

Genital prolapse in crossbred cows: prevalence, clinical picture and management by a modified Bühner's technique using infusion (drip) set tubing as suture material

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ABSTRACT

Eighty-six cows presented for treatment of genital prolapse (uterine - 44 and vaginal - 42) were included in this study. Vaginal prolapse mostly occurred during advanced pregnancy and uterine prolapse following parturition. At the time of examination, most of the animals with uterine prolapse were recumbent, while those with vaginal prolapse were standing. The highest prevalence of genital prolapse was recorded in crossbred Jersey cows around the 2nd parturition during the autumn season. The number of cases with grade 1 vaginal prolapse was highest (52.38%) followed by grade 3 (33.33%) and grade 2 (14.29%) respectively. Grade 1 vaginal prolapse could be managed successfully by exogenous progesterone therapy (500 mg hydroxyprogesterone i.m. two times at weekly interval) along with hind quarter elevation in 45.45% cases (10/22); however, in the remaining 54.55% cases the prolapse was converted to grade 2. A few (27%) animals with uterine prolapse were simultaneously suffering from milk fever, dystocia and retained fetal membranes. In all the cows with grade 2 and 3 vaginal prolapse, and also those with uterine prolapse, the mass was repositioned following the standard technique under caudal epidural analgesia. A modified Bühner's technique, using sterile infusion set tubing as suture material, was effective in retention of the mass in all the cows. Complications and disfigurement of the vulvar area were not noticed, even in cases where the suture was kept in-situ for a prolonged period.

Key words: uterine prolapse, vaginal prolapse, modified Bühner's suture, infusion set tubing, crossbred cows

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Introduction

Genital prolapse is a major but not very common reproductive disorder in cattle and buffaloes (SETH, 1970; AHMED et al., 2005). It is regarded as an emergency condition and should be managed before excessive edema, mucosal trauma, contamination and fatal hemorrhage lead to a grave prognosis (MIESNER and ANDERSON, 2008). Although a high estrogen level is considered as a prime factor for ante partum vaginal prolapse (ROBERTS, 1998), the exact etiology of uterine prolapse is still unclear (NOAKES et al., 2001a). Hypocalcaemia results in myometrial fatigue and delays cervical involution, both of which could predispose to uterine prolapse (ODEGAARD, 1977; MURPHY and DOBSON, 2002; ROBERTS, 2004). Forced extraction of the fetus has also been incriminated as an etiological factor (NOAKES et al., 2001a). Foods containing estrogenic substances, such as subterranean clover pasture in Western Australia, soybean meal, mouldy maize and barley, may result in a high incidence of vaginal (BENNETT, 1944; DAVIS and BENNETT, 1959) or uterine prolapse in sheep (NOAKES et al., 2001a). Although incidence of prolapse as high as 43% has been reported in buffaloes (SAMAD et al., 1987); however, in cattle it is only 1 to 2% (WOODWARD and QUESENBERRY, 1956; PATTERSON et al., 1981). The incidence of vaginal prolapse has been recorded as 1.1% in Hereford cattle (WOODWARD and QUESENBERRY, 1956) and of uterine prolapse as 0.2% and 0.3% in American beef cattle (PATTERSON et al., 1981) and Scandinavian dairy cattle (ODEGAARD, 1977) respectively. This condition places considerable stress on the animal. Delayed cases may develop fatal septicemia (BHATTACHARYYA et al., 2007).

To retain the prolapsed mass after proper reduction, various through and through transvulvar suturing techniques have been tried (NOAKES et al., 2001b; ROBERTS, 2004; ANONYMOUS, 2006; BHATTACHARYYA et al., 2007), but they are prone to tear the vulva particularly in cases showing subsequent violent straining (NOAKES et al., 2001b). The currently most favored technique is Bühner's subcutaneous perivulvar suture application using vetafil or umbilical tape. However, under field conditions vetafil is very costly and umbilical tape is not readily available in sterile form (ANONYMOUS, 2006).

Inadequate information is available in the literature on the prevalence and clinical picture of cows suffering from genital prolapse. Therefore, the purpose of this study is to put on record these details of vaginal and uterine prolapse in cows. Also the management of the disease is described by a 'modified' Bühner's technique, using an unconventional type of suture material.

