OLEKSANDR MALIEV/shutterstock

Abstract

When newborns need resuscitation, veterinary nurses are often the primary responders, being patient-side at the surgery table or in the whelping box. The RECOVER Newborn Resuscitation Guidelines provide practical steps veterinary nurses can take to support the vital first breath and improve neonatal outcomes in these cases. Understanding the "why" behind these specific protocols, such as why it is no longer recommended to "swing" puppies or why resuscitation should begin with room air, is essential for implementing these lifesaving standards. This article walks through the logic of the RECOVER newborn algorithm.

GET CONTINUING EDUCATION CREDIT

Scan the QR code after reading this article to take the quiz at vetfolio.com and earn free CE.

EMERGENCY MEDICINE/CRITICAL CARE

Small Patients, Specific Protocols: Implementing the RECOVER Newborn Resuscitation Guidelines

Kenichiro Yagi, *MS, RVT, VTS (ECC), (SAIM)*
Veterinary Emergency Group, White Plains, New York

The transition from the womb to the outside world is arguably the most dangerous journey any veterinary patient will ever take. In a matter of seconds, a newborn must shift from total placental dependence to independent pulmonary gas exchange. While many puppies and kittens navigate this transition seamlessly, the stakes are exceptionally high when they do not. Neonatal mortality increases significantly with dystocia and emergency cesarean delivery.[1-3]

For years, veterinary teams relied on a mix of anecdotal evidence, "old school" traditions, and adaptations of adult cardiopulmonary resuscitation (CPR) protocols. However, newborns are not small adults; their physiology is unique, and their

Take-Home Points

- **The algorithm is the roadmap:** Use the RECOVER Newborn Algorithm as a cognitive anchor to ensure the team follows established branching points rather than relying on intuition under stress.
- **Ventilation first:** Lung aeration is the single most important intervention in newborns, as neonatal bradycardia is typically a secondary response to hypoxia, not primary heart disease.
- **120 is the magic number:** A heart rate below 120 beats per minute (bpm) is the signal to stop stimulation and immediately begin positive pressure ventilation.
- **Start with room air:** Initiating resuscitation with 21% oxygen (room air) minimizes oxidative stress and improves outcomes compared with starting with 100% oxygen.
- **Safe stimulation:** Replace "swinging" with vigorous drying and gentle bulb suctioning to avoid the risk of intracranial hemorrhage and aspiration.
- **50 bpm is the cardiopulmonary resuscitation trigger:** A heart rate below 50 bpm in a newborn indicates critical circulatory failure. Waiting for the heart to stop completely is a fatal mistake.
- **Update your pharmacology:** Routine atropine use and indiscriminate doxapram use are discouraged.
- **Defend against the "H's" (hypothermia and hypoglycemia):** Successful resuscitation is only the first step. Maintaining a core temperature of 35 °C to 37 °C (95 °F to 99 °F) and closely monitoring blood glucose are critical to prevent rapid secondary decompensation.

reasons for arrest are almost always respiratory rather than primary cardiac failure. Recognizing this gap, the Reassessment Campaign on Veterinary Resuscitation (RECOVER) Initiative (**recoverinitiative.org**) has released the Newborn Resuscitation Guidelines to provide a standardized, evidence-based framework designed specifically for these first minutes.[4-6]

THE NEWBORN TRANSITION

Newborn puppies and kittens must rapidly transition from placental oxygen delivery to independent pulmonary gas exchange. As the newborn takes its first breaths, the lungs expand, dropping pulmonary resistance and signaling the fetal circulatory shunts (specifically the foramen ovale and ductus arteriosus) to close. If this lung aeration fails, the physical transition halts, leading to profound hypoxia and secondary bradycardia.

The Primary Driver: Hypoxia and Lung Aeration

In adult veterinary patients, cardiac arrest typically involves a failure of the cardiovascular system. By the time the heart stops, the pump has failed, which is why the adult RECOVER guidelines prioritize immediate chest compressions to artificially generate blood flow. However, newborns in distress are not experiencing a heart attack or systemic collapse; they are failing a physiologic transition. Their heart is perfectly healthy, simply waiting for the lungs to provide oxygen. Therefore, newborn resuscitation does not start with chest compressions. With successful aeration of the lungs and reversal of the hypoxia, the newborn's heart has a good chance to recover on its own.

When the transition from the placenta fails, the newborn enters a cycle[6]:

- **Primary apnea:** This is the initial response to oxygen deprivation. The newborn stops breathing, but the cardiovascular system is still compensating; therefore, the heart rate remains normal or only slightly decreased. Because the brain's respiratory center is still responsive to sensory input, vigorous drying or rubbing of the thorax is highly effective. This tactile stimulation sends signals to the central nervous system, often triggering a reflex gasp that restarts the respiratory drive.
- **Secondary (terminal) apnea:** If hypoxia continues, compensatory mechanisms fail. Breathing stops completely, and oxygen deprivation directly impacts the heart muscle, causing a precipitous drop in heart rate (severe bradycardia). The critical clinical takeaway is that a patient in secondary apnea is neurologically unresponsive to touch. Continuing to rub or stimulate wastes precious time. The only effective intervention is immediate positive pressure ventilation (PPV) to force oxygen into the lungs, reversing the hypoxia so the heart can recover.

