Cesarean section (C-section) is the most common abdominal surgery performed on small ruminants.\(^1\) Incidence of dystocia requiring surgical intervention has been described as affecting as many as 482 of 15,584 (3%) small ruminant pregnancies in the veterinary literature, with some variation in geographical location.\(^2–4\) Typical indications for C-section in goats include failure of cervical dilation (“ringwomb”), fetal malpositioning, fetopelvic size disproportion, fetal abnormalities, and pregnancy toxemia.\(^4\) The procedure is most commonly performed in standing or sedated recumbent ruminants via left paralumbar fossa laparotomy or left oblique laparotomy; however, ventral midline, paramedian, and ventrolateral approaches under general anesthesia have also been described.\(^5\) While most veterinary literature reports preferentially evaluate the effect of C-section on the adult goat’s postoperative outcomes, there are few evaluations of factors affecting kid survival. In 1 study,\(^4\) kid and lamb survival was inversely associated with duration of dystocia, incomplete dilatation of the cervix, and prematurity of parturition; however, to the authors’ knowledge, there have been no veterinary studies to incorporate the effect of anesthesia type (sedation or general anesthesia) on kid survival.

In humans, C-sections performed under general anesthesia have been associated with increased risk of CNS depression.\(^6,7\) Aspiration of gastric contents, postpartum hemorrhage, postoperative pain, increased risk of thromboembolism, and prolonged breastfeeding interval have been associated with C-sections performed under general anesthesia in humans.\(^8\) Anesthetic drugs typically used in veterinary medicine, such as ketamine, thiopental, and propofol, have been shown to produce CNS depression in human newborns.\(^8\) In goats, administration of anesthetic agents like propofol and a propofol-sevoflurane combination was shown to induce significant hypotension in the caprine fetus and reduce uterine activity.\(^9\) Alternative methods such as intrathecal administration of local anesthetics in sedated goats undergoing C-sections may be a strategy to avoid the need for general anesthesia, with a quick return to standing, eating, and hind limb motor function.\(^10\) However, no studies have been published comparing kid survival rates in goats undergoing C-sections performed under sedation or general anesthesia. Therefore, the primary aim of the present cohort retrospective study was to evaluate whether the kid survival rate following C-section in goats is affected by the type of anesthesia procedure used (general anesthesia vs procedural sedation). The secondary aim of the study was to evaluate the rate of perioperative complications in the cohort of studied goats undergoing C-sections. Hence, the primary hypothesis of

**Sedated cesarean sections are associated with increased kid survival compared to general anesthesia in goats: retrospective cohort of 45 cases (2011–2021)**

George L. Elane, DVM, MS\(^1\)*; Diego A. Portela, DVM, PhD\(^2\); Kallie J. Hobbs, DVM, MS\(^1\); Anje G. Bauck, DVM, PhD\(^1\); Adam H. Biedrzycki, DVM, PhD\(^1\)

\(^1\)Department of Large Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL
\(^2\)Department of Comparative, Diagnostic, and Population Medicine, College of Veterinary Medicine, University of Florida, Gainesville, FL

*Corresponding author: Dr. Elane (gelane@ufl.edu)

doi.org/10.2460/javma.22.10.0466

**OBJECTIVE**

To determine whether anesthesia type (sedation or general anesthesia) affects kid survival to discharge in caprine cesarean sections (C-sections).

**ANIMALS**


**PROCEDURES**

All surgeries were performed via left flank laparotomy in right lateral recumbency. The number of kids alive at presentation, surgery, and discharge was recorded. Kids that were dead on presentation or euthanized intraoperatively were excluded. Goats were classified as “healthy” (American Society of Anesthesiologists status \(\leq 2\)) or “sick” (\(\geq 3\)).

**RESULTS**

Kid survival was significantly higher for C-sections performed under sedation (47/52 [90%]) than for C-sections performed under general anesthesia (16/24 [66%]; *P* = .004). Relative risk was 1.4 and odds ratio was 4.7.

**CLINICAL RELEVANCE**

Performing C-sections in sedated goats may improve kid survival rates over those under general anesthesia.
the study was that the C-section performed in sedated goats (SED group) would have a higher kid survival rate than those undergoing general anesthesia (GA group). Our secondary hypothesis was that the incidence of perioperative complications in the adult goats (eg, aspiration pneumonia) would be higher in sedated and nonintubated goats undergoing C-sections under procedural sedation.