Materials and methods

Eighty-six cases of genital tract prolapse (44 uterine and 42 vaginal) in cattle were included in the present study. The breed, parity, season, time of occurrence and details of other accompanying diseases of all the animals were recorded. The season comprised

summer (June to August), spring (March to May), autumn (September to November) and winter (December to February). Apparent vulvar pathological changes were also recorded. Severity of vaginal prolapse was classified as grades 1, 2 and 3 (BOSSE et al., 1989). In grade 1, vaginal mucosa protruded from vulva when the animals were recumbent, but disappeared on standing. In animals with grade 2, vaginal mucosa remained exposed while the animal was standing but the cervix was not visible. In grade 3, protrusion of both the vagina and cervix occurred (Fig. 1). Corrective measures were taken on the basis of the severity of the condition. Complications encountered were also recorded. Animals with grade 1 vaginal prolapse were treated with exogenous progesterone (500 mg hydroxyprogesterone, i.m, weekly 2 times) and hind quarter elevation (20-25° from the floor level) continuously for 2 weeks.



Fig. 1. Grade 3 vaginal prolapse in a crossbred HF cow

All the animals with grade 2 and 3 vaginal prolapse (32) and all 44 with uterine prolapse (Fig. 2) were managed as per the following technique:

Analgesia was induced using 2% lignocaine hydrochloride (5 to 10 mL) as a caudal epidural block. For easy replacement of the prolapsed mass, straw filled gunny bags were placed beneath the hind quarters of all the cows. The prolapsed mass was rinsed thoroughly with cold (<15 °C) potassium permanganate solution (1:1000), ice packs were applied, it was lubricated with sterile Vaseline, followed by massaging and replacing carefully after holding it up with lubricated gloved hands and pushing it into the cow's pelvis. During repositioning, rotation of the uterus was avoided. The entire perineal region including the vulvar lips were disinfected with 70% alcohol.



Fig. 2. Uterine prolapse in a crossbred HF cow

After proper repositioning of the prolapse, using a sterile infusion (drip) set as suture material, the following procedure was adopted for application of the modified Bühner's technique:

An unthreaded sterilized Bühner needle was introduced on one side of the vulvar lip (2 to 3 cm away from the vulvar margin and 3 to 4cm dorsal to the ventral commissure) in an upward direction, without piercing the vulvar surfaces. The tip of the needle emerged in the mid area between the anus and the dorsal margin of the vulvar opening. Sterile infusion set tubing was inserted through the hole of the needle. The threaded needle was pulled out of the insertion point. After the needle was disengaged, it was reinserted in the same direction on the opposite side of the vulva keeping similar distances from the corresponding vulvar edge and its tip was pushed out through the previous hole above the dorsal commissure.



Fig. 3. Modified Böhner's technique using infusion set tubing as suture before tying the knot in a crossbred HF cow

The needle was threaded with the free end of the infusion set hanging from the skin hole above the dorsal commissure. The needle was then pulled out and disengaged. Thus the free ends of the infusion set tubing came out through two openings (Fig. 3) 3 to 4 cm above the ventral vulvar commissure. Now a slipping knot (Fig. 4) was applied and tied firmly. A gap for urination remained towards the ventral vulvar commissure. Calcium borogluconate 25% (200 to 400 mL) was then administered intravenously to all the cows. On the entry and exit portals of the Böhner's needle antiseptic povidone iodine was applied (5%). An analgesic (meloxicam 0.2 mg/kg body weight) and antibiotic (enrofloxacin 10 mg/kg body weight) were administered intramuscularly for 3 consecutive days. Additionally, in 4 animals (showing continuous straining), caudal epidural block using 5 mL of bupivacaine was induced twice with a gap of 6 hours. In all animals, the infusion set tubing was kept in situ for 4 days and then its knot was released but the tubing was not pulled out to ascertain recurrence of prolapse.



Fig. 4. Completed Modified Bühner's technique using infusion set tubing as suture in a crossbred Jersey cow

Owners were advised to watch for recurrence of the condition for up to 48 hours. Subsequently, in non-recurring cases, they were advised to remove the tubing by gently pulling it out. However, in cases suffering from vaginal prolapse during mid to advance stages of pregnancy (18 cows) the tubing was retained until parturition and the owners advised to carefully loosen the knot without pulling the tubing out at parturition and retie it after delivery. In cases showing recurrence during parturition when the knot had been released for unobstructed delivery, the prolapsed organ was again replaced and a slipping knot applied to the intact infusion set tubing around the vulva, followed by a course of antibiotic. The tubing was maintained in these cows for 2 to 4 months and removed only around 20 days after parturition. The owners were directed to wash and disinfect the exposed tubing regularly until its removal.

