Article

A study of 55 field cases of uterine torsion in dairy cattle

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Abstract — Two-hundred and seventy-three animals were enrolled in a case-case comparison of uterine torsions and other dystocias. The purpose of the study was to describe field cases of uterine torsion and their clinical management, compare them with other types of dystocia attended by field veterinarians, and evaluate the effect of season and housing on the incidence of torsions. Fifty-five cases of uterine torsions representing 20% of the dystocias were diagnosed. Most cases of uterine torsion were successfully corrected and followed by the vaginal delivery of a live calf. When compared with other types of dystocia, cows were at greater risk for uterine torsion than were heifers (OR = 5.2; $P < 0.0001$), while animals suffering from fetopelvic disproportion or carrying twins were at a lesser risk (OR = 0.05; $P < 0.0001$ and OR = 0.09; $P = 0.007$, respectively). Heifers had a lower risk when calving alone in a pen versus a tie-stall (OR = 0.2, $P = 0.04$). There was no significant effect of season on the risk of uterine torsion.

Résumé — **Étude sur le terrain de cinquante-cinq cas de torsion utérine chez des vaches laitières.** Deux cent soixante-treize animaux ont été enrôlés dans cette étude cas-cas comparant les torsions utérines à d'autres types de dystocies. Le but de l'étude était de décrire les torsions utérines et leur résolution et de les comparer avec d'autres types de dystocies rencontrées sur le terrain, et d'évaluer l'effet des saisons et du logement sur la fréquence des torsions. Cinquante-cinq cas de torsions utérines ont été rencontrés, représentant 20 % du total des dystocies. La plupart des torsions utérines ont été corrigées et suivies de la naissance d'un veau vivant par voie naturelle. Lorsqu'on les compare à d'autres types de dystocies, les vaches étaient plus à risque que les taures (OR = 5,2; $P < 0{,}0001$), et les animaux souffrant de disproportion foeto-pelvienne ou portant des jumeaux étaient moins à risque (OR = 0,05; $P < 0{,}0001$ et OR = 0,09; $P = 0{,}007$, respectivement). Les primipares étaient moins à risque lorsqu'elles vêlaient seules dans un enclos de vêlage plutôt qu'attachées dans une logette (OR = 0,2; $P = 0{,}04$). Aucun effet de la saison sur le risque de torsions utérines n'a pu être démontré.

(Traduit par les auteurs)

Can Vet J 2008;49:366–372

Introduction

Uterine torsion has been reported to occur in most domesticated species. The condition was first described in 1766 by Boutrolle (1). It is occasionally observed as a cause for dystocia in beef cows, bitches, queens, ewes, does, and mares, but rarely in sows (2). In dairy cattle, it is observed more frequently, with reported incidences between 3% and 10.7% of dystocias attended by general practitioners (2–6). An incidence of 19% has also been reported among 918 obstetrical cases referred to a veterinary hospital (7).

The etiology of the condition is not well understood. It generally occurs during late 1st stage or early 2nd-stage labor (8), but there are some reports of prepartum uterine torsions (9). The instability of the gravid uterus is certainly the most important predisposing factor in bovine uterine torsions. Each uterine horn is supported in a dorsolateral direction by the broad ligaments, which are attached to the ventral surface of the uterus. The greater curvature of the uterus is dorsal and, in advanced pregnancy, the uterus is positioned beyond the relatively stable area of attachment, resting on the abdominal floor and being supported by the rumen, viscera, and abdominal wall (10). In addition, the manner in which the cow lies down, with the forequarters going down first, and rises, by elevating the hindquarters first, implies that each time the cow lies down or rises, the gravid uterus is suspended in the abdominal cavity. Therefore, a sudden slip or fall could cause torsion of the unstable gravid uterus. However, there must be some contributory factors in addition to instability that occur during 1st-stage labor, otherwise uterine torsion would also be seen frequently in late gestation, which is not the case (8). Many authors suggest that the increased fetal movements that occur during 1st-stage labor in response to the contraction of the myometrium may be the precipitating parturient factor. Other factors that have been mentioned are a sudden push from another cow, decreased

