Effects of Teat Dilators and Teat Cannulas on Udder Health

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Abstract

The objective of this study was to evaluate the effect of teat dilators and teat cannulas on udder health. Over a period of 15 days, the teats of four dairy cows were inserted with teat dilators, teat cannulas or were left untreated (controls). Cows were milked twice daily. Teat dilators were removed for milking. During milking time, the plugs of the teat cannulas were removed and milk was drained. All teats were examined using endoscopy before the start (day 0) and after the end (day 16) of this study. The California Mastitis Test (CMT) and bacteriological examination were performed on milk collected in the morning on days 0, 5, 11, and 16. The use of teat dilators and teat cannulas was associated with injuries and cisternitis. The character of these injuries indicated that teat dilators and teat cannulas pierce the teat cistern lining. In three of seven teats the removal of the teat cannula caused circular separation and eversion of the Fürstenberg rosette and teat canal skin. The use of teat dilators and teat cannulas significantly increased CMT scores and the odds of a positive bacterial culture. We conclude that the use of teat dilators and teat cannulas may harm udder health.

Introduction

Teat dilators[5] and teat cannulas[1] are often used in dairy cows. Inflammation of the teat cistern (cisternitis) has been observed when teat cannulas were used over a period of several weeks.[11] In a recent experiment, teat dilators and teat cannulas caused cisternitis when left in the teat canal for five days.[9] The objective of this study was to evaluate the effect of teat dilators and teat cannulas on udder health under practice conditions.

Materials and Methods

Four Bavarian Brown (Allgäuer Braunvieh) cows were used. They were housed in tie-stalls and milked twice daily during the 16 day study. The teat canals of each cow were inserted with teat dilators[a], teat cannulas[b] (Figure 1) or left as untreated controls (Table 1). Teat dilators were removed for milking. The plugs of the teat cannulas were removed during milking time to drain the milk. After milking, fresh dilators or plugs were inserted and left until the next milking. All teats were examined using endoscopy at the start and at the end of the study. At the start, endoscopic examination was performed via the teat canal. At the end of the study, endoscopic examination was performed via the teat canal and via the teat cistern wall.[4] On days 0, 5, 11, and 16, morning milk was collected and examined using the California Mastitis Test (CMT) and cultured for bacteria.

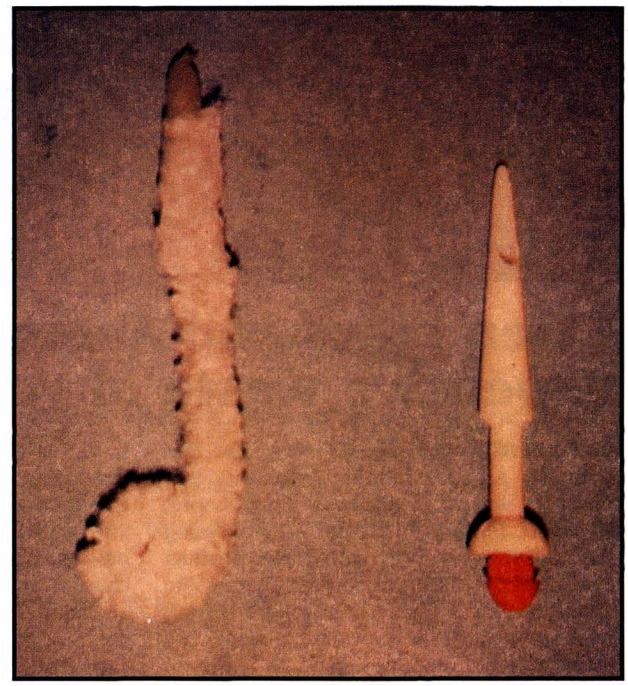

Figure 1. Teat dilator (left) and teat cannula (Bykanula®) (right)

Table 1. Herd and lactation number of four study cows and quarters administered with a teat dilator (D), a cannula (C) or nothing as control (0). FL = front left, FR = front right, HL = hind left, HR = hind right teat

Herd	Cow	Lactation	FL	FR	HL	HR
A	1	1	0	C	D	D
A	2	2	0	D	C	C
A	3	5	0	C	D	C
B	4	3	C	C	D	0

The effects of device (dilator or cannula) and time on CMT scores or bacterial test results were evaluated using generalized linear models. The CMT score (0 = negative, 1 = slightly positive, 2 = moderately positive, 3 = highly positive) or the bacterial test result (0 = negative, 1 = positive) were the outcome variables. Administraion of a device (0 = none, 1 = dilator, 2 = cannula), and experimental day (0, 5, 11, 16) were explanatory class variables. The effect of cow was adjusted using the generalized estimation equations approach.[3] SAS was used for computation.[8]

Results

At the beginning of the study, the teat canal, the Fürstenberg rosette (Figure 2) and the teat cistern lining (Figure 3) were grossly normal during endoscopy in all teats. At the end, however, all teats inserted with a teat dilator or a teat cannula showed injuries and cisternitis. Teats inserted with dilators showed alterations over the entire lining. The Fürstenberg rosette was reddened and deformed (Figure 4). In the proximal cistern, alterations were red or white and looked like warts, strings of pearls (Figure 5) or wasp's nests (Figure 6). Similar findings were seen in the distal cistern, but to a lesser degree.

