

Prevention of uterine adhesion formation following caesarean section in bovines

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ABSTRACT

The present study was planned in 41 dystocia affected bovines to assess the comparative efficacy of natural (chromic catgut, CC) or synthetic (polyglycolic acid, PGA) absorbable suture material used for uterine incision, with or without intra-peritoneal infusion of sodium carboxy methyl cellulose (SCMC 1% @ 14 ml/kg) during caesarean for preventing the post-operative formation of uterine adhesions. All the animals were evaluated for the presence of uterine adhesions either between 30–40 days post-caesarean or at the time of post-mortem if the animal died during the course of study. The animals were divided into groups, viz. 1a (CC, n=9), 1b (CC+SCMC, n=10), 1c (PGA, n=10) and 1d (PGA+SCMC, n=12). All the animals of group 1a exhibited severe degree of uterine adhesions whereas percentage of animals exhibiting severe uterine adhesions were less in group 1d compared to group 1a and 1b. Depending upon the time elapsed between the occurrence and relieving of the dystocia through caesarean section, animals were divided into groups, viz. 2a (<12h, n=12), 2b (12–36h, n=11) and 2c (>36h, n=18). Majority of the animals in group 2a either had no development of uterine adhesions or were not of severe degree in comparison to group 2c. In conclusion, formation of uterine adhesions could be prevented by the use of PGA, instead of CC, for suturing uterine incision along with intra-peritoneal infusion of SCMC during caesarean. Moreover, caesarean section should be performed preferably within 12 h of occurrence of dystocia to reduce the severity of post-caesarean uterine adhesions.

Key words: Bovine, Caesarean section, Dystocia, Suture material, Uterine adhesions

Suture materials may play an important role in uterine tissue repair. Absorbable suture material such as chromic catgut (CC) which is commonly used by the bovine practitioners for suturing uterine incision induces severe inflammation and may lead to formation of adhesions along the suture line (Dhindsa *et al.* 2008a). In comparison, synthetic absorbable sutures like polyglycolic acid (PGA) produce mild inflammatory reaction and the by-products of its hydrolysis do not provide a growth medium for bacteria (Niles and Williams 1999). In addition, high molecular weight absorbable viscous solutions (sodium carboxy methyl cellulose 1% solution, SCMC) were infused intra-peritoneally to prevent formation of adhesions between uterus and adjacent serosal surfaces through their lubricating and hydrofloatation effect (Moll *et al.* 1992). Moreover, the time elapsed between the occurrence of dystocia and caesarean operation also leads to intra-peritoneal biochemical and uterine tissue alterations, which may predispose to uterine adhesion formation (Dhindsa *et al.* 2008b, 2009). Hence, to

improve upon the technique of caesarean section in bovines, the present study was planned to assess the comparative efficacy of CC or PGA with or without the intra-peritoneal infusion of SCMC during caesarean on post-operative uterine adhesion formation. Moreover, the impact of duration of dystocia before subjecting the animal to caesarean operation was analyzed on post-caesarean uterine adhesion formation.

MATERIALS AND METHODS

Bovines (31 buffaloes and 10 cattle) presented for the treatment of dystocia at the Teaching Veterinary Hospital, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, and which required caesarean section to deliver the fetus were included in the present study. Caesarean operation was carried out in right lateral recumbency and under local infiltration anaesthesia (lignocaine HCl 2%) as per the standard technique. The uterine incision was sutured with chromic catgut (CC) number-2 or polyglycolic acid (PGA) number-2 by continuous cushioning pattern, while abdominal muscles and peritoneum were sutured with braided silk thread number-3 by continuous lock-stitch pattern in 1 or 2 layers in cattle and buffalo, respectively. Horizontal-mattress stitches with braided silk were applied on the skin incision.