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amounts of uterine fluid, a flaccid uterine wall, a small non-gravid horn, and excessive fetal weight (7,9,11). In the report of 1 study, pastured animals were more at risk (12), but in that of another study, uterine torsions were 3 times more frequent when animals were confined in stables for long periods (13). Twin pregnancy, on the other hand, tends to prevent torsion, because the bicornual nature of most cases of bovine twins stabilizes the gravid uterus (2).

Our clinical impression was that the incidence of uterine torsion in dairy cows and heifers was higher than previously reported, and that uterine torsions were more common in the early summer months. In light of the conflicting reports in the literature, we also wanted to evaluate the effect of cow housing on the incidence of uterine torsions. The purpose of this study was to describe field cases of uterine torsion and their clinical management, and to compare them with other types of dystocia attended by field veterinarians.

Materials and methods

Data collection

A case-case comparison of uterine torsion versus other types of dystocia was used for our study. Cases of dystocia attended by 14 clinicians from 2 university veterinary teaching hospitals' ambulatory services (New York State College of Veterinary Medicine, Cornell University, USA, and the Faculté de médecine vétérinaire de l'Université de Montréal, Québec) between April 25th, 2001, and May 28th, 2002, were recorded. Clinicians enrolled bovine dystocia cases by filling in a questionnaire designed for the study. Information was obtained on the calf (presentation, position, and posture, presence of a twin, gender, approximate weight, and viability) and dam (breed, parity, breeding date). Herd information, such as the number of lactating cows, lactating and dry cow housing, and calving facilities, were noted. For all the calvings, details were recorded on the type of dystocia, presence of laceration(s), and treatment for hypocalcemia (preventive or clinical). The presence and location of laceration(s) was evaluated by visual and vaginal examination following delivery of the calf. For this study, a uterine torsion was defined as a displacement of the uterus along its longitudinal axis as determined by the attending clinician through vaginal palpation, rectal palpation, or both. The method of diagnosis and the degree and direction of the torsion, as well as the method of correction, were recorded. The degree of torsion was estimated by the veterinarian, based on the position of the fetus, the tightness of the spiral folds in the vagina, and the size of the opening between the vagina and the uterus. Uterine torsion dystocias were designated as cases; other types of dystocia were used as a comparison group and designated as control dystocias. In addition, a database of Cornell University's client billing information and a Quebec animal health databank (DS@HR) were used to determine the total number of bovine dystocias and the percentage of those that were diagnosed as uterine torsion from 1992 to 2006.

Statistical analysis

Descriptive statistics were calculated and other statistical analyses were performed by using a statistical software program for personal computers (SAS Version 9.1 for Windows; SAS Institute, Cary, North Carolina, USA). Variables pertaining only to the uterine torsions (location, direction and severity of the torsion, method of diagnosis, and treatment) were tested for equal proportions by using chi-square goodness-of-fit tests. The other independent variables (presentation, position, posture, nondilation of the vagina and cervix, laceration, uterine inertia, calf viability, parity, milk fever, fetopelvic disproportion, twins, housing, and season) were each examined via univariate analysis with a contingency table for an association with the outcome (uterine torsion versus other type of dystocia). All the variables were dichotomous or categorical, and due to the relatively small sample size and to avoid the problem of cells containing no observations, variables with multiple categories were either dichotomized or collapsed into a maximum of 3 or 4 categories. Because of a strong suspicion that parity (primiparous versus multiparous) would be an effect modifier for many other variables, a stratified analysis was performed. Data were compared by use of a chi-square test, or Fisher's exact probability test when an expected cell value was < 5. Odds ratios (OR) and their 95% confidence intervals (95% CI) were generated by using univariate logistic regression for those variables that were significant at a P-value ≤ 0.25. Mantel-Haenszel ORs and their 95% CI were calculated for the dichotomous explanatory variables, after testing for homogeneity of the stratum-specific ORs. A multivariable model was evaluated, but it could not be used because of the lack of data for some combinations of the variables.

