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Outcome and complications of repeat cesarean deliveries in Dogs

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Abstract
The effect of repeat cesarean section in dogs with a history of previous emergency cesarean was evaluated. Ten dogs that had an emergency cesarean in their previous whelping were pursued through their subsequent oestrous cycle. Eight out of ten dogs exhibited next oestrus within a period of 4 to 5 months and the mean interestrous interval in these dogs was 5.10 ± 1.48months. Seven dogs that conceived in next oestrous cycle were subjected to elective cesarean. Intra-operatively, abdominal adhesions varying in density as well as uterine scars and lacerations on the uterus at the hysterotomy site was evident. Live birth rate and neonatal survival upto one week was highest in elective compared to emergency cesarean. Although repeat cesareans are intricated with adhesion occurrence, no remarkable complications were observed from repeat procedures. Close monitoring of the high risk pregnancy dogs in their subsequent pregnancy to time the elective procedure is inevitable.

Keywords: canine, repeat cesarean, perioperative complications

1. Introduction
Cesarean section is frequent in small animal practice and about 60 to 80 per cent of dystocia cases in the dog necessitate surgical intervention and about 58 per cent of cesarean sections are executed on emergency basis [7]. It has been revealed that there are fewer complications related with planned cesarean section over unplanned, emergency cesareans in humans [2]. Comparable interpretations on the benefit of planned cesarean in dogs were reported using a combination of hormonal assays and temperature changes [8]. Cesarean section could be performed on an average of two days before the date of expected parturition, exclusive of any harmful outcome for the dam and the neonate [4]. The incidence of neonatal mortality following normal delivery is reported to be as high as nine per cent to 26 per cent and even higher (30% to 40%) following complicated whelping in dogs [1]. The economic impact of such a high incidence of neonatal mortality in a commercial breeding programme could be huge. The better live birth rate and neonatal survival rate after cesarean section in dogs has attracted its relevance as a common procedure in whelping management. Moreover, the safety of the procedure for the dam and the neonate has improved with the advances in anaesthetic techniques, surgical procedures and neonatal care. However, reports are lacking regarding the benefits as well as the risks and complications associated with repeat cesarean section in dogs that underwent a primary cesarean section.

2. Materials and Methods
Ten dogs of different breeds presented with dystocia from foetal or maternal cause of dystocia at University Veterinary Hospital, Kokkalai, Kerala Veterinary and Animal Sciences University that experienced a primary cesarean section for the relief of dystocia and performed with repeated cesarean in subsequent pregnancies from a high risk pregnancy status were investigated. Data regarding the maternal age at primary cesarean, the necessity for initial cesarean, number of live puppies, neonatal viability, post cesarean complications, next exhibited proestrus and number of cesarean deliveries were collected. Foetal viability in all the dogs were assessed before surgery by trans-abdominal B-mode ultrasonography and fetal heart rate (FHR) recorded. Radiographic evaluation to assess the fetal number was also performed. Planned repeat cesarean after primary cesarean was scheduled once the dog exhibited initial symptoms of whelping or once the progesterone level was below 2 ng/ml. Vaginoscopic examination was done using Welch Allyn sigmoidoscope and cervical relaxation was deemed from expression of foetal sac at anterior vagina. All C-sections were performed under glycopyrrolate premedication, propofol induction and isoflurane maintenance of anaesthesia.

Demographic characteristics, intra and post-operative complications as well as the maternal and foetal outcome after each repeat cesarean were analyzed.

3. Result and Discussion

The breed that experienced the greatest number of repeated cesarean deliveries was beagle (6/10) followed by British bull dog (2/10), Chihuahua and Pug (1 each). At primary cesarean, the mean maternal age was 1.84 ± 0.12years (1 to 2.5 yrs). Sixty percent of the dogs were performed with primary cesarean in their first gestation and rest of them (40%) that experienced it from their second gestation beyond had a record of eutocia in their first whelping. The reason for primary decision of emergency cesarean was due to maternal causes of dystocia in 60 percent cases and rest of it was performed due to foetal causes. A primary emergency cesarean was opted in 40 percent cases due to maternal causes of dystocia from complete primary uterine inertia not responding to medical management and 20 percent cases due to primary uterine inertia. Primary uterine inertia was secondary to high litter size (60%) as well as small litter size (20%) including single pup syndrome (20%) with resultant foetal oversize. Foetal cause of dystocia from malposture concluded in emergency cesarean in 40% of the cases and the main malposture encountered was ventral deviation of head. Live birth rate following primary emergency cesarean section was 82.05% (32/39) and the neonatal mortality upto 24h and one week was recorded as 12.50% (4/32) and 7.14% (2/28). The overall neonatal survival upto one week following primary emergency cesarean section was 81.25% (26/32).