Results

At the time of clinical examination, the majority of the animals (38/44; 86.36%) suffering from uterine prolapse were in lateral recumbency and did not get up on persuasion. However, all animals suffering from vaginal prolapse were either standing or could be persuaded to stand.

The highest number of genital prolapse was observed in crossbred Jersey cows, mostly in the 2nd and then their 1st and 3rd and 4th parity (Table 1). Uterine prolapse was most frequently noticed in summer and vaginal prolapse in the autumn season (Table 1).

The majority of the animals (31/44; 70.45%) suffering from uterine prolapse had already been handled by quacks/ para-veterinarians/ field veterinarians before referral

to us. Comparatively fewer of cows (21/42; 50%) with vaginal prolapse were referred. Animals suffering from uterine prolapse were presented after a mean gap of 22.2 hours (range 3 to 96 hour) from the time it was first noticed by the owners.

Uterine prolapse was observed within 6 days following parturition in the majority of the animals (42/44; 95.45%). However, in two cows it appeared on the 14th and 60th day following parturition respectively. In two cows the uterus had prolapsed along with the calf during forced extraction. Contrarily, vaginal prolapses predominantly (34/42; 80.95%) occurred during pregnancy from the 5th month onwards (Table 2). However, in four animals it occurred during the first month and in another four during estrus in the post-parturition period (Table 2). Sixteen animals suffering from vaginal prolapse (16/42; 38.10%) had reportedly suffered from the same condition around a previous parturition. In 18 (18/42; 42.86%) animals with vaginal prolapse, recurrence of the prolapse was noticed on loosening the suture. In these cows the infusion set tubing had to be retained for 2 to 4 months until successful parturition. Immediately after parturition (before reapplication of the knot) in 8 out of these 18 cows vaginal (6) or uterine (2) prolapse recurred again. Among the cows with uterine prolapse, 15 (15/44; 34.09%) had also suffered from vaginal prolapse during a preceding pregnancy. Uterine prolapse was simultaneously accompanied by other diseases in 12 (27.27%) cows. They included milk fever (2), retained fetal membranes (4) and dystocia (6).

Table 1. Prevalence of genital prolapse in crossbred cattle

Parameters		Uterine prolapse (n = 44)	Vaginal prolapse (n = 42)	Total genital prolapse (n = 86)
Breed (Crossbred)	Jersey	40 (90.91%)	40 (95.23%)	80 (93.02%)
	Holstein Frisian	4 (09.09%)	2 (04.77%)	6 (6.98%)
Parity	Heifers	0	4 (9.52%)	4 (4.65%)
	1 st	8 (18.18%)	8 (19.05%)	16 (18.60%)
	2 nd	14 (31.82%)	10 (23.81%)	24 (27.91%)
	3 rd	6 (13.64%)	8 (19.05%)	14 (16.28%)
	4 th	8 (18.18%)	6 (14.29%)	14 (16.28%)
	5 th	4 (9.09%)	4 (9.52%)	8 (9.30%)
	6 th	4 (9.09%)	2 (4.76%)	6 (6.98%)
Season	Spring	8 (18.18%)	10 (23.81%)	18 (20.93%)
	Summer	16 (36.36%)	8 (19.05%)	24 (27.91%)
	Autumn	12 (27.27%)	16 (38.10%)	28 (32.56%)
	Winter	8 (18.18%)	8 (19.05%)	16 (18.60%)

Hyperemia, laceration and tearing of the vulva were observed in 28 (28/86; 32.56%) animals suffering from genital prolapse. There were more of these (20/42) in cows with vaginal prolapse than those with uterine prolapse (8/44).

Four (9.09%) cows suffering from uterine prolapse died within 24 hours following treatment and 8 (8/44; 18.18%) more developed metritis subsequently. However, in animals with vaginal prolapse complications were not noticed.

The cows showing vaginal prolapse were distributed on the basis of increasing severity into grade 1 (22), 2 (6) and 3 (14) (Table 2). Exogenous progesterone therapy, along with hind quarter elevation cured 45.45% (10/22) of animals with grade 1 vaginal prolapse. All the remaining cases (12/22) in this group progressed to grade 2. Thus, a modified Böhner's suture was applied in a total of 76 (uterine prolapse: 44, grade 2 vaginal prolapse: 18 and grade 3 vaginal prolapse: 14) cows.