The RECOVER Newborn Resuscitation Guidelines have formally retired the practice of "swinging" (centrifugation) to force fetal lung fluid out of the bronchioles. Swinging creates a high risk of intracranial hemorrhage caused by acceleration–deceleration forces, as well as the risk of inducing aspiration of stomach contents, and is now strictly contraindicated.

Definitions Matter: Newborn Versus Neonate

For the purposes of these guidelines and practices' clinical protocols, it is important to distinguish the stages of early life:

- **Newborn** specifically refers to the patient during the immediate transition period (the first minutes to hours after birth). This is the window where the RECOVER Newborn Resuscitation Algorithm is applicable (**FIGURE 1**).

BOX 1

Roles During Newborn Resuscitation*

- **Team leader:** Essential for maintaining a global view of the resuscitation effort, keeping track of time, and making the call to escalate to positive pressure ventilation (PPV) or chest compressions
- **Receiver (airway and stimulation):** Responsible for the immediate first steps of the algorithm (drying, tactile stimulation, and clearing the airway)
- **Monitor (heart rate):** Responsible for assessing the heart rate (whether by auscultation, Doppler ultrasonography, or apex beat) to ensure that the decision to initiate PPV is not delayed
- **Ventilator:** Responsible for delivering breaths via a tight-fitting mask if the heart rate drops below 120 beats per minute

**Veterinary team members may be assigned multiple roles, but all functions need to be served.*

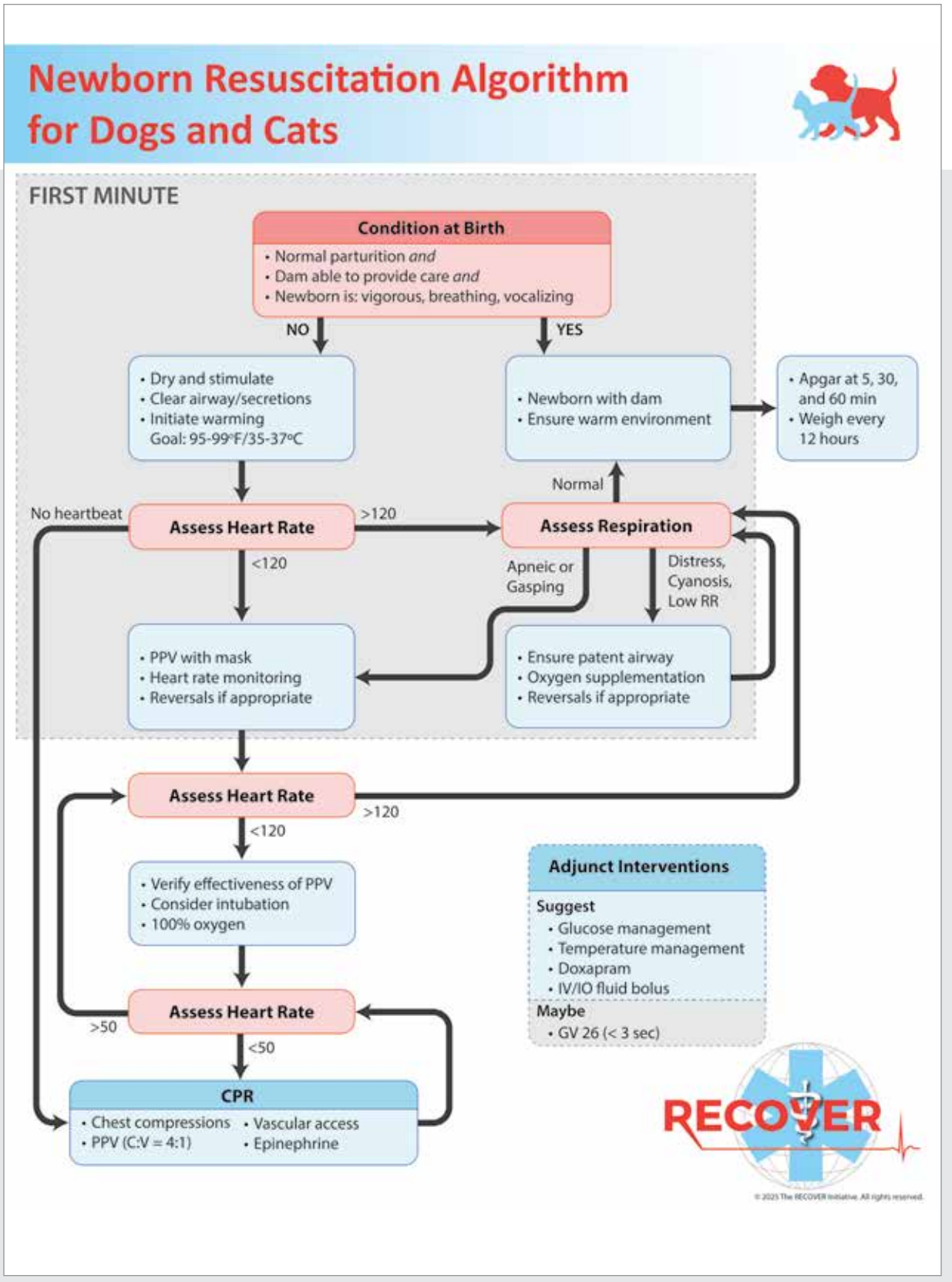


Figure 1: courtesy RECOVER

FIGURE 1. The RECOVER Newborn Resuscitation Algorithm for Dogs and Cats.

