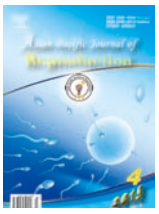
Asian Pacific Journal of Reproduction

Journal homepage: www.apjr.net



Document heading doi: 10.1016/j.apjr.2015.07.009

Incidence of uterine torsion during veterinary-assisted dystocia and singleton live births after vaginal delivery in Holstein-Friesian cows at pasture

Faria N[1], Simões J[2*]

[1] *Agricultural Association of San Miguel. Campo de Santana. 9600-096 Rabo de Peixe (Ribeira Grande), Azores, Portugal*

[2] *Department of Veterinary Science. University of Trás-os-Montes e Alto Douro. 5000-811Vila Real, Portugal*

ARTICLE INFO

Article history:
Received 24 January 2015
Received in revised form 25 March 2015
Accepted 20 April 2015
Available online 20 December 2015

Keywords:
Cows
Dystocia
Live births
Obstetrics
Uterine torsion
Singletons

ABSTRACT

Objective: To determine the incidence of uterine torsion and their association with live births after vaginal delivery at pasture. **Methods:** A total of 119 veterinary-assisted dystocia, occurred in Holstein-Friesian cows, were accessed between September 2012 and February 2013 from Azores islands (Portugal). The general health status of dam, cause of dystocia, obstetric treatment choice, number and viability of fetus were evaluated. **Results:** The uterine torsion represented 24.4% (29/119) of total assisted dystocia. The general health status was normal or slowly affected, at delivery time, for 96.6% (28/29) of the cows with uterine torsion. Vaginal delivery after rolling cows, cesarean section or euthanasia were performed in 72.4% (21/29), 24.1% (7/29) and 3.5% (1/29) of dams with uterine torsion, respectively. Singletons were observed in 96.6% (28/29) and 86.7% (78/90) of cows with uterine torsion and remaining dystocia, respectively. After vaginal delivery, the occurrence of singleton live births was more probable to occur in cows with uterine torsion (17/21) than the remaining cows (37/70) of control group (odds ratio=3.79; 95% interval of confidence from 1.16 to 12.41; $P<0.05$). **Conclusions:** A high frequency of uterine torsion was observed in Holstein-Friesian cows with normal or slowly affected general health status at delivery time at pasture. The singleton live births prevailed and, in general, their occurrence by vaginal delivery after uterus reposition was most likely to occur in cows with uterine torsion than dams presenting other dystocia.

1. Introduction

Dystocia in cows, with special emphasis for Holstein-Friesian genotype, is an important adverse condition that can reach 10% of total calvings in herds and have significant economic impact in dairy industry[1]. Although genetic traits can influence the incidence of dystocia[2], a decrease of their incidence appears to occur in free management systems, such as pasture[3]. However, the incidence variation of dystocia observed between housing and pasture systems can be the reflex of several factors related with cows (genotype, nutrition, body condition score and exercise) and factors related with the herd size and the calving management[1].

Feto-pelvic disproportion, fetal oversize or malposition, and maternal conditions related with incomplete cervical (and vulvar) dilatation and uterine inertia are considered the most significant direct cause of dystocia[4]. Although low relative proportions (3%-10%) of uterine torsions were related in the past[5,6], recent studies suggest an improvement of uterine torsion incidence, more than 20%, regarding the dystocia assistance by field veterinarians[7,8], independently of the management systems and particularly in summer season[9]. However, more determinations of uterine torsion incidence, regarding the different seasons and herd management systems are necessary from different worldwide regions.

