ASSESSMENT OF CANINE NEWBORN VIABILITY BY UMBILICAL VEIN LACTATE EVALUATION AND ITS PROGNOSTIC VALUE IN SHORT TERM NEONATAL SURVIVAL

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ABSTRACT

The present study estimated umbilical vein lactate (UL) in healthy puppies, and the puppies stressed due to difficult whelping as well as the association of UL with neonatal viability status and the duration of labor. Umbilical vein lactate in puppies from dystocic deliveries was higher ($p<0.05$) compared to those delivered by spontaneous whelping. The pups delivered through emergency cesarean had highest UL (12.99±2.02 mmol/l) and pups born by elective cesarean had lowest UL (4.08±0.84 mmol/l, $p<0.05$). Highest UL was recorded in puppies delivered of labor duration exceeding 12 h. A clear demarcation of UL at birth between surviving and dead puppies at 24 and 48 h was evident and the puppies with UL d"8.0±0.24 mmol/l survived by day 14. In brief, umbilical vein lactate is a useful prognostic indicator for the assessment of survival of newborn puppies.

Keywords: Canine, Lactate, Neonate, Survival, Umbilical vein

INTRODUCTION

Parturition signifies an important challenge to neonatal adaptation, as the uterine and abdominal contractions during labor promote intermittent hypoxia (Ruth and Raivio, 1988). There is a critical requirement for a simple and reliable evaluation system in canine neonates that may help in identifying the distressed puppies and thereby reduce neonatal mortality. In human obstetrics, measurement of lactate from fetal scalp or umbilical cord at delivery is performed to identify neonates exposed to intrapartum asphyxia (Borruto *et al*., 2008). Lactate in fetal blood is the end product of anaerobic glycolysis and is primarily of fetal origin than maternal as only a small portion of the lactate crosses the placenta (Nordstrom *et al.*, 2004). Till date, there are only limited records on the significance of lactate measurement in the evaluation of newborns. This study intended to quantify the umbilical vein lactate (UL) in stressed newborn puppies in contrast to healthy ones and to evaluate its concentration in puppies delivered of different obstetrical interventional techniques as well as its association with neonatal viability status and the duration of labor.

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MATERIALS AND METHODS

The present study at obstetrical unit of Department of Veterinary Gynecology and Obstetrics, Veterinary College, Bengaluru was carried out in 55 dogs undergoing spontaneous whelping or required assistance during whelping (Table). In assisted whelping group, vaginal manipulative procedures were successful for the relief of dystocia with subsequent spontaneous expulsion of remaining fetuses. Cesareans were carried out either under total intravenous anesthesia with 6 mg/kg propofolor or under gaseous anesthesia with 2% Isoflurane. Venous lactate concentrations in umbilical cord were analyzed using automated lactate measurement equipment (LACTATE PRO™ 2, Arkray, Japan). The sensitivity ranged from 0.5 to 25.0 mmol/l. The umbilical vein lactate (UL) concentration of pups at birth and its association with type of delivery, the difference in UL concentration between pups surviving or dead at 24h, 48h, 7d and 14d were compared by one way analysis of variance

(ANOVA). The associations of UL and duration of labor were subjected to multiple regression analysis.

RESULTS AND DISCUSSION

In the present study, UL was much lower ($p<0.05$) when the pups whelped by elective cesarean as compared to other groups (Table). Also, the UL in spontaneous whelping group was lower ($p<0.05$) compared to corresponding values in pups of other dystocic groups ($p<0.05$). The highest concentration of UL was recorded in pups delivered through emergency cesarean; however, the variation between the dystocic groups was not statistically significant ($p>0.05$, Table). The variation in UL between puppies delivered of spontaneous whelping and dystocic deliveries was due to dystocia-induced long-lasting bradycardia and metabolic acidosis as well as stress-induced release of maternal cortisol and catecholamines, which may impair placental flow (Kredatusova *et al*., 2011). The lowest UL in elective cesarean could be due to the fact that caesarean was performed before or at the labor onset, earlier than the effect of uterine contractions leading to hypoxic-ischemic changes in the fetus (Borruto *et al.,* 2008 and Groppetti *et al*., 2010). The highest values recorded in pups delivered of emergency cesarean irrespective of type of anesthesia agrees with the findings in babies (Borruto *et al.,* 2008) and in puppies (Groppetti *et al*., 2010) delivered of emergency cesarean section owing to fetal distress and hyperlactatemia incidental to dystocia or hypoxic-ischemic effects of uterine contractions on placental vessels, anesthesia, dam hypotension, and hypovolaemia.

The duration of labor and UL of neonates at birth had a positive association in the present study. The concentrations of UL increased from 5.6±0.72 mmol/l in pups born at duration of labor <4h, to 10±2.90 mmol/l in puppies with duration of dystocia between 4-8h, and further increased to 12±2.10 mmol/l with the duration between 8-12h and 14±3.0 mmol/l with duration extending >12h. This increasing trend could be attributed to the more distress the fetus experience while spending a more time in labor associated with total or partial placental detachment and increase in fetal PCO_2, that exacerbate the fetal acidosis (Groppetti *et al.,* 2010).

The puppies that survived beyond 14d had mean UL of 8±0.24 mmol/l at birth. In contrast, the concentrations of UL at birth in pups having neonatal mortality within 24h (n=29), 24-48 h (n=10) and 48h-7d (n=9) was determined as 15.0±0.88, 10.0±1.80 and 9.3±0.99 mmol/l, respectively. No neonatal mortality was recorded after day seven of the neonatal period. Majority puppies (88.09%) with UL concentration of >10 mmol/l at birth died within 48h. However, its importance in signifying the neonatal outcome beyond 48h was not distinct. Seven pups that died within a week also had lower UL values at birth that could be due to reasons beyond the scope of this investigation. In general, when the UL concentration was very high at birth, the chances of neonatal mortality were equally high. This signified the prognostic importance of umbilical vein lactate at birth in predicting neonatal outcome in 48h of birth. Its importance in

Table: Umbilical vein lactate (UL) concentrations of pups at birth and its association with type of delivery

Type of whelping	UL (mmol/l)
Spontaneous Whelping, SW, n=7	6.82 ± 2.51^{b}
Assisted Whelping, AW, n=7	10.61 ± 3.40^{a}
Complete Primary Uterine Inertia, cPUI, n=6	11.11 ± 2.32^{a}
Partial Primary Uterine Inertia, pPUI, n=10	11.69 ± 1.93^{a}
Elective Cesarean under i.v. anesthesia, ELCSiv, n=7	4.08 ± 0.84^{c}
Elective Cesarean under gaseous anesthesia, ELCSg, n=7	4.12 ± 1.23^{c}
Emergency Cesarean under i.v. anesthesia, EMCSiv, n=11	12.99 ± 2.02^{a}
Emergency Cesarean under gaseous anesthesia, EMCSg, n=7	12.36 ± 3.06^{a}

Means bearing common superscript are similar

clinically identifying the vulnerable puppies warranting special attention for resuscitation and instituting medical/ conservative treatments for a favorable outcome corroborate was also reported earlier in babies (Gjerris *et al*., 2008) and in dogs (Groppetti *et al.*, 2010).

In conclusion, the present study confirmed the merit of umbilical vein lactate estimation at birth in puppies as a safe, easy and quick means of assessment of tissue oxygenation. Also, umbilical vein lactate concentration at birth was predictive of neonatal outcome within 48h of delivery.

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