Materials and Methods

Medical records of C-sections performed on goats of different breeds at the University of Florida Large Animal Hospital from 2011 to 2021 were recorded. The number of records evaluated was based on availability in the electronic database, and an a priori sample size calculation was not performed (convenience sample size). Owner consent allowing anonymous use of animals’ medical information for scientific purposes was obtained for all patients admitted to the veterinary teaching hospital. Procedures were excluded if the anesthetic record, surgical report, or discharge summary were incomplete or missing.

Anesthetic protocols were selected by the attending anesthesiologist on the basis of goats’ physical status and personal clinical preferences. Goats were categorized on the basis of the American Society of Anesthesiologists’ (ASA) physical status system on a scale from 1 (clinically normal) to 5 (moribund, not expected to survive without surgery). Health status of each goat was determined on the basis of physical examination, CBC, and biochemistry profile or blood gas analysis, including electrolytes and serum lactate. Upon arrival and before administering any medications to the goats, kid vitality was determined by ultrasonographic assessment of fetal heart rate.

All goats received a partial µ-agonist (butorphanol, 0.05 mg/kg) or a full µ-agonist (mepatadone, 0.1 mg/kg; or meperidine, 5 mg/kg) IV and benzodiazepine (midazolam or diazepam, 0.2 mg/kg, IV) as preanesthetic medication. Goats undergoing C-sections under GA were induced with ketamine (2.2 mg/kg, IV), propofol (0.5 to 1 mg/kg, IV), or a combination of both and were maintained with isoflurane or sevoflurane in 100% oxygen through a rebreathing circuit. Endotracheal intubation with an appropriately sized, cuffed endotracheal tube was placed in all goats of the GA group. Goats in the SED group received oxygen supplementation (5 L/kg/min) through a face mask. When required, goats in the SED group were administered propofol boluses (0.2 mg/kg, IV, per bolus, given to effect) to maintain an adequate plane of sedation for surgery. Intraoperative monitoring consisted of continuous evaluation of heart rate via ECG, SpO₂, end-tidal CO₂, direct or indirect blood pressure monitoring, and rectal temperature. Mechanical ventilation was provided in intubated goats when end-tidal CO₂ was higher than 50 mm Hg. Arterial blood gases were measured in anesthetized goats via arterial catheter in the caudal auricular or radial artery at induction and every 30 to 60 minutes for the duration of the surgery. Arterial pressures were monitored noninvasively via pressure cuff in sedated goats.

When mean arterial blood pressure was lower than 65 mm Hg, goats in both groups received ephedrine (0.05 to 0.1 mg/kg, IV) or constant rate infusions of norepinephrine (0.2 to 0.5 µg/kg/min), dobutamine (0.5 to 5 µg/kg/min), or dopamine (2 to 7 µg/kg/min) IV. The locoregional anesthesia technique used in each goat was selected by the attending anesthesiologist and consisted of local infiltration, dorsal paravertebral block, sacrococcygeal or lumbosacral epidural anesthesia, or lumbosacral spinal (subarachnoid) anesthesia. The local anesthetic used was lidocaine, meptivacaine, or bupivacaine.

All goats were positioned in right lateral recumbency for C-section via left paralumbar fossa celiotomy. Perioperative antimicrobials included cefotiofur sodium (2.2 mg/kg, IV), potassium penicillin (22,000 mg/kg, IV), or both. Goats whose creatinine were normal received flunixin (1.1 mg/kg, IV), those with abnormal blood gas values received analgesics according to the clinical indication and preference of the attending anesthesiologist as described above. The left paralumbar fossa was clipped, aseptically prepared, and draped for surgery in a routine fashion. An approximately 10-cm incision was made in the left paralumbar fossa halfway from the last rib to the left tuber coxa, the uterus was exteriorized from the abdomen and packed off with saline-soaked laparotomy sponges, the hocks of the closest kid were manipulated to the left horn, and a 10- to 15-cm hysterotomy was made. The kids were exteriorized from the uterus individually and immediately passed to a residency-trained large animal internal medicine assistant for resuscitation. The uterus was closed in 2 layers with absorbable suture (typically 2-0 polydioxanone), and the abdomen was lavaged and closed in 3 layers. Goats continued to receive antimicrobials and analgesics (butorphanol or flunixin meglumine) for 3 to 5 days, according to the preference of the attending surgeon.

