

PLANNED CESAREAN SECTION AND OTHER OBSTETRICAL INTERVENTIONS IN DOGS: A COMPARATIVE EVALUATION BASED ON NEONATAL SURVIVAL

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Dystocia is a frequent problem in canine reproduction with regard to various causes of maternal, fetal or combined origin. The incidence of stillbirths and neonatal mortality was found to be fairly high and even higher following difficult births. The present study aimed to evaluate the value of planned cesarean section in comparison to normal whelping and other obstetrical interventions based on the stillbirth rate and neonatal survival in dogs. The study was conducted among dogs undergoing spontaneous whelping (n=7), assisted whelping (n=7), successful medical management in complete (n = 6) and partial (n = 10) primary uterine inertia, emergency cesarean under intravenous (n = 12) and gaseous anesthesia (n = 9), elective cesarean under intravenous (n=11) and gaseous anesthesia (n=7). The present investigation clearly established the safety and reliability of planned cesarean over spontaneous whelping and other obstetrical assistance in dogs as evident from the lowest stillbirth rate and highest neonatal survival rate during the neonatal period.

Delivery of healthy offspring is the ultimate goal of a breeding program. However, as compared to other species of animals, the incidence of neonatal mortality following normal delivery is reported to be as high as nine per cent to 26 per cent (Davidson, 2014) and even higher (30% to 40%) following complicated whelping in dogs (Mosier, 1981). The economic impact of such a high incidence of neonatal mortality in a commercial breeding programme could be huge. Timely medical or surgical interventions for dystocia are crucial for both maternal and fetal survival. Cesarean section is common in small animal practice and approximately 60 to 80 per cent of dystocia cases in the dog require surgical intervention and about 58 per cent of cesarean sections are performed on emergency basis (Moon *et al.*, 1998). It has been shown that there are fewer complications associated with planned cesarean section over unplanned, emergency cesareans in humans (Hager *et al.*, 2004). Mirroring this situation in dogs, it could be suggested whether performing a planned cesarean is advantageous or not. The present study aimed at investigating

the reliability of planned cesarean section in high risk group dogs compared to spontaneous whelping and other obstetrical interventions.

Materials and Methods

The present investigation was conducted in two phases on female dogs presented to the obstetrical unit of the Department of Veterinary Gynecology and Obstetrics, Veterinary College, Bengaluru. The first phase of the study was carried out in seven animals undergoing Spontaneous Whelping (Group I: SW). The second phase of the study was conducted in 18 female dogs subjected to elective cesarean section (Group II and III) as well as 44 dystocic dogs presented by the owners for relief of dystocia (Group IV to VIII). The causes for subjecting the animals for elective cesarean section included previous cesarean section (n = 5); previous dystocia (n = 4); gestation in excess of 64 ± 1 day based on ultrasound (n = 2); single pup syndrome (n = 4) and excessive litter size (n = 3). Elective cesarean was carried out under total intravenous anesthesia in group II (EICSIV), and under gaseous anesthesia in group III (EICSG).

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Each case with complaint of dystocia presented during the course of the investigation was subjected to clinico-obstetrical evaluation to identify the cause of dystocia and was categorized as maternal or fetal. Animals diagnosed with dystocia, fetal or maternal in origin, were further subjected to the diagnostic procedures like a) Abdominal ultrasonography to identify fetal viability and fetal distress b) Vaginal Endoscopy using a rigid fibro-optic vaginal endoscope (STORZ, KARL STORZ-ENDOSCOPY) to confirm presence or absence of Chorio-allantoic sac, fetal appendages, patency of the cervix and also the nature of discharge and c) Gloved finger examination of the vagina to identify abnormalities of the vagina, pelvis and presentation, position or posture of the fetus.

Among the animals diagnosed as a case of dystocia, 14 animals as dystocia due to malpresentation, position or posture of the fetus; 16 animals diagnosed as cases of complete primary uterine inertia and another 14 as cases of partial primary uterine inertia were randomly selected and subsequently, they were allotted to the following obstetrical intervention procedures.