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Groups

Group 1: On the basis of type of suture material (chromic catgut, CC or polyglycolic acid, PGA) used for uterine incision with or without infusion of an intra-peritoneal lubricant (sodium carboxy methyl cellulose, SCMC) during caesarean, the groups were 1a (CC, n=9), 1b (CC+SCMC, n=10), 1c (PGA, n=10) and 1d (PGA+SCMC, n=12). Intra-peritoneal solution of SCMC (1% @ 14 ml/kg) was infused after applying uterine sutures.

Group 2: Animals were divided into groups depending upon the time elapsed between the occurrence and relieving of the dystocia, viz. 2a (<12h, n=12), 2b (12–36h, n=11) and 2c (>36h, n=18).

The study was planned in a way that there was near equal distribution of similar type of animals in each sub-group of the groups 1 and 2. For example, it was tried to equally distribute the animals with fresh or delayed dystocia to each of the sub-groups based upon the suture material and intra-peritoneal lubrication.

Preparation of SCMC solution: Solution (1%) of SCMC was prepared by boiling 200 ml of double distilled water and slowly adding 10 g of SCMC powder while stirring. Additional double distilled water was added while stirring to bring the total volume to 1L. The SCMC solution was then transferred to 1L glass bottles and was autoclaved for 20 min at 121°C.

Supportive treatment: Intravenous (IV) fluid therapy consisting of 5L normal saline solution was administered during caesarean section and on subsequent days until day 6 post-caesarean or the death of the animal within 6 days post-caesarean. Intra-muscular (IM) antibiotic therapy comprising gentamycin (5 mg/kg body weight, twice a day), streptopenicillin (2.5 g, twice a day) was administered to all animals on the day of caesarean operation and on subsequent days. Other drugs, viz. adrenochrome monosemicarbazone, dexamethasone, meloxicam, multivitamins, pheneramine maleate and rumenotorics were administered through appropriate route (im, iv, or per-oral).

Evaluation of uterine adhesions: The formation of uterine adhesions begins during the inflammatory stage of healing (24–48 h after injury) and was detectable by rectal palpation around 30 days post-caesarean. The animals that survived following caesarean operation were subjected to rectal

examination between days 30 to 40 post-caesarean. The criteria for the absence of uterine adhesions were based upon the free movement of uterine horns and the involution of uterus. The animals that died during their stay in hospital were subjected to post-mortem examination to assess the degree of uterine adhesions visually and manually (Table 1).

Statistical analysis: The percentage of animals exhibiting different degrees of uterine adhesions between sub-groups were subjected to student's *t*-test. Statistical analyses were performed using MINITAB release 13.2 statistical software.

RESULTS AND DISCUSSION

When chromic catgut (CC) was used alone all the animals exhibited severe uterine adhesions during post-operative period (group 1a, Table 2). This could be due to the fact that the resorption of CC causes serious inflammation (Niles and Williams 1999). In another group, when CC was used along with the infusion of SCMC through intra-peritoneal route during caesarean, there was little ($P>0.05$) improvement as 77.8% animals exhibited severe and a few (22.2%) had developed mild adhesions (group 1b, Table 2). This indicated that the use of SCMC solution as anti-adhesive measure could be successful. The solution of SCMC is highly viscous and may serve to prevent adhesion by its lubricating, as well as, hydrofloatation effect (Holtz and Backer 1980). During the inflammatory stage of healing, SCMC is thought to act by separating the abdominal viscera because during this period intra-peritoneal structures will not adhere to each other unless they are in direct opposition (Moll *et al.* 1992). The volume of SCMC increased in the present study compared to a previous report (Fredericks *et al.* 1986) with the hypothesis of further decreasing the number of adhesions because the major trauma is inflicted especially in the pelvic area. A smaller volume of SCMC might have pooled in the ventral portion of the abdomen and may not have covered the pelvic viscera to prevent adhesions by mechanically separating peritoneal surfaces.

