

# Detection of Stomach Cancer by TV-Endoscope Colour Enhancement Image Processing.No1

M.Miyamoto、 S.Morimoto. T.Nakashima, T.Oh, S.Saeki 1) ,F. Tamada 2)

Hyogo College of Medicine 1), Kaibara Red-Cross hospital 2)

## Abstract

Using modern TV-endoscope equipment, we have experimented image processing in several ways. This time, we designed new image processing unit called "the Color Subtracted Enhancement image processing unit". This unit was made by combining the RGB-Subtraction image processing device with the color enhancement image processing device. The RGB-subtraction device is an analogue unit that enables us to remove the visible red, green, blue, peaks from the image. We can subtract following images; R-G, R-B, G-R, B-R, B-G, simply by changing the switches. The color enhancement device (developed by Olympus optical corporation inc.) is a digital processing unit that lets us reinforce any of these colors. This unit let us enhance any of RGB colors on the image which is processed by RGB-subtraction device. Using this unit, we tried to clarify the border between normal and diseased mucosa.

We detected invasion of the lesion and compared the original image with the processed images. Moreover, we marked the border visualized by this unit and compared the marking point with histological border. **Result:** Based on the R-G image (i.e. that was produced by subtracting green from red) and the R-B image, the processed images are more clearly than those based on the B-G image, the G-B image, the B-R image and the G-R image. The color subtracted enhancement image processing enabled us to detect the border between normal and diseased mucosa and showed us the concavity and convexity of early cancer and gastric ulcers. **Conclusions:** Elevations, depressions and color changes of gastric mucosa were clearly visible by using the TV-endoscope color subtracted enhancement image processing unit. This technique will facilitate the treatment of gastric lesions with endoscopic surgery.

## Subject and Methods

Several gastric lesions (chiefly early gastric cancers) were observed with a TV-endoscope. Obtained images of gastric lesions were processed with a CSE system Images before and after processing were compared. Furthermore the boundary of lesion visualized by this system was marked with clipping and compared with histological boundary of the lesion

1)Case1: II c early gastric cancer (a 43-year-old male named Y.K.) [Original image. CSE image. ] (Figure 3)

2)Case2: Atypical mucosa (ATP) (a 52-year-old male named Y.S.) [Original image. CSE image. ] (Figure 4)

3)Case3: II b early gastric cancer (a 63-year-old male named W.T.) [Original image. CSE image. Macro histological boundary and Marking points by clips ] (Figure 5)

4)Case4: II b early gastric cancer (a 66-year-old male named O.Y.) [Original image. CSE image. Macro histological boundary and Marking points by clips ] (Figure 6)

5)Case5: II b early gastric cancer (a 65-year-old male named I.Y.) [Original image. CSE image. Macro histological boundary and Marking points by clips ] (Figure 7, Figure8)

## Introduction

Following development of electronic instruments, a new stage of endoscopy has begun. The use of CCD provides clearer and brighter endoscopic images than ever, greatly contributing to observation of lesions. Furthermore, image processing is relatively easy with newly developed TV-endoscopic Systems. We have recently developed a color subtracted enhancement system (CSE) which combines an RGB-subtraction device with a color enhancement device. With this system, red (R), green (G) and Blue (B) components of an image are first processed with the RGB-subtraction image processor, followed by enhancement of particular color by the color enhancement image processor to provide a clear image of the lesion. We applied this system to assessment of several gastric lesions (chiefly early cancers.) At the same time, we evaluated the value of parameters such as subtraction rate and gain number etc.

## Instrument

The CSE system consists of an RGB-subtraction device and a color enhancement device. The RGB-subtraction device is made of analog subtraction circuit, by which RGB signals are led into two lines, and the difference in the signals between the two lines is visualized on a TV-monitor. Optimum image can be obtained by adjusting subtraction rate and gain number. The color enhancement devices converts analog RGB signals into digital ones and displayed on a monitor. RGB components are adjusted by dialing. The CSE systems connects these two devices in series. The image enhanced by the RGB-subtraction device is additionally subjected to color reinforcement by the color enhancement device to provide lesions as clearly as possible.

(Figure1. Figure2)