Attempts were made to correct the malposture of the fetus using gloved finger or sponge forceps following copious lubrication with a sterile water soluble lubricating jelly. Vaginal manipulative procedures were successful in relief of dystocia with subsequent spontaneous expulsion of the remaining fetuses in only seven animals and hence the maternal and neonatal evaluation of puppies born after Assisted Whelping (AW) was restricted to these seven animals only.

The medical treatment employed for complete and partial primary uterine inertia (CPUI and PPUI) consisted of intravenous infusion of Dextrose 10 % (1gm/kg b.wt), followed by 10% calcium gluconate (CALCIUM-SANDOZ®, Novartis India Limited) @ 0.2 ml / kg b.wt I/V, but not

exceeding a total dose of 10 ml and oxytocin @ 2 units, I/M fifteen minutes after calcium administration. The treatment was considered successful if a pup was delivered within 30 minutes following injection of oxytocin.

The animals assigned to emergency cesarean consisted of cases of dystocia in which vaginal manipulative procedures or medical treatment protocols completely failed to relieve dystocia or were partially successful. A total of 21 such animals were randomly allotted to two different groups in which emergency cesarean section was carried out using two anesthetic protocols, namely intravenous anesthesia (12 animals in EmCSIV) and gaseous anesthesia (9 animals in EmCSG) as detailed for elective cesarean section.

In both the phases, prior to initiation of any treatment, the concentration of serum progesterone was determined by ePro Check 2.0® (Minitube, Germany) instrument using progesterone test kit for canine serum based on Enzyme Linked Immunosorbent Assay (ELISA). The influence of type of whelping on the incidence of stillborn births and incidence of mortality at different stages of the neonatal period, during the first 24 hours and subsequently by 48 hours, 7 days and 14 days were recorded.

Results and Discussion

The mean progesterone concentration in serum of seven female dogs which completed the process of parturition without any assistance (SW) was determined as 0.22 ± 0.04 ng/ml. The concentration of progesterone in the serum of female dogs presented with complaint of dystocia was also similar (Table I). On the other hand, majority of the animals (72.22%) subjected to elective cesarean section had mean progesterone levels between 1 to 2 ng/ml and five dogs (27.78%) showed serum progesterone levels between 2 to 4 ng/ml.

Table I: Maternal Serum progesterone concentration (ng/ml)

Type of delivery	Group I (SW)	Group II (EICSIV)	Group III (EICSG)	Group IV (AW)	Group V (CPUI)	Group VI (PPUI)	Group VII (EmCSIV)	Group VIII (EmCSG)
n	7	11	7	7	6	10	12	9
Mean ± SE (ng/ml)	0.22 ± 0.04 ^b	1.68 ± 0.21 ^a	1.45 ± 0.41 ^a	0.25 ± 0.05 ^b	0.66 ± 0.06 ^b	0.25 ± 0.04 ^b	0.54 ± 0.10 ^b	0.41 ± 0.07 ^b

* Superscript in row: ab

* Means bearing common superscript in row did not differ significantly with each other (P < 0.05)

Johnston *et al.* (2001) has reported that the serum progesterone concentration of atleast 2ng/ml is required for maintenance of pregnancy and the serum progesterone decrease to lower than 2 ng/ml within 24 to 48 hours of parturition. The maternal serum progesterone level in animals exhibiting spontaneous delivery as well as in dystocic patients in the present investigation was less than 1 ng/ml suggesting the complete lysis of the corpus luteum. Concannon *et al.* (2000) stated that in late gestation, progesterone can be as high as 15 ng/ml or as low as 3 ng/ml and declines from 4 to 5 ng/ml to near or below 2 ng/ml during the 24 h period before the onset of labor. Animals subjected to elective cesarean section in the present study, majority of them had mean progesterone levels between 1–2 ng/ml, suggesting imminent onset of labor and five dogs (27.78%) had serum progesterone levels between 2–4 ng/ml, suggesting that they were very close to the onset of parturition. The history and clinical examination of these animals were suggestive that they were in their advanced pregnancy and serum progesterone concentration confirmed that the selected animals were close to the time of parturition and the planned elective cesarean section was not carried out prematurely. Rosset and Buff (2008) has similarly opined that estimation of serum progesterone concentration could be taken up to plan elective cesarean section as the puppy survival rate could be related to the stage at which the cesarean section was employed. Most elective cesarean sections are scheduled only after recording the first signs of parturition or until the progesterone level falls below 2 ng/ml, to

avoid immaturity of the fetus. However, Levy *et al.* (2008) observed that cesarean section could be performed on an average of two days before the date of expected parturition, without any harmful consequence for the dam and the neonate.