CPR = cardiopulmonary resuscitation; C:V = compression-to-ventilation ratio; GV = governing vessel; PPV = positive pressure ventilation; RECOVER = Reassessment Campaign on Veterinary Resuscitation; RR = respiratory rate

- **Neonate** refers to the patient from birth until weaning (typically 3 to 4 weeks of age). While neonates still require specialized care, their resuscitation after the initial transition period begins to align more closely with standard pediatric or adult protocols.

Focusing on the newborn phase targets the precise moment when intervention in a failing transition can support the patient's first successful shift to independent breathing.

PREPARATION: THE PREBRIEF

In emergency medicine, success is determined before the patient presents. For newborn resuscitation, this is especially true. Whether the situation is an expected dystocia, a planned cesarean delivery, or a surprise presentation in the emergency room, the first minute of life leaves no time for gathering supplies or debating roles.

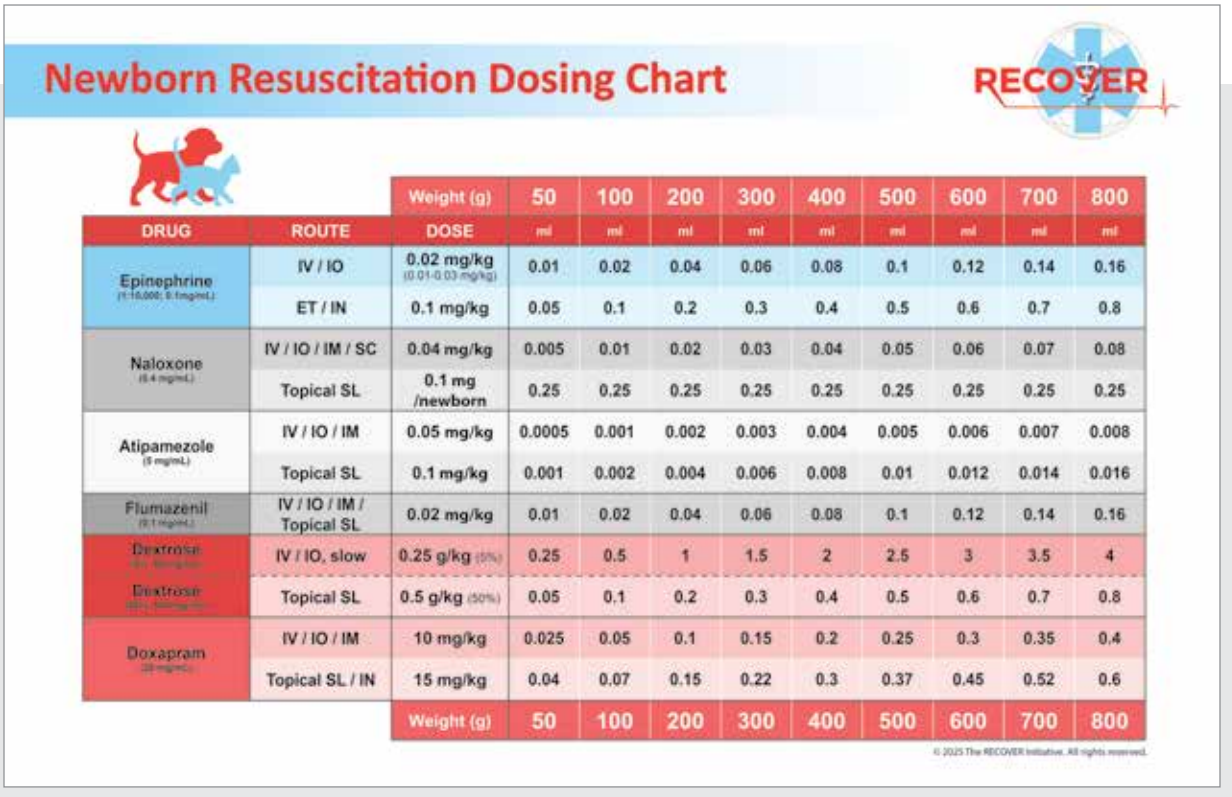
Implementing the RECOVER newborn guidelines begins with "just-in-time" training and prebriefing. The algorithm should be accessible as a cognitive aid in the surgery suite or whelping area. Before the first puppy or kitten is delivered, the team should huddle to assign roles (**BOX 1**). Who is the team leader? Who is receiving the newborns? Who is responsible for monitoring the heart rate?

Equally critical is the establishment of a dedicated resuscitation station where the RECOVER newborn algorithm and precalculated neonatal drug chart (**FIGURE 2**) are prominently displayed or accessible. A properly stocked station prevents frantic scrambling that can delay critical interventions (**BOX 2**).

By preparing the environment and the team ahead of time, veterinary nurses can ensure that when a depressed newborn is handed to them, every second of the first minute is spent actively reversing hypoxia rather than searching for equipment.

