

The Development of Endoscopic Suturing Devices: Challenges in the Treatment of Iatrogenic Perforation and Bleeding

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Endoscopic submucosal dissection (ESD) has gained popularity since it was first reported in Japan, and in recent years this modality has spread throughout the world. *En bloc* specimens that are resected by ESD contribute to accurate to the performance of pathological examinations upon which a patient's treatment and prognosis relies (1). Primary duodenal adenoma and cancer are reported to account for approximately 0.02-0.04% (2) and 0.035-0.12% (3) of all gastrointestinal neoplastic lesions, respectively.

Duodenal ESD is the most technically difficult and challenging form of digestive tract ESD (esophagus, stomach and colon). This is because the duodenum is fixed on the retroperitoneum with two bending portions (the superior and lower duodenal angles), making it difficult to secure sufficient operation view and to manipulate the endoscope. Moreover, it is difficult to obtain a sufficient degree of mucosal bulging via a local injection due to the presence of the Brunner glands and the thin mucosal layer. Ono et al. conducted a multicenter questionnaire survey in 13 facilities in Japan and showed that the intraoperative and delayed perforation rates in duodenal ESD were 9.3% and 3.1%, respectively, resulting a total perforation rate of 12% (1). In EMR and ESD, the intraoperative perforation rates were 3.9% and 24% respectively, while the delayed perforation rates were 1.2% and 6%. Thus, in Japan, duodenal ESD remains controversial due to the incidence of high-grade complications, especially intraoperative and delayed perforation. Moreover, the continuous exposure of the artificial ulcer floor to pancreatic juice and bile acid induces another serious complication in the form of delayed perforation.

Various closure methods for the ulcer floor have been reported. These include the use of hemoclips, detainment snare and the Over-The-Scope Clip (OTSC) system (Ovesco Endoscopy GmbH, Tübingen, Germany). The rate of com-

plete closure without any adverse events using the OTSC system is increasingly reported to be very high. Although a number of reports have demonstrated the successful prophylactic closure of post-duodenal ESD using OTSC, there are few reports on the complete closure of perforation during ESD. In the current issue of this journal, Furukawa et al. reported, for the first time, a case in which with closure and hemostasis were simultaneously achieved in a patient with arterial bleeding during duodenal ESD using the OTSC system (4).

The development of endoscopic suturing devices has been continuing since 2004, when Kalloo et al. first reported the observation of the abdominal cavity using a flexible endoscope following an incision on the stomach wall (5). So-called natural orifice transluminal endoscopic surgery (NOTES) using a flexible endoscope has received attention due to the minimally invasive surgical method, which does not require a skin incision. In terms of the invasiveness and safety of NOTES, laparoscopic surgery has already been established with many laparoscopic suturing devices, including laparoscopic staplers. Numerous full-thickness closure devices have also been developed (6). The Overstitch endoscopic suturing system (Apollo Endosurgery, Austin, USA) and the OTSC system are currently commercially available. However, in Japan, only the OTSC system is covered by medical insurance. Although the OTSC system was originally developed for full-thickness suturing in NOTES, it is currently used to close iatrogenic perforation during endoscopic treatment. The OTSC system can be attached to a normal multi-purpose endoscope can be used easily. However, it is a clip-type suturing device, and thus cannot be reset once it has been released.

Furukawa et al. demonstrated the closure of a large iatrogenic perforation with arterial bleeding using the OTSC sys-

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tem, which avoided the need for surgical intervention (4). This article is dedicated to the endoscopists who perform duodenal ESD and who should master the use of the OTSC system in order to better treat cases of perforation.

In conclusion, there are numerous advantages in performing minimally invasive endoscopic intervention with regard to the decreased incidence of adverse events, including intraoperative and delayed perforation in duodenal ESD. This endoscopic intervention is also helpful for reduce the patient burden and the medical costs. Thus, continued research and development of new endoscopic suturing devices like the OTSC would greatly benefit the current super ageing society as it moves towards the next century.

The authors state that they have no Conflict of Interest (COI).

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