When PGA was used alone post-operative condition of animals with regard to development of uterine adhesions was better ($P>0.05$, group 1c) compared to the animals where CC was used alone (group 1a) or with SCMC (group 1b, Table 2). This suggested that tissue reactivity by the use of PGA suture material may be less as compared to CC (Niles

Table 1. Classification of the degree of uterine adhesions as detected by rectal or post-mortem examination

Type of examination	Observations	Degree of uterine adhesions		
		Absent	Mild	Severe
Rectal	Free movement of uterine horns Uterine involution	Easily movable Complete/uterus in pelvic cavity	Slight movement Incomplete/uterus at pelvic brim	No movement Uterus in abdominal cavity
Post-mortem	Visual and manual examination of uterine horns	No adhesions	Easily breakable adhesions	Unbreakable adhesions

Table 2. Percentage of caesarean-operated animals with various degrees of post-operative uterine adhesions in relation to the type of suture material used for uterine incision, either with or without intra-peritoneal SCMC infusion during caesarean (group 1)

Degree of uterine adhesions	Sub-groups			
	1a (CC, n=7*)	1b (CC+SCMC, n=9*)	1c (PGA, n=10)	1d (PGA+SCMC, n=10*)
Absent	0 ^a	0 ^c	10	30 ^{bd}
Mild	0 ^a	22.2	30	50 ^b
Severe	100 ^a	77.8 ^c	60	20 ^{bd}

^a vs ^b, ^c vs ^d $P < 0.05$: Significantly different within row; PGA, polyglycolic acid; CC, chromic catgut; SCMC, sodium carboxy methyl cellulose; *5 animals (2 each of sub-group 1a and 1d and 1 of sub-group 1b) were excluded from the data presented because the adhesions were not evaluated in these animals as they were sold by the farmer about 20–30 days post-caesarean.

Table 3. Percentage of caesarean-operated animals with various degrees of post-operative uterine adhesions in relation to the time elapsed between the occurrence of dystocia and caesarean operation (group 2)

Degree of uterine adhesions	Sub-groups		
	2a (<12 h, n=10*)	2b (12–36h, n=11*)	2c (>36 h, n=15*)
Absent	30 ^a	9	0 ^b
Mild	40	36.4	13.3
Severe	30 ^a	54.5	86.7 ^b

^a vs ^b $P < 0.05$: Significantly different within row; *5 animals (1 each of sub-groups 2a and 2b and 3 of sub-group 2c) were excluded from the data presented as per the reason described under Table 2.

and Williams 1999). Additionally, the beneficial effect of PGA further improved when PGA was used along with SCMC (group 1d, Table 2), because higher ($P < 0.05$) percentage of animals were either without or with mild uterine adhesions and lower ($P < 0.05$) percentage of animals were with severe degree of uterine adhesions in comparison to animals where CC was used alone (group 1a) or with SCMC (group 1b, Table 2).

The development of post-operative uterine adhesions was absent in dystocia affected bovines subjected to caesarean section within 12 h of occurrence of dystocia (group 2a, Table 3). However, all the dystocia affected bovines which had elapsed more than 36 h between the occurrence of dystocia and caesarean section developed uterine adhesions during post-operative period which were of severe degree (group 2c, Table 3), compared to animals which were operated within 12 h of occurrence of dystocia ($P < 0.05$, group 2a, Table 3). This could be due to higher bacterial infection and fibrin clots in peritoneal cavity of animals having prolonged duration of dystocia. The mechanism by which infection induces adhesions has not been clearly established, however, bacteria release numerous enzymes that may damage tissues and produce substantial inflammatory exudates. Moreover, in

delayed cases of dystocia, uterus and peritoneum after becoming ischemic loses their spontaneous ability to lyse fibrin and also inhibit fibrinolysis thus leading to fibrin deposition and adhesion formation (Buckman *et al.* 1976).

In conclusion, use of PGA along with intra-peritoneal infusion of SCMC was highly effective in reducing post-caesarean development of uterine adhesions. The animals in which CC was used for uterine suturing are highly prone to uterine adhesion formation. Early decision (within 12 h of dystocia) to operate animal is must to prevent the development of post-operative uterine adhesions.

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