Table 2. Occurrence of vaginal prolapse at different stages of reproduction in crossbred cows

Stages of occurrence	Number of animals (%)			Total number of animals (%)
	Grade 1	Grade 2	Grade 3	
3 rd month of pregnancy	2 (4.76%)	0	0	2 (4.76%)
4 th month of pregnancy	2 (4.76%)	0	0	2 (4.76%)
5 th month of pregnancy	2 (4.76%)	2 (4.76%)	2 (4.76%)	6 (14.28%)
6 th month of pregnancy	2 (4.76%)	0	0	2 (4.76%)
7 th month of pregnancy	2 (4.76%)	1 (2.38%)	4 (9.52%)	7 (16.77%)
8 th month of pregnancy	4 (9.52%)	0	6(14.28%)	10 (23.81%)
9 th month of pregnancy	2 (4.76%)	1 (2.38%)	2 (4.76%)	5 (11.90%)
Within 10 days following parturition	2 (4.76%)	0	0	2 (4.76%)
11-30 days following parturition	2 (4.76%)	0	0	2 (4.76%)
Estrus (5-6 months following parturition)	2 (4.76%)	2 (4.76%)	0	4 (9.52%)

In the present study, the modified Böhner's suture technique using infusion set tubing as the suture resulted in complete and permanent retention of the prolapsed mass in all the cows. Complications or disfigurement of the vulvar area were not noticed in any of the cows, including those with the suture in place for several months.

Discussion

Vaginal prolapse in cows is often a chronic, recurrent, hereditary pre-partum disease, whilst uterine prolapse is nonhereditary and mostly associated with hypocalcaemia or

forceful fetal extraction (ANONYMOUS, 2006). Uterine prolapse is a very painful and serious condition due to which most of the animals cannot remain standing for long. Animals suffering from uterine prolapse either remain in sternal or in lateral recumbency (RICHARDSON et al., 1981). Vaginal prolapse is comparatively less serious and therefore such animals usually remained standing or were easily persuaded to stand.

The higher prevalence of genital prolapse in crossbred Jersey cows noticed in this study might be due to the larger population of this breed in the local area. The high prevalence of genital prolapse during the 2nd parity noticed in the present study is contrary to an earlier finding, where more cases were noticed at the time of the 1st calving and again after attaining 7 years of age (WOODWARD and QUESENBERRY, 1956). In our study, only a small number of animals suffered from genital prolapse beyond the 5th parity. Animals are generally culled in this locality beyond the 5th parity. None of the pregnant heifers suffered from uterine prolapse, in contrast to vaginal prolapse. An earlier study also indicated that in dairy breeds multigravida are more often affected than heifers (NOAKES et al., 2001a). Uterine prolapse, according to one report, is more common in younger (2 to 4 year) animals (RICHARDSON et al., 1981). In a study involving beef cattle, uterine and vaginal prolapse among primiparous dams accounted for 40.3 and 82.8% respectively (PATTERSON et al., 1981).

A high prevalence of uterine prolapse in summer (June to August) and that of vaginal prolapse in autumn (September to November) was noticed in our study. In Kashmir (temperate climate) most of the cows show estrus during late spring or summer. Consequently the proportion of pregnant cows during autumn and parturition in the following spring or summer is higher than other seasons. In buffaloes, the highest incidence of vaginal prolapse has been recorded in May, while postpartum uterine prolapse showed the highest incidence in July to September (AHMED et al., 2005).

In this study, in 54.55% (12/22) cows grade 1 vaginal prolapse turned to grade 2. According to an earlier study pertaining to embryo flush cows, grade 1 vaginal prolapse is likely to progress to grade 2, without temporary retaining sutures or a permanent fixation technique (WOLFE and CARSON, 1999). However, in our study no temporary suture was applied initially to any of the cows with grade 1 vaginal prolapse. Ten of these animals (10/22; 45.45%) were successfully treated with exogenous progesterone therapy along with hind quarter elevation. In sheep, exogenous progesterone therapy has been found effective in controlling cervicovaginal prolapse (BHATTACHARYYA et al., 2006). Exogenous progesterone administration may neutralize the excess estrogen produced by the placenta. Therefore, this treatment may be tried under field conditions as a preliminary modality before application of temporary retaining sutures. However, progesterone is not recommended during late gestation, as it may delay parturition (ROBERTS, 2004).

Vaginal prolapse was mostly observed during pregnancy, particularly beyond the 5th month of gestation. This finding is in accordance with an earlier report where the

maximum number of such cases were noticed in the last 2 months of gestation (NOAKES et al., 2001b). In that report it was also inferred that advancing pregnancy tends to accentuate the condition. In this study, 16 cows had previously suffered from vaginal prolapse. Due to the hereditary nature of ante partum vaginal prolapse, MIESNER and ANDERSON (2008) advised culling such cows after weaning the current offspring. In contrast to vaginal prolapse, uterine prolapse occurred most frequently a few hours following parturition. This finding is in accordance with several earlier reports (MANFIELD, 2006; MIESNER and ANDERSON, 2008).