Other than risk factors, the clinical management of uterine torsion also have a significant impact in animal health and economics losses or expanses for farmers. Frazer *et al* [5] reported that the cesarean section was performed in 62% (n=95) of cows with uterine torsion

*Corresponding author: João Simões, Department of veterinary Science. University of Trás-os-Montes e Alto Douro. 5000-811Vila Real, Portugal.
Tel.: +351259350666
Fax: +351259350480
E-mail address: jsimoes@utad.pt

and a vaginal delivery, after uterus relocation, was made only in 38% of the dams. The incomplete cervical dilatation after successful uterine torsion correction was an important constraint observed in their study. However, in the study performed by Aubry *et al* [7], only 11% (*n*=6) of the cows with uterine torsion was subjected to cesarean section and the incidence of birth canal lacerations following vaginal delivery was similar to cows presenting other dystocia. In fact, at our knowledge and experience, the vaginal delivery until 3 hours after rolling the cow[9] seems to be the greater choice in the majority of the uterine torsion cases without apparent adverse effects for the dam and calf. Consequently, both animal welfare and herd economics expanses can be minimized by the decreasing of caesarian section number.

The main aims of the present study were (1) to determine the incidence of uterine torsion of Holstein-Friesian cows exclusively at pasture, regarding veterinary-assisted dystocia, and (2) to evaluate singleton live births occurrence after vaginal delivery.

2. Materials and methods

2.1. Animals and dystocia classification

The present study was conducted at Agricultural Association of San Miguel (http://www.aasm-cua.com.pt/) from pastures of S. Miguel Island –Azores between September 15 2012 and February 15 2013. A total of 119 Holstein-Friesian cows at pregnancy term ($\geqslant$260 days) and presenting dystocia were evaluated. All heifers had older than 24 months at calving time. The study was prospective and all dystocia assisted by experimented veterinarians working in the agricultural association.

The definitive diagnosis was performed by veterinarian and maternal or fetal dystocia classified according the described by Noakes *et al* [10] as uterine inertia (primary or secondary), failure of abdominal expulsive forces, incomplete cervical dilatation, uterine torsion, feto-pelvic disproportion and/or fetal oversize, fetal maldisposition (posterior presentation, lateral or transversal position and malposture), fetal death, developmental defect or other presumed minor prevalent causes. In each clinical case, the more significant cause of dystocia was considered the primary dystocia.

In cows presenting uterine torsion, the presence of feto-pelvic disproportion and/or fetal oversize and incomplete cervical dilatation, if existing, were also registered.

All cows with uterine torsion were subjected to uterus correction by rolling method without or with a plank ('Schäfers' method), as well described by Lions *et al.* [9], before fetal extraction. The remaining cows, presenting dystocia (other than uterine torsion), were considered as the control group.

For all dystocia, the fetal extraction was performed and classified as (1) vaginal delivery (without fetotomy), (2) caesarian section of the entire calf or (3) fetotomy followed by vaginal removal of the body parts. Euthanized dams were also registered and considered as case resolution.

2.2. Data from clinical records

After dystocia diagnosis and/or treatment of the parturient, each veterinarian also registered and classified several variables, such as parity (1st, 2nd, 3rd or $\geqslant$ 4th), general health status, pregnancy type (single *vs.* twin) and viability of each fetus (stillbirth *vs.* live birth until veterinarian departure).

The general health status was categorized in three classes, as normal, slowly affected or severely affected parturient, according the clinical global evaluation and using progressive degrees of depression, weakness, respiratory and heart or pulse rates, rectal temperature and standing *vs*. recumbent position indicators of the parturient during the obstetric examination.

2.3. Statistical analysis

Descriptive statistical analysis was used in order to determine uterine torsion incidence and several proportions of studied traits according cows with uterine torsion or dystocia causes of the control group. Univariate logistic regression models were tested in order to determine the effect of the two groups (independent variable) on the several parameters (dependent variables). Odds ratios and their 95% confidence were also calculated. Differences between groups were significant level for Likelihood ratio tests at a *P*-value 0.05 level. The JMP® 7[11] software statistical package was used.

3. Results

Regarding all dystocia, the incidence of uterine torsion was 24.4% (29/119). The incidence of each primary dystocia included in the control group was reported in Table 1.