The puppy survival rate at birth and incidence of stillbirth following Spontaneous Whelping (SW), Elective Cesarean (EICSIV and EICSG) and relief of dystocia (CPUI, PPUI, EmCSIV and EmCSG) is presented in Table II. A total of 281 pups were delivered from 69 bitches and 253 (90.04%) were born alive. The overall incidence of stillbirths was determined as 9.96 per cent, irrespective of the type of delivery. A total of 79 puppies were delivered from dams subjected to Elective cesarean section and none of the puppies were stillborn. The incidence of stillbirths delivered from dams assigned to the other groups ranged from 3.45 per cent (SW) to 20.68 per cent (AW). A total of 173 puppies were delivered from dams diagnosed as cases of dystocia and subjected to Assisted Whelping, medical treatment protocol or emergency cesarean section (Group IV to VIII) and 146 of these were delivered live following relief of dystocia. The incidence of stillbirth delivered from animals with dystocia (Assisted Whelping, Medical management and Emergency cesarean section) in the present study was recorded as 15.61 percent. This incidence was about 12 per cent higher than the incidence observed in Spontaneously Whelping (SW) group of animals. Although the incidence of stillbirth was high from the group of animals subjected to Assisted Whelping and Emergency Cesarean, Chi-square test revealed that this incidence of stillbirth was

not significantly different from those recorded in other groups.

The still birth rate recorded in the

present study is higher than the reported value of 5.5 per cent (Nielen *et al.*, 1998) and 4.8 per cent (Gill, 2002), but the values

Table II: Effect of type of delivery on puppy mortality at birth, 24h, 48h, 7d and 14d

Type of whelping	No. of dogs	Total no. of Pups born	Live at birth n (%)	Still born n (%)	Neonatal mortality			Total neonatal mortality from birth to 14d n (%)	χ^2_{14} df value
					Within 24h after birth n (%)	within 48h after birth n (%)	within 7d after birth n (%)		
Group I (SW)	7	29	28 (96.55)	1 (3.45)	3 (10.71)	3(10.71)	4(14.29)	4(14.29)	
Group II (EICSIV)	11	42	42 (100)	0 (0)	1(2.38)	4 (9.52)	4 (9.52)	4 (9.52)	
Group III (EICSG)	7	37	37 (100)	0 (0)	3 (8.11)	3 (8.11)	4(10.81)	4 (10.81)	
Group IV (AW)	7	29	23 (79.31)	6 (20.69)	6 (26.09)	6 (26.09)	8 (34.78)	8 (34.78)	
Group V (CPUI)	6	19	17 (89.47)	2 (10.53)	2 (11.76)	2 (11.76)	3 (17.65)	3 (17.65)	
Group VI (PPUI)	10	26	22 (84.62)	4 (15.38)	5 (22.73)	5 (22.73)	7 (31.82)	7 (31.82)	
Group VII (EmCSIV)	12	51	45 (88.24)	6 (11.76)	6 (13.33)	12 (26.67)	13(28.89)	13(28.89)	
Group VIII (EmCSG)	9	48	39 (81.25)	9 (18.75)	6 (15.38)	7 (17.95)	8 (20.51)	8 (20.51)	
Total	69	281	253(90.04)	28 (9.96)	32 (12.65)	42 (16.60)	51(20.16)	51(20.16)	
χ^2_7 df value	5.18^{NS}				29. 68*	67. 33*	24.12*	31.44*	82.60*

• Significant at 0.05 level)