A remarkable observation in these animals that underwent cesarean section was that 80% (8/10) of these dogs exhibited next oestrus within a period of 4 to 5 months with the exception of one dog that exhibited it after 6 months and single one after 8 months. The mean ± SD interestrous interval in the ten dogs that underwent primary cesarean was 5.10 ± 1.48months. The duration and character of next proestrus and oestrus in these dogs following primary cesarean was comparable to that of natural oestrus and the conception rate in next oestrus after breeding with proven fertile stud dogs was 70% (7/10).

An elective cesarean section was performed in all these seven dogs in view of the high risk pregnancy status from a previous emergency cesarean section. Elective cesarean was performed once the signs of first stage labour were evident with the expression of foetal sac at anterior vagina or on record of peripheral progesterone level below 2ng/ml with clinical signs of first stage labour. Intra-operatively, post-surgical abdominal adhesions varying in density after the primary cesarean section were noticed. These adhesions did not complicate the normal anatomical function of any of the abdominal organs. However, distorted anatomy from dense adhesions to the uterine body as well as the uterine horns was noticed that complicated the exteriorization of the whole gravid uterus and position of uterine incision in subsequent surgeries (Fig. 1 & Fig. 2). So also, uterine scars as well as lacerations on the uterus at the hysterotomy site (Fig. 3) of previous cesarean were evident in some dogs particularly the dogs with large litter size. No uterine rupture was noticed in any of the dogs that underwent repeated cesarean while the presence of perimetrial cyst was noticed in a dog (Fig. 4). No bladder as well as intestinal damages was noticed in any of the dogs that experienced repeat cesarean. Live birth rate following second cesarean section was 100% (37/37) and the neonatal mortality upto 24h and one week was recorded as 5.41% (2/37) and 5.71% (2/35). The overall neonatal survival upto one week following secondary cesarean section was 89.19% (33/37).

The dogs that underwent an emergency cesarean are considered a high risk pregnancy in subsequent gestations [3]. An unprecedented increase in the cesarean section in dogs has occurred in the present times that necessitate the understanding of potential risks and complications associated with repeat cesarean. Well programmed and timely elective cesarean is effective in maximizing the neonatal survival in comparison to emergency cesarean as observed from the results of this study. With repeat cesarean performed on an elective way, the neonatal viability at birth was 100 percent. The observations made in this study strongly suggest the advantage of elective cesarean for maximizing the maternal and neonatal outcome. Similar observations on the advantage of planned cesarean in dogs were reported by timing cesarean using a combination of hormonal assays and temperature changes [8]. The puppy survival rate by one week after birth was highest in animals subjected to elective cesarean section (89.19%) compared to emergency cesarean (81.25%). This signifies the safety of elective cesarean as a technique of maximizing neonatal survival in dogs.

Repeated cesarean sections are related to more severe maternal and fetal complications compared to the first cesarean birth in human beings. But, the safety of repeated cesarean has increased several folds with the positive advances in surgical techniques and patient care [6]. Except for the risk of intra-abdominal dense adhesions, repeated cesarean are without complications in dogs as can be observed in this study. The normal wound-healing process after injury to the peritoneum involves a complex inflammatory cascade of fibrin deposition, coagulation, and influx of inflammatory cells. Physiologically, fibrinous exudate serves as a matrix for healing, but it can also allow for the formation of a permanent connection between two adjoining tissues. When adhesion formation is being considered, it is important to recognize that, unlike skin and other tissue that heals from the edges of disrupted epithelium, the peritoneum epithelializes over the whole surface simultaneously. Formation of adhesions begins immediately after surgery. Although adhesions can be remodeled and strengthened for approximately 1month after the trauma, new adhesions typically are not formed at above a week after surgery or the inciting event [5]. In addition to differences in size and location which may influence clinical effects, density of adhesions can vary greatly. Some adhesions are easily separable and filmy in density; other adhesions are thick and dense, particularly after multiple repeat cesareans.