Table 1

Causes of dystocia in the control group (*n*=90) and their incidence according the 119 veterinary-assisted cows (*n*, %).

Cause of dystocia	Incidence
Fetal malposture	23(19.3)
Fetal posterior presentation	16 (13.4)
Incomplete cervical dilatation (ICD)	14(11.8)
Feto-pelvic disproportion	12(10.1)
Fetal death	6(5.0)
Secondary uterine inertia	5(4.2)
Failure of abdominal expulsive forces	4(3.4)
Primary uterine inertia	4(3.4)
Fetal monsters	3(2.5)
Fetal lateral position	2(1.7)
Fetal transversal presentation	1(0.8)

The uterine torsion was corrected after rolling cow in 92.9% (26/28) of the treated cases. In this group, vaginal delivery, cesarean section or euthanasia was performed in 72.4% (21/29), 24.1% (7/29) and 3.5% (1/29) of the cows, respectively. No fetotomy was performed in cows with uterine torsion, contrarily to the control group (five fetotomies).

Several studied parameters according the percentages observed in each group were reported in Table 2.

Feto-pelvic disproportion was lesser probable to occur in cows with uterine torsion than in dams of control group (odds ratio=0.12; 95% confidence interval from 0.02 to 0.92; $P<0.05$).

The incidence of singleton live births after vaginal delivery was 81.0% (17/21) in cows with uterine torsion and 52.9% (37/70) in remaining dams (control group) and were significantly affected ($P<0.05$) by group variable (odds ratio=3.79; 95% *IC* from 1.16 to 12.41).

Table 2

Proportion of several studied parameters on cows with uterine torsion (n=29) and dams of control group (n=90).

Parameter		Uterine torsion (n, %)	Control group (n, %)	P value*
Parity	Heifers	6(20.7)	29(32.2)	> 0.05
	Cows at 2nd calving	9(31.0)	17(18.9)	
	cows at 3rd calving	8(27.6)	14(15.6)	
	cows ⩾ 4th calving	6(20.7)	30(33.3)	
General health status	Normal	23(79.3)	55(61.1)	> 0.05
	Slowly affected	5(17.2)	21(23.3)	
	Severely affected	1(3.5)	14(15.6)	
Dystocia	Incomplete cervical dilatation	6(20.7)	16(17.8)	> 0.05
	Feto-pelvic disproportion	1(3.5)	21(23.3)	< 0.05
Calving	Single	28(96.6)	78(86.7)	> 0.05
	Twinning	1(3.5)	12(13.3)	
Entire fetus extraction	Vaginal delivery	21(72.4)	70(77.8)	> 0.05
	Cesarean section	7(24.1)	12(13.3)	
	Euthanasia	1(3.5)	3(3.3)	

* According Likelihood ratio tests.

4. Discussion

4.1. Uterine torsion incidence

A high incidence of uterine torsion, approximately 25% of total veterinary-assisted dystocia, was observed in the present study and was one of the more frequent four causes. This uterine torsion incidence is in agreement with the 20% (n=55) and 23% (n=73) observed by Aubry *et al* [7] and Lyons *et al* [8], respectively, during ambulatory clinics and primarily in Holstein-Friesian cows. All three studies evidenced an improvement of uterine torsion incidence when compared with the low relative proportions reported in the previous decades[5,6,9].

During last decades, several general and specific risk factors, such as season, management systems and their different variations, debility and insufficient exercise of dams prior to calving, excessive fetal movements at 1st calving stage, increased uterine instability at pregnancy term, deeper abdomen of cows, or fetal size and gender were reported to justify the uterine torsion occurrence[4,5,7,12–15].

In our study, the incidence of feto-pelvic disproportion was only 3.5% in cows with uterine torsion and less probable to occurs (odds ratio=0.12; $P<0.05$) than in remaining cows. A lower risk factor (odds ratio = 0.04) was also observed in cows with uterine torsion by of Aubry *et al* [7]. These researchers suggested that the feto-pelvic disproportion as a protective factor of uterine torsion occurrence, even if oversize could be a risk factor of uterine torsion, as reported by Fraser *et al* [5].