Six of 18 animals showing vaginal prolapse during mid to advanced pregnancy, had recurrence of the disease following parturition. According to NOAKES et al. (2001b) post-parturient prolapse of the vagina in cattle is associated with persistent irritation and straining caused by vaginal trauma and infection (usually by *Fusobacterium necrophorum*).

In our study uterine prolapse in two cows had resulted from forced extraction of the fetus. Forced extraction of the calf and dystocia have been incriminated as causes of uterine prolapse in dairy (HOPPER, 2007; NOAKES et al., 2001a) and beef (RICHARDSON et al., 1981) cattle. In beef cattle 39% vaginal and 45% uterine prolapse cases have been associated with dystocia (PATTERSON et al., 1981).

Our results indicate that 27% (12/44) of the cows with uterine prolapse also suffered from milk fever, dystocia or retained fetal membrane. Association of these diseases with uterine prolapse has also been reported earlier (GUSTAFSSON et al., 2004). MURPHY and DOBSON, (2002) opined that hypocalcaemia and dystocia cause myometrial fatigue, that may predispose cows to uterine prolapse. Retained fetal membrane may initiate eversion of the gravid horn, followed by complete uterine prolapse (MIESNER and ANDERSON, 2008).

A caudal epidural block using lignocaine hydrochloride (2%) was effective in controlling straining and provided satisfactory regional analgesia. Low doses of xylazine can be added to prolong the duration of analgesia (NOAKES et al., 2001b). It also provides sedation for easy restraint of the animal (IVANY and MUIR, 2004). However, xylazine is contraindicated in pregnant animals, as it may induce abortion (FAZILI and BHATTACHARYYA, 2008). In order to prolong the effect of analgesia, use of either lignocaine hydrochloride with adrenaline or bupivacaine for achieving caudal block is comparatively safer. To prevent tenesmus for several days to a week or more, induction of artificial pneumoperitoneum has been reported (NOAKES et al., 2001b).

Most of the cows with prolapsed uterus were recumbent at the time of examination. Replacement of prolapsed genitalia places considerable stress on both the dam and the attending veterinarian, due to severe straining. In delayed cases, replacement was more difficult due to the swelling and hardening of the prolapsed mass. Although topical application of osmotic agents, such as sugar or salt, may reduce or prevent edema by

squeezing fluids out of the uterus (WHITE, 2007; MIESNER and ANDERSON, 2008), these agents may also amplify endometrial trauma (MIESNER and ANDERSON, 2008). Manual massaging during repositioning of the mass after application of an ointment or a lubricant is an effective alternative technique (YOUNQUIST, 1997). In the present study, the rear portion of the cows was elevated by placing a soft mattress or other locally available cheap materials, such as straw-filled gunny bags; this resulted in minimum physical effort during replacement. Some workers used a fore end loading tractor to raise the rear end of the cow to a height of about one meter (WHITE, 2007). However, PARKER (1986) regarded lifting to such a height to be a welfare unfriendly practice. Most of the cows stood up immediately after the procedure was completed. Sometimes the urethra is positioned along the prolapsed mass at an acute angle that prevents normal urination. In these cases lifting of the uterus results in straightening the urethra enough to allow urination, improving cow comfort and reducing subsequent straining (MIESNER and ANDERSON, 2008).

In the present study, the modified Bühner's technique, using infusion set tubing as suture material, was found to be very satisfactory in preventing recurrence of the prolapse and therefore is recommended as an alternative technique, particularly in developing countries where farmers cannot afford repeated costly treatment of their livestock. The advantages of this modified technique over the standard Bühner's technique include: i) sufficient space (between the suture knot and the ventral vulvar commissure) for urination without difficulty, ii) no need to create and suture the incisions above and below the vulva, iii) the suture can be loosened and reapplied by the owner himself, as and when required, or at the time of calving, iv) quick application with no additional man power and instruments requirement, and v) it does not lead to anatomical disfigurement or physiological defects in the vulvar area.