Results

Generalities

A total of 273 dystocias were attended by the veterinarians from the 2 veterinary colleges (Université de Montréal, $n = 165$; Cornell, $n = 108$). Twenty percent ($n = 55$) of the dystocias were uterine torsions, and this was similar for both ambulatory clinics. Out of 1478 bovine dystocias recorded in Cornell University's databank from 1997 to 2006, 16.6% were uterine torsions, and there was no change in the percentage of uterine torsions over that time period. In Quebec, the number of dystocias requiring the assistance of a veterinarian, in herds recorded in a provincial databank, decreased gradually between 1992 and 1997, but it has remained fairly constant since.

Ninety-two percent of the animals for which the information was available (132/143) were Holstein cattle, which is a good representation of the clientele from the 2 veterinary clinics. The other breeds represented were Ayrshire, Jersey, and Brown Swiss.

Only a few cows in our study had access to pasture during their lactation. Seventy-six percent (91/120) were housed in a tie-stall barn and 23% (27/120) in a free-stall barn. During their dry period, most of the animals (89%, 108/121) were stabled, with no outdoor access. Sixty-two percent (75/121) were housed in a tie-stall barn, 30% (30/121) in a free-stall barn, and 2% (3/121) on a bedded pack. Ten percent (12/121) were on pasture and 1 cow had access to a small exercise yard. Table 1 illustrates the various types of calving facilities. Because the vast majority of uterine torsions happen during 1st-stage labor (8), we chose to look at the effect of calving location on uterine torsion.

Table 1. Calving facilities

	Uterine torsions		Control dystocias	
Calving location	Number	%	Number	%
Tie-stall	23	41.8	74	34.3
Free-stall	3	5.5	7	3.2
Bedded pack	31	14.4	9	13.4
Calving box	15	27.3	96	44.4
Pasture	5	9.1	7	3.2
Exercise yard	0	0	1	0.5
Total	55	100	216	100

Table 2. Frequency distribution of the degree of torsion in 47 field cases

Degree	Number	%
90	8	17
180	27	57
270	8	17
360	4	9

$P < 0.0001$

The different types of location were grouped as tied (tie-stall), loose individual housing (calving pen), or loose group housing (free-stall, bedded pack, exercise yard or pasture). Primiparous cows were found to be at a lower risk for uterine torsion when they were alone in a calving pen, as compared with a tie-stall (OR = 0.2, P = 0.04). No significant association was found between calving location of cows and uterine torsion, although cows that were housed in a group tended to be more at risk for uterine torsion than were cows that calved in a tie-stall barn (OR = 2.3, P = 0.1).

Diagnostic methods and findings

Two-thirds of the torsions (33/50) were diagnosed by vaginal examination alone, whereas in most of the remaining cases (15/50), both a vaginal and a transrectal examination had to be performed. In 2 cases only, a transrectal examination alone was used to diagnose the torsion.

The presence or absence of vaginal folds (indicative of a torsion extending caudally beyond the cervix) was noted in 49/55 cases. Vaginal involvement (63%, 31/49) was numerically, but not statistically (P = 0.09), more common than no vaginal involvement (37%, 18/49). The direction of the torsion was recorded in 50/55 cases. Counterclockwise torsion (62%, 31/50) was more frequent than clockwise torsion (38%, 19/50), but this difference was not statistically significant (P = 0.12). Table 2 shows the distribution of the severity of torsions to the nearest quadrant.