Although some of these risk factors need further studies in order to determine their real impact on uterine torsion incidence, most of them are probably related with farms management and genetic change expression (deep abdomen) in actual Holstein-Friesian cattle industry[9,15]. Aubry *et al* [7] also suggested the potential influence of higher veterinary dystocia assistance than past in the increment of uterine torsion diagnosis. In fact, veterinary education of farmers can contribute to a better calving assistance of cows by them. However, in our study all producers had an annual membership fees without a direct cost of veterinary consultations. This economic aspect may have influenced positively a quickly veterinary-dystocia assistance.

All cows of the present study were free-stall and had free access to pasture during the autumn-winter season, suggesting that the confinement and season were not relevant risk factors for uterine torsion. In United Kingdom, Lawrence *et al*[9] observed a moderate effect of season on uterine torsion with 4% increase in cases through the summer, and an improvement of uterine torsion incidence from 1997 to 2007. Due to a more animal housing after the outbreak of foot and-mouth disease in 2001, these researchers suggested the inexistence of a "housing" factor for uterine torsion. Desliens [12] had already observed a more commonly occurrence of uterine torsion during the summer season and referred the increased animal mobility and a primarily pasture-based diet (reduced rumen volume) as significant risk factors of this dystocia. However, a lower risk (odds ratio=0.2; $P<0.05$) was observed by Aubry *et al* [7] in heifers housed in a free-stall barn than in a tie-stall barn, suggesting that the lack of (moderate?) exercise was negative factor. More studies are necessary to determine the extension of exercise and movements (dam and fetus) contribution for uterine torsion occurrence, in different management systems, during at least the last month before calving and at 1st calving stage.

4.2. Singleton live births

In our study, 81% of singleton live births at vaginal delivery was observed in cows with uterine torsion and was 3.79 more times likely

to occurs than in control group (P<0.05). This live births incidence is in agreement to the observed in cows with uterine torsion (71% of alive calves) by Aubry *et al* [7]. The global perinatal mortality in calf observed by Mee *et al* [16] after normal and abnormal calvings in Irish herds was 4.29% with higher prevalence in heifers with dystocia. Although, in the present study no data was available until 48h after the calf birth in order to strictly define the concept of perinatal mortality[4], the high singleton viability observed in cows with uterine torsion was consistent with the > 95% of alive calves reported by Mee *et al* [16].

According Noakes *et al* [10], the fetal death occur essentially by loss of fetal fluids or separation of the placenta and is not directly dependent of de severity of the uterine rotation. At our experience, the fetal involucres (at least the amnion) are not normally disrupted, presumably due to the obstruction of soft birth canal, maintaining fetal fluids. This aspect can preserve the fetus viability at veterinary intervention time. In several other dystocia, both fetal involucres (amnion and allantoides) are most frequently ruptured at this intervention time. However, other researchers[9] suggest that the prolonged situation of uterine torsion can induce fetal hypoxia and improve calf mortality. Systematic observational studies are necessary to confirm these conditions regarding the degree of uterine torsion and they effect in blood uterine vessel performance and the fetus viability.

In our study, the incomplete cervical dilatation was the quasi totality (6/7) of concomitant cause of (potential) dystocia in cows with uterine torsion, and was probably due to the physical obstruction provoked by the torsion (as consequence of uterine torsion). This dystocia complication is the most common reason for additional veterinary assistance after rolling the cow[5,9]. Aubry *et al* [7] also observed the non-dilatation of the cervix after successful detorsion of the uterus in 1/3 of the cases. A cesarean section after successful detorsion in 35% (31/89) of the cases due to the incomplete cervical dilatation was also reported by Fraser *et al* [5]. However, in our study, the presence of incomplete cervical dilatation was not influenced by groups, suggesting that this condition also is a major primary cause of dystocia in cows.

