Teat endoscopy (theloscopy) in cattle - equipment and procedure

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Abstract

The objective of this article is to describe teat endoscopy (theloscopy). The goal of theloscopy is to diagnose reasons of milk flow disorders and to monitor the treatment. The equipment consists of a small wireless battery-operated theloscope for air insufflation and endoscopy, and instruments for small surgery. The patient is prepared by sedation, fixation of head, tail and hindlimbs, cleaning and disinfection of the teat, injecting an anesthetic into a teat vein, draining off milk, clamping teat basis and flushing the teat cistern using saline. Theloscopy can be performed via the teat canal or via the lateral teat wall. A small opening in the teat wall is made for endoscopy via the lateral teat wall; it is sutured after finishing endoscopy. By endoscopy via the teat canal the teat canal and the teat cistern can be inspected. In this scenario the view is directed upwards. By endoscopy via the lateral teat wall the teat cistern and the inner opening of the teat canal can be inspected. In this scenario the view is directed downwards. This procedure has been developed in veterinary practice on several hundred patients. The authors find it useful for the diagnosis of milk flow disorders and for monitoring the treatment.

„Precise examination is the basis of veterinary work“ Richard Götze

Introduction

In the past it was difficult to exactly diagnose the reasons of milk flow disorders in teats with undamaged skin. Inspecting, palpating, probing and hand milking the affected teat were certainly helpful, but often sonography, radiography or thelotomy was needed. With teat endoscopy (theloscopy) a new and simple technique has become available to exactly diagnose milk flow disorders.

The objective of this article is to describe theloscopy as it is performed by the authors. The aim of theloscopy is to exactly diagnose milk flow disorders and to monitor the treatment. Insight into the teat may be gained via the teat canal or via the lateral teat wall. With the insight via the teat canal (axial theloscopy) the view is directed upwards into the teat canal (Fig. 1 and 2) or the teat cistern (Fig. 3 and 4). With the insight via the lateral teat wall (lateral theloscopy) the view is directed downwards into the teat cistern and onto the inner opening of the teat canal (Fürstenberg rosette) (Fig. 5 and 6). The frequent disorders located in the area of the inner opening of the teat canal may better be seen via the lateral teat wall than via the teat canal.
Fig. 1 (left): Insight into the teat canal. Schematic representation. Fig. 2 (right): Teat canal seen through the teat canal. Note: Longitudinal bulges thrown up by the underlying longitudinal muscle bundles.

Fig. 3 (left): Insight into the teat cistern. Schematic representation. Fig. 4 (right): Teat cistern seen through the teat canal. Note: Circular folds and longitudinal blood vessels.

Fig. 5 (left): Insight via the lateral teat wall. Schematic representation. Fig 6 (right): Inner opening of the teat canal (Fürstenberg rosette) seen via the lateral teat wall. Note: Radial folds.
Equipment

The equipment consists of a small, wireless, battery operated theloscope to inflate and to look into the teat. Instruments for small surgery are also needed. Our theloscope consists of a rigid scope, a blow pipe and a handle (Fig. 7). The scope allows for straight insight (0°) into the teat and has a working length of 12 cm. It runs in a blow pipe with an outer diameter of 3.0 mm. Via the blow pipe air is blown into the teat cistern to dilate the teat for examination. Scope and blow pipe are bolted and attached to the handle. The handle contains a lamp, an air pump and two batteries (or rechargables), which power the lamp and the pump for several hours. Lamp and pump may be switched on seperately.

Fig. 7: THELOSCOPE – wireless teat endoscope.

The instruments for small surgery are: THELOMETER to measure teat canal length, round ended probe, STERIL – sterile disposable milking tubes, THELOKAL – extra wide milking tube, California Mastitis Test (CMT), stretching forceps and rubber rings, obturator, slide tube, syringes, needles, teat knife, THELOTOM - teat punch, THELAB - foreign body forceps, NIT – natural teat inserts, SIMPL - silicone implants, needle holder, dissecting forceps, scissors, needle-thread-combination, swabs, ELLA – elastic long lasting adhesive teat bandaging strips, xylazine, oxytozin, seventy-percent isopropylic alcohol, nine-permille saline and two-percent lidocaine solution.

