ORIGINAL ARTICLE

Real-time tele-endoscopic guidance for endoscopic antireflux mucosectomy using a novel high-speed mobile network system

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Background and Aims: Advances in telemedicine and high-speed mobile networks, including multichannel 4G and 5G connectivity, have enabled real-time remote endoscopic support across international settings without imposing additional demands on institutional internet infrastructure. These technologies enhance access to expert guidance for complex procedures, improving safety and facilitating knowledge transfer. However, real-world clinical applications of international tele-endoscopic support remain limited.

Methods: We describe the implementation of a tele-endoscopy system (Medical Edge; Zao-X, Tokyo, Japan) using a high-speed mobile network and present a case of endoscopic antireflux mucoplasty performed under real-time remote guidance. An 80-year-old man with postgastrectomy gastroesophageal reflux disease (GERD) refractory to medical therapy was selected. The system provided high-definition, low-latency imaging, bidirectional audio communication, video pausing, and on-screen annotation, enabling precise procedural instruction. Representative endoscopic findings are shown in the esophagus and remnant stomach, as well as a small sliding hiatal hernia.

Results: The procedure was completed without intraoperative or postoperative adverse events. The patient was discharged on postoperative day 4. Follow-up endoscopy demonstrated reduction of a sliding hiatal hernia and complete resolution of reflux esophagitis. Symptom scores improved, with the frequency scale for the symptoms of GERD score decreasing from 15 to 6, and the GERD questionnaire score improving from 9 to 4 by postoperative day 14.

Conclusions: This case demonstrates the feasibility and clinical utility of real-time international tele-endoscopic guidance using a high-speed mobile network system. (VideoGIE 2026;11:421-4.)

Recent advances in telemedicine and high-speed mobile networks, including multichannel 4G and 5G connectivity, have enabled real-time remote endoscopic support across international settings without placing additional demands on existing institutional internet infrastructure. These technologies broaden access to expert guidance, particularly for complex or emerging endoscopic procedures. Remote support may enhance procedural safety by providing immediate expert input during critical steps and can promote knowledge transfer and training for local endoscopists.

High-speed mobile network systems, including 5G systems, enable high-definition and ultra-high-definition video transmission with low latency, enabling real-time remote guidance with on-screen annotation.[1] Despite these capabilities, real-world clinical application of international, real-time remote endoscopic support remains limited.

TELE-ENDOSCOPY SYSTEM AND PROCEDURE

A newly developed tele-endoscopy system (Medical Edge; Zao-X, Tokyo, Japan) based on a high-speed mobile network was used to establish a real-time connection between Japan and Australia. The system enabled high-definition video transmission with minimal latency and bidirectional audio communication.

Abbreviation: GERD, gastroesophageal reflux disease.

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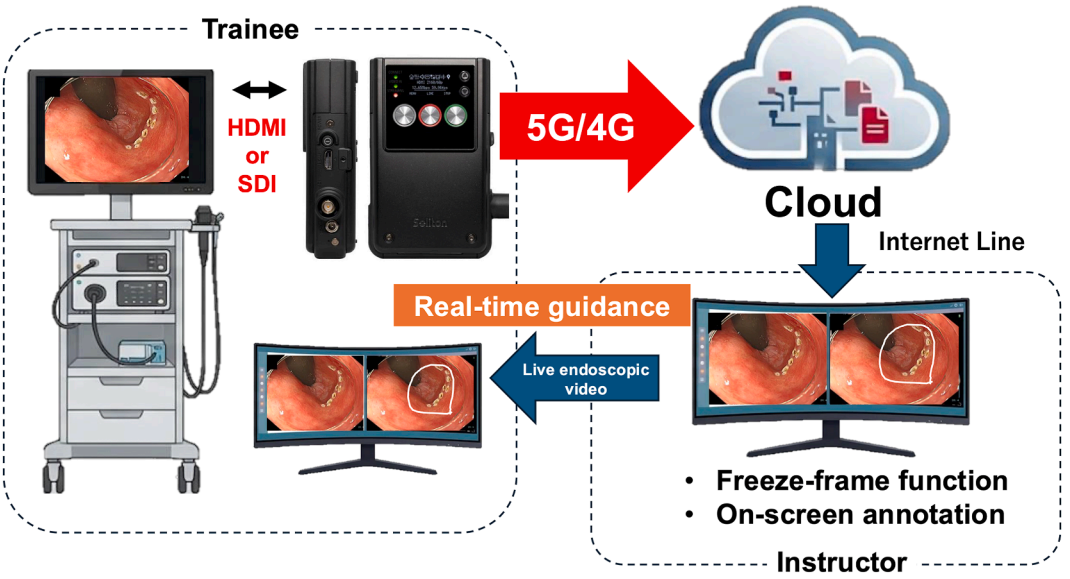


