INTRODUCTION
With increasing popularity of endoscopic procedures, iatrogenic perforation is more frequently seen than in the past. Iatrogenic perforation is divided into intraoperative and postoperative perforation. Because most intraoperative perforations could be diagnosed during the operation, endoscopic treatment, such as titanium clipping, can be used for perforation closure. If endoscopic treatment is not possible, timely laparoscopic or open surgical repair is needed. Most postoperative perforations happen within one to two days after operation can also cause serious complications such as acute peritonitis/pneumoperitoneum, requiring urgent management.

The objective of this report was to document the frequency, timing, and management of iatrogenic gastrointestinal perforation following endoscopic therapeutic procedures on stomach and intestines.

METHODOLOGY
Case records of patients undergoing therapeutic gastrointestinal procedures were evaluated. Demographic data, procedure, location, timing, and management was noted in all patients.

Written and informed consents from all patients were obtained to publish and to report individual patient data.

RESULTS
From 2008 to 2016, total of 3,389 therapeutic endoscopic procedures were performed in our department. There were 12 patients with perforation. The perforation rate was 0.35%. Among them, 6 cases were closed by titanium clipping and 1 case by purse string suture. In another case after cap-assisted endoscopic mucosal resection (EMRC), attempted titanium clipping failed, emergency surgery had to be performed. One each case, after Argon plasma coagulation (APC) and case after endoscopic piecemeal mucosal resection (EPMR), recovered well spontaneously. In two cases, titanium clips fell off endoscopic mucosal resection (EMR) resulting in delayed perforation, required surgery. Key factors for preventing and managing the perforation of endoscopic treatment, include the choice of endoscopic approach, processing method of perforation, detail processing in endoscopic therapy, proficient degree of operators and psychological quality.

mucosal resection (EPMR), Argon plasma coagulation (APC), and cap-assisted endoscopic mucosal resection (EMRC), was performed in one case, respectively. There were five patients with intraoperative gastric perforation. Among them, three cases had ESD for EGC and one case had EFR for gastrointestinal stromal tumor (GIST) on the gastric fundus which was closed by endoscopic clipping. One case had EFR for GIST on the greater curvature of gastric body was closed by endoscopic purse-string suture using endoloops with endoclips. Intraluminal continuous decompression and drainage, fasting, antibiotics and bedrest was used for perforation healing, and postoperative recovery was good. Another case underwent EMRC for sigmoid colon 2.5 x 2.5 cm LDP (Figure 2), SIMBASWC was performed before EMR. After resection, the wound was closed with titanium clips; but perforation still occurred after钛-clipping and emergency surgery was required. For another case after EPMR (sigmoid colon 4 x 4cm LDP), SIMBASWC was performed before EPMR. After resection, the wound was closed with titanium clips; however, perforation still occurred and the patient recovered well on conservative treatment.

DISCUSSION

The incidence of iatrogenic digestive tract perforation is 0.01% ~ 4%.1,3-5 The present report also describes a compatibly lower frequency. In the past, most of the perforations were treated with traditional surgical operation.2 With the development of endoscopic technology in recent years, majority of iatrogenic perforations can be closed via appropriate endoscopic closure, thus avoiding further surgery.6 Studies on perforation repair by endoscopic treatments mention the use of titanium clipping, stent occlusion, biological glue plugging, ligation, suture and bio-patch repair.6-8 Among them, the commonly used methods include titanium clipping, endoscopic interrupted suture via nylon rope and titanium clip, endoscopic suture via over-the-scope clip system (OTSC).9 These techniques can reduce the severity of gastrointestinal complications associated with endoscopic treatment. The exact etiology of delayed perforation is not clear. It may be related to the factors such as excessive electrocoagulation, titanium clip exfoliation, anastomotic lesions, diabetes, and hemodialysis.10 Some delayed perforations can heal after the aforementioned endoscopic treatment combined with conservative treatment such as fasting, gastrointestinal decompression and antibiotics. If the closure fails, surgical procedures should be performed promptly for both intraoperative and postoperative perforation.11

In addition, the endoscopist's experience is also one of the risk factors.12 Due to inappropriate treatment of iatrogenic perforation causing serious consequences, it has higher requirements for the technological level and perioperative management capabilities of endoscopic
physicians. If perforation occurred during treatment, it should be operated by an experienced endoscopist, who may choose the best way to close the perforation in order to minimize the incidence of adverse events.

Conservative treatment is instituted according to the condition of patients. For gastric perforation, risk of peritonitis and septicemia is low because the stomach is in a sterile state and the majority can escape surgery. All cases of gastric perforation recovered by conservative treatment in this series. For colonic perforation, there is high risk of bacterial peritonitis, sepsis and other serious complications due to fecal contamination of peritoneal cavity; the success rate of conservative treatment is low and some patients need timely surgery. In this report, there were six cases of colonic perforation, and only half of the cases were treated with surgery.

In addition, the operating level of the endoscopist has a great impact on the outcome. In this group, two patients were operated by relatively inexperienced endoscopist, resulting in serious consequences as both the patients underwent surgical procedures. Special attention should be paid to standardized training of endoscopy, so as to enhance the ability to deal with emergencies and reduce the incidence of complications.

CONCLUSION

For preventing and managing the perforation of endoscopic treatment, there are some key factors for success including the choice of endoscopic approach, skillful execution of endoscopic salvage treatment by experienced endoscopists, and the ability to recognize early and late complications of endoscopic therapy with appropriate and timely referral to surgeons.

REFERENCES