THELOSKOP – teat endoscope, Eickemeyer, Tuttlingen/Germany, www.eickemeyer.de
Energizer LR 14, 1,5 V, 8000 mAh, www.energizer.com
THELOMETER – probe for measuring teat canal length, Eickemeyer, Tuttlingen, Germany
STERIL – sterile disposable milking tube, Kruuse, Marslev/Denmark, www.kruuse.com
THELKLAL – extra wide milking tube, Eickemeyer, Tuttlingen/Germany
Obturator, Eickemeyer, Tuttlingen/Germany
Slide pipe, Eickemeyer, Tuttlingen/Germany
HUG’s teat lancet, Eickemeyer, Tuttlingen/Germany
THELOTOM – teat punch, Eickemeyer, Tuttlingen/Germany
THELAB – teat foreign body forceps, Eickemeyer, Tuttlingen/Germany
NIT – natural teat insert, Kruuse, Marslev/Denmark
SIMPL - silicone implant, Kruuse, Marslev/Denmark
ELLA – elastic long lasting adhesive teat bandaging strips, Kruuse, Marslev/Denmark
Preparing the Patient

First a case history may be provided and a brief general examination performed. The special examination is performed with the cow standing. She may be fixed in a claw trimming device. Lifting this device up or examining the cow from a pit (Fig. 8) may ease the examination. Another option is putting the cow on a tilt table.

Fig. 8 (left): Teat examination may be performed with the cow in a claw trimming device and the examiner standing in a pit. Fig. 9 (right): Fixation of the hindlimb that is next to the examiner.

Prior to the examination the cow is administered with xylazine (0.2 ml of a two-percent solution per 100 kg body mass i.v.) and oxytozin (30 I.U. i.v.). Head, tail, and the leg of the cow that is next to the examiner are fixed (Fig. 9). The teats are thoroughly cleaned with warm water and soap, dried, degreased with seventy-percent isopropyl alcohol, and disinfected with three-permille acridine solution. Scrupulous cleanliness is a success prerequisite.

Inspecting, Palpating, Probing and Hand Milking the Teat, Determinig Teat Canal Length, Examining Milk

First the teat is examined from outside. Then the teat canal, the teat cistern and the teat wall are palpated. The patency of the teat canal is tested by drawing off a few streams of milk. The change in teat canal length may be determined with a Thelometer as compared to the contralateral teat. Teat canal lengthening by more than 2 mm is indicative for a rupture in the teat canal area with inversion of tissue into the teat cistern. The course of the teat canal may be examined with a round ended probe. A sterile milking tube may be used to test the patency of the teat canal and to obtain a milk sample. The CMT should be performed on each milk sample. Examination for pathogens and residues and an antibiogram may provide additional information.

Clamping the Teat Basis, Anesthetizing the Teat, Rinsing the Teat Cistern

Now a rubber ring is put around the teat basis to prevent milk from entering the teat cistern and blood from entering the teat wall. The teat is anesthetized by puncturing a teat vein with a 0.6 mm needle, draining blood and injecting 8 to 10 ml of a two-per-cent lidocain solution (Fig. 10 and 11). Then the teat cistern is rinsed through a milking tube with sterile saline until the draining saline is clear.

b Mobile tilt table for cattle, Bartmann, Lübbecke/Germany
Fig. 10 (left): Blood vessels in the teat: Artery (A), part of the Fürstenberg vein ring (B) and veins (C). Plastiod. Fig. 11 (right): The teat is anesthetized by puncturing a teat vein with a 0.6 mm needle, draining blood and injecting 8 to 10 ml of a two-per-cent lidocain solution.

**Insight via the Teat Canal**

For axial theloscopy the scope and blow pipe are inserted into the teat cistern via the teat canal. After switching on the pump air is blown into the teat to dilate the cistern. After switching the lamp on the teat cistern may be examined (Fig. 12). The teat canal may be examined during removing scope and blow pipe.

Fig. 12: Theloscopy via the teat canal.
Insight via the Lateral Teat Wall

For lateral theloscopy a small opening is made in the lateral teat wall. Through this opening scope and blow pipe will be inserted into the teat cistern. For this purpose an obturator is run via the teat canal into the teat cistern and pushed through the lateral teat wall (Fig. 13). The slide pipe is inserted from outside along the obturator into the teat cistern (Fig. 14), and the obturator is removed.

Fig. 13 (left): For lateral theloscopy a small opening is made in the lateral teat wall. For this purpose an obturator is run via the teat canal into the teat cistern and pushed through the lateral teat wall. Fig. 14 (right): The slide pipe is inserted from outside along the obturator into the teat cistern and the obturator is removed. Then scope and blow pipe are inserted via the slide pipe into the teat cistern.

Then scope and blow pipe are inserted via the slide pipe into the teat cistern. The slide pipe protects the artificial opening during the examination. After the pump is switched on air is blown into the teat dilating the cistern. After switching on the lamp the distal part of the teat cistern and the inner opening of the teat canal may be inspected (Fig. 15). To make ruptures in the area of the teat canal better visible a milking tube may be shoved into the teat canal while looking onto the inner opening of the teat canal.