ASSESSMENT: HEART RATE AS THE DRIVING VITAL SIGN

If tactile stimulation, warming, and airway clearance do not yield a vigorous, crying newborn, the team must immediately transition from basic supportive care to



DRUG	ROUTE	Weight (g) / DOSE	50 ml	100 ml	200 ml	300 ml	400 ml	500 ml	600 ml	700 ml	800 ml
Epinephrine	IV / IO	0.02 mg/kg (0.01-0.03 mg/kg)	0.01	0.02	0.04	0.06	0.08	0.1	0.12	0.14	0.16
	ET / IN	0.1 mg/kg	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Naloxone	IV / IO / IM / SC	0.04 mg/kg	0.005	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08
	Topical SL	0.1 mg /newborn	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Atipamezole	IV / IO / IM	0.05 mg/kg	0.0005	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008
	Topical SL	0.1 mg/kg	0.001	0.002	0.004	0.006	0.008	0.01	0.012	0.014	0.016
Flumazenil	IV / IO / IM / Topical SL	0.02 mg/kg	0.01	0.02	0.04	0.06	0.08	0.1	0.12	0.14	0.16
Dextrose	IV / IO, slow	0.25 g/kg (5%)	0.25	0.5	1	1.5	2	2.5	3	3.5	4
Dextrose	Topical SL	0.5 g/kg (50%)	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Doxapram	IV / IO / IM	10 mg/kg	0.025	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4
	Topical SL / IN	15 mg/kg	0.04	0.07	0.15	0.22	0.3	0.37	0.45	0.52	0.6
		Weight (g)	50	100	200	300	400	500	600	700	800

FIGURE 2. The Newborn Resuscitation Dosing Chart.

Figure 2: courtesy RECOVER

BOX 2

Newborn Resuscitation Kit Checklist

- **Warming support:** Utilize a radiant heat source or forced-air warming blanket. The goal is to maintain normothermia between 35 °C and 37 °C (95 °F and 99 °F). Rapid heat loss in newborns exacerbates hypoxia and bradycardia.
- **Abundant dry towels:** Primary tools for both drying and the tactile stimulation needed to treat primary apnea
- **Airway clearance tools:** Bulb syringes for gently clearing the mouth and nares*
- **Ventilation equipment:**
  - Tight-fitting masks of appropriate sizes to accommodate newborns of varying sizes
  - Access to an oxygen source
  - Equipment for delivering positive pressure ventilation, such as a T-piece resuscitator, a self-inflating bag, or an anesthesia machine with the smallest possible rebreathing bag attached
- **Monitoring device:** A stethoscope or, preferably, a Doppler ultrasonography probe for rapid heart rate assessment
- **Metronome:** Auditory anchor to prevent rushing compressions under stress and to ensure the 4:1 ratio remains perfectly timed
- **Laminated RECOVER newborn algorithm and drug chart at eye level:** Cognitive anchors to eliminate the need for midcode calculations and ensure the team follows the evidence-based branching points for escalation without delay
- **Pharmacology:** If the dam received sedative analgesics (e.g., opioids, benzodiazepines) prior to delivery, the appropriate reversal agents (e.g., naloxone, flumazenil) should be drawn up and ready.

RECOVER = Reassessment Campaign on Veterinary Resuscitation.
**The outdated and dangerous practice of "swinging" (centrifugation) is now strictly discouraged due to the high risk of intracranial hemorrhage and aspiration.*

clinical assessment. In the newborn, the single most important vital sign and the primary driver for all subsequent interventions is the heart rate.

Because hypoxia quickly leads to bradycardia in the perinatal period, the heart rate serves as an indirect but highly reliable measure of oxygenation. In the RECOVER algorithm, the critical threshold is 120 beats per minute (bpm). A heart rate above 120 bpm generally indicates that the newborn is adequately compensating. A heart rate below 120 bpm despite initial stimulation and airway clearance is a red flag that the patient is suffering from asphyxial injury and requires immediate escalation of care.

How to Measure Heart Rate

Obtaining an accurate heart rate in a newborn requires the right approach.

- **Auscultation and palpation:** Auscultation with a pediatric stethoscope or direct palpation of the apex beat through the chest wall are the simplest and most accessible methods.
- **Doppler ultrasonography:** For patients requiring attention, placing a Doppler ultrasonography probe directly over the heart is highly effective as it creates a "shared mental model" for the room, gives the person providing ventilation instant feedback on whether their breaths are effective, and provides the team leader real-time insight.

While electrocardiography is considered the most accurate monitoring tool, securing leads on a tiny newborn is often clinically impractical.

Notably, the RECOVER guidelines issue a strong recommendation *against* relying on pulse oximetry during this phase. Pulse oximeters are notoriously inaccurate in newborn puppies and kittens due to poor peripheral perfusion, and waiting for a reliable reading will delay lifesaving interventions.[6]

The Role of Apgar Scoring

Apgar scores can be a helpful tool to monitor trends in a vigorous or recovering newborn.[7] They are based on assessments of 5 health parameters at 5, 30, and 60 minutes of life (**TABLE 1**).[7] However, they are *not* a triage tool for initial resuscitation. If a newborn is nonvigorous at birth, do not pause to calculate an Apgar score. Apgar scores should be considered during the postresuscitation phase; their proper use will, therefore, be discussed in further detail later in this article.

TABLE 1 Modified Apgar Scoring for Veterinary Patients

PARAMETER	0 POINTS	1 POINT	2 POINTS
Heart rate	Absent	<180 bpm	>220 bpm
Respiratory effort	Absent	Gasping/irregular	Crying/vigorous
Reflex irritability	No response	Mild response	Vigorous (grimace/cry)
Motility (tone)	Flaccid	Mild flexion	Active motion
Mucous membranes	Cyanotic/pale	Dusky/gray	Pink

RESPIRATORY SUPPORT: THE PRIORITY OF VENTILATION

In the newborn, profound bradycardia is almost entirely driven by a lack of oxygen. If the lungs are successfully aerated, the heart almost always recovers on its own. Therefore, PPV is the primary lifesaving tool.