In uterine torsions, 80% (39/49) of the calves were in anterior presentation and 20% (10/49) were in posterior presentation. For the control dystocias, 70% (128/184) of the calves were in anterior presentation, 30% (55/184) in posterior presentation, and 1 calf was in transverse presentation. More uterine torsion calves were in dorsoileal (17%, 8/47) or dorsopubic position (43%, 20/47) than were the control dystocia calves, where most of the calves (60%, 109/182) were in a normal dorsosacral position. This difference was statistically significant (P = 0.05). Twins were less common among uterine torsion cases than among the control dystocias. There were only 2 sets of twins out of 53 uterine torsions (4%), but 26 sets of twins (14%) among the control dystocias (P = 0.05). Fetopelvic disproportion was present in only 1 case of uterine torsion as compared with 34% (63/186) of the control dystocias.

Table 3. Frequency distribution of the location of laceration following 228 field dystocias

	Uterine torsions		Other dystocias	
Location of laceration	Number	%	Number	%
None	38	79.2	144	80.0
Vulva	1	2.1	6	3.3
Vagina	4	8.3	29	16.1
Cervix	4	8.3	0	0
Uterus	1	2.1	0	0
Multiple	0	0	1	0.6
Total	48	100	180	100

$P = 0.90$

Management of the uterine torsions and outcomes

Four different methods of correction were used by the clinicians in this study. In 22 cases, the attending veterinarian successfully corrected the torsion manually; in 1 of those cases, the manual correction was completed after a failed attempt at rolling the cow. The uterus was successfully repositioned using a detorsion rod in 6/7 cases (4 as a first choice, 3 after failed rolling without a plank). Twenty-one cows were rolled, with (n = 14) or without (n = 7) a plank. Eleven of the 14 cases that were rolled with a plank were successfully corrected, compared with 4/7 cases where rolling without a plank was attempted. This difference was not statistically significant. A cesarean section had to be performed to resolve 11% (n = 6) of the uterine torsions, compared with 6% (11/190) for the control dystocias. This difference was not statistically significant. In 5/6 uterine torsions, surgery was performed after successful detorsion of the uterus, because of incomplete cervical dilation. In 1 case, the cesarean section was performed because of the impossibility to otherwise correct the torsion.

The cervix failed to dilate in a third of the cases (18/53) following the correction of the uterine torsion. Nondilatation of the cervix was significantly ($P < 0.0001$) less likely to happen in the control dystocias, where it affected 11/172 (6%) cows. This higher incidence of nondilatation of the cervix was accompanied by a higher incidence of cervical laceration following vaginal delivery. Four cows suffered a cervical laceration following correction of the torsion, whereas none had it happen in the control dystocia group. However, even if the distribution of the location of the lacerations seems slightly different between the 2 groups (Table 3), the overall incidence of lacerations was the same.

Uterine inertia was significantly more common among cows with control dystocias than with uterine torsion (31% vs 15%, P = 0.03). Two-thirds of the animals (32/47) treated for uterine torsion received calcium. Twelve of them (35%) had clinical signs of hypocalcemia and 20 (59%) were given calcium preventively, because they were considered at risk by the attending clinician (older cow, history of milk fever in a previous lactation). Fewer cows treated for control dystocias received calcium (43%, 73/170). Sixty-two percent of them (45/73) received a

Table 4. Results of the univariate analysis

Variable	Torsion	Control dystocias	OR_c (95% CI)	$OR_{primiparous}$ (95% CI)	$OR_{multiparous}$ (95% CI)	BD *P*-value	OR_{MH} (95% CI)
Parity							
Primiparous[a]	11	98	**5.22**[b]	NA	NA	NA	NA
Multiparous	39	82	(2.38–11.47)	NA	NA		NA
Fetopelvic disproportion							
Yes	1	63	**0.04**	Zero cell	**0.09**	0.39	**0.05**
No[a]	52	123	(0.01–0.28)		(0.01–0.68)		(0.01–0.37)
Twins							
Yes	2	26	**0.25**	Zero cell	**0.10**	0.80	**0.09**
No[a]	51	165	(0.06–1.08)		(0.01–0.80)		(0.01–0.73)
Presentation							
Anterior[a]	39	128	0.60	0.63	0.46	0.75	0.50
Posterior	10	55	(0.28–1.28)	(0.13–3.16)	(0.17–1.26)		(0.21–1.18)
Received calcium							
Yes	34	80	**2.68**	3.12	0.86	0.14	1.17
No[a]	16	101	(1.38–5.20)	(0.69–14.03)	(0.34–2.18)		(0.52–2.62)