Fig. 15: Theloscopy via the lateral teat wall.
Often theloscopy is used for both diagnosis and monitoring of the surgical treatment. For treatment the Thelotom (Fig. 16) or Hug's lancet are used. Tissue impeding milk flow may be removed with the Thelotom. A guideline may be: „Removal of sick tissue – preservation of healthy tissue“. Tissue removal may be monitored through the theloscope inserted via the lateral teat wall (Fig. 17 and 18). A helper may hold the theloscope while the surgeon performs the treatment.

Fig. 16 (left): THELOTOM – teat punch. Fig. 17 (center): Monitoring the thelotom treatment. Schematic representation. Fig. 18 (right): Removal of tissue that had ruptured in the teat canal and inverted into the teat cistern by using the thelotom. Seen through the theloscope inserted via the lateral teat wall.

Incisions into the teat canal may be made with Hug’s lancet to widen the narrowed teat canal. Here a guideline may be: „One, two (at 0 and 180°) or three (at 0, 120 and 240°) V-shaped incisions in the area of the inner opening of the teat canal – preservation of the outer teat canal opening“ (Fig. 19 and 21). The incisions may also be made without monitoring the procedure through the theloscope.

Fig. 19 (left): Making one, two or three V-shaped incisions in the area of the inner opening of the teat canal to widen the narrowed canal. Schematic representation. Fig. 20 (right): Making an incision with Hug’s lancet. Seen through the theloscope inserted via the lateral teat wall.
A forceps may be used to remove bodies from the teat cistern that may stem from inside (papilloma, blood or milk clots) or from outside (foreign bodies) the teat (Fig. 21 and 22).

Fig. 21 (left): THELAB – teat foreign body forceps. Fig. 22 (right): Removal of tissue that had plugged the inner opening of the teat canal by using a forceps inserted via the teat canal. Seen through the theloscope inserted via the lateral teat wall.

**Aftercare**

Only the skin of the artificial opening may be closed with a diagonal suture. The rubber ring at the teat basis is cut with scissors. The milk flow is tested by hand milking and the residual milk from the quarter is drained. Normal milk may be drained with a narrow disposable milking tube (Fig 23). Mastitis milk may be drained with a specially designed wide milking tube (Fig. 24). Draining the milk washes off tissue left from surgery.

Fig. 23 (left): STERIL - sterile disposable milking tube with Luer cone for draining normal milk. Fig. 24 (right). THELOKAL – extra wide milking tube for draining mastitis milk.
Then an intramammary antibiotic is instilled into the teat cistern to prevent or to treat mastitis. For this purpose long acting penicillinase-resistant β-lactame antibiotics and antibiotics effective against coliform bacteria may be used. A sterile natural teat insert (Fig. 25) is inserted into the teat canal to keep the teat canal patent or a sterile silicone implant (Fig. 26) is inserted to prevent teat canal stenosis.

![Fig. 25](left). To keep the teat canal patent after surgery a sterile NIT - natural teat insert may be inserted into the teat canal. NIT's adjust to the teat canal; they have no medicaments and disintegrate after a few days. Fig. 26 (right): A sterile SIMPL - silicone teat canal implant (yellow – thin, purple – thick) may be inserted into the teat canal to prevent teat canal stenosis after surgery. SIMPL are tissue friendly and pliable.

The suture may be removed again now. Then the teat is bandaged and rested, i.e. not milked. For bandaging the teat a strip of elastic long lasting adhesive tape is applied in a longitudinal manner (U-shape) (Fig. 27) and one strip is applied in a circular manner. The way and the duration the teat is rested varies with the type of the disorder. Often teats are rested for 3 x 3 days after surgical intervention and then milked again.

![Fig. 27](left): Bandaging the teat by using ELLA - elastic long lasting adhesive teat bandaging strips. Degrease and dry the teat first. One strip is applied longitudinally (U-shaped) and one strip is applied circularly. The bandage protects the teat, prevents the NIT or SIMPL from falling out and indicates to the milker not to milk the teat.

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1-2 g Oxacilline or Cloxacilline
1-2 g of Neomycine or Gentamycin
Resting the teat for 3 x 3 days means cessation of milking for 9 days. It also means draining off milk, administration of an intramammary antibiotic, insertion of a teat insert, and bandaging the injured teat on day 1, on day 4 and on day 7 and recommence milking on day 10. The teat can not be rested in the case of mastitis. In this case milk needs to be drained twice a day.

**Discussion**

The procedure described here was developed in hundreds of cases in rural bovine practice. With this technique milk flow disorders may be diagnosed easily and precisely. It also allows to treat milk flow disorders according to a precise diagnosis and to monitor the treatment. Many milkflow disorders have been successfully treated by using this technique.

More information is available on the internet at www.thele.net