When to Initiate Positive Pressure Ventilation

The decision to start PPV is straightforward. It should be initiated immediately if the newborn is apneic or gasping or if the heart rate is below the critical threshold of 120 bpm despite initial drying and tactile stimulation. A common pitfall is spending too much time rubbing a nonresponsive patient. Do not wait for a full minute to pass before reaching for the mask; the goal of the RECOVER algorithm is to accomplish stimulation, assessment, and the initiation of PPV all within the first 60 seconds of life if the patient needs it.

The Tight-Fitting Mask

In adult CPR, securing the airway with an endotracheal tube is a top priority, second only to starting compressions. In newborns, attempting early intubation is a common pitfall. The neonatal airway is small, and standard endotracheal tubes rarely fit. Searching for workarounds wastes critical time while the hypoxia worsens.

Instead, the guidelines strongly recommend starting PPV with a tight-fitting face mask. Because newborns come in vastly different shapes and sizes (an Irish wolfhound neonate requires very different equipment than a Chihuahua), having a variety of mask sizes readily available at the resuscitation station is vital to achieving the right seal quickly (**FIGURE 3**).

Dialing in the Pressure

When providing PPV, the goal is to mechanically force open alveoli that have never been expanded and are still filled with fetal lung fluid. Because of this, the required pressures are often higher than those typically used for healthy, anesthetized adult patients. When using an anesthesia circuit or a T-piece resuscitator, target the following parameters[6]:

- **Peak inspiratory pressure:** 20 to 25 cm H_2O
- **Positive end-expiratory pressure (PEEP):** If equipment allows, applying a PEEP of 4 to 8 cm H_2O is beneficial for keeping freshly opened alveoli from collapsing between breaths.
- **Rate and time:** Deliver 20 to 30 breaths per minute, utilizing a short, brisk inspiratory time of approximately 1 second.

Start With Room Air

One of the most significant paradigm shifts in the RECOVER newborn guidelines is the recommendation regarding oxygen concentration. In emergency veterinary medicine, the instinct is to immediately reach for 100% oxygen when a patient is in distress.

However, for a newborn that has been in a prolonged hypoxic state, suddenly flooding the system with 100% oxygen can cause severe oxidative stress and exacerbate ischemia-reperfusion injury to the brain.[8]

FIGURE 3. Proper placement of tight-fitting face mask for positive pressure ventilation in a newborn.

Figures 3 and 4: courtesy RECOVER

The guidelines suggest initiating PPV with room air (21% oxygen). Mechanical expansion of the lungs and delivery of baseline environmental oxygen should trigger the vasodilation needed to transition the circulation. Escalating to 100% supplemental oxygen is recommended if the newborn fails to respond to effective mask ventilation, indicated by a persistently low heart rate, ongoing cyanosis, or lack of spontaneous breathing.

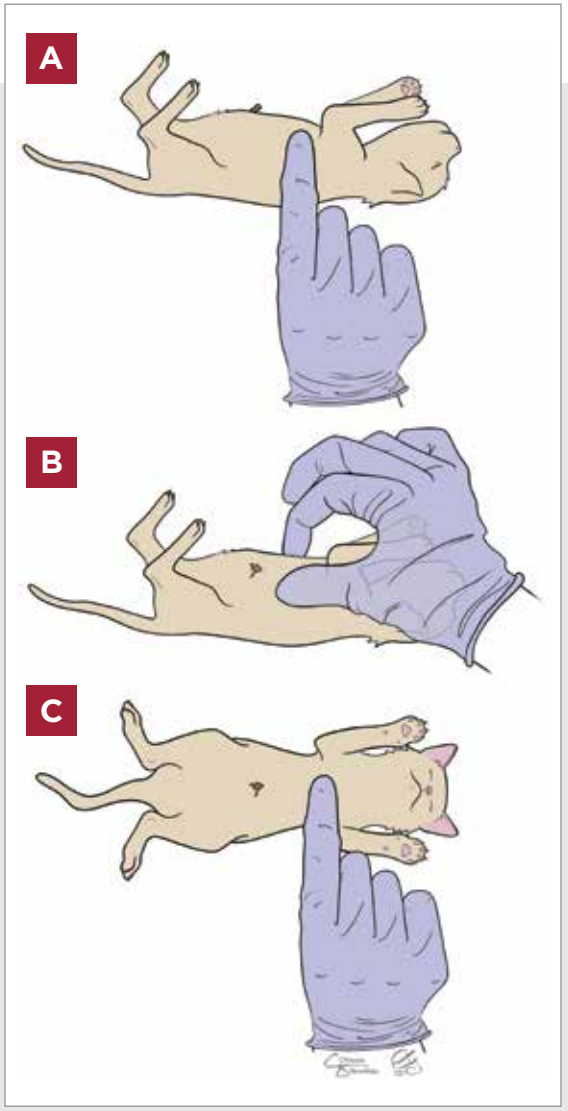


FIGURE 4. Chest compression techniques for newborns. **(A)** The 1- or 2-finger technique involves using the index finger or the index and middle fingers to compress the chest over the heart while the patient is in lateral recumbency. **(B)** The "pinch" technique is performed by wrapping the thumb and index finger around the thorax to deliver compressions. **(C)** When dorsal recumbency is required for umbilical vein access, compressions are performed ventrodorsally over the sternum, with the depth slightly shallower to avoid trauma.

