Clinical Case Reports International

Short Communication
Published: 12 Jan, 2022

Image Processing of Low-Cost Endoscope for Observation of Blood Vessel of External Uterine Ostium and Vaginal Wall

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Abstract

Purpose of this study was to examine the estrous cycle by an intravaginal image of a cow in a livestock barn using an inexpensive endoscope. Because the floor of barn was not clean due to straw and manure, it was difficult to move a large endoscope image processing device using casters. Recently, inexpensive endoscopes that can use mobile phones as image displays have been commercialized. However, it is hard to use for diagnosis of the estrous cycle from structural changes in blood vessels and tissues, since mobile phones do not have an image processing function. Therefore, we would like to introduce an image process method for intravaginal images obtained by inexpensive endoscope to make clear images of blood vessel of external uterine ostium and vaginal wall.

Keywords: Endoscope; Clinical imaging; Barn; Ostium

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Received Date: *15 Dec 2021*
Accepted Date: *05 Jan 2022*
Published Date: *12 Jan 2022*

Citation:
Kawaguchi T, Kunii H, Shimasaki T, Kubo T, Takahashi M. Image Processing of Low-Cost Endoscope for Observation of Blood Vessel of External Uterine Ostium and Vaginal Wall. Clin Case Rep Int. 2022; 6: 1263.

Introduction

Commercial endoscope uses Narrow Band (NB) imaging for making clear image of blood vessels of tissue [1-4]. Briefly NB imaging is introduced here. Hemoglobin absorbs light at 415 nm and 540 nm to 560 nm. Collagen also has auto fluorescence at the wavelength from 390 nm to 470 nm. Endoscope is assembled with band pass filters of wavelength of absorption peak of hemoglobin and collagen in the camera. Obtained images clearly exhibit distribution of hemoglobin and collagen. This method is very useful for diagnosis of illness of tissue.

Image of Complementary Metal Oxide Semiconductor (CMOS) sensor of digital cameras are composed of RGB light receiving elements. Red (R) element receives light from 570 nm to 680 nm, and the Green element (G) receives light from 460 nm to 600 nm. Blue element (B) receives light from 400 nm to 450 nm. A composite of the electrical signals received by these elements is called an RGB image. Obtained image is saved as JPEG, BMP, and TIFF format images, but the file is composed of RGB signals. Here, we propose that the saved image file could be separated to each RGB signal and then could be superimposing the G and B images, it would be possible to acquire an image specialized for hemoglobin in tissue.

We noticed the technical innovation of fiberscope that can be connected to mobile phones. They are now sold at a low price of approximately $20. Inexpensive fiberscopes are used for check of the condition of hair, scalp of the head, and ears. Technician also can use the inexpensive fiberscope to inspect washbasin drains, air conditioning air ducts, and washing machine pipes. This inexpensive fiberscope can be connected not only to mobile phones *via* Lightning or USB, but also *via* Wi-Fi. Thus you can bring the inexpensive fiberscope to the research field even though a large endoscopic diagnostic imaging device cannot be used there. Therefore, we propose here to use an inexpensive fiberscope as an endoscope for cow in the barn.

Experimental

In this study, the inexpensive endoscope developed by NIDAGE was used [5]. This endoscope has two cameras with a pixel count of 1980x1080 installed at the tip and side. Thus images of both the external uterine ostium and vaginal wall can be acquired at the same time. This number of pixels

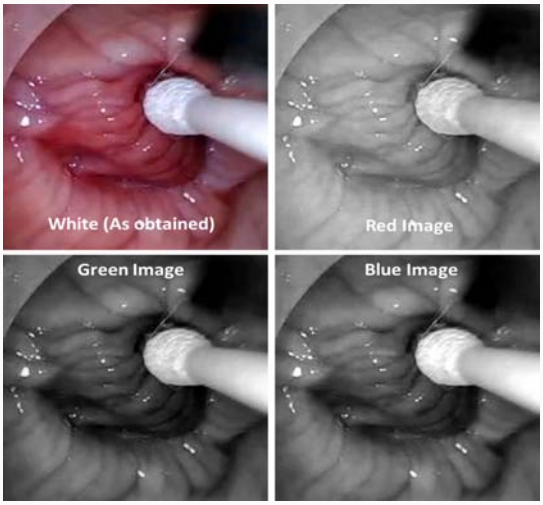

Figure 1: Endoscopic images of external uterine ostium of cow in the period of estrus; endoscopic image as obtained (White) and images separated to Red, Green, and Blue images.

