Esophageal endoscopic submucosal dissection on postendoscopic variceal ligation scars with injection under red dichromatic imaging

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Red dichromatic imaging (RDI) has recently been developed, and there have been several reports evaluating the usefulness of RDI for endoscopic diagnosis or treatment.[1-11] RDI enables visualization of blood vessels in deep submucosa using 3 different relatively long wavelength lights (green, amber, and red) (Fig. 1).[12] Similar to narrow-band imaging, we can easily switch to RDI by pressing the button on the endoscope. RDI has 3 modes that can be switched in sequence by pressing the button on the image processor (EVIS X1; Olympus Medical Systems, Tokyo, Japan). In particular, mode 2 creates an image with irradiating light with wavelengths of 600 nm and 630 nm and by using complex signal processing. Through these processes, mode 2 enhances the red tone of deep blood vessels and significantly improves the visibility of blood vessels.[13]

In esophageal endoscopic submucosal dissection (ESD), we often encounter bleeding during injection, which causes submucosal hematoma and reduces the visibility of the submucosa, preventing safe resection during submucosal dissection. We performed ESD using RDI during injection for high-risk superficial esophageal cancer, which is located on the postendoscopic variceal ligation (EVL) scars and adjacent to the esophageal varices (Video 1, available online at www.giejournal.org).

The patient was a 72-year-old man with alcoholic liver cirrhosis who had undergone previous EVL for esophageal varices (Fig. 2). In this case, a 40-mm 0-IIc lesion was detected on the anterior wall of the lower esophagus, which was considered to be an indication for ESD, with a diagnosis of superficial esophageal squamous cell carcinoma. The lesion was located adjacent to residual esophageal varices, and the post-EVL scar was located inside the lesion (Fig. 3). Moreover, the patient was taking warfarin for portal vein thrombosis, so careful resection avoiding injury of blood vessels (including the varices) was required. Considering that the varices were F1 and negative for the red color sign, and that further EVL or endoscopic injection sclerotherapy would cause new scars, we decided to perform ESD without further treatment for residual esophageal varices.

During ESD, we sedated the patient with dexmedetomidine hydrochloride and flunitrazepam. A therapeutic endoscope with a water jet function (GIF-H290T; Olympus, Tokyo, Japan) was used. Submucosal injection was performed using a 25-gauge sharp needle (NeedleMaster, Olympus), and a submucosal injection of 10% glycerin solution (Glyceol; Chugai Pharmaceutical Co, Ltd, Tokyo, Japan) was administered. For the energy device, we used

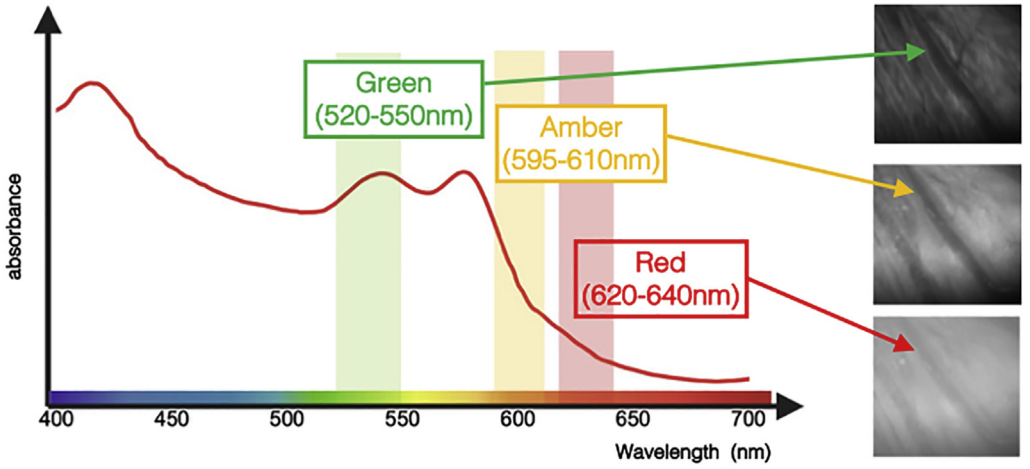

Figure 1. The light absorption curve of hemoglobin. In red dichromatic imaging, 3 types of light are irradiated, each with a different central wavelength: red, amber, and green.