When to Intubate

If the heart rate still fails to climb above 120 bpm during effective PPV via a mask, it is time to escalate. At this point, intubation should be attempted. Because standard tubes are usually too large, the nursing team must be resourceful. Utilizing large-bore intravenous catheters (e.g., 14- or 16-gauge) attached to an airway adapter, sometimes guided by a small speculum, is often the most effective method for securing these undersized airways. Once the airway is secure, switch to 100% oxygen and continue ventilation while continuously monitoring the heart rate.

CARDIOPULMONARY RESUSCITATION: WHEN POSITIVE PRESSURE VENTILATION IS NOT ENOUGH

Despite the team's best efforts with warming, stimulation, and ventilation, some newborns fail to respond. If the heart rate drops below 50 bpm or if there is no heartbeat detected at birth, the patient is in critical circulatory failure, and CPR must be initiated immediately. This represents a distinct escalation from standard newborn resuscitation into full CPR.

In adult veterinary patients, chest compressions are typically not indicated for a patient that still has a pulse. Newborns are physiologically different. Because their heart muscle is immature and stiff, they have a fixed stroke volume; they cannot squeeze harder to compensate for a slowing heart.[8] Their cardiac output is entirely dependent on their heart rate. Therefore, a heart rate below 50 bpm indicates that cardiac output has plummeted and full arrest is imminent. Waiting for the heart to stop completely before starting compressions is a fatal mistake.

Chest Compressions: Technique and Mechanics

The physical mechanics of neonatal CPR require a delicate but effective touch (**FIGURE 4**). Because newborns have highly compliant chests and a small heart, the 2-handed technique used in adults is strictly contraindicated.

- **Positioning:** For most newborns, compressions should be performed in lateral recumbency (laterolateral). Use a 1- to 2-finger technique (index, with or without middle, finger over the heart) or a "pinch" technique, wrapping the thumb and index finger around the thorax.

- **Depth:** Compress the chest by one-third to one-half of its width, allowing for full elastic recoil between compressions.
- **The ventrodorsal exception:** If the team needs to access the umbilical vein for drug administration, the newborn can be placed in dorsal recumbency. Compressions are performed ventrodorsally over the sternum. However, the depth should be slightly shallower (closer to one-third the depth of the chest) to avoid trauma caused by compressing against the spine and epaxial muscles.[6]

The 4:1 Ratio

Because a cuffed endotracheal tube is rarely in place to seal the airway in newborns, continuous compressions cannot be performed simultaneously with ventilation. Instead, the newborn guidelines recommend a 4:1 compression-to-ventilation ratio.

The target is 150 "events" per minute, which breaks down to 120 compressions and 30 breaths per minute.[6] The team leader or timekeeper should set a metronome to 150 bpm. The rhythm should be executed as a coordinated cycle: compression, compression, compression, compression, breath.

Pause compressions for a brief second to deliver the breath and watch for chest rise, then immediately resume the next set of 4 compressions.

The 2-Minute Cycle: Do Not Stop

Once this 4:1 rhythm begins, it must be maintained uninterrupted for a full 2 minutes. Every time compressions are stopped, the artificial perfusion pressure built up in the cardiovascular system instantly plummets to zero. It takes several continuous compressions just to rebuild pressure to a level that effectively forces blood to the brain and heart muscle; therefore, the team should *not* stop to check the heart rate midcycle.

At the end of 2 minutes, the timekeeper announces the end of the cycle, and the team pauses for no more than 10 seconds to evaluate the heart rate (ideally via audible Doppler ultrasonography) and check for spontaneous respiratory effort.[6] If the heart rate remains below 50 bpm or is absent, immediately resume the next 2-minute cycle.

Pharmacology: Use With Intention

In adult patients, advanced life support emphasizes several drugs as interventions. In newborn CPR, pharmacology plays a much more minor role, and interventions are highly specific.

- **Epinephrine:** If there is no response after at least 2 full minutes of effective ventilation and chest compressions, epinephrine may be administered at a dose of 0.01 to 0.03 mg/kg. Intravenous or intraosseous routes are highly preferred, with the umbilical vein often being the most accessible route in a freshly delivered neonate.
- **Reversal agents:** If the dam was given sedative analgesics (such as opioids or benzodiazepines) prior to a cesarean delivery or during dystocia, administering the appropriate reversal agent (naloxone or flumazenil) to the newborn is strongly recommended to remove any chemical respiratory depression.
- **Atropine:** Unlike adult vagally mediated bradycardia, newborn bradycardia is almost exclusively caused by myocardial hypoxia. Administering atropine simply forces a starved heart to work harder without fixing the lack of oxygen. It is generally discouraged unless primary vagally mediated bradycardia is suspected.
- **Doxapram:** Historically considered a "go-to" respiratory stimulant, doxapram is now highly controversial. It works by stimulating the brain's respiratory center, which increases cerebral oxygen demand. Giving doxapram to a cyanotic, hypoxic newborn can actively worsen hypoxic-ischemic brain injury. It should only be considered as an adjunctive measure in a pink, well-oxygenated newborn that is simply bradypneic.[8]

Beyond the First Hour: Transitioning to Standard Basic Life Support

These specific protocols, including the 4:1 ratio and the use of room air, are optimized exclusively for the initial transition from fetal to postnatal life.

