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# The **RVT** JOURNAL

Proudly published by the Ontario Association of Veterinary Technicians (OAVT)



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# Letter from the Editor



## The RVT Journal Redesigned: A Fresh Look for a Modern Future

As your professional association, we are committed to continuously improving our offerings to meet the evolving needs of our valued members. We are excited to share a significant update to the RVT Journal, redesigned to provide a more modern, accessible, and engaging reading experience.

Our unwavering commitment to keeping you at the forefront of the veterinary profession is the driving force behind this redesign. It's essential that our magazine not only informs but also inspires. The new design is characterized by a fresh, dynamic layout that captures your attention, making engaging with the educational and industry content we curate for you easier than ever.

Accessibility is a cornerstone of our redesign. We recognize the importance of the Accessibility for Ontarians with Disabilities Act (AODA) guidelines and want to ensure our magazine reaches every member of our community. Our commitment to inclusivity drives us to create easily navigable, understandable, and enjoyable content for all readers, regardless of their individual needs. By prioritizing AODA compliance, we aim to set a standard where all members can access the knowledge and insights that empower them to excel.

While the overall look of the Journal has changed, some things will stay the same. Continuing education articles continue to be a central focus of the Journal. CE articles help RVTs keep on top of valuable industry knowledge and allow RVTs to earn credits towards maintaining their credential. The Journal's general content will encompass a diverse range of topics, from mental health and human resources to personal stories of triumph and growth in the field.

We want to hear from you as well! Your experiences, opinions, and insights are valuable to us. The redesign of the RVT Journal is an opportunity for us to align our efforts with your preferences and needs. We encourage you to share your thoughts on the type of content you find most valuable and any suggestions you have for enhancing your reading experience.

Thank you for being an essential part of our association and for your unwavering dedication to the well-being of animals everywhere. Thanks for reading -- and for joining us in celebrating the RVT profession!

Warm regards,

Victoria Evans  
Editor-in-Chief, The RVT Journal, Ontario Association of Veterinary Technicians

## Welcome to The RVT Journal

The RVT Journal is a quarterly national publication with OAVT-approved CE articles in each issue delivered directly to your door!

Our team is working hard to bring Canadian RVTs great content for RVTs, by RVTs.

### Thanks to our contributors this issue!

Mandy Di Lazzaro, CRHA

Danika Glover-Netherton, RVT,  
Wellness and Nutrition Advisor

Tracey Lawrence, RVT VTS (ECC)  
(Anesthesia/Analgesia)

Kelsey Streef, RVT, CCRP



### COVER IMAGE

RVT Kristen Vander Pryt's dog  
Buck enjoying fall.

## The RVT Journal team

Victoria Evans (Editor-in-Chief)  
Laurie Williams, BA, MA, CELTA, RVT (Technical Editor)  
Teresa Kelly, RGD (Layout)

Thank you to our volunteer reviewers:

Marg Brown, RVT  
Monica Tighe, RVT  
Shanna Himburg, RVT  
Ann McCallum, RVT  
Oscar Mindreau, RVT  
Linda Baril, RVT

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# The RVT JOURNAL

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**Don't forget – RVTs can earn CE credits by completing CE quizzes in The RVT Journal. Visit the Resource Library in your member portal at [oavt.org](http://oavt.org) for more details**

Want to write CE articles for The RVT Journal? We are particularly interested in helping RVTs share their knowledge! Send your ideas to The RVT Journal technical editor RVT Laurie Williams, [laurie@oavt.org](mailto:laurie@oavt.org).

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CE Article 1

# Anesthesia for the Emergency Canine and Feline Caesarean Section

Tracey Lawrence, RVT VTS (ECC) (Anesthesia/Analgesia)

CE articles help RVTs earn credits toward maintaining their RVT credential. Correctly answer the quiz associated with this article to earn one CE credit.

The decision to perform a Caesarean section (C-section) can be pre-planned, but often occurs as an emergency procedure. In both instances, it is important that the anesthetist be knowledgeable in how to provide anesthesia that is safe for the dam or queen, as well as the neonates. The physiologic changes that occur in the pregnant patient and fetuses need to be considered when preparing an anesthetic protocol. Successful anesthetic planning should provide analgesia for the mother, facilitate her rapid recovery, and support the survival of the neonates.