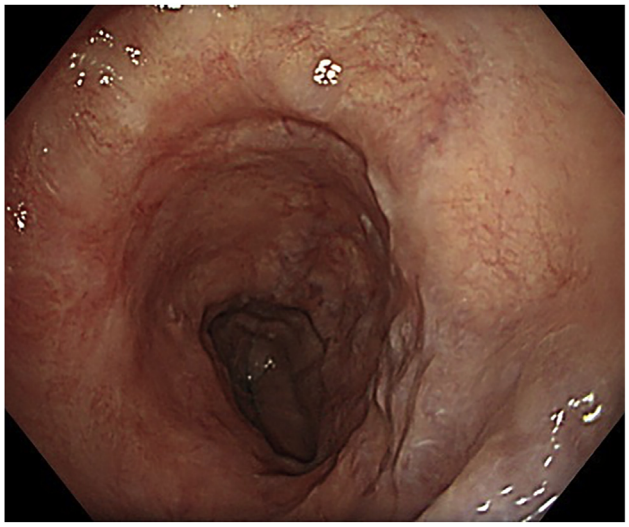

Figure 2. White-light imaging of the lower thoracic esophagus. Esophageal varices and postendoscopic variceal ligation scars were seen.

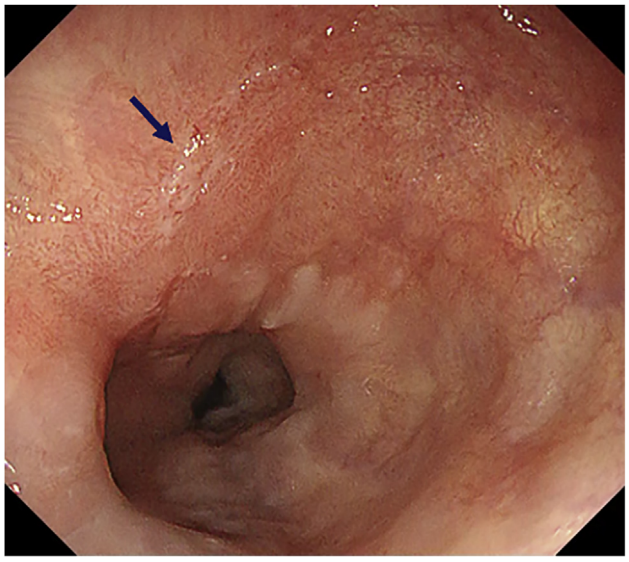

Figure 3. White-light imaging of the lesion. A 40-mm, flat, depressed lesion was found on the anterior wall of the lower thoracic esophagus. There was a scar due to previous endoscopic variceal ligation (*arrow*).

a needle-type knife with injection function (DualKnife J, Olympus).

We observed the esophagus using white-light imaging, narrow-band imaging, and iodine staining to identify the area of the lesion (Fig. 4). After marking dots around the lesion, iodine was washed off with sodium thiosulfate. The blood vessels were confirmed by RDI (mode 2) (Figs. 5 and 6), and we performed injection under RDI (mode 2) to avoid injuring those blood vessels (Fig. 7). During ESD, a total of 17 injections were performed, and there was only 1 minor bleed associated with the

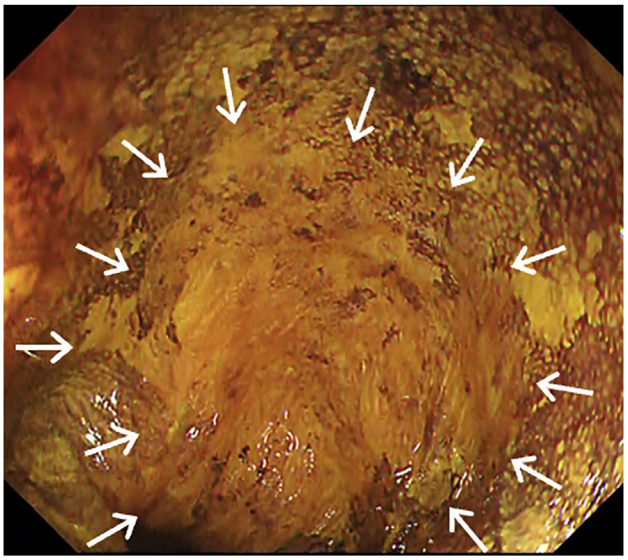

Figure 4. White-light imaging of the lesion with iodine staining. The lesion with iodine staining is surrounded by *arrows* to describe the lesion area.

injection. In addition, there was only 1 hematoma that decreased the visibility of the submucosa. We did not use RDI during submucosal dissection; blood vessels were directly visible, so there was little advantage of using RDI during this phase. Although the submucosa was highly fibrotic at the site of previous EVL (Fig. 8), en bloc resection was achieved. After resection of the lesion, triamcinolone was injected to prevent stricture (Fig. 9). ESD was completed without any adverse events, and the procedure time was 90 minutes.