Variable	Torsion	Control dystocias	OR_c (95% CI)	$OR_{primiparous}$ (95% CI)	$OR_{multiparous}$ (95% CI)
Season					
Spring[a]	11	63	—	—	—
Summer	20	51	**2.25** (0.99–5.12)	1.19 (0.15–9.19)	**2.42** (0.82–7.19)
Fall	9	55	0.94 (0.36–2.43)	1.210 (0.19–7.81)	0.97 (0.25–3.73)
Winter	15	49	**1.75** (0.74–4.16)	2.38 (0.40–14.32)	**2.06** (0.62–6.87)
Calving facilitites					
Tied[a]	23	74	—	—	—
Loose–individual	15	96	0.50 (0.25–1.03)	**0.18** (0.04–0.94)	0.66 (0.27–1.60)
Loose–group	17	46	1.19 (0.58–2.46)	0.57 (0.11–3.07)	2.33 (0.84–6.47)

[a] Reference category
[b] The odds ratios that are in bold indicate a $P \leq 0.05$
OR — Odds ratio; OR_c — Crude odds ratio; 95% CI — 95% confidence interval of the OR; OR_{MH} — Mantel-Haenszel estimate of the OR; BD *P*-value — *P*-value of Breslow-Day test for homogeneity of the ORs

preventive treatment and 38% (28/73) presented clinical signs of hypocalcemia. Nonetheless, 80% of the cows in each group were standing at the end of the veterinary visit.

Out of the 49 uterine torsions for which the information was available, 36 calves (71%) were alive, including 1 set of twins, and 15 calves were dead (also including 1 set of twins).

Risk factors for uterine torsion

Univariate analysis

The results from the univariate analysis are presented in Table 4, for those variables that had an association with the outcome at $P \leq 0.25$. Multiparous cows were more likely than primiparous cows to present with a uterine torsion, as compared with control dystocias (32% and 10% of all dystocias, respectively, $P < 0.0001$). Fetopelvic disproportion and twin pregnancy were both protective for uterine torsion, and parity had a confounding effect on both variables. The Mantel-Haenszel adjusted OR (OR_{MH}) is therefore a more appropriate estimation of the association between those 2 variables and the outcome. Presentation of the calf did not have a significant effect on the outcome. As for the treatment for milk fever, there was a possible interaction with parity. There was a tendancy for heifers that received calcium to be more at risk for uterine torsion. For cows, there was no association between milk fever and uterine torsion. Because of the small number of uterine torsions in certain months, dystocias were grouped in seasons, and were found to be distributed almost equally throughout the year. There was a tendency for more uterine torsions to occur in the summer and winter, as compared with spring, but the effect of season was not significant. Finally, calving facilities were compared: tied (stanchion in a tie-stall barn), loose alone (calving stall), or loose group (bedded pack, pasture, free-stall barn or exercise yard). Heifers that calved alone in a calving stall seemed to be less likely to present with a uterine torsion, as compared with those calving in a tie-stall. Multiparous cows seemed more likely to suffer from a uterine torsion when they calved in a group area.

Multivariable analysis

The 7 variables chosen for the complete main effects model were parity, twins, fetopelvic disproportion, season, presentation, treatment for milk fever, and type of calving facilities. All the biologically plausible interaction terms were then added to the model. However, the model would not converge when parity was included as an interaction term: 2 of the variables suspected of having an interaction with the variable parity had no observations in the heifer group. A second model was then built that excluded primiparous animals, but the number of observations was then too small to build an adequate model.