Figure 1. Overview of the newly developed high-speed mobile network system (Medical Edge; Zao-X, Tokyo, Japan). *HDMI*, High-definition multimedia interface; *SDI*, serial digital interface.

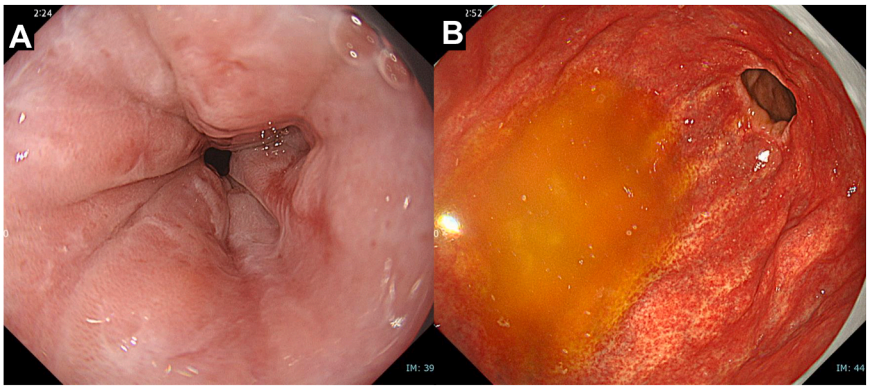


Figure 2. A, Endoscopic view demonstrating reflux esophagitis classified as Los Angeles grade B. **B,** Bile retention in the remnant stomach.

The endoscopic video output was connected to the system via an high-definition multimedia interface, allowing real-time sharing of endoscopic images with the remote expert. The remote expert could view the live feed and provide guidance through verbal communication and on-screen annotations. The system also allowed temporary pausing of the video stream to facilitate precise instruction.

At the operator site, the endoscopist performed the procedure while receiving real-time feedback through audio communication. At the remote site, the expert continuously monitored the procedure and provided step-by-step guidance.

The operator site was equipped with an endoscopy tower and transmission unit, whereas the remote site included a receiving workstation capable of live video display, bidirectional audio communication, and annotation. A schematic of the system configuration is shown in Fig. 1. By simple installation of a dedicated application on both the operator-side personal computer and the remote expert-side personal computer, video transmission and reception, real-time communication, and on-screen annotation could be performed.

The procedure was performed in accordance with institutional guidelines for patient privacy and data protection. Written informed consent was obtained from the patient, including consent for remote expert involvement.

CASE PRESENTATION

An 80-year-old man with a history of distal gastrectomy presented with worsening gastroesophageal reflux disease (GERD) symptoms refractory to pharmacologic therapies. Esophagogastroduodenoscopy revealed Los Angeles grade B[2] reflux esophagitis, bile retention in the esophagus and