Data collected from the medical records were analyzed to evaluate the rate of kid survival at discharge (main outcome) and the perioperative complications in the goats (secondary outcome). Goats included in the study were divided into 2 groups on the basis of the type of anesthesia procedure used to perform the C-sections (GA group or SED group). Goats were included in the GA group if they were intubated after receiving an induction agent (eg, propofol or ketamine) and maintained through the surgical procedure with inhalant anesthesia. Goats that were not intubated and remained sedated with active swallowing reflex during the surgical procedure were included in the SED group. Goats in the SED group that needed conversion to general anesthesia and were anesthetized and intubated were placed in the GA group. Pharmacological interventions to improve the anesthetic or sedation (rescue anesthetics) or analgesic (rescue analgesics) plane were recorded. Anesthetic and analgesic drugs, locoregional anesthetic techniques, and local anesthetics used in each goat were recorded and compared between the 2 groups.

Goats were classified as “healthy” if the ASA status was ≤ 2 or “sick” if the ASA status was ≥ 3. Surgical duration was considered as the time in minutes from skin incision to closure. Anesthesia duration was defined as the time in minutes from induction to exsufflation for the GA group and the time from first sedation to skin closure in the SED group. The kid survival rate (primary outcome) was calculated as the ratio between the number of kids alive and deemed viable immediately after removal from the uterus at surgery and the number of kids alive at discharge in
each goat. Kids that were dead on presentation or euthanized intraoperatively due to prematurity were excluded from statistical analysis. The rate of perioperative complications, such as hypotension (mean arterial pressure ≤ 65 mm Hg), hypertension (mean arterial pressure ≥ 110 mm Hg), bradycardia (heart rate < 60 beats/min), tachycardia (heart rate > 130 beats/min), hypoxemia (PaO₂ < 80 mm Hg or SpO₂ < 94%), hypercapnia (PaCO₂ > 55 mm Hg), hypothermia (temperature < 38 °C), hyperlactatemia (serum lactate > 2.0 mmol/L), hypoponatremia (Na < 142 mEq/L), hypokalemia (K < 3.5 mEq/L), reproductive tract problems (uterine rupture or uterine artery tear), regurgitation, and respiratory complications (pneumonia or cough) in the goats were compared between the 2 groups. The use of sympathomimetic drugs (eg, dobutamine, dopamine, norepinephrine, ephedrine, or atropine) and the use of boluses of fluids or synthetic colloids to manage cardiovascular complications were recorded.

A total of 99 medical records of goats undergoing C-sections were retrieved for the studied period (31 in the GA group and 68 in the SED group). The prevalence of goats having nonviable kids at presentation was 35.5% and 51.5% for the GA and SED groups, respectively (P = .19). After applying the exclusion criteria for the study, 3 goats with incomplete medical records and 51 goats with kids that were dead on presentation or euthanized intraoperatively were excluded. Sedation in 1 goat had to be converted into general anesthesia; this animal was included in the GA group. Therefore, a total of 45 goats were used for further analysis, of which 16 were included in the GA group and 29 in the SED group (Figure 1; Table 1).

Data were assessed for normality using the Shapiro-Wilk test. A 2-tailed Fisher exact test was used to compare the rate of events of categorical data between the 2 groups. Multiple logistic regression was used to identify which variables would impact the outcome of kid survival. The regression model was constructed using survival at discharge as the dependent variable (outcome), and the type of anesthesia (GA vs SED), health status (healthy vs sick), anesthesia duration, opioid or benzodiazepine use, multiple kids at parturition (1 kid vs > 1 kid), intraoperative hypotension, and total dose of lidocaine used as independent, explanatory variables. Multicollinearity was checked using the variance inflation factor and R² for each individual independent variable; collinearity was not present for the studied independent variables. Continuous data distributed normally are presented as mean ± SD and not normally distributed data as median (range). Differences were considered significant when P < .05. Statistical calculations were performed using GraphPad Prism version 8.0 (GraphPad Software Inc).