Teats inserted with cannulas showed local or general alterations of the lining. The teat canal was often widened and the teat canal skin was thickened (Figure 7). The folds of the rosette were indistinct. Alterations around the rosette looked like reddish (Figure 8) or red cauliflowers (Figure 9). In the proximal cistern alterations were red or white and looked like warts, craters or strings of pearls (Figure 10). Similar findings were seen in the distal cistern, but to a lesser degree. In three of seven teats, the removal of the teat cannula caused circular separation and eversion of the Fürstenberg rosette and teat canal skin (Figure 11). The eversion left a large and irregular cavity in the Fürstenberg rosette area (Figure 12). Untreated teats were grossly normal during the second endoscopic examination.

Figure 2. Fürstenberg rosette around the inner opening of the teat canal. Endoscopic representation via the teat cistern wall

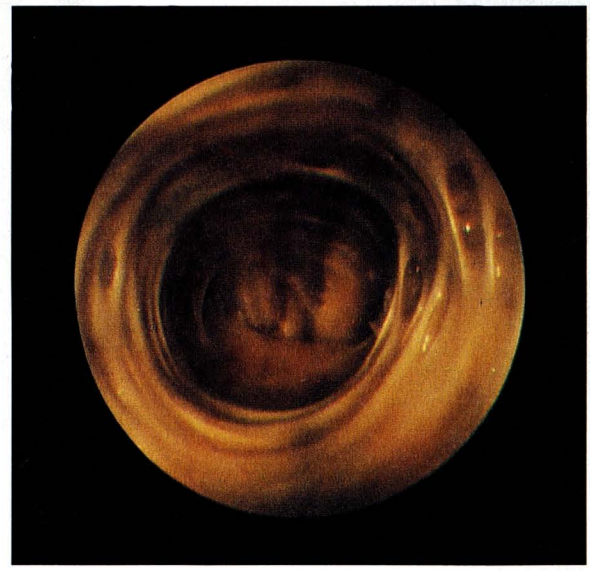

Figure 3. Circular and longitudinal folds in the teat cistern. Endoscopic representation via the teat canal

The use of a dilator or a cannula increased CMT scores compared to control teats. Dilators significantly increased CMT scores by almost one unit (e.g. from 0 to 0.9 or from negative to slightly positive) and cannulas increased CMT scores by three quarters of a unit. CMT had increased by one quarter of a unit on day 11 and one unit on day 16 compared to day 0 (Table 2). Dilators and cannulas also significantly increased the odds of finding bacteria in the milk. The odds of finding bacteria in the milk also increased significantly on day 11 and day 16 (Table 3).

Figure 4. Reddening and deformation of the Fürstenberg rosette with the use of a dilator. Endoscopic representation via the teat cistern wall

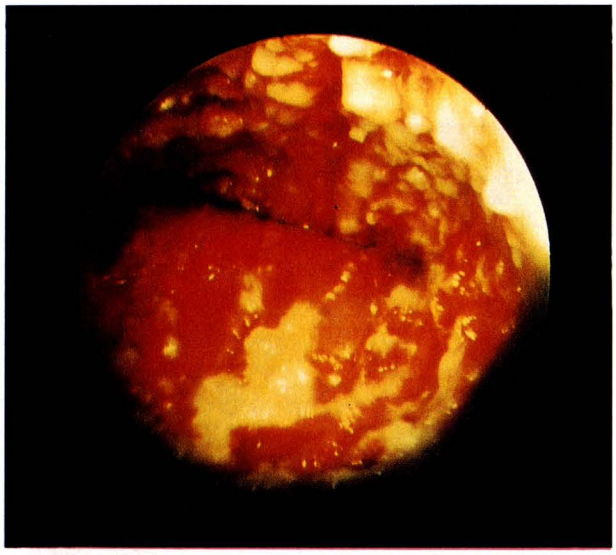

Figure 5. Reddening and pearl string-like alteration of the teat cistern after use of a teat dilator. The fold indicates where the teat clamp sits. Endoscopic representation via the teat canal

Discussion

Teat dilators and teat cannulas are often used for several days or weeks. Usually these devices are used in a single teat, however, they are occasionally used in two or more teats. These devices are frequently left in the teat between milkings. This study attempted to mimic this situation.