NS: Non significant at 0.05 level

SW: Spontaneous Whelping

CPUI: Complete Primary Uterine Inertia

EmCSIV: Emergency Cesarean under Intravenous anesthesia

EICSIV: Elective Cesarean under Intravenous anesthesia

AW: Assisted Whelping

PPUI: Partial Primary Uterine Inertia

EmCSG: Emergency Cesarean under gaseous anesthesia

EICSG: Elective Cesarean under gaseous anesthesia

are comparable to the reported incidence of 8 per cent (Moon *et al.*, 2000) and 10.9 per cent (Indrebo *et al.*, 2007) respectively. However, it's lower than the overall still birth rate of 22.3 per cent and an overall 14 per cent independent of the type of delivery observed by Veronesi *et al.* (2009). The average incidence of stillbirths during both complicated and uncomplicated vaginal deliveries is reported to range from 5.55 per cent to 33.0 per cent (Davidson, 2003). Lawler (2008) established that stillbirths should be less than 30 per cent of full-term puppies that do not survive to weaning. A reported still birth rate of 11.54 per cent by Vassalo *et al.* (2015) correlate to the observations of the present study.

Following elective cesarean section, the viability of the neonates at birth was 100 percent irrespective of the type of

anesthesia employed. The observations made in the present study strongly suggest that elective cesarean section is a safe procedure for maximizing maternal and fetal outcome. Similar observations on the advantage of planned cesarean in dogs were reported by Smith (2007) who timed cesarean using a combination of hormonal assays and temperature changes. However, Levy *et al.* (2008) observed that cesarean section could be performed on an average of two days before the date of expected parturition, without any harmful consequence for the dam and the neonate. The maximum survival rate of puppies delivered of elective cesarean in the present study, irrespective of the type of anesthesia employed, substantiate this outlook.

The incidence of neonatal mortality of puppies at various stages of the neonatal

period is illustrated in Table II. It was observed that a total of 253 puppies were delivered live at birth and between birth and 24 hours, 32 puppies had undergone mortality (12.65%). Between 24 to 48 hours, another 10 puppies were lost and the incidence of neonatal mortality from birth to 48 hours had risen to 16.60 percent. Further, 9 more puppies were again lost between 48 hours and seven days of birth and the overall neonatal mortality by seven days after birth was determined as 20.16 per cent. No further mortality was recorded after seven days and the overall puppy survival rate by 14 days after birth was recorded as 79.84 percent. The lowest overall incidence of neonatal mortality was recorded in puppies which were delivered following elective cesarean section (9.52%, Group II and 10.81%, Group II). The overall incidence of neonatal mortality in puppies by 14 days after birth in puppies delivered spontaneously was recorded as 14.29 per cent. The corresponding incidence of neonatal mortality by 14 days after birth in puppies which had been delivered through assisted whelping, in cases of complete uterine inertia, partial primary uterine inertia, emergency cesarean under intravenous and gaseous anesthesia was recorded as 34.78 per cent, 17.65 per cent cesareans in unproductive cases would have contributed to dam exhaustion or distress of the puppies and / or dam contributing to the high neonatal mortality in dystocic animals as observed in the present study.

In conclusion, the present study established that the incidence of stillbirths and neonatal mortality in canines is fairly high and even higher following difficult births, substantiating the need to determine procedures to save them. Well programmed and timely planned cesarean section is effective in maximizing neonatal survival, as observed from the results of this investigation. Properly timed elective cesarean section is an appropriate therapeutic modality to be practiced in whelping management, particularly in high

cent, 31.82 per cent, 28.89 per cent and 20.51 per cent respectively. The overall incidence of neonatal mortality in puppies delivered in the dystocic group was determined as 26.71 per cent. Statistical analysis revealed significant variations between groups in mortality rate of puppies at different intervals of time. No maternal mortality upto 14 days was recorded in any of the animals among different groups.

The puppy survival rate by 14 days after birth was highest in animals subjected to elective cesarean section and the type of anesthesia that had been employed for the surgery appeared to have no significant effect on the overall neonatal mortality. The higher survival rates at different intervals observed in elective cesarean could be attributed to the lack of key factors contributing to neonatal death like prolonged labor, dystocia and resultant hypoxia (Moon *et al.*, 2000 and Rosset and Buff, 2008). This also signifies the safety of elective cesarean as a technique of maximizing neonatal survival in dogs. There are also many reports which have recorded a higher incidence of neonatal mortality after difficult births (Lawler, 1989 and Moon *et al.*, 2000). Medical managements before reference to the emergency clinic followed by emergency risk group of dogs, thereby optimizing the outcome of the dam and the neonate.

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