In conclusion, a high incidence of uterine torsion was observed in Holstein- Friesian cows at pasture. Although approximately 20% of cows with uterine torsion also had incomplete cervical dilatation, provoking birth canal constriction, the vaginal delivery prevailed. Singleton live births were more common in females with uterine torsion after vaginal extraction of fetus than in the other cows, confirming this treatment option. Further studies are necessary in order to determine the extension of risk factors of calf perinatal mortality for uterine torsion and other cause of dystocia, and them importance for the contemporaneous dairy cattle industry and animal wellfare.

Conflict of interest statement

Both authors declare that they have no conflict of interest.

Acknowledgements

The authors thank to Dr. João Vidal and all other veterinarians of the Agricultural Association of San Miguel (Azores), whose contribution was essential to obtain the data of the present study.

References

[1] Mee JF, Berry DP, Cromie AR. Risk factors for calving assistance and dystocia in pasture-based Holstein-Friesian heifers and cows in Ireland. *Vet J* 2011; **187:** 189-194.

[2] Gevrekci Y, Akbas Y, Kizilkaya K. Comparison of different models in genetic analysis of dystocia. *Kafkas Univ Vet Fak Derg* 2011; **17:** 387-392.

[3] Olmos G, Mee JF, Hanlon A, Patton J, Murphy J, Boyle L. Peripartum health and welfare of Holstein-Friesian cows in a confinement-TMR system compared to a pasture-based system. *Anim Welf* 2009; **18:** 467-476.

[4] Mee JF. Prevalence and risk factors for dystocia in dairy cattle: a review. *Vet J* 2008; **176:** 93-101.

[5] Frazer GS, Perkins NR, Constable PD. Bovine uterine torsion - 164 hospital referral cases. *Theriogenology* 1996; **46:** 739-758.

[6] Laven R, Howe M. Uterine torsion in cattle in the UK. *Vet Rec* 2005; **157:** 96.

[7] Aubry P, Warnick LD, Descoteaux L, Bouchard E. A study of 55 field cases of uterine torsion in dairy cattle. *Can Vet J* 2008; **49:** 366-372.

[8] Lyons NA, Knight-Jones TJD, Aldridge BM, Gordon PJ. Incidence, management and outcomes of uterine torsion in UK dairy cows. *Cattle Pract* 2013a; **21:** 1-6.

[9] Lawrence K, Tulley W, Laven R. Observations on the incidence and seasonality of uterine torsion and left displaced abomasum following the 2001 outbreak of foot-and-mouth disease in the UK. *Vet J* 2013; **196:** 332-338.

[10] Lyons N, Gordon P, Borsberry S, Macfarlane J, Lindsay C, Mouncey J. Clinical Forum: Bovine uterine torsion: a review. *Livestock* 2013b; **18:** 18-24.

[11] Noakes DE, Parkinson TJ, England GCW. Arthur's *veterinary Reproduction and Obstetrics*. Eighth Edition. London: WB Saunders; 2001, pp. 203-218.

[12] SAS Institute Inc. *JMP user's guide*. Version 7.0. Cary, NC, USA: SAS Institute Inc.; 2007.

[13] Desliens L. De la torsion de l'utérus chez la vache. Étiologie et considérations pratiques [Uterine torsion in the cow. Etiology and practical considerations]. *Bull Acad Vet Fr* 1967; **120:** 147-156.

[14] Drost M. Complications during gestation in the cow. *Theriogenology* 2007; **68:** 487-491.

[15] Mee JF. Prevalence and risk factors for dystocia in dairy cattle - with emphasis on confinement systems. *WCDS Advances in Dairy Technology* 2012; **24:** 113-125.

[16] Mee JF, Berry DP, Cromie AR. Prevalence of, and risk factors associated with, perinatal calf mortality in pasture-based Holstein–Friesian cows. *Animal* 2008; **2:** 613-620.