Discussion

The overall incidence of uterine torsion was higher than that previously reported for field cases (3–6). Moreover, part of this study was conducted at the Ambulatory Clinic of the New York State College of Veterinary Medicine and there was a report of an incidence of 7.3% uterine torsions of 1555 dystocias treated from 1943 to 1953 in the same clinic (2). There is only 1 report, from the UK, of an apparent increase in the incidence of uterine torsions in cattle, going from 5.5% of dystocias in 1997 to 10.7% in 2004 (3). The authors did not know the cause for this increase, but they speculated that it may have been associated

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with increased cow size or reduced rumen volume before parturition. The average size of cows in the UK may have increased slightly between 1997 and 2004, but it is not obvious why the rumen volume before parturition would be reduced. Referring to the same report, another author suggested that the apparent increase in the prevalence of uterine torsion might be due to farmers calling the veterinarian for assistance with dystocias less often now than 10 y ago but still needing assistance for the correction of uterine torsions. Therefore, uterine torsions would represent a greater proportion of recorded dystocias, without the overall incidence of uterine torsions among all parturitions having necessarily changed (14). In Quebec, the number of dystocias requiring the assistance of a veterinarian has remained fairly constant since 1997 and at Cornell's ambulatory clinic, there was no change in the percentage of uterine torsions between 1997 and 2006. The increase in the proportion of uterine torsions that we and other authors have observed is probably real but also due, in part, to a decrease in the total number of dystocias attended by veterinarians.

Most commonly, the torsion extends caudally beyond the cervix, such that the vaginal wall is involved in the rotation (2,8,10). In our study, vaginal involvement was obvious in most cases, consistent with the fact that two-thirds of the torsions were diagnosed by vaginal examination alone. In all the other cases, a transrectal examination was performed, either as the sole diagnostic method or in addition to a vaginal examination, reinforcing the point made by Frazer et al (9) that the presence of a uterine torsion should not be ruled out unless a transrectal palpation has been performed.

Most authors agree that counterclockwise torsions are more frequent (between 63% and 75% of torsions) than clockwise torsions (4,7,9), in agreement with results of this study. In general, the gravid horn rotates over the nonpregnant horn (10). A counterclockwise torsion would then be found mostly in cases of right horn pregnancy, in line with the reported frequency of 60% to 68% right horn pregnancy in dairy cattle (7,8,15). In his report of 115 torsions, Desliens (12) describes a majority of counterclockwise torsions, but with almost three-quarter of the pregnancies in the left horn. This discrepancy between Desliens's study and those reported by others is difficult to explain.

The degree of torsion varies considerably from 1 study to another, and there is a marked difference between referral and field cases (4,7,9,10). Almost all the referral cases are torsions of at least 180º, with approximately 25% of these being greater than 270°. In our field study, 75% of the torsions were 180° or less. Torsions of less than 45° probably do not cause dystocia and many dystocias where the fetus is in dorsoileal or dorsopubic position are actually uterine torsions of low magnitude (13).

We found fewer posterior presentations with uterine torsions than with control dystocias, where posterior presentations are over-represented compared with a normal population (10). Compared with the expected proportion of posterior births among all calvings, which is around 5% (7,9), it seems that uterine torsions could be more common with the calf in posterior presentation.