**Results**

The durations of anesthesia and surgical procedure were not significantly different between the groups (Table 1). Regional anesthesia was used in 68.75% and 96.5% of goats in the GA and SED groups, respectively (P = .01). Goats that received regional anesthesia received 1 or a combination of 2 different techniques. The type of anesthetic and analgesic drugs used in each group are listed (Table 2). Lidocaine was administered at 4.16 mg/kg (0.24 to 5.17 mg/kg) in the GA group and 2.0 mg/kg (0.22 to 9.78 mg/kg) in the SED group (P = .14).

The kid survival rate was significantly higher in the SED (90.4%) group compared to the GA group (66.7%; OR, 4.7; 95% CI, 1.43 to 15.03; Figure 2). The health status of the goats and rate of multiple kid pregnancy were similar between the groups (Table 1). The multiple logistic regression model identified general anesthesia (P = .01), the presence of multiple kids (P = .006), and preoperative administration of opioids (P = .04) as independent variables associated with a significant reduction in kid survival rate. Other independent variables, such as health status of the goat, duration of anesthesia, administration of preoperative benzodiazepines, or total dose of

### Table 1—Distribution of patient variables for goats presenting for cesarean section.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group GA</th>
<th>Group SED</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of goats enrolled</td>
<td>16</td>
<td>29</td>
<td>—</td>
</tr>
<tr>
<td>No. (%) of goats with ASA status ≥ 3</td>
<td>9 (56.2%)</td>
<td>21 (72.4%)</td>
<td>.33</td>
</tr>
<tr>
<td>No. (%) of goats with multiple kids</td>
<td>6 (37.5%)</td>
<td>15 (51.7%)</td>
<td>.53</td>
</tr>
<tr>
<td>Duration anesthesia (min)</td>
<td>84 (45-121)</td>
<td>86 (50-183)</td>
<td>.58</td>
</tr>
<tr>
<td>Duration surgery (min)</td>
<td>68 (41-98)</td>
<td>76 (43-144)</td>
<td>.14</td>
</tr>
<tr>
<td>No. of kids presented alive</td>
<td>24</td>
<td>52</td>
<td>—</td>
</tr>
<tr>
<td>Survival rate (%) of kids surviving to discharge</td>
<td>16 (66.6%)</td>
<td>47 (90.3%)</td>
<td>.02</td>
</tr>
</tbody>
</table>

Data were compared using a 2-tailed Fisher exact test.
ASA = American Society of Anesthesiologists.
— = Not assessed.
Table 2—Distribution of anesthetic and locoregional anesthetic variables for goats undergoing cesarean section.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group GA</th>
<th>Group SED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthetic and analgesic drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butorphanol</td>
<td>7 (43.8%)</td>
<td>24 (82.8%)</td>
</tr>
<tr>
<td>Meperidine</td>
<td>1 (6.3%)</td>
<td>—</td>
</tr>
<tr>
<td>Methadone</td>
<td>1 (6.3%)</td>
<td>—</td>
</tr>
<tr>
<td>Diazepam</td>
<td>5 (31.3%)</td>
<td>21 (72.4%)</td>
</tr>
<tr>
<td>Midazolam</td>
<td>5 (31.3%)</td>
<td>6 (20.7%)</td>
</tr>
<tr>
<td>Ketamine</td>
<td>2 (12.5%)</td>
<td>—</td>
</tr>
<tr>
<td>Propofol</td>
<td>13 (81.3%)</td>
<td>5 (17.2%)</td>
</tr>
<tr>
<td>Isoflurane</td>
<td>5 (31.3%)</td>
<td>—</td>
</tr>
<tr>
<td>Sevoflurane</td>
<td>11 (68.8%)</td>
<td>—</td>
</tr>
<tr>
<td>Sympathomimetics</td>
<td>4 (25%)</td>
<td>3 (10.3%)</td>
</tr>
<tr>
<td>Locoregional anesthesia technique</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incisional block</td>
<td>3 (18.8%)</td>
<td>16 (55.2%)</td>
</tr>
<tr>
<td>Paravertebral block</td>
<td>6 (37.8%)</td>
<td>8 (27.6%)</td>
</tr>
<tr>
<td>Lumbosacral epidural</td>
<td>2 (12.5%)</td>
<td>9 (31%)</td>
</tr>
<tr>
<td>Intrathecal anesthesia</td>
<td>1 (6.3%)</td>
<td>5 (17.2%)</td>
</tr>
<tr>
<td>Local anesthetic used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lidocaine</td>
<td>9 (56.3%)</td>
<td>28 (96.6%)</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>1 (6.3%)</td>
<td>3 (10.3%)</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>1 (6.3%)</td>
<td>—</td>
</tr>
</tbody>
</table>

Data are given as number (%) of goats. — = Not assessed.