The infusion set tubing used in this study was found to be better than many other suture materials (viz. Vetafil, Umbilical tape, Finlayson thread, nylon) used routinely (ROBERTS, 1998; NOAKES et al., 2001a; WHITE, 2007) in Bühner's technique. This tubing possesses many of the desirable qualities of an ideal suture material. They include satisfactory tensile and functional strength, non-capillarity, non-reactivity, good tolerance by tissues, flexibility and elasticity, ease of handling, better knot holding power, low cost, easy availability in sterilized form, uniform thickness, smooth surface and non-braided form. Its non-absorbable nature and wide diameter are highly desirable features for continued retention of the prolapse without tearing the tissues. Additionally, the exposed portion of the suture, including the knot, can be easily and repeatedly washed and disinfected without loss of strength.

Intravenous use of calcium borogluconate at completion of the suture application helps to correct the hypocalcaemia occurring simultaneously in the majority of prolapsed cows (RICHARDSON et al., 1981). Calcium borogluconate therapy is recommended (even

if the animal does not shows clinical signs of hypocalcaemia), along with a course of parental antibiotic (NOAKES et al., 2001a). Postoperative oxytocin treatment in uterine prolapse, although not tried in the animals of this study, is considered helpful in restoring uterine tone and subsequent prevention of recurrence of prolapse (NOAKES et al., 2001a). However, preoperative treatment with oxytocin, although it reduces the size of the prolapsed organ, makes replacement more difficult (ANONYMOUS, 2006; MANFIELD, 2006).

In the present study, the survival rate of the cows given treatment for uterine prolapse was better (90.91%) than in several other studies on dairy (JUBB et al., 1990; MURPHY and DOBSON, 2002) and beef (PATTERSON et al., 1981) cattle. In a retrospective study conducted in the United Kingdom, 80% of the 90 cows with uterine prolapse survived after treatment (MURPHY and DOBSON, 2002). In that study 20% mortality was attributed to shock, blood loss, refractory downer cow syndrome and humane euthanasia. JUBB et al. (1990) recorded 73.5% (50/ 68) survival rate and 84% post prolapse conception rate in dairy cows.

From this study it was concluded that almost half (45.45%) the cows with grade 1 vaginal prolapse could be managed by a combination of exogenous progesterone therapy and hind quarter elevation for 2 weeks. This medicinal protocol may be used as a preliminary strategy for managing such cases under field conditions. Cows suffering from Grade 2 and 3 vaginal and also those with uterine prolapse can be effectively managed by modified Bühner's suture technique. Infusion set tubing is superior to many other routinely used suture materials used for Bühner's technique in cattle.

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H. K. Bhattacharyya et al.: Prevalence, clinical changes and management of genital prolapse in cows

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BHATTACHARYYA, H. K., M. R. FAZILI, B. A. BUCHOO, A. H. AKAND:
Izvala maternice i rodnice u križanih krava: prevalencija, klinička slika i liječenje
preinačenim Bühnerovim postupkom upotrebom infuzijske cjevčice kao šivaćeg
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SAŽETAK

U istraživanje je bilo uključeno 86 krava: 44 s izvalom maternice, a 42 s izvalom rodnice. Izvala rodnice pretežno se javljala u visokom stupnju bredosti, a maternice nakon telenja. Za vrijeme pretrage većina krava s izvalom maternice je ležala, dok su one s izvalom rodnice stajale. Izvala spolnih organa najčešće je ustanovljena u križanih Jersey krava prilikom drugoga telenja i to u jesen. Broj slučajeva prvog stupnja izvale rodnice bio je najveći (52,38%). Slijedi broj izvala trećeg stupnja (33,33%) te drugog stupnja (14,29%). Prvi stupanj izvale rodnice bio je uspješno izliječen u 45,45% slučajeva (10/22) davanjem 500 mg hidrokspirogesterona intramuskularno dvaput tjedno uz podizanje stražnjeg dijela tijela. U ostalih 54,55% slučajeva izvala je prešla u drugi stupanj. U manjeg broja (27%) životinja s izvalom maternice bila je ustanovljena mliječna vrućica, težak porođaj i zaostajanje posteljice. U svih krava s drugim i trećim stupnjem izvale rodnice i onih s izvalom maternice, organi su bili vraćeni u normalan položaj standardnim postupkom uz kaudalnu epiduralnu anesteziju. Preinačen Bühnerov postupak upotrebom sterilne infuzijske cjevčice kao šivaćeg materijala pokazao se učinkovitim u liječenju svih krava. Komplikacije i promjene oblika stidnice nisu primijećene čak ni u slučajevima kad je šav duže vrijeme ostao in situ.

Ključne riječi: izvala, maternica, rodnica, preinačen Bühnerov šav, infuzijska cjevčica, križane krave