Once a newborn has successfully transitioned and stabilized (typically within the first hour of life), any subsequent cardiopulmonary arrest should be managed using the standard RECOVER Basic and Advanced Life Support Guidelines.[9,10]

At this stage, the lungs are aerated and the fetal shunts have likely closed, meaning the patient now requires 100% oxygen and continuous chest compressions to maximize the chances of a successful resuscitation.

POSTRESUSCITATION CARE AND MONITORING

Successfully restoring a heart rate above 120 bpm and establishing spontaneous breathing marks the end of the acute resuscitation phase, but it is only the beginning of the neonatal transition. Newborns that required intervention are at a high risk for secondary decompensation, hypothermia, and hypoglycemia. The nursing focus must now shift from rapid lifesaving interventions to meticulous critical care.

The Proper Time for Apgar Scoring

As mentioned, the adapted Apgar scoring system is not a triage tool for the initial resuscitation, but it is an exceptional monitoring tool for the postresuscitation phase.[7] The team should formally assess and record the Apgar score at 5, 30, and 60 minutes of life. A rising Apgar score over that first hour indicates a successful transition. A stagnant or dropping score alerts the nursing team that the newborn is fatiguing and may require further intervention, such as supplemental oxygen or restarting PPV (**BOX 3**).

Aggressive Thermoregulation

Hypothermia is the enemy of the neonate. As the newborn is stabilized, they must be moved to a controlled, warm environment, such as a dedicated pediatric incubator or a heavily padded area with a radiant heat source. The target core temperature for the first week of life is 35 °C to 37.2 °C (95 °F to 99 °F). Veterinary nurses must be vigilant to avoid iatrogenic thermal burns; never place a newborn directly on a heating pad or hot water bottle without ample, thick bedding between the heat source and the patient.

Umbilical Care

Once the patient is stable, the umbilicus should be properly managed to prevent ascending infection and sepsis. Ligate the umbilical cord approximately 1 to 2 cm from the body wall using absorbable suture material. Afterward, dip the stump in a dilute antiseptic solution, such as 0.5% chlorhexidine or dilute povidone-iodine.

BOX 3

Using the Apgar Score

Apgar score categories (viability ranges)

- **7–10 (excellent/normal):** Vigorous neonate transitioning well. Requires only routine care (warmth, drying, nursing).
- **4–6 (moderate concern/distress):** Struggling neonate. Requires prompt intervention such as clearing the airway, active tactile stimulation, and potentially supplemental oxygen.
- **0–3 (critical):** Severe distress. Immediate and aggressive resuscitation is required (e.g., positive pressure ventilation [PPV], chest compressions).

Pro tip: If the heart rate is between 180 and 220 beats per minute (bpm), or if the membranes are pale pink, use clinical judgment to assign a 1. The goal is not mathematical perfection; it is identifying the trend (e.g., is a 4 becoming a 7, is an 8 dropping to a 5?).

Example 1: The "slow starter"

- **Assessment at 5 minutes:** Heart rate is 160 bpm (1), gasping (1), pulls paw away weakly when pinched (1), limp limbs (0), and membranes are gray (1).
- **Total score:** 4 (moderate concern/distress)
- **Nursing actions:** This patient has not adequately transitioned. Ensure warmth and airway patency; provide PPV if gasping or ineffective breathing persists. Check blood glucose.

Example 2: The "vigorous responder"

- **Assessment at 30 minutes:** Heart rate is 230 bpm (2), strong crying (2), screams when the umbilicus is touched (2), kicking and squirming (2), and membranes are bubblegum pink (2).
- **Total score:** 10 (excellent)
- **Nursing actions:** This patient has successfully transitioned. Maintain a warm environment and move toward initiating the first nursing session with the dam.

Defending Against Hypoglycemia

Newborns possess minimal hepatic glycogen stores and rely almost entirely on exogenous nutrition to maintain blood glucose. The physical stress of a prolonged or difficult delivery, combined with the metabolic toll of hypoxia and resuscitation, rapidly depletes whatever minor reserves they have.

Because these patients can slide into a crisis in minutes, monitoring blood glucose is essential if they are not suckling. A simple blood sample can be obtained via a marginal ear vein or a paw pad prick using a small-gauge needle or sterile lancet.

According to the RECOVER guidelines, the threshold for intervention is a blood glucose below 60 mg/dL.

- **The first-line goal:** If the dam is stable and awake and maternal instincts are present, encourage nursing as soon as possible. Early nursing provides both glucose and lifesaving colostrum for passive immunity.
- **For stable, warm neonates:** If the dam is unavailable but the patient has a strong sucking reflex, the priority is immediate tube-feeding of colostrum or a commercial milk replacer.
- **For weak or symptomatic neonates:** If the patient is lethargic or has a poor sucking reflex, the nursing team must act quickly. While preparing for systemic access, a small amount of 50% dextrose at 0.5 g/kg can be applied directly to the buccal mucosa for rapid absorption.
- **For severe cases:** If intravenous or intraosseous access is available, a slow bolus of 12.5% dextrose at 0.25 g/kg should be administered.

SUMMARY

The release of the RECOVER newborn guidelines marks a pivotal moment for the veterinary nursing profession, providing an evidence-based roadmap that prioritizes the most critical physiological need of the newborn: the transition from placenta to lungs. By recognizing the resiliency of the neonatal heart, the dangers of oxidative stress from 100% oxygen, and the vital importance of the first minute, the nursing team can move with a level of precision and confidence.