Several methods can be used to correct a uterine torsion and are well described in obstetrics textbooks: manual detorsion or rotation of the fetus and uterus *per vagina,* rolling the cow, use of a detorsion rod, and cesarean section (2,8,10,17). Some authors mention that manual correction of a torsion is impossible when the torsion does not involve the cervix (8,9). In our study, 8 out of 18 torsions that were manually reduced did not present vaginal folds, which could indicate that the torsion did not involve the cervix. However, 6 of those 8 torsions were 180° or less, so vaginal involvement may not have been noted because of the low magnitude of the torsion. All reported attempts at manual detorsion were successful, and followed by vaginal delivery of the calf in our study. Other authors have reported success rates of manual correction varying between 24% and 96%, with the rate being higher when correction *per vagina* is attempted as a 1st choice in field cases (4,7,9,10). Rolling the cow has been reported to be successful in 34% to 100% of cases (10,17,18). Because Schaffer's method for rolling the cow with a plank (8) seemed more successful than without a plank in this and another study (18), it is probably advisable to use a plank, if one is available. Also, some cows need to be rolled more than once before the torsion is corrected and, according to some authors, rolling should be attempted 4 or 5 times before failure is admitted and another technique is tried (2). Looking at the distribution of the methods of correction by clinic (data not shown), it was clear, although not statistically significant, that the method of correction was more the personal preference of the attending clinician, the availability of assistance, and the convenience of location to roll the cow than the severity of the torsion. The only exception was cesarean section, which was never performed as a 1st choice, only after all other attempts at detorsion had failed (n = 1) or because of failure of cervical dilatation after detorsion (n = 5).

According to various authors, the cervix is incompletely dilated following 20% to 52% of successful detorsions (5,7,9); in most of those cases, vaginal delivery is impossible and a cesarean section has to be performed. However, some cases described as incompletely dilated could still have a partial torsion, especially if a transrectal examination was not done after correcting the torsion. In our study, the cervix failed to dilate properly in two-thirds of the uterine torsion cases, but only 5 of those cases required a cesarean section to deliver the calf. Interestingly, none of the 5 uterine torsions had been resolved by manual detorsion prior to the surgery. Likewise, fewer than a quarter of the uterine torsions had an undilated cervix following manual correction of the torsion, compared with half when other correction methods were used. We hypothesize that the manipulations through the cervix to correct the torsion can help to effectively dilate the cervix. Although some authors mention that oxytocin might be used to induce cervical dilation (2,10), no drug has consistently proven efficient in inducing cervical dilatation in cattle. The cervix seldom dilates if the fetus is already dead; even when the fetus is alive, the cervix may fail to dilate following a torsion (9). It would thus be advisable to proceed immediately to a cesarean section when vaginal delivery of a dead fetus is impossible because of an undilated cervix. Otherwise, if the fetus is alive, one may elect to wait a few hours to see if labor will naturally proceed to 2nd stage. However, this occurs in only a minority of cases and delay beyond 3 h is pointless and even dangerous, especially if the fetal membranes have already ruptured (7).

Approximately 30% of uterine torsions happen in heifers and 70% in cows. This is generally thought to be a reflection of the number of animals at risk (2,7,10). However, heifers are more at risk of dystocia than are cows (2,8,10). In our study, 47% of dystocias were seen with heifers, but cows accounted for 78% of the uterine torsions, making them at 5.2 greater odds than heifers of having a uterine torsion. One author who observed uterine torsion more commonly in cows than in heifers suggested that it could be because cows have a larger abdominal cavity than heifers, decreased uterine tone, and a stretched mesometrium (2).

Excessive fetal weight appears to be a predisposing factor for uterine torsion (7,9). Accurate data on calf weight in this study were insufficient to evaluate its role as a risk factor for uterine torsion. However, we determined that uterine torsion was rare when fetopelvic disproportion was present. Forty percent of the heifers had fetopelvic disproportion and none of them had uterine torsion. For multiparous cows, the odds of having a uterine torsion with fetopelvic disproportion were approximately 11 times lower than the odds without fetopelvic disproportion. Excessive fetal weight may be a predisposing factor for uterine torsion, but small size of the dam could be a protective factor.

The odds of a uterine torsion were higher in heifers that had received calcium than in those that had not. However, milk fever is rare in primiparous animals, and only 2 of the 16 heifers that received calcium after a dystocia had clinical signs of milk fever. The other 14 animals probably received calcium because the owner or the veterinarian perceived that the animal was not looking well, and heifers that suffered from a uterine torsion might have been looking worse than heifers with a control dystocia. We were not able to show an association between milk fever and uterine torsion in multiparous cows.