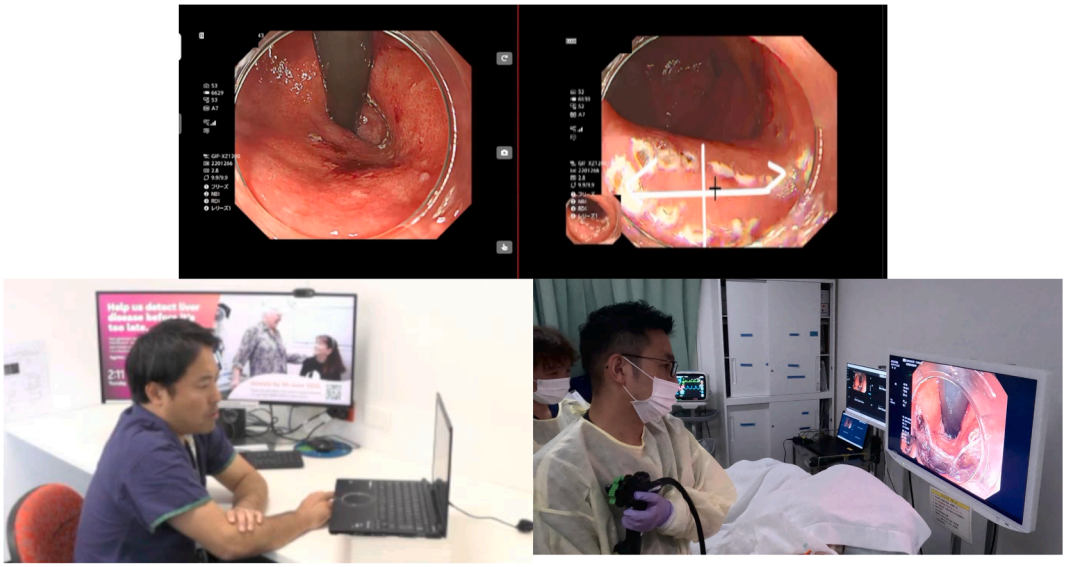


Figure 3. Endoscopic antireflux mucoplasty performed under real-time remote guidance using the tele-endoscopy system (Medical Edge; Zao-X, Tokyo, Japan).