Moreover, the uterine scar formation and lacerations of the uterine wall from primary cesarean observed in some dogs with large litter size didn't complicate to uterine rupture or other maternal and foetal complications. The incidence of wound dehiscence from repeat cesarean did not vary from the normal incidence noticed in primary cesarean. Other complications from adhesions reported from studies in women undergoing repeat cesarean like bladder injury, bowel injury, bowel obstruction and excessive bleeding were not observed in any of these dogs.

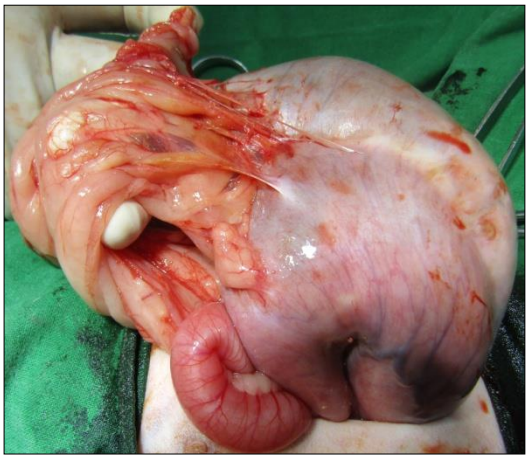

Fig 1: Dense adhesions on the uterus

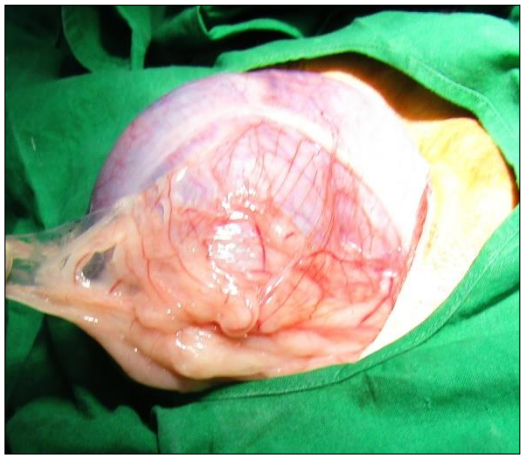

Fig 2: Thin adhesions on the uterus

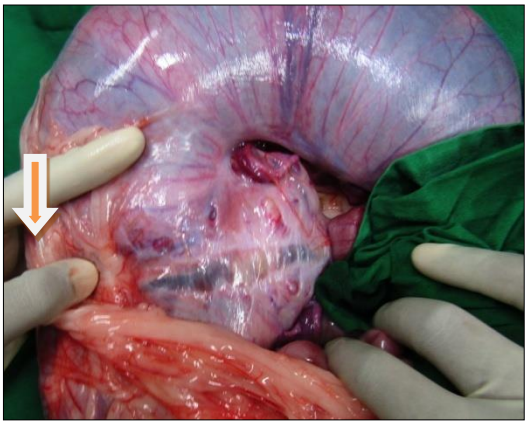

Fig 3: Laceration at hysterotomy site

Fig 4: Perimetrial cysts

4. Conclusions

With the increasing rate of cesarean section in canine obstetrical management, it's pertinent that the clinician recognizes the advantages and potential risks of repeat cesarean. An evaluation of the repeat elective cesarean following primary emergency cesarean in canines disclosed a safe procedure that can be implemented without much peri-operative complications except for the adhesions noticed. Further clinical studies are needed to evaluate the maternal outcome, intra-operative and peri-operative complications following repeated cesarean more than twice.

Table 1: Overview of primary emergency C-section and repeat elective C-section

Age at primary C- section	1.84 ± 0.12years (1 to 2.5 yrs)
Foetal cause for primary C- section	40%
Maternal cause for primary C- section	60%
Number of puppies delivered	39
Live birth rate from primary C-section	32 (82.05%)
Neonatal mortality within 24 hours	4 (12.50%)
Neonatal mortality within one week	2 (7.14%)
Overall neonatal survival upto one week	26 (81.25%)
Interval between primary C-section and next cycle	5.10 ± 1.48 months (4 to 8.5months)
Conception rate in oestrus after primary C-section	70 % (7/10)
No. of puppies in second C-section	37
Live birth rate from elective C-section	37 (100%)
Neonatal mortality within 24 hours	2 (5.41%)
Neonatal mortality within one week	2 (5.71%)
Overall neonatal survival upto one week	33 (89.19%)

5. Acknowledgement

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