Endoscopy by a medical gastrointestinal fiberscope in bovine obstetrics

INOUE, Tadahiro, Yoh-Ichi MIYAKE, Harumichi YAMANAKA*,
Keiichiro KAWATA** and Tsune ISHIKAWA

*Department of Veterinary Obstetrics, Faculty of Veterinary Medicine,
Hokkaido University, Sapporo-shi 060, Japan*

The application of the glassfiberscope in clinical diagnosis has gradually increased in veterinary medicine. Recently, endoscopy has become routine in medical examinations of human subjects. Using accessory instruments, biopsy specimens for histopathological diagnosis can also be obtained from some limited regions using endoscopy. Only a few reports, however, have been made on endoscopy in veterinary medicine, although there is a considerable need for them, in teaching, research, and in clinical practice. KELLING¹⁾, who examined the abdominal organs of the dog using a human cystoscope, is probably the first worker who used the endoscope in veterinary medicine. MORI²⁾ used a modified human bronchoscope to observe the genital organs of cattle, and a few other authors have also modified human endoscopes for animal use. The endoscopes employed by these earlier workers, however, were directoscopes. This paper reports some techniques for the clinical application of a new type of endoscope, the medical gastrointestinal fiberscope, in bovine obstetrics.

Equipment and animals

Equipment: The endoscope used is a medical gastrointestinal fiberscope, GIF-type P, Olympus Optical Co. Ltd., Tokyo, Japan (fig. 1). The thinnest insertion tube, 7.2 mm in diameter, was chosen because of its suitable flexibility and traceability. The operator can control it in a 2-way angulation (120° up and down, fig. 2), and moreover, orientation of its distal end is easily maintained in a narrow cavity for observation or photography. This versatile fiberscope is very suitable for endoscopic examination as screening, and in addition, biopsy may be done using improved forceps.

A cold light supply, model CLE-3 distributed by the same company, was used. This handy light source emits an intense cold light to permit the examination of fine details for accurate endoscopic diagnoses. A built-in full automatic exposure system can take photographs with depression of a simple shutter release button. The exposure time varies automatically in a range from 1/4 to 1/100 sec according to the distance between the objective lens and the target. Water or a prepared solution can also be introduced by a built-in pump with a water container. Air and water feeding systems are used for inflating the lumen of the target organs and for cleansing

Present address: * National Institute of Animal Health, Kodaira-shi, Tokyo 187, Japan; ** Department of Veterinary Obstetrics and Gynecology, School of Veterinary Medicine, Rakunogakuen University, Ebetsu-shi, Hokkaido 069-01, Japan.

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the objective lens during operation.

Animals: A heifer and six cows of Holstein Friesian, 2~8 years, were used in this experiment.

Techniques and results

The authors devised a special trocar with a stainless steel sheath for puncturing the vaginal wall (fig. 3, a & b), and a special cervical dilatator concealed by a cover tube of stainless steel for guiding the insertion tube through a narrow cervix (fig. 3, c & d).

The instruments for endoscopy were sterilized with alcohol or an antiseptic solution prior to use. The cows fasted for at least 12 hours before examination in order to reduce rumen volume and to allow free movement of the genital tract. They were then placed in stocks in a standing position and tranquilized by an intramuscular injection of propionylpromazine (Combelen*, 2 ml/100 kg). The vulva and vagina were washed with an antiseptic solution before operation.

The experiments were carried out (1) to observe the ovaries; (2) to observe the endometrium; (3) to collect biopsy specimens; and (4) to make an amniocentesis.

1) *Endoscopy of ovaries:* After opening the vagina with a speculum, the portio vaginalis uteri was grasped by a cervical forceps and pulled backward. The trocar attached to the cover tube, was inserted into the vaginal cavity, and pushed through the vaginal wall just above the cervical os. A sound of air inspiration into the pelvic cavity was heard when the peritonium was punctured by the trocar. The trocar was withdrawn, leaving the cover tube and the fiberscope, which was introduced through the tube. When the fiber-

Fig. 4. Fiberscope is introduced through the cover tube via a trocared hole in vaginal wall.

scope was inserted into the pelvic cavity, its distal end was pushed out of the tube and moved up and down or right and left in search of its target. In approaching the ovary, the fiberscope was oriented by grasping the ovary with a hand, which was inserted into the rectum. Then, the distal end of the fiberscope was moved onto the surface of the ovary for final observation by manipulating the angle knob of the endoscope (fig. 4).