In some textbooks, it is mentionned that uterine torsions are more frequent in cows confined in stables for long periods, and it is hypothesized that insufficient exercise leads to slackness of the abdominal musculature, which may increase the risk of uterine torsion (2,10), in which case, where cows go outside, uterine torsions would be more common at the end of winter, after months of confinement. On the other hand, it is reported in the same textbooks that in most cases, uterine torsion is possibly precipitated by a mechanical factor such as a fall, walking up a steep slope, or being pushed by another cow, all of which are more likely to happen when cows are out on pasture or in a free-stall barn rather than in a tie-stall barn. Our data did not enable us to show a significant effect of season on the incidence of uterine torsion. Few cows in our study had access to pasture, and most cows housed in a tie-stall barn were stabled all year round, so more uterine torsions were not expected at the end of the winter due to slackness in the abdominal muscles. The odds of a uterine torsion were lower in primiparous cows that calved alone in a pen than in a tie-stall. Dairy heifers are often raised in loose housing and then moved to the tie-stall barn just before calving. Some of these animals may have difficulty lying down and rising up in a tie-stall, if they are not accustomed to it, thereby increasing the chance of slipping or falling, and increasing the risk of uterine torsion. Even for animals that were tied before calving, the increased weight of the fetus in late gestation, as well as the increase in udder size in the days before calving, could make it more difficult for them to get up and down in their stall. We did not find any significant association between calving location of cows and uterine torsion, although cows that were housed in a group tended to be more at risk for uterine torsion than were cows that calved in a tie-stall barn. This could reflect the fact that cows in group housing can be bumped on the side by another cow, which is obviously not the case in a tie-stall barn.

There were 3 main limitations to our study. The first 2 are inherent to the study design: uterine torsions were compared with control dystocias instead of normal calvings. This was done for a practical reason: normal calvings are usually not attended by veterinarians. Obtaining detailed information on all normal calvings for all the farms in the study would have been nearly impossible. A matched case-control study design could have been used, but that would have required more input from the clients than could reasonably be expected: they would have had to attend the next normal calving of a cow of the same parity, and fill in a detailed questionnaire for that particular cow. When interpreting the results of such a case-case study, one needs to be aware of the 2 problems that can arise from this design (19). First, the "control-cases" might not be representative of exposures in the population from which they originated. Therefore, the comparisons between the cases and controls cannot be used to make inferences about the general population. For example, an increase in control-cases associated with any study factors (more fetomaternal size mismatch for heifers) can introduce an association of that factor with uterine torsion, even if the true incidence in the population is not affected by the factor. Also, the exposures that are associated with both comparison groups will not be identified, or might be underestimated. The third limitation of our study is the relatively small number of animals enrolled (especially case animals) and the fact that some combinations of the variables were nonexistent when the data were stratified by parity, making it impossible to use a multivariable model.

We conclude that uterine torsion is a common cause of dystocia in dairy cows, but that most field cases can be corrected successfully, and followed by vaginal delivery of a live calf. When compared with control dystocias, multiparous cows are at a greater risk of uterine torsions than are heifers, and fetopelvic disproportion and carrying twins reduce the risk of torsion.

Authors' Contributions

Drs. Aubry, Warnick, and DesCôteaux designed the study and questionnaire.

Drs. Aubry and DesCôteaux conducted the study at Cornell University and the University of Montreal, respectively.

Dr. Bouchard retrieved and analyzed the data from the Quebec databank.

Drs. Aubry and Warnick carried out the statistical analyses.

Dr. Aubry wrote and all authors reviewed the article.

Acknowledgments

The authors thank all the veterinarians who enrolled cases in the study, as well as Isabelle Dutil and Michelle Stefanski-Seymour for their assistance with data entry, and Dr. Denis DuTremblay for his search in the DS@HR databank. CVJ

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