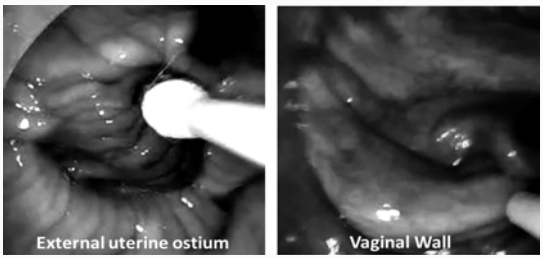

Figure 2: Composited images of G and B of external uterine ostium and vaginal wall of cow in the period of estrus.

corresponds to a Full-HD image, and an endoscope image can be acquired as a photo and a movie. In addition, it has a total of 7 LEDs on the tip and side, allowing taking bright images of the inside of the vagina. Since this endoscope has a waterproof function equivalent to IP67, it can be safely used even in the vaginal environment.

It is difficult to take single photo during diagnosis using endoscope, because this diagnosis is huge burden on the cow. Therefore, we limited the diagnosis time within 1 min in total. Hence we shot a video and saved as MPEG4 file, and then, Adobe Premiere Pro (version 15.2.0) was used for taking single photo image (JPEG file). It was possible to acquire single photo image with Windows Media Player as well, but the image quality deteriorated significantly and it was not possible to obtain images of blood vessels.

ImageJ-win64 (free software) was used to decompose the single photo image into RGB signals [6]. As you select Color-Split Channel from Image icon, the JPEG file will be split into R, G and B files. Since hemoglobin strongly absorbs G and B light, blood vessels appear as dark color.

In order to further improve the contrast of the blood vessel image due to the absorption of hemoglobin light, the G and B images were combined using RegiStax V6 (free software) [7]. You select G and B JPEG image files, and then, perform set aligns points, align and limit are automatic process work. The image misalignment will be automatically corrected and the composed image will be displayed. Finally, stacked (composed) image can save the composited image.

Results and Discussion

A stick fixed with an endoscope and a mucus collection tool was inserted into the vagina of an estrus cow in the barn. Figure 1 (White) shows an image of the external uterine ostium. This image was saved from a video file obtained by endoscope. It was clearly seen that the external uterine ostium illuminated by white light. Next, the images obtained by decomposing the white image into RGB are shown as Red, green, and blue images in Figure 1. Red image illustrated the distribution of minor blood vessels that seemed to be capillaries. Green and blue images depicted the distribution of thick blood vessels in the folds of external uterine ostium.

The composed images of green and blue images of the external uterine ostium and the vaginal wall are shown in Figure 2. Thick blood vessels could be clearly observed. Image of the vaginal wall also showed blood vessels and it was different from white image.

In estrus cows, the blood flow increases due to the excitement, and the endometrium looks reddish as a whole. We believe that the blood flow can be seen in the amount of hemoglobin in the blood vessels as a result of the increase in the activity of cow.

Currently, it is attempted the prediction of the estrus period by accurately grasping the estrous cycle from diagnostic imaging and monitoring of pregnancy signal substances. We hope that diagnostic imaging can be used as the primary screening for the diagnosis of pregnancy.

Conclusion

In this study, it is attempted to observe blood vessels in the external uterine ostium and vaginal wall of cow using an inexpensive endoscope. It was possible to obtain an endoscopic image more easily than the method using a conventional large-sized endoscopic image processing device. Since the blood vessel image could be clarified by image processing, it can be expected to be used for the primary screening for the diagnosis of pregnancy in the future.

Acknowledgement

This work was supported by a Grant-in-Aid for Livestock promotion of Japan Racing Association.

References

1. Kutwin P, Konecki T, Cichocki M, Falkowski P, Jabłonowski Z. Photodynamic diagnosis and narrow-band imaging in the management of bladder cancer: A review. Photomed Laser Surg. 2017;35(9):459-64.
2. Vu A, Farah CS. Narrow band imaging: Clinical applications in oral and oropharyngeal cancer. Oral Dis. 2016;22(5):383-90.
3. Piazza C, Del Bon F, Peretti G, Nicolai P. Narrow band imaging in endoscopic evaluation of the larynx. Curr Opin Otolaryngol Head Neck Surg. 2012;20(6):472-6.
4. Naselli A, Hurle R, Puppo P., The role of narrow-band imaging in the management of non-muscle-invasive bladder cancer. Expert Rev Anticancer Ther. 2012;12(12):1523-8.
5. Endoscope. NIDGE.
6. ImageJ. Image Processing and analysis in Java.
7. Astronomie. Registax V6. Free image processing software.