It was generally impossible to observe the entire surface of the ovary. In most cases, however, the outside appearance of an ovarian follicle, a corpus luteum, a portion of the oviduct, and the uterus could be seen. When needed, satisfactory color photography was available (figs. 9 & 10). No considerable bleeding in the punctured part nor any adhesion was noted around the ovaries and other pelvic organs with this endoscope technique.

A solution of chondroitin sulfate or physiological saline was fed by the water container of the light supply for washing objective lens and visual field. This solution was proved also to be effective in preventing adhesions.

2) *Endoscopy of the endometrium:* The cervical dilatator and its cover tube were introduced into the cervical canal by grasping

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Fig. 5. Fiberscope and its cover tube are introduced through cervix.

the portio with the forceps. When it reached the uterine body, the dilatator was withdrawn, leaving the tube in the cervix. The fiberscope, sterilized and dried, was introduced into the uterus through the tube, and then an examination was performed (figs. 5 & 6). When the cow was in estrus or in puerperium, the dilatator could be introduced easily, however, this proved to be difficult when the cow was in diestrus. In the latter case, the cervix was dilated by a set of dilatators designed for uterine irrigation. The appearance of the endometrium and the mucus in the uterine cavity could be examined (fig. 11). The fiberscope could be inserted into the right or left uterine horn by manipulating the angle knob. In estrus, massive amount of cervical mucus obstructed the field of vision at times but it could be blown off by means of the ventilation and/or washing by the chondroitin sulfate solution or the physiological saline.

3) *Visual endometrial biopsy*: By inserting the biopsy forceps from the "forceps opening" of the fiberscope (fig. 7), a visual biopsy of the endometrium could be performed. The forceps were placed in the center of the visual field, and the tips of the forceps were opened, and then closed; thus, a piece of tissue could

be biopsied from a target region of the endometrium. The tissue was put into some fixatives for histological examination. Because of the small size of tissue, care should be taken when processing it.

4) *Amniocentesis*: Collection of amniotic fluid from a pregnant bovine uterus was accomplished by insertion of a teflon cannula, 1.6 mm in diameter and 200 cm in length, from the "forceps opening" or the fiberscope, which was introduced into the abdominal cavity through the trocared vaginal wall, as mentioned above. A piano wire inserted into the cannula easily passed through the endoscope and punctured the wall of the pregnant uterus (fig. 8). When the uterine wall was punctured, a visual examination was made in order to avoid hitting the uterine blood vessels. The piano wire was thrust forward by the operator into the amniotic sac, the wire was withdrawn, and the amniotic fluid was sucked into a syringe adapted to the cannula. The fluid obtained was useful in chromosome analysis for prenatal sex diagnosis.

Discussion

Some authors have described the approach to the ovaries of domestic animals by means of endoscopy. MEGALE *et al.*³⁾ mentioned the following three methods; puncture of the vaginal fornix; puncture of the peritoneal cavity via the paralumbar fossa; and retention of a cannula in the paralumbar fossa. The endoscopes used by these investigators, however, were non-flexible directoscopes. LAMOND & HOLMES⁴⁾, BAKER⁵⁾, MOTOYOSHI & MIURA⁶⁾ and WISHART & SNOWBALL⁷⁾ observed the ovary of the cow by endoscopy through the incised dorsal wall of the vagina or the paralumbar fossa, but they found many adhesions around the ovaries and other pelvic organs in most

of the cows following treatments. The present authors also noted extensive adhesions between the ovaries and the other organs due to incisions of about 5 cm long made in the dorsal wall of the vagina in preliminary experiments. The procedures applied in the present work prevented profuse bleeding, and no adhesion was observed around the ovaries and other pelvic organs after the operation. This may be attributed to the chondroitin sulfate solution or the physiological saline poured onto these organs during operation, and also to using a trocar instead of making a wide incision.

In endoscopy, the blood vessels on the ovarian surface appeared slightly larger than those observed in necropsy. In cows showing the estrous cycle, the ovarian follicles and corpora lutea could be seen clearly, and good photographs were obtainable (figs. 7 & 8).

Because the endoscope was inserted through the metal tube, the tip of the endoscope holding the lens and light guide was free of blood or mucus. The approaching of the distal end of the endoscope to the target organ was easily made by manipulating the metal tube, operating the angle knob of the endoscope, and/or moving the tip of the endoscope from the rectum. The distal end was highly flexible.