These results suggest that teat dilators and teat cannulas may harm the teat canal, Fürstenberg rosette and teat cistern. These findings are similar to other reports.[9,10] We hypothesize that the tips of these devices pierce the cistern lining, because the most severe

Figure 6. Reddening and wasp's nest-like alteration of the teat cistern with the use of a teat dilator. Endoscopic representation via the teat cistern wall

Figure 7. Widening of the inner teat canal opening and cauliflower-like alteration of the teat cistern after use of a teat cannula. Endoscopic representation via the teat cistern wall

alterations were found in the proximal cistern, where the tips of these devices are located. This is likely to

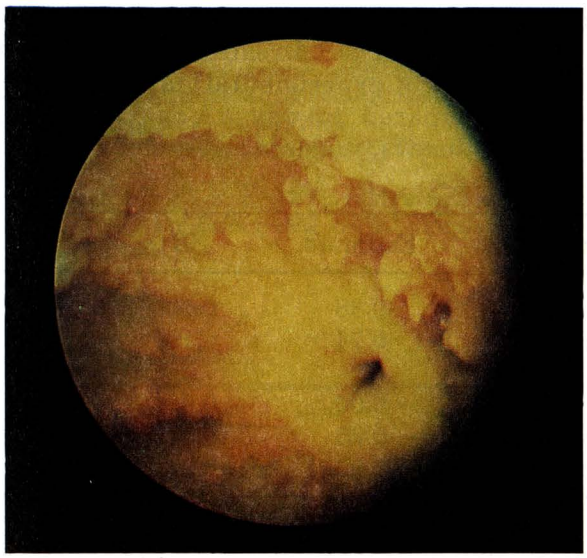

Figure 8. Thickening and slightly reddened cauliflower-like alteration of the Fürstenberg rosette after use of a teat cannula. Endoscopic representation via the teat cistern wall

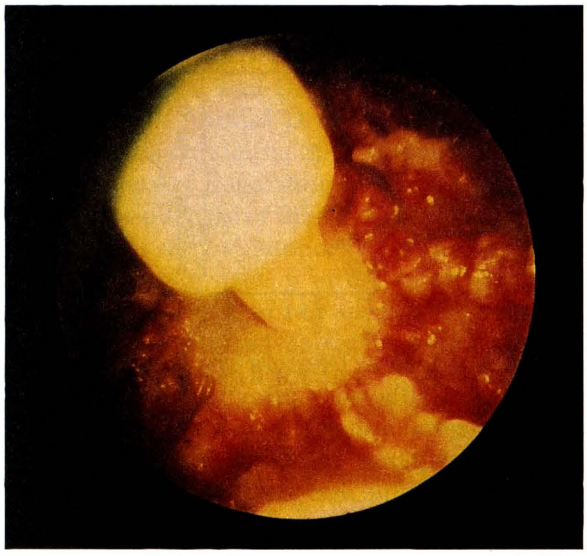

Figure 9. Thickening and highly reddened cauliflower-like alteration of the Fürstenberg rosette after use of a teat cannula. Endoscopic representation via the teat cistern wall

occur when cows lay down and teats are bent (Figure 13). As the location of the tip changes, the distal cistern may be affected as well. Cannulas caused more severe alterations than dilators, possibly because cannulas are stiffer than dilators. The alterations found on the teat canal skin suggests that dilators brush the teat canal skin like pipe cleaners. The findings also indicate that the removal of cannulas can cause eversion of the teat

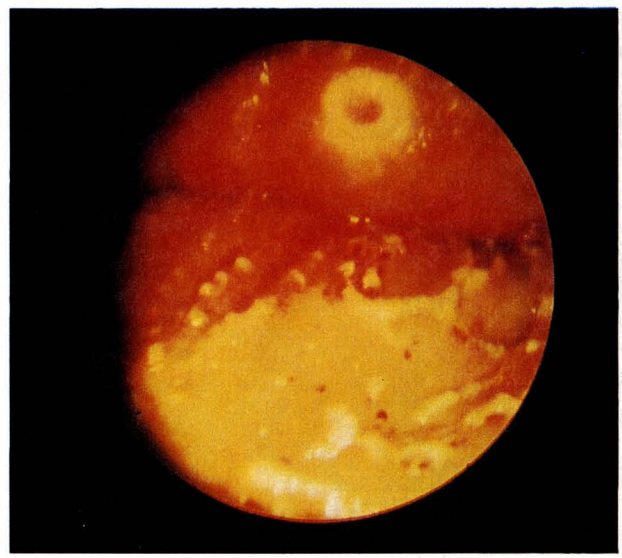

Figure 10. Reddening, crater-like and pearl string-like alteration of the teat cistern after use of a teat cannula. The fold indicates where the clamp sits. Endoscopic representation via the teat canal

Figure 11. Complete eversion of the Fürstenberg rosette and the teat canal skin caused by removal of a teat cannula. Representation of the teat tip (photo taken via the endoscope)

canal skin. We propose two reasons for this: 1). leaving a cannula in the teat canal for two weeks may harm the Fürstenberg rosette and teat canal skin and, 2). the diameter (5 mm) at the base of the teat cannula cone is large enough to damage the teat canal. When removed, the cannula may grasp the pre-damaged Fürstenberg rosette and teat canal skin and evert both out of the canal.