## Patients at Risk for Dystocia

In our canine patients, brachycephalic and toy breeds have been identified as having an increased risk for requiring a C-section when compared to mixed breed dogs, with French Bulldogs, Boston Terriers, Pugs and Chihuahuas coming in at the top of the list.<sup>1</sup> In cats, brachycephalic and dolichocephalic breeds have a higher incidence of dystocia, with one study identifying British Shorthairs and Oriental breeds as having the highest rates of dystocia. Domestic cats were identified as having the lowest incidence of dystocia.<sup>2</sup> Scheduled Caesarean section is associated with lower mortality rates for both the mother and neonates when compared to emergent C-section, where neonatal mortality can be as high as 90%.<sup>3,4,5</sup> Emergency Caesarean section should be considered when the length of time between delivery of the neonates is greater than two to four hours; if there is an extended period of unproductive abdominal straining lasting longer than 30 minutes; or if parturition has not been completed within 24 hours and the mother has not responded to medical management.<sup>6,4</sup> Maternal factors contributing to dystocia include uterine fatigue or inertia and anatomical limitations. Dystocia can also result from fetal factors such as abnormal presentation in the birth canal, or fetomaternal disproportion. (Figure 1)

**Figure 1** | A lateral abdominal radiograph of a pregnant American bulldog dam presenting with dystocia. There are four puppies visible, with the skull of one puppy obstructing the pelvic canal.



## Maternal Physiologic Considerations

During pregnancy, the mother and the fetuses have increased metabolic requirements. Maternal blood volume can increase by approximately 40%, primarily due to an elevation in plasma volume. This is not accompanied by an increase in the production of red blood cells, resulting in a dilution anemia. It is not uncommon for the packed cell volume (PCV) of pregnant dogs to be between 30-35%, with the severity of anemia often becoming more pronounced as the number of fetuses increases.<sup>7,3</sup> Therefore, if the mother presents with a PCV in the normal range at the time of a C-section, dehydration should be suspected, due to the dilution effect caused by increases in plasma volume. PCV should always be evaluated alongside total protein, to better assess hydration status. The increase in blood volume contributes to a proportional increase in heart rate (HR) and stroke volume (SV), leading to an elevation in cardiac output (CO) of approximately 30-50%.<sup>8</sup> As cardiac workload increases, cardiac reserves decrease throughout pregnancy. Mothers with pre-existing stabilized cardiac disease require careful management, as they are at increased risk for cardiovascular decompensation and developing active heart failure during pregnancy and labour.<sup>3</sup>

Ensuring sufficient delivery of oxygen (DO<sub>2</sub>) is crucial for the well-being of the fetuses. The adequate perfusion of the uterus, placenta, and DO<sub>2</sub> to the fetuses relies on maternal blood pressure and oxygen content. Cardiovascular performance and compensatory reflexes such as the baroreceptor reflex for maintaining blood pressure are often delayed in the mother, which can negatively impact DO<sub>2</sub> to the fetuses.<sup>9,4</sup>

The maternal respiratory system undergoes significant changes during pregnancy, such as a decrease in total lung capacity (TLC) and functional residual capacity (FRC), due to the upward displacement of the diaphragm from the gravid uterus. Oxygen consumption (VO<sub>2</sub>) increases to meet the oxygenation needs of both the mother and the fetuses, with reported VO<sub>2</sub> increases of approximately 20%.<sup>7,9</sup> To compensate for the reduced TLC, lower FRC, and higher VO<sub>2</sub>, alveolar ventilation increases through elevation of tidal volume and respiratory rate, which contributes to hypocapnia. This combination of a decreased FRC and increased minute ventilation enable rapid equilibration between the inspired and alveolar concentrations of inhaled anesthetics, resulting in faster changes in depth from adjustments in inhalant concentration when compared to nonpregnant animals. Elevated levels of progesterone during pregnancy sensitize the respiratory centre to the partial pressure of carbon dioxide (PCO<sub>2</sub>) in the blood, promoting an increase in minute ventilation.<sup>9</sup> Stress, anxiety, and pain from labour can also contribute to hyperventilation and hypocapnia. These respiratory changes make the mother more susceptible to hypoxia and rapid oxygen desaturation.