Discussion

The present retrospective cohort study showed that the kid survival rate was significantly higher (90.4%) when C-sections were performed under sedation compared to C-sections performed under general anesthesia (66.6%). These results supported our first hypothesis that C-sections performed in sedated goats would have a higher kid survival rate than those performed under general anesthesia. However, due to a low postoperative rate of respiratory complications and the study being underpowered (post hoc 0.055) for these variables, we could not support our second hypothesis that endotracheal intubation for C-sections under general anesthesia would be associated with a lower rate of perioperative complications.

The multiple logistic regression analysis in our study revealed that the independent variables of anesthesia type (general anesthesia), presence of multiple kids at the time of parturition, and preoperative use of opioids were the only statistically significant independent variables associated with a decreased outcome of kid survival at discharge. In humans, C-sections performed under general anesthesia have been associated with decreased Apgar scores and Neurologic and Adaptive Capacity scores of the neonates. Apgar scores quantify a newborn’s medical condition and act as an indirect measure of fetal well-being, whereas the Neurologic and Adaptive Capacity score acts as a screening test to detect CNS depression; neither test has been adapted to neonatal goats. Anesthetic drugs such as ketamine and propofol have been shown to depress human newborns through placental transfer, muscular hypotonia, and transient somnolence mechanisms, and these compounds are frequently used in veterinary medicine. Similarly, volatile anesthetics have been shown to exert a neurotoxic effect on human neonates undergoing general anesthesia. It stands to reason, therefore, that neonatal goat kids would suffer similar depressant effects from these anesthetics and that performing C-sections under sedation can limit their administration and promote a more favorable outcome for kid survival to discharge.

Opioids are known to cause respiratory depression in a dose-dependent manner, with concurrent minor depression on the cardiovascular system as well. In human neonates, opioids (specifically morphine) have also been shown to have a neurotoxic effect via apoptosis of neurons and their associated glia. In the present study, the multiple logistic regression model identified the perioperative use of opioids as an independent variable associated with reduced kid survival. However, the comparison of the kid survival rates between goats receiving preoperative opioids using the Fisher exact test was not different between the SED and GA groups (most likely due to the small number of goats receiving or not receiving opioids in each group). Therefore, it is dif-

Figure 2—Bar graph comparing kid survival rate between anesthetized and sedated goats undergoing cesarean sections.

The kid survival rate was not significantly different in goats receiving preoperative opioids in the SED and GA groups (P > .99). Rescue anesthetics were required in 52.6% and 68.9% of goats in the GA and SED groups, respectively (P = .52). In the SED group, 41.3% of the goats required multiple doses of induction agents (ie, propofol or ketamine) to maintain an adequate level of sedation. Goats required intraoperative rescue analgesics in 43.7% and 41.1% of the GA and SED groups, respectively (P > .99). The rate of goats requiring pharmacological interventions to treat hypotension was 37.5% and 10.3% in the GA and SED groups, respectively (P = .05). Postoperative pneumonitis was observed in 1 goat in each group. The goat that developed postoperative pneumonitis in the SED group was euthanized. Postoperative complications resulting in euthanasia in the GA group included uterine and colonic tear, hypotension, and surgical dehiscence resulting in septic peritonitis in 1 goat each.
difficult to confirm the role of preoperative opioids in the survival rate of kids born from C-sections, and more studies are necessary to understand whether preoperative opioids could be given safely to goats undergoing C-sections.