Dilators and cannulas may increase somatic cell count (SCC). Increased SCC may be the consequence of

Figure 12. Cavity in the area of the Fürstenberg rosette after eversion of the Fürstenberg rosette and teat canal skin caused by removal of a teat cannula. Endoscopic representation via the teat cistern wall

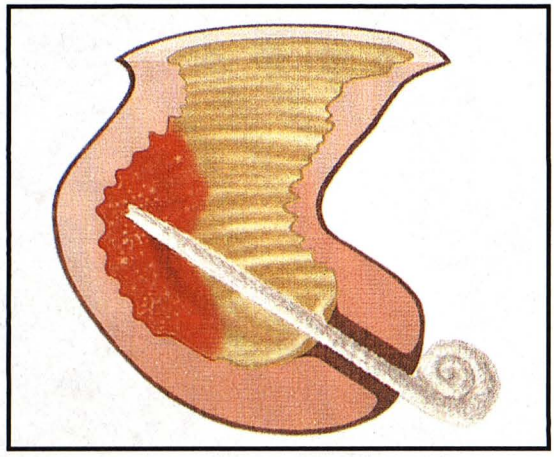

Figure 13. We hypothesise that teat dilators and teat cannulas pierce the teat cistern lining when cows lay down and teats get bent

irritation and inflammation of the teat lining caused by these devices. Dilators and cannulas also increase the odds of finding bacteria in the milk. It is possible that teat canals are inoculated with bacteria by insertion of these devices. Cannulas and dilators may also impair defense mechanisms in the teat canal (closure, formation of sebum) such that bacteria can grow through the teat canal into the teat. Our findings are in agreement with other reports,[7,10] suggesting that dilators and cannulas may cause mastitis.

Because dilators and cannulas may harm udder health, their use may not be compatible with guidelines

Table 2. Effect of teat dilators or teat cannulas (compared to untreated control teats) and effect of experimental days 5, 11, or 16 (compared to day 0) on CMT scores. Estimates, standard errors and P-values are given

Variable	Estimate	SE	P
Dilator	0.88	0.10	0.00
Cannula	0.74	0.19	0.00
Day 5	0.06	0.03	0.30
Day 11	0.25	0.11	0.02
Day 16	1.00	0.22	0.00

Table 3. Effect of teat dilators or teat cannulas (compared to untreated control teats) and effect of experimental days 5, 11, or 16 (compared to day 0) on the log odds of a positive bacterial result. Estimates, standard errors and P-values are given

Variable	Estimate	SE	P
Dilator	4.8	1.6	0.00
Cannula	2.2	1.3	0.08
Day 5	0.0	1.2	1.00
Day 11	1.6	1.0	0.01
Day 16	5.2	1.3	0.00

for animal health care. Dilators and cannulas are often used to prevent adhesions after teat canal injuries or surgery. Teat canal adhesions may better be prevented by silicone teat canal implants (SIMPL)[c]. They are tissue-friendly, pliable and sterile.[6]

Footnotes

[a] Wollzitzenstift. Essex, Munich, Germany.
Bykanula®. Essex, Munich, Germany.
[c] SIMPL®. Thomas Instrument, Wittibreut, Germany. (www.profs-products.com)

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February 11, 1999

Finalized Minor Uses/Minor Species Guidance Available

The Food and Drug Administration has finalized guidance entitled "Guidance for lndustry—FDA Approval of Animal Drugs for Minor Uses and Minor Species." This guidance document (number 61), supersedes Guideline 26, "Guidelines for the Preparation of Data to Satisfy the Requirements of Section 512 of the Act Regarding Minor Use of Animal Drugs."

The purpose of this document is to provide specific guidance on the means for generating effectiveness and safety data to support the approval of minor use animal drugs. A minor animal drug use is defined as use in a minor species or use in any animal species for a condition that is rare or that occurs in limited geographic areas. Minor species are defined by exclusion, as any species other than major species. Major species are defined as cattle, swine, chickens, turkeys, horses, dogs, and cats. According to current regulations, sheep are a minor species except with respect to human food safety data collection requirements, for which sheep are considered major species. Other guidance addresses issues related to exotic and wildlife species.

This document represents the Agency's current thinking on drug approval for minor uses and minor species. It does not create or confer any rights for or on any person and does not operate to bind the FDA or public. An alternative approval may be used if such approach satisfies the requirements or the applicable statute, regulations, or both.

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