The success of these cases starts with a prebrief, a well-stocked station, and a team that speaks the same language of heart rates and lung aeration. Veterinary nurses are the primary guardians of the "first minute." Through diligent application of the RECOVER guidelines, every puppy and kitten is given the best possible chance at a healthy, vibrant life. TVN

Kenichiro Yagi

With 26 years of dedication to the field, Ken is on a mission to redefine veterinary nursing. Serving as the Chief Veterinary Nursing Officer at VEG ER for Pets and on the RECOVER Initiative's Executive Board, Ken blends top-tier clinical expertise with visionary leadership. As an award-winning international speaker, he frequently publishes and presents on emergency and critical care and transfusion medicine. He is also the co-editor of the *Veterinary Technician and Nurse's Daily Reference Guide* and the *Manual of Veterinary Transfusion Medicine and Blood Banking*. Passionate about professional recognition, Ken challenges veterinary teams globally to constantly ask "Why?" to unlock new limits in what we can achieve together.

References

1. Cornelius AJ, Moxon R, Russenberger J, Havlena B, Cheong SH. Identifying risk factors for canine dystocia and stillbirths. *Theriogenology*. 2019;128:201-206. doi:10.1016/j.theriogenology.2019.02.009
2. Schrank M, Sozzi M, Mollo A. Prevalence of cesarean sections in Swiss bernese mountain dogs (2001–2020) and identification of risk factors. *Acta Vet Scand*. 2022;64(1):42. doi:10.1186/s13028-022-00664-9
3. Schmidt K, Feng C, Wu T, Duke-Novakovski T. Influence of maternal, anesthetic, and surgical factors on neonatal survival after emergency cesarean section in 78 dogs: a retrospective study (2002 to 2020). *Can Vet J*. 2021;62(9):961-968.
4. Hooper SB, Kitchen MJ, Polglase GR, Roehr CC, Te Pas AB. The physiology of neonatal resuscitation. *Curr Opin Pediatr*. 2018;30(2):187-191. doi:10.1097/MOP.0000000000000590
5. Katheria A, Finer NN. Newborn resuscitation. In: Gleason CA, Juul SE, eds. *Avery's Diseases of the Newborn*. 10th ed. Elsevier; 2018:273-288.
6. Boller M, Burkitt-Creedon JM, Fletcher DJ, et al. RECOVER guidelines: newborn resuscitation in dogs and cats. Clinical guidelines. *J Vet Emerg Crit Care (San Antonio)*. 2025;35(S1):60-85. doi:10.1111/vec.70013
7. Veronesi MC, Panzani S, Faustini M, Rota A. An Apgar scoring system for routine assessment of newborn puppy viability and short-term survival prognosis. *Theriogenology*. 2009;72(3):401-407. doi:10.1016/j.theriogenology.2009.03.010
8. Boller M, Burkitt-Creedon JM, Byers CG, et al. RECOVER guidelines: newborn resuscitation in dogs and cats. Evidence and knowledge gap analysis with treatment recommendations. *J Vet Emerg Crit Care (San Antonio)*. 2025;35(S1):3-59. doi:10.1111/vec.70012
9. Hopper K, Epstein SE, Burkitt-Creedon JM, et al. 2024 RECOVER guidelines: basic life support. Evidence and knowledge gap analysis with treatment recommendations for small animal CPR. *J Vet Emerg Crit Care (San Antonio)*. 2024;34(S1):16-43. doi:10.1111/vec.13387
10. Wolf J, Buckley GJ, Rozanski EA, et al. 2024 RECOVER guidelines: advanced life support. Evidence and knowledge gap analysis with treatment recommendations for small animal CPR. *J Vet Emerg Crit Care (San Antonio)*. 2024;34(S1):44-75. doi:10.1111/vec.13389

EARN CE CREDIT

Small Patients, Specific Protocols: Implementing the RECOVER Newborn Resuscitation Guidelines

SCAN THE QR CODE to take the quiz for free on VetFolio

This article has been submitted for **RACE approval for 1 hour of continuing education credit** and will be opened for enrollment upon approval. To receive credit, take the test at **vetfolio.com** by searching the name of the article or scanning the QR code.

- Free registration is required.
- Questions and answers online may differ from those below.
- Tests are valid for 2 years from the date of approval.

1. **What is the critical heart rate threshold in a newborn that indicates the need for positive pressure ventilation (PPV)?**
   a. 60 bpm
   b. 90 bpm
   c. 120 bpm
   d. 180 bpm

2. **According to the RECOVER guidelines, what is the recommended initial oxygen concentration for ventilating a hypoxic newborn?**
   a. 21% (room air)
   b. 50%
   c. 75%
   d. 100%

3. **When performing cardiopulmonary resuscitation on a newborn, what is the recommended compression-to-ventilation ratio?**
   a. 4:1
   b. 10:1
   c. 15:2
   d. 30:2

4. **Which outdated practice is now strictly contraindicated due to the risk of intracranial hemorrhage and aspiration?**
   a. Using a bulb syringe to clear the nares
   b. Tactile stimulation via vigorous drying
   c. "Swinging" the newborn to clear fetal lung fluid
   d. Placing the newborn in lateral recumbency

5. **At what point should a veterinary team transition from the newborn algorithm to standard RECOVER basic and advanced life support guidelines?**
   a. Immediately after the first breath is taken
   b. After the newborn has stabilized, typically within the first hour of life
   c. Only if the patient reaches weaning age (4 weeks)
   d. After the first successful nursing session