Improvement of lens and modern instrumentation equipped with glass fiber have provided better visualization and the possibility for obtaining more excellent photographic studies in endoscopy. KONISHI & ICHIJO⁸⁾ have studied the bladder mucosa of bovine chronic hematuria using a medical gastroscope equipped with a glass-fiberscope. In the field of veterinary obstetrics, OHTAGAKI *et al.*⁹⁾ have demonstrated that the postpartum uterus in Japanese Black Breed could be visualized by inserting a gastrointestinal fiberscope

through the cervical canal until the 13th to 20th day postpartum. Our experimental procedures, however, were applicable for examination of the uterine lumen at any stage of the estrous cycle in cattle.

The biopsy forceps were very suitable for collecting biopsy specimens from the bovine endometrium.

The endoscopic technique used by the authors will offer a safer method for amniocentesis¹⁰⁾ because uterine puncture will be made rather easily, avoiding uterine blood vessels. This method combined with amniocentesis will provide also a safer diagnostic procedure for the prenatal cytogenetical examination of sex in cattle.

From the results obtained, it may be concluded that the present medical gastrointestinal fiberscope will be satisfactorily used in bovine obstetrics; i.e., for endoscopic observation of the ovary and uterine lumen, visual endometrial biopsy, and for safer amniocentesis.

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牛の臨床繁殖領域における内視鏡の応用

井上忠恕・三宅陽一・山中晴道*・河田啓一郎**・石川 恒

(北海道大学獣医学部)

医学界においては内視鏡検査が広く行われているが、獣医学界では未だ実験的段階にとどまっている。今回、人体用ガストロファイバースコープ (GF) を用い、牛の臨床繁殖学領域に内視鏡の応用を試みた。

GF としては上部消化管検査用の汎用ファイバースコープ (オリンパス社製, GIF-type P) に必要な一部の器具を加えたものを用いた。

検査牛は 12 時間以上絶食とし、術前に沈静剤投与、梓場内に起立保定した。

1) 腹腔内: 予め洗浄した腔壁上部を特別に設計した套管針を用いて穿刺し、外套管を通じて GF を腹腔に挿入する。卵巢表面、特に卵胞、黄体、または卵管、子宮表面の内視的観察、必要に応じて写真撮影も可能である。これにより、卵胞の成熟度、黄体の形成状態、癒着

の有無、あるいは従来困難であった卵管外部表面の観察が可能である。

2) 子宮内: 子宮頸管を通じて GF を子宮内に挿入し、子宮内膜の観察、撮影が可能である。これにより、子宮内の異物、内膜の病変の確認、必要に応じて生検用鉗子を用いることにより直視下で内膜材料の採取も容易である。

3) 羊水採取: 腔壁を穿刺し、骨盤腔内に GF を挿入、子宮壁を通じて羊膜囊内から羊水を採取し得る。これにより、羊水の各種検査、細胞遺伝学的検索に供し得る。

以上のように GF と外套管を組み合わせることにより、腹腔内、子宮内の観察、子宮内膜、羊水の採取が可能であって、臨床診断上利用価値も高い。

現所属: * 農林省家畜衛生試験場, ** 酪農学園大学獣医学科

Explanation of plate

Fig. 1. Medical gastrointestinal fiberscope and cold light supply.

1: Distal end	2: Bending section
3: Insertion tube	4: Air/water feeding button
5: Suction button	6: Forceps opening
7: Shutter release button of camera	8: Eyepiece
9: Camera	10: Angle knob for up and down movement
11: Cold light supply	12: Water container
13: Biopsy forceps	

Fig. 2. Bending section (120° up and down)
Arrow showing metal tube (Fig. 3-b).

Fig. 3. a: Trocar for puncturing vaginal wall
b: Stainless steel cover tube for protecting light guide and lens from being soiled by blood or mucus
Arrow showing guard for limited insertion
c: Cervical dilatator
d: Stainless steel cover tube for guiding fiberscope through cervical canal.

Fig. 6. General appearance of performing intra-uterine endoscopy in cow via cervical canal.

Fig. 7. Biopsy forceps.

Fig. 8. Teflon cannula with piano wire for amniocentesis.

Fig. 9. Mature ovarian follicle (arrow) at standing estrus.

Fig. 10. First day after ovulation.

Fig. 11. Endometrium in luteal stage.