After ESD, the patient was hospitalized for 4 days as initially planned. The final pathology result was squamous cell carcinoma with invasion depth of lamina propria mucosae and negative horizontal and vertical margins, without lymphovascular invasion. In this case, we performed a semicircumferential resection; however, no symptoms of stricture have occurred requiring endoscopic balloon dilation or stent placement. We are planning an endoscopic follow-up 6 months after ESD.

Although the patient was treated with warfarin and the lesion was located on the post-EVL scars and adjacent to esophageal varices, injection under RDI (mode 2) minimized bleeding and hematoma formation, resulting in safe resection of the lesion.

DISCLOSURE

All authors disclosed no financial relationships.

Abbreviations: ESD, endoscopic submucosal dissection; EVL, endoscopic variceal ligation; RDI, red dichromatic imaging.

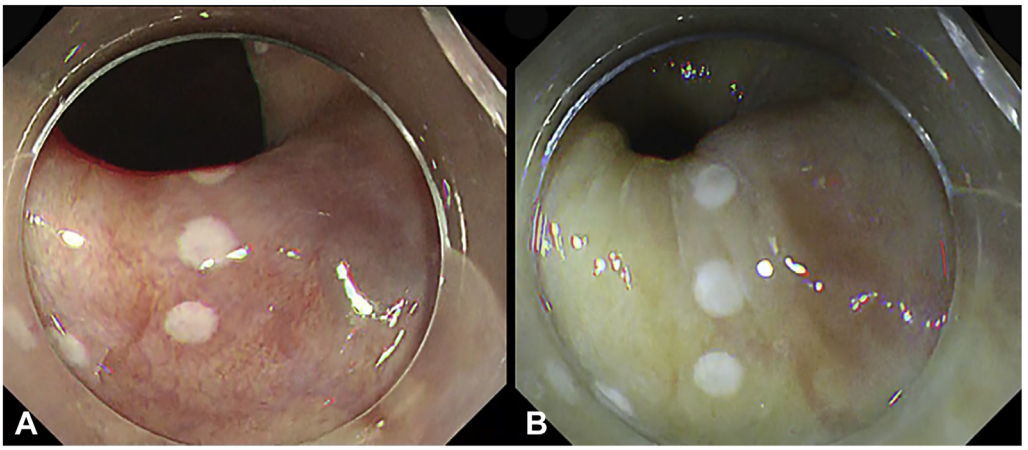

Figure 5. The difference in visibility of esophageal varices between **(A)** white-light imaging and **(B)** red dichromatic imaging. The esophageal varices were more clearly confirmed under red dichromatic imaging (mode 2) than white-light imaging.

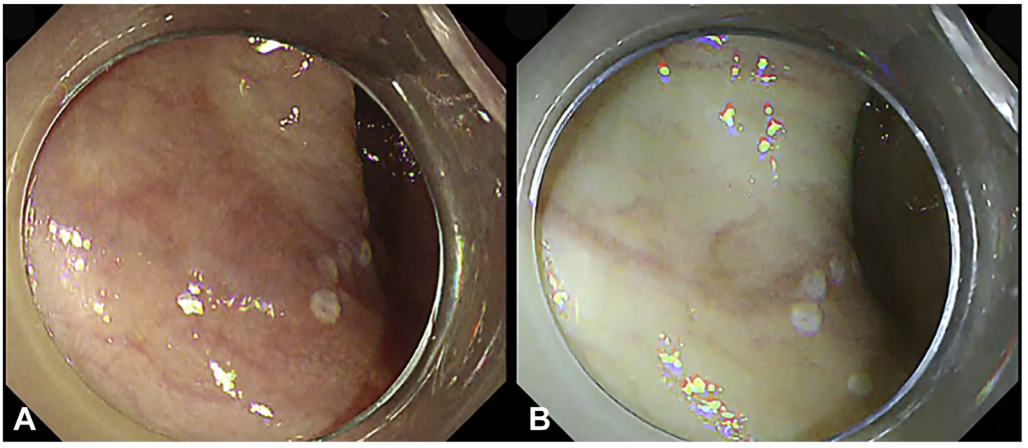

Figure 6. The difference in visibility of blood vessels in the deep submucosa between **(A)** white-light imaging and **(B)** red dichromatic imaging. The blood vessels in the deep submucosa were more clearly confirmed under red dichromatic imaging (mode 2) than white-light imaging.