It is worth mentioning that while 13 (81%) of the goats in the GA group received propofol IV for induction, 5 (17%) of the goats in the SED group also received propofol IV to maintain an adequate surgical plane. In humans, it has been demonstrated that propofol crosses the placental barrier in a dose-dependent fashion, with neonatal plasma propofol levels dependent on the maternal plasma propofol levels. In the present study, goats in the GA group were administered an anesthetic dose of 0.5 mg/kg propofol IV, whereas goats in the SED group were administered a subanesthetic sedative dose of 0.2 mg/kg propofol IV, which likely further contributed to the association of the SED group with an increased kid survival to discharge.

The detrimental effect of multiple kids at parturition on kid survival outcome in our regression analysis was not anticipated. In goats presenting to our hospital for C-section, the presence of multiple kids is often associated with pregnancy toxemia, when the goat’s metabolic activity cannot support the fetal demand. Indeed, a previous study showed that kids born to goats suffering from pregnancy toxemia were less likely to survive to discharge than their nontoxemic control counterparts. In another study comparing umbilical cord blood of kids from normal goats to kids born to goats with pregnancy toxemia, kids in the latter group were found to be significantly more acidemic in utero, with higher L-lactate concentrations. Both studies found significant differences between base excess, bicarbonate, and total carbon dioxide concentrations in control and toxemic pregnancy kids at 0 and 72 hours after parturition. The metabolic derangements detailed in these studies likely make it more challenging to resuscitate kids in the immediate postparturient period, which may have contributed to the decreased association between multiple kids at parturition and kid survival in the current study.

Despite its intended benefits of creating a system designed to categorize physical status for more uniform statistical analysis, the modern ASA classification system (adopted in 1961) has been shown to be highly variable between observers and even between countries. Factors in our multiple logistic regression that were found to not have affected outcome were health status classification (“healthy” [ASA ≤ 2] or “sick” [ASA ≥ 3]), anesthesia duration, and opioid type. In 1 study, the percentage of ASA status agreement between the 2 groups was only fair in all groups (κ indices 0.21 to 0.4), with exaggerated differences between locally and overseas trained specialists. It stands to reason, therefore, that a wide range of variability in ASA status determination would result in poor statistical power of that variable in a multiple logistic regression model, as was observed in the current study. Duration of anesthesia was also found not to affect the outcome of kid survival; this may be due to the lower number of anes-thetized goats in the GA group compared to sedated goats. Lastly, the type of opioid administered was not found to affect the outcome; this may be due to the high variability in the type of opioids administered, or to the low doses of opioids used, both of which were left to the anesthetist’s discretion.

Other trends that did not reach statistically significant differences (possibly due to the small sample size) were observed in this study; however, they warrant discussion. First, goats that were perceived as “sick” (ASA status ≥ 3) tended to have C-sections performed under sedation. This may be due to the anesthetist’s perceived benefit of enhanced cardiovascular parameters in the patient by avoiding common complications such as hypotension that are generally associated with general anesthesia in ruminants. Second, goats that had C-sections performed while sedated tended to have an increased frequency of intervention (“rescue anesthesia or analgesia”) than those under anesthesia. The difference in interventions between the 2 groups may be due to a variety of factors, including inadequate depth of sedation or a regional anesthesia technique that was not providing adequate intraoperative analgesia.

This study has several limitations. First, being a retrospective study, there is a lack of protocol standardization, difference anesthetic management, and selection bias. Furthermore, there was a difference in the distribution of goats between the 2 groups, with more sedated goats than anesthetized goats. All surgeries were also performed via a left laparotomy approach with the goat in right lateral recumbency, which increased standardization between groups but does not allow for interpretation of the effects of recumbency or surgical technique on kid survival. Another limitation is the lack of reporting time from induction or sedation to kid delivery in the anesthetic records, which precludes drawing conclusions about the impact of this variable on kid survival, which has been shown to be a significant factor in canine C-sections. Finally, this study only demonstrated an association between the type of anesthesia used and kid survival to discharge and did not evaluate the development of complications on long-term follow-up.

In conclusion, in the cohort of goats evaluated in this study, C-sections performed under sedation were associated with increased kid survival, whereas the use of GA, presence of multiple kids, and use of preoperative opioids were associated with decreased kid survival to discharge. Further prospective studies are warranted to more definitively identify causative factors in kid survival and the development of caprine neonatal capacity scores.

Acknowledgments

No external funding was used in this study. The authors declare that there were no conflicts of interest.

References