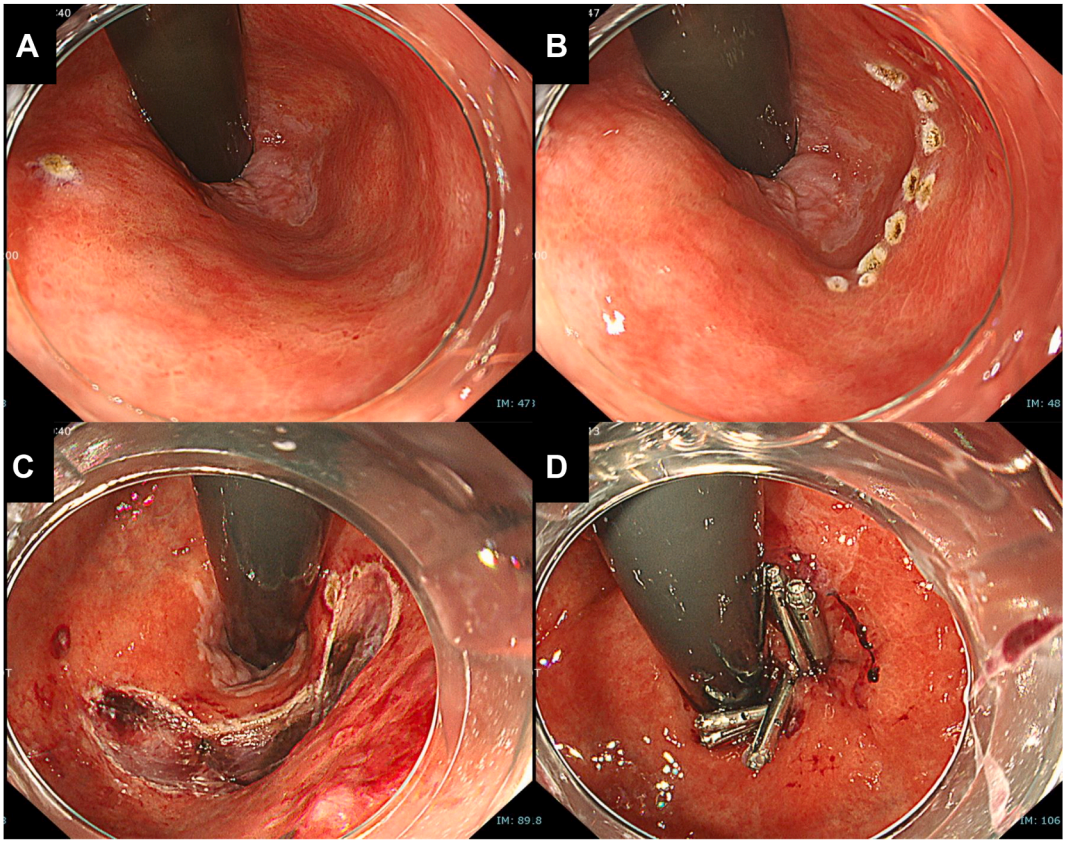


Figure 4. Intraoperative images illustrating key steps of the procedure. **A,** Hiatal hernia at the gastroesophageal junction. **B,** Marking to determine the area for mucosal resection. **C,** Mucosal defect after resection. **D,** Completion of antireflux plasty with endoscopic clips.

remnant stomach (Fig. 2), and a small sliding hiatal hernia (<2 cm). Based on these findings, the patient was considered a suitable candidate for antireflux mucoplasty.[3] Because institutional experience with this procedure was limited, real-time remote guidance from an expert endoscopist in Australia was used (Fig. 3). The on-site endoscopist had adequate expertise in therapeutic endoscopy and met the institutional competency requirements for advanced endoscopic procedures.

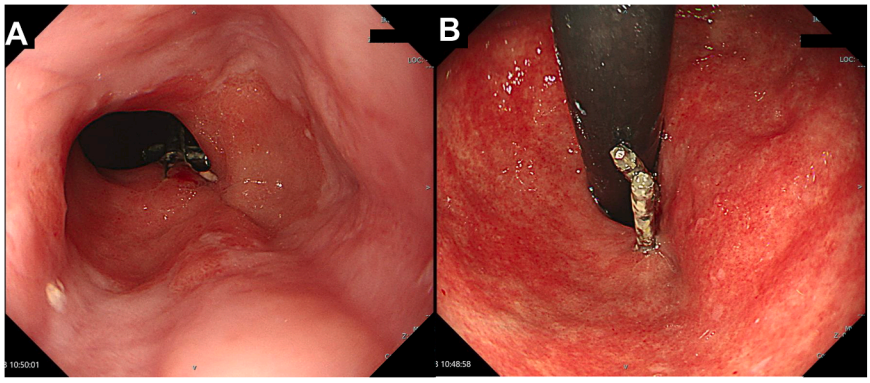


Figure 5. A, Reduction of the hiatal hernia following antireflux mucoplasty. **B,** Complete resolution of reflux esophagitis, with disappearance of mucosal erosions.

Key procedural steps and remote guidance are shown in Video 1, available online at www.videogie.org.

The procedure was completed without intraoperative or postoperative adverse events (Fig. 4). The patient was discharged on postoperative day 4. Follow-up endoscopy showed reduction of the hiatal hernia (Fig. 5A) and complete resolution of reflux esophagitis (Fig. 5B). Clinical outcomes also improved: the frequency scale for the symptoms of the GERD score[4] decreased from 15 to 6, and the GERD questionnaire score[5] from 9 to 4. Antireflux medication was continued during the early postprocedural follow-up period.

DISCUSSION

This case highlights the feasibility and potential utility of real-time international tele-endoscopic guidance using a high-speed mobile network system. The system enabled stable, high-definition image transmission with low latency, allowing effective real-time communication between the operator and the remote expert. The ability to provide on-screen annotations and immediate feedback contributed to procedural safety and educational value. Despite these advantages, several challenges should be considered. Implementation requires careful attention to institutional approval processes, patient privacy, local regulatory requirements, and personnel training. In addition, the cost of the tele-endoscopy system and the requirement for a stable high-speed network may limit its widespread adoption. It is important to note that tele-endoscopic guidance cannot replace the fundamental technical skills required for therapeutic endoscopy. Operators must have sufficient baseline competency, and direct hands-on supervision or training may still be necessary for selected procedures. Contingency planning, including backup communication strategies in the event of network disruption, is essential to maintain procedural safety.

DISCLOSURE

The following author disclosed financial relationships: K. Uchita: Advisor for Medical Edge, which distributes Zao-X, the tele-endoscopy system used in this study. All other authors disclosed no financial relationships.

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