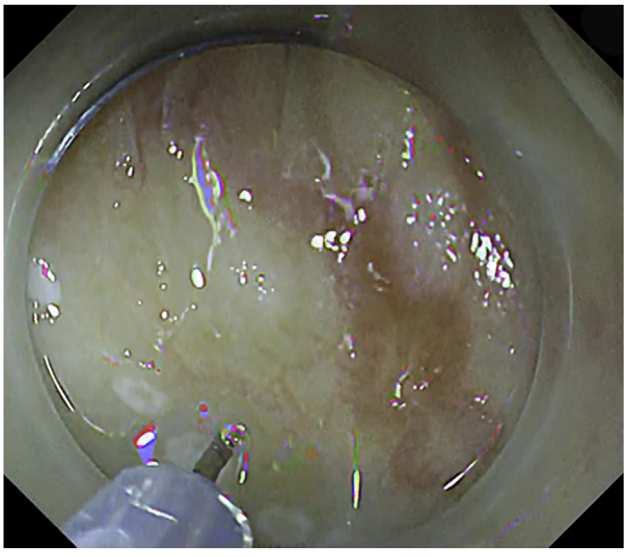

Figure 7. Submucosal injection under red dichromatic imaging. Safe submucosal injection was achieved by avoiding the blood vessel under red dichromatic imaging.

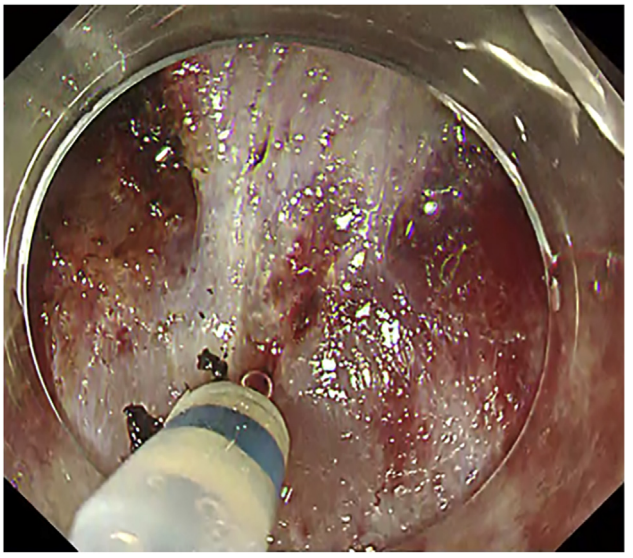

Figure 8. White-light imaging of submucosal fibrosis. The submucosa was highly fibrotic at the site of previous endoscopic variceal ligation.

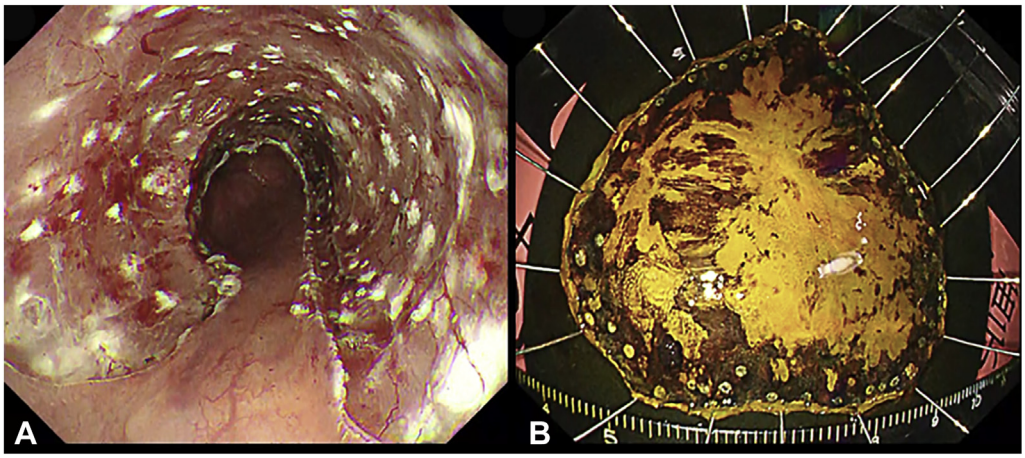

Figure 9. A, Postendoscopic submucosal dissection ulcer after triamcinolone injection. **B,** Endoscopic submucosal dissection specimen with iodine staining. En bloc resection was achieved, and we injected triamcinolone to prevent stenosis.

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