“ The decision to perform a Caesarean section (C-section) can be pre-planned, but often occurs as an emergency procedure. In both instances, it is important that the anesthetist be knowledgeable in how to provide anesthesia that is safe for the dam or queen, as well as the neonates. ”

Serum progesterone levels in the mother are elevated at the end of pregnancy, which can result in a decreased requirement for anesthetic drugs by 25-40%. This is due to the depressive effects of progesterone on the central nervous system (CNS), particularly its action on gamma-amino-butyric acid A (GABAA) receptors, as GABAA receptors are the target of many anesthetic and CNS depressant drugs.<sup>4,10</sup> As a result, pregnant animals may face an increased risk of relative anesthetic overdose. However, this effect may not be apparent when inhalant-only anesthesia is used without the reduction in minimum alveolar concentration (MAC) from sedative drugs. The unique presentation of the patient should always be considered, and anesthetic protocols should be based on the requirements of the individual. Elevated progesterone levels during pregnancy also contribute to a decrease in gastric and lower esophageal sphincter tone. When combined with the physical displacement of the pylorus caused by the enlarged uterus, there is an elevated risk of regurgitation, esophagitis, and aspiration during anesthesia.<sup>3</sup> Ensuring the security and protection of the airway in pregnant patients is crucial.

Elevations in blood volume and cardiac output contribute to increases in renal blood flow and glomerular filtration rate. This physiological adaptation results in decreased serum levels of blood urea nitrogen (BUN) and creatinine compared to non-pregnant animals.<sup>8</sup> Patients with normal or elevated BUN levels may be dehydrated or experiencing kidney dysfunction, and require intravenous fluid therapy.<sup>11</sup> Additionally, the mammary glands secrete growth hormone during pregnancy. The combination of increased renal blood flow, glomerular filtration rate (GFR), and growth hormone secretion contributes to the development of insulin resistance during pregnancy, resulting in hyperglycemia. This insulin resistance can diminish the effectiveness of exogenous insulin therapy in diabetic pregnant dogs.<sup>3</sup> (Table 1)

**Table 1** | Summary of Maternal Physiologic Changes

Physiologic Change	Anesthetic Significance
Blood volume increases by 40% (serum>RBCs)	Dilutional anemia, decreased oxygen carrying capacity
Increased HR, SV = increased CO by 30-50%	Increased oxygen demand, poor tolerance for hypoxia
Decreased cardiac reserve	Decreased compensatory response to cardiovascular stressors, cardiac patients at risk for pulmonary congestion and heart failure
Decreased systemic vascular resistance	Hypotension
Increased minute volume	Elevated respiration rate, increased tidal volume contributing to hypocapnia, rapid response to changes in inhalant percentage
Increased O <sub>2</sub> consumption (20%)	Contributes to hypoxemia
Decreased partial pressure of oxygen in arterial blood (PaCO <sub>2</sub> )	Expected hypocapnia
Decreased functional residual capacity	Contributes to hypoxemia and hypercapnia from hypoventilation
Decreased GI motility and gastric pH	Risk of regurgitation, aspiration of gastric fluid leading to pneumonia
Decreased lower esophageal sphincter tone	Risk of regurgitation, aspiration of gastric fluid leading to pneumonia
Increased progesterone	Sensitization to PaCO <sub>2</sub> Elevation in RR, decreased end tidal carbon dioxide (ETCO <sub>2</sub> ) (expected) Decreased anesthetic requirements Insulin resistance (hyperglycemia)
Increased GFR and renal plasma flow by 60%	Decreased BUN, creatinine (expected) Normal values could indicate renal disease or dehydration
Decrease in epidural space from vascular engorgement	Decrease epidural drug volume by 50% or risk of cranial migration

Once the decision for surgical intervention has been made, the anesthesia team must be prompt and efficient. The patient should be placed on IVF and baseline blood work should be performed. Minimum laboratory tests should include assessment of the packed cell volume (PCV), total protein (TP), blood urea nitrogen (BUN), ionized calcium (Ca), blood glucose (BG) and electrolyte levels.<sup>11</sup> Decreases in PCV and BUN can be anticipated as a result of normal maternal physiologic changes. A PCV or BUN in the normal reference range may be an indication of dehydration. Patients that are pregnant with large litters or who are experiencing uterine inertia may become hypocalcemic. If labour contractions are prolonged hypoglycemia may also be present, particularly in toy breed dogs.<sup>12</sup> Any abnormalities should be addressed while preparations are made to take the patient to surgery.