 ml tidal volume and a 300-500 ml reservoir bag and when in doubt round up