Figure 1. Profile and Block diagram of CSE

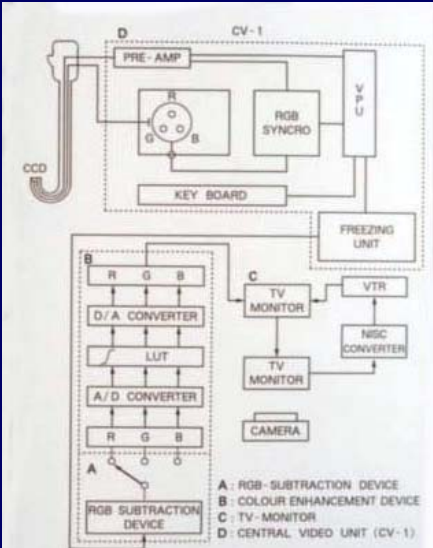
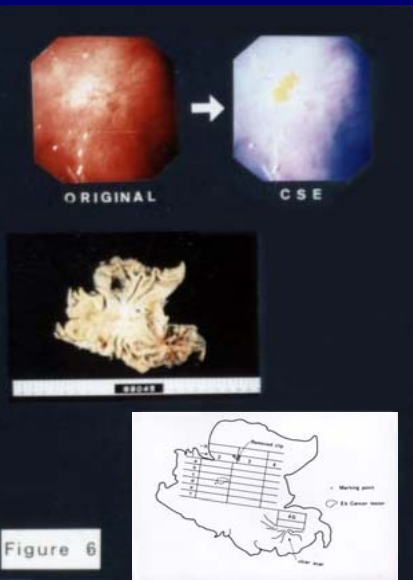
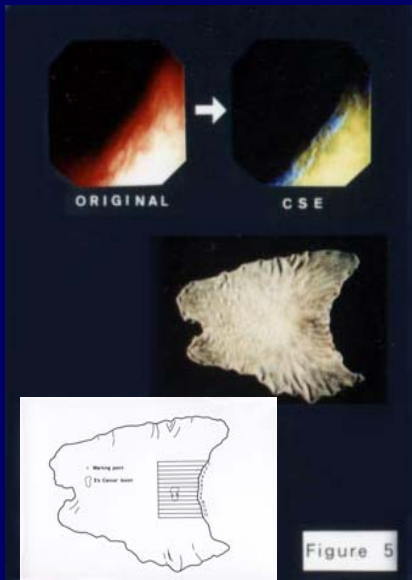
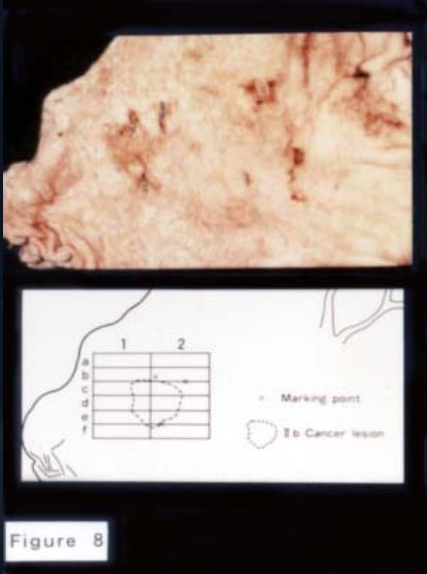
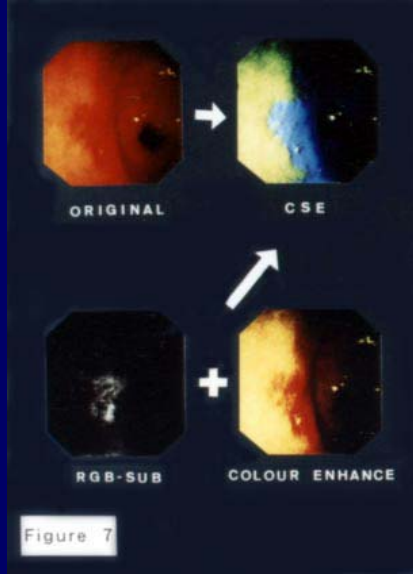
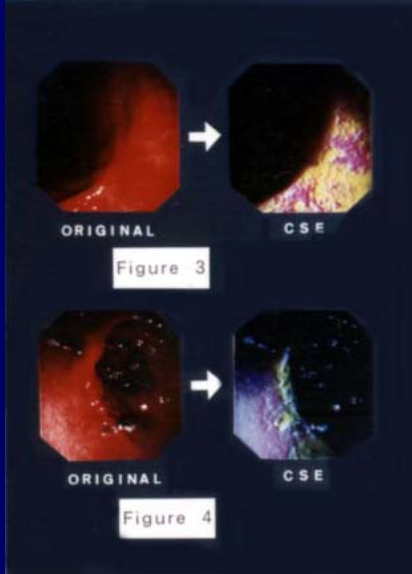


Figure 2. Block diagram of CSE system

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Hyogo College of Medicine 1), Kaibara Red-cross hospital 2).



## Result

- (1) Depression and surrounding region of depressed type II c early gastric cancer were clearly visualized. (Figure 3).
- (2) With CSE system, surface irregularities and boundary of ATP lesion were clear. (Figure 4)
- (3) In case of flat type II b early gastric cancer, discolored region on original endoscopic image was visualized as light blue region, thus marking by the boundary clearer. The point marked by clipping was approximately consistent with histological boundary of lesion. (Figure 5)
- (4) In case of flat type II b early gastric cancer, where hardly any redness was visible on original images. CSE processing provided an image in which red region was blue and the surrounding region was yellow, thus marking the boundary clearer. The point marked by clipping was approximately consistent with histological boundary of lesion. (Figure 6)
- (5) In case of flat type II b early gastric cancer, presenting With slightly redness on n original images, the region of redness was colored blue and the surrounding region yellow. thus

marking the boundary clearer. The point marked by clipping was approximately consistent with histological boundary of lesion. (Figure 7 Figure 8)

(6) When an optimum setting for image processing with this system was explored, the following subtraction. R-G (subtracting green from red) and R-B :subtraction rate: 7.9-8.6, gain number: 7.6-8.5.

When dials for red, green and blue adjustment were set at 7.0-8.4, 7.6-9.1, 7.9-9.3. respectively, better images were obtained optimum setting will be found in these ranges.

## Conclusion

When images of gastric lesions (chiefly early Cancers) were subjected to color processing using CSE system, the boundary of lesions and minute changes on lesions could be clearly visualized.

The boundary of lesions on CSE processed images were approximately consistent with their histological boundary. These results suggest that the CSE system will be useful in accurate assessment of lesion boundary, determination of the area to